ISTS Technical Memorandum

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# PROCEEDINGS OF THE FORTY-THIRD SYMPOSIUM ON SEA TURTLE BIOLOGY AND CONSERVATION

March 22 – 27, 2025
Accra, Ghana

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## PRESIDENT'S WELCOME

**43rd Symposium on Sea Turtle Biology and Conservation**

22-27 March 2025, Accra, Ghana

**Andrews Agyekumhene**

Dear 43rd ISTS Symposium Participants,

I warmly welcome you to the city of Accra, the capital of Ghana, and to the 43rd International Sea Turtle Society Symposium. This is a historic moment as we gather for the first time in Africa for an ISTS Symposium. I speak with the voice of the sea turtle community when I say Ghana is excited and privileged to host this remarkable gathering of sea turtle experts, conservationists, students, and enthusiasts from around the world. We appreciate you joining us to make history in Africa.

This symposium is an opportunity for learning, networking, and inspiring one another. There will be several platforms in the symposium to share the latest research ideas, discuss emerging threats and contribute to the global efforts of preserving sea turtles and their habitat for present and future generations.

The theme for this year, **"Unity and Collaboration,"** goes to the core of this beautiful family and reflects the heart of this symposium. Sea turtle conservation is not a task for one project or country, it requires combined efforts by sharing knowledge, research, and experiences. It is only through this that we can achieve a bigger impact at protecting these magnificent creatures and their habitats. It is my hope that our time together here during these six days will bring us closer to each other and enable us to develop special bonds as a family, build friendships, strengthen partnerships, and explore opportunities to work together towards a brighter future for sea turtles worldwide.

Ghana, known for its warm hospitality and peaceful atmosphere, welcomes you with open arms. We encourage you to take some time to experience our rich culture, friendly people, scenic coast, and explore your wild side in our many National Parks. The country also boasts of some castles and forts built during the slave trade era and I encourage you to visit these historic monuments.

While you are here, if you need any help or guidance, my team is always available and ready to assist you.

At the end of the symposium, I have no doubt that you will return home with many wonderful memories of the event but also of Ghana and its people. Always remember that as much as you love Ghana, Ghana loves you more. You are always welcome back; Ghana is your home now.

Enjoy the symposium and enjoy your stay in Ghana.

Akwaaba!

Andrews Agyekumhene, PhD

President

International Sea Turtle Society

# PRESIDENT'S REPORT

**Summary Report - 43rd Annual Symposium on Sea Turtle Biology and Conservation (ISTS 43)**

By Dr. Andrews Agyekumhene, Symposium President

The 43rd Annual Symposium on Sea Turtle Biology and Conservation (ISTS 43), organised by the International Sea Turtle Society (ISTS), was held from 22–27 March 2025 at the Mensvic Grande Hotel in Accra, Ghana. This landmark symposium marked the **first ISTS symposium** to be held **in Africa** since the Society's inception. Convened under the theme **"Unity and Collaboration,"** the event emphasised inclusive partnerships, cross-regional cooperation, and equitable participation in sea turtle conservation science and practice. The official symposium logo visually reinforced the theme of unity and collaboration. The design incorporates the Ghanaian flag at the sides of the ocean (blue half circle) indicating the host country for the symposium, but also as a reminder of the hospitality and cultural diversity of Ghanaians, three sea turtle species commonly found in Ghanaian waters (olive ridley, leatherback, and green turtles), and traditional Adinkra symbols, *"Funtumfunefu Denkyemfunefu"* (Siamese crocodiles) and *Nkonsonkonson*" (chain link), which collectively symbolize unity in diversity, community, and shared purpose.

The symposium attracted **over 350 registered participants from 65 countries**, representing researchers, conservation practitioners, students, policymakers, and governmental and non-governmental organisations. Participation reflected strong global representation across Africa, Latin America, Asia, Europe, North America, and Oceania.

Pre-symposium activities held between **21–23 March 2025** included **one dedicated sea turtle necropsy session**, **six technical workshops**, **four regional meetings**, and **one student career workshop**. These activities focused on capacity building, skills development, and regional collaboration in areas such as rehabilitation and veterinary care, fisheries bycatch reduction, environmental education, behaviour change communication, male sea turtle research, and conservation communication.

The main symposium opened with formal and traditional Ghanaian ceremonies, followed by welcome addresses and the President's Address, which underscored the importance of hosting the symposium in Africa and called for inclusive, community-driven, and decolonised conservation approaches. The plenary program featured **three keynote addresses**, offering national, regional, and global perspectives on sea turtle conservation challenges and opportunities.

Scientific sessions included **142 oral presentations and 117 poster presentations**, totalling **259 scientific contributions**, organised across **nine core thematic areas**. In addition, **three special sessions** addressed decolonising conservation, Marine Turtle Specialist Group priorities, and targeted knowledge exchange initiatives.

To enhance accessibility and equitable participation, ISTS awarded **106 travel grants**, providing full lodging support during the symposium. Grant recipients represented all major regions, with **30 awards to African participants**, **18 to Europe**, **17 to Mexico, Central America and Spanish-speaking Caribbean**, **13 to North America**, **12 to Asia**, **8 to South America**, **6 to the Middle East and North Africa**, and **2 to Oceania/Polynesia**. These grants significantly increased participation by students and researchers from low- and middle-income regions.

Student engagement was a central component of ISTS 43 and included a student career workshop (**23 students**), a student social mixer, and a **Speed-Chatting with the Experts** session involving **30 students and 8 senior experts**. Outreach and cultural activities included a public **Video Night** showcasing **26 short films from more than 20 countries**, with attendance exceeding **100 participants**.

Sustainability was integrated into symposium operations through plastic-free refreshment practices, reusable materials, and digital communication strategies aimed at reducing environmental impact. The symposium concluded with Society business meetings, presentation of **career, student, and grassroots conservation awards**, and the ceremonial transition to the incoming ISTS President.

Overall, ISTS 43 strengthened global collaboration, elevated African leadership in sea turtle conservation, and reinforced the importance of unity and collaboration in advancing effective and inclusive conservation action.

# COMMITTEES, CHAIRS, AND KEY ORGANIZERS

## EXECUTIVE COMMITTEE

| Executive Committee Role | | Member |
|---|---|---|
| President | | Andrews Agyekumhene |
| Secretary | | Manjula Tiwari |
| Treasurer | | Nicholas Blume |
| President Elect | | Alexander Gaos |
| Past President | | Stephen Dunbar |

## BOARD OF DIRECTORS AND THEIR END OF TERM

| Board Member | End of term |
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| Daniela Freggi | 2025 |
| Amanda Southwood Williard | 2025 |
| Diego Amorocho | 2025 |
| Andrea Phillott | 2026 |
| Justin Perrault | 2026 |
| Itzel Sifuentes Romero | 2027 |
| Joseph Pfaller | 2027 |
| Seh Ling Long | 2028 |
| Richard Reina | 2028 |

## ORGANIZING COMMITTEE

| Organizing Committee Role | Member |
|---|---|
| Local Organizing Committee | Betty Delali Dordzi, Patrick Abbeyquaye, Jannatul-Firdaus Alhussein, Jenniffer Dede Ankra, John Selasi Yao Agudogo, Abigail Baidoo, Sampson Kofi Mawuko Kudior, Richmond Korang |
| Symposium Coordinator | Ingrid Yañez |
| Webmaster / I.T. Liaison | Paul Whittock |
| Registrars | Naty Teryda, Sophie Mills, Ruth Doñate Ordóñez |
| Vendor Committee | Richmond Korang, Betty Delali |
| Workshops Committee | Jannatul-Firdaus Alhussein, Abigail Baidoo, Edward Aruna, Wafae Benhardou, Josea Sagbo Dossou Bodjrenou.<br><br>**Workshop Organizers:** Christine Figgener, Daniela Freggi, Ashleigh Bandimere, Bryan Wallace, Antonio Trujillo, Marco Garcia |
| Volunteer Coordination Team | Daniela Rojas, Betania Ferreira, Eunice Konadu Asamoah |
| Student Committee | Janie Reavis, Derek Aoki, Chandana Pusapati, Abhishek Thawait, Mildred Alpizar, Sarahi Ramos, Fitra Nugraha, Heather Seaman, Lindsay Curl, Aiyana Reissman, Emily Turla |
| Video Night & Origin Stories Coordinators | Patrick Abbeyquaye, John Selasi Yao Agudogo, Sampson Kofi Mawuko Kudior |
| Sea Turtle Trading Post | Kate Mansfield |
| Silent and Live Auction Team | Marina Zucchini, Roderic Mast |
| MTSG Group Meeting | Roderic Mast, Paolo Casale |
| Archie Carr Awards Committee | Andrea Phillott, Natalie Wildermann |
| Grassroots Conservation Award Committee | Wafae Benhardouze |
| ISTS Career Awards Committee | Jesús Tomás, Earl Possardt, Jacques Fretey, Roderic Mast, Ryan Welsh |
| ISTS Nominations Committee | Mustapha Aksissou, Imed Jribi, Connie Ka Yan, Jeanette Wyneken, Kellie Pendoley |
| Social Media Support | Caroline Clavien, Hamed Mallet, Jenniffer Dede Ankrah |

## ORGANIZING COMMITTEE cont.

| Organizing Committee Role | Member |
|---|---|
| Travel Grants Committee | Andrew Maurer (Chair), Angela Formia (Africa), Karen Eckert (Caribbean), Jose Urteaga (Mexico, Central America & Caribbean), ALan Rees (North Africa & Middle East), Daniela Freggi (Europe), Alejandro Fallabrino (South America), Andrea Phillott (South Asia), Mark Hamann (Southeast Asia/Pacific), Kelly Stewart (USA & Canada) |
| Fundraising Officer | Ingrid Yañez |
| Book Keeper | Terry Meyer |

## PROGRAM COMMITTEE

| Program Committee Role | Member |
|---|---|
| Program Chairs | Phil Allman, Kate Levasseur, Katrina Phillips, Liliana Colman |
| Session Chairs | Daniela Freggi, Mariluz Parga, Justin Perrault, Roldan Valverde, Maximilliano Polyak, Irene Kelly, Kathy Zagzebski, Mario Mota, Christina Fahy, Jane Hardwick, Terry Meyer, Sabrina Mashburn, Damaris Marin-Smith, Daniela Rojas, Anna Stamatiou, Anna Ortega, Angela Manekuor Lamptey, Eunice Konadu Asamoah, Nicholas Pilcher, Michael Liles, Michel (Tony) Nalovic, Gabriela Velez, Nathan Robinson, Ryan Welsh, Mariela Pajuelo, Janie Reavis, Andie Fisher, Ray Carthy, Aliki Panagopoulou, Catherine Hart, Ed McGinley, Jeff Schwenter, Sean Williamson, Marco Garcia, Joseph Pfaller, Armando Barsante Santos, José Urteaga, Eugenia Naro-Maciel, Emily Duncan, Laura Exley, Oyeronke Adegbile |
| Poster Session Chairs | Phil Allman, Gustavo Stahelin, Kelly Sloan |
| Proceedings Compilers | Patrick Abbeyquaye, Paul Whittock, Lisa Belskis |
| Proceedings Chair | Joseph Pfaller |

## TRAVEL GRANT COMMITTEE

| Travel Grant Committee Role | Member |
|---|---|
| Chair | Andrew Maurer |
| Regional Chair – Africa (except North Africa) | Angela Formia |
| Regional Chair – Caribbean (English speaking) | Karen Eckert |
| Regional Chair – Mexico, Central America, and Spanish-speaking Caribbean | José Urteaga |
| Regional Chair – North Africa, and Middle East | ALan Rees |
| Regional Chair – Europe | Daniela Freggi |
| Regional Chair – South America | Alejandro Fallabrino |
| Regional Chair – South Asia | Andrea Phillot |
| Regional Chair – Southeast Asia/Pacific | Mark Hamann |
| Regional Chair – USA and Canada | Kelly Stewart |

## REGIONAL MEETING ORGANIZERS

| Regional Meeting | Organizer |
|---|---|
| Africa | Manjula Tiwari, Andrews Agyekumhene, Angela Formia, Jacques Fretey |
| Indian Ocean and Southeast Asia (IOSEA) | Lalith Ekanayake |
| Latin American Meeting (RETOMALA) | Jimena Gutiérrez, Daniela Rojas, Ana María Moncada, Eneida Fajardo, Antonio Trujillo |
| Mediterranean Reunion | Imed Jribi, Aliki Panagopoulou |

## SPONSORS AND CONTRIBUTORS

The 43rd International Sea Turtle Society Symposium and the International Sea Turtle Society gratefully acknowledge the generous and valuable financial support from our sponsors:

### Loggerhead Sponsor

Marisla Foundation

### Kemp's Ridley Sponsors

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- Lotek
- SEE Turtles
- Association of Zoos and Aquarium's sea turtle SAFE program
- Turtle Foundation
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- Coastal Wildlife Club Inc.

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- Wildlife and Human Resources Organization (WHRO Ghana)
- Department of Marine and Fisheries Sciences, University of Ghana

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- Oceanic Society (The State of the World's Sea Turtles (SWOT) Program)
- The Leatherback Trust
- African Marine Mammal Conservation Organization
- Lotek
- Nature Seekers
- Wildlife Computers

# AWARDS

## ISTS Lifetime Achievement Awards

- Wallace J. Nichols
- Anton D. (Tony) Tucker (posthumously)

## ISTS Champions Awards

- Association Kratten Du Développement Durable de la Culture et du Loisir (AKDDCL, Tunisia)
- Adilson Monteiro Ramos (Fundacao Tartaruga, Cape Verde)
- Bryan Wallace
- Manjula Tiwari

## ISTS President's Awards

- Wildlife Division (Forestry Commission, Ghana)
- Department of Marine and Fisheries Science, University of Ghana
- Avaa Kojo Armah (ESL Consulting Limited, Ghana)
- Phil Allman
- Manjula Tiwari

## Grassroots Conservation Award

African Marine Mammal Conservation Organization, Cameroon: "*Siren Citizen Science: The Story of A Fisherman From Poacher To Sea Turtle Hero*".

## Archie Carr Student Awards

A total of 70 student presentations (44 oral and 26 poster presentations) were nominated for consideration under the Archie Carr Student Awards during the 43rd Annual Symposium on Sea Turtle Biology and Conservation. Presentations were evaluated within four award categories, as nominated by the student presenters: Biology Poster, Conservation Poster, Biology Oral, and Conservation Oral. Judges in each category were tasked with selecting a winner and a runner-up. Following the evaluation process, eight (8) student presentations were recognized for outstanding scientific and conservation contributions, with both a winner and runner-up selected in all four categories. Award recipients represented a diverse range of institutions across Africa, Asia, Europe, North America, and Australia, highlighting the symposium's strong international and inclusive student participation. Winning institutions were based in seven countries, reflecting the global scope of student research showcased at ISTS 43 and the Society's continued commitment to supporting early-career researchers worldwide.

**Student Awards for Poster and Oral Presentations at ISTS 43, Accra, Ghana:**

| Category | Prize | Student | Institution | Presentation Title |
|---|---|---|---|---|
| Biology Oral | Winner | Anna Ortega | University of Western Australia, Australia | Integrating energy budget and migration models to guide captive releases of leatherback turtles |
| | Runner up | Lindsay Curl | North Carolina State University, USA | Assessing microplastic contamination in unviable loggerhead sea turtle eggs |
| Biology Poster | Winner | Derek Aoki | Florida Atlantic University, USA | Comparisons of longevity of various attachment methods for satellite and acoustic transmitters on adult leatherback sea turtles |
| | Runner up | Lucas Capitão | Universidade Agostinho Neto, Angola | Olive ridleys nesting in the Sereia Peninsula and Praia dos Pobres, Soyo Region, Angola, and their associated productivity |
| Conservation Oral | Winner | Liyana Izwin Khalid | Universiti Malaya, Malaysia | Evaluating the effectiveness of TEDs as a bycatch reduction measure for sea turtles in Sabah, Malaysia |
| | Runner up | Lindsey West | University of Kent, United Kingdom | Exploring motivations and experiences of participation in community-based sea turtle conservation in Tanzania |
| Conservation Poster | Winner | Mildred Alpizar | IPN-CIIDIR Sinaloa, Mexico | Influence of climatic variables, position, and circadian rhythm on the incubation temperature of leatherback turtles in San Luis de la Loma, Guerrero |
| | Runner up | Madhurika Nandi | FLAME University, India | An assessment of the evidence for individual and population level effects of heavy metals on sea turtles |

## OPENING AND CLOSING REMARKS, KEYNOTES, AND ADDRESSES

### OPENING PRAYERS
Dr. Collins Prah Duodu
*Lecturer, Department of Marine and Fisheries Sciences, University of Ghana*

Nuumo Akwaa Mensah III
*Nai Wulomo*

### WELCOME ADDRESS
Prof. Langbong Bimi
*Dean, School of Biological Sciences, University of Ghana*
*(with the address delivered on his behalf by Dr. Francis Gbogbo)*

### OPENING REMARKS
Dr. Benjamin Botwe
*Head, Department of Marine and Fisheries Sciences, University of Ghana*

### A MESSAGE FROM THE UNSUNG HERO
Mr. Osei Kwame Korankye
*School of Performing Arts, University of Ghana*

### PRESIDENT ADDRESS
Dr. Andrews Agyekumhene
P*resident, International Sea Turtle Society*

### KEYNOTE ADDRESSES
- Mr. A. K. Armah
  *CEO, ESL Consulting Limited, Accra*
- Prof. Denis W. Aheto
  *Pro-Vice Chancellor, University of Cape Coast (UCC)*
  *Director, Africa Centre of Excellence in Coastal Resilience (ACECor), UCC- Cape Coast*
  *(with the address delivered on his behalf by Dr. Noble Asare)*

### MESSAGES FROM CONSERVATION PARTNERS
Dr. Joseph Boakye Esq.
*Executive Director, Wildlife Division, Forestry Commission Ghana*
*(with the address delivered on his behalf by Dr. Godfred Bempah)*

Dr. Seth Appiah-Kubi
*National Director, A Rocha Ghana*
*(with the address delivered on his behalf by Jacqueline Mbawine)*

### CLOSING REMARKS
Prof. Langbong Bimi
*Dean, School of Biological Sciences, University of Ghana*
*(with the address delivered on his behalf by Dr. Francis Gbogbo)*

# SPECIAL FEATURES

## SPECIAL SESSIONS

**Decolonizing Sea Turtle Conservation**
Chairs: Amanda Robbins, Aileen Lavelle

**Lunch & Learn: Protecting Africa's Tortoises and Freshwater Turtles**
Organizer: *Turtle Survival Alliance*

## WORKSHOPS

**Harnessing the Power of Social Media for Non-Profits & Individual Researchers**
Organizer: *Christine Figgener*

**Sea Turtle Rehabilitation, Care and Medicine**
Organizers: *Daniela Freggi, Mariluz Parga*

**Creating Behavior Change Campaigns for Sea Turtle Conservation**
Organizers: *Ashleigh Bandimere, Roderic Mast, Brian Hutchinson, Lindsay Mosher, Rachel Smith, Kelley Anderson*

**5TH Environmental Education Workshop: Interdisciplinary and Collaborative Environmental Education Projects**
Organizers: *Antonio Trujillo, Alba Lopez, Eneida Fajardo*

**Toward Holistic Stategies for Fisheries Sustainability and Bycatch Reducation**
Organizers: *Bryan Wallace, Joanna Alfaro-Shigueto, Agnese Mancini*

**Male Sea Turtles: Global Research Update & Methodology Development for guiding Conservation Efforts**
Organizers: *Marco García Cruz, Renato Bruno, Hector Barrios*

**Student Workshop: Career Paths and Techniques in Sea Turtle Conservation**
Organizer: *Janie Reavis*

## VIDEO NIGHT

For this session, 26 short films from over 20 countries across Africa, the Pacific, the Americas, Europe, and the Middle East. Stories came from Ghana, Cabo Verde, Mauritania, Guinea-Bissau, São Tomé and Príncipe, Egypt, Jordan, Tunisia, Madagascar, South Africa, Seychelles, Fiji, Panama, Grenada, Brazil, Mexico, the USA, France (French Guiana and French Polynesia), Spain, Reunion Island, and the Maldives. These powerful visual stories highlighted the diverse ways communities, researchers, and organizations are working to protect sea turtles and their habitats.

| Video Title | Location | Presenter / Organization |
|---|---|---|
| Sea Turtle conservation in West Africa | Cabo Verde, Mauritania, Guinea-Bissau | Ana Rita Patrício / CE3C, Faculty of Sciences, University of Lisbon |
| Seasonal Protected Areas | Mahé, Seychelles | Christophe Mason-Parker / Marine Conservation Society Seychelles |
| Nadogo District's Historic Marine Protected Area & Turtle Sanctuary Declaration | Fiji | Ravai Vafo'ou / WWF-Pacific Fiji Office |
| Gamechangers: the football team scoring conservation goals | Gomoa Fetteh, Ghana | Sofija Korf / Environmental Justice Foundation |
| Community engagement & environmental education | Mediterranean | Nikolaos Simantiris / Mediterranean Association to Save the Sea Turtles (MEDASSET) |
| STC in Panama: Signals from the Sea & Training the Next Generation | Bocas del Toro, Panama | Daniel Evans / Sea Turtle Conservancy |
| Protecting Turtles, Empowering Communities: Programa Tatô Story | São Tomé Island, São Tomé and Príncipe | Betania Ferreira Airaud / Programa Tatô |
| ProTetuga – Sea turtle focused environmental education in Príncipe | Príncipe Island, São Tomé and Príncipe | Asiem Sanyal / Fundação Príncipe/ Fauna & Flora |
| Looking for Leatherbacks: Collaborating to Protect Turtles at Sea | California, USA | Kayla Sargent / Upwell Turtles |
| Tracking Turtles into their Lost Years | Cape Town, South Africa | Talitha Noble-Trull / Two Oceans Aquarium Foundation |
| The First Ever Sea Turtle Survey in Carriacou, Grenada | Carriacou, Grenada | Scott Thomas Eanes / The Hawksbill Project |
| Arriba | French Guiana | Michel Nalovic / Marine Turtle Specialist Group |
| Turtle Nesting Monitoring on Tetiaroa Atoll in French Polynesia | French Polynesia | Gaspar Cecile / TE MANA O TE MOANA |
| Leatherback | Ghana & The Netherlands | Mirthe Dokter / Pollif Projects |
| The Turtleman | Tanzania | Lindsey West / Sea Sense |

**Video Night cont.**

| Video Title | Location | Presenter / Organization |
|---|---|---|
| Lavavolo Tortoise Center | Lavavolo, Madagascar | Jordan Gray / Turtle Survival Alliance |
| Turtle Conservation Project Panadura Beach | Panadura | Thushan Kapurusinghe / Turtle Conservation Project (Sri Lanka) |
| S.O.S Caretta, Fisher for Biodiversity | Andalusia, Spain | Daniel Gonzalez-Paredes / S.O.S Caretta |
| The History of Aruanã Project | Rio de Janeiro, Brazil | Suzana Machado Guimarães / Projeto Aruanã |
| Welcome to Atoll Marine Conservation Centre | Lh. Naifaru, Maldives | Daniela Caballero / Atoll Marine Conservation Centre |
| Towards Effective Restoration of Marine Turtles in Jordan's Aqaba Coast Line | Aqaba - Jordan | Abeer Bilbeisi / Jordan Society for the Conservation of Turtles & Tortoises |
| Sea Turtle Wee Mini Series: Inside the World of Working with Sea Turtles | several countries | Brad Nahill / SEE Turtles & Sea Turtle Week |
| What a wonderful life | Mexican Pacific Ocean | Mildred Alpizar Quezada / Kutzari A.C |
| Turtle Watch Egypt 2.0: Protecting Sea Turtles in the Red Sea | Red Sea Coast, Egypt | Micol Montagna / Marine Life Watch; and Marine Life Conservation and Preservation Foundation |
| Projecto Kitabanga +20 years | Angola | Débora de Carvalho / Projecto Kitabanga |

## SPEED CHATTING WITH THE EXPERTS

The ISTS Student Committee once again held a speed chatting event where students had an opportunity to meet, network with, and get to know sea turtle experts in a casual environment.

The Speed Chatting event provided a dynamic and informal platform for 30 students to engage directly with leading experts in sea turtle research and conservation. Modelled after the concept of "speed dating," the session featured structured 10-minute one-on-one interactions, allowing students to ask questions about research, career pathways, and ongoing projects, or to connect personally with professionals in the field. The event offered an approachable and effective mentoring and networking opportunity, particularly valuable for students meeting, often for the first time, researchers whose work they have read, cited, or admired. Eight senior experts generously participated, sharing their time, experience, and insights in a relaxed and supportive environment.

**Experts:** Matt Ware, Manjula Tiwari, Hiltrud Cordes, Brad Nahill, George Shillinger, Tony Nalovic, Kate Mansfield, and Kartik Shankar

## ORIGIN STORIES

Origin Stories is a special International Sea Turtle Society Symposium tradition where participants share personal experiences from the field, their communities, and their conservation journeys. The session celebrates the human side of sea turtle work, moments of challenge, discovery, humour, and inspiration that shape our paths. From night patrols and research encounters to unexpected lessons learned, these stories foster connection and reflection across cultures and disciplines.

## TURTLE TRADING POST

This event is open to students, travel grant recipients, NGOs, and groups in countries experiencing economic, environmental, and/or humanitarian hardship. The idea is for researchers with unneeded, gently used research gear to donate it to those who can give it a second life.

## SILENT AND LIVE AUCTIONS

Proceeds from both the Silent and Live Auctions go toward travel grants for the next symposium.

## SYMPOSIUM LOGO

The symposium logo was designed by Fiifi Simons. The logo shows the Ghana flags at the sides of the ocean (blue half circle) indicating the host country for the symposium, but also as a reminder of the hospitality and cultural diversity of Ghanaians. Swimming in the ocean are the three species of sea turtles (olive ridley, leatherback and green) that are commonly found in Ghana's waters, and also nest on Ghana's beaches. These species are also common in most African countries. There are two Ghanaian symbols above the symposium name both signifying unity. On the left is the "*Funtumfunefu Denkyemfunefu*" or the "Siamese crocodiles" which feature two conjoined crocodiles symbolizing unity in diversity and the importance of working together with a common purpose even when faced with conflict or competition. On the right is the "*Nkonsonkonson*" which means "chain link", a symbol of unity and community (human relations). The combined elements of the logo drums home the message that in unity lies strength, re-echoing the theme for this symposium*, Unity and Collaboration*, as captured in the logo under the ocean.

# ABSTRACTS

## ANATOMY, PHYSIOLOGY AND HEALTH

### EVALUATING THE RELATIONSHIP BETWEEN IMMUNE FUNCTION AND FIBROPAPILLOMATOSIS IN TWO AGGREGATIONS OF JUVENILE GREEN SEA TURTLES*

**Tiffany M. Dawson, Sean R. Doolittle, Kate L. Mansfield**

*Department of Biology, University of Central Florida, United States of America*

Fibropapillomatosis (FP), a neoplastic disease commonly seen in juvenile green turtles (*Chelonia mydas*), is thought to be immunosuppressive and exacerbated by poor habitat quality. However, knowledge on the specific suppressed functions is inconsistent across studies. Common immunosuppression metrics for sea turtles include anemia, overproduction of globulins, and decreased lymphocyte production (e.g., reduced adaptive immunity). Immune function in sea turtles also declines seasonally during colder months, which may leave FP-positive individuals more susceptible to secondary infections. To evaluate juvenile green turtle FP status and the relationship with immune function and season, we sampled 180 individuals from two coastal habitats in eastern Central Florida, USA during 2021-2023. Both sampling locations are year-round foraging habitats for juvenile green turtles and each have environmental concerns; one with reduced seagrass habitat and harmful algal bloom events and the other a man-made basin in close proximity to cruise ship terminals and military activities. Standard morphometrics, external FP status, and a blood sample were collected from each turtle. Blood was evaluated for packed cell volume, white blood cell differentials, plasma biochemistry, and plasma protein quantification as proxies for turtle immune function. We found significant relationships between FP status and sampling location, season, and immune proxies using multivariate statistics. Results indicated that immunosuppression occurs in FP-positive individuals and during colder periods. The resiliency of FP-positive turtles may further depend on habitat quality or additional environmental stressors. Understanding the relationship between immune function and FP in sea turtles is an important factor in developing clinical treatments for the disease and in better understanding the etiology and disease progression. As FP prevalence continues to persist or increase in green turtle populations but also other sea turtle species, understanding how turtles respond to the disease and what threats may increase mortality is important for conservation management of this life stage.

### TEMPORAL TRENDS IN TOXICOLOGY: THE IMPORTANCE OF LONG-TERM MONITORING PROJECTS IN CHARACTERISING CHEMICAL EXPOSURE

**Kimberly A. Finlayson[1], Cesar A. Villa[2], Arthur D. Barraza[1], Colin J. Limpus[2], Jason P. van de Merwe[1]**

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Sea turtles are exposed to, and accumulate, contaminants such as trace elements and organic chemicals (e.g. industrial chemicals, pesticides, pharmaceuticals) that can have negative implications for health. These contaminants enter the environment through a variety of urban, agricultural and industrial sources,

which means that chemical exposure can change over time. However, the majority of toxicological studies only include one timepoint, which provides only a snapshot of chemical exposure. A long-term monitoring project carried out in Port Curtis, Australia, one of Australia's largest shipping ports, has offered the unique opportunity for temporal analysis of contaminants in the green turtle population foraging within the port. Since 2016, Trace elements have been assessed chemical analysis and organic contaminants have been assessed using novel, cell-based techniques recently developed for sea turtles. Cell-based techniques can be used to assess the effects of environmentally relevant mixtures and concentrations of organic contaminants to which turtles are exposed by extracting contaminants from turtle blood and testing the toxicity of extracts on sea turtle cells. Trace elements such as Mn, Co, Zn, and Mo showed significant decreases in concentrations from 2016. Se and Cd exhibited significant increases in concentration between 2016 and 2021, followed by a decrease in 2022. Organic contaminants have also demonstrated significant temporal changes, remaining relatively stable until 2019 where there was a significant increase in exposure. Exposure levels returned to pre-2019 levels in 2021, then increased again in 2022. These results highlight the importance of including temporal aspects in experimental design for toxicology studies to better identify exposure baselines, and changes to exposure that have the potential to impact turtle health.

## FIRST COMPREHENSIVE, MULTI-YEAR HEALTH ASSESSMENTS OF JUVENILE HAWKSBILL SEA TURTLES (*ERETMOCHELYS IMBRICATA*) IN THE NORTHWEST INDIAN OCEAN: CLINICAL BLOOD ANALYTES, PHYSICAL EXAMINATIONS, ULTRASONIC STUDIES AND GUT MICROBIOME CHARACTERIZATION ACROSS EIGHT ATOLLS IN THE MALDIVES

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The health status of critically endangered hawksbill sea turtles from the Indian Ocean area is largely unknown as few studies have been performed on this population. Insights into the health status of this species can inform local conservation measures that are not available by other monitoring and assessment means. The Republic of Maldives is home to a resident juvenile hawksbill foraging population with over 5,000 individuals identified. We evaluated clinical indices of health in wild-caught juvenile hawksbill sea turtles (n=68) from eight atolls in the north central (NC) and south central (SC) regions of the Republic of the Maldives in 2023-24 in order to 1) establish clinical reference intervals for plasma biochemical and haematological analytes, 2) perform morphometric, physical, cardiopulmonary, and neurological examinations, 3) assess anatomically available structures by ultrasound study, 4) collect colonic and cloacal samples for gut microbial evaluation, and 5) determine sex by ultrasound. All work was subjected to

independent animal welfare review. Blood analytes included Complete Blood Counts with manual differentiation, Packed Cell Volume, Total Solids, Glucose, Symmetric Dimethylarginine, Creatinine, Blood Urea Nitrogen, Uric Acid, Phosphorus, Calcium, Total Protein, Albumin, Globulin, Albumin:Globulin ratio, Alkaline Phosphatase, Aspartate Aminotransferase, Gamma-Glutamyl Transferase, Beta Hydroxybutyrate, Total Bilirubin, Cholesterol, Amylase, and Lipase. Full physical examinations were performed on each animal, including neurological and cardiopulmonary examination by ultrasound. Further ultrasound examinations were performed using pre-femoral and axillary access to evaluate all available organ systems. Samples were collected from the cloaca and distal colon using a specialized technique validated for this project. Gut samples were stored for subsequent microbial analysis. All animals were returned to the reefs without incident. Clinical biochemical analytes revealed hyperuricemia in animals from all regions. Haematological evaluation revealed marked increases in the SC atolls in the granulocytic lines (heterophils and eosinophils) with accompanying mild to moderate toxicities compared to the NC region. Ultrasound studies revealed evidence of mild to moderate enteric disease in 8.3% (3/36) in the NC atolls and 27.6% (8/29) in the SC atolls, and 13.8% (4/29) pulmonary disease in the SC atolls compared with none in the NC region. Sex determination by ultrasound revealed 9.3% male in the NC region and 37.9% male in the SC region. Body Condition Index (BCI) was $0.98 \pm 0.11$ in the NC region and $1.1 \pm 0.22$ in the SC region. Gut microbiome data are pending evaluation. Physiologic stressors and clinical evidence of renal, enteric and pulmonary disease were evident in both regions, but more pronounced in the SC region, which may reflect foraging ground disturbances from development and benthic ecosystem deterioration in this area. More males were present in the SC region than the NC, but this is likely a sampling bias. Interestingly, BCI did not correlate with health status, which has implications for the reliability of this morphometric measurement of fitness. This represents the first comprehensive health assessment of a population of critically endangered hawksbill sea turtles in the northwest Indian Ocean.

## COMPARATIVE ANALYSIS OF THE STRUCTURAL REPRESENTATION OF GRAPHS WITH MORPHOLOGICAL INFORMATION IN GRAPH ATTENTION NETWORKS FOR SEA TURTLE IDENTIFICATION*

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The conservation of sea turtles is essential for maintaining the balance of marine ecosystems, making it crucial to identify them individually to keep accurate records in conservation programs. By leveraging their morphological features, it is possible to identify them individually. In recent years, non-invasive photo-identification methods have been developed, which, despite representing technological advancements, face challenges in uncontrolled environments, posing a significant challenge for computer vision. Extracting the morphological features of sea turtles through image content analysis and representing them specifically using mathematical and computational algorithms is highly important to enable these photo-identification methods to accurately learn to identify each sea turtle. In this context, graph-based algorithms are particularly useful for capturing detailed information about the morphology of sea turtles. The shape of the scales, shields, head, shell, and flippers is represented through a structure of nodes or specific points using graphs, and the relationships among these shapes are determined by linking their structure, coloration, and texture, facilitating precise identification. These algorithms analyze patterns, shapes, and unique markings, enabling individual distinction. This work presents a comparative analysis of the performance of two graph-based algorithms: the Region Adjacency Graph (RAG), which prioritizes spatial contiguity, and the K-Nearest Neighbors Graph (KNN), which relies on metric proximity. Both algorithms are designed to generate graph structures that capture relevant morphological features derived from images

of sea turtles. The graph structure is integrated into an optimized architecture of Graph Attention Networks (GAT), developed for the automatic identification of sea turtles. GAT leverages attention mechanisms, enabling graph nodes to extract information from their neighborhoods. This enhances both the accuracy of sea turtle identification and the adaptation to the complexities of graph representations. The results show that the RAG algorithm plays a crucial role in the identification process, outperforming KNN in terms of accuracy and computational efficiency. Its ability to extract only the key information of each sea turtle allows for more robust and efficient representation, even under uncontrolled image capture conditions. This RAG-GAT development framework is efficient, enabling its application across various image capture conditions and eliminating the need for controlled environments for individual identification. To the best of our knowledge, this is the first study to explore these parameters in a GAT architecture using a real and diverse dataset, such as that of sea turtles, promoting the use of innovative models for the conservation of these species. The ability to quickly and accurately identify each turtle through photo-identification methods not only supports conservation efforts, detailed population records, and the development of non-invasive methods, but also provides effective technological tools for their monitoring and preservation in their natural habitats. Moreover, it deepens our understanding of their ecology and behavior, which is essential for ensuring their long-term protection.

## PREVALENCE OF FP TUMORS ON JUVENILE GREEN SEA TURTLES IN A NORTHEAST FLORIDA ESTUARY*

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Sea turtles have long been affected by the changing environment. Fibropapillomatosis (FP) is a tumor-causing herpes virus primarily affecting green sea turtles. The main cause of FP is Chelonid herpesvirus 5, however, the pathophysiology is not fully understood. Some chemicals and biotoxins may encourage the growth of the virus. Past research has identified a correlation between the presence of sea turtles with FP and polluted/unhealthy coastal environments. Populations of sea turtles have been documented in St. Augustine, Florida in the Western Atlantic Ocean since 2020. Over this period, tumor prevalence has been noted as well. We aimed to calculate the amount of sea turtles with noticeable signs of FP to determine the prevalence of the virus in the St. Augustine population. Two marinas in St. Augustine, Florida were walked once a week and videos were taken of sea turtles using a GoPro 12. Using the unique patterns on their heads, sea turtles were identified using the Internet of Turtles software. Additionally, FP tumors were recorded on individual turtles. In conjunction with the University of Florida's Sea Turtle Hospital at Whitney Lab and the Volusia Marine Science Center, we were able to track and document incidences of individual sea turtles before and after hospital visits. To date, we have identified 797 total individuals: 338 hospital patients and 459 wild sea turtles. Of those, 11 sea turtles have been seen in the wild that were also patients at the Sea Turtle Hospital at Whitney Lab. None of our identified sea turtles have been patients at Volusia Marine Science Center. These data suggest that there is a much larger population of green sea turtles in this area than our previous research shows. We may have been underestimating tumor prevalence by only observing sea turtle's dorsal side, before utilizing GoPros to examine their full body. Preliminary results show that FP tumor load on St. Augustine's sea turtle population is higher than thought from dorsal observations alone. To date, 120 minutes have been recorded of wild sea turtles. Videos are being analyzed for tumor load on the St. Augustine sea turtle population and early results indicate tumors are more common on the ventral side of the turtles. It is crucial to understand the cause and effects of FP on sea turtles to further conservation efforts of the endangered keystone species.

# LOCOMOTION VARIABILITY IN LOGGERHEAD SEA TURTLE HATCHLINGS*

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During their reproductive seasons, multiple paternity occurs across various taxa, including marine turtles, terrestrial turtles, reptiles, and mammals. In Florida, an estimated 31-70% of sea turtle nests show evidence of multiple paternal contributions. For sea turtles, multiple paternity is hypothesized to increase fitness benefits for males, increase fertilization success, and increase genetic diversity. Increasing genetic diversity could also result in females indirectly increasing their fitness if their offspring are of higher quality and are successful. The rate of multiple paternity varies due to factors such as mate selection and mate availability. Sperm competition may increase the genetic diversity within a clutch of eggs and could potentially increase the genetic quality of the offspring if the strongest males' contribution were used for fertilization. Predation of hatchlings directly after emergence is a considerable risk, with approximately 10% of hatchlings dying on their way to the water. Hatchlings with better locomotive efficiency have a higher chance of reaching the shoreline, which increases their chances of survival. 15 nesting females and a subset of their hatchlings were examined in 2024 in Casey Key, Florida, one of the Gulf of Mexico's largest loggerhead turtle rookeries. For this study, females that were observed completing one successful nesting event were selected, to allow for the possibility of greater genetic diversity, and potentially differing paternal contributions, between nests. By analyzing loggerhead sea turtle hatchling locomotion and comparing those values to paternity, we can discover if multiple paternity rates impact hatchling locomotive efficiency. Mean clusters comparing self-righting response and crawling test results of individual hatchlings within the same clutch were created. Using DNA analysis to compare individual hatchling paternity, these mean clusters of locomotive efficiency may represent different fathers within the clutch, suggesting that hatchling fitness is impacted by their paternity, which may encourage sperm competition in females. This study aims to quantify the incidence of multiple paternity within loggerhead clutches for females observed nesting a single time on Casey Key, Florida and to evaluate whether the paternity of individual hatchlings affects their locomotive efficiency, influencing their survival rates.

## NEW METHOD FOR DOCUMENTING ABNORMAL SCUTES IN SEA TURTLE HATCHLINGS

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Variation in carapacial scute patterns among sea turtle hatchlings has gained attention over the past decade as a potential indicator for environmental stressors and genetic variability. Traditional methods of documenting these anomalies often categorize abnormalities as "present/not present," overlooking the frequency, type, and location of anomalies. This study introduces a standardized method for categorizing scute anomalies in loggerhead hatchlings by scute type and location on the carapace, providing a detailed framework for identifying patterns and assessing their prevalence across nesting sites and seasons. Data collected from 2022, 2023, and 2024 from Gulf of Mexico beaches in Florida revealed variations in scute anomalies, which may correlate with environmental conditions. Analysis showed the most frequent anomalies occurred in marginal and vertebral scutes, with side-specific differentiation allowing for detailed assessments of asymmetrical patterns. In 2024, Hurricane Debby significantly impacted nesting success, reducing the sample size and highlighting the vulnerability of sea turtle populations to extreme weather events. These results emphasize the importance of precise documentation and the need for conservation strategies addressing environmental stressors and climate change. This methodology provides a robust approach for comparing scute patterns globally, contributing to a deeper understanding of factors influencing sea turtle development.

## STATUS OF FIBROPAPILLOMATOSIS IN WESTERN AUSTRALIA

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Fibropapillomatosis (FP) is a globally distributed tumour-forming disease of marine turtles thought to be caused by chelonid alphaherpesvirus 5 (ChHV5). In Australia, reports of this disease have typically limited to incidental data. More recently, efforts increased to better characterise the spatial distribution of this disease and the associated viral variants along the coast of the eastern state of Queensland. Consistent with studies from other regions, the results of the Queensland studies showed that prevalence varies between sites and years, with juvenile green turtles (*Chelonia mydas*) being the most frequently affected by the disease. The viral variants were similarly consistent with other regions, clustering geographically and supporting the theory that the virus is likely transmitted horizontally at foraging grounds. However, the distribution of this disease and variants in other Australian states and territories has not yet been assessed. Western Australia hosts six of the seven species of marine turtle. This state has the longest coastline of all Australian states and territories, posing significant challenges to the monitoring of marine turtles. Though long-term monitoring has been conducted at several sites (both nesting and foraging) in Western Australia, reports of FP in this region are limited. Tumour samples from two nesting loggerhead (*Caretta caretta*) turtles were collected and analysed alongside the Queensland samples in 2017. The viral variants obtained from these samples clustered with others from northern Queensland. Opportunities to collect additional

samples have been scarce. Through a targeted project aimed at better understanding the health and disease status of marine turtles in Western Australia, FP tumour samples from four (n=4) juvenile green turtles and one olive ridley turtle (*Lepidochelys olivacea*; n=1) were archived for analysis. These samples were collected from a relatively wide geographic scope that included Rottnest Island, Roebuck Bay and Shark Bay. An additional 17 samples were collected from the Cocos Keeling Islands, a remote territory, 2600 km of the WA coast. To establish the viral variant associated with each sample, extracted DNA was then subjected to a validated PCR assay. The resulting DNA sequences were utilised to generate a phylogenetic tree that compared the Western Australian samples with published sequences from Australian and international locations. The results of the phylogenetic analysis highlighted that the Western Australian samples cluster with either the North Queensland cluster or the earlier sequences obtained from the nesting loggerheads. The similarity in viral variant sequences observed, despite the vast distance separating these study sites, warrants further investigation regarding habitat connectivity. Continued efforts are needed to better understand this distribution and elucidate why, given the similarities in viral variants, disease prevalence still appears to be relatively low.

## EXPLORING THE GUT MICROBIOME OF GREEN (*CHELONIA MYDAS*) AND HAWKSBILL (*ERETMOCHELYS IMBRICATA*) SEA TURTLES IN THE RED SEA AND ITS ROLE IN HEALTH AND DISEASE: THERAPEUTIC IMPLICATIONS

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The gut microbiome is essential for maintaining host health, influencing immune responses, digestion, metabolic function, vitamin and amino acid synthesis, and the gut-brain axis. Disruptions in host-associated microbiome, known as dysbiosis, can result from various factors such as stress, environmental changes, and antibiotic use and have been associated with numerous health disorders, including inflammatory and autoimmune diseases. Thus, understanding which beneficial microbial organisms are impacted during this shift from a healthy to a dysbiotic microbiome is important in developing clinical therapies. Even though advances in high throughput sequencing techniques have significantly expanded research on the gut microbiome of several hosts, much remains to be explored on marine hosts, such as sea turtles. Most prior research has relied on fecal or cloacal samples to infer sea turtles' gut microbiota composition. Although valuable, these samples are unreliable due to contamination from environmental and anatomical sources, potentially impacting the microbiome profiles. In a collaboration between King Abdullah University of Science and Technology (KAUST) and the General Organization for Conservation of Coral Reefs and Sea Turtles in the Red Sea (SHAMS), the first marine animal hospital has been established in the Kingdom of Saudi Arabia. In this clinical setting, we will examine the gut microbiome of green and hawksbill sea turtles using a novel sampling technique to directly access the distal colon to more accurately assess the intestinal microbial landscape than from cloacal sources alone. In this longitudinal study, samples will be collected weekly from hospitalized turtles and compared to those from wild-caught turtles. Comprehensive physical examinations and blood work will be conducted on the wild turtles to determine their health status. Only healthy wild-caught turtles will be used as a baseline reference for comparison. In parallel to the next-generation sequencing investigative approaches, this study aims to use culturing techniques to isolate beneficial bacteria from healthy wild sea turtles to develop targeted microbial therapeutics at the SHAMS/KAUST Center for Veterinary Care. While probiotics are increasingly recognized in conservation medicine, their use in reptiles remains largely unexplored and entirely novel for sea turtles. This research seeks to bridge this gap by creating a framework for the selection and use of probiotics that can restore the

gut microbiome of hospitalized animals, enhancing nutrient absorption and overall health to support effective recovery prior to release. Insights into the dynamic of the 'core microbiome' of these species could serve as a diagnostic tool for detecting disease or compromised immunity. By advancing our understanding of the gut microbiome's impact on sea turtle health, this study aims to refine clinical practices and ensure that hospitalized animals are returned to the wild in optimal condition.

## BIOMARKERS OF FORAGING AND REPRODUCTION IN CAPTIVE ADULT FEMALE HAWKSBILL SEA TURTLES (*ERETMOCHELYS IMBRICATA*)*

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Hawksbill sea turtles are listed by the IUCN as critically endangered. Due to their endangered status, conservation measures are important for the continuation of the species. To implement best practices for Hawksbill conservation, the biology of the animal should be well understood. Prior work indicates that the breeding strategy of free-ranging Hawksbill sea turtles in Bocas del Toro with regard to how they support their metabolism remains unknown. In general, captive and wild animals have different physiologies, but comparing the two can provide valuable insight on how wild animals may behave when inaccessible to humans. Captive Hawksbill samples are instrumental in providing a perspective to interpret the wild free ranging animals' results. The goal of this study was to explore biomarkers of foraging and reproduction in captive, female Hawksbill sea turtles. Captive animals were sampled at Okinawa Churaumi Aquarium in Okinawa, Japan for an entire year in 2018 and exhibited mating and laying over the course of sampling. We measured the concentration of β-hydroxybutyrate (BHB), triglycerides (TRG), and testosterone (T). BHB and TRG are foraging biomarkers, and at elevated concentrations should indicate fasting and foraging, respectively. T is a reproductive hormone which has been observed to gradually decline throughout a female sea turtle nesting season. BHB concentrations were significantly higher during the breeding season (April – July, $p<0.05$) compared to the non-breeding period (November – March). Analysis revealed that TRG concentrations were highest early in the breeding season (April – May), gradually decreased throughout the season, and showed a significant decline in October ($p<0.05$). Testosterone concentrations were significantly elevated during the breeding season, particularly in May ($p<0.05$), which marked the onset of mating. These results indicate that the animals are behaving as capital breeders and fasting during breeding season. Results also suggest TRG concentration is more related to reproduction than foraging in these animals.

## COLOUR PREFERENCE IN JUVENILE HAWKSBILL AND GREEN SEA TURTLES*

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Variations in ecological roles of sea turtle species may lead to differentiations in ocular design and visual sensitivity to the colour spectrum. The capability of green turtles and loggerhead turtles possessing visual components necessary for colour vision has been supported through electroretinograms and microspectrophotometry studies. Behavioural colour preference studies in air and in water on hatchling and post hatchling green turtles found evidence of a longer wavelength preference and a blue hue attractiveness when given a choice between blue, red, and yellow colours. This paper assessed and compared the colour preferences to singular colours via behavioural responses of hawksbill turtles and green turtles at 15 months of age and again at 22 months of age. Eleven hawksbill turtles and twelve green turtles were presented with one coloured water balloon per day (purple (400-450 nm), dark blue (450-490 nm), cyan (490-520 nm), green (520-560 nm), yellow (560-590 nm), orange (590-635 nm), and red (635-700 nm)) with a seven-month gap before repeating the study. Balloons were secured mid water and turtles were individually placed into their housing compartments opposite the stationary balloon. Latency time for turtles to contact balloons with beak and behaviours exhibited by turtles were recorded. Interaction with balloon colour was significantly influenced by species. Hawksbill turtles had the highest levels of interactions between balloons of shorter wavelengths with hue preference being between 450-490 nm. Green turtles consistently had the highest level of interaction to longer wavelengths with a yellow (560-590 nm) hue preference seen in both experimental phases. Smaller Hawksbill individuals have a longer cumulative contact time than larger individuals. On the other hand, no trend has been found for the green turtles. This study supports physiological differences between these two turtle species that may reflect variations in visual capabilities as a result of different ecological niches of hawksbill turtles and green turtles.

## UNRAVELING THE LONG-TERM IMPACT OF INCREASING INCUBATION TEMPERATURES ON NEONATAL LOGGERHEAD HEALTH

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Loggerhead sea turtles (*Caretta caretta*) are listed as endangered under the Endangered Species Act and on the IUCN Red List. Climate change, particularly elevated temperatures, poses a significant threat to this

species by negatively impacting their survival both in the ocean and on beaches. While previous work demonstrated that increased incubation temperatures adversely affect hatchling health, the possible long-term impacts on neonatal sea turtle health remain unclear. To begin to fill this large knowledge gap, we investigated the relationship between incubation temperatures and key blood analytes in neonatal loggerhead sea turtles (i.e., 4-5 weeks of age). Blood samples were collected from 114 neonates across 12 nests located in Boca Raton and Juno Beach, Florida. Key blood analytes (i.e., packed cell volume (PCV), total protein (TP), agarose gel electrophoresis (AGE), and capillary zone electrophoresis) were analyzed and compared to incubation temperatures. We found that neonates that incubated at higher temperatures had significantly higher PCV, and lower TP, albumin, beta-1, beta-2, and gamma globulins. The blood analyte shifts observed suggest that neonates that incubated in higher temperatures may be suffering from dehydration, malnutrition, and or immunodeficiency at 4-5 weeks of age. Prolonged suboptimal physiologic states such as these may negatively impact overall fitness and survival of a neonate in the wild. These data provide initial information to begin assessing the long-term negative impact of increasing incubations on neonatal health and possibly elucidate a cause for decreased survival in hatchlings incubated at higher temperatures. Ultimately, these findings can be useful for developing management strategies to mitigate the effects of elevated incubation temperatures in nature.

## A FIRST LOOK AT FUNGAL MICROBIOTA ON THE SKIN OF NEONATAL LEATHERBACK SEA TURTLES

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In recent years, there has been a significant rise in the prevalence of infectious diseases caused by fungi in marine ecosystems, presumably because of the rapid increase in ecological disturbances associated with anthropogenic climate change. Most fungi are opportunistic pathogens and increasing temperatures and regional shifts in precipitation can foster fungal overgrowth, dysbiosis, and ultimately lead to the development of fungal diseases. Unfortunately, research investigating fungi as a part of the microbiome is lagging far behind bacterial research and large data gaps persist. Filling these knowledge gaps is critical for imperiled species. The leatherback sea turtle is one such imperiled species and recent work has revealed that neonatal leatherbacks appear to be susceptible to fungal infections such as sea turtle egg fusariosis and mycotic dermatitis. Here we present the first fungal skin microbiota data from neonatal leatherbacks. Additionally, we identified shifts in measures of diversity that suggest increasing temperatures are altering the fungi present on the skin of neonatal leatherbacks. As the skin is a primary defense mechanism against the outside world, shifts in fungal organisms may result in disease and ultimately negatively impact overall fitness and survival. These data not only provide novel baseline fungal microbiota data but may also be used to elucidate a cause for the development of fungal infections and ultimately decreased survival of neonates that incubate at higher temperatures.

## ARGININE VASOTOCIN AND CORTICOSTERONE IN NESTING AND NON-NESTING LOGGERHEAD SEA TURTLES IN THE YUCATÁN PENINSULA*

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Arginine vasotocin (AVT) is a neuropeptide involved in various physiological processes. In reptiles, AVT has been shown to stimulate smooth muscle contraction in the oviduct, facilitating egg deposition. In sea turtles, AVT concentration has been shown to increase significantly during egg laying, peaking around mid-clutch. Before and after egg laying, sea turtles exhibit a distinct series of behaviors; however, not all individuals successfully oviposit. Some females display disruptions in their typical nesting behavior, returning to the water without laying eggs, referred to as a non-nesting emergence (NNE). We tested the hypothesis that external disturbances contribute to NNEs. We predict that increased corticosterone, the sea turtle stress hormone, inhibits AVT production, thus preventing the animals from nesting. To address this hypothesis, we collected blood samples (n=32) from nesting loggerhead turtles at the X'cacel-X'cacelito sanctuary in Quintana Roo, Mexico from June 7 to June 18. We collected samples from the dorsal cervical sinus during successful oviposition and NNEs and categorized samples according to oviposition stages and nest behavior: mid clutch (around 50% full; n=6), end of laying (more than 75% full; n=7), covering of the egg chamber (n=14), and NNEs (n=5). The primary aim of this study is to establish baseline data on the physiological mechanisms occurring during NNEs. AVT and corticosterone concentration analysis will help determine if these hormones are linked to disruptions in nesting behavior, and whether they can be considered physiological markers for NNEs.

## DEEP LEARNING BASED BLIND IMAGE DEBLURRING AS AN IMPROVEMENT OF IN-HOUSE MULTIMEDIA TOOL FOR SEA TURTLE IDENTIFICATION*

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Wildlife identification through multimedia material has become very common, as it provides researchers with various tools for species care and conservation. One of these tools is photo-identification, a non-invasive method that uses animal photographs to recognize unique markings that distinguish individuals. This method which uses computer vision techniques, that have advanced rapidly in recent years, is cost-effective compared to other tagging methods. This method allows researchers to gather specific data, which is essential to understand species conditions and establish conservation goals, such as animal population estimates. However, capturing photographic material in wildlife presents challenges, as it often takes place under uncontrolled conditions. Factors such as lighting, constant animal movement, heat distortion (caused by temperature differences between air and ground), and camera settings (such as shutter speed or dynamic range) may not always be optimized. While some of these settings can be adjusted, doing so for each shot would be time-consuming. Using sophisticated equipment could address some of these issues, enabling higher resolution trough sensors that capture a larger number of pixel or support high dynamic range (HDR) images. However, this would significantly increase the cost of the photo-identification method in wildlife settings. Additionally, some factors, like adding external lighting or slowing down the animal's movement,

are unfeasible in the wild. This is important because given the variability of motion blur and/or defocus, image quality is degraded and the accuracy of image analysis algorithms used in photo-identification methods is reduced. In this work, we present an algorithm capable of accurately identifying individual sea turtles in photographs that exhibit such blur variability. By incorporating an initial step using deep learning algorithms for blind image deblurring, our approach enhances image quality. This improvement allows for highly accurate identifications of sea turtles in uncontrolled environments using traditional low-cost multimedia capture devices, eliminating the need for sophisticated equipment and maintaining photo-identification as a cost-effective method. In addition, this implementation improves the accuracy of the in-house developed multimedia tool, addressing its current limitations and expanding the possibilities for wildlife identification with materials that challenge computer vision tools.

## BIOFLUORESCENCE APPEARS UNIVERSAL BUT VARIES BETWEEN SEA TURTLES SPECIES

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Fluorescence – the property of absorbing light of one wavelength (color) and re-emitting it at a longer wavelength – has been recently observed in the skin, scales, hair, or feathers of a growing number of animals. The first record of fluorescence in sea turtles was reported in 2015, when it was observed that hawksbill turtles (*Eretmochelys imbricata*) will emit intricate patterns of green and red light from their carapace while loggerhead turtles (*Caretta caretta*) will emit a uniform green light from the paler scales and scute on their ventral surfaces. To further investigate how these patterns differ among other sea turtle species by assessing for the presence of fluorescence in green (*Chelonia mydas*), olive ridley (*Lepidochelys olivacea*), and leatherback turtles (*Dermochelys coriacea*). Using a blue flashlight (Sola NIGHTSEA light, NIGHTSEA, USA) emitting in the 440 – 460nm range, we illuminated adults from each of the three species at night as they emerged from the water to nest onto Playa Cabuyal in northwest Costa Rica. For filming, we used a Sony A7S III low-light camera with a long-pass filter that blocked all wavelengths shorter than 500nm. In addition, we used the same setup to film juvenile green and loggerhead turtles in an aquarium (Oceanografic) in Spain. In adult green turtles, we observed a uniform green fluorescence all over the skin as well as a mix of green and red fluorescence on the carapace. Yet when examining juvenile green turtles in captivity, we only observed green fluorescence on the paler scales and scute on their ventral surfaces and we did not observe any red fluorescence. While this could suggest a difference in fluorescence between life-stages, we think a more likely conclusion is that most green fluorescence, and potentially all the red fluorescence, observed in green turtles in the wild could be caused by algae on the turtles' bodily surface. In adult olive ridley turtles, we observed a very dim, yellow-green fluorescence around the rim of the carapace and sides of the face, but it was largely absent from the flippers and the center of the carapace. Whether the relative lack of fluorescence in olive ridley turtles compared to green turtles is due to differences in their epibiotic algae communities or a true physiological difference between the species remains to be determined. Finally, in adult leatherback turtles, we observed dim green fluorescence on all

body surfaces as well as very prominent red fluorescence above the eyes, the corners of the mouth, and around the neck. Considering that the locations of the red fluorescence coincided directly with areas where leatherback turtles have high, superficial blood flow, we think that this is likely driving the observed patterns. We conclude that there are a variety of factors leading to the production of a wide range of fluorescent patterns in sea turtles and further research is needed to determine the ecological implications of this eye-catching phenomena.

## METAGENOMICS AND CULTUROMICS OF FREE LIVING *CHELONIA MYDAS* CLOACA SAMPLES

**Fernanda Sobral Short[1], Gisele Lôbo Hajdu[2], Rosane Silva[1]**

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The worldwide increase in antimicrobial resistance (AMR) is a global problem, due to the contamination of soil, water and animals using antimicrobials for fattening and disease prevention, as well as the uncontrolled use of antimicrobials by the human population. Efforts to deal with the spread of AMR require the adoption of a One Health approach. Bioindicator species are important to correlate with a particular anthropogenic factor or natural factor with potential impact and *Chelonia mydas*, is an example of a bioindicator species because they spend most of their lives in coastal environments, which exposes them to anthropogenic factors. Our objective was to evaluate the dissemination of microorganisms carrying resistance genes present in green turtles by comparing metagenomics and cultivation methods. Green turtles were captured in 2019 on Itaipu Beach, Rio de Janeiro, Brazil (SISBIO License - number: 71913-1) in partnership with the Aruanã Project. Samples of biological material followed the collection guidelines and standards. Cloacal samples from 16 green turtles were collected using sterile swabs and conditioned in DNA preservation medium for metagenomic analysis and in a rich culture medium. Metagenomic analyses were carried out on samples preserved in DNA preservation liquid and on cultured metagenomes (culturomes). The sequences generated were analyzed for taxonomy and resistance genes. We observed less diversity in the culturomes compared to the metagenome. In the latter, Bacteroidia, Alphaproteobacteria and Gammaproteobacteria predominated, in contrast to Bacilli, which were abundant in the culturomes. We found genes that confer resistance to antimicrobials widely used in human and environmental medicine, such as fluoroquinolones, aminoglycosides, rifampicin and multidrug resistance. The biomonitoring of marine habitats will be of great value in regulating preservation programs and restricting the discharge of pollutants into the environment and could partly prevent the spread of antimicrobial-resistant bacteria.

## THE INTESTINAL MICROBIOTA OF FREE-LIVING *CHELONIA MYDAS* IN GUANABARA BAY, RJ, BRAZIL*

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Guanabara Bay, located in the state of Rio de Janeiro, Brazil, is part of the metropolitan region and holds strategic importance due to its facilitation of activities such as fishing, navigation, and tourism. The bay hosts a diverse array of ecologically significant organisms but has suffered for decades from pollution, primarily from sewage discharge. This pollution introduces pathogens that can cause a variety of diseases. One resident species, *Chelonia mydas* (green turtles), is regularly exposed to these anthropogenic factors. Juvenile green turtles in polluted areas often present fibropapillomatosis, a disease characterised by the development of tumours. As bioindicator species, green turtles provide insights into environmental health, which has implications for human health as well, aligning with the One Health concept. This study aimed to identify bacteria and antimicrobial resistance genes present in the microbiota of free-living green turtles using culture-independent methods. Between 2022 and 2024, more than 200 green turtles were captured across three sites at Guanabara Bay: Charitas (CNC), Marina da Glória (MG) and Urca (FSJ) (SISBIO License: 71913-4). The first two places were visually more polluted than Urca. Metadata such as curvilinear carapace length (CCL, cm), curvilinear carapace width (CCW, cm), weight (kg), and the presence of fibropapillomas (FP) were collected. Turtles from CNC and MG showed a higher incidence of FP and larger tumours compared to those from FSJ. Cloaca swabs were collected and preserved in DNA stabilisation liquid for metabarcoding and metagenomic analyses. Microbial taxonomy was determined through PCR barcoding of the 16SrRNA gene, using the V6V7V8 region, followed by massive parallel sequencing on the S5 ion torrent system. Sequencing reads were analysed using a metagenomics plugin in the CLC Genomics Workbench, with reference to the SILVA database. Results from 63 cloaca samples (22 from CNC, 19 from FSJ and 22 from MG) revealed a predominance of genus Moraxella in polluted areas (CNC, MG), a genus of significance in both veterinary and human medicine. In contrast, the genus Psychrobacter, which includes environmentally adapted species, was more prevalent in FSJ. Non-cultivable genera were abundant across all sites, irrespective of FP presence. Alpha diversity was significantly higher in FSJ than in MG, suggesting that turtles in more polluted sites harboured distinct microbial communities compared to those in less polluted locations. The analysis of 16S sequences provided a comprehensive representation of the gastrointestinal bacterial community, much of which remains non-cultivable using traditional microbial techniques.

## HEALTH STATUS OF FREE-LIVING GREEN TURTLES OF GUANABARA BAY, BRAZIL

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Sewage discharge contributes to the nutrient-rich environment of Guanabara Bay (GB), located on the southeast coast of Brazil, in Rio de Janeiro. Green turtles serve as valuable marine bioindicators because

their coastal foraging habits, long lifespan, and transoceanic migrations make them sensitive to environmental changes. Guanabara Bay, Brazil's second-largest bay, is heavily impacted by urbanization, with industries, residential areas, and agricultural activities contributing significant waste to its waters. Despite significant pollution, the bay remains ecologically diverse and provides a critical feeding ground for green turtles. However, the full extent of anthropogenic impacts and potential pathogens on the bay's ecosystem and its green turtle population remains unclear. To address this gap, we investigated the health status of green turtles feeding in Guanabara Bay. Our study focused on the presence of antibiotic-resistant bacteria and fibropapilloma (FP) tumors, we also evaluated the turtles' body condition. Green sea turtles were intentionally captured using fishing nets, cloacal samples were collected with sterile swabs. Samples were preserved in DNA stabilization medium and rich culture medium for metagenomic and microbiological analyses. Metagenomic and cultured metagenomes (culturomes) analyses were carried out and the generated sequences were analyzed for taxonomy and resistance genes. Of the 107 turtles analyzed, 61% (n = 65) showed signs of fibropapillomatosis (FP). FP tumors were more common in turtles with a curved carapace length (CCL) of 40–65 cm (54.2%, n = 58) and an average to low body condition index (BCI: 1.11 ± 0.09). Enterobacterales was the most prevalent bacterial order (83.3%), with Citrobacter freundii emerging as the most common tetracycline-resistant pathogen. These findings indicate significant contamination from anthropogenic sources in the bay, as evidenced by resistance genes in the turtles' microbiome linked to antimicrobials commonly used in human and veterinary medicine. Despite its reputation as a polluted feeding ground, Guanabara Bay remains a key developmental habitat for juvenile green turtles. Our findings reveal their compromised health status and underscore the critical impacts of human activities and pathogens on these turtles and their environment.

## COMPARISON OF PLASTIC INGESTED BY GREEN SEA TURTLES (*CHELONIA MYDAS*) WITH AND WITHOUT FIBROPAPILLOMATOSIS (FP)*

**Rachel Theresa Southards, Heather Ann Seaman, Sarah L. Milton**

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Marine ecosystems are increasingly threatened by plastic pollution, with sea turtles being among the most vulnerable species. These reptiles, all of which are listed as vulnerable to endangered on the IUCN Red List, frequently ingest plastics, leading to severe physiological consequences such as gut compaction, perforation, and the leaching of toxic chemicals into their tissues. This study explores one potential impact of plastic ingestion on sea turtles, specifically comparing the types of plastics consumed by green sea turtles with and without Fibropapillomatosis (FP). The research investigates the different types of marine debris ingested by turtles across various habitats and ontogenetic stages. Necropsies were performed on 46 green sea turtles, and their gastrointestinal tracts were examined for plastic debris. The contents were processed using 10% KOH digestion, and debris larger than 2mm was categorized and counted using ImageJ software. The results showed that 81% of the FP turtles (17 out of 21) had plastic in their digestive tracts, while 63% of the non-FP turtles (15 out of 24) ingested plastic. In total, 742 pieces of marine debris were found, with 40% of this debris found in FP turtles. Polyamide, polyethylene, and polypropylene were among the most common plastic types identified. The most frequently encountered form of debris in both FP and non-FP turtles was filament, found in 69% and 72% of the cases, respectively. Black and white plastic pieces were the most common colors found. These findings suggest there are no significant differences in plastic ingestion between FP and non-FP green sea turtles. This study contributes to our understanding of plastic pollution in marine ecosystems and its potential links to the health of sea turtles, particularly those afflicted by FP.

## FROM SPRINTERS TO MARATHONERS: A MORPHOLOGICAL AND KINEMATIC COMPARISON OF LEATHERBACK SEA TURTLE SWIMMING AT DIFFERENT LIFE STAGES*

**Samantha Elizabeth Trail, Jeanette Wyneken**

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As hatchling sea turtles emerge from subsurface nests on the beach, they exhibit an innate hyperactive state: rapidly crawling to the water, followed by almost continuous swimming for 24-48 hours as they escape coastal, predator-rich waters. This "frenzy period" is dominated by powerstroking – characterized by elaborate ranges of motion of both forelimbs (flippers) bilaterally, as dorsoventral "flapping". Cheloniid sea turtles incorporate dogpaddling or "rear-flipper kicking" for routine swimming after the frenzy. In contrast, leatherbacks seem to continue powerstroking almost exclusively throughout life. How can we understand why leatherbacks only use the powerstroke? Unlike cheloniid sea turtles, sightings of neonate or juvenile leatherbacks at sea are virtually nonexistent. Their open-ocean life history makes the study of ontogenetic shifts and dispersal challenging and rare. We compared the powerstroke of over 60 leatherback individuals at two different life stages, as hatchlings and then as neonates. The turtles came from nests on the same nesting beaches in Southeast Florida, USA between 2022 and 2024. We hypothesize that morphological and behavioral shifts between life stages are reflected in kinematic differences in the powerstroke at different life stages. To test this hypothesis, hatchlings were collected on the day of nest emergence, measured, marked with high-contrast dots for motion tracking, placed in a sea water-filled tank, and swimming was video recorded at high resolution. Force data were collected synchronously with videos to measure thrust patterns in concert with flipper motions. Both force measures and video were sampled at high rates, allowing us to uniquely pair when in the stroke force is produced (i.e., upstroke versus downstroke) and identify the corresponding motion of the flipper (i.e., location and angle of the flipper) with peaks and troughs of force values within a single stroke cycle. Turtle swimming was compared as hatchlings and after 4-8 weeks of growth. We found (1) ratios of flipper length to straight carapace length decreased with age. (2) Flipper movements and thrust production patterns (force/time per stroke) differ across life stages and among individuals at the same life stage. These results identify ontogenetic shifts and individual variation. By using the same methodology to compare the well-studied movement of hatchlings, to the understudied movement of older neonates, we identified functional and behavioral differences that likely contribute to the mysterious early dispersal of leatherback sea turtles.

# HEMATOLOGICAL BIOMARKERS REFLECTING HEALTH STATUS IN *CHELONIA MYDAS* FROM THE GUANABARA BAY, RJ, BRAZIL

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Despite serving as a crucial feeding ground for juvenile green turtles (*Chelonia mydas*), the coastal area of Rio de Janeiro (RJ) is also a hub for significant anthropogenic pressures that adversely affect these animals. As sea turtles serve as environmental sentinels, monitoring their health is essential for marine conservation efforts. This study, carried out by the Aruanã Project, involved capturing 94 turtles using a gillnet at Marina da Glória, located in Guanabara Bay. Following capture, turtles underwent thorough physical examinations, and blood samples were drawn from the external jugular vein. The animals were then assessed for body condition, weight, behavior, reflexes, and fibropapillomatosis (FP) lesions. A total of 102 blood samples were collected from 94 individuals, with eight turtles sampled multiple times throughout the year. The clinical assessments revealed varying body condition scores: 54.4% displayed fair condition, 34% were in good condition, and 11.6% were in poor condition, hinting at nutritional deficits or underlying health issues. Nevertheless, all turtles exhibited active behavior and normal consciousness. FP was prevalent in 44.7% of turtles, with tumors primarily in soft tissues and the plastron. Polycythemia appeared in 17.4% of samples, while 5.9% showed regenerative anemia with polychromatophils. The mean red blood cell (RBC) count was 0.49 for FP-affected turtles, compared to 0.53 for those without. Leukocyte analysis showed lymphocytosis in 86.3% of FP-affected samples, accompanied by leukocytosis (68.6%), eosinophilia (59%), thrombocytopenia (52.3%), and heterophilia (45.4%). Both FP-affected and unaffected turtles exhibited elevated blood biochemistry parameters, with alkaline phosphatase (AP) and creatine kinase (CK) levels averaging 45.8 IU/L and 1,723 IU/L, respectively—considerably above reference values. Aspartate aminotransferase (AST) levels increased in 71.3% of samples, averaging 250 IU/L. Lymphocytosis and heterophilia likely stem from FP, while elevated uric acid levels suggest dehydration. Increased CK values may directly result from stress and muscle exertion during gillnet capture. The study's findings indicate that turtles at Marina da Glória face compromised health, highlighted by FP prevalence exceeding 40% and haematological abnormalities. The bay endures significant pollution due to urban runoff, industrial discharge, and untreated sewage, introducing heavy metals, chemicals, microplastics, and pathogens that threaten marine health, including that of sea turtles. Addressing these environmental challenges is crucial for preserving turtle health and maintaining the bay's ecological balance.

## CONSERVATION, MANAGEMENT AND POLICY

### FROM SHORE TO SEA: LIFE MARENATURA PAVES THE WAY TO THE 30*30 TARGET IN GREECE SHOWCASING PROGRESS ON IMPLEMENTATION SINCE THE LAUNCH OF THE PROJECT

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Aiming to protect nine vulnerable marine species, namely, the Mediterranean monk seal, the sperm whale, the Cuvier's beaked whale, the harbor porpoise, the common dolphin, the loggerhead sea turtle, the green turtle, the yelkouan shearwater and the Audouin's gull, LIFE MareNatura[1] project pioneers in applying cutting edge research methods to designate new marine protected areas in Greece and in Italy. Twelve institutions and organizations cooperate for the implementation of the project, under the coordination of the Hellenic Centre for Marine Research (HCMR), with beneficiaries, the Natural Environment and Climate Change Organization (NECCA), the University of the Aegean, the University of Crete - Natural History Museum of Crete, the National Observatory of Athens, the Italian Institute for Environmental Protection and Research (ISPRA), the NGOs Hellenic Ornithological Society, Hellenic Society for the Study and Protection of the Monk Seal, ARCHELON The Sea Turtle Protection Society of Greece and the Mediterranean Association to Save the Sea Turtles (MEDASSET), and the private companies Nature Conservation Consultants-NCC and WaterProof Marine Consultancy and Services BV. The environmental think tank The Green Tank is the project's policy specialist advisor. The project is implemented with the contribution of 75% of the LIFE financial instrument of the European Commission and the co-financing of the Green Fund and the Foundation A.G. Leventis, with a total of €10.7 million. To achieve its goals, extensive field surveys are being conducted, using advanced techniques like telemetry, bioacoustics, and environmental DNA sampling to gather data on species distribution, migration routes, feeding grounds and underwater noise. During the 1st year of the project, more than 4,500 nautical miles have been covered carrying out boat and aerial surveys, while 85 transmitters have been placed on seabirds and loggerhead turtles. The project will also map the threats of the targeted species and hence develop a decision-support tool and an integrated monitoring system to assess their conservation status and plan future management

strategies. Key components of the project include Policy actions for effective communication and interaction with the competent authorities and other stakeholders, as well as public awareness campaigns. Through the identification of key habitats within Greek and Italian territorial waters and the Exclusive Economic Zone (EEZ) for inclusion in the Natura 2000 network of protected areas, the project is aligning with the EU Biodiversity Strategy aka 30*30 strategy, which targets the protection of at least 30% of land and sea in Europe by 2030. LIFE MareNatura stands as the largest European project ever implemented in Greece for the protection of marine biodiversity.

## DESPITE CONSERVATION EFFORTS, THE STATUS OF SEA TURTLES IN THE DEMOCRATIC REPUBLIC OF THE CONGO (DRC) REMAINS CONCERNING

**David Angenda Mbuli**

*ICCN, Democratic Republic of the Congo*

The Mangrove Marine Park is a protected area created by Ministerial Order No. 0044/CM/ECN/92 of May 2, 1992. Located in the far west of the Democratic Republic of the Congo (DRC), the park spans 40 kilometers of coastline along the Atlantic Ocean. Since 1996, the Mangrove Marine Park has been recognized as a wetland of international importance and is listed under the Ramsar Convention. Three species of sea turtles visit the DRC coast. The beaches of the Marine Park serve as nesting habitats for the olive ridley turtles (which account for 99% of the nests) and leatherback turtles (1% of the nests). Green turtles are also observed at sea and as bycatch in fishing nets. Some observations of green turtles coming ashore but not nesting suggest a basking behavior similar to that observed in Hawaii (basking turtles). Each year, the Mangrove Marine Park, managed by the Congolese Institute for Nature Conservation (ICCN), implements a sea turtle monitoring program. Mating occurs at sea during September and October, while nesting begins on October 15 and ends in late February. From October 1 to March 31 each year, 50 eco-guards patrol the coastline of the Democratic Republic of the Congo. During these patrols, nesting activities are counted, and nests exposed to predation or erosion are transferred to hatcheries. Monitoring conducted since 2019, according to SWOT minimum standards, highlights a negative trend in olive ridley turtle nesting activities. The DRC coastline is also exposed to numerous threats, including: (1) the loss of nesting habitats due to significant erosion, leading to the disappearance of sandy areas; (2) poaching of nesting females and egg collection; (3) accidental capture by artisanal and industrial fisheries; (4) illegal fishing; and (5) plastic and oil pollution. The situation is therefore concerning, and additional resources are urgently needed to counter the current negative trend. The proposed actions to improve the conservation status of sea turtles in the Congo include: Fighting coastal erosion through nature-based solutions that can maintain or restore the sandy strip, a critical turtle nesting habitat; Combating poaching; Developing mitigation and avoidance measures for accidental captures; Tackling plastic pollution.

## SEA TURTLE PROTECTION IN INDONESIA: A REVIEW OF CONSTITUTIONAL AND CUSTOMARY REGULATIONS

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Sea turtles have been a conservation priority in Indonesia since 1978. Despite numerous regulations at national, regional, and local levels, their populations and habitats continue to decline. Effective management is often hindered by gaps and overlap in regulatory frameworks, which can lead to unclear jurisdiction, conflicting policies, and inefficiencies in enforcement. These challenges create barriers to coordinated conservation efforts, making it difficult to implement consistent and effective protection measures for sea turtles. This study assessed current national and provincial (Aceh) regulations for sea turtles using text mining and extensive review to identify strengths, weaknesses, gaps, and overlap. Subsequently, the local customary laws (Hukum Adat Laot) from Aceh were included as a case study to compare their approaches with constitutional laws in protecting sea turtles and their habitats. Analysis of 96 constitutional documents with 47 terms related to species, habitat, management, and protection revealed that six institutions have been appointed to oversee sea turtle conservation since 1978. Furthermore, significant regulatory and institutional overlap was also identified in almost all aspects of sea turtle conservation, with no single institution clearly mandated to manage and protect sea turtles. National and provincial regulations primarily emphasise management, which received the highest recognition across both levels of legislation (50.19% in Aceh laws and 43.03% in national laws), while largely neglecting critical aspects such as life-history stages and broader ecological needs. In contrast, Hukum Adat Laot demonstrated greater comprehensiveness, scoring 85% across species, habitat, management, and protection categories. While it provides detailed species and habitat protections, it also permits the use of eggs under strict conditions, including limited egg poaching for local consumption, highlighting the need for a balanced approach when integrating customary and constitutional conservation measures. Despite existing measures, regulatory fragmentation persists, leading to uncoordinated conservation efforts. We discuss the need for specific regulations that address life-history stages, assign clear institutional responsibilities, and incorporate customary law principles to create a cohesive and effective conservation framework.

## THE "ZERO-PLASTIC COASTLINE" GRASSROOTS PROGRAM TO PRESERVE SEA TURTLE HABITATS AROUND THE MAYANGE NA ELOMBO MARINE PARK IN SOUTHERN CAMEROON, WEST AFRICA

**Isidore Ayissi**

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The collection of plastic waste is a key component of the “Zero-Plastic Coastline” initiative, launched by the Sea Turtle Network in Central Africa (RASTOMA) and implemented by the Cameroonian Association for the promotion of Marine Biology (ACB) around the Mayange na Elombo Marine Park in southern Cameroon, Central Africa. This program is carried out in collaboration with local communities and is funded by SeeTurtle. It is a direct response to the significant impact of plastic pollution on endangered sea turtles and their habitats. The main objectives of this program are: To organize regular plastic waste

collection campaigns on sea turtle nesting beaches and promote waste sorting to reduce the presence of plastics and ghost nets in the coastal environment; To establish simple recycling units in coastal villages, where turtle-shaped plastic keychains are made to initiate a circular economy that benefits both local communities and sea turtle conservation efforts; To measure the amounts of marine litter found in the digestive tracts of dead, stranded sea turtles in order to assess the contamination of coastal and marine ecosystems, as well as food chains, by macro and microplastics. This program allows for: Concrete and urgent action to clean beaches and coastal habitats, limiting the impact of plastic waste on the environment, biodiversity, and human health; Establishing an initial diagnosis of the quantity and nature of plastics in the area. This diagnosis will serve as a foundation for strengthening permanent solid waste management systems in the region. As part of this initiative, recommendations were made to various stakeholders, including park managers, local councils, port authorities, and government services, to extend and support this initiative in order to protect sea turtles and their habitats in this critical protected area for the well-being of both wildlife and local communities.

## COLLABORATIVE EFFORTS TO REDUCE BYCATCH MORTALITY AND ENHANCE KNOWLEDGE FOR SEA TURTLE CONSERVATION IN THE SOUTHWEST INDIAN OCEAN

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Interactions between sea turtles and longline fisheries represent a significant threat to these species and their populations. Since 2006, in Reunion Island, the Kelonia Care Center has partnered with local fishermen to address this challenge. Fishermen willingly report and return bycaught turtles to Kelonia, where they receive medical treatment, and are released back into the ocean once fully recovered. Over the past 24 years, 583 turtles have been admitted to rehabilitation for various reasons, with 72% of cases directly linked to fishermen's contributions. In recent years, the SaveTurtleRUN project, launched as part of this initiative, has significantly increased participation among fishermen. Starting with just one captain in 2000, 81% of captains (n=43) are now actively involved. Annual training and experience-sharing sessions since 2013 have empowered fishermen with safe and adapted turtle-handling techniques. In 2024 alone, fishermen successfully released 42% of by-caught turtles (n=79) directly into the sea using specialized techniques and tools provided by the project. Additionally, 40% of them were brought back alive to the care center, while 18% were returned already dead for necropsy purposes. Fishermen also contribute valuable data on fishing practices, such as hook type and size, bait type, and GPS coordinates, enhancing scientific understanding and conservation measures. Care centers like Kelonia serve as a vital interface, facilitating access to species typically found in challenging marine environments. This significantly enhances research opportunities by providing a unique and invaluable source of data. Particularly impacted by bycatch, loggerheads (n=318) and olive ridleys (n=23) have been central for research efforts. Beyond the monitoring required for treatment purposes (e.g., physiology, morphology, biometry), studies have also focused on satellite tagging to monitor both vertical and horizontal movements, along with analyzing diving profiles of loggerheads to better understand their foraging strategies and habitat use, genetic studies to explore population connectivity, assessments of plastic ingestion (positioning loggerheads as bioindicators for plastic pollution in the Southwest Indian Ocean), and isotopic signatures to clarify their trophic roles. These integrated approaches provide critical insights into the health and ecology of marine turtles while also helping identify emerging threats, ensuring adaptive and effective conservation strategies. In addition, Kelonia shares its findings through initiatives that engage children and adults, raising awareness and responsibility for the marine environment. These programs are

vital for sustaining long-term conservation efforts and promoting the protection of marine turtles. This long-standing partnership demonstrates the tangible conservation benefits of interdisciplinary efforts, combining fishermen's expertise and commitment with Kelonia's care and scientific knowledge. It served as a potential mitigation measure for bycatch-related mortality, reflected in the decline of mortality rates among impacted loggerhead and olive ridley turtles—from 55% in the early years (n=22) to 20% in the past three years (n=112), demonstrating improved rehabilitation outcomes. Moreover, it has expanded scientific knowledge, raised public awareness, and strengthened advocacy for sea turtle conservation. Future collaborations will focus on microbiota assessments, skeletochronology, isotopic signatures, and deeper understanding of post-release survival rates following incidental catches.

## ENVIRONMENTAL RESPONSIBILITIES OF COMPANIES ON THE PROTECTION OF MARINE AND COASTAL SPECIES IN WEST AFRICA

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Corporate social and environmental responsibilities (CSR) towards the protection of marine and coastal species in West Africa are part of a legal, ethical and societal framework that is increasingly important in various coastal countries. Companies operating in West Africa, particularly in sectors related to the sea and the coast (ports, construction of infrastructure, energy, oil well drilling, land, river and maritime transport, fishing, tourism, etc.), have an essential environmental responsibility in the protection of marine and coastal ecosystems. These ecosystems are home to exceptional biodiversity including several species of sea turtles, whales, African manatees, mangroves and many fish species, some of which are classified as endangered. Companies here therefore have key roles to play in protecting these environments and ensuring their sustainability. In Brazil, the oil company PETROBRAS and NGOs support the TAMAR Project, which is a great example of success in protecting sea turtles and other endangered species. It includes protection centers along the Brazilian Atlantic coast and environmental education programs. In Gabon, several companies (BW Energy, Perenco) and organizations also actively contribute to the protection of marine and coastal species, including sea turtles. Some oil companies operating there, support conservation initiatives in partnership with local and international NGOs. These initiatives include the protection of marine habitats and the promotion of sustainable fishing practices. These efforts show the importance of collaboration between companies, NGOs and local communities for the conservation of marine and coastal species in Africa. For several years now, in Benin, experiments have been underway to engage companies in the context where existing texts are very little implemented for various reasons including the lack of generalized environmental awareness. Some ongoing actions are taking place with great success in the context of supporting NGOs for the implementation of certain CSR policies. More and more constructive debates are being held on important subjects including the negative impacts of major construction works on coastal roads, artificial lights on turtles and seabirds. Bright lights on beaches, often caused by artificial lighting from tourist infrastructure, homes or industrial facilities by the sea, have significant impacts on marine and coastal biodiversity, particularly on sensitive marine species such as sea turtles, birds, as well as on coastal ecosystems in general. Today, ports (PAC), container ship owners (CMA-CGM), companies building roads and infrastructure at sea and on the coast (SOGEA-SATOM, BOSKALIS; SDI-DEME) are committed to the preservation of these marine species. Although this is new in Benin thanks to their international subsidiaries, the current experiences can serve as a starting point for the amplification of measures in the countries of the sub-region in more responsible commitments in order to better protect marine and coastal resources severely negatively impacted by the major developments of coastal cities in Africa.

# THE COLLABORATION BETWEEN OKRA PROJECTS AND THE SARDINIAN REGIONAL NETWORK FOR THE CONSERVATION MANAGEMENT OF SEA TURTLE NESTS BY RAISING AWARENESS OF LOCAL STUDENTS AND CITIZENS

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All the seven of the sea turtle species are threatened and protected worldwide due to direct human impacts and to the altering of natural conditions of their habitats. In Sardinia (Italy) the loggerhead sea turtle (*Caretta caretta*) is the most common marine turtle, that is currently under a strong protection program by the Sardinian Regional Network for the conservation of marine wildlife (SRN). Since the year 2000, almost 1000 sea turtles have been rescued by seven of the Rescue and Emergency Centers, which represent the main partners of the network. However, in later years, more attention was focused on both the management of nesting sites along the coasts of the Island (reaching more than 60 nests) and on the marine litter analysis ingested by alive and dead sea turtles. The protocols issued under the Marine Strategy Framework Directive through the projects related litter monitoring (INDICIT, MEDSEALITTER, BASEMAN) allowed us to involve extra-Mediterranean partners. These partners are located in northern Africa, where the pollution problem needed more attention. Within the scope of these activities, a collaboration was initiated between the National Research Council (CNR) and Okra Projects, a Ghanian NGO operating to support education within the Turtle Conservation and Recycling fields. Okra has been working with turtle conservation since 2021. During that year, Okra started some educational programs in the area of Beyin (Western Region) like a turtle conservation program with some schools in that area, in hopes to raise awareness with students and adults regarding the problems related to pollution and sea turtle conservation. During the past three years, the number of villages involved has increased to six along a 15 Km range of coastline. Since there was a lack of information and knowledge; the SRN began cooperating with Okra to create a scientific partnership using this new approach to share this important knowledge with its members and volunteers. It is a known fact that sea turtles lay their eggs on the beaches, and this represents a food source for many countries; in fact, sea turtles and their eggs still represent a food resource for many countries, despite that they are protected by law in Ghana. In conclusion, the aim of this work is to improve the management of sea turtle nests and increase the hatching success of relocated eggs to the protected areas. During the first year of this collaboration there was a noticeable and positive improvement with regard to the collaboration involving the local citizens and hatchlings which allowed them to reach the ocean safely.

## AIDING SEA TURTLE CONSERVATION THROUGH COASTAL MONITORING AND MODELING*

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Climate change and human activity pose many different challenges to sea turtles, including the flooding and erosion of their nesting beaches. The latter closely parallel issues studied and monitored by coastal scientists—for example high water level events, beach groundwater dynamics, or structural beach erosion due to a combination of sea level rise and human infrastructure (coastal squeeze). Methods and tools used in coastal science therefore hold significant potential for sea turtle conservation, specifically coastal monitoring and modeling. These are critical in the design and assessment of potential nature-based solutions that mitigate coastal threats to nesting beaches and might even help expand global nesting habitats. Examples of such solutions may include turtle-friendly beach nourishments, artificial reefs, and coastal vegetation aimed at reducing erosion and flooding. Despite these overlaps, collaboration between the scientific sea turtle and coastal communities remains limited. Monitoring nearshore hydrodynamics and beach groundwater can help understand the processes behind the repeated flooding of turtle nests on the beach. Long-term beach monitoring and coastal remote sensing tools (e.g., satellite-derived shoreline data) can provide information on how nesting beaches have evolved over the past decades and continue to change today, even in remote areas. Such monitoring efforts are essential for informing predictive coastal models, which can simulate how nesting beaches might respond to environmental shifts (e.g., sea level rise and intensifying storms) and assess the impact of potential nature-based solutions. For example, many studies have assessed the impact of sea level rise on turtle nesting beaches by combining a higher mean sea level with a digital elevation model of the beach. However, beach response to sea level rise depends on a complex interplay of many different variables, and therefore requires complex models to predict. Combined with data science and machine learning techniques, these models can also help upscale findings from local case studies to more regional scales. Here, we present an overview of work conducted over the past four years, where coastal monitoring and modeling techniques were employed to aid sea turtle conservation science. We share findings from extensive field campaigns monitoring hydrodynamics and groundwater levels at nesting beaches in two contrasting coastal environments (Texas, USA, and Ostional, Costa Rica). Additionally, we demonstrate how large-scale coastal datasets, combined with machine learning, were used to (1) identify patterns in the global distribution of turtle nesting; and (2) detect beach evolution trends at several nesting hotspots around the world using satellite-derived shorelines. Through these examples, we aim to inspire more interdisciplinary collaboration by bridging the gap between sea turtle biology and coastal dynamics and showcasing how coastal monitoring and modeling tools can be effectively leveraged in sea turtle conservation.

## LONG-TERM EROSION TRENDS ON IMPORTANT SEA TURTLE NESTING BEACHES IN THE NORTH PACIFIC OF COSTA RICA*

**Keilor Enrique Cordero Umaña[1,2], Pilar Santidrián Tomillo[2]**

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Sandy beaches are highly dynamic ecosystems and represent key habitats for sea turtle breeding. However, nesting beaches are subject to constant erosion processes produced by high tides, storms, and rising sea levels, which results in nesting area losses and reduced clutch survival. Therefore, it is important to evaluate and quantify the occurrence of erosion over time to understand its potential impacts on sea turtle nesting populations. With this aim, we used publicly available satellite imagery to evaluate changes in shoreline position over 40 years on several important sea turtle nesting beaches in North Pacific Costa Rica. Our results showed that beaches in the North Pacific have lost suitable nesting areas in the last decades. The erosion rate varied between the studied beaches and within each beach, suggesting a differential level of risk for sea turtle clutches. Given the current rates of sea level rise, higher extreme storm frequency, and the constant development pressure, beach erosion could be exacerbated in the region. Shoreline data is key to evaluating these changes and also to predict the potential different effects on each sea turtle nesting beach. Publicly available resources, such as satellite imagery, can help to fill in existing data gaps on erosion long-term trends and contribute to the conservation management of sea turtles.

## EFFECTIVE SEA TURTLE CONSERVATION STRATEGY IN GRAND-BEREBY, COTE D'IVOIRE

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Since 2010, the NGO Conservation des Especes Marines (CEM) has been based on the 54-km coast of Grand-Bereby in the San Pedro region of Cote d'Ivoire, carrying out activities to protect marine turtles in an important nesting and feeding area for olive ridley, green, leatherback and hawksbill turtles (as well as occasional loggerheads). Back in 2010, local communities were involved in poaching sea turtles and collecting the eggs for consumption or for sale, without understanding how vulnerable these species are and the importance of these nesting sites in their life cycle. We therefore started working with the communities to protect turtles and their habitat, while providing support for local sustainable development in harmony with the environment. We will describe here the development of infrastructure and livelihood initiatives that we carried out in the communities, which generated a strong and lasting support for conservation, which in turn resulted in each village ruling authority banning all sea turtle exploitation. As a direct consequence, all poaching in the area was halted and protection for all sea turtles became self-policed by the local communities. In addition, the presence of turtles has allowed CEM, in partnership with area hotels, to promote ecotourism in the region which also benefits the local population. CEM has also acquired and placed at the disposal of the Maritime Police of Grand-Bereby a patrol boat that is essential in the fight against illegal trawling (which benefits the local artisanal fishermen as well) and therefore in the protection of important marine habitats, sea turtles and more than 20 species of sharks and rays. In addition to the local communities, CEM are now supported by a range of local and international partners,

and by the regional and national authorities. Thanks to CEM's work, the government created in Grand-Bereby the first Marine Protected Area of Cote d'Ivoire in July 2022.

## TURTLE & NATURE PARK: A HOPE FOR MARINE TURTLE RESCUE & REHABILITATION IN SENEGAL

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Wildlife Recovery Centers have as their main objective the rehabilitation of injured or sick protected fauna. In the Canary Islands, there are currently three Recovery Centers (Fuerteventura, Tenerife, and Gran Canaria) that take care of thousands of wild animals every year. These centers are also ideal places to carry out outreach and environmental education projects where visitors can see first-hand, e.g. the consequences of pollution on wild animals, and how humans can reverse some of their main threats. Among the main threats are runovers, collisions, electrocutions, poisoning with toxic substances, and predominantly the presence of plastic and nets in the sea that seriously affect marine species such as turtles. In this sense, only in the year 2022 on the island of Tenerife, a hundred loggerhead sea turtles (*Caretta caretta*) had plastics in their digestive content, in addition, more than 90% of these animals had also suffered "entanglement" with marine litter. The creation and/or modernization of Wildlife Recovery Centers in the cooperation area (involving the Canaries, Azores, Madeira, Cabo Verde, Senegal, Mauritania, Ghana, Ivory Coast, Gambia, and São Tomé and Príncipe), will profit from the experience of the Cabildo de Tenerife (which manages the Tahonilla Recovery Center). This new Recovery Center Network will enable a common working framework, that will enhance the conservation of marine and migratory species present in the cooperation area. In this way, the Turtle & Nature Park in Joal in Senegal-West Africa has been designed not only as significant improvement in the conservation of marine turtle and migratory species will be made, but also contributes to the protection of our natural heritage, and Biodiversity. On one hand, this project would suppose what is colloquially called "a win to win" since all the regions would benefit from the established synergies between the different countries, and on the other hand, we will all learn effective actions that work and serve as a model for other regions. In this sense, technical projects for the implementation of Recovery Centers would be developed and specific training exchange programs with long-term stays on the island of Tenerife would be organized. Experts in Wildlife Recovery Centers management of the Canary Islands would share their experience with technicians and public employees of the involved countries. In addition, through the collaboration of the Canary Islands Universities, procedures would be carried out to enable the exchange of samples of injured animals, in order to analyze the presence of poisons and/or emerging diseases. Finally, taking into account that these centers will become future green infrastructures that could serve as places of environmental awareness and specific environmental education plans that promote sustainable tourism in the involved regions, enabling the creation of a green economy.

## PROGRAMA TATÔ: AN INTEGRATED APPROACH TO SEA TURTLE CONSERVATION ON SÃO TOMÉ ISLAND, WEST AFRICA

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Located in the Gulf Guinea, São Tomé and Príncipe is a Portuguese-speaking, two-island nation with approximately 215,000 inhabitants. It is recognized among the world's top 25 biodiversity hotspots, hosting key nesting and foraging habitats for hawksbills (*Eretmochelys imbricata*) and green turtles (*Chelonia mydas*), as well as a significant rookery of olive ridleys (*Lepidochelys olivacea*) and a small population of leatherbacks (*Dermochelys coriacea*). Loggerheads (*Caretta caretta*) are also occasionally sighted in these waters, further highlighting the ecological value of the archipelago. Historically, sea turtles have been exploited for commercial, cultural and subsistence reasons, with trade representing an important source of income for local communities. Today, pressure from unregulated fishing, rising poverty, declining fish stocks, and an increased demand for animal protein due to rapid human population growth (1.92% annually) have driven local fishers toward more destructive practices, including sea turtle harvesting, which contributes to the degradation of coastal and marine ecosystems. Conservation efforts began in the 1990s, but it was only in 2018 that Programa Tatô formally become an NGO, engaging a broad network of stakeholders to address São Tomé's conservation and socio-economic challenges. Recognizing that sea turtle conservation demands a holistic approach, Programa Tatô has implemented an integrated conservation approach to protect key habitats and foster sustainable community development. This community-based program combines research, ecological monitoring, protection of critical sites, environmental education, advocacy, and alternative livelihoods, such as ecotourism and the reconversion of former harvesters and traders into new roles. Programa Tatô now includes a team of around 60 members, 90% of whom are São Tomé nationals. These efforts are specifically designed to tackle the diverse, interlinked challenges to sea turtle conservation, enhance scientific understanding of all sea turtle species found around São Tomé Island, and promote collaboration between fishing communities, national authorities, and the public. Through research and monitoring, we collect critical data on nesting trends, population dynamics, and anthropogenic pressures, which inform adaptive management strategies and targeted conservation actions. Today this conservation program has fostered widespread public awareness and appreciation for sea turtles. By engaging communities in the conservation process, we are not only shifting current attitudes towards these species and the broader marine ecosystem but also inspiring a lasting cultural change. Through Programa Tatô's environmental education initiatives, we are fostering a sense responsibility and care in future generations, encouraging young people to grow into lifelong advocates for their natural heritage and dedicated supporters of marine conservation. Here, we outline Programa Tatô's conservation strategy, highlighting key intervention areas and sharing valuable insights gained, while emphasizing the importance of an integrated, multidisciplinary, community-centered strategy, to ensure that São Tomé's unique marine biodiversity continues to succeed and contribute to global conservation priorities.

## NEST DOMES: THE NEW ALTERNATIVE TO COMBAT CLIMATE CHANGE IN THE SEXUAL DETERMINATION OF SEA TURTLES

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The TSD (Temperature dependent sex determination) refers to the determination of the sex or gender of sea turtles by temperature, this is defined during the second third of the incubation period of each species, which is known as PTS (thermosensitive period); the temperature of the PTS where a proportion of 50% of each sex is achieved, that is, females and males, is known as "pivot temperature". If in the incubation period, the average temperature oscillates between 25 to 27°C, the majority of the turtles will be males, while from 28 to 32°C they will be females. Currently, the effects of climate change are reflected in different ways in everyday life, and unfortunately, sea turtles are no exception. With higher temperatures recorded on our beaches, most of the baby sea turtles that hatch are females, which will be a problem in the future, since there will be an imbalance, with a large number of females without males to reproduce with. Fortunately, there is a new tool that can provide a solution: NEST DOMES, the first natural domes made from tropical wood, which regulate temperature thanks to their design that allows air circulation, thus providing freshness to the nest's temperature, helping to achieve a 1:1 sex ratio. This project was implemented on the Mexican coast, in the area of Rancho San Cristóbal, Baja California Sur, Mexico, by placing data loggers in protected nests in a corral, resulting in a temperature regulation of 4ºC, comparing a nest with data logger control and another without it. The results are preliminary, but they are a step towards a tool for regulating temperature and future sexual proportion in sea turtles.

## STUDYING CONFLICT AND COOPERATION ASSOCIATED WITH SEA TURTLE CONSERVATION*

**Achsah Steffi John, Andrea D. Phillott**

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Efforts to conserve biodiversity, including sea turtles, can result in cooperation or conflict among different actors depending on their interests, principles, engagement, and agreement when developing and meeting conservation objectives. Understanding the variables leading to these different states can help to inform the conservation and management of sea turtles and their habitats, by facilitating a state of cooperation instead of conflict. We are examining scenarios of cooperation and conflict associated with sea turtle conservation through a systematic scoping review of peer-reviewed publications from around the world. Our objective is to describe the conceptual framework (e.g., Social Ecological Systems, Human-Environment Interaction Model, Conservation Conflict Diagnostic Framework) and methods (e.g., ethnography, conflict mapping, stakeholder mapping, interviews, focus group discussions, Q methodology) used by researchers to identify and characterise cooperation and conflict situations in different contexts and highlight successful paths for strengthening cooperation or resolving conflict. We are currently reviewing >200 papers to extract data on the sea turtle species and RMU, location, interaction state (cooperation or conflict) and focus (e.g., ecotourism, community-based management, illegal take, governance), actors involved, and other information relevant to the study objective. Understanding the

strengths and potential weaknesses of approaches that have been used to understand conflict and cooperation associated with sea turtle conservation in the past will help emerging researchers in this field meet challenges of the United Nations Decade of Ocean Science for Sustainable Development (2021-2030) (e.g., #2 Protect and restore ecosystems and biodiversity and #4 Develop a sustainable, resilient and equitable ocean economy) and goals of the 2030 Agenda for Sustainable Development (e.g., #14 Life Below Water).

## CONSERVATION AND MANAGEMENT OF SEA TURTLES IN SRI LANKA

**Thushan Jayalath Kapurusinghe**

*Turtle Conservation Project, Sri Lanka*

Sri Lanka is an island nation situated at the Southern point of India, separated from the mainland by the shallow seas of the Gulf of Mannar. The island has a 1,585 Km coastline and is 353 km from north to south and 183 Km at its widest point, covering a land area of 65,610 Km². Five species of sea turtles (Green, Olive ridley, Leatherback, Hawksbill and Loggerhead) are found nesting in Sri Lanka. Green turtle is the most common nesting turtle species in Sri Lanka. Although the nestings are reported throughout the year, peak nesting season is between March and June. Key nesting sites are located at Benthota, Induruwa, Kosgoda, Rekawa, Kalametiya and Bundala (Kapurusinghe, 2006). Olive ridley is the second common nesting turtle in Sri Lanka based on TCP beach surveys and long-term nesting data. Nesting season is between December and April and the main nesting sites are located at Benthota, Induruwa, Kosgoda and Panama areas. The Leatherback is the third common nesting turtle species found in Sri Lanka. Peak nesting season is between April and July. Ussangoda-godawaya, Rekawa, Tangalle and Bundala are the main nesting sites for leatherbacks. The Hawksbill turtle is not a common nesting turtle species in Sri Lanka. Benthota, Induruwa and Kosgoda are the key nesting sites. The species Loggerhead is probably the rarest of all marine turtle species found in Sri Lanka. Although the loggerhead turtles are quite common and widely distributed in the global context, morphological differences (mainly the colouration) suggest that the Sri Lankan loggerhead population can be a distinct and unique population that must be considered as a separate management unit. Despite the legal protection, marine turtles in Sri Lanka are still being exploited for their eggs and meat. In addition, turtle nesting beaches are being disturbed by tourism development activities and foraging habitats, such as sea grass beds and coral reefs are being destroyed by destructive harvesting practices and marine pollution. Thousands of marine turtles are accidentally caught and drowned in fishing gear around the island and this can be considered as the most negatively affecting threat for the survival of marine turtles in Sri Lanka. Although the nesting turtles are protected in National Parks (NP) such as Yala NP, Kumana NP, Wilpattu NP etc., natural predators such as wild boars, jackals, water monitors and land monitors consume the eggs and hatchlings in National Parks. In addition, dogs have been reported attacking nesting turtles and eating turtle eggs and hatchlings. In-situ sea turtle conservation programme is conducted at Rekawa turtle sanctuary by TCP, NFR and the department of Wildlife Conservation as a collaborative project. Educational programmes are being conducted enhancing the community knowledge on sea turtles. Ex-situ conservation practices are implemented by the turtle hatcheries which are mainly located along the southern coastal areas. NARA, Wildlife department and the Coast Guard department are the key government institutions in Sri Lanka which carry out turtle research and conservation activities. TCP and NFR are the main NGOs involved in turtle conservation activities.

## NETWORKING, COORDINATION AND COOPERATION IS CURCIAL TO CONSERVE ENDANGERED AND MIGRATORY SEA TURTLES: THE REDTORCAN PROJECT IN CANARY ISLANDS

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Identify main threats and evaluate their impacts on a specie or a specific population, is essential to conduct conservation assessments at local and global scales, and for guiding conservation management strategies and policy. For sea turtles, monitoring population status and their threats is particularly challenging because of their scale of distribution, migratory nature, complex life cycles, long generation times and cryptic early life stages. In the last IUCN Red List global status review, the loggerhead turtle (*Caretta caretta*) is categorized as "vulnerable" based on the "increasing trend" registered by some subpopulations, but with many subpopulations categorized as "data deficient", due to the lack of information for many parts of their global range. In many cases, most part or the information is obtained on the breeding sites, where animals are more accessible, but few data are obtained from their other life stages. Stranding networks and rescue centers attending sea turtles worldwide are distributed in the shores of many countries, but they usually work independently, uncoordinated and without any communication between them, or with other groups working in marine fauna conservation. In many cases, different criteria are used for treating the animals, and different kind of data are collected from each turtle. This establishes a great barrier to know the global status of some populations, restricting the assessment of their threats in specific areas or life stages. In the Canary Islands, due to its archipelagic orography, each island has developed their own system to attend stranded sea turtles, with, in many cases, different criteria between them. The Project REDTORCAN ("Implementation of the coordinated network for stranding sea turtles in the Canary Islands"), aims to establish a coordinated network in the Canary Islands to reinforce and improve the attention to stranded sea turtles, and the adequate collection of standard data and biological samples, to identify potential threats and impacts, and transfer the homogenized data obtained in this important region to the monitoring programs at a local, national or international levels (Marine Strategy Framework Directive, OSPAR Convention, Barcelona Convention, etc.).

## BLUE CORRIDORS FOR TURTLES

**Christine Anne Madden[1], Hugo Bourgogne[1], Marc Oremus[1], Lily Bentley[2], Daniel C. Dunn[2], Andrew DiMatteo[3], Brendan Hurley[4,5], Zachary Posnik[4], Arjan de Groene[1], Nathalie Houtman[1], Gavin Jolis[1], Andrew S. Maurer[6], Eduardo Videira[1], Soraya Wijntuin[1], Michael P. Jensen[1]**

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After decades of conservation efforts, six of seven turtle species remain threatened, with many populations in decline and some sliding towards extinction due to unsustainable human activities and climate change impacts. Traditional conservation efforts are often undertaken in isolation and focus on local nesting beaches, overlooking the oceanic habitats where turtles spend most of their lives. This has created critical knowledge gaps, with data often incomplete, regionally biased, skewed towards nesting females and not publicly available. Conservation of turtle populations is further hindered by limited information on which genetically distinct populations exist and where, as well as uncertainties about which population is being impacted the most. To address these gaps, a better understanding of how turtles are connected locally and across ocean basins is needed, to act at scale and with greater impact. Fortunately, there is a growing movement and urgency to improve ecological connectivity for migratory species, like marine turtles. As a result, practitioners, policymakers and communities are calling for a shift towards comprehensive and collaborative approaches to marine turtle conservation. Here, we introduce the Blue Corridors for Turtles project, an initiative that aspires to be a pivotal force for marine turtle conservation on a global scale. Together with the marine turtle community, we aim to compile comprehensive satellite tracking, nesting and genetic data (from ShellBank) for all seven species, to assess and map transboundary migrations, enhancing our understanding of key habitats and movement patterns. By identifying critical habitats (as Important Marine Turtle Areas) and assessing geographically distributed threats, this framework seeks to identify the most at-risk populations in need of urgent protection and provide tools and products at global and regional scales to support long-term recovery efforts. Building on previous global-scale projects such as Regional Management Units, these tools and products, particularly the Important Marine Turtle Areas, will give turtles 'a seat at the table' of global conservation efforts and address underrepresentation compared to other marine taxa like seabirds, marine mammals, and sharks and rays. Defined by tracking and tracing all seven marine turtle species from nesting beaches to foraging grounds through genetic data (ShellBank) and satellite tracking, Blue Corridors for Turtles will deliver new insights and provide data-driven science for governments to deliver on their commitments under the Global Biodiversity Framework, including, the 30x30 agenda, High Seas Treaty, and sustainable development goals. This initiative is particularly relevant for coastal communities dependent on marine turtles for food security, livelihoods, and cultural practices, as we will also map and connect communities working on marine turtles to help foster regional connections and strengthen management outcomes. Then together, we can target conservation efforts to the populations and places that are most vulnerable. The Blue Corridors for Turtles project thrives on the expertise and collaboration of international commissions, research institutions, NGOs, universities, private companies, and local communities worldwide. Together, we form a global network dedicated to more effective marine turtle conservation actions across government and community scales. We look forward to engaging the community to make these products and processes a reality.

## REPURPOSING FOR CONSERVATION: A RECYCLED FLOATING STATION AS A SEA TURTLE REHABILITATION CENTER ON THE KERKENNAH ISLANDS*

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The Kerkennah Islands play a critical role in the life cycle of sea turtles in the Gulf of Gabès, particularly as a feeding habitat for loggerhead turtles (*Caretta caretta*). The islands' shallow, warm waters provide a safe refuge for juvenile and adult turtles, offering protection from deep-sea predators. However, intensive fishing activities around the Kerkennah Islands contribute to substantial bycatch, posing serious threats to sea turtle populations. Such incidents often result in injuries that require rehabilitation and close monitoring prior to release. Due to the islands' remote location and the logistical difficulties in transporting injured turtles to specialized care facilities, these turtles face heightened health risks. In 2024, an abandoned aquaculture cage washed ashore on the Kerkennah Islands was transformed into a floating rehabilitation station, serving as a localized care facility for turtles impacted by bycatch. Financed by the Specially Protected Areas Regional Activity Centre (SPA/RAC), This station not only enables turtle rehabilitation within their natural habitat but also fosters environmental education and ecotourism. Since June 2024, the station has received twenty loggerhead turtles, incidentally captured in fishing gear; nineteen of these turtles have been successfully treated, tagged, etched with unique shell markings, and returned to the sea. Analysis of bycatch data revealed that turtles were captured using various fishing methods, with 45% from fixed traditional fishing (Charfia), 25% from drift nets, 10% each from gill and trammel nets, and 5% each from longlines and plastic traps. Beyond its rehabilitation efforts, the Sea Turtle Rehabilitation Station (STRS) serves as an important resource for monitoring sea turtle behavior during recovery through underwater video recording. The station also attracts volunteers, tourists, and researchers, enhancing both public engagement and scientific understanding of these endangered species. This innovative floating rehabilitation station offers a sustainable solution for sea turtle conservation in remote locations such as the Kerkennah Islands. Future efforts will focus on extending monitoring capabilities and developing partnerships to reduce bycatch, thus contributing to the conservation of sea turtle populations in the Mediterranean.

## SOUTHERN MAHÉ, SEYCHELLES, SEASONAL PROTECTED AREAS

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The establishment of coastal Seasonal Protected Areas (SPAs) is a novel approach to marine protected areas in Seychelles. The concept of the SPAs as dynamic conservation areas based on the critical habitats used by marine vertebrates constitutes an innovative approach for mainstreaming ecosystem and biodiversity considerations effectively into a productive seascape and as a coping strategy for fluctuating impacts of climate change. SPAs are permanently designated but activated and managed only at certain times of the year, i.e. During the nesting season. Data collected from two decades of monitoring (2004-2024) by the Marine Conservation Society Seychelles has shown a 31% decrease in hawksbill nesting activity across Mahé's southern beaches. This indicates that the protection afforded to the species in 1994 is alone insufficient to halt a decline in numbers. The purpose of the SPAs is to enhance the protection of

turtle nesting beaches on the island of Mahé through the mitigation of anthropogenic disturbances and impacts during the nesting season of hawksbill turtles from October to April, as well as through the protection and rehabilitation of their critical nesting habitat on the beach crests. In Seychelles, SPAs will be open to community use and active community participation in the management of the areas is encouraged. The SPAs provide a promising new approach to MPA management in Seychelles and are well aligned with the country's evolving approach to protected areas management. In general, the Government of Seychelles is interested in transitioning from an implementing role to a facilitating role in environment conservation, and community-managed SPAs provide an opportunity for the Government to transfer the responsibility of environmental protection to a greater portion of the Seychelles community.

## 20 YEARS OF SEA TURTLES CONSERVATION IN CONGO

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Renatura Congo is a Congolese association created in the Republic of Congo in 2005. For 20 years, its teams have been working for sea turtle conservation doing nesting monitoring all along the country's 170 km coast and by-catch releasing. All its efforts have permitted to reduce poaching significantly but also to better understand sea turtles populations, especially nesting trends (and threats) of leatherback and olive ridley turtles and feeding and growing sites for green and hawksbill turtles. Since 2005, Renatura has also been developing a large awareness and outreach program, which reaches more than 40 000 children every year and has managed to create a measurable change of mindset around sea turtles in coastal communities. Thanks to its studies and advocacy, sea turtles have been nationally protected in 2011, and in 2023 the first community-based Marine Protected Area was created with the aim of protecting sea turtle habitats.

## INSIGHTS FROM 30 YEARS OF SEA TURTLE CONSERVATION IN LAMU, KENYA

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To curb increased poaching, the late Korschens joined hands with the Shella community in 1992 and established Lamu Marine Conservation Trust (LaMCoT), a not-for-profit organization with the aim of ensuring effective conservation and protection of sea turtles around the island. LaMCoT has since then helped raise awareness of the importance of sea turtles and helped the community patrol the beaches to curb the poaching menace. Transformed poachers, who really understood the importance of conserving these species were employed. They have been patrolling for over 30 years, yielding a lot of insights on turtle conservation. The project also involved tagging sea turtle by-catch and releasing them back to the ocean. As of 2024, LaMCoT has rescued and released more than 1265 sea turtles, 95.8% of them being the Endangered Green Sea Turtles (*Chelonia mydas*) and 4% the Critically Endangered Hawksbill (*Eretmochelys imbricata*). 903 nests have successfully hatched under our supervision, with an overall average incubation period of 51.29 days. 100,093 hatchlings have been released. Despite the efforts on patrolling and monitoring the nests, there has been several unsuccessful nests especially in 2021 and 2022. This has led to the organization to collaborate with other partners to figure out the reason behind it. Mohamed is a potential PhD candidate on the sea turtle ecology. This link with academia will open up more doors to the organization.

## THE PACIFIC LEATHERBACK HUB: A DECISION-SUPPORT TOOL FOR THE CONSERVATION OF TWO CRITICALLY ENDANGERED LEATHERBACK POPULATIONS

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Conservation planning for endangered species like Pacific leatherback sea turtles requires data-driven tools to guide stakeholders in assessing the effectiveness of different conservation actions. Here we present a publicly accessible decision-support tool, the Leatherback Risk Management and Recovery Model (LRMRM) that integrates data on leatherback threats, past conservation efforts, and population models to support innovative approaches to future conservation. The LRMRM was built upon a multi-language systematic review of grey and academic literature to quantify leatherback mortality in Pacific fisheries. We assigned risk to specific fisheries based on fishery characteristics, potential estimated mortality, and fisheries behavior. The tool enables users to view spatial and temporal maps of fisheries risk, in relation to known areas of critical foraging and nesting habitat for Pacific leatherbacks. These findings inform population viability analysis models for two populations (East, West) and five subpopulations (Mexico, Costa Rica, Nicaragua, Indonesia (Jamursba-Medi, Wermon), Papua New Guinea). These individual-based population models run in the IUCN-hosted Vortex software - allowing users to predict population trajectories under current conditions or in response to different conservation actions (bycatch reduction, egg translocation, and short-term captive rearing (headstarting)). The outputs include population size and probability of population survival over time, with plans to incorporate a cost component to allow for more comprehensive evaluations. Additionally, the literature review compiled numerous studies on bycatch mitigation strategies, enabling a bycatch mitigation quiz with tailored suggestions for specific gear types or within certain regions. Future plans include creating a platform for shared learning between conservation and fisheries stakeholders to understand what barriers to success may exist in certain fisheries or governments. The Leatherback Risk Management and Recovery Model provides data to empower stakeholders to effectively evaluate conservation actions for Pacific leatherbacks across multiple scales, while simultaneously offering a model that is easily adaptable for other endangered species.

## LESSONS IN PARTICIPATORY GOVERNANCE FOR MARINE PROTECTED AREAS: A CASE STUDY ON HAWKSBILL CONSERVATION IN PUNTA AMAPALA, EL SALVADOR

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Community participation in managing Marine Protected Areas (MPAs) is often essential to achieving MPAs' social, economic, cultural, and conservation goals. However, collaborative governance is not a guaranteed solution. While local participation can support sustainable and equitable resource governance,

it does not ensure effective environmental management. Communities may lack the experience, resources, or cohesion to organize effectively, and external actors like NGOs or governments may inadvertently hinder or neglect such engagement. Thus, while consensus grows around involving communities in MPA governance, practitioners and policymakers continue to debate the best ways to enable meaningful participation. This presentation explores these themes through a case study in El Salvador, highlighting key opportunities and challenges. El Salvador hosts one of the largest remaining aggregations of eastern Pacific hawksbill turtles (*Eretmochelys imbricata*), representing nearly half of the known regional nesting population. Although substantial progress has been made in protecting nesting beaches, bycatch mortality remains a critical threat. Punta Amapala, along El Salvador's southern coast in the Gulf of Fonseca, is a major bycatch hotspot. Within this area, Poza de la Gata (1 km²) serves as a biodiversity-rich foraging and resting ground for hawksbills but also reports some of the highest bycatch mortality rates globally, threatening population recovery. ProCosta, a national conservation NGO, has partnered with local fishers for over a decade to reduce bycatch. Through this collaboration, alongside ongoing bycatch mitigation efforts, fishers and practitioners have reached a growing consensus on the need for spatial-based conservation to protect hawksbills and their habitats. In response, a group of local fishers proposed establishing a small MPA at Poza de la Gata to safeguard hawksbills and juvenile fishery species. Concurrently and independently, the Salvadoran government and other organizations are advancing a similar initiative but at a larger scale. This presentation examines the opportunities and challenges of fostering community involvement in the proposed MPA. We discuss the initiative's mixed origins—from grassroots to governmental—and outline ongoing efforts to support local participation in MPA governance, including integrating local knowledge, organizing communities, and facilitating interinstitutional collaboration. Finally, we provide recommendations and lessons learned from this experience.

## A STRUCTURED DECISION-MAKING FRAMEWORK FOR EVIDENCE-BASED ASSESSMENT OF THREATS AND PROTECTION OF SEA TURTLE EGGS AND HATCHLINGS

**Andrea D. Phillott**

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A structured decision-making framework is proposed to help practitioners (conservationists, managers, beach monitoring personnel) decide on which action(s) to take in protecting sea turtle eggs and hatchlings to maximise hatchling production. The framework recognises that eggs and hatchlings have an important ecological role as a nutrient source for beach and in-shore ecosystems, and not every egg/hatchling needs to be protected from threats. Mortimer (1999) suggests that hatchlings should emerge from ~70% of nests/eggs. The framework proposes that if <30% of clutches/eggs are affected by threat(s) then conservation actions may not be required unless the population is demonstrating significant decline or is in the early stages of recovery. There are four common actions that practitioners can choose among to mitigate threats to eggs and/or hatchlings in a clutch, and additional conservation actions can also be applied to the entire beach (e.g., turtle friendly lighting). Steps in the decision-making process to choose which of the four conservation actions to implement are: Assess threats to eggs and/or hatchling using evidence-based methods; Consider the potential conservation actions to achieve the objectives; Evaluate the risk for each action based on available resources and other requirements; Implement the conservation action; Evaluate the outcome based on data and modify the action if needed again in the future. This presentation will outline the proposed framework including each step in the decision-making process, evidence-based assessment of threats to eggs and/or hatchlings, potential mitigation actions at the individual clutch- and beach-level, potential risks when implementing common actions for the mitigation of threats to eggs and/or hatchlings, requirements to meet before implementing common actions for the

mitigation of threats to eggs and/or hatchlings, and trigger-points for reconsidering the decision-making process.

## 'WIPING THE SLATE CLEAN': DOCUMENTING AND ELIMINATING POACHED TURTLE REMAINS ON BEACHES OF BOA VISTA, CAPE VERDE

**Adilson Ramos[1], Marcel Maierhofer[2], Euclides Resende[1], Hiltrud Cordes[2], Thomas Reischig[2]**

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The island of Boa Vista has long faced significant threats to its nesting loggerhead turtles from hunting for their meat, with up to a third of the nesting females once killed in a single season. However, intensified conservation efforts have reduced poaching mortality to less than 5% by 2017. With stricter laws, increased efforts by local conservation organisations, and a dedicated anti-poaching team led by Fundação Tartaruga, it fell further to below 0.2% by 2018. Despite this progress, poaching remains a challenge that requires ongoing, costly efforts to maintain low levels, with hopes of eventually eliminating it. For many years, poachers left turtle carcasses on the beaches, resulting in an accumulation of more or less complete carcasses and bones scattered across the sands and hidden under bushes. While most of these remains primarily date back several years, “younger” and still complete carcasses can cause confusion in identifying recent poaching incidents. In addition, a complete record of all carcasses could provide valuable information on past and present poaching hotspots, but the recording process and any follow-up surveys could risk significant issues with double counting. Therefore, with the approval of the local department of the National Directorate for the Environment, it was decided to 'wipe the slate clean' and remove all turtle carcasses and bones from the beaches once they had been recorded and geolocated. Starting in spring 2023, Fundação Tartaruga’s anti-poaching unit, the Dog and Drone Team, began recording and clearing carcasses outside the critical nesting season (June–October). On designated project days, they selected specific 2–5 km sections of beach, with team members deployed in dispersed formations to cover both shoreline and inland areas. In this way, the team worked systematically through the nesting beaches in contiguous sections. When a carcass or bone cluster was found, data was recorded, photos were taken, and the turtle remains were then collected and transported to a local landfill. To date, 56 km of beaches have been surveyed and cleaned on the north, east, and south-east coasts of Boa Vista, covering the island’s key nesting beaches. In total, 1061 carcasses or bone accumulations were recorded, with 649 identifiable as individual turtles through presence of skulls, mandibles, or complete carapaces. The remaining cases lacked these identifying features, so the number of individuals represented could not be accurately determined. Based on random weighing of the turtle remains, approximately 10 metric tonnes of material have been removed from Boa Vista’s beaches so far. This project, which we believe is the first of its kind, aims to complete its work by the start of the 2025 nesting season in June. The data from the clean-up will help identify and analyse past and present poaching hotspots, including those not previously covered by standard beach patrols, which in turn will improve protection strategies for the nesting turtles. Beyond conservation, the effort also benefits local tourism, as the sight of poached turtle carcasses and bone piles on otherwise pristine beaches detracts from the island’s appeal.

## ESTABLISHMENT OF WASTCON: A NEW PARADIGM SHIFT TO SAVE SEA TURTLES ON THE ATLANTIC COAST OF AFRICA

**Ebiegberi Henry Raynus**

*Safe Earth Foundation, Nigeria*

Introduction: The West Africa Sea Turtle Conservation Network (WASTCON) was established in 2020 to address the urgent need for coordinated sea turtle conservation across West Africa. Supported by international partners, including Programmes de Petites Initiative (PPI), IUCN's Central and West Africa Programme (IUCN PACO), and Sea Turtles Africa Team (RASTOMA), WASTCON unites 15 civil society organizations (CSOs) from seven countries—Benin, Côte d'Ivoire, Ghana, Gambia, Nigeria, and Togo. Its mission is to foster collaboration among CSOs, governments, and local communities to protect sea turtles through policy advocacy, conservation action, and awareness campaigns. Coordinated Conservation Efforts: WASTCON's key initiatives address threats like illegal poaching and bycatch by promoting sustainable fishing practices, reducing habitat destruction, and protecting nesting sites. By advocating for stronger conservation policies, the network collaborates with national governments to enhance legislation and enforcement measures. Acting as a bridge between CSOs and authorities, WASTCON supports a conducive policy environment for impactful conservation. Key Achievements: WASTCON has made significant progress, including releasing over 50,000 hatchlings and 2,500 adult turtles through its member organizations. Its notable successes include co-organizing the African Sea Turtles Congress in Benin with RASTOMA and NASNet, which brought together 45 experts and stakeholders to discuss conservation challenges and share best practices. Additionally, WASTCON hosted webinars on datasheet harmonization, advocacy, and conflict management, involving over 100 conservation actors from West, Central, and North Africa. These initiatives have fostered regional collaboration and advanced sea turtle conservation efforts. Challenges and Obstacles: Despite its successes, WASTCON faces significant challenges. Limited funding and the absence of salaried staff hinder its ability to organize face-to-face meetings, exchange visits, and expand programs. Many member organizations operate with constrained budgets, restricting community outreach and conservation activities. Varied legal frameworks, cultural practices such as turtle egg consumption, and weak enforcement standards across countries further complicate regional coordination. Future Strategies: To address these challenges, WASTCON is pursuing long-term funding from international donors and strengthening partnerships with environmental organizations. Expanding community outreach and education aims to build local ownership of conservation programs, fostering lasting change at the grassroots level. The network also plans to establish a unified conservation framework for its member states, facilitating information sharing and coordinated responses. Additionally, WASTCON is intensifying its policy advocacy efforts to encourage governments to adopt stronger legal protections for sea turtles. Conclusion: WASTCON has made significant strides in sea turtle conservation through policy advocacy, community engagement, and collaborative action. However, addressing financial constraints, enhancing regional coordination, and securing stronger legal protections are crucial to ensuring the long-term survival of sea turtles in West Africa. With sustained effort and improved resources, WASTCON is well-positioned to achieve its conservation goals.

## INTER-NESTING HABITAT USE FOR THE LARGEST NESTING AGGREGATION OF GREEN TURTLES IN THE ATLANTIC BASIN*

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Animal tracking is often the only way to link impacts of various threats to widely distributed marine megafauna populations. The assessment of potential impacts from those threats requires a description of overlapping distributions between animal populations and dire conditions threatening their survival. The implementation of satellite telemetry and remote sensing have increased our understanding of the spatial ecology of marine animals. Despite their broad distribution, green turtle (*Chelonia mydas*) populations display evidence of a distinct long-term fidelity to nesting areas. Such fidelity increases the vulnerability of marine turtles to anthropogenic and natural events suddenly altering and degrading key habitats. Tortuguero National Park, located on the Caribbean coast of Costa Rica, is considered the largest rookery for green turtles in the Atlantic basin. Due to different threats, including illegal harvesting across their migratory range, nesting trends for green turtles at Tortuguero have shown a significant decline over the past 15 years. In this study we estimate the inter-nesting area used by female green turtles nesting at Tortuguero, assessing the utilization of Marine Protected Areas (MPA's) and interaction with potential local threats. Over the past 25 years we have equipped several nesting green turtles with satellite tags to study their post-nesting movements. We assessed the inter-nesting behaviour of 45 tracked turtles nesting at Tortuguero. Using a movement-based kernel density estimator, we calculated the utilization distribution (UD) for the inter-nesting area used by green turtles from this rookery. We overlaid each UD with spatial information on maritime traffic, fisheries activities and MPA boundaries, to assess potential risks to turtles in these areas between nesting events. We found that tracked turtles spent a mean of 43 days (range: 11-98) at the inter-nesting area, measuring from tag deployment. During this period, all turtles remained close to shore (<20 km), and within the territorial waters of Costa Rica. Over 60% of the inter-nesting area used by green turtles was within Tortuguero National Park's MPA and the Marine Management Area "Barra del Colorado", where human activities are restricted. In direct conflict with the protection status of these management areas, turtles have been found to be harvested in these MPA's. Our findings also uncovered that inter-nesting areas of green turtles that nest at Tortuguero expand southwards. We found that turtles are spending time around the heavy maritime traffic areas that surround the ports of Limón and Moin, where the risk of water pollution and boat strikes are constant threats for marine wildlife. Green turtles nesting at Tortuguero face multiple threats whilst resting in inter-nesting habitats, despite the protection of important MPA's. The effects of these threats on the green turtle population nesting at Tortuguero, Costa Rica require further exploration to inform protection agencies and policy makers in Costa Rica.

# FACTORS SHAPING DECISIONS ABOUT SEA TURTLE NEST MANAGEMENT IN THE INDIAN OCEAN SOUTHEAST ASIA REGION*

**Amanda Elaine Robbins[1], Andrea D. Phillott[2]**

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Sea turtle nesting beaches support several sea turtle life stages, including developing embryos and hatchlings (Shenoy et al., 2011; Ogello et al., 2022). Therefore, threats on nesting beaches threaten embryo development and survival and hatchling production, fitness, and survival. Potential threats include coastal development, take and trade of eggs and/or hatchlings, pollution, depredation, pathogens, environmental events such as storm surges and tidal inundation, and climate change which can lead to increased storm frequency and strength, sea-level rise, and temperature extremes (Sivakumar et al., 2016; Phillott & Kale, 2018; Ogello et al., 2022). Nest management can mitigate these threats by 1) protecting clutches in situ or ex situ; and/or 2) manipulating the incubation environment of in situ or ex situ clutches. Decisions about if and how to manage nests are often based on the physical/biological elements of the natural habitat (e.g., flora, fauna, climate, and weather), resource availability (financial, material, or personnel), sociocultural or religious beliefs/practices, institutional practices, and/or legal or policy requirements (Shenoy et al., 2011; Sivakumar et al., 2016; Ario et al., 2018; Phillott et al., 2021; Phillott & Kale, 2022). Understanding the factors which influence decisions about management of sea turtle nests can inform resource allocation and policy instruments so that the most beneficial conservation outcome can be achieved. We are conducting a systematic review of publications about nest management decision in the Indian Ocean and Southeast Asia (IOSEA) region to identify the ecological, economic, sociocultural, and/or institutional factors affecting nest management decisions and, by extension, hatching success across the region. The study is ongoing, and our presentation at the symposium will examine all relevant literature published to 2010-2023. We have identified 28 papers to date following standardized systematic review methodology. Data being extracted from the publications encompasses the turtle species, regional management units (RMUs), countries, primary, secondary, and tertiary decision makers, nest management decisions (eggs are unprotected in situ, protected in situ, relocated to a safer location on the beach, or relocated to a hatchery), and ecological (e.g., depredation, tidal wash), economic (e.g., tourism, take for trade), sociocultural (e.g., take for nutrition, beach recreational activities), institutional (e.g., standard practice, human resources), and other (e.g., pollution) that shape the decisions around nest-management. Our findings will facilitate a better understanding of how implementation of known best practices in nest management is impacted by ecological, economic, sociocultural, and/or institutional factors to shape recommendations to the IOSEA Marine Turtle MoU about maximising hatchling production in RMUs in the Indian Ocean and Southeast Asia region.

## ILLEGAL TAKE OF SEA TURTLES IN BOCAS DEL TORO, PANAMANIAN CARIBBEAN*

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In Bocas del Toro, Panama, sea turtles have been exploited for generations to supply local, national, and international markets with meat and shells. This exploitation led to the decline of the sea turtle population in the early 90s. However, following species protection in the early 2000s and conservation efforts in the area by the Sea Turtle Conservancy (STC), sea turtle populations have increased, making Bocas del Toro one of the most important regions for sea turtle conservations in the Caribbean Basin. Despite these efforts, the illegal take of sea turtles in the area has not been assessed in the last twenty years. This study aims to elucidate the illegal take of sea turtles in Bocas del Toro's nesting beaches (Playa Bluff, Playa Drago, Playa Larga, Playa Soropta, Rio Caña, Escudo de Veraguas, and Playa Roja); monitored by the STC. We used data collected between 2003 and 2024 during night patrols and daily surveys in the seven nesting beaches. We concluded that a sea turtle had been taken when (1) there were no down tracks of the turtles returning to the sea, (2) when the turtles were found butchered on the beach, and (3) when the sea turtles were found stranded tied, or with harpoon injuries. Additionally, egg clutches taken were identified by the presence of human footprints, holes made with a stick, or the absence of eggs in a fully formed nest chamber. We recorded the species, nesting beach, and date of each incident. Preliminary results show that between 2003 and 2024, at least 1,190 sea turtle clutches and 194 sea turtles were illegally taken in Bocas del Toro. Leatherback clutches were the most affected (60%), while hawksbills were the most frequently taken turtles (91.7%). This is likely to be underestimated since evidence of illegal take may have been concealed. This study highlights the extent of illegal take in Bocas del Toro, reducing the lack of information on this issue in the Caribbean Sea. Additionally, the finding will help identify hotspots of sea turtle illegal activity in Bocas del Toro, contributing to the protection of sea turtles in the context of Panama's new sea turtle protection law.

## INTEGRATING ESG PRINCIPLES INTO TERENGGANU'S TURTLE TOURISM

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Terengganu's captivating marine landscapes provide a distinct opportunity for ecotourism, particularly focusing on sea turtle conservation. The region has recently experienced a surge in tourism driven by visitors' desire to engage with these iconic marine creatures in their natural settings. This growing interest highlights the critical need for tourism practices that are economically beneficial yet environmentally sustainable. The Terengganu Turtle Tourism Blueprint offers a comprehensive strategy to manage this potential responsibly. Its goal is to stimulate the local economy while safeguarding the natural habitats of sea turtles by integrating Environmental, Social, and Governance (ESG) principles effectively. Environmentally, the strategy promotes ecotourism practices that minimize habitat disruption, advocates for sustainable practices such as waste reduction and the use of renewable energy, and enhances conservation efforts through collaborations with local groups. Socially, the blueprint champions

community engagement and cultural immersion. It suggests employing locals as tour guides, supporting area businesses for services and accommodations, and facilitating cultural exchanges through educational and interactive experiences. This inclusive approach aims to distribute tourism benefits equitably and increase community support. On the governance front, the blueprint underscores the importance of transparency, accountability, and collaboration with local authorities and conservation organizations to establish a regulatory framework that supports sustainable tourism. It also calls for regular monitoring and evaluation to better understand tourism's impacts on local ecosystems and communities. Finally, the blueprint introduces engaging tourism products such as volunteer conservation initiatives, scientific exhibitions, sea turtle hatchling releases, guided turtle nesting observations, and snorkelling excursions. These activities aim to enrich the tourist experience, educate visitors on marine conservation, and foster a deeper appreciation for marine life.

## THOUGHTS ON THE POPULATION RECOVERY OF SEA TURTLES IN THE XISHA ISLANDS, SOUTH CHINA SEA

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Sea turtles serve as flagship species for marine conservation, playing a crucial role in maintaining biodiversity and ecosystem stability. In 1993, the sea turtle population in the South China Sea was estimated at 16,800-46,300 individuals. However, long-term overexploitation, illegal trade, and human disturbances have led to drastic decline in their numbers, posing a severe threat to their survival. The green sea turtle (*Chelonia mydas*) is the primary species that breeds in Chinese waters, with the Xisha Islands hosting the largest nesting site. Over the past five years, an average of 250 nests per year have been recorded in the Xisha Islands. A successful recovery of this species in the region could significantly contribute to the restoration of other sea turtle populations and enhance marine biodiversity throughout the China Sea. To ensure the survival of Chinese sea turtles, comprehensive conservation efforts are required. Firstly, reducing human exploitation is a critical strategy for restoring green sea turtle populations. This includes enforcing stricter measures against hunting, egg collection and illegal trade, minimizing bycatch, and rigorously reviewing captive breeding and exhibition licenses. Such licenses should only be granted following thorough professional evaluations by the relevant authorities. Furthermore, all forms of captive breeding and exhibition should be minimized, as our research indicates that captive green turtles have a Chelonid Herpesvirus 5 (ChHCV5) detection rate of 31.1%. Consequently, artificial breeding is not a viable approach for population restoration. Secondly, improving habitat conditions is essential for population recovery and broader marine biodiversity conservation. Plastic and microplastic pollution is prevalent in sea turtle nesting grounds in the Xisha Islands, with debris even found at the bottom of turtle nests, posing a direct threat to hatchlings. It is therefore imperative to reduce waste discharge and pollution, limit fishing activities, and curb coastal zone encroachment and transformation. The establishment of marine national parks, coupled with comprehensive and strictly enforced protection measures, is strongly recommended. Third, enhanced international cooperation is essential for effective conservation. Joint law enforcement efforts, stricter regulation of pollutant emissions, and increased academic collaboration can bolster conservation initiatives.

## MAKING THE BEST OF IT: THE CHALLENGES OF COEXISTENCE BETWEEN MARINE TURTLES AND GAS EXPLORATION

**Isabel Marques Silva**

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Gas and oil exploration has invaded the sea since the 1890s, but in the 1940s, it exploded with the expansion into more depth waters. While oil spills coming from cargo, tankers, or rigs have strong direct effects. Gas spills are less dramatic for the sea and its animals and plants. The effects of the permanent rigs intensified ship movement and noises in shallow or deep water, and there were also fewer studies on the impacts on the migration routes and feeding ground of turtles. Both forms of exploration are difficult, if not impossible, to stop, especially in 3rd world countries. Gas also requires bigger investments in gas pipelines and LNG (Liquidized Natural Gas) facilities, which require bigger loans with Investment funds. The investment funds demanded more scrutiny to ensure that the money invested was used in environmentally safe and socially responsible investments: no one wants to buy or invest in "dirty gas" from unsustainable environmental and unfair social practices. This tighter responsibility allows working with oil companies to reduce the impacts and even restore what was lost. More and more countries are adopting laws that bind companies to offset their impacts on animal populations and protect and restore their habitats. This environment creates opportunities for financing turtles' conservation and their habitats. Conservationists need an open mind and prepare for this opportunity that is very different from what they are used to, and the turtle conservation community needs to be less critical of their members who work with the industry. Several success stories of cooperation exist across the world. In the north of Mozambique, where a low-incidence Islamic terrorist war is happening, investment in research and conservation of marine turtles can only come from the oil and gas industry that also works in the region. Conservation NGOs and Government agencies don't work or invest in conservation projects in the region due to instability in the security situation. The gas and oil industries are the only ones that can give security support and money for conservation, research, and community activities in marine turtle conservation. In Mozambique, they are obliged to do it by a modern state-of-the-art offset law, but they are also doing it voluntarily to please their investor and investment funds.

## HOW SEA TURTLES HAVE LED THE DEVELOPMENT OF MARINE CONSERVATION IN THE REPUBLIC OF CONGO

**Antoine Szadeczki, Quentin Bodiguel**

*Renatura Congo, Republic of the Congo*

Renatura Congo is a Congolese association founded in the Republic of Congo in 2005. For 20 years, it has been working on sea turtle conservation through nesting monitoring and bycatch release with local fishermen. In an environment where marine science was virtually absent, the data collected over the years have highlighted key areas for sea turtles along the coast. While stretches of sandy beaches are home to important nesting grounds for olive ridley and leatherback turtles, several rocky reefs serve as strategic foraging zones for green and hawksbill turtles. These species are good indicators of the presence of the habitats they need to thrive. As it turns out, these rocky reefs are key areas for marine biodiversity in general. The presence of sea turtles led Renatura to conduct further scientific studies on these habitats to better understand the ecosystems they support and to increase the scope and impact of conservation efforts.

In the 2010s, Renatura began advocating for the creation of marine protected areas in Congo, particularly in the Bay of Loango, home to crucial marine and coastal habitats and numerous sea turtles. The data collected by the association on sea turtles led to the designation of Loango Bay and Mvassa Bay as priority sites for the creation of the country's first marine protected areas, through WCS's marine spatial diagnosis. In 2017, the government of Congo launched a national project for the creation of the Marine Community Reserve of Loango. From 2020 to 2023, Renatura supported this project through baseline studies, consultations with communities, and facilitation of the legal and administrative processes. This resulted in the official creation decree being signed in December 2023. The general objective of the marine reserve is to ensure the conservation and sustainable management of natural and fishery resources through the participatory protection of marine turtle habitats. Since then, Renatura has been preparing for the operationalization of the reserve through community capacity-building, work on community governance, rules, and sustainable fishing plans with locals, and the drafting of a management plan. Since the early 2000s, sea turtles have served as a flagship for the development of marine conservation in Congo. Renatura's work on conservation has led to more scientific studies on other marine life components and has drawn the attention of the public and the government to the importance of preserving marine and coastal ecosystems. As of the end of 2024, the Congo is about to organize the management of its first marine protected areas. Although much work remains to be done to get them up and running, this is a great achievement and a significant milestone after 20 years of sea turtle conservation efforts in the area.

## INTERNATIONALLY AGREED CONSERVATION MEASURES FOR MARINE TURTLES OF THE ATLANTIC COAST OF AFRICA

**Manjula Tiwari[1], Heidrun Frisch-Nwakanma[2]**

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Dating back to 1999, the Memorandum of Understanding concerning Conservation Measures for Marine Turtles of the Atlantic Coast of Africa (African Atlantic Turtle MOU) is one of the oldest regional conservation agreements under the Convention on the Conservation of Migratory Species of Wild Animals (CMS). Covering 14,000 km of coastline across 26 countries, from Morocco to South Africa, the MOU has been signed by 23 States and protects vital nesting sites, feeding areas, and migration corridors for six marine turtle species: loggerhead (*Caretta caretta*), green (*Chelonia mydas*), leatherback (*Dermochelys coriacea*), hawksbill (*Eretmochelys imbricata*), Kemp's ridley (*Lepidochelys kempii*), and olive ridley (*Lepidochelys olivacea*). At the 3rd Meeting of Signatory States (MOS3), held in Saly, Senegal, in September 2023, national reports from governments and stakeholders helped to assess the implementation of conservation and management activities, identifying threats, threat-reduction measures, stakeholder engagement, and capacity-building needs. This analysis informed a new framework of priorities and actions for Signatory States, Range States, and the CMS Secretariat. Based on a draft presented at the meeting, a Revised Conservation and Management Plan (CMP) for the African Atlantic Turtle MOU was agreed upon by government representatives, with expert input supporting the discussions. The CMP aims to achieve eight key objectives: (1) Improve our knowledge of marine turtle presence and distribution in-water and on the nesting beaches; (2) Improve our knowledge of threats impacting marine turtle populations and their habitats; (3.1) Reduce direct and indirect causes of marine turtle mortality; (3.2) Protect, conserve and restore terrestrial and marine habitats for marine turtles; (4) Increase awareness to threats facing marine turtles and their habitats, and enhance stakeholder participation in conservation activities; (5.1) Enhance research and capacity-building programmes to improve the understanding and conservation of marine turtle populations; (5.2) Enhance national, regional and international cooperation; (6) Promote implementation of the Memorandum of Abidjan and its Conservation and Management Plan.

With 23 associated programmes and specific activities outlined for each objective, the CMP provides a comprehensive framework for coordinated conservation efforts across the MOU area. We offer an overview of the activities agreed upon by the Signatory States and relate them to the findings of the national report analysis, providing a region-wide summary of internationally coordinated conservation measures to be implemented by Range States individually and collectively.

## CHRONOLOGICAL ANALYSIS OF FISHING REGULATIONS AND OTHER MEASURES FOR THE PROTECTION OF SEA TURTLES IN CUBA

**Raidel Borroto Vejerano**

*Centro de Investigaciones Pesqueras de Cuba, Cuba*

The Cuban archipelago is recognized as an important nesting and feeding habitat, in the Caribbean region, mainly for green, hawksbill and loggerhead sea turtles. This paper provides information on the different regulations and other measures registered in Cuba, for the protection of sea turtles, from the first regulatory measures established since the beginning of the last century, to the most recent decreed, for the conservation of these species threatened. The results of the analysis of the chronological information indicate how, fundamentally in the last three decades, the country has directed the greatest efforts for trait to reduce the number of turtles captured both in the water and on nesting beaches, based on the increase in legislation, which include new bans and sanctions, to mitigate illegal actions that occur and harm these species.

## FROM RESEARCH TO ACTION: SCIENCE-BASED CONSERVATION OF SEA TURTLES IN SÃO TOMÉ ISLAND, WEST AFRICA

**Sara Alexandra Vieira[1,2], Betania Ferreira-Airaud[1,2], Frederic Airaud[1], Catarina Monteiro[1], Antunes Pina[1], Venceslau Soares[1]**

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The unique archipelago of São Tomé and Príncipe provides vital habitats for five of the world's seven sea turtle species, each listed on the IUCN Red List. Globally recognized as a top biodiversity hotspot, this country is particularly vital for green turtles (*Chelonia mydas*) and is home to the last significant rookery for the critically endangered hawksbill (*Eretmochelys imbricata*) in the Eastern Atlantic. Although legal protections were established only 10 years ago (Law-Decree 8/2014), sea turtles in São Tomé have been historically exploited for commercial, cultural and subsistence purposes – a practice that has posed a significant threat to their populations. To tackle such complex challenges, it is not enough to monitor sea turtle numbers alone. Recognizing this, Programa Tatô has developed a science-driven conservation model to transform how conservation decisions are made. Our research goes beyond population counts, employing an interdisciplinary approach to map population structures, track migratory and internesting areas, and identify key habitats – filling critical knowledge gaps that inform precise and effective conservation strategies. Over the past decade, Programa Tatô has been combine methods such as nesting and in-water surveys, satellite tracking, small-scale fisheries monitoring, and socio-economic studies. For example, tracking sea turtles during the internesting period has allowed us to define core areas for marine protected areas (MPAs) design, while monitoring small-scale fisheries can offer a robust estimation of sea

turtle bycatch. These efforts generate detailed, actionable insights that not only guide the design of São Tomé's first network of marine protected areas, but also supported the creation of special reserves and sea turtle sanctuaries in high-priority nesting and foraging sites. This model leverages both ecological and human dimensions, offering a nuanced understanding of how sea turtles interact with local environments and communities. Here, we present the latest findings from a decade of multidisciplinary research, reflecting substantial progress in science-based sea turtle conservation in São Tomé Island. Our studies reveal complex linkages between human activities, environment factors, and the survival of these endangered species. By aligning scientific inquiry with conservation management, Programa Tatô is not only protecting sea turtles but also building a robust framework for the long-term, sustainable stewardship of São Tomé's unique marine ecosystems.

## ENHANCING TURTLE CONSERVATION ACROSS A MOZAMBICAN SEASCAPE THROUGH EARTHRANGER AND OTHER CONSERVATION TECHNOLOGIES

**Jessica Lauren Williams[1,2], Bruce Jones[3], Taryn Gilroy[4], Lorena Michel da Encarnação Matos[5]**

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Central-Southern Mozambique's coastal waters are a globally significant biodiversity hotspot, serving as a vital habitat for five sea turtle species and other conservation-dependant marine megafauna species. The Save-Bazaruto Seascape region serves as a core foraging, nesting, and migratory corridor habitat for sea turtles with its unique ecosystems making it a critical stronghold for turtle conservation in the South Western Indian Ocean. The region's productivity is driven by diverse ecosystems, including vast mangrove forests, expansive reefs, and estuaries that support marine biodiversity and provide critical resources for local communities. However, this area faces numerous threats from illegal and unsustainable fishing practices, habitat destruction, extractive industry, and the impacts of climate change, highlighting an urgent need for innovative marine conservation strategies. In response to these challenges, a coalition of organisations- Akashinga, African Parks, National Administration for Conservation Areas (ANAC) at Bazaruto Archipelago National Park, and Vilanculos Coastal Wildlife Sanctuary- has implemented innovative conservation strategies, leveraging conservation technologies like EarthRanger and other complementary technologies to enhance management and conservation actions. While EarthRanger is not a silver bullet, the tool is helping to accelerate and amplify how these conservation teams operate. From tracking tagged turtles and monitoring nests to conducting illegal take surveys and assessing in-water habitats, EarthRanger plays a crucial role in enhancing operational efficiency. The tool's capacity to organise, and analyse data empowers field teams to make more informed and timely decisions, improving daily operations in turtle monitoring. A notable contribution of EarthRanger is its role in fostering collaboration across organizations. The shared platform allows for improved data exchange, helping to align methodologies between conservation programs, share insights, and coordinate actions across the region's seascape. This application has a real-world impact by streamlining daily operations and enabling quicker, more informed decision-making for those working on the ground. In addition to EarthRanger, these organizations utilise complementary technologies, such as Skylight, an AI-powered maritime domain awareness tool. Skylight enhances monitoring capabilities, improves resource management, and strengthens law enforcement responses to illegal fishing activities within the seascape. Together, these technologies enable a comprehensive approach to marine conservation, empowering teams to advance the protection of turtles, assess environmental changes, and address threats to marine ecosystems. This

presentation will provide an overview of EarthRanger and its practical applications in supporting daily conservation work. Real-world examples will demonstrate how collaboration and technology, combined with the dedication of field teams, are accelerating conservation outcomes in Mozambique. Attendees will also gain insights into how integrating multiple tools creates synergies that strengthen conservation initiatives. This presentation emphasizes the critical importance of unity, collaboration, and technology in safeguarding marine ecosystems. Above all, it celebrates the hard work of the individuals and field teams, whose dedication and expertise are central to protecting Mozambique's rich marine biodiversity.

## EDUCATION, OUTREACH AND ADVOCACY

### COMMUNITY-DRIVEN MARINE CONSERVATION: INTEGRATING SEA TURTLE PROTECTION AND LOCAL ENGAGEMENT IN LAGOS LAGOON

**Felix Abayomi**[1,2,3]

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[3]*Lagos Lagoon Waterkeeper, Lagos Nigeria*

This presentation examines the integration of sea turtle conservation and community engagement initiatives conducted in Lagos Lagoon, Nigeria, from January to September 2024. The Wildlife of Africa Conservation Initiative, in collaboration with Lagos Lagoon Waterkeeper and supported by A & F Wildlife Foundation Inc., implemented a multifaceted approach to marine conservation. Key activities included monitoring 12 nesting sites along the Lekki-Ajah Coastline, intercepting poaching attempts, and relocating 127 sea turtle eggs to secure environments. Community outreach programs were pivotal, offering economic alternatives to Indigenous populations traditionally involved in illegal poaching such as the provision of safe and drinking water in the community. Educational initiatives, such as citizen science programs and establishing eco-clubs in schools, were instrumental in fostering environmental stewardship among local youth. The presentation will discuss the challenges encountered, including funding constraints and policy enforcement issues, and will highlight the strategies employed to overcome these obstacles. The outcomes underscore the significance of community involvement and cross-sector partnerships in achieving sustainable marine conservation goals.

# IMPROVING BUILDING CAPACITY OF WESTERN MEDITERRANEAN TECHNICIANS ON SEA TURTLE NESTING MANAGEMENT IN A RECORD TIME: PRACTICAL TRAINING FOR LOGGERHEAD SEA TURTLE CONSERVATION IN CABO VERDE (AFRICA), AN INITIATIVE OF LIFE TURTLENEST PROJECT

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A technical and practical nesting management training programme has been established in Cabo Verde as part of the LIFE TURTLENEST project, which takes a multidisciplinary approach to protect emerging loggerhead sea turtle (*Caretta caretta*) nesting habitats in the western Mediterranean. The project aims to foster collaboration between Italy, Spain, and France to mitigate the threats posed by coastal development and increasing tourism pressure on beaches, which, due to global warming, are becoming warmer and more suitable for nesting. This training is designed to yield high-impact results by building the capacity of technicians in the western Mediterranean to be able to make conservation decisions, that support the survival and resilience of the species in the region. Additionally, it ensures that personnel in the three countries obtain formal certification, validating their competence in this specialised field. Cabo Verde, currently recognised as potentially the world's largest nesting site for loggerhead sea turtles, provides an ideal setting for this training. During the peak nesting season, more than 100 nests per kilometre are recorded nightly in the surveyed areas, while the hatchery manages more than 600 nests per season. These conditions enable intensive hands-on training in nest, females and hatchling management every night along a small stretch of coastline. Over a two-week period, participants acquire essential skills such as managing nesting females, assessing site suitability for nest incubation (including clutch identification and relocation decisions), and conducting nest and hatchling monitoring and management. These activities are carried out in accordance with western Mediterranean Sea turtle conservation protocols and the specific local contexts of each participating country. The training is organised in collaboration with BIOS.CV's Sea Turtle Conservation Camp, a local organisation that monitors 5 km of coastline each season within the Reserva Natural das Tartarugas on Boa Vista Island. This location offers an optimal environment for experiential learning and facilitates the exchange of nesting management strategies between participants and trainees from both emerging and well-established nesting areas. During the first edition, in August 2024, each participant assessed on average more than 900 tracks, approximately 500 nests, and managed 200 nesting females. The programme is aimed at environmental technicians, government conservation managers, and sea turtle researchers from Italy, Spain, and France, and it will be repeated and improved based on this first experience in the following years. In Italy, certification obtained through this training will become a mandatory requirement for individuals involved in the study and management of sea turtle nests within the country.

## ADDRESSING BYCATCH THROUGH FISHERMEN'S WIVES AND CHILDREN IN THE KINGDOM OF MOROCCO

**Wafae Benhardouze[1], Mustapha Aksissou[1], John Dutton[2], Manjula Tiwari[2]**

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The Kingdom of Morocco extends from the Mediterranean into the Atlantic Ocean with a coastline of 3,446 km. Little nesting takes place in the country, but juvenile and sub-adults loggerheads are the most commonly encountered species in these waters. Evaluating and mitigating mortality of sea turtles in Moroccan fisheries and creating a greater awareness for their protection are crucial to the survival and recovery of several nesting populations in the Atlantic and the Mediterranean. Efforts have been underway since 1999 to organize sea turtle workshops at major ports, and recruit and train fishermen to collect data on turtles caught in their fishing gear. More recently, women's groups were created in northwestern Morocco to promote the involvement of local women (fishermen's wives, and women who go fishing and diving) in addressing fisheries issues and marine conservation. The women's groups are engaged in beach clean-ups, ocean surface garbage clean-ups, and in education and awareness activities about plastics and the proper disposal of discarded fishing gear and garbage by the fishermen. A marine education program has also been started for their children by high school students and includes quizzes, drawing competitions, etc. Theatrical plays and short films by fishermen children were produced and published on social networks. Activities of the women and children have been filmed and will be played back to them and other communities to generate further discussion about marine issues. The goal is to gradually make this a national women's and children's network. By making marine conservation a family activity, where fishermen's wives /children can begin to influence their husbands/fathers, the project hopes to have an even bigger impact on sea turtle conservation in Morocco.

## ENHANCING MARINE TURTLE CONSERVATION IN JORDANIAN GULF OF AQABA: A COLLABORATIVE APPROACH TO REDUCING BYCATCH AND BUILDING AWARENESS AMONG FISHERS AND MARINE PERSONNEL

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The Gulf of Aqaba is home to four primary marine turtle species: hawksbill (*Eretmochelys imbricata*), green (*Chelonia mydas*), loggerhead (*Caretta caretta*), and, less frequently, leatherback (*Dermochelys coriacea*). Hawksbill and green turtles are particularly prevalent in the shallow coral reef areas, which serve as essential feeding and nesting grounds. However, the Gulf's status as a hub for activities such as fishing, shipping, tourism, and recreational diving creates significant anthropogenic pressures on these habitats, highlighting the urgent need for effective conservation measures. In response to threats from bycatch and other human-induced risks, the Jordan Society for the Conservation of Turtles and Tortoises (JSCT) initiated a project aimed at enhancing the conservation of marine turtles and reducing bycatch in the region's commercial fisheries. This project focuses on decreasing marine turtle injuries and mortality caused by fishing operations and boat strikes through public awareness and skill-building programs tailored

to fishers and marine personnel. The project's first phase involved conducting surveys among key stakeholders, including the Royal Jordanian Navy and local fishers, to evaluate their awareness and practices in marine turtle conservation. This was followed by a workshop designed to deepen participants' understanding of marine turtles, their ecological roles, and the risks associated with fishing activities. Workshop participants received general information on the conservation of marine turtles, threats they encounter, and effective bycatch reduction strategies. Training sessions also covered the proper steps for rescuing and rehabilitating captured turtles, with rescue kits distributed to several naval vessels and fishers to support these efforts. Survey findings revealed that 90% of the fishing gear used in the Gulf is longline equipment, and 5% of fishers reported incidental marine turtle captures. Furthermore, 90% of these fishers could not identify the species of captured turtles, and 65% lacked the knowledge necessary to safely handle and release them. Through theoretical and practical training sessions, approximately 70 fishers and 35 members of the Royal Jordanian Navy have gained skills in reducing bycatch and learned about the biology and ecology of marine turtles in the Gulf of Aqaba. This knowledge aims to improve conservation practices and support long-term protection efforts for marine turtles in the region. The JSCT seeks to perform effectively through an integrated national network including improve coordination and communication between fishermen, rehabilitation facilities, government coordinators and related stakeholders.

## LHAVIYANI TURTLE FESTIVAL

**L. Daniela Caballero-Encinales, Lorraine Aldridge, Mohamed Ahmed Fulhu**

*Atoll Marine Conservation Centre*

The Lhaviyani Turtle Festival, organized annually on Naifaru Island by the Atoll Marine Conservation Centre (a division of the Maldivian NGO Naifaru Juvenile), promotes awareness about sea turtle conservation and the importance of a healthy marine ecosystem. The festival encourages the local community to understand their environmental impact and empowers them to make positive changes. It is especially designed for local students, providing educational experiences in marine conservation and opportunities to participate in efforts to protect wildlife and habitats. The festival's main goals include: ignite passion for the environment, balancing culture with sustainability; to educate youth about marine ecosystems, informing the community on waste management impacts, and guiding resorts on sea turtle rescue and nest protection; data collection on community attitudes toward the marine environment and effective communication and engagement. Launched in 2016, the festival marked its seventh edition in 2024. For the 2023 event, the program expanded to two days, with the first day dedicated to the Atoll Marine Symposium. This symposium covers topics like marine megafauna, climate change, and coral restoration, featuring presentations from various NGOs and government organizations, as well as discussion panels. This collaborative forum allows citizens, scientists, NGOs, and students to discuss pressing environmental issues facing the Maldives. The second day is the main festival, offering stalls, contests, and activities for all ages. Local schools, NGOs, and other organizations host interactive booths to promote conservation awareness and community involvement. Competitions for students focus on recycling, with activities like creating sculptures from waste, recycled fashion, and sand turtle sculptures. Community-wide contests include traditional dance, recycling challenges, and underwater photography. Additionally, a large-scale plastic bottle collection takes place a week before the festival, awarding the group that gathers the most waste. The festival has grown significantly since its inception, with approximately 1,000 attendees in the first year, half of whom were children from Naifaru and nearby islands. Over the years, schools from five atolls, including Lhaviyani and Malé, have participated, and interest from nearby resorts and the local community has steadily increased. This engagement reflects the festival's success in promoting recycling and environmental awareness. Looking ahead, the festival aims to expand school participation and strengthen the symposium to attract more local leaders, especially public

officials, whose decisions influence local and national policies. This growth supports the festival's mission to foster a conservation-minded community with lasting impacts on marine life and environmental health.

## MIXING SCIENCE, EDUCATION AND CONSERVATION: WORKSHOP ON GENOMICS OF THE COLONISATION OF MARINE TURTLES IN THE MEDITERRANEAN

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The current biodiversity crisis demands urgent actions to mitigate the extinction of species worldwide. However, conservation should include scientific evidence and be accompanied by education actions to involve citizens in biodiversity restoration. For this reason, conservation offers unique opportunities to develop educational activities with multiple complementary objectives, including: a) dissemination of scientific approaches, applications and results for conservation; b) education on the biology and threats of target species and; c) information on how citizens can aid their conservation. Here, we present the workshop entitled "Genomics of the colonisation of marine turtles" developed under the umbrella of the project LIFE TURTLENEST (LIFE 21 NAT/IT/101074584) in the context of the ongoing colonisation process of the loggerhead sea turtle (*Caretta caretta*) in the western Mediterranean. This region experiences an increasing number of nests of this species, where nesting was absent or very infrequent in past decades. Consequently, citizens in this region are mostly unaware of the presence of turtles on the beaches, the reasons for their current nesting activity, and how they can contribute to their conservation. This workshop invites the public to become sea turtle detectives using genomic tools to understand why sea turtles are laying eggs in new areas and explains how citizens can contribute to their conservation. The workshop has three different phases: a) understanding sea turtles, b) genomics of the colonisation, and c) sea turtle threats and conservation. In the first phase, we use group dynamics to learn about sea turtle biology and conservation, necessary for the development of the workshop. This phase ends by asking if they know that sea turtles are nesting on nearby beaches, and why they think this is happening. In the second phase, we introduce the role of science, particularly genomics, to obtain the answers. The level of detail given will depend on the age of the public, but at least it should contain the idea that DNA has a lot of information related to the parents and the origin of the animals. Participants role-play as scientists, obtaining imaginary blood samples from plush sea turtles and sending them for 'sequencing'. Then, they are given bracelets with a code of four coloured marbles representing DNA nucleotides and they have to find the matching results sheet with the same code (DNA) to obtain the information. By combining the results of the group, they conclude that the colonisation is originated from distant nesting areas in the Atlantic and the Mediterranean and that different nests were laid by the same female. During the last phase, participants engage once again in group dynamics to review the threats turtles face and discuss ways they can help them thrive and establish in these new areas. The workshop concludes with the main message of what to do when they encounter tracks, females or hatchlings on the beach. As a result, the proposed workshop benefits from an ongoing conservation project to deliver key messages on the importance of STEM disciplines, education on biodiversity and public awareness to aid conservation.

## LOCAL COMMUNITY INVOLVEMENT IN SEA TURTLE CONSERVATION

**Marlene Djoumessi, Rodric Xavier Ndounteng Ndjamo**

*Tube Awu, Cameroon*

Sea turtle conservation largely involve active participation of local communities living near marine ecosystems. Established in 2021, the Manyange Na Elombo Campo Marine Park aims to preserve the rich marine biodiversity while promoting the sustainable management of resources for the benefit of neighboring communities. Sea turtles, emblematic species of this park, face numerous threats, including by catch, plastic pollution, habitat destruction, egg harvesting, and poaching for their meat. These pressures endanger their survival and disrupt the balance of marine ecosystems. To tackle those threats, a community-based organization called TUBE AWU working in and around the marine park is implementing several activities including outreach in school and sensitization within communities. In this context, over 200 fishers from 10 local associations have been mobilized to integrate environmental awareness and participatory science into conservation efforts. Since 2018, 25 awareness sessions have reached 500 people, and 750 kg of plastic waste have been collected through cleanup campaigns. Since 2022, our environmental education program has engaged 7 primary and secondary schools, raising awareness among approximately 1,000 children. We also organize annual cultural events, fostering community involvement in preserving natural heritage, alongside collecting biological data, with 50 samples taken from accidentally captured turtles. The results show a significant 50% increase in the reporting of accidental captures, with one in two fishers now releasing live turtles caught unintentionally. These improvements highlight the positive impact of community awareness on fishing behaviors, reducing the accidental mortality of sea turtles. This participatory model, based on co-education and community empowerment, fosters shared awareness and active protection of this endangered species. It offers a replicable approach for other coastal regions in West Africa, providing a sustainable solution to marine conservation challenges.

## SOUTH-SOUTH COOPERATION AND THE PROTECTION OF MARINE AND COASTAL SPECIES BETWEEN BENIN AND BRAZIL (CASE OF SEA TURTLES, WHALES AND AFRICAN MANATEE)

**Josea Sagbo Dossou Bodjrenou[1], Marie Domiho Djengue Dossou-B[1], Blandine Mimonzoude[1], Nadège Hounsou[1], Patrice Sagbo[1,2]**

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*[2]ADeD ONG*

South-South cooperation, which refers to collaboration between developing or southern countries, has emerged as a strategic approach to address common global challenges, particularly in areas such as environmental protection. This cooperation, characterized by partnerships between countries of the South to solve common problems and share knowledge and resources, plays a vital role in protecting marine and coastal ecosystems. Benin, in West Africa, and Brazil, in South America, although geographically distant, share similar environmental challenges, including the conservation of marine species (sea turtles, whales, manatees) and the preservation of coastal areas. In this context, non-governmental organizations such as Nature Tropicale, which have been working to preserve biodiversity for over thirty years, play a key and leading role in facilitating cooperation between these two countries. The expertise of Projeto TAMAR of Brazil in the protection of sea turtles and other marine and coastal resources, which dates back more than

forty years, could well set a precedent in West Africa, starting with Benin. With the support of the Brazilian state and several companies including PETROBAS, Projeto TAMAR manages 1,100 km of protected and monitored beaches with approximately 2 million nests protected per year and 16 monitored fisheries where standardized data has been collected since 1981. More than 1,800 direct and indirect jobs are created, more than a million visitors per year in its 22 environmental education centers. These centers generate more than 75% of resources through self-financing. The Projeto TAMAR is an example of success in the conservation of sea turtles and management marine and coastal resources. Through an integrated approach combining scientific research, awareness raising, education, local cooperation and sustainable tourism. As a prelude to the establishment of South-South partnership between Benin and Brazil, a Brazilian delegation visited Benin in June 2024 for a prospecting mission of experts in the conservation of endangered marine and coastal fauna. Brazilian experts in the conservation of sea turtles and other endangered species worked for a week with Beninese for the preservation of sea turtles, the African manatee and whales. This mission made it possible to realize the realities of the conservation of sea turtles and other emblematic species in Benin and in the sub-region. The delegation met authorities at various levels and local communities, active with Nature Tropicale in the field. There were very fruitful working sessions to note the challenges faced by the populations. During the various discussions, endogenous practices for preserving resources that are often not taken into account in legislation were discussed; aspects related to the creation of the sanctuary for the conservation of whales in the South Atlantic. Following this Brazilian mission to Benin, discussions will continue between the two countries for the development of a project that will be the subject of cooperation for the conservation and promotion of marine and coastal species including sea turtles, whales and the African manatee in wetlands at a time when Benin has committed to create Marine Protected Areas (MPAs). This project could be expanded to countries in the Atlantic sub-region of Africa.

## BRIDGING LOCAL AND GLOBAL CONSERVATION: THE INTERNATIONAL SEA TURTLE AMBASSADORS (ISTA) PROGRAM AS A MODEL FOR COLLABORATIVE IMPACT

**Yvette Fernández**

*Inwater Research Group, United States of America*

The ISTA program highlights the critical need for a multi-faceted approach to sea turtle conservation, combining local and global initiatives. Grassroots efforts address community-specific challenges, while global collaboration bridges knowledge gaps and shares best practices. Inwater Research Group's ISTA program supports this approach by empowering global partners through conservation education tailored to their unique contexts. Launched in 2023 in Acapulco, Mexico, and Bogotá, Colombia, ISTA features an interactive PowerPoint and hands-on activities using a juvenile green sea turtle model. These sessions educate participants on local sea turtle species, their ecology, human impacts, and actionable conservation measures. The program adapts to each partner's needs by considering specific threats, cultural nuances, and realistic behavior changes. Results were obtained through pre- and post-tests administered in Spanish to literate participants, assessing knowledge on topics like species identification, threats, and conservation actions. Only participants completing both tests were included in the analysis. The average pre- and post-test scores revealed a 37% improvement in knowledge, with 91% demonstrating increased conservation awareness. Challenges included literacy variability and excluded participants who could not take the tests, but culturally relevant tools and standardized protocols were implemented to enhance consistency. Following its ISTS 2024 presentation, global demand for the program surged, expanding its reach to 10 countries, including the U.S.A., Costa Rica, Egypt, and several in Southeast Asia. By providing a flexible framework tailored to diverse local contexts, ISTA empowers communities worldwide, demonstrating that effective conservation requires both a global perspective and sensitivity to local needs and challenges.

## SIREN CITIZEN SCIENCE: THE STORY OF A FISHERMAN FROM POACHER TO SEA TURTLE HERO*

**Cedrick Fogwan Nguedia, Eddy Nnanga, Guy Aristide Mengoue, Aristide Takoukam**

*African Marine Mammal Conservation Organization, Cameroon*

In Cameroon and other resource-limited countries, the consumption of marine turtle meat is among the main threats to these species. The scarcity of data, combined with the high cost of dedicated surveys, presents a significant barrier to marine turtle research and conservation. While some monitoring and conservation efforts have been ongoing on the southern coast of Cameroon, nothing had been done on the northern coast until 2016. Fishers and marine turtles share habitats and resources daily, creating potential for fishers to act as citizen scientists. We established a network of over 80 fishers who regularly report marine mammal sightings using a Smartphone App, SIREN. This user-friendly app, compatible with Android and iOS, allows fishermen to document marine megafauna sightings, capture and upload up to four photographs, and provide additional information such as descriptions. The App automatically associates a location and date with the report, providing data that can be used to design conservation measures. In 2016, one of the fishers engaged in the network, Papa Mensah, was a renowned sea turtle consumer, collecting eggs from nesting females on the beaches, as well as retaining bycatch alive. Since he has been engaged in the network, he learned the importance of sea turtles and noticed the declining trend from his reports. This effective contribution through reporting sightings completely changed his perspective towards the species. From 2016 to 2023, Papa Mensah reported over 200 sightings of marine turtles, including feedings, swimming individuals, nesting females, tracks, bycatch, and strandings. Species reported by Mensah include Olive ridley, leatherback, hawksbill, and green turtles. Through these years, Mensah has sensitized more than 20 other fishermen in his community, and together, they have rescued 40 marine turtles from bycatch and poaching. Beyond the various reports he made, he helped our scientific team conduct necropsies on two stranded green turtles in 2020 and 2022, which revealed the presence of 22 and 23 pieces of plastic in their bowels, confirming the impact of plastic as a threat to marine turtles in Cameroon. Mensah sadly passed away in 2023, but his son Prince Kuko, who is also a fisherman, is continuing to preserve sea turtles in his father's footsteps. Recently, during the month of October 2024, he led to the documentation and rescue of five marine turtles. Thanks to fishermen like Mensah, fishers are no longer considered a problem but are part of the solution, as their stories inspire many more fishers and the data collected are being used to develop plans to mitigate bycatch and for school outreach.

## MOVING SEA TURTLE CONSERVATION FORWARD: ENHANCING LEARNING AND EMPATHY THROUGH SCIDANCE

**Lekelia Jenkins**

*Arizona State University, United States of America*

This project sought to understand how co-creating dance as a form of storytelling impacts knowledge and attitudes toward sea turtle conservation. The study used a controlled experimental design to test the distinctive potential of dance to affect participants' experience, empathy, and knowledge. This study probed the effectiveness of "SciDance," a science engagement program that investigates the impact of dance creation and performance on adult learning and empathy towards conservation issues. Study participants first attended a talk and question and answer session on sea turtle conservation. Half of the

participants were then assigned to the treatment group and collaborated with artistic facilitators to create a dance to interpret the research. The facilitators provide music, props, and movement-generation activities, but the choreography is co-developed, with participants taking on performance roles. This pilot study tested three hypotheses. The project proposed that, compared to participants in a standard "science café" style lecture, participants in the SciDance program would: 1) Better understand and retain ideas from the research topics presented; 2) demonstrate greater empathy for sea turtles; and 3) show other positive outcome and reactions to the science outreach experience. We used mixed methods to test these hypotheses. We collected survey-based data at crucial points (before the program, immediately following the program, and 6-8 weeks later) to quantitatively measure specific outcomes and compare responses and changes between the groups. Self-administered interviews collected data on the dancers' experiences to provide qualitative context for the distinctive value of the SciDance experience and outcomes. The evidence indicates that the outcomes of SciDance are more robust than those of a science café lecture in several predicted areas. Quantitative data from the two treatment groups shows statistically significant outcomes: dance far more strongly activates empathy – including perspective-taking, feeling connection, and increased feelings of hope and compassion for sea turtles. It also increased and sustained feelings of upset about human actions that harm sea turtles. Additionally, it was clearly evident that SciDance was more joyful and enjoyable than a science café lecture – extremely valuable outcomes for any free-choice learning experience. While both formats effectively conveyed information from sea turtle research, the dance experience prompted more and a broader set of sea turtle conservation concepts to stick with participants; the lecture was better at conveying just one "cool fact" (in this case, turtle excluder devices). A unique outcome that emerged was how strongly the dance created a safe, supportive learning community among strangers. In essence, instead of focusing on "doom and gloom" and feeling sad for endangered species, SciDance activated hope, compassion, joy, and community that may be more productive for long-term engagement in sea turtle conservation.

## FROM OCEAN TO CLASSROOM: KELONIA'S APPROACH TO SEA TURTLE CONSERVATION ON REUNION ISLAND

**Marie Amalia Lauret-Stepler, Thiébaut Levi-Funck, Claire Jean, Mathieu Barret, Stéphane Ciccione**

*Kelonia, Réunion, France*

Located on the west coast of Reunion Island in the southwestern Indian Ocean, Kelonia is a sea turtle conservation center with 1,500$m^3$ of seawater-fed tanks, and 1,500$m^2$ of outdoor spaces. It pursues three main missions: to rehabilitate injured sea turtles, conduct scientific research, and promote environmental education. Since opening in 2006, annual visitor numbers have doubled from 100,000 to 200,000, fuelled by the public's fascination with sea turtles and a growing commitment to environmental conservation. This engagement provides an invaluable opportunity to raise awareness of marine conservation, particularly among schoolchildren. Each year, Kelonia hosts 13,000 to 17,000 schoolchildren, aged 3 to 18—doubled compared with numbers prior to the renovation in 2004. Two full-time science communicators support these educational efforts, developing activities that align with Kelonia's research and address regional environmental challenges while adhering to the standards of the French school curriculum, including Education for Sustainable Development. Partnership with various institutions plays a crucial role in the development of educational content. Each activity is designed to be interactive and tailored to the student's education level. The main program topics include: Marine Turtle Biology: This foundational topic covers adaptation, species diversity, life cycles, and threats, fostering an understanding of the ecological importance and vulnerability of turtles. Habitat Restoration: In partnership with the Mascarin National Botanical Conservatory, this program introduces children to nesting beach restoration through the

reintroduction of native plants, illustrating the vital connections within an ecosystem. Over the past two decades, approximately 500 indigenous plants have been reintroduced along the beaches surrounding Kelonia, helping to restore the natural habitat. Plastic Pollution: Launched alongside a campaign against plastic bags, this activity uses real case studies from Kelonia's rehabilitation center to demonstrate the impact of plastic on marine life, making the issue more tangible for students. Turtle Sponsorship: Originally a legacy program, the sponsorship initiative has evolved to engage both local and national students, fostering a personal connection with turtle conservation. In the case of an ongoing scientific program to track turtles by satellite, sponsors can track turtles' movements. Since opening, around 200 turtles have been released with the participation of schoolchildren, offering a unique opportunity to demonstrate both the negative impact of human activities on turtle populations and the crucial role of the rehabilitation center in species preservation. Museum Treasure Hunt: A fun and interactive way for children to engage with information, encouraging exploration and learning in a museum setting. An educational toolkit, developed to support schools facing financial barriers to transportation, support access to Kelonia's resources on-site as well as external events. Kelonia's programs go beyond standard guided tours, offering a dynamic, hands-on educational experience that cultivates a lifelong commitment to conservation in young minds. Through active involvement in ecological restoration and interactive learning, Kelonia cultivates environmental stewardship and inspired both local and global visitors to participate in conservation efforts.

## FROM BYCATCH TO PROTECTION: HOW FISHERS ARE TAKING THE LEAD IN SEA TURTLE CONSERVATION IN KENYA

**Leah Nyarangi Mainye, Juma Gwerenya, Jenni Choma, Joana M. Hancock, Stephanie Köhnk, Risha Rasheed**

*Olive Ridley Project - Kenya, Kenya*

Sea turtles, critical to healthy marine ecosystems, face numerous threats. The Olive Ridley Project - Kenya investigates the effectiveness of community-led conservation in mitigating these threats, focusing on fisherfolk engagement in Kwale County, Kenya. We explore methods, benefits, challenges, and initial outcomes of a collaborative approach with 9 Beach Management Units consisting of 31 landing sites along a 50 km coastline. While fishers demonstrate enthusiasm for sea turtle conservation, limitations in funding, training, and access to information hinder their efforts. Our program addresses these limitations through targeted outreach, raising awareness, and fostering co-creation of conservation strategies. Notably, the program prioritizes balanced participation across gender, age, and stakeholder groups, ensuring inclusivity from authorities to fishers and community members. This study sheds light on the potential of community-led conservation for sea turtle protection. Initial findings indicate high fisherfolk engagement, with over 120 fishers trained and 91 certified as Sea Turtle Ambassadors highlighting the importance of addressing resource limitations. We present a framework for overcoming these challenges and fostering long-term, inclusive conservation efforts.

## SEA TURTLE WEEK: A GLOBAL ANNUAL CELEBRATION

**Brad Nahill, Bethany Holtz**

*SEE Turtles, United States of America*

In 2019, SEE Turtles launched our Sea Turtle Week campaign, inspired by and expanding on an effort by NOAA to highlight their work to protect sea turtles. Since, Sea Turtle Week has evolved into a global celebration of these animals taking place every June. The week begins on June 8th (World Oceans Day) and runs until June 16th (World Sea Turtle Day), with each day in between focused on a different species and threat. Each year, the campaign has reached more than 8 million people to educate and inspire action for these animals. Since then, we have partnered with more than 100 organizations around the world to reach more than 8 million people each year. The program has developed a variety of outreach materials including social media graphics, a video series, and student lesson plans. The campaign also runs contests including a student art contest, a photography contest, and an in-person Global Ocean Cleanup in collaboration with the Oceanic Society. The Sea Turtle Week social media network has grown dramatically with more than 13,000 followers across Instagram, Facebook, and Twitter. On these networks, we highlight partners and individuals, share information year-round, and more. We will be presenting information on how organizations and individuals can participate and how to be eligible for grants, contests, and promotion.

## EDUCATION AND AWARENESS OF COASTAL COMMUNITIES IN THE DEMOCRATIC REPUBLIC OF THE CONGO: A KEY LEVER IN THE FIGHT AGAINST SEA TURTLE DECLINE IN CENTRAL AFRICA

**Samuel Mbungu Ndamba**

*CICOBIO NGO, Democratic Republic of the Congo*

Characterized by a coastal strip approximately 39 kilometers long, interrupted by two estuaries—the Congo River and Tonde estuaries—the coastal area of the Democratic Republic of the Congo (DRC) is located between 5°46’ and 6°03’ South latitude and 12°12’ and 12°22’ East longitude. Stretching between the point of Banana and the Angolan enclave of Cabinda, this maritime façade runs in a northwest-southeast direction. The coastal strip is connected to the mainland by the Bangu Mountain chain. In several locations along this coastline, from September to the end of February each year, olive ridley turtles (*Lepidochelys olivacea*, 95%) and leatherback turtles (*Dermochelys coriacea*, 5%) come to nest. Several villages are located along this coastline, including BANANA, TONDE/MUANDA Village, NSIAMFUMU, KONG, TSHIENDE, and MALONGO. These densely populated villages are home to fishermen and their dependents, who also practice market gardening. During the nesting season, these communities intentionally or accidentally capture sea turtles at sea or on the nesting beaches. Some poachers destroy the nests that have not been identified in time to be relocated to hatcheries. Despite wildlife laws in the DRC that protect sea turtles and their eggs, the poverty and food insecurity faced by these populations lead them to view sea turtle eggs and meat as valuable food sources and/or items to sell for a modest income. Thus, environmental education and awareness is a crucial lever for action. Awareness-raising and educational activities are therefore central and ongoing in our sea turtle conservation projects in Central Africa in general, and in the Democratic Republic of the Congo in particular. With the support of a donor and the assistance of the Central Africa Sea Turtle Conservation Network (RASTOMA), the CICOBIO NGO has

educated and raised awareness among 319 individuals. To reach an even broader audience, we also record radio programs in local studios, which are broadcast monthly. In a local context where anthropogenic pressures on these endangered species are high and the enforcement of laws is insufficient, it is essential to mobilize more resources to reverse the current decline in sea turtle populations observed in Central Africa.

## CONNECTING CHILDREN IN CAMEROON TO MARINE WILDLIFE THROUGH VISUAL STORYTELLING

**Karel Cyndi Ngnah**

*African Marine Mammal Conservation Organization, Cameroon*

Cameroon's coastal villages, Batoke and Bakingili, host a remarkable diversity of sea turtles, with five of the world's seven species nesting along their shores. These turtles are vital to marine ecosystems, supporting healthy seagrass beds and coral reefs, while also holding cultural significance for local communities. However, they face severe threats such as poaching, plastic pollution, bycatch, and habitat degradation, leading to sharp population declines. Conservation efforts, including environmental education in local schools, have sought to address these challenges. Yet, traditional teaching methods have struggled to engage children effectively, with a pretest revealing over 80% of students were unaware of basic sea turtle ecology or the human activities threatening them. To overcome these limitations, we developed a culturally relevant animated cartoon to raise awareness and inspire action. This first cartoon is inspired by the real-life story of Paa Mensa, a local fisherman who transitioned from poaching sea turtles to passionately protecting them after being sensitized by AMMCO. At its heart, the cartoon conveys a compelling message about the impact of a polluted beach on sea turtle hatchlings. Paa Mensa sensitizes local children, showing how baby turtles often become trapped in abandoned fishing nets or plastic waste, unable to reach the sea. Through his guidance, the children learn about the harmful effects of marine debris and abandoned nets, inspiring them to take action by cleaning the beach and encouraging their fishing families to adopt sustainable practices. Paa Mensa also educates the children on the ecological importance of sea turtles, deepening their understanding of why these creatures need protection. The cartoon, designed as a 5-minute animation, uses vibrant and relatable storytelling to engage viewers. It features a cast of characters, including Paa Mensa and local children, set against a backdrop that authentically reflects the coastal environment of Cameroon. To enhance the experience, the cartoon incorporates culturally inspired music, adding to its emotional appeal and making it an effective and engaging educational tool. Featuring Paa Mensa and characters like Daniela and other children from the community, the cartoon is brought to life by the voices of local children who were thrilled to participate. Their enthusiasm has fuelled excitement across the community, with children eagerly sharing the story with friends and family. Preliminary results from sharing the cartoon during the holiday club with about 100 children have been highly encouraging. The children's excitement and engagement were evident as they asked thoughtful questions and pledged to protect sea turtles. The cartoon resonated especially with those familiar with Paa Mensa's story, amplifying its impact. Its reach extended beyond the classroom, with broadcasts on major platforms like CRTV and local television channels, further spreading its conservation message. Moving forward, the cartoon will serve as a vital educational tool for other communities and events, locally and internationally, uniting storytelling, outreach, and creativity to safeguard sea turtles' future.

## ENVIRONMENTAL EDUCATION FOR SEA TURTLE CONSERVATION IN THE GULF OF GUINEA: A CASE STUDY FROM PRÍNCIPE, SÃO TOMÉ AND PRÍNCIPE

**Jormicilesa Pires Amado do Sacramento Ceita Dias[1], Asiem Sanyal[1,2]**

*[1]Fundação Príncipe, a Registered Charity in São Tomé and Príncipe, Rua OUA, Santo António, Príncipe, Island, São Tomé and Príncipe*
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The Gulf of Guinea is home to critical sea turtle nesting sites, particularly on Príncipe Island in São Tomé and Príncipe, with key breeding sites for species such as the green (*Chelonia mydas*), leatherback (*Dermochelys coriacea*), and hawksbill (*Eretmochelys imbricata*). Despite national and international protections, these endangered populations face threats such as poaching, habitat degradation, and limited local awareness. Fundação Príncipe, a local conservation organisation on Príncipe Island, has pioneered educational initiatives aimed at fostering environmental stewardship among school-going children as a long-term strategy for sea turtle conservation. By integrating environmental education alongside primary and secondary school curricula, Fundação Príncipe has cultivated a generation of young conservation advocates with a nuanced understanding of sea turtle ecology and the human impacts on these species. Educational activities included; beach cleanups, turtle-nesting monitoring activities, and interactive workshops. These have heightened students' awareness of their island's unique biodiversity and the vital role they play in its preservation. Research suggests that such education can significantly improve pro-environmental behaviours in children and, by extension, their families and communities, fostering a culture of conservation (Mogias & Boubonari, 2019; Kollmuss & Agyeman, 2002). Environmental education as a conservation tool is particularly crucial on Príncipe, where livelihood practices have historically intersected with wildlife resources. By empowering youth with ecological knowledge, Fundação Príncipe's programme addresses root causes of sea turtle threats, promoting sustainable practices that respect local traditions while protecting biodiversity. These efforts align with São Tomé and Príncipe's national objectives to strengthen community-based conservation, contribute to marine protected area management, and fulfil regional agreements such as the Abidjan Convention. Moreover, this programme serves as a scalable model for the Gulf of Guinea, where similar pressures on biodiversity exist, highlighting the potential for replication in other island and coastal communities. We discuss Fundação Príncipe's programme design, key achievements, and challenges, emphasising the value of environmental education as an effective, long-term strategy for sea turtle conservation. Through this case study, we underscore the role of education in building local capacity for conservation, illustrating how community-driven initiatives can contribute to the preservation of ecologically and culturally significant species within the Gulf of Guinea.

## "ONLY CONNECT": PUTTING EMOTION INTO THE GAMES WE PLAY FOR POSITIVE CONSERVATION OUTCOMES

**Anna Stamatiou, Kostas Thomopoulos**

*MEDASSET, Greece*

"Humans are emotional creatures and many of the emotional creatures that were my friends were not taking steps to help the living world, not because they lacked information but because they lacked connection to it" (Conservation biologist, Tom Mustill, wildlife filmmaker and author of "HOW TO SPEAK WHALE")

Globally, the demand for conservation to be 'decolonised' is growing. What we at the Mediterranean Association to Save the Sea Turtles (MEDASSET) understand that to mean in practice is that conservationists must increasingly recognise the importance of supporting local communities (whether in the developed or developing world), to take responsibility in their own way for the health and wellbeing of their own natural environments and the habitats and living organisms that those habitats support. One of the ways we seed and build local interest and active engagement in conservation work is through our educational outreach programmes. We contend that human emotions are and must remain at the heart of public engagement efforts, and that the outreach work NGOs undertake must mobilise them... or fail. Further, that nowhere is it more vital to get this right than in the programmes we offer to the young. This presentation describes how we, at MEDASSET, approach creating memorable content in our outreach work, and take a close look at some of our most popular programmes. We will look at some examples of the engagement tools we use across a range of age groups – from primary school children to pensioners – and highlight the principles that lie behind them and make them successful. We will particularly emphasise the role physicality plays in generating our most prized immediate outcome - an emotional response. Although the challenge of evaluating long term effectiveness remains, the insights and experience MEDASSET has gained in over 30 years of community engagement and educational outreach will offer ideas that can be adapted by colleagues globally, and support other environmental NGOs working to develop their own public engagement tools.

## MARINE CONSERVATION IN PRACTICE: A SHORT-FORM FIELD COURSE PEDAGOGICAL MODEL FOR INTERDISCIPLINARY TRAINING OF AND COLLABORATION BETWEEN THE NEXT GENERATION OF SCIENTISTS

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Sea turtles are found in a vast range of marine ecosystems that cover more than 65% of the planet's surface, but the academic field of marine conservation is relatively nascent. Sometimes considered a subfield of conservation biology while alternately labelled as independent fields of study, it is inherently interdisciplinary. Conservation of sea turtle ecosystems is robust and multifaceted, practiced by professionals in academia, industry, non-profit, and government settings, each of which has unique approaches to protecting the oceans. The vastness of these challenges invites, and demands, new pedagogical approaches to effectively train the next generation of scientists and practitioners. The University of Florida School of Natural Resources & Environment partnered with the NOAA Southwest Fisheries Science Center to develop a short field course for students to provide immersive, hands-on exposure to marine conservation in practice, with a particular sea turtle focus. Experiential learning focused on practice rather than theory presented students a chance to scaffold their learning, building a stronger appreciation for the interdisciplinary nature of these conservation challenges. Focus was placed on several disciplines involved in sea turtle conservation, engaging practitioners and organizations beyond typical academic settings. Students were able to effectively build their learning through the course. Their learning scaffolded notably, from the initial baseline engagement in pre-departure meetings, which posed introductory questions, to the travel, which built more complex understandings and examples on a daily basis, ultimately ending with notably more involved post-trip reflection, tasking students to reflect on the ways their own career trajectories might intersect with marine conservation and how their understanding of the topic as a collaborative interdisciplinary project had been informed by their observations during the course. The post-trip reflections as well as the students' evaluations of the course showed high student satisfaction, with several noting that they enjoyed learning while having the chance to travel and have fun,

which was inherently linked to the structure of the course. Students expressed excitement about the chance to see sea turtle science in action. The most affirming comment received indicated that the class was a chance to engage with the full cycle of science, illustrating a deep engagement with complexities of both marine conservation and of science more broadly. Beyond these qualitative-driven conclusions, the course was also a success; it had a waitlist and ultimately had an enrolment above capacity. The success of our course provides a case study for future pedagogical strategies, emphasizing that there is both a need and demand for courses with experiential learning components in higher level science education institutions which can simultaneously provide a clear benefit to sea turtle conservation. Our experience with this course illustrates that students want to learn the material that faculty are able to teach, and they want to do it in creative and hands-on ways.

## ENGAGING ARTISANAL FISHERS IN SEA TURTLE CONSERVATION: A MULTI-STAKEHOLDER APPROACH TO BYCATCH REDUCTION IN THE BAZARUTO ARCHIPELAGO

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Bycatch in artisanal fisheries is considered one of the most significant threats to sea turtles in the Southwest Indian Ocean. Over the past 10-15 years, the widespread adoption of unsustainable net fisheries, coupled with the abandonment of more selective, lower-impact fishing gear, has become a concerning trend in the region. The nearshore waters and foraging grounds of sea turtles in Mozambique overlap directly with the resource use of artisanal fishers, exacerbating the bycatch issue. To address this challenge, a collaborative conservation initiative was launched in the Bazaruto Archipelago National Park (BANP), uniting various stakeholders, including marine protected area (MPA) management staff, law enforcement personnel, community monitors, conservation biologists, and artisanal fishers. The initiative's goal was to enhance awareness and foster engagement among these groups to improve outcomes for turtles caught in nearshore seagrass seine net fisheries. In this program, the conservation team worked closely with community fisheries monitors and artisanal fishers from the nearby island communities of Sitone and Zengulemo. The team utilized fisher-caught turtles as subjects for satellite tagging. During the tagging campaigns, the conservation team collaborated directly with fishers to assist in net retrieval and turtle handling. Turtles were then measured, flipper-tagged, photographed for individual identification, and equipped with satellite tags (Lotek FastGPS F6 series, 2023-2024) and acoustic tags (2024). Two field campaigns were conducted in 2023 (satellite tagged turtles: n = 7, total turtles processed: n = 17) and 2024 (satellite tagged turtles: n = 20, acoustic tagged turtles: n = 31, total processed: n = 52), processing a total of 69 turtles over approximately 15 days across two field trips. This study presents preliminary findings from this multi-stakeholder tagging project, highlighting key methodological insights and the engagement of artisanal fishers. High levels of overlap between artisanal fisheries and the foraging grounds of resident sea turtles (*Chelonia mydas* and *Caretta caretta*) were detected within the park. Additionally, the study facilitated the development of critical relationships with local fishers, improving the understanding of their perspectives on bycatch and the challenges it presents for park management. These insights are invaluable in shaping future strategies to mitigate bycatch and enhance the conservation status of sea turtles in the region.

## FISHERIES AND THREATS

### BYCATCH OF SEA TURTLES IN SOUTH MOROCCO

**Mustapha Aksissou[1], Mohamed Erradi[1], Wafae Benhardouze[1], Manjula Tiwari[2]**

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The study on bycatch of sea turtles was conducted in two fishing zones in southern Morocco: Tan-Tan (Zone A) from January 1 to June 15, 2024, involving 60 monitored fishing vessels, and south of Sidi El Ghazi (Zone B) during the winter octopus fishing season from January 1 to March 31, 2024, with 45 vessels targeted. Overall, the study reported 75 incidental captures across both zones, primarily consisting of loggerhead turtles (*Caretta caretta*). In Zone A (Tan-Tan), 30 bycatch were recorded among the 60 fishing vessels, all identified as loggerhead turtles. The captures primarily came from coastal trawlers (73%), with smaller contributions from small-scale fishing boats (13%), and longliners and purse seiners (7%). In Zone B (South of Sidi El Ghazi): 45 bycatch of sea turtles are reported, with 36 from industrial trawlers and 9 from coastal trawlers. The average capture depth was 51.53 meters. In terms of the sizes of the 75 captured turtles, the curved carapace length (CCL) ranged from 24 cm to 80.2 cm, with an average of 54.76 cm. The curved carapace width (CCW) varied from 22 cm to 80 cm, averaging 50.66 cm. Descriptive analysis revealed that 83% of the captured turtles were juveniles (CCL < 70 cm), with the most frequent size class being between 50 cm and 60 cm, which accounted for 32% of the total captures. The spatial distribution of captures in both zones underscores the urgent need for effective management strategies to address the high rates of turtle bycatch, along with considerations of capture depths that may influence turtle vulnerability in these fishing areas.

### PRELIMINARY STUDY ON LIGHT POLLUTION IN CATALONIA'S BEACHES (NORTHERN SPANISH MEDITERRANEAN COAST): CRITICAL POTENTIAL IMPACT ON AN EMERGING NESTING POPULATION

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Light pollution is a major threat to loggerhead sea turtles (*Caretta caretta*) as it can negatively affect nesting females and disorientate hatchlings, reducing their survival rates. Therefore, effective management of light pollution on beaches and the implementation of mitigation measures are crucial in areas where sea turtle nesting occurs. In this context, the beaches of the western Mediterranean Sea have become particularly vulnerable, as the entire coastline has recently experienced a significant increase in loggerhead nesting activity due to global warming (particularly in Italy, France, and Spain). As a result, managers of

these beaches are facing a new and unprecedented situation. This is the case in Catalonia, northern Spain, where beaches—like those along the Spanish Mediterranean coast—are highly developed and heavily frequented by tourists during the summer, making light pollution a big potential impact to consider, particularly as nesting activity is expected to increase next years. Along the Catalan coastline, which spans approximately 280 km, this upward trend in nesting activity has already been particularly noticeable in the last decade, reaching 31 nests from a total of 80 detected in Spain. A record of 10 nests in Catalonia was attained in 2023. This study aims to provide a preliminary characterisation of the artificial light at night (ALAN) present on Catalan beaches, in order to identify optimal areas along the coast and also determine the most problematic sites, with the future objective of improving management practices to support sea turtle nesting and species conservation. Preliminary data were collected from several representative Catalan beaches using a Sky Quality Meter (SQM), which measures night sky brightness in magnitudes per square arcsecond (mag/arcsec²) to quantify light pollution, and a lux meter, which measures illumination in lux, to assess the intensity of artificial lighting at nesting sites. The SQM recorded high quality night sky values in areas such as the Ebro Delta Natural Park, where readings exceeded 21 mag/arcsec² at the zenith, indicating very good night sky quality. This area corresponds to Catalonia's highest light protection category (E1), which includes the park's marine zone. In contrast, values below 17 mag/arcsec² were recorded at some other beaches, indicating poor night sky quality. Lux measurements were taken at turtle eye level and typically ranged between 0 and 0.3 lux at most sites, although some areas exceeded 3 lux. The study provides preliminary data on ALAN along the Catalan coast, identifying areas with the best levels of sky darkness (with potential to support nesting activity) and pinpointing light pollution hotspots. This research is part of the national InGeNi-Caretta project, which aims to assess the suitability of Spanish Mediterranean beaches for loggerhead sea turtle nesting. In addition, light pollution technicians from the Catalan government (Generalitat de Catalunya) contributed to the ALAN assessment of the study area. The project's findings will improve conservation strategies and guide effective light pollution mitigation measures to support this vulnerable species as nesting continues to expand in the western Mediterranean.

## A CITIZEN SCIENCE APPROACH TO STUDYING INJURY AND MORTALITY PATTERNS OF SEA TURTLES IN THE RED SEA

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Studying injury and mortality patterns is vital to understanding what is needed for threatened and endangered sea turtles to recover. These types of studies are needed as the area is about to undergo massive coastal development. The objective of this study was to examine the anthropogenic and natural attributed mortality and injury patterns of sea turtles in the Egyptian Red Sea. Sea turtle survival in the Red Sea is now dependent upon the intensity of anthropogenic factors. Fishing was attributed as the major source of mortality, while boat strikes were attributed as the major source of injuries. We observed an urban coastal effect as anthropogenic mortality and injuries were more intense within the vicinity of largest city. There is some intentional harvesting of hawksbill turtles, *Eretmochelys imbricata*, and stranding data suggest that current stranding rates for the critically endangered hawksbill turtles may not be sustainable. The breeding and nesting season were particularly dangerous for sea turtles due to the higher than expected stranding

and mortality during this period. This study provides a baseline to assess future changes in the intensity of anthropogenic disturbances in the Red Sea.

## IDENTIFYING DIRECT CAUSES, SPATIAL DENSITY, AND EMERGING THREATS OF SEA TURTLE STRANDINGS ACROSS THE U.S. VIRGIN ISLANDS (2018-2023)*

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The U.S. Virgin Islands (USVI) has a strong network of volunteers who respond to stranded sea turtles found in-water and washed ashore. The Territorial stranding network has operated under the non-profit Sea Turtle Assistance and Rescue (STAR) Network since 2019, but efforts made by local agencies, non-profits, and conservationists to find and document stranded turtles span decades. We conducted a 5-year review of the most recent strandings to identify current turtle strandings drivers. We created spatial hotspots of where these strandings occurred using kernel density estimation, with the goal of informing managers of transportation, port authority, and power utilities, as well as encouraging public and private entities to implement direct action to protect sea turtles. From 2018 to 2023, 165 sea turtle strandings were recorded around the USVI. Of these strandings, 120 were identified as green turtles (*Chelonia mydas*), 32 were hawksbill turtles (*Eretmochelys imbricata*), three were leatherback turtles (*Dermochelys coriacea*), two were loggerhead turtles (*Caretta caretta*), and nine were of undetermined species.vPreliminary comparison to other island groups shows that the USVI has a relatively high rate of turtle strandings for the size of our territory (Hawaiian Archipelago – 0.106 turtles/year/mile of shoreline vs. USVI – 0.282 turtles/year/mile of shoreline). The most common cause of strandings across the USVI was boat strikes (19.9%), followed by entrapment in vegetation (14.5%), fishing gear entanglement (13.9%), and entrapment in human-made structures (12%). As expected, boat strike injuries were highly correlated with areas of high boat traffic, such as inter-island routes, and fishing gear entanglements were correlated with popular on-land fishing locales, specifically on St. Croix. These results will be used to directly inform and advocate for no-wake zones and speed regulations in the boat strike hotspots outlined by this study. We hope to use this as evidence for increased support for all actions recommended by the STAR Network, like boating slowly, mitigation fencing and barrier removals around shorelines, and collecting monofilament during fishing activities. The evidence herein supports the advocacy of the volunteers and agencies that have been rescuing our sea turtle species since the inception of conservation efforts in the USVI.

## ANTHROPOGENIC THREATS LEADING TO THE ADMISSION OF SEA TURTLES TO ATOLL MARINE CENTRE OVER THE YEARS

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*Atoll Marine Conservation Centre*

Atoll Marine Conservation Centre (AMC) is a sea turtle rescue and rehabilitation facility on Naifaru Island in the Lhaviyani Atoll, Maldives. Established in 2012 to combat the illegal pet trade of sea turtle hatchlings, a serious threat to the turtle population in this archipelago. AMC expanded in 2016 to treat turtles of all ages affected by anthropogenic threats, such as entanglement in marine debris. By understanding the epidemiology of AMC's turtle admissions, insights into regional threats and trends can be gained, supporting targeted conservation and community outreach efforts. Despite this expansion, hatchlings remain the most common patients, with a hatchling-to-juvenile/adult ratio of 0.6. Of these, 82% are admitted due to poaching for illegal pet trade, followed by only 5% found disoriented due to habitat degradation. In contrast, since 2016, AMC has admitted over 100 juvenile and adult turtles, with 75% entangled in marine debris, 16% suffering from buoyancy disorders of unknown origin, 3% struck by watercraft, 4% ingesting foreign objects, and 3% admitted for other causes. AMC has successfully rehabilitated and released 55 of them, including 47 entanglement victims, though the mortality rate remains 11% for these cases. In addition, a peak in entanglement cases is observed between January and March, which is related to the northeast monsoon season. Data collection at AMC has faced challenges, including early reliance on volunteer staff, limited technological resources, and gaps in records from 2020–2021 due to COVID-19. Despite these limitations, findings confirm that poaching for pet trade and entanglement remain critical threats to sea turtles in the Maldives. Poaching for consumption—a suspected but underreported risk—remains unaddressed due to the lack of comprehensive data in this area. Ultimately, AMC's work highlights the ongoing need for targeted conservation efforts to protect vulnerable sea turtle populations from both poaching and entanglement in the region.

## PLASTIC POLLUTION IN CRITICAL SEA TURTLE NESTING HABITATS ON REMOTE ISLANDS: A BASELINE STUDY OF PRINCIPE, GULF OF GUINEA

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Plastic is the most abundant marine anthropogenic debris in the ocean and is of serious global environmental concern. The location of small remote islands in the ocean and dynamics affecting plastic deposition on their coastline makes them regions of interest for monitoring marine plastic debris. Monitoring and conserving these island habitats is vital due to the potential direct and indirect harm caused to sea turtles by plastic pollution in the water and on nesting beaches. This study provides novel baseline information on the quantities of marine debris found on the island of Príncipe in the Gulf of Guinea in the Atlantic coast of Central Africa. Príncipe has important breeding, foraging, and nesting grounds for four threatened sea turtle species including one of the last remaining hawksbill turtle nesting aggregations in

the region. A total of 13,196 items were collected with 64.5% of these items being plastic. Plastic pieces the size of 2.5–50 cm made up 20.8% of all plastic items, followed by plastic bags (13.3%) and fishing material (11.39%). The density of mesoplastic items (5mm) ranged between 0 and 6.78 items m− 2 . Beach location, community presence, and beach level were important factors in explaining differences in plastic abundance and density around the island. This study highlighted that significantly higher proportions of plastic accumulated along the turtle nesting line (TNL) than the strandline (SDL) on critical nesting beaches. This pattern aligns with findings in other studies on remote islands, and raises concerns, as the TNL serves as an indicator of plastic accumulation in nesting areas and risks posed by excessive accumulation. Long-term monitoring of plastic accumulation on these beaches is important for the evaluation of seasonal or annual variations impacting debris accumulation on the beach which can then be compared with sea turtle nesting seasonality. Our results highlight the significance of high plastic pollution accumulation on remote island habitats for sea turtles.

## FROM THE DEATH TO LIFE*

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From a holistic perspective, all efforts and methodologies that can be implemented to safeguard sea turtles and their nesting are an added value for conservation. This study describes a postmortem procedure carried out by Kitabanga Project after an olive ridley drowned in a fishing net was acquired in Base do Longa (S10°16′24′′ and E13°31′19′′) in Angola. It represents an attempt to minimize a negative impact and transform a death into life. When a necropsy was carried out on the olive ridley, 222 fully formed eggs, that would have been deposited during its next nesting attempt, were carefully removed one by one and taken to be artificially incubated in a plastic box (50 cm depth x 30 cm width x 40 cm height) filled with sand at the Longa ex-situ incubation center (Kitabanga Project site). Incubation duration was 69 days, a relatively long period for this species in-situ on Angolan beaches, but closer to incubation duration in some regions. Hatching success was 56.7%, with 122 live hatchlings and 4 dead hatchlings in the nest. Among the remaining eggs, 85 had clear evidence of embryonic development and 11 eggs did not. The hatching success obtained is lower than other similarly artificially incubated nests, which have a hatching success around 75 to 100%. Nevertheless, the effort contributed hatchlings to the populations that normally would have perished with the dead turtles. Postmortem egg collection and incubation could become a viable strategy to increase hatchlings and help conserve endangered species. It is assumed that the stage of development of the eggs and the state in which the animal is found at the time of death, influence the viability of the eggs and their success. Additionally, a quick response and appropriate handling techniques are required for success. However, the practice must be regulated by strict ethical and legal guidelines to ensure that only females killed by natural causes or accidentally are used. Human intervention must be minimally invasive and with clear conservation purposes.

# UNITY AND COLLABORATION FOR AN EFFECTIVE WEST AFRICAN FRAMEWORK TO UNDERSTAND AND REDUCE BYCATCH OF MARINE MEGAFAUNA*

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Bycatch mortality is considered a major threat to marine megafauna worldwide. REDUCE is one of the current projects aimed at increasing knowledge and mitigating the impact of bycatch on marine megafauna, concentrating efforts on the Central-East Atlantic. This project is collecting information from a variety of sources including fisheries observers, interviews with fishers and tagging of animals. Here we present an initiative to assess and, where possible, improve the potential for collecting information about bycatch mortality from strandings. This initiative aims to build a robust, effective and independent long-term framework to monitor stranded marine megafauna for a better understanding of the threats faced, rooted in unity and collaboration. Robustness will be pursued by creating a strong, stable and extensive network of stakeholders with the opportunity to attend strandings and collect information from such valuable events. Effectiveness is sought by learning from stakeholders and promoting the exchange of information among them, accounting for ongoing initiatives with similar or complementary objectives, and providing the necessary logistic support to collect data and samples. Independence is sought by adapting data collection methods to local constraints, developing training workshops to strengthen skills, and strengthening network links by creating a platform for internal communication. Individual meetings and collective roundtables with stakeholders from more than 10 countries in the Central-East Atlantic have provided information on their current situation regarding stranding attendance, the methods used to collect data and samples, and the limitations they face. Systematic collection of basic data such as species, location, dates and photographs is frequent, but collection of relevant information and samples to diagnose the cause of stranding or death is really rare. Despite the limitations, our conversations with numerous stakeholders suggest that there is a common and strong willingness to make progress on this issue. Even though these are first steps, collection of new data and samples has already started in a few locations, based on adaptations of existing protocols. From now until the end of the REDUCE project in December 2027, we hope to make the unions stronger and the collaborations more effective as mentioned above, to support an independent network of organisations with increased potential to collect information on the impact of bycatch and other threats on marine megafauna.

# TRAUMA DUE TO BYCATCH AND VESSEL STRIKES: MAIN CAUSE OF DEATH OF THE SEA TURTLE ON THE ANDALUSIAN COAST (2020–2024)

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Strandings of live and dead sea turtles occur frequently along the Iberia peninsula and its islands. The Andalusian coast, especially the Gulf of Cadiz, Strait of Gibraltar and Costa del Sol, is critical for sea turtles, representing migration and feeding grounds. Full necropsies on stranded animals are key, to diagnose the cause of death and to provide useful scientific data to support the development of mitigation measures. To date, there is none published information on the causes of strandings and/or mortality in sea turtles on Andalusian coast. This study describes the pathological findings and causes of death (CD; grouped as 'pathological entities') of 43 sea turtles, representing 4 species, stranded in Andalusia between 2020 and 2024: 34 loggerhead (*Caretta caretta*), 5 leatherback (*Dermochelys coriacea*), 3 green (*Chelonia mydas*), and 1 Kemp's ridley (*Lepidochelys kempii*) sea turtles. A CD was recognized in 36/43 (84%) studied individuals (whilst the cause of death in 7 could not be due to the state of the carcass). Direct human activity is responsible for 79% (34/43) of sea turtles deaths, while 'natural' pathologies would account for 5% (2/43). Interaction with fishing activities encompassed 28 out of 34 while vessel strikes were responsible for 6 out of 34. Regarding the interaction with fishing activities, the prevalence of the different findings was analyzed: 28 (100%) of the cases showed a good body condition; digestive content; cardiovascular presence of gas (embolism); subcutaneous, muscular and bronchoalveolar haemorrhages; bronchoalveolar edema; hepatic congestion; and multifocal scratches in carapace, head, or plastron. Additionally, 25 (89%) of the animals, showed multiple areas of skin abrasions, ulceration and necrosis in the plastron and/or carapace. These lesions are consistent with entanglement in fishing gear. Also, an increased serosanguineous free fluid in the coelomic cavity, were found. In 18 (64%) individuals, pulmonary emphysema was identified. At last, 5 showed mandibular fractures, 8 limbs fractures or amputation and 3 retraction of the limbs. Signs of asphyxia or water aspiration were detected in 16 individuals. Macroscopic evidence of drowning during the necropsy of a sea turtle can vary, is often nonspecific, and frequently altered by post-mortem changes, making the diagnosis difficult to establish and often reliant on the exclusion of other causes. Boating and fishing can cause traumatic injuries to sea turtles. In our study we identified blunt force trauma as the cause of death in 6 out of 34 due to vessel strike. 6 showed fractures in the carapace, plastron or head, as well as muscular, subcutaneous and intracoelomic haemorrhages; 5 individuals presented damaged of the liver and alveolar edema. Direct human activity is responsible for nearly 80% of the sea turtles in our study, primarily due to fishing gear interactions and vessel strikes, the leading causes of mortality along the Andalusian coast. The analysis highlights the significant impact of bycatch, with injuries such as abrasions, ulcerations, and haemorrhages commonly associated with entanglement in fishing gear. These findings stress the need for mitigation measures, including better protection in key areas and continued research to guide conservation actions.

# INSIGHTS INTO LEATHERBACK TURTLE MORTALITY AND STRANDINGS IN SOUTHERN SPAIN (2007–2024) AND A WAY FORWARD

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The only representative of its genus, the leatherback sea turtle (*Dermochelys coriacea*) is the largest and most distinctive of the seven marine turtle species and is unique for having a soft skin which covers its osteoderms. The species is well adapted to deep diving, cold water endurance and long migratory movements but its ecology remains largely unknown. Leatherbacks face numerous direct and indirect threats around the world. Investigations of stranded animals can provide important insights into the health status of a population and the nature of anthropogenic threats. Understanding the causes of death and their relative prevalence is essential for conservation and management. A total of 191 leatherback turtles stranded along the Andalusia coast between 2007 and 2024. The 191 reported stranding events show significant interannual variation over the period, with a peak of 15% in 2015 followed by around 10% in 2011, 2020 and 2024. Seasonally, strandings were most frequent (81%, n=154) between April and October. Geographically, 70% (n=134) of reported strandings occurred along the South Atlantic Demarcation, primarily in Huelva (n=72) and the western region of Cádiz (n=61). Complete standardized necropsies were able to be conducted in 7 animals: 2014 (n=1), 2020 (n=3), 2022 (n=1), and 2024 (n=2). All seven turtles (100%) showed good nutritional status (undigested or partially digested food), gas embolism, and hepatic as well as generalized congestion. All but one (86%) showed bronchoalveolar and alveolar edema, haemorrhages, intestinal mucosal congestion with a segmental pattern, increased fluid in the coelomic cavity and gas in the cardiovascular system. In addition, five (71%) showed multiple areas of skin abrasions, ulceration and necrosis in the plastron and/or carapace, consistent with entanglement in fishing gear. Three (43%) of the turtles showed pulmonary emphysema. The preliminary results indicate that the most probable cause of death in all seven cases is interaction with fishing gear. From many years, the study of the cause of death in sea turtles was not part of the regional stranding response protocol this has been a key factor limiting the number of cases analyzed. Our projects have shown the feasibility and conservation value of conducting comprehensive, standardized necropsies and reaching presumptive diagnoses. It is thus essential for administrations to allocate long-term resources to sustain these studies, which are vital for identifying threats and implementing priority mitigation measures. Already the evidence suggests that interactions with fishing gear pose a significant threat to this species, highlighting the urgent need for further study and the development of effective mitigation strategies.

## SEA TURTLE BYCATCH IN COMMERCIAL TRAWL AND PURSE SEINE FISHERIES IN SABAH, MALAYSIA*

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*Marine Research Foundation, Malaysia*

Sabah is home to four turtle species: *Chelonia mydas*, *Eretmochelys imbricata*, *Lepidochelys olivacea*, and *Dermochelys coriacea*. These species are threatened by accidental captures during fishing activities, particularly in trawl fisheries. In Malaysia, fishers are not allowed to capture sea turtles as they are legally protected. However, this does not protect the sea turtles from being caught accidentally. Fishers often discard the turtles, leaving a gap in information about where and when these capture events occur and whether the turtles are still alive when released. As part of an unrelated comprehensive project to assess shark and ray bycatch, electronic monitoring cameras were deployed on fishing trawlers and purse seiners to capture images of all species that were landed on a subset of 47 fishing vessel decks. Images of green and olive ridley turtles were captured by the cameras, while fishers provided footage of turtles being landed on deck, including leatherback turtles, serving as citizen-contributed data. These images were stamped with date, time and GPS coordinates, and this provides us with accurate location and timing data for each capture. Hotspot areas where most of the capture events occurred were identified by combining and analysing all location data, and overlaying this with fishery pressure. Olive ridley turtles comprised 19% of the bycatch, green turtles accounted for 48%, and the remaining individuals could not be identified. The capture of olive ridleys is a riddle as few have been observed nesting in Sabah. The size of each captured individual will be estimated from accurate measurements of the boat decks, and both the size composition and age-group distribution of the turtles caught by the vessels will be determined. These data will be used to investigate the spatial and temporal trends of these accidental captures, that can be used for future conservation management of the species and address the accidental catches of turtle, such as to protect the species in the hotspot areas from trawling or encourage the trawlers that operate in the hotspot areas to install Turtle Excluder Devices (TEDs).

## EVALUATING THE EFFECTIVENESS OF TURTLE EXCLUDER DEVICES (TEDS) AS A BYCATCH REDUCTION MEASURE FOR SEA TURTLES IN SABAH, MALAYSIA*

**Liyana Izwin Khalid, Kooi Chee Ho, Jonathan Jiun Lang Phu, Mohd Syahiran Masrin, Chun Xue Chai, Nicolas James Pilcher**

*Marine Research Foundation, Malaysia*

In Malaysia, shrimp trawl fisheries have significantly contributed to the decline of sea turtles, with thousands taken as bycatch annually. Limited ecosystem-based fishery management and insufficient stakeholder involvement exacerbate this issue, affecting not only juvenile and trash fish but also large marine species such as sea turtles. Effective bycatch reduction strategies must protect turtles but not at the expense of negatively impacting fishers' income and livelihoods, making gear modifications, such as the Turtle Excluder Devices (TEDs) more practical than spatial restrictions. This study focuses on TEDs implementation in Sabah, home to Malaysia's largest trawl fleets (>1,000 vessels). The Marine Research Foundation conducted 57 paired trials in 2015-2019 to compare catches from TED-equipped and non-

TED-equipped trawlers. Each trial involved a minimum of two-hour tow, followed by sorting, weighing, and comparing catches of shrimps, commercial fish, trash fish, and debris. Key findings revealed a slight increase in shrimp catches 4% in absolute catch in kg and 0.02% as an average across all catches in TED-equipped vessels. Commercial fish catches showed a minimal decrease (0.05% absolute and 0.03% average), representing fish that remain available for future trawls. The reduction in trash fish landings (0.24% absolute and 0.21% average) and debris (0.23%) demonstrates significant indirect benefits of TED adoption. By minimizing unwanted bycatch and debris, fishers benefit from shorter sorting times and reduced wear and tear on fishing gear, leading to lower operational costs and improved efficiency. The project also explored innovative TED designs, including a modified TED design featuring a 1m x 1m trapdoor flap to enhance catch retention and a Malaysian-designed frameless TED, a novel approach aimed at improving efficiency and usability. While the modified trapdoor design addressed fishers' concerns about potential catch loss, it is essential to note that TEDs themselves do not reduce the overall number of fish entering a net. The frameless TED underwent a pilot trial, highlighting areas for design refinement, and the need for additional testing to enhance effectiveness. Fishers were generally pleased that TEDs did not result in significant catch losses, addressing a critical perception challenge. While some trials were impacted by low catch volumes outside peak shrimp seasons or equipment damage, the overall results demonstrated that TEDs did not significantly reduce total catches. Instead, TEDs provided indirect benefits, including reduced debris, shorter sorting times, and improved fuel efficiency. The results also indicated that TEDs consistently improved catch quality. One limitation of short-term trials is the variability of fishing conditions, where outcomes can vary between nearby fishing areas. For instance, a TED-equipped vessel might trawl through a school of commercially valuable fish one day, while the non-TED vessel might do so another day. To address this, results across all 57 paired trials were aggregated and fishers were advised to use TEDs for at least a month before assessing their overall effectiveness. This study highlights the potential of TEDs as a low-cost, practical solution for balancing sea turtle conservation efforts with the economic needs of fishers while promoting sustainable fisheries management in Malaysia.

## THE SHRIMP FISHERY AND ITS INTERACTION WITH SEA TURTLES IN THE SOUTHEASTERN REGION OF CUBA

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In Cuba, shrimp trawl fisheries are carried out in the southeastern region, one of the most important areas of distribution of sea turtles on the Cuban shelf. In this paper, the interaction of shrimp trawls with sea turtles is analyzed, taking into account turtles caught, fishing effort and satellite tracking. The study was conducted both during the fishery (January-June) and on survey cruises (January-December) during the years 2021 and 2022. A total of 9 turtles were reported as bycatch (5 green turtles, 3 hawksbills and 1 loggerhead), during the two years. Of these, 7 were alive (77.7%) and 2 were dead. The values obtained indicated low incidence and low mortality of these species by this fishery. Satellite data of hawksbills tracked during different periods in the southeastern region, analyzed to complement this study, allowed us to identify important areas where this species remains, in which, due to the characteristics of the bottom, shrimp trawling operations are not carried out, thus reducing the possibility of their capture by the shrimp fleet. These results confirm the studies carried out over the years on the biodiversity of the fauna accompanying the shrimp fishery in the southeastern region of Cuba, based on the study of its structure and composition, which highlight that more than 90% of the bycatch are fish and crustaceans, the rest are molluscs, sponges and echinoderms; and that the capture of a turtle occurs occasionally and sporadically in this fishery, since, in general, they do not coincide with the areas where shrimp trawling is carried out.

Nevertheless, it is vitally important to comply with the established regulations for the return of live turtles or the possibility of saving them as a mitigation measure.

## FROM HARM TO HOPE: PROMOTING AWARENESS TO COMBAT MUTILATIONS OF SEA TURTLES IN THE EGYPTIAN RED SEA

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TurtleWatch Egypt (TWE) is a citizen science initiative focused on monitoring and protecting marine turtles in the Egyptian Red Sea through data collection and photo identification. By engaging divers, snorkelers, local citizens, and partnering with local authorities, TWE gathers crucial information on marine turtle abundance and distribution in the region. While most reports capture sightings of turtles in the water, TWE occasionally documents cases of stranded, injured, or deceased turtles along the coastline, which has recently evidenced a new, emerging and serious threat. In 2024, TWE and the National Park (NP) received a concerning report from a local resident who found a critically endangered hawksbill turtle (*Eretmochelys imbricata*) stranded on the shore. Upon examination, the NP team found the turtle alive but severely mutilated, with no skin on its head and carapace. This incident marks the first recorded instance of a turtle found alive with such severe injuries, although it is not an isolated case. A similar incident occurred in 2018, when a deceased hawksbill turtle was reported with comparable injuries, including the removal of the carapace's keratin layer. Further sightings of dead turtles with similar carapace damage along the Egyptian Red Sea coast indicate a troubling, deliberate pattern of harm, likely linked to certain fishing practices, as suggested by environmental authorities. The specific targeting of the turtles' heads and carapaces leaves them highly vulnerable to infection, exposure, and eventual death from starvation, regardless of their immediate survival. The recurrence of such incidents underscores an urgent need for investigation and action. The absence of a regional rehabilitation center and limited access to trained personnel constrain emergency response efforts. Currently, the NP and TWE relies on the expertise of international veterinarians, who assist by evaluating cases and providing guidance on treatment options. As keystone species, sea turtles play a critical role in marine ecosystems, maintaining healthy seagrass beds and coral reefs, which in turn support diverse marine life and contribute to the sustainability of local fisheries. In response to these events, the NP and TWE, are planning workshops to engage fishermen, promoting awareness on the conservation importance of marine turtles. Additionally, the NP and TWE are organizing surveys to assess the extent and impact of these incidents on the local turtle population. These efforts aim to raise awareness, correct misconceptions, and foster shared responsibility for protecting critically endangered sea turtles, crucial for marine ecosystem health and regional fishing sustainability. There is also a pressing need to organize specialized training courses for local veterinarians who can respond effectively to such cases under the guidance of international experts. This highlights the necessity of securing funding to support these training programs and ensure sustained conservation efforts. In summary, a coordinated approach of education, law enforcement, and community involvement is essential to protect the critically endangered sea turtles of the Red Sea.

# TURTLE EXCLUDER DEVICE (TED) EFFICIENCY TRIALS ABOARD A KENYAN SHRIMP TRAWLER, APRIL 5TH - MAY 5TH , 2018

**Tony {Michel Anthony} Nalovic[1], Edward Kimani[2], Nina Wambiji[2], Sean Fennessy Fennessy[3]**

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As a component of the Western Indian Ocean Marine Science Association (WIOMSA) funded Bycatch Assessment and Mitigation in Western Indian Ocean Fisheries (BYCAM) program, a fishing gear specialist accompanied by one Fisheries scientist from the Kenya Marine and Fisheries Research Institute (KMFRI) collected information on catch rates of fish and bycatch from trawls equipped with a 10 cm bar spacing TED constructed In country for testing aboard a Kenyan shrimp trawler. Trawling operations were conducted out of Mombasa (Map 1) on the Kenyan coast in East Africa between the 20th of April and 3rd of May 2018. Catch data was collected from TED versus non-TED equipped trawls during a series of 73 consecutive comparative tows (both top and bottom opening TEDs where experimented). The duration of the tows and fishing zones were at the captain's discretion. The 73 tows can be separated into 3 categories of data since 1) the first 23 tows were used to adjust gear (both the trawls and the TED configuration), 2) the next 30 tows (all. Top opening) considered here to be the preliminary experiment and 3) the last 20 tows (all top opening) which were à continuation of the first 30 tows but this time conducted without the gear specialist onboard the fishing vessel. These 20 tows and the previous 30 tows were considered a data series and so analysis was also conducted on the series of 50 tows. A statistical analysis of the catch data between a top-opening TED-equipped trawl and non-TED trawl for the second category of data (30 tows) shows no difference in the catch rates of targeted shrimp, fish or bycatch. Large fish specimens of Pawizi (Lobotes surinamensis) were captured less often in the TED equipped trawl. Adversely, the statistical analysis of the 3rd category of data (50 tows) for the same TED configuration shows a difference in the catch rates of targeted fish and bycatch. Large fish specimens of Pawizi were again captured less often in the TED equipped trawl. Shrimp catch showed no difference in catch rates. The study culminated in a summary meeting between project personnel, NGO's, industry and the KMFRI and KEFS representatives. It was noted that members of the fishing industry actively participated in the project and directly contributed to its success. The positive results of the study may serve to catalyze an interest in continued TED implementation activities in the region by WIOMSA especially for trawlers operating in Kenya, Tanzania and potentially including Mozambique leading the way for broader TED adoption in shrimp and fish trawls of the sub region.

## AN ASSESSMENT OF THE EVIDENCE FOR INDIVIDUAL AND POPULATION-LEVEL EFFECTS OF HEAVY METALS ON SEA TURTLES*

**Madhurika Nandi, Andrea D. Phillott**

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Heavy metal pollutants resulting from anthropogenic activities, such as agricultural runoff and mining, can pose a serious threat to marine life. In particular, the long persistence of heavy metals in the marine environment coupled with the continued and increased impact due to bioaccumulation and biomagnification are of significant concern. In most cases, the development and survival of the affected individuals are threatened, and heavy metals can also negatively impact predator species. Sea turtles are one of the taxa that are vulnerable to heavy metal toxicity in both the aquatic (e.g., foraging) and terrestrial (e.g., embryo developmental) habitats occupied by different life stages. However, the potential for heavy metals to have an impact at both the individual and population level has yet to be determined. We are conducting a systematic review to examine literature that investigates the impact of heavy metals on sea turtles. Searching peer-reviewed literature published up to 2024 has identified 119 relevant research publications, from which data on location, species, life-stage, tissue examined, heavy metals detected or examined, and evidence of effects at the individual and population-level is being extracted. Our findings synthesise the current body of research on this threat to sea turtles, identify research gaps, and give direction to new studies investigating the scale and impact of heavy metals on sea turtles.

## THE EFFECT OF PROTECTED AREAS, COASTAL DEVELOPMENT, AND ARTIFICIAL LIGHT AT NIGHT ON NESTING MARINE TURTLES

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Coastal development and artificial light are increasingly causing habitat degradation and impacting species such as sea turtles, with coastal squeeze limiting possible climate change adaptation. In highly developed coastal regions such as the Mediterranean this is a particular challenge. We used long term clutch counts and satellite imagery to investigate the impacts of specially protected areas (SPAs), coastal development, and artificial light at night (ALAN) on green (*Chelonia mydas*) and loggerhead turtles (*Caretta caretta*) nesting in Cyprus, where both populations appear to be recovering from historical population declines. Nearly all green turtle clutches were laid on beaches within SPAs, while just over half of loggerhead turtle clutches were laid in these areas. During three decades of monitoring, green turtle clutch counts increased significantly more than loggerhead turtles within SPAs. There was no significant difference between loggerhead turtle clutch count increases inside or outside SPAs, possibly due to poor management of certain important loggerhead beaches in key SPAs. Beaches used by green turtles had a significantly lower beach

development score than those used by loggerhead turtles, but this was not the case for ALAN. There was no relationship between clutch count increase and beach development, or ALAN, regardless of sea turtle species. However, both the median development and ALAN scores were significantly greater for beaches used by loggerhead turtles located outside SPAs than those used by both species inside SPAs. Our study demonstrates that a) SPA management plans can be effective when they are applied, b) mitigation measures could benefit loggerhead turtles at some SPA beaches where management plans have not been adhered to, c) more SPAs are needed for loggerhead turtles and significantly more clutches could be protected by bringing a small number of beaches into the SPA network.

## MEASURING SEA TURTLE BEHAVIORAL RESPONSES TO GILLNETS: ASSESSING LEARNING EFFECTS FROM REPEATED EXPOSURE*

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Fisheries bycatch is a major source of anthropogenic mortality for sea turtle populations worldwide. Here, we add to our previous work addressing knowledge gaps in fine-scale behavioral responses of sea turtles to gillnet fishing gear. We conducted binary choice experiments using wild-caught juvenile green and loggerhead turtles in a testing tank at the St. Lucie Power Plant in Jensen Beach, Florida. Each turtle was presented two treatment pathways, one blocked by a gillnet, and one fully open. Individual turtles participated in three consecutive trials with netted and netless choices alternating between each trial. Behavioral metrics included binary choices made, avoidance and escape behaviors, and time spent in each treatment area. To assess potential net avoidance learning, we compared each metric among first, second, and third trials. Our results support a hypothesis that sea turtles learn from encounters with nets, with additional research needed to assess learning retention over longer periods.

## MARINE DEBRIS INGESTION BY STRANDED SEA TURTLES IN FLORIDA*

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Over the years, plastic production has increased to astonishing numbers and is predicted to continue. Sea turtles are known to mistake plastic for prey, which can result in gut compaction, perforation, and chemical leaching. This study compared marine debris ingestion across species and ontogenically, as different species and life stages inhabit different habitats which will influence exposure and thus risk. Plastic ingestion was investigated by collecting contents from the gastrointestinal (GI) tract of freshly euthanized or dead sea turtle carcasses in Florida. All work was performed under FWC permit MTP053 to SLM. We collected 104 GI tracts from loggerheads (*Caretta caretta*) (n=28), greens (*Chelonia mydas*) (n=61), hawksbill (*Eretmochelys imbricata*) (n=2), and Kemp's Ridley (*Lepidochelys kempii*) (n=13) sea turtles. The contents were digested with 10% KOH and filtered through a 2mm mesh metal filter. Plastics were then categorized and imaged. Nearly half (48%) of turtles overall were found with marine debris in their

GI tract. Plastics were found in all species; ranging from 2/2 hawksbills (both washbacks) down to loggerheads with the lowest rate of ingestion (14%). Marine debris was found in all age classifications where washbacks had the highest presence (80%) and adults the lowest (19%). In total we found 2010 individual pieces of plastic across the 104 individuals; one green sea turtle washback had 779 pieces in the GI tract. A female, juvenile green sea turtle had the longest piece of marine debris at 463.7cm in length. White marine debris and hard marine debris were the most common color and type of marine debris ingested. This study is essential for conservation as it investigates the widespread ingestion of marine debris among sea turtles. Researching these patterns helps inform stakeholders and legislators on what actions are needed to reduce plastic pollution, mitigate its effects, and protect organisms and their habitats.

## MICROPLASTIC POLLUTION IMPACT ON ENVIRONMENTAL PARAMETERS IN SEA TURTLE NESTS

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The abundance of microplastics (MPs) on beach sediments is considered to have tripled over the course of the past two decades. While stranded at the beach, MPs tend to be easily distributed within the sediment layers through erosion and accretion processes that control the sediment volume. Due to their unnatural weathering patterns (a result of their chemical properties), MPs were shown to increase the permeability, porosity, and temperature of beach sediments due to their high specific heat capacity (especially for dark-colored MPs). This is a highly significant threat to the development of sea turtles' eggs which are influenced by temperature in terms of the duration, sex determination, and successful hatching of the offspring. Hence, the occurrence of high abundances of MPs within the sand in turtle nests can have a negative impact on the species' next generations. This work investigates the occurrence of MPs on sea turtle nests in very important nesting areas of loggerhead (*Caretta caretta*) in Albania and Greece, olive ridley (*Lepidochelys olivacea*) in the Maldives, and hawksbill (*Eretmochelys imbricata*) and olive ridley (*Lepidochelys olivacea*) sea turtles in Japan. Using Raman spectroscopy, we determine the polymer types of the identified MPs, and use statistical analysis to evaluate the impact of different polymer types and abundance of MPs on the environmental parameters (temperature and humidity) of the nests.

# TRUST, TRAPS, AND TURTLES: LEVERAGING STAKEHOLDER AND FISHER PERSPECTIVES TO ENHANCE SEA TURTLE BYCATCH REPORTING AND MITIGATION IN FLORIDA'S TRAP FISHERIES*

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Recovery of imperiled species requires addressing conservation challenges within complex social-ecological systems (SES). Sea turtle bycatch in Florida's trap fisheries exemplifies this challenge, combining ecological risks to turtles, economic impacts on fishers, and mistrust between fishers and regulatory authorities. We used a mixed-methods approach to explore stakeholder and fisher perspectives on sea turtle bycatch in trap fisheries and identify strategies to improve reporting and mitigation of bycatch events. In Phase I, we conducted semi-structured interviews with 24 stakeholders representing diverse roles within the SES, including biologists/natural resource professionals, commercial fishers, wildlife law enforcement officers, and charter/tour boat operators. We aimed to examine the influence of diverse ways of knowing and lived experiences on attitudes and beliefs around sea turtle conservation, bycatch in trap fisheries, and potential mitigation strategies. Thematic analysis revealed key factors influencing fisher engagement in reporting and mitigation of turtle bycatch events, including trust in and perceived competence of institutions, social norms governing behavior within fishing communities, and concerns of legal consequences or overregulation. Stakeholder groups differed in their beliefs about the risks posed to turtles by the trap fisheries, with biologists describing an underreported and likely significant threat and fishers minimizing the threat in relation to other environmental challenges, such as poor water quality. Insights from these interviews informed Phase II, a multimodal survey distributed to Florida's commercial trap fishers (n=249; response rate: 18.2%). Survey responses quantified fishers' knowledge of and salient beliefs about 1) reporting and mitigation behaviors and 2) preferences for conservation interventions. Significant barriers to reporting turtle bycatch include an aversion to interacting with authorities, inefficiency of filing reports, and not understanding the need or value of reporting. Fishers considered safe handling and release training to be the most acceptable mitigation strategy. There was not broad support for other interventions such as gear modifications, trap reduction programs, or time/area closures, despite those being the primary suggestions offered by biologists and managers during Phase I. Optimization actions can include revising reporting protocols to ensure anonymity, incentivizing engagement through trusted messengers, and leveraging fishers' operational concerns, such as trap damage caused by turtles, as a collaborative starting point for bycatch mitigation efforts. By integrating stakeholder perspectives with SES principles, this research offers actionable pathways for mitigating sea turtle bycatch and enhancing collaboration in conservation efforts.

## TURTLES OF ARABIA: UNVEILING 15 YEARS OF SEA TURTLE MORTALITIES IN DUBAI

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The Arabian Gulf, characterized by high salinity, shallow waters, and elevated temperatures, presents a unique and often harsh environment for marine life, including sea turtles. Despite these challenges, the Gulf also boasts extensive seagrass beds, coral reefs, and sandy beaches, providing an ideal habitat for sea turtles. This retrospective study examines sea turtle mortalities in Dubai, UAE, over a 15-year period from 2010 to 2024, aiming to identify primary causes of death, seasonal trends, and potential hotspots for turtle strandings. By analyzing data from local wildlife rehabilitation centers, stranding records, and environmental agencies, the study highlights various threats to turtle populations, such as entanglement in fishing gear, ingestion of marine debris, boat strikes, and habitat degradation. Findings show significant seasonal mortality patterns, particularly during the winter months when water temperatures drop. Anthropogenic threats are also a major contributor to sea turtle deaths. A major challenge in the study was the limited availability of data from government agencies, coupled with reluctance to release crucial information, hindering a full understanding of the scope of the problem. This study offers critical insights that can inform future conservation efforts and policy-making aimed at reducing mortality rates and ensuring the long-term survival of Dubai's sea turtle populations.

## ENVIRONMENTAL POLLUTANTS IN OLIVE RIDLEY TURTLES: A COMPARATIVE STUDY OF PLASTIC AND HEAVY METAL ACCUMULATION AT ODISHA'S NESTING BEACHES*

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Many marine species, including sea turtles, face threats due to pollution. In particular, heavy metals and plastic pollution in form of debris and microplastic are increasing rapidly in sea turtle's habitats. These contaminants are known to have numerous detrimental physiological effects including sublethal effects such as endocrine disruption and hatchling deformities to lethal effects such as blockage of gut. Recent studies have highlighted the interactions between microplastics and heavy metals in small animal model systems. As of now, there are not many studies on the presence of these pollutants in sea turtles in the Indian Ocean, with a very small number of microplastic studies. The Bay of Bengal in the Indian Ocean is home to crucial nesting sites for olive ridley turtles. Among these are Rushikulya, an active mass nesting beach, and Devi, a historically significant nesting site which witnesses high mortality. However, this region is experiencing an alarming rise in pollution. Riverine influx and intensive fishing activities are contributing to high levels of pollutants, making these nesting beaches high-risk areas for plastic ingestion and heavy metal exposure in sea turtles. The current study aims to fill this knowledge gap by examining the extent of plastic ingestion, and bioaccumulation of microplastics and heavy metals in olive ridley turtles. On-field necropsies were conducted on 94 dead stranded turtles from the nesting beaches of Rushikulya (n = 51) and Devi (n = 43) in Odisha from November 2023 to February 2024, to collect scute,

muscle, liver and whole gastrointestinal tract samples. The muscle and liver samples were analysed for microplastic presence. Alkaline digestion (10% KOH at 60 ºC) followed by vacuum filtration was performed to separate potential microplastics. Visual identification through stereomicroscope was done to categorise microplastic based on shape and colour. Ingested macro-plastics or plastic debris were found in 12.5% of the turtles. Microplastics were detected in liver and muscle tissue in all the samples (n = 38) analysed so far, with clear fibre being the most abundant microplastic type. The total microplastic load was significantly higher in Rushikulya than in Devi, and in liver than in muscle tissue. Based on microplastic type and colour, this study suggests that microplastics likely originate from fishing related activities. The microplastic aggregation around nesting beaches might be influenced by ocean currents and does not necessarily localize around the sources with higher pollutant influx. This research underscores the urgent need to better understand and mitigate plastic pollution in marine ecosystems. Furthermore, the ongoing analysis on heavy metals will shed light on the presence of other pollutants in sea turtles at this important nesting rookery.

## FACTORS INFLUENCING FISHER WILLINGNESS TO PARTICIPATE IN SEA TURTLE BYCATCH REDUCTION INITIATIVES*

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Intense fishing efforts can lead to high capture and mortality of species not targeted by fisheries (i.e., bycatch). To reduce bycatch of threatened marine species, especially sea turtles, bycatch reduction technologies and gear modifications (BRTs) have been developed and tested in collaboration with fishers under simulated and actual fishing conditions. However, there is limited research on what factors contribute to fishers' willingness to participate in bycatch reduction initiatives, including testing of BRTs. We used coastal fisheries in Baja California Sur, Mexico as a study system to first test what factors influence fishers' willingness to participate in bycatch reduction initiatives for sea turtles, and second evaluate the experiences of fishers who have previously participated in BRT trials. We conducted 98 structured interviews with coastal fishers from 11 fishing communities using a mixed-methods approach. For each open-ended question, we used inductive coding to identify a set of common themes among fisher responses. Upon asking fishers if they would be interested in participating in a scientific experiment testing BRTs, we found 94% (n=92) of fishers agreed to participate. Most common reasons for fishers' willingness to participate in BRT experiments were interest in conservation and protecting the environment (27%), protecting fish stocks (17%), and desire to learn something new (16%). From the 6% (n=6) of fishers who indicated they would not be willing to participate in BRT experiments, their decision was primarily due to physically not being able to participate (43%). From our sample, we identified 13% (n=13) of fishers who participated previously in BRT experiments; where 92% of these reported an overall positive experience. Experiencing no negative impact on target catch (23%) was commonly considered a positive reason for participating in the experiment, while experiencing fieldwork challenges (31%) was often a reason for discouraging participation. Our findings shed light on the importance of understanding fisher perspectives toward developing fisher-friendly and sustainable solutions to reduce sea turtle bycatch.

## IN-WATER BIOLOGY

# IDENTIFYING NORTH ATLANTIC FORAGING GROUNDS OF NESTING LEATHERBACK SEA TURTLES (*DERMOCHELYS CORIACEA*) ON JUNO BEACH, FLORIDA USING TELEMETRY AND STABLE ISOTOPES

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Telemetry and stable isotope analysis (SIA) are two complementary tools that can be used to gain insights into sea turtle foraging location and ecology. Satellite and acoustic telemetry allow for the tracking of sea turtle movements; however, the high cost of transmitters often results in limited sample sizes. Stable isotope analysis provides a cost-effective method when compared to biotelemetry to gather information on feeding ecology and trophic position by analyzing stable isotope ratios of light elements, but prior knowledge of geographic locations and related isoscapes is required for analysis. Combining both methods can help describe the diet and foraging strategy of an individual at its known forging areas. If isotopic signatures from distinct foraging areas are significantly different, individuals can then be assigned to putative foraging grounds based on SIA alone. Leatherback sea turtles (*Dermochelys coriacea*) primarily feed on gelatinous zooplankton, have broad-ranging migrations, and exhibit fidelity to discrete foraging regions, making them ideal candidates for using SIA to infer foraging grounds prior to nesting events. Previous SIA studies of northwest Atlantic leatherbacks only infer foraging grounds by grouping similar δ13C and δ15N values, which does not give information about specific locations, and none have paired telemetry with SIA. Here, we assign isotopic signatures to known foraging locations and suggest the best tissue to sample to infer foraging areas for leatherbacks. In 2023, we tagged 25 nesting leatherbacks with satellite (N=20) and acoustic (N=5) transmitters and sampled 30 individuals for SIA on Juno Beach, Florida, USA. Whole blood, plasma, serum, red blood cells, skin, and egg samples were collected for the analysis of δ13C and δ15N values. Mean values of δ13C and δ15N varied among tissue type and location of foraging grounds. Red blood cells had the lowest δ15N value (mean: 10.95‰; range: 6.92–13.10‰) and skin had the highest δ15N value (mean: 13.16‰; range: 9.53–17.99‰). Unhatched eggs had the lowest δ13C value (mean: -23.40‰; range: -25.09–-21.76 ‰) and skin had the highest δ13C value (mean: -17.40‰; range: -18.83– -14.90‰). Results indicate that skin samples are the most enriched in nitrogen and carbon, suggesting that leatherbacks primarily forage in coastal shelf habitats and feed on jellyfishes rather than lower-level zooplankton (i.e., holoplanktonic salps). Skin also has a long turnover rate (> 6 months), thus is commonly used to identify previous foraging grounds for other sea turtle SIA studies. A principal components analysis will be used to illustrate relationships between tissues sampled, and a PERMANOVA with Pillai's trace test will be run to determine differences in isotopic value and known foraging grounds identified from satellite tracked leatherbacks. A wards hierarchical cluster analysis will be run to delineate foraging clusters based on δ13C and δ15N signatures. Then, a discriminative function analysis will be performed to determine if untracked leatherbacks (N=5) can be assigned to foraging areas. Results will allow us to suggest the best tissues to analyze for leatherback SIA studies, contribute to isotopic values of δ13C and δ15N of northwest Atlantic leatherbacks, and identify foraging grounds for Florida leatherbacks.

# COMPARISONS OF LONGEVITY OF VARIOUS ATTACHMENT METHODS FOR SATELLITE AND ACOUSTIC TRANSMITTERS ON ADULT LEATHERBACK SEA TURTLES (*DERMOCHELYS CORIACEA*)*

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Biotelemetry technology has helped to describe and explain sea turtle movement patterns, behaviors, and habitat use. However, electronic tags may cease transmitting for various reasons, limiting the duration and quality of data collected. A better understanding of when and why tags stop transmitting may inform solutions to mitigate against early tag failure and maximize tag retention. For leatherback sea turtles (*Dermochelys coriacea*), tag attachment protocols are constantly being refined to determine 'best-in-practice' guidelines. These include exploring alternative materials and/or attachment locations to maximize retention rates and improve animal welfare (i.e., reducing pain response and drag effects). For example, the typical attachment site for archival and acoustic tags deployed on leatherbacks is the pygal process; however, the size and shape of this region varies across individuals, making it difficult to determine the optimal and safest location to attach the tag. This study aims to investigate tag retention rates between nylon-coated and monofilament wires and experiment with two attachment procedures for acoustic transmitters to reduce pain responses from the turtles. A total of 71 Wildlife Computers, Inc. SPLASH10-295 (N=33) and Sea Mammal Research Unit CTD/SRDL (N=5) satellite and Vemco V16-4x (N=33) acoustic transmitters were attached to nesting leatherbacks (N=59) during 2019–2024 on Juno/Jupiter Beach, Florida USA and Pacuare Nature Reserve, Costa Rica. The first 13 satellite transmitters were affixed with a nylon-coated stainless-steel wire, and for the remaining 25 tags, a monofilament line with a 300 lb. test was used. Satellite tags were affixed to the medial carapacial ridge, marginally posterior to the highest point. Tagging procedures and materials were identical for all satellite tags except for the two types of wire. Twenty-three acoustic tags were affixed to the pygal process using stainless-steel (N=13) and monofilament (N= 10) wires, Delrin buttons, crimps, and beads; however, turtles tagged in Florida (N=15) exhibited a negative reaction (i.e., flailed front flippers) to the drilling process (N=12), but did not abandon egg laying or nest covering. Additionally, blood and other tissues can fall into the clutch if towels are not held under the drilling site, further complicating this method. As such, the attachment site was moved to the medial ridge in 2024 (N=10) to eliminate this pain response. For satellite tags, the mean (±SD) duration of the monofilament line (326 ± 196 days) is significantly longer ($P = < 0.001$) than the stainless-steel wire (73 ± 69 days). For acoustic transmitters, no significant differences ($P= 0.4$) were found between the mean (±SD) duration of the stainless-steel wire (272 ± 319 days) and monofilament line (75 ± 98 days). Results suggest monofilament lines provide longer retention rates than nylon-coated stainless-steel wires. Previous studies have noted the use of a variety of wires to attach transmitters, but rarely attribute these materials as the reason for premature tag detachment. Additionally, turtles did not exhibit any negative reaction to attachment procedures on the medial ridge for acoustic transmitters, reducing pain and eliminating the possibility of nest abandonment or clutch contamination from excess tissue during the drilling process.

## SATELLITE TRACKING REVEALS PREFERENCE OF OCEANIC FORAGING HABITATS IN LATE JUVENILE LOGGERHEAD TURTLES FROM THE WESTERN MEDITERRANEAN SEA*

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Satellite telemetry has been increasingly used during the last decades to investigate loggerhead sea turtles' movement patterns, which are known to vary according to the turtle's life stage. Juveniles are thought to progressively move from oceanic to neritic habitats, a shift that in the Mediterranean can already occur in turtles as small as 26 cm curved carapace length (CCL). However, some studies also highlighted that Mediterranean turtles in sub-adult and adult size ranges (>60 cm) still continue to use oceanic foraging areas. We intended to investigate the habitat use and preference of such large turtles in the Tyrrhenian Sea through satellite telemetry. During the period May-June 2024, we caught six free-ranging, healthy loggerhead turtles in a pelagic area approximately 10 km offshore from Ventotene island's Marine Protected Area (Western Italy) and equipped them with Satellite-linked Data Loggers (SDL). Tagging operations took place on the boat used for spotting the turtles, and each turtle was released within an hour, in the same location of its capture. A seventh turtle, ID07, was instead recovered off the coast of Tuscany and kept for a few days at the 'Acquario di Livorno' for observation prior to tag attachment and release offshore Livorno. CCLs of the seven tracked individuals ranged from 60 to 73 cm, thus they can all be classified as subadults and adults. As of Jan. 2025, turtles were tracked for period between 129 and 244 days, with five of them still transmitting. Six of the seven loggerheads remained within the oceanic area of the Tyrrhenian Sea, located between Sicily, Sardinia and western Italian coasts, for more than 94% of time, where they are still roaming. Only one turtle moved to the wide Tunisian continental shelf immediately after her tagging and release. These results confirm a preference of adult and subadult loggerhead turtles for an oceanic foraging area in the Tyrrhenian Sea, as shown in recent studies. These data may be instrumental for guiding appropriate conservation strategies for loggerheads and will help to shed light on the still limited knowledge of plasticity in life history patterns and behaviour that characterizes this species.

## INTENTIONAL BEHAVIORAL EXPRESSIONS IN JUVENILE GREEN SEA TURTLES

**Fiona Beu**

*NA*

Current research on sea turtle behavior leaves much of their social preferences and habits vastly unexplored. Very little is known about the fine-scale risk assessments that drive the daily behaviors of juvenile green sea turtles, a species whose survival depends on strategic energy expenditure, at a critically vulnerable life stage. This in-water observation investigated the patterns of behavior among a cohort of 10

juvenile green sea turtles along northern Providenciales, Turks and Caicos. Over 23 hours of daily foraging activities were recorded at this "multiple use" marine protected area by a single researcher in January and May, 2021. Behavior was analyzed using an ethogram of 13 discrete physical activities, assisted by face-scale identification. We found that these turtles perform a range of adaptive behaviors in response to external stimuli, including one specific gesture that might be interpreted as a directly intentional act of expression. Gaining insight into how juvenile greens adapt to potential risks at this critically underexamined life stage can inform conservation practices, guide policy decisions, and improve their future prospects for survival.

## THERMAL HABITAT AND DIVING BEHAVIOUR OF MEDITERRANEAN LOGGERHEAD SEA TURTLES IN A WARMING SEA*

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Rising seawater temperatures pose potential threats for marine turtles, yet studying these impacts is very difficult due to the complexities of marine environments and to turtle elusive behaviour. Recent advances in animal-borne telemetry, have greatly enhanced our ability to collect detailed spatial and behavioural data from freely-moving turtles even over long time periods. In this study, we monitored the spatial and diving behaviours of loggerhead sea turtles (*Caretta caretta*) dwelling in the central Mediterranean Sea while experiencing a variety of thermal conditions. Seven adult female loggerhead turtles caught along the coastlines of Lazio and Tuscany, Italy, were tracked by satellite over a period of more than six months including the hottest period of the year. Each turtle was equipped with a satellite-linked data logger (SDL) that collected data from onboard depth and temperature sensors and relayed them via the Argos system. The SDLs provided continuous information on the turtles' depth and temperature profiles, maximum dive depth and duration, and percentage of time spent in predetermined temperature and depth ranges. In this way, we have been able to reconstruct the spatial distribution and diving behaviour of the tracked turtles, and to characterize their thermal habitat. The results showed that turtles adjusted their diving behaviour to cope with changing thermal conditions, as water temperatures ranged from 15°C to above 32°C. Specifically, during the hottest period tracked turtles spent longer time at depths below 50 m than during the winter period, exploiting cooler waters with temperatures lower than 18°C. Our findings provide useful insights into how loggerhead turtles respond to increasing sea temperatures, which is critical for understanding their resilience and vulnerability to climate change.

# NOVEL MINIATURIZED SATELLITE TAGS REVEAL VERTICAL BEHAVIORS OF EARLY-LIFE STAGE LEATHERBACK TURTLES*

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After hatching, sea turtles disappear into the ocean, remaining unseen until many years later when they return to natal regions where that may reproduce, but also risk interaction with fishing gear, or other coastal threats. Within the sea turtle community, this period at sea is commonly referred to as the “Lost Years”. Until recently, the very small sizes and prolonged dispersal phases of juveniles posed many challenges for the development of satellite tracking studies. Recent advances in tag miniaturization technologies and data compression algorithms have enabled researchers to undertake groundbreaking studies on the movements and dispersal of early-stage turtles. Among others, new tags equipped with solar energy cells and pressure sensors have prolonged tracking durations and provided first-ever dive data for early-stage leatherback sea turtles for periods of a few days to a few weeks. This study harnessed an unprecedented dataset gathered since 2022 from 36 early-stage juvenile leatherbacks satellite tagged and released off eastern Florida and western Thailand. The turtles from Florida were neonates with straight carapace lengths (SCL) ranging from 7.4-9.7 centimeters and weights ranging from 75-146 grams. The turtles from Thailand were considered juveniles with SCLs ranging from 22.0-36.0 centimeters and weights ranging from 1,075-3,857 grams. Microsatellite tags, manufactured by Lotek Wireless Inc., were attached using neoprene or elastane fabric pads secured with suture anchors and adhesives. The smallest turtles were equipped with K4H 130B tags (2.9g; 26x14.7x7.7mm), while the larger turtles used K4G 132A tags (12.1g; 47.7x30x21.9mm). Tags attachment methods and performances were detailed in Candela et al. (2024). Tag-derived data (e.g., location data and vertical behavioral metrics), including time distribution at depth, daily maximum depth, and time underwater, present an opportunity to examine intricate relationships between diving behavior and other variables. We analyzed tracking durations, carapace lengths, physical variables of the dynamic marine environment of the Gulf Stream and within the Andaman Sea (e.g., water temperature, significant wave height, chlorophyll-a concentration), using a suite of remotely sensed and modeled data. Despite the apparent limitations due to reduced tracking durations, the findings derived from this novel dataset reveal that Florida neonates mostly (>90%) remained in the upper 10 meters of the ocean but were capable of much deeper dives to 75 meters or more. In contrast, the larger and older Thailand juveniles, spent more time at depth and reached daily depths near 100 meters, with an impressive 184 meters dive recorded. Our analysis revealed for both size classes clues to progressive adaptations for open ocean life (vertical behavior changes over time elapsed since release), optimization of swimming conditions (behavior shifts apparently linked to changes in the sea state), and possibly thermoregulatory behaviors, better marked in the large turtles released off Thailand. Our study promises to offer new insights into adaptative strategies and survival mechanisms employed by early-life stage turtles, effectively demystifying the earliest phases of the "Lost Years". This research informs sea turtle conservation and management by providing guidelines for reducing bycatch in fisheries or identifying critical habitats requiring protection during poorly understood early life stages.

# VALIDATING EPIBIOTIC BARNACLES AS ECOLOGICAL INDICATORS OF HABITAT USE IN SEA TURTLES*

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Sea turtles are highly migratory, shifting between various habitats across life-stages and reproductive cycles. Understanding the long-distance movements of sea turtles is therefore key to understanding their ecology as well as developing effective conservation strategies for protecting these endangered species. One potential, yet currently under- utilized tool, for studying sea turtle movement patterns is to use epibiotic organisms as indicators of habitat use. This relies on the concept that some epibiotic organisms only settle on hosts in specific habitats, and so a turtle is colonized with these species must have recently occupied the same habitat. Recent research on loggerhead turtles in the Mediterranean has shown that the barnacle genus *Chelonibia* likely suggests that the host turtle was recently in coastal habitats, while the barnacle genera *Conchoderma*, *Lepas*, and *Platylepas* are indicative of recent residence in offshore waters. Nevertheless, it is not known if these trends are applicable outside of the Mediterranean and across all sea turtle species. Here, we utilized a global database of over a century of records to examine how the frequency of occurrence of these four barnacle species (*Chelonibia*, *Conchoderma*, *Lepas*, and *Platylepas*) differ between turtles in different habitats and life stages. Our results reveal that, across the four sea turtle species with sufficient data (loggerhead, green, hawksbill, and olive ridley turtles), *Chelonibia* spp. were significantly more associated with turtles inhabiting coastal areas (< 10 km) (83%), while *Conchoderma* spp. and *Lepas* spp. were significantly more associated with turtles inhabiting offshore areas (> 10 km) (70 and 60%, respectively). In contrast, our results indicated *Platylepas* spp. were not significantly more associated with turtles inhabiting offshore areas (30%). Notwithstanding all this, most data came from loggerhead (N = 16) and green turtles (N = 19), confirming *Chelonibia* spp., *Conchoderma* spp. and *Lepas* spp. as indicators of habitat use for this species, although this may also apply to most species. Some barnacles can serve as ecological indicators of habitat use in sea turtles on a global scale, although further data is required to confirm this hypothesis for all sea turtle species.

# EXPLORATION OF A DYNAMIC THERMAL CORRIDOR: EXPERIMENTAL OCEANOGRAPHY AND MIGRATION OF NORTH PACIFIC LOGGERHEAD SEA TURTLES

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Until recently, scientists had no idea how loggerhead sea turtles (*Caretta caretta*) migrate from their nesting beaches in Japan to nursery grounds in Baja California, Mexico. The Thermal Corridor Hypothesis (TCH, Briscoe et al. 2021) combined 16 years of satellite-tracked movement data to propose an intermittent thermal corridor that allows juvenile loggerheads to transition from the Central North Pacific (CNP) to the west coast of North America. The TCH proposes that this migratory corridor opens during anomalously warm conditions and closes during cool conditions, causing turtles to stay in the CNP. Here we report on the deployment of two experimental cohorts, one in 2023, during warm El Niño conditions, and one on 2024, during the onset of cooler La Niña conditions. In 2023, all loggerheads experienced warmer than average SST, due to a marine heatwave and an El Niño. The entire cohort moved north until September 2023, and then they moved south, with 7 of 23 turtles moving towards North America — 3 of which entered coastal waters of Southern California and Baja Mexico. These responses confirmed the TCH that under warm conditions, loggerheads can pass through the thermal corridor. In 2024, the experimental cohort was deployed with a projected onset of La Niña into the fall. Initially, nearly 2/3rds of the turtles headed east. It is possible that strong Ekman transport and/or warm SST anomalies, in response to especially strong westerlies, may have driven these eastward movements, leading to the loggerheads entering the California Current further north than is typical. Late fall movements tended to shift southward again, but the cold California current may prevent reaching the coastline. Distributional shifts due to changing ocean conditions will allow us to dynamically manage and protect this species. If a corridor were to open more frequently or in a changing ocean location, it could alter abundances and risks for these endangered turtles.

# OPERATIONAL SEX RATIO IN BLACK SEA TURTLE (*CHELONIA MYDAS AGASSIZII*) POPULATION IN MICHOACAN, MEXICO

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Colola beach is the most important nesting site for black turtles (*Chelonia mydas agasizii*) in Michoacán, Mexico. Most nesting activity occurs from September to March, although nesting occurs practically all year round. A characteristic of this population is that mate and courtship interactions occur throughout the nesting season, with peak activity occurring from September to January. We conducted 336 hr of observations of black turtle courtship and mate reproductive interactions off Colola beach during the 2004, 2009, 2017 and 2023 seasons. In total, 653 mates groups were observed involving 1,986 males and 669 females. We estimated an overall operational sex ratio (OSR) of 2.96:1 males per female ( 3.0:1 male/female), with a range of 1-17 males per female in mating groups. By sampling period we obtained different estimates of PSO. In 2004, 150 h of observations were carried out in which a total of 352 mating groups were identified in which 1,079 males and 368 females were involved, estimating a PSO of 3.0:1 male/female (range = 1-13 males/female). During this period, the monthly OSP estimates showed slight variations: in September, the estimated OSP was 2.8:1; in October-November it was 3.1:1 and in December the estimated OSP was 3.3:1 male/female. In the 2009 breeding season, 86 hours of observations were carried out and 83 mating groups were recorded in which 442 individuals were involved, 359 males and 86 females. In this period the highest estimate of OSP was obtained with 4.3:1 male/female (range= 1-17 males per female). In the copulation groups recorded, it was observed that in 26.5% only one male participated, while in 73% of the mating groups two or more males were observed. In the 2017 season, 40 hrs of mate and courtship observations were conducted. Forty mating groups were identified in which 163 individuals (123 males and 40 females) were identified (range =1 - 9 males per female) and a PSO of 3:1 male/female (range= 1-9 males per female) was estimated. In this period only one male was observed in 17.5% of the mating groups, while two or more participating males were observed in 82.5% of the groups. In 2023, 60 hr of observations of reproductive interactions were conducted in which 178 mating groups were identified in which 603 breeding adults (425 males and 178 females) were identified, estimating a PSO of 2.3:1 male/female (range = 1 - 12 males per female). This was the lowest PSO estimate of the entire sampling period considered in this work. On the other hand, only one male was observed in 41.5% of the mating groups, while two or more males were observed in 58% of the groups.

# DIVING WITH LUNGS HALF-FULL? DIVING BEHAVIOR OF JUVENILE GREEN TURTLES IN SHALLOW MANGROVES CREEKS IN THE BAHAMAS

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Sea turtles spend most of their lives underwater, where they typically feed, breed, and rest – only periodically returning to the surface to breathe. Their ability to dive several hundred meters deep has garnered attention for their physiological adaptations, promoting research aimed to quantifying the maximum depth and duration of dives across sea turtle species. However, much less is known about the diving behavior of sea turtles in shallow waters (< 5 m depth), which are commonly used by juvenile green turtles (*Chelonia mydas*) throughout the Caribbean. To address this research gap, we aimed to (1) characterize the diving behavior of juvenile green turtles in shallow-water habitats in The Bahamas, and (2) assess how dive depth, activity patterns, surface interval duration, and water temperature may influence dive duration. We deployed 58 animal-borne cameras equipped with time-depth recorders on green turtles (*Chelonia mydas*) ranging from 32.6 to 63.7 cm Straight Carapace Length. To account for multiple dives per individual, we used a mixed modeling approach within the Bayesian framework. Overall, we recorded 174.9 h of footage with a mean duration of 180 min ± 17 SD. Turtles exhibited notably short mean dive durations (66.43 s ± 75.85 SD) with a mean dive depth of 0.99 m ± 0.79 SD, compared to longer dive durations observed in other studies in deeper waters (e.g., Rice and Balazs, 2008; green turtles with mean dive durations of 38.2 min and mean dive depth of 26 m). Models revealed that maximum dive depth, surface duration before each dive, and mean water temperature had a statistically significant positive relation with dive duration. In addition, active dives (i.e., a combination of swimming, socializing, digging, and crawling) were typically shorter than resting dives, while foraging dives were equally likely regardless of dive duration. The short dive durations observed in this study suggest that, in shallow water habitats, juvenile green turtles dive with only partially inhaled lungs to remain negatively buoyant. This could also explain why surface interval exhibited a notably strong influence on dive durations as turtles may need to rely more on blood oxygen stores (which can be replaced over multiple breathing events) than lung oxygen stores while diving. Furthermore, the limited lung oxygen stores could explain why increased activity patterns were typically associated with shorter dives. Our findings suggest that sea turtles diving in shallow water habitats may dive with their lungs only partially full, and thus will limit oxygen stores. This has important conservation implications, as sea turtles caught in fishing nets in shallow waters could drown faster than those caught in deeper water habitats.

## OBSERVED DIFFERENCES IN HAWKSBILL RESIDENCY TIMES BETWEEN AREAS OF HIGH AND LOW HUMAN ACTIVITY

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Hawksbill sea turtles (*Eretmochelys imbricata*) rely on coastal habitats for foraging and refuge, yet little is known about how human activity influences their localized distribution. Limited studies suggest that boat traffic and snorkelling can alter hawksbill behavior, affecting foraging and surfacing time, while others find no clear relationship between human presence and abundance. To explore this gap, we conducted in-water surveys in St. John, USVI, and Carriacou, Grenada, over two field seasons (2023–2024). Sampling occurred over 21 days in St. John and 22 in Carriacou, with four free divers working from boats to hand-capture turtles. Sites were categorized as "high" or "low" human-use based on local knowledge, accounting for boat traffic, snorkelling, and scuba diving. Daily Catch Per Unit Effort (CPUE) was calculated for each site, and non-parametric tests compared CPUE between human-use levels. Across both locations, turtles were significantly less prevalent in high-use areas. In St. John, mean CPUE was 0.002139 in low-use sites and 0.000704 in high-use sites (Mann-Whitney $U = 21.5$, $p = 0.011$). In Carriacou, mean CPUE was 0.0048 in low-use sites and 0.0001 in high-use sites (Mann-Whitney $U = 10.00$, $p = 0.000734$). No significant differences in benthic habitat composition were observed between human-use levels. This suggests hawksbill avoidance of high-use areas is behavioral rather than habitat-driven, indicating habitat protection alone may not be sufficient for conservation. However, we did not measure other environmental factors that may influence distribution. Further research is needed to clarify hawksbill-specific responses to human marine activity and disentangle the relative influence of environmental and anthropogenic drivers.

## COMPARISON OF INTER-NESTING MOVEMENTS AND HABITAT USE AMONG MULTIPLE SPECIES AND ACROSS MULTIPLE NESTING BEACHES OVER A QUARTER CENTURY

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The Sea Turtle Conservancy has been using satellite telemetry to study the post-nesting migration of female sea turtles since 2000. Over 25 years, we have deployed 240 transmitters on loggerhead (*Caretta caretta*), green (*Chelonia mydas*), hawksbill (*Eretmochelys imbricata*) and leatherback (*Dermochelys coriacea*) turtles at eight nesting beaches (Archie Carr National Wildlife Refuge (ACNWR) and Anna Maria Island, Florida USA; Nevis, St. Kitts & Nevis; Playa del Carmen, Mexico; Tortuguero and Jalova, Costa Rica;

Chiriquí and Soropta Beaches, Panama). This data set allows us to answer additional questions related to sea turtle behavior and movement, specifically the inter-nesting period, both before migration to a foraging area (n = 159) and tracked returning to the nesting beach for a second nesting season (n = 6). Of the 240 turtles satellite tracked, 160 provided at least 10 days of inter-nesting data. This includes 42 loggerheads, 28 hawksbills, 49 greens and 41 leatherbacks. We used daily locations to determine a kernel density estimate (KDE) for individual core areas (50% contour), plus combined core and resident areas (95% contour) for all turtles from the same nesting beach (grouped by species for ACNWR and Tortuguero). When turtles were tracked over multiple nesting seasons, we calculated separate KDE for each nesting season. The centroid was calculated for individual core areas. For each centroid, the depth (m) and distance to the nearest shoreline (km) were calculated. Inter-nesting period ranged from 10 to 131 days (mean 39 + 23 days). The shape of combined inter-nesting areas reflected the influence of the bathymetry adjacent to the nesting beach, as well as the roaming nature of leatherbacks. For loggerheads, greens and hawksbills, core inter-nesting areas were constrained to the continental shelf (< 200 m). Combined core inter-nesting area size ranged from 20.8 $km^2$ for greens nesting in Playa del Carmen, Mexico to 3,759.5 $km^2$ for leatherbacks nesting in Chiriquí Beach, Panama. Both core and residential inter-nesting areas overlapped between hawksbill and green turtles from Tortuguero, with hawksbills having larger core and residential areas and centroids farther from shore than greens. A similar trend was seen for turtles from the ACNWR, with loggerheads having larger core and residential areas with centroids being farther from shore compared to green turtles. This large dataset allows for a comparison of inter-nesting movements and habitat use among different species of sea turtles, as well as among different nesting beaches. Interestingly, we observed many similarities in the inter-nesting movement patterns and habitat use across sea turtle species suggesting that local conditions, such as bathymetry and ocean currents, play a key role. Turtle movements during the nesting season should be an important consideration for resource managers when looking to establish critical habitat areas, considering slow boat zones in areas with high overlap between boats and sea turtles, and where to focus in-water anti-poaching efforts.

## COMPARING JUVENILE GREEN SEA TURTLE UTILIZATION OF ARTIFICIAL VS. NATURAL REEFS: INSIGHTS FROM A BREAKWATER IN SOUTHEASTERN FLORIDA

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Juvenile green sea turtles (*Chelonia mydas*) inhabit sabellariid worm rock reefs along Florida's southeastern coast. These shallow nearshore reefs provide foraging habitat and shelter for juvenile green turtles until they approach maturity and migrate to deeper foraging grounds. Artificial reefs are common along Florida's coast and provide similar resources (food and shelter), however there is limited research on how green turtles use these structures compared to natural reefs. This study examines green turtle utilization of a 500-meter artificial breakwater constructed in 2020 to mitigate shoreline erosion near the St. Lucie Nuclear Power Plant in St. Lucie County, Florida. This shallow breakwater mirrors the shelter and foraging opportunities of the adjacent natural reefs. From 2020 to 2023, we conducted 13 Distance Sampling surveys using five fixed transects along the breakwater and a natural reef 1 km south of the breakwater, a known juvenile green turtle habitat. A total of 264 turtles were observed during these surveys with only 15 (5.7%) recorded at the breakwater site. Despite this artificial structure's proximity to an established green turtle foraging area at the worm rock reef site, the breakwater exhibited significantly lower turtle densities. This suggests that, even after three years post-deployment, the artificial habitat may not fully meet the ecological needs of juvenile green turtles. The lack of observed residency or increase in turtle abundance at the breakwater, despite anticipated food availability as the structure matured, contrasts

with findings from other artificial structures like fishing piers and jetties, where turtle presence implies an attractant effect. In this case, the physical presence of the artificial structure alone appears insufficient to draw turtles at a comparable rate to the nearby natural reef habitat.

## BENEATH THE SURFACE: A COMPREHENSIVE IN-WATER MONITORING PROGRAM FOR SEA TURTLE CONSERVATION IN THE KINGDOM SAUDI ARABIA, KSA, RED SEA

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In-water monitoring is essential for elucidating the spatiotemporal distribution and connectivity of sea turtles across life stages, especially for populations in the Red Sea, where five species, including the Endangered green turtle and Critically Endangered hawksbill, are under-researched. Standardized and comprehensive assessments are needed to identify critical habitats, including developmental areas, foraging grounds, mating sites, and migratory corridors. Such data are increasingly vital as climate change and human pressures intensify, compounding the risks to these vulnerable species. SHAMS initiated a comprehensive in-water monitoring program to provide strategic guidance for standardized assessment and monitoring protocols on the KSA Red Sea Coast and establish structured data collection efforts. Between July and October 2024, we conducted 24 snorkelling surveys across five areas: the Far Northern Red Sea (NEOM region), Northern Red Sea (Prince Mohammed Bin Salman Royal Reserve, PMBSRR), Central Red Sea (Ras Baridi), Farasan Banks (Islands offshore Al Qunfudhah), and the Jazan and Farasan Islands. These surveys aimed to identify high-abundance turtle areas, characterize habitats, document behaviors, and record threats. A total of 45 sea turtles were observed over 15 hours and 16 minutes, with an average sighting rate of 2.95 turtles/hour. Among them, 40 were green turtles, including 9 juveniles, 3 subadults, 12 adult females, 14 adult males, and 2 of undetermined sex. Additionally, 5 hawksbill turtles were recorded, consisting of 3 juveniles, 1 subadult, and 1 adult male, all found in coral reef and seagrass beds habitats. Observed behaviors across both species included swimming (73.3%), resting (11.1%), feeding (11.1%), and surface breathing (4.4%). The primary threats identified in these habitats included habitat degradation (65.2%), marine debris (39.1%), and fishing activities (21.7%). Biometric data were collected from four adult females captured, with a mean curved carapace length (CCL) of 102.77 cm (SE = 2.84) and a mean curved carapace width (CCW) of 91.23 cm (SE = 3.30). Key sites for monitoring green turtles in feeding habitats were identified at West Mandhar in the Jazan and Farasan Islands region and Sila Island in the Far Northern Red Sea region due to the high number of adult females, males, subadults and juveniles in extensive seagrass beds. The observed proximity of males and females swimming together may be associated with the nesting season, indicating possible reproductive activity; however, further monitoring and research is needed to clarify these patterns. This assessment and monitoring program will continue through 2025, aiming for at least 160 survey days along the KSA Red Sea coast. Throughout the year, surveys and capture techniques will be employed to develop a seasonal map of sea turtle abundance and connectivity, utilizing satellite transmitters, acoustic tags, and underwater cameras. This approach will enable comprehensive data collection, including biometric measurements, capture and recapture data, photo IDs, tissue and blood samples from individual turtles, advancing our understanding of population structure, dynamics and habitat use. This program provides a solid foundation for ongoing research and conservation efforts, reflecting a strong commitment to accurate data management and reinforcing dedication to sea turtle conservation in the region.

## DIVING DEEP INTO CONSERVATION: TRACKING SEA TURTLE BEHAVIOR IN NEOM'S COASTAL WATERS

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Sea turtles are key indicators of healthy marine habitats, using nesting and feeding areas along NEOM's coastline in the northern Red Sea of Saudi Arabia. NEOM covers 26,500 km² and provides critical nesting sites for two sea turtle species: the hawksbill (*Eretmochelys imbricata*) and the green turtle (*Chelonia mydas*). NEOM aims to combine economic growth with environmental care as a global hub for innovation and sustainability. During surveys in 2022 and 2023, we monitored female sea turtles using satellite tracking and found they mostly nest on three main islands: Walah, Shushah, and Delajala. Shushah Island is especially important for hawksbill turtles, while Walah Island is a key site for green turtles. Tracking 6 green and 11 hawksbill turtles, we identified 8 main feeding areas, stretching from the Gulf of Suez in Egypt to Red Sea Global in Saudi Arabia, and observed their diving patterns based on nearby seagrass and coral reef habitats. This study offers the first detailed look at habitat use by NEOM's turtles, showing that nesting green turtles usually dive between 3–20 meters, while hawksbills dive deeper, reaching up to 87 meters. These results highlight the need for a conservation plan, including marine protected areas, and emphasize the importance of further research to protect these essential marine species.

## OCCURRENCE OF SEA TURTLES IN GUANABARA BAY, SOUTHEASTERN BRAZIL

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The identification of occurrence areas, habitat use, and major threats in foraging and developmental zones of sea turtles is a crucial tool for informing the implementation of effective conservation measures. Guanabara Bay (GB), located in the metropolitan region of Rio de Janeiro, Brazil, holds significant economic and environmental importance. However, it has been adversely affected by a range of anthropogenic impacts, including the influx of solid waste, untreated domestic sewage, and pollutants, rendering it one of the most polluted estuarine systems along the Brazilian coast. Despite these challenges, GB still supports a rich marine biodiversity, including the sea turtles that inhabit its inner waters. Although the historical occurrence of these turtles is recognized in Rio de Janeiro waters, there are a lack of systematic studies that specifies the occurrence locations, species that enter this estuary, and how they utilize this habitat. Currently, the region is monitored by the Santos Basin Beach Monitoring Project (BMP-SB RJ Area), which focuses on recording marine tetrapod strandings, and by the Aruanã Project which, since 2022, has been conducting a Citizen Science (CS) program that gathers data on sea turtles occurrence and habitat use through community participation. Observations are submitted via social media, phone, or Aruanã Project's website. This participatory methodology is widely adopted globally, serving as a vital

ally for conservation efforts. CS not only functions as an essential tool for scientific data collection but also enhances public engagement and fosters a sense of responsibility among community members. The present study combines data from the BMP-SB and the CS efforts of the Aruanã Project to generate the first evaluation of the occurrence and habitat use of sea turtle species within the interior of GB. The data from BMP-SB spans the period from September 2019 to June 2024, during which 879 strandings were recorded, including 817 *Chelonia mydas* (117 alive), 54 *Caretta caretta* (3 alive), 4 *Lepidochelys olivacea*, 3 *Eretmochelys imbricata*, and 1 *Dermochelys coriacea*. Meanwhile, the Citizen Science data encompassed the period from October 2022 to August 2024, with reports of 177 *C. mydas* (91 alive) and 15 *C. caretta* (4 alive). These findings indicate that all five sea turtle species occurring in Brazil utilize waters of GB. There is strong evidence suggesting that both *C. mydas* and *C. caretta* utilize GB as a feeding and residency area. CS data indicate a predominance of live *C. mydas* individuals (54.4%). This species is already recognized for its coastal behavior and residency in foraging areas. The records of *C. caretta* present a novel occurrence for interior waters of GB, emphasized by differences in distribution patterns between records from CS and the BMP. Fishermen report incidental captures of juvenile *C. caretta* in their nets, indicating that these turtles should enter GB to feed on the shrimp present in the internal area of the bay. In conclusion, this study underscores the importance of community collaborative efforts in monitoring the occurrence, to identify hotspots and threats that sea turtles are facing in Guanabara Bay to better direction conservation strategies.

## SEA TURTLES OF CAGARRAS ISLANDS, A MARINE PROTECTED AREA IN SOUTHEASTER BRAZIL

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One of the techniques used to identify and monitor sea turtles is through photographs of the keratinized plates on their heads, which allow for individual identification. The photo-identification technique is already well-established and effective for identifying individuals at a local level without the need for animal capture. In situ studies provide important information on habitat use, behavioral patterns, fidelity to areas, identification of dietary items, ecological interactions with other organisms, threat identification, and they also help identify critical areas for juvenile population maintenance. This study was conducted at the Cagarras Islands Natural Monument, a no-take marine protected area (MPA) in the metropolitan region of Rio de Janeiro, Brazil. The area is also recognized as a Mission Blue Hope Spot. Data were collected through scuba diving, during which researchers actively searched for sea turtles in the water column and on the seafloor. The dives were concentrated on the Redonda and Comprida islands. When a turtle was sighted, the researchers took photographs of both sides of its head and the entire body. The animals' behaviors are also recorded, including whether they are resting, swimming, feeding, or interacting with other organisms. The identification of the individuals was performed with the aid of the I3S software and visually by comparing images in the database of the sea turtles recorded over the years. Between September 2020 and June 2024, 125 individuals were identified (62 at Comprida Island and 63 at Redonda Island), with 124 belonging to the species *Chelonia mydas* and 1 to *Eretmochelys imbricata*. Fifty-eight individuals displayed residence behavior, meaning they were re-sighted at least once after the first observation, with the highest number of sightings for one individual being 42. The most extended stay was 45 months for a *C. mydas* first sighted on September 12, 2020, and last seen on June 13, 2024, totalling seven sightings. No resident individual from Comprida Island was recorded on Redonda Island, and vice-versa, showing

high site fidelity. The *C. mydas* turtles, during their active period, were mainly observed at depths shallower than 10 meters, with feeding areas concentrated on rocks closer to the surface (up to 5 m deep), where red algae and filamentous green algae are abundant; these being the preferred food items. They were also commonly observed feeding on gelatinous organisms. The presence of fishing gear and anthropogenic debris on the islands were the most significant threats identified to the sea turtles. Despite the ban on extractive activities within 10 meters of the islands' rocky shores and on using fishing nets within 200 meters, ghost fishing caused by lines, hooks, and nets still frequently occurs in the MPA limits and surroundings. Only two individuals were observed with fibropapillomatosis, which may indicate a healthy environment despite the proximity to Guanabara Bay, a polluted area. This study identified that these islands, close to a large metropolis, represent a relevant feeding and developmental area for juvenile green sea turtles, highlighting the importance of establishing and strengthening marine protected areas for sea turtles conservation efforts.

## TECHNOLOGY ADVANCES IN UNDERWATER ACOUSTIC TELEMETRY FOR USE IN SEA TURTLE HATCHLING TRACKING: PILOT STUDY RESULTS FROM BARROW ISLAND, WESTERN AUSTRALIA

**Blair Hardman, Julian Kalau**

*Chevron Australia Pty Ltd, Australia*

Chevron Australia conducts monitoring and research at some key Flatback turtle rookeries in Western Australia. These sites include Barrow Island and mainland beaches at Mundabullangana, Onslow and the Ashburton River Delta. In partnership with Australian and International experts, the design of our monitoring and research programs provides an intensive and long-term data set on important aspects of the Flatback sea turtle's life cycle. One aspect where we have applied continued development in data collection, analysis and interpretation is the nearshore dispersal and survivorship of sea turtle hatchlings. Advances in underwater acoustic technology have recently increased the range at which tagged hatchlings can be detected using an acoustic receiver array or curtain. Innovasea's NexTrak digital Receivers and associated tags (V6, 69 kHz) were trialled in a Pilot Study on Barrow Island Flatback Turtle hatchlings in February 2024. The Study resulted in increased range of detection from less than 100 m in older model receivers and tags (180 kHz) up to 207 m (50% detection probability, 438m 20% detection probability) in the new digital NexTrack Receivers and associated tags, depending on water depth. The increase in range detection provides a more cost and resource effective avenue for utilising acoustic technology in large study areas (e.g. >20 $km^2$) such as industrial ports, to enable assessment of any potential changes to sea turtle hatchling dispersal and survivorship.

## TRACKING FORAGING MARINE TURTLES: SPATIO-TEMPORAL DISTRIBUTION IN THE BAY OF BENGAL AND ADJACENT REGIONS*

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Bay of Bengal and the adjacent regions contains diverse reptilian fauna, comprising endangered turtle species. The foraging and spatio-temporal distribution of endangered turtle species, in this Bay of Bengal region, is largely unexplored and satellite tracking technology can be used in this context. Current study utilised satellite tracking on Olive Ridley Turtle (*Lepidochelys olivacea*) to investigate foraging grounds, post nesting migration and finally categorised GPS coordinates at north-eastern Bay of Bengal – significant for this species conservation. Seven individuals were tagged with the satellite Platform Transmitter Terminal (PTT) and tracked for 15 to 245 days (125 + 79). The turtles migrated 12 – 2138 km (886 + 655) from their release locations. They travelled 4629 + 2894 km cumulative distance with a highest and lowest record of 8622 km and 202 km respectively. We categorised different number of records into 3 different zones, ranging from - highly important Zone-1 (>75 track records), moderately important Zone-2 (>50 & <75 track records) and less important Zone-3 (<50 track records), and finally found 20-210N & 89-910E coordinates for multiple turtle individuals, which is recommended areas of international attention for conservation and management aspects. Current research shows urgency to initiate transboundary research and effective conservation initiative to conserve endangered turtle species around this region.

## CITIZEN SCIENCE CONTRIBUTION TO IN-WATER SEA TURTLES MONITORING: TWO DECADES OF INSIGHTS FROM REUNION ISLAND

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In-water monitoring of sea turtles can take various approaches, depending on objectives, geographical context, and resources available. As with all monitoring, one of the major challenges is to sustain efforts over long periods of time. Citizen science programs, which rely on public participation, have become an effective approach for collecting scientific data over large areas and extended timeframes. On Reunion Island, a small volcanic island (2512 km$^2$) in the southwest Indian Ocean, sea turtles are not easily accessible due to their distribution on rocky or coral slopes at depths between 10 and 50. Involving divers and marine users in data collection appeared to be the best solution to complement existing knowledge from aerial surveys and to better characterize sea turtle populations. Therefore, since 2007, Kelonia has initiated a citizen science program based on photo-identification to monitor turtles at sea while also raising awareness. Contributions from divers and snorkelers have led to the collection of 6,480 photographs and the identification of 653 individual green and hawksbill turtles around the island, with a species distribution ratio of approximately 70:30. The data indicated a recent increase in the number of hawksbill turtles expanding their habitat range over time. Most observed individuals are juveniles or subadults, with only

54 adults documented (21 males and 33 females). The longest interval between an initial and final encounter spans 20 years (mean: 3.97 ± 3.78 years) for individuals first observed as juveniles and now as adults. Photo-ID data also reveal strong site fidelity and limited coastal movement over relatively long periods (average range: 1.15 km). Additionally, citizen contributions help monitor local threats, including boat strikes, bycatch and entanglements in ghost fishing gear. Injured turtles are rehabilitated at Kelonia care center, while photo-ID is used to track wound healing in turtles that remain in the wild. Photo-ID data have also complemented scientific research, improving accuracy. For example, aerial surveys combined with photo-ID have enhanced abundance trend estimates by life stage for both turtle species (see Laforge et al. abstract 199). Furthermore, photo-ID has helped address gaps in satellite tracking data, particularly in very shallow habitats where turtles exhibit modified diving behavior, reducing surface time (see Laforge et al. abstract 198). Despite challenges inherent such as uneven public participation and unknown effort levels, citizen science provides invaluable data that supplement traditional scientific research. These findings enhance understanding of turtle biology and ecology, inform conservation strategies, and foster greater public awareness.

## SOCIAL INTERACTIONS OF JUVENILE GREEN TURTLES (*CHELONIA MYDAS*) IN BREWERS BAY, ST. THOMAS, U.S. VIRGIN ISLANDS*

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A growing number of studies have revealed that marine turtles exhibit complex and frequent social behaviors at various life-stages; however, the ecological and evolutionary purposes of these interactions are still relatively unknown. Using underwater camera surveys in Brewers Bay, St. Thomas, U.S. Virgin Islands, we conducted 89 hours of snorkel surveys with handheld cameras from October 2023 to September 2024 to document over 300 examples of social behaviors in green turtles. All interactions were categorized using an ethogram including the following behaviors: approach, bite, contact, displacement, group feeding, group resting, head touch, inspection, and pursuit. Interactions were further categorized as passive or aggressive. Aggressive behaviors entailed displays of dominance, like physical altercations, while passive behaviors were ultimately described as behaviors not encompassed in the aggressive definition. For each interaction, we recorded the local habitat (seagrass, rocky and coral, sand, and near anthropogenic structures), whether the instigating turtle was larger or smaller than the other, seasonality, time of day, and weather conditions. We compared models to assess the relationship between the extrinsic factors, the individual behaviors seen, and the aggressive or passive nature of the behavior. Overall, a majority of the interactions documented were passive and occurred in seagrass habitats. The behaviors most frequently observed were group feeding and approach, with biting being the least observed behavior. This study expands on the growing literature regarding marine turtle sociality by providing additional evidence of nuanced social interactions and by assessing the role habitat and other external variables can have on marine turtle interactions.

# MIGRATIONS AND HOMERANGE AREAS OF POST-NESTING HAWKSBILL TURTLES (*ERETMOCHELYS IMBRICATA*) TAGGED ON MOSO ISLAND, REPUBLIC OF VANUATU*

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Hawksbill turtles (*Eretmochelys imbricata*) are a migratory species found globally in tropical regions. Vanuatu has several known hawksbill nesting sites on multiple islands including Moso Island (Hickey et al., 2023). Previous work with seven satellite tagged postnesting hawksbills (Jim et al, 2022) has shown that those nesting on Moso Island have come from home ranges on the Great Barrier Reef (GBR)(3), New Caledonia (3) and Aneityum Island, Vanuatu (1). This study expands on these findings, examining the post-nesting migration and home ranges of four additional turtles tagged with satellite transmitters in 2023 and 2024 with an added focus on migratory speeds at neritic and oceanic locations along with sea surface temperatures and chlorophyll concentrations along the turtles‘ migratory routes. Satellite tags were deployed on four post-nesting female hawksbill turtles on Moso Island in January 2023 (Makala) and January 2024 (Vatu Mau, Bule Lapa and Vonu e Rao). Makala traveled to Olympic Reef in the GBR, Vonu e Rao migrated to Emperor Reef in the GBR, Vatu Mau traveled to southern New Caledonia, Réserve Intégrale Yves Merlet, and Bule Lapa migrated to Australia’s Donovan Shoal. Makala traveled 67 days from nesting ground to home range area in GBR, traveling 1842 km, at an average speed of 1.45 km/hr. Vonu e Rao reached her home range in GBR, traveling 2575 km in 57 days at 1.85 km/hr. Bule Lapa traveled 2695 km to her home range in 82 days at 1.36 km/hr, and Vatu Mau traveled 692 km to southern New Caledonia in 26 days at 1.10 km/hr. All four turtles slowed in neritic area (200m) versus oceanic segments (deeper than 200m), averaging 0.85 km/hr in their neritic segments, and 2.03 km/hr in oceanic segments. Home range kernel densities were analyzed at 95% and 50% levels using Zoatrack software. Makala had a 95% kernel density of 0.6 km² and a 50% density of 0.1 km². Vonu e Rao’s home range was 8.8 km² (95%) and 1.3 km² (50%), Vatu Mau’s were 1.6 km² (95%) and 0.2 km² (50%), and Bule Lapa’s were 5.4 km² (95%) and 0.6 km² (50%) of home range. This study confirms the connection between hawksbill turtles nesting on Moso Island and home ranges in New Caledonia and Australia, and expands upon the importance of neritic areas along migratory routes. Varying travel speeds during neritic and oceanic stages of migration from nesting to home ranges suggest resting or feeding in shallow areas. Home range habitat area varied with 95% KUD ranging from 0.624 km² to 8.8 km² for the four tagged turtles.

# FOOD PREFERENCE AND FORAGING SITE FIDELITY IN GREEN TURTLES REVEALED BY TRANSLOCATION EXPERIMENTS

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Juvenile green turtles are generally considered to occupy narrow ranges in neritic areas, where they predominantly consume marine algae and seagrass. In recent years, green turtle overgrazing has led to a decline in seagrass resources, thereby reducing the amount of seagrass which is available to them. Investigating how strongly they exhibit fidelity to foraging sites is important for understanding their foraging ecology and conserving seagrass habitats, but few studies have examined this topic. In this study, we evaluate green turtle preference for specific marine algae and seagrasses, and fidelity to foraging sites. During 2018-2024, field studies were conducted at Kuroshima (24°14'13" N, 124°00'35" E), a small subtropical island with a diameter of about 4 km and surrounded by coral reefs. Green turtles were captured using an entanglement net set in foraging areas in the inner reef on the northern and southern sides of Kuroshima. Identification of food items ingested at the capture site was carried out by oesophageal lavage. Animal-borne data loggers were attached to 18 turtles, with four turtles released near the capture site and the other 14 turtles relocated 2-4 km away from their capture site in marine algae or seagrass habitats around the islands. The devices were retrieved after 3-4 days. Food items and feeding time were analyzed from video data, and homing routes were investigated from behavioral data. The feeding time ratio was calculated as the total feeding time relative to the total video-recorded time. All four turtles released near capture sites stayed there and 12 out of 14 translocated turtles returned to their original capture sites. The feeding time ratio of turtles released near the capture sites ranged from 17.1 to 70.8%. For turtles that returned from the release site, the feeding time ratio before or during their return was low (0-1.9%) but increased near the capture site (0-31.8%). Five of six turtles, from which oesophageal lavage samples were collected, consumed the same species of algae that they had consumed at the capture sites, and they rarely consumed other species of algae before or during their return. Of the two turtles that did not return, one consumed the same species at the release site as it consumed at the capture site. The other was released in site where seagrass consumed at the capture site was not growing and did not feed. The returned turtles moved through the inner reef on the east side of the island and arrived at the capture sites in about 4-7 hours, avoiding the west side, where rocky exposures occur at low tide in the inner reef. Turtles translocated to the western area returned through the outer reef on the west side, taking about half a day to one day. The reasons for choosing to return through the inner reef may include familiarity with the terrain and/or escaping predators such as sharks outside the reef. Green turtles indicated strong fidelity to foraging sites. One reason may be their preference to consistently feed on the same species.

## OBSERVING JUVENILE GREEN SEA TURTLE BEHAVIOR IN A NORTHEAST FLORIDA ESTUARY*

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After establishing a local population of juvenile green sea turtles through the identification of individual head scale patterns in a project started in June 2020, further research is being conducted examining their behaviors. Starting in September 2024, we began quantifying behavior through observations at Camachee Cove Marina and Conch House Marina, located in St. Augustine, Florida along the Intracoastal Waterway. Observations were recorded regarding feeding, time spent in the area, and social behavior as individuals grazed along the floating docks of marinas. Green sea turtles were located in the marina and given one minute to acclimate to human presence. Then, we observed the turtle from the floating docks for 10 minutes and recorded the number of breaths, interaction with other turtles, swimming behavior, and feeding using tallies. Social behavior with other juveniles includes pursuing, biting, feeding adjacently, circling, etc. Thus far, the primary behavior observed is feeding: 50% of the time feeding behavior is observed, turtles are grazing along floating docks. However, they are also seen feeding on floating material and growth on boats. From our observations, we calculated that they take one breath about every 2 minutes. Of all our turtle encounters, 29.4% of the time the sea turtles were observed in groups of at least two turtles, and the dominant group behavior observed was pursuing another turtle. Further data is being collected as this is an ongoing project and these are the preliminary findings. This information can help better understand juvenile green sea turtle behavior and their usage of man-made structures in marinas.

## COMBINING AERIAL SURVEYS AND PHOTO-IDENTIFICATION TO STUDY IN-WATER SEA TURTLE DISTRIBUTION AT REUNION ISLAND (2008–2023)

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The sea turtle populations of Reunion Island, a small volcanic island in the western Indian Ocean between Madagascar and Mauritius, were significantly impacted by human colonization in the 17th century. However, after 40 years of local and regional conservation efforts, these populations show signs of recovery. This study examines spatiotemporal trends in the abundance and distribution of green turtles (*Chelonia mydas*) and hawksbill turtles (*Eretmochelys imbricata*) along the west coast of Reunion Island from 2008 to 2023. Data were collected through lightweight aerial surveys and photo-identification (photo-ID) methods. Results indicate a consistent increase in turtle abundance, primarily juveniles, with green turtles comprising 78% of observations based on photo-ID. Size-class estimates from aerial surveys suggest that annual fluctuations in abundance are driven largely by variations in the number of smaller turtles, underscoring Reunion Island's role as a critical developmental habitat. The highest concentrations of turtles were observed in fringing reef areas characterized by shallow, gently sloping bathymetric zones. Photo-ID

also revealed strong site fidelity for both species. Combining aerial surveys and photo-ID, this study provides life-stage-specific abundance trends over 9% (5.5 km²) of the surveyed area (60 km²) and highlights distribution patterns linked to food availability. Notably, the decline in green turtle numbers correlates with the disappearance of Reunion Island's most significant seagrass bed. These findings advance understanding of the spatial ecology of in-water turtles and offer valuable insights for local and regional conservation planning. They further emphasize the role of sea turtles as indicators of coastal ecosystem health.

## HABITAT USE DYNAMIC AND EXPLORATORY MOVEMENTS OF JUVENILE HAWKSBILL TURTLES REVEALED BY FASTLOC-GPS TRACKING AT REUNION ISLAND

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Understanding the spatial dynamics of marine animals is essential for developing effective conservation strategies, including the design of marine protected areas (MPAs). Spatial use by marine animals changes over time, influenced by life stages, habitat variability, and individual plasticity. The hawksbill turtle (*Eretmochelys imbricata*), classified as critically endangered in the IUCN RedList, exemplifies a species with complex spatial ecology. Between 2015 and 2023, 20 juvenile hawksbill turtles (mean CCL (±SD) = 56.1 ± 9.9 cm, range 41.0 - 71.0 cm) were tagged at five contrasted neritic sites around Reunion Island in the Southwest Indian Ocean. The tags recorded precise locations at decametric-level resolution over extended periods (mean = 7 months; SD = 4 months). Notably, seven of these tags were recovered (35 %), yielding additional location data beyond those received via the Argos satellite network (1.5–2.5 times more locations). The recovery of tags also allowed to access high temporal resolution records (3–10-second intervals) of wet/dry switch activity, a proxy for surface time, which has not been previously exploited in studies. Our analyses focused on daily and seasonal variations in spatial use, home range, surface time patterns, and nocturnal clustering, considering individual characteristics (size and site). We addressed three key questions: (1) How does spatial use vary on a daily scale? (2) How do movements and spatial use evolve over longer temporal scales (monthly to seasonal)? (3) What are the advantages and limitations of Fastloc tracking in ecological studies? Juvenile hawksbills exhibited site-specific variation in home range, influenced by habitat type, particularly the presence of reef platforms. Temporal stability in home range indicated consistent habitat preferences across seasons. However, wet/dry switch data revealed distinct seasonal basking behaviors, with increased surface time during early mornings in winter, likely related to thermoregulation (sea temperature range: 23–28°C). Nocturnal clustering showed that individuals favored a limited number of night sites, with strong preferences for sites closest to their daily core habitat. Additionally, more than half of the turtles undertook exploratory movements (1–5 km) beyond their home ranges, generally returning within the same day. Two individuals demonstrated long-distance migrations (500 km and 2,000 km), highlighting long-range habitat shifts during immature stages. The recovery of tags also enabled an evaluation of the relationship between data volume and home range quality, identifying a minimum number of locations required for accurate home range estimation and showing how daily surface time patterns influence GPS location volume. These findings enhance our understanding of juvenile hawksbill spatial ecology, providing critical insights to inform conservation strategies for Reunion Island and the broader region.

## TURTLE UP: ADVANCED TRACKING TECHNOLOGY FOR OLIVE RIDLEY SEA TURTLE CONSERVATION AND RESEARCH*

**Nicolas Loudner, Mark Mysonhimer, Abdulkareem Alfaraj, Corinne Brion, Bill Kaval, Chris Yakopcic**

*Turtle Up, United States of America*

Olive Ridley sea turtles, an endangered species, play a vital role in maintaining marine ecosystems, making their conservation crucial. Tracking their movements and understanding their environmental conditions is essential for effective protection and research efforts. Turtle Up's custom-designed tracking device addresses this need by combining GPS, temperature, and pressure sensors in a compact, durable system optimized for these turtles' unique habitats. This combination of devices aids conservationists by providing detailed data that enhances understanding of the turtles' migratory patterns and responses to environmental changes, enabling more targeted and informed conservation actions. Temperature, pressure, and GPS sensors each serve unique roles and use specialized mechanisms to monitor environmental conditions. GPS sensors, or Global Positioning System devices, calculate precise geographical coordinates by measuring the time delay of signals received from satellites, achieving accuracy within centimeters in newer models. Temperature sensors detect thermal energy within an environment by using thermistors, thermocouples, or infrared sensors to measure temperature fluctuations with high precision, which is essential for scientific research and industrial applications. Pressure sensors, meanwhile, measure the force exerted by fluids or gasses on surfaces, utilizing piezoelectric, capacitive, or resistive transducers to convert this force into electrical signals, enabling us to determine the depth that the turtle currently is at. Each type of sensor employs specific technologies and principles that suit particular applications, with advancements continually enhancing their precision, durability, and adaptability. Among these, Turtle Up's tracker combines GPS, temperature, and pressure sensing capabilities into a single integrated system, optimized for monitoring Olive Ridley turtles in marine conditions. Unlike standard sensors, this device features a durable, low-profile design and advanced signal processing algorithms that mitigate underwater signal interference, ensuring accurate tracking even in challenging oceanic environments. Its sensors are finely tuned for rapid adaptation to the marine ecosystem, allowing for data collection that supports marine conservation efforts. The tracker's enhanced reliability, adaptability to saline conditions, and efficient data transmission make it an invaluable tool for marine biologists and conservationists, expanding data collection capabilities and paving the way for more effective conservation strategies.

## WATER-BORNE CHEMICALS RATHER THAN APPEARANCE FROM BIOFOULING CAN PROMOTE PLASTIC DEBRIS INGESTION IN GREEN TURTLES (*CHELONIA MYDAS*)*

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Marine plastic debris poses significant threats to marine wildlife, particularly sea turtles. Plastic debris found in digestive tract and cases of mortality have been reported globally. Many previous studies focused on colour and texture suggested that visual similarity between plastic and jellyfish (their common prey) may lead to mis-ingestion. However, animal-borne camera videos on juvenile green turtles (*Chelonia mydas*) have shown that not all encountered plastic debris was ingested under natural environments (61.8%

encounter-ingestion ratio). Therefore, the mechanisms behind mis-ingestion remain unclear. Biofouling is known to occur almost everywhere in the ocean, thus long persistent marine plastic debris is a target for attaching microorganisms. Such biofouling may alter properties of plastic debris in ways that could influence ingestion behaviour in sea turtles. We hypothesized that biofouling may make plastic debris more attractive to green turtles and aimed to further understand the key sensory behind the mis-ingestion. To test this hypothesis, we conducted a series of experiments. In the first experiment (A), biofouling was artificially carried out on plastic sheets for 3 weeks allowing attachment of microorganisms. Then, the cultivated samples and clean plastic samples were displayed separately in random order (9 displays per sample type per individual and each display last for 5 minutes) to 12 juvenile green turtles. The bite actions towards samples were counted. Since biofouling not only altered the colour of the plastic sample but also emitted odours, two subsequent behavioural experiments (B: I. & II.) were conducted to investigate the role of in-water chemical cues and visual cues in attracting sea turtles to plastic debris. In experiment B, 8 juvenile green turtles were exposed to: I. (chemical cues): bio-fouled samples sealed in a zip bag with no holes (no chemical cues; denoted as [FI]) and with holes (chemical cues present; denoted as FI) and II. (visual cues): brownish bio-fouled plastic ([FII]) and translucent clean plastic ([CII]), both sealed in zip bags to prevent the release of chemical cues into the water. During these experiments, several behaviours of turtles were observed including noticing, close observing or touching, attempting to bite and actual biting. Except noticing, all other reactions (referred to as positive interactions) were recorded. The results of experiment A showed that the turtles were significantly more likely to bite bio-fouled samples with 24 bites compared to 9 bites on clean samples (Turkey pairwise, $p = 0.009$). According to experiment B, a total of 39 positive interactions were seen towards FI (bio-fouled samples with chemicals) but only 20 towards [FI] (no chemicals released from bio-fouled samples) in experiment I (c2 test, $p <= 0.002$). In contrast, no differences (c2 test, $p = 0.062$) can be seen in experiment II (22 for [FII] vs. 19 for [CII]). Our findings suggest that biofouling can play a crucial role in the mis-ingestion of plastic debris and water-borne chemical cues from biofouling were a stronger attractant than visual cues.

## REGIONAL DIFFERENCES IN THE DIET OF GREEN TURTLES INFERRED FROM STABLE ISOTOPE ANALYSIS AND SATELLITE TELEMETRY*

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The stable isotope composition in the scutes of green turtles (*Chelonia mydas*) preserves dietary information for up to 10 years, allowing insights into long-term feeding patterns. This study investigates the diet of 44 nesting. female, green turtles in the Red Sea using stable isotope analysis of $\delta^{13}C$ and $\delta^{15}N$ values from turtle scutes, combined with macrophyte isotope data collated from the literature. We categorised macrophyte isotopic values by habitat and taxa, and applied a mixing model to estimate the relative contributions of various habitats and taxonomic groups to green turtle diets. Our results show that green turtles rely heavily on seagrass habitats, with seagrass species being the primary components of their diet. Notably, *Cymodocea nodosa* was the most frequently consumed species, followed by *Enhalus acoroides*. The high consumption of *Cymodocea*, a genus not typically identified as a primary food source, may reflect its elevated nitrogen content, which could help compensate for the nutrient-poor conditions of the Red Sea. In addition to dietary analysis, we explored the relationship between the curved carapace

length (CCL) (mean; 100.73 cm, range; 91.9 - 111.7 cm) of turtles and the distance between their nesting and foraging sites. Using a Gaussian mixture model, we identified two distinct clusters of foraging behavior: "Close" foragers that remain near nesting areas and "Distant" foragers that travel farther to forage. Our analysis found that "Distant" foragers are significantly smaller in CCL, with slightly lower $\delta^{13}C$ values and significantly higher $\delta^{15}N$ values than "Close" foragers. These isotopic differences may reflect regional nutrient gradients, as nitrogen levels increase in the southern Red Sea near the Bab al Mandeb Strait where it connects to the Indian Ocean. The elevated $\delta^{15}N$ levels in "Distant" foragers could indicate exposure to different nutrient baselines, possibly due to a shift in diet or feeding in distinct isotopic environments. The patterns observed may also relate to the remnants of dietary habits from earlier life stages when juvenile turtles consume invertebrates and plankton. These findings provide valuable insights into green turtle foraging ecology in the Red Sea, identifying key seagrass species that support their diet. The distinct clusters of foraging behavior highlight variability in individual foraging ranges, likely shaped by resource availability and habitat distribution. This research underscores the importance of protecting seagrass meadows and conserving critical foraging habitats that sustain green turtle populations across the Red Sea.

## HAWKSBILL DISTRIBUTIONS IN THE WESTERN ATLANTIC: INSIGHTS DERIVED THROUGH COLLABORATIVE SYNTHESIS

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Sea turtles are transboundary—their movements and migrations connect distant habitats, thereby linking diverse research projects, communities, and management entities. Therefore, sea turtle conservation is also transboundary, and human cooperation at the scale of regions, RMUs, and beyond can significantly improve our ability to support population recovery. Here, we introduce a multinational collaboration within the Western Atlantic, pooling data among research programs across the region to present a large-scale panorama of hawksbill sea turtle (*Eretmochelys imbricata*) movement and habitat use. We synthesize satellite telemetry data for over 250 adult females, identifying key migratory corridors, high-use foraging areas, and geographic data gaps. We also use the regional dataset to evaluate patterns in hawksbill migratory distance and bathymetry use. Broadly, our findings indicate high rates of basin-wide migratory connectivity, yet also show a diversity of migratory strategies, including many turtles that remain within the exclusive economic zone of their nesting site. Satellite tracks reveal that hawksbills establish residency in neritic foraging habitats throughout the region, including multiple high-use areas that may be worthy of elevated management focus, such as the Nicaragua Rise. Our findings represent just the first step in a project that we envision will evolve as more turtles are tracked and secondary analyses are conducted (e.g., spatial overlap with threats). We demonstrate how reanalysis and synthesis of existing data can advance our capacity to conserve sea turtle populations.

# TURTLEWATCH EGYPT: A CITIZEN SCIENCE INITIATIVE FOR SEA TURTLE CONSERVATION IN THE EGYPTIAN RED SEA

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TurtleWatch Egypt (TWE), launched in 2011, is a citizen science initiative dedicated to gathering essential information on endangered marine turtles across foraging grounds in the Egyptian Red Sea, with no data collection conducted at nesting sites. Engaging local communities, tourists, and dive centers, TWE has compiled a 20-year dataset on turtle populations, with sightings dating back to the first photographic report in 2003. In total, 9,562 sightings were logged across multiple locations, corresponding to 1,441 green turtles (*Chelonia mydas*), 1,371 hawksbills (*Eretmochelys imbricata*), 4 loggerhead turtles (*Caretta caretta*), 1 olive-ridley turtle (*Lepidochelys olivacea*), and one leatherback turtle (*Dermochelys coriacea*). In 55 cases, the quality of the picture was insufficient to identify the species. Data collection has involved both TWE team-led surveys and reports from citizen scientists, with contributions from 960 trained ordinary citizens and partnerships with 96 dive centers. TWE's collection methods included 6,376 reports from citizen scientists and 1,200 team-led surveys, resulting in 3,186 sightings, yielding extensive information on the turtles' age and sex distributions: 908 juveniles, 886 sub-adults, 636 adult females, and 1,024 adult males. Among the identified turtles, 381 individual green turtles were observed multiple times (2–141 times), and 144 hawksbill turtles were resighted (2–84 times). Key turtle activity sites, such as Marsa Abu Dabbab (3,031 sightings), Hermes (899 sightings), and Shams Alam (657 sightings), highlight critical habitats where human-turtle interactions are frequent. TWE data on injuries—a significant indicator of human impact—recorded 40 injured turtles across 290 sightings since 2011, with vessel strikes as a major cause, particularly at high-traffic sites like Hermes and Marsa Abu Dabbab. Resighting data have provided valuable insights into the likely travel distances between sites for individual turtles, although these represent only the minimum distances between locations where they were sighted. For example, two adult female green turtles, "Aussie" and "Milka" undertook significant journeys. Milka traveled a minimum distance of approximately 277 km between Tondoba Bay and the Saudi coast before returning, while Aussie moved an estimated 310 km between Saudi Arabia and foraging grounds in Marsa Abu Dabbab and Hermes. Another notable movement within Egypt included a green turtle's minimum travel of 94 km between Marsa Mubarak and Marsa Fukera. Hawksbill turtles generally showed shorter movement ranges (0.5–33 km), with two exceptions in the southern Egyptian Red Sea: turtles migrated between Zabargad Island and Sha'ab Maksur and between Daedalus Reef and Wadi Lahmi Azur House Reef, each covering a minimum recorded distance of 89 km. Beyond ecological research, TWE emphasizes community education and collaboration. Through bilingual workshops and awareness events, TWE has educated over 2,300 participants, including children, boat captains, dive instructors, and tourists. Impact assessments introduced in 2024 show positive outcomes: Turtle Talks and training sessions increased knowledge by 20%, Turtle Trunk educational activities improved understanding by 26%, and 10% of trained boat captains reported enhanced skills in avoiding turtle interactions. Through long-term monitoring, citizen science, and education, TWE enhances Red Sea turtle conservation, reduces human-turtle conflicts, fosters sustainable tourism, and protects vital habitats.

# MINIATURE SATELLITE TAGS REVEAL DISPERSAL MOVEMENTS AND BEHAVIOURS OF EARLY STAGE POST-STRANDED AND REHABILITATED JUVENILE LOGGERHEAD TURTLES

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South Africa is home to two species of nesting sea turtles, the leatherback and loggerhead. Nesting occurs along the northeastern coastline during early summer. After hatching, neonates are swept southward by the warm Agulhas current. As the current retroflects, many young turtles are pushed into cold coastal waters, where they strand on beaches, sometimes injured and often exhibiting cold shock. The Two Oceans Aquarium Foundation, through its Turtle Conservation Centre (TCC), has been actively rehabilitating stranded sea turtles for the last 15 years. Situated at the southern tip of Africa, the TCC is strategically located to receive post-hatchling loggerhead turtles. Over 1300 sea turtles have been successfully rehabilitated and released through the work of this program. Whilst sub-adult and adult turtles have been satellite tracked to confirm post-rehabilitation success, the small size of the post-hatchlings has prevented us from being able to track them, until now. In a recent collaboration initiated by, Upwell Turtles, we have undertaken the first satellite tracking of young juvenile loggerhead turtles in South Africa. We tagged twelve rehabilitated juveniles (mean 621.32g, mean 14.24cm) with miniature Lotek satellite tags during January 2024, and another twelve turtles (mean 545.76g, mean 13.64cm) with the same tags during October 2024. The first group of turtles was released 22 nautical miles offshore southwest off the Cape Peninsula and the second group was transported to KwaZulu-Natal and released 1 nautical mile off Sodwana Bay, within the warmer waters of the Agulhas Current. The tracks have already revealed many fascinating insights about early-stage loggerhead dispersal and ecology. The data are also providing first-time evidence of medium-term post-release survivorship of early stage stranded turtles, demonstrating the efficacy and benefits of sea turtle rehabilitation efforts. This novel work is helping to better understand the movement of rehabilitated young loggerheads at sea and amplify the conservation message of these ocean ambassador.

# STABLE ISOTOPE ANALYSIS REVEALS ECOLOGICAL STRATEGIES OF SEA TURTLES

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Learning the structure and function of ecosystems is crucial for understanding the dynamics of nutrient flow, energy transfer, and species interactions within these systems. This knowledge is not only essential for effective conservation and management, but also for assessing potential impacts of climate change on marine biodiversity. In particular, sea turtles play key roles in marine food webs, serving as indicators of ecosystem health and shifts in community dynamics. However, the trophic strategies of sea turtles remain poorly understood, especially in highly dynamic marine ecosystems such as off the coast of Peru. In this study, we investigated the ecological strategies of four sympatric sea turtle species in Peru (*C. caretta*, *C. mydas*, *D. coriacea*, and *L. olivacea*) using stable isotope analysis of carbon (d13C) and nitrogen (d15N) from 133 turtle skin samples collected between 2003 and 2009. We found a significant latitudinal trend in d15N for *C. mydas* and *L. olivacea*, likely attributed to baseline isotopic differences, confirming a similar regional trend observed in other taxa. No latitudinal effects were observed for d13C. To further explore how these isotopic patterns vary spatially, we examined the three distinct geographic areas in Peru with distinct biotic and abiotic features used by sea turtles: North, Central and South. Our results revealed that both d13C and d15N values characterized these areas for *C. mydas* and *L. olivacea*, suggesting region-specific foraging patterns. In contrast, isotopic values did not differentiate these areas for *C. caretta* and *D. coriacea*, indicating that these species may be moving among regions. To compare isotopic niche spaces, we focused on the Central region of Peru, where we had a robust sample size from all species. We found that *C. caretta* and *D. coriacea* exhibited broader trophic niches, while *L. olivacea* showed more specialized resource use, and *C. mydas* exhibited intermediate niche size. *C. caretta* also exhibited the highest d15N values, which suggests a higher-trophic level diet and/or use of areas with high denitrification rates (i.e., baseline influence). Additionally, we found moderate niche overlaps for all turtles except *C. caretta*. Niche overlap among *C. mydas*, *D. coriacea*, and *L. olivacea* ranged from 14% to 45%, indicating greater resource sharing among these species. *C. caretta* exhibited minimal overlap, confirming its distinct resource use. These findings provide new insights into the trophic relationships and niche differentiation of sea turtles in the southeastern Pacific high seas and Peruvian waters, with important implications for their conservation and management in a changing environment.

# HABITAT USE AND MOVEMENT PATTERNS OF POST-NESTING LOGGERHEAD SEA TURTLES IN THE WESTERN MEDITERRANEAN*

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The loggerhead sea turtle (*Caretta caretta*) is the most abundant species of sea turtle in the Mediterranean Sea, with major nesting grounds located in the eastern basin. In recent years, this species has expanded the nesting range into the Western Mediterranean Sea. The Cilento National Park, South-west Italy, has become a hotspot for these emerging nesting areas, offering an opportunity to study this colonisation event. While increasing number of female sea turtles return each year to nest along the western Italian coasts, their foraging and wintering grounds remain largely unknown. What habitats do they utilise and how can their post-nesting movement strategies be characterised in relation to oceanographic features? To address these questions, eight females were satellite-tagged after they had nested in the Cilento National Park between 2020 and 2024. At the time of abstract writing, our analysis included data collected from 2020 to 2023 (three turtles), as tracking for later periods was still ongoing. Once complete, the full dataset from all eight turtles will be analysed to improve the study's robustness. Location data were filtered and interpolated at 3-hour intervals using a continuous-time correlated random walk state space model. Foraging and travelling behaviours were classified using a Hidden Markov Model (HMM) via the "momentuHMM" R package. A move persistence index was calculated with the "aniMotum" R package and correlated with three environmental variables (Chlorophyll a, sea surface height, and current intensity). Turtles' movement directions were also analysed relative to current flow. Finally, a General Additive Model was applied to assess the correlation between turtle movement efforts and current intensity. Our results show that six turtles foraged in the pelagic waters of the Western Mediterranean, while one foraged on the Tunisian shelf, and another in the neritic waters along Sardinia's northeastern coast. Preliminary findings suggest a positive relationship between current intensity and movement persistence ($Z = 5.03$, $P < 0.001$), with turtles preferring low-intensity currents for foraging as supported by previous studies. Low-current intensity likely enhances manoeuvrability and prey capture. Conversely, during travel, turtles selected high-intensity currents and optimized energy efficiency by moving perpendicular or aligned with the current. Current intensity was significantly negatively correlated with turtle movement effort ($P < 0.001$), indicating that active swimming effort decreased in stronger currents, likely as turtles took advantage of currents to aid their movement. These results suggest behavioural adaptations to exploit oceanographic features, minimising energy costs while maximising movement efficiency. This study reveals an unexpectedly high proportion of female turtles foraging in pelagic habitats in the Western Mediterranean, rather than joining established neritic foraging sites commonly used by turtles from major Mediterranean rookeries. It also presents preliminary evidence of adaptive behaviours in response to current dynamics among loggerheads nesting in southern Italy, shedding light on their habitat use and movement strategies during post-nesting migrations. These findings highlight the need for further research on habitat connectivity to help identify priority areas for effective conservation efforts.

# UNCOVERING A NEW MIGRATION PATTERN FOR GREEN TURTLES FROM THE BIJAGÓS ARCHIPELAGO, WEST AFRICA

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Sea turtles are highly migratory, occupying breeding and foraging areas often hundreds to thousands of kilometers apart. Their breeding phenology is influenced by body condition and environmental cues at foraging and breeding grounds. While breeding typically follows a defined seasonal pattern, some locations experience year-round nesting or dual breeding seasons. These aspects make sea turtle conservation challenging if threats and management vary across their range or if research and conservation efforts are limited to a too-narrow time frame. Understanding sea turtle spatiotemporal distribution across the geographic areas they use is thus essential for conservation and ecological insight. Poilão Island, part of the Bijagós Archipelago in Guinea-Bissau, West Africa, hosts one of the world's largest green turtle (*Chelonia mydas*) nesting populations, with over 15,000 nesting females. The primary nesting season spans June to November, peaking in August-September during the rainy season, but nesting occurs year-round. Tracking data from 2018 to 2021 for both adult females (n = 44) and males (n = 9) that breed during the main season revealed the primary foraging grounds for this population. Most post-breeding females migrate 1,000 km north to Mauritania's Banc d'Arguin, with about 25% traveling 300-400 km north to Joal Fadiouth, the Saloum Delta, or Bijol Islands in Senegal and The Gambia. The remaining 25% stay within 40-90 km of the nesting site, at the Bijagós Archipelago. Males generally use similar foraging areas but tend to stay closer to the breeding site. To expand our understanding of this population's range, we deployed satellite tags in 2023 on breeding females (n = 9) nesting during the dry season at Poilão (January - March). All but one turtle migrated about 2,000 km south to forage offshore near Accra, Ghana, revealing a new migratory pattern for Poilão's population linked to nesting phenology. Our findings suggest that two subpopulations of green turtles nest at Poilão Island, during contrasting seasons, and reinforce the importance of sampling outside the main breeding season for a better understanding of spatiotemporal distribution of sea turtles. This seasonal dichotomy may hold particular significance in the context of climate change. Cooler sand temperatures during the dry season at Poilão could enhance egg incubation and hatchling survival in the near future, while in recent years, intense rainfall and tidal surges during the rainy season have led to high clutch mortality. Should turtles nesting in the dry season gain a fitness advantage under these changing conditions, this could drive phenological adaptation at Poilão over evolutionary timescales, with possible shifts in main foraging locations.

# RESILIENCE OR VULNERABILITY? LOGGERHEAD SEA TURTLES FACE THE MARIANA DAM'S MINE TAILINGS

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In November 2015, a major environmental disaster occurred in Brazil when the Mariana Dam broke. The failure of the dam released 43.7 million cubic meters of mine tailings into the Doce River, causing a toxic brown mudflow to pollute the river and beaches near its mouth. The mouth of the Doce River region is an important loggerhead nesting aggregation in Brazil and one of the loggerhead index nesting sites for population, underscoring the need to assess the impacts of these elements on sea turtles. To monitor and check possible changes in loggerhead behavior, Fundação Projeto Tamar was hired to evaluate in-water habitats used by nesting females. Here, we present the results of satellite tracking post-nesting loggerhead sea turtles during the internesting period, migration, and foraging habitats and quantify the overlap with marine areas directly affected by the toxic plume. A total of 20 females were monitored between the 2020/21 and 2021/22 nesting seasons. We used Fastloc Depth Sensing Tags from Wildlife Computers to evaluate core use areas and dive behavior. GPS and ARGOS locations were filtered to remove unrealistic fixes, such as those on land, low accuracy, or faster than 3 m/s. A continuous-time state-space model within the 'aniMotum' R package was used to regularize tracks in 24-hour intervals. Latent behaviors were estimated based on the behavioral index from a movement persistence model ('mpm') in combination with the straight distance from the nesting beach. The number of dives within 24 hours served as an activity level index for comparing identified behaviors, and GIS layers of high- and low-concentration plume areas were used to analyze spatial overlap. Animals were monitored on average for 398 days (range 141 – 747), with 11.1% of points classified as internesting, 20.4% migration, and 68.6% as foraging. Animals were mostly exposed to the plume area during the internesting period (95.7% of locations), and most foraging areas were located outside the plume area. Notably, activity levels were the highest within the high-concentration area (average 61.3 dives/day) and during the internesting period (average 54.5 dives/day) surpassing those observed during migration (average 50 dives/day) and foraging (average 36.3 dives/day). In addition, diving data indicated that during the internesting period individuals spend most of their time near the substrate, increasing the likelihood of interacting with toxic elements. However, the lack of baseline activity data limits the direct attribution of patterns to contamination exposure, posing challenges for evaluating physiological impacts. Their reproductive parameters appear stable to date, suggesting resilience while reinforcing the need for long-term monitoring. By integrating satellite tracking data with detailed movement analysis, this study reveals the overlap of loggerhead sea turtle internesting habitat to the contaminated area from the Mariana Dam disaster. The findings emphasize the importance of collecting baseline data and detailed in-water habitat use information to inform effective conservation strategies for this vulnerable population and its critical nesting habitat.

## IN-WATER MONITORING OF ENDANGERED LEATHERBACK TURTLES OFF THE US WEST COAST

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Pacific leatherback turtles (*Dermochelys coriacea*), are federally listed as endangered under the United States Endangered Species Act (ESA) and are recognized as being under threat of extirpation within the Pacific Ocean. Leatherbacks that nest at beaches in the tropical western Pacific migrate across the Pacific to forage on seasonally abundant sea nettles, *Chrysaora fuscescens*, in two known areas off the U.S. West Coast: central California and Oregon-Washington (OR-WA). Both areas are designated as Leatherback Critical Habitat (77 FR 4169, 27 February 2012). Since 2000, integrated aerial survey, satellite telemetry, and in-water sampling have been successfully conducted off central California to characterize leatherback distribution, movements, abundance, habitat use, foraging behavior, and health. More limited information on leatherback occurrence is available off OR-WA, and no estimate of leatherback abundance is available for this region. Here we present an overview of the methodologies and results from over twenty-five years of leatherback monitoring research efforts off the US West Coast, including 1) replicated aerial surveys to document distribution and estimate abundance via line transect methodology; 2) satellite and acoustic telemetry to identify movements following at sea capture of leatherbacks using a specially designed leatherback capture vessel, with plane support to guide the boat to surfacing leatherbacks; and 3) suction-cup attached VHF/camera tags with time-depth recorders for fine-scale foraging and behavior studies.

## FIRST LOGGERHEAD'S SIMULATIONS OF THE SEA TURTLE ACTIVE MOVEMENT MODEL (STAMM), VALIDATED WITH OBSERVED TURTLE TRAJECTORIES

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Understanding dispersal of sea turtles during the juvenile stage, known as “lost years”, is a key step to be able to protect them. To fill this gap, modeling is an available strategy. This is the purpose of the Sea Turtle Active Movement Model (STAMM): a Lagrangian model which simulates sea turtle trajectories under combined effects of oceanic drift and habitat driven swimming activity. In this work, we study a simplified form of the STAMM parameterization of the habitat-driven swimming velocity adapted for loggerhead sea turtles. We seek to calibrate it directly using satellite tracked trajectories of juvenile loggerheads in North Pacific from NOAA PIFSC Marine Turtle Research Program. The modeled habitat depends on the Sea Surface temperature and a proxy for food abundance. Several food proxies are tested. A Kolmogorov Smirnov based metric is defined to compare spatial distribution of simulated turtles with observed turtles. Then, the model main parameters are estimated from sensitivity analysis to calibrate the model. Results suggest that, in that modeling context, (1) chlorophyl-a concentration is the most appropriate proxy for food abundance and (2) meridional movements of satellite tracked turtles, which describe a clear seasonal cycle, are well reproduced by STAMM simulated trajectories. However, some of the parameter optimal values, such as preferred temperature range and the distance over which habitat gradients are computed are unexpected and thus questionable. This work provides the first simulations of juvenile loggerhead trajectories using a simplified version of STAMM directly calibrated using satellite tracking data. The simulated spatial dispersal is satisfactory but is obtained with some unexpected parameter values. This suggests that further work is needed to improve the formulation of the used habitat and/or swimming velocity models.

## THE SEA TURTLE ACTIVE MOVEMENT MODEL (STAMM): AN AVAILABLE TOOL TO SIMULATE JUVENILE SEA TURTLE'S TRAJECTORIES

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The juvenile pelagic stage of sea turtles is still poorly understood. It has long been assumed that small sea turtles drift, mostly passively, with ocean currents but evidence is growing that juveniles are more active than initially thought. Improving knowledge on this early dispersal phase is much needed to implement effective conservation strategies. As satellite tracking of small juveniles remains technically challenging and thus rare, numerical modeling of their dispersal is a complementary approach to help reduce the knowledge gap. For that purpose, the Sea Turtle Active Movement Model (STAMM), originally proposed by Gaspar and Lalire (2017) is now further developed at Mercator Ocean International (MOI). This Individual-Based-Model can be used to simulate the trajectories of juvenile sea turtles dispersing either purely passively under the sole effect of oceanic currents or under the combined effects of currents and habitat-driven movements triggered by the need to find food and suitable water temperatures. The active component of STAMM involves several parameters such as growth rates, suitable temperatures and food requirements as function of age. These can be inferred from literature and/or from model calibration techniques using tracking data. The latest STAMM model version is freely available and easy to use. In this poster we briefly present this new model version and how it can be used to simply perform a simulation of juvenile sea turtle dispersal for a population in any oceanic area. In addition, we show how the model can be exploited on the MOI EDITO Datalab platform (https://datalab.dive.edito.eu/). Specific viewers and analysis tools to visualize and analyze model are also into development before release. Their use will be demonstrated on the spot. Work on STAMM continues to make it a powerful, easily usable, tool to help understand juvenile sea turtles’ dispersal and contribute to their conservation.

# SURFACE DETECTION PROBABILITY OF LEATHERBACK TURTLES AT THE RIO DE LA PLATA, SOUTH AMERICA*

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The Río de la Plata Estuary and its Maritime Front (RdLPEMF) in the Southwester Atlantic Ocean has been highlighted as a crucial feeding ground for leatherback sea turtles (*Dermochelys coriacea*). This region receives large juveniles and adult individuals mostly from Western Africa nesting colonies, between November and May. Despite this, in-water population estimates for leatherback turtles are outdated, due to traditional population research techniques (i.e. vessel/aircraft surveys) being budget, time, and logistically constrained, hindering effective conservation efforts. Uncrewed Aerial Systems (UAS) have been applied successfully for in-water sea turtle studies, however, they depend on the visibility of the target at or below the surface. Essential parameters such as the surface detection probability or availability bias, g(0), have not been previously published. This parameter is essential for relative density estimates and is region-specific in terms of turtle aggregation behavior and environmental conditions. Consequently, we integrated UAS observations and satellite tag diving data to obtain the first leatherback turtle detection probability estimation in RLPEMF, and the proportion of time spent at the surface which will allow better leatherback density estimates in the region. We conducted UAS over-water surveys in Samborombon Bay, Argentina in March 2020. Flights recorded 4k video and followed turtles until they dove. Additionally, we analyzed satellite tag dive behavior data from 6 turtles that remained within the study area or returned to it. Finally, we used Barlow et al (1988)'s equation to calculate g(0), which accounts for the time spent submerged (d) and at the surface (s), and the average time spent at the surface per emergence event (t). We recorded 2.13 hours of video over the water surveys during 4 field days, with 45 successful leatherback observations. From these observations, we obtained t=18.67 seconds (Min= 1.4 sec, Max= 58.88; SD± 18.85). In contrast, the satellite data analysis resulted on t= 211.80 seconds (Min= 4 sec, Max= 720 sec; SD± 112.58), and s=27.80% (Min = 4.8%; Max = 93.7%; SD± 20.10). Based on the satellite data, we estimated that g(0) for leatherback turtle in the region to be g(0)=0.3183. Additional analysis to compare drone and satellite values for parameter t is still pending to evaluate the efficacy of using drone observations for relative density estimate. By estimating surface visibility probability using satellite tag data and direct observations, we addressed a key gap in leatherback turtle population-specific parameters in the study area. These results allow us to significantly advance in the characterization of the diving behavior of the species in this region. This is also a key step to improve relative density estimates of leatherback turtles in the area, which are critical for future population studies that will provide valuable insights for conservation efforts. Lastly, we showed the potential of drone applications in reduced water visibility conditions, that can provide comprehensive, highly valuable, and needed information on the leatherback turtle in the region.

## KEMP'S RIDLEY SEA TURTLE IN THE MEDITERRANEAN, NOT SO SPORADIC

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The presence of the Kemp's ridley turtle (*Lepidochelys kempii*) in the Mediterranean has been reported in the past, and Its presence has been described as sporadic. However, some recent records may indicate that it is more common than previously thought. In this study we review all records of *L. kempii* in the Mediterranean to date, including 3 previously unpublished records. All specimens are of typical juvenile size. Their presence in Mediterranean waters can be explained in the same way as the presence of loggerhead turtles (*Caretta caretta*) of Atlantic origin, which reach our waters following the eastward Atlantic currents and enter the western Mediterranean through the Strait of Gibraltar. The increase in records in recent years may indicate an increase in their population in their nesting areas and the success of relocation programmes from Mexico to the southern United States, although the population trend on their main nesting beaches appears to have stabilised in the last two decades. We discuss other explanations for the increase in Mediterranean records, such as increased effort due to the improvement of stranding networks or geographic range expansion due to climate change. Finally, almost all of the records included here are associated with fisheries interactions or entanglement in ghost fishing gear and marine debris; therefore, the species suffers from the same anthropogenic threats as other sea turtle species in the western Mediterranean and it should be included in Mediterranean countries and European Union conservation management plans.

## TRACKING OCEANOGRAPHIC CONDITIONS AND HABITAT USE OF LOGGERHEAD TURTLES IN THE NORTH ATLANTIC VIA ANIMAL-BORNE SENSORS

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This work presents the preliminary results of an innovative approach to monitor captive-reared loggerhead turtles (*Caretta caretta*) after their release into the ocean, to evaluate the habitats used and the influence of oceanographic parameters. The two loggerhead turtles included in the study were reared under similar controlled conditions for 14 years, under exhaustive and regular monitoring. After their release in Cofete beach, Fuerteventura (Canary Islands, Spain), both turtles, tracked with satellite devices equipped with sensors (temperature and pressure), explored two different habitats, the open ocean in the North Atlantic, and coastal environments in Western Africa, both characterized by pronounced thermal gradients and biologically productive upwelling systems. The combination of telemetry data, real-time data collected by sensors (temperature and deep), and remotely-sensed environmental variables—such as sea surface temperature, chlorophyll-a and satellite altimetry- enabled a detailed analysis of their habitat use, diving patterns, and reliance on ocean currents for navigation, revealing how these behaviors are influenced by

the oceanographic context. The findings highlight the value of animal-borne telemetry sensors to gather specific insights critical for conservation strategies and efforts worldwide for this endangered species.

## REVEALING THE ORIGIN OF THE LOGGERHEAD TURTLES IN ATLANTO-MEDITERRANEAN FORAGING AREAS USING INDIVIDUAL GENOMIC ASSIGNMENTS*

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Sea turtles are highly migratory species, with nesting sites and foraging areas often separated by vast distances. Individuals from different breeding populations may utilize the same foraging grounds. Consequently, accurately determining the natal origin of individuals in feeding areas is crucial to unveiling the effect of bycatch on effective management and conservation. Genetic techniques offer a powerful solution to these challenges, providing exceptional resolution for evaluating foraging grounds. Over the years, population genetic studies on loggerhead sea turtles have predominantly relied on Mixed Stock Analysis (MSA) based on the mitochondrial DNA (mtDNA) control region, D-loop. However, this approach only estimates the proportion of individuals in a foraging area originating from different nesting sites with large confidence intervals. Contrarily, genomic methodologies, such as 2bRAD, have proven particularly effective for individual assignments, offering a more detailed understanding of population structure. In this study, using 2bRAD we sequenced 232 individuals from nine foraging grounds: one in the Atlantic: Canary Islands (CAN), two in the transition between the Atlantic and Mediterranean: Andalusia (AND1 and AND2) separated by the Straits of Gibraltar, and six in the Mediterranean: Valencia (VAL), Balearic Islands (BAL), Catalonia (CAT), Lampedusa (LAM), western Aegean Sea (WAG), and eastern Aegean Sea (EAG)). We used a baseline previously built from data collected at well-established nesting sites, representing the potential origins of these individuals. We genotyped the baseline and the foraging ground individuals together and performed individual assignments for the unknown individuals. Our approach followed a hierarchical structure, starting with a global perspective with the three regional management units (RMUs) that could contribute to the assayed foraging grounds: West Atlantic (WAT), East Atlantic (EAT), and Mediterranean (MED). Then, we narrowed it down to a subregional level for the

Mediterranean nesting individuals. We successfully assigned each individual to one of the three RMUs. We observed a decrease in individuals assigned to Atlantic origins in the nine foraging grounds following the entrance of Atlantic water in the Mediterranean. At the Mediterranean subregional level, we observed different contributions of the three subRMUs (Greece, Libya and the Levantine Region) and the presence of admixed individuals among them. Additionally, we compared our newly assigned samples using 2bRAD with previous foraging grounds assignments derived from MSA on mtDNA, both at RMU and subRMU levels. We observed a decrease in individuals assigned to Atlantic origins and an increase in those linked to Mediterranean nesting populations, particularly from Levantine sites contributing to Western Mediterranean foraging areas. While some differences in assignment data may reflect methodological variations due to the low resolution of the mtDNA, the significant discrepancies observed suggest potential temporal and spatial shifts in the composition of Mediterranean foraging grounds. However, additional research is needed to discard any methodological influences and to fully understand these shifts and their implications.

## A BEHAVIORAL PERSPECTIVE ON SEA TURTLE HABITAT UTILIZATION: IMPLICATIONS OF LONG-TERM CONSERVATION MEASURES AND ECOLOGICAL PRESSURES*

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This study investigates habitat utilization, site fidelity, and life stage transitions of Green and Loggerhead Turtles along Florida's Atlantic coast. Leveraging a 47-year capture-recapture dataset, we apply Hidden Markov Models to classify green and loggerhead turtles into three latent behavioral states—Nomadic, Resident, and Transitory—based on size and temporal patterns in habitat use. These classifications offer insights into turtles' adaptive behaviors across life stages, illustrating how habitat use evolves in response to individual growth and environmental factors. Our findings reveal distinct behavioral trends for both species, with clear shifts between states that align with known ecological strategies, such as post-dispersal and migratory behaviors. Temporal analysis shows that while the Nomadic state in green turtles remains stable over time, the Resident and Transitory behavioral states of green turtles, as well as all three states for loggerheads, have shown increases in average size, particularly since the 1990s. These size increases likely reflect reduced mortality and the progression of individuals through life stages, balanced by shifts in habitat use. These changes align with two major conservation measures: the introduction of Turtle Excluder Devices in United States shrimp trawl fisheries and the state of Florida's gill net ban. These findings underscore the efficacy of conservation actions in promoting population stability and influencing habitat utilization patterns. However, this sustained increase in sizes, especially within Resident and Transitory stages, may reflect an imbalance between high survival and low recruitment rates of smaller individuals, suggesting that while bycatch reduction has positively impacted survival, juvenile recruitment remains constrained.

# POPULATION STRUCTURE AND ECOLOGY OF A MIXED-STOCK AGGREGATION OF JUVENILE HAWKSBILL TURTLES IN SOUTHEAST FLORIDA, USA

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Like most species of hard-shelled sea turtles, oceanic post-hatchling hawksbill turtles return to nearshore environments as small juveniles. Upon arrival, they distinguish themselves from the other species by maintaining a close association with coral reef habitats, in which they are believed to play an important ecological role. Since hatchling dispersal patterns throughout the Caribbean basin are largely dictated by oceanic currents, mixed-stock foraging aggregations of juveniles are a common outcome. In some cases, these aggregations can be located quite a distance from the turtles' points of origin. It has been known for some time that an aggregation of primarily immature hawksbill turtles resides on a roughly 500 km long barrier reef system that lines Florida's SE coast. Previous investigations have characterized a portion of the population in the northern part of the reef system that was dominated by larger individuals (mean straight carapace length 56.6cm), but were unable to identify recruitment sites for small juveniles first arriving from the oceanic environment. To better understand the abundance, distribution, and dispersal patterns of the region's neonate hawksbills, approximately 300 hours of in-water surveys were conducted across 70 reef sites in The Florida Keys National Marine Sanctuary (FKNMS) from Key Largo through the Marquesas Keys. The Sanctuary protects over, 7,500 sq. km of marine habitats in the waters of Monroe County, Florida, including the southernmost terminus of the SE Continental Reef Tract. Over a ten-year period, 61 hawksbill turtles were hand captured, weighed, measured, and sampled, in some cases multiple times. A combination of Restriction Site-Associated DNA sequencing (RADSeq) and mitochondrial DNA (mtDNA) analyses were used to identify the likely origins of each turtle and to describe the demographic history, gene flow, and effects of female-mediated dispersal on the population structure of Florida's hawksbill aggregation. Additionally, we attempted to link genetic origin to fine-scale variations in morphology, growth, and distribution among individuals in the study. Based on the mean body size (38.1 ± 10.2 cm SCL) of the turtles found on the shallow reefs of FKNMS, we hypothesize that the southern portion of the Reef Tract represents a likely entry point to Florida's reef system for successive generations of young hawksbills that originate from many distinct source rookeries around the Caribbean, particularly nesting beaches along the east coasts of central and south America. Though logistically difficult to obtain, particularly over large, functionally meaningful spatiotemporal ranges, data concerning the relative abundance, habitat use, growth rates, and spatial ecology of immature turtles are vitally important to inform overall recovery efforts.

# ACOUSTIC TAGGING OF POST-REHABILITATION SEA TURTLES IN SOUTH AFRICA

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Presented is a collaborative project between the four major public aquaria and registered sea turtle rehabilitation facilities in South Africa: PE Museum at Bayworld; East London Aquarium; SAAMBR (South African Association of Marine Biological Research); and Two Oceans Aquarium. For many decades these aquaria have been responsible for the rehabilitation and release of all five species of sea turtles commonly found in southern African waters. Said species include nesting Loggerheads (*Caretta caretta*) and Leatherbacks (*Dermochelys coriacea*); and transient Green (*Chelonia mydas*; Hawksbill (*Eretmochelys imbricata*) and Olive Ridley (*Lepidochelys olivacea*) turtles. Rehabilitation is costly and time consuming, and gauging the success of releasing rehabilitated individuals back into the wild is challenging. Globally, marine biotelemetry via the use of acoustic transmitters has been widely utilized. Acoustic transmitters can be externally attached to sea turtles from all species and life history stages, after which the animals' movements are passively tracked via an array of moored inshore acoustic receivers. In recent years, acoustic telemetry has been widely utilized for the tracking of various fish and elasmobranch species along the South African coastline using the ATAP acoustic receiver array network. However, this has never been done for any sea turtle species. Historically in South Africa, most rehabilitated animals are sexually immature, too small for traditional satellite telemetry and therefore do not form part of the extensively monitored KZN Loggerhead and Leatherback nesting populations. By utilizing post-rehabilitation turtles as candidates for acoustic studies, rehabilitation facilities have ideal access and opportunity to study these subset populations. To date, 29 post-rehabilitation sea turtles from 3 of the 5 species (Greens, Loggerheads and Hawksbills) have been acoustically tagged and released, the majority of which are in the juvenile life history class. Novel movement patterns have been observed for a small number of individuals from each species tagged. The dataset from this ongoing study will form part of a long-term monitoring programme made possible by the longer battery life of acoustic transmitters. In addition to tracking movement patterns and post-rehabilitation success, comparisons of external acoustic transmitter attachment methods, including body attachment locations and adhesives used, will form part of this ongoing pilot study. Such a research project is essential in addressing the considerable knowledge gaps with regard to the movements of smaller sexually immature sea turtles off Southern Africa and provides a unique opportunity for improving acoustic tracking studies in the Western Indian Ocean region.

## NESTING BIOLOGY

### INFLUENCE OF CLIMATIC VARIABLES, POSITION, AND CIRCADIAN RHYTHM ON THE INCUBATION TEMPERATURE OF LEATHERBACK TURTLES (*DERMOCHELYS CORIACEA*) IN SAN LUIS DE LA LOMA, GUERRERO*

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External and internal factors influence the incubation temperature of sea turtle nests, which in turn affects hatchling sex and hatching success. This study, conducted in San Luis de la Loma, Guerrero, aimed to evaluate the influence of climate variables —including air temperature (°C), humidity (%), precipitation (mm), and solar radiation (W/m²)— along with nest position (top, middle, bottom) and circadian rhythm, on the incubation temperature, hatchling sex ratios, and hatching success of *Dermochelys coriacea*. During the 2020-2021 and 2021-2022 nesting seasons, 12 nests were analyzed. Climate variables significantly influenced incubation temperature, except for solar radiation ($F = 0.01$; $df = 1$; $p = 0.91$). Circadian rhythm did not have a significant effect ($F = 0.80$; $df = 1$; $p = 0.37$), whereas the position within the nest significantly influenced incubation temperature ($F = 25.56$, $df = 2$, $p < 0.01$). All nests achieved a hatching success rate above 50%. The highest recorded incubation temperature was $31.37 \pm 0.70$˚C, while the lowest was $27.51 \pm 0.39$˚C. Among the nests, 58.33% experienced feminizing temperatures, 25% had incubation temperatures near the pivotal temperature, 8.33% experienced masculinizing temperatures, and 8.33% had temperatures close to the female-dominant range.

### REPRODUCTIVE SUCCESS AND MORPHOMETRIC MEASUREMENTS OF LEATHERBACK TURTLES (*DERMOCHELYS CORIACEA*) DURING THE 2023-2024 NESTING SEASON

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The eastern pacific population of the leatherback turtle (*Dermochelys coriacea*) is considered critically endangered by the IUCN Red List of Threatened Species. Conservation efforts on nesting beaches, female monitoring, and recruitment of hatchlings to the sea are strategies implemented for the recovery of sea turtle populations. Santuario Playa Tierra Colorada in Guerrero, Santuario Playa Cahuitán and Santuario Playa Barra de la Cruz-Playa Grande in Oaxaca are index nesting beaches for this population in Mexico.

During the 2023-2024 season, the curved carapace length (CCL) and curved carapace width (CCW) of nesting females were measured, and each female was identified as a remigrant or neophyte using metal tags and PIT-tags. The percentages of hatching success, infertility, and embryo mortality were recorded in the nests of 35 females. The CCL, CCW, and weight of hatchlings were also recorded. The average CCL of nesting females was 142.5 cm (131.7-152.0 cm), and the average CCW was 100.8 cm (88.8-110.0 cm). Hatchlings measured an average of 5.9 cm in CCL, 4.9 cm in CCW, and weighed 40 grams. Female identity did not influence reproductive success during this season. The percentage of infertility was 20.10% (6.98-44.23 %), hatching success was 8.4 % (0-30.56 %), and embryo mortality was 64.69% (5.26-90.70 %). External factors affecting the nest might influence embryo development and hatching success, as well as hatchling condition. Continuing research on maternal effects and maturity in nest success is important.

## REPRODUCTIVE BIOLOGY OF THE HAWKSBILL TURTLE NESTING AT GANDOCA BEACH, COSTA RICA – DATA FROM FIVE YEARS OF MONITORING

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Hawksbill turtles, *Eretmochelys imbricata*, are critically endangered by extinction and, besides some larger nesting aggregations in the Caribbean, tend to nest in smaller numbers on secluded beaches. Our study focuses on their reproductive biology at Gandoca Beach, a recently discovered critical nesting site on the Caribbean coast of Costa Rica. For five nesting seasons, from 2020 to 2024, we conducted a comprehensive investigation to understand nesting patterns and other parameters such as female size, clutch success, and hatching success. Our research involved nightly beach patrols to record nesting events, tagging of nesting females for individual identification, and detailed data collection regarding female size, clutch size, incubation duration, and clutch success rate (percentage of nests documented that incubated for 55+ days) and hatching success rate (percentage of eggs within a nest that produced a live embryo, which hatched). Our data revealed a mean of 115.6 clutches per season, 152.54 eggs per clutch and a mean incubation duration of 63.32 days. The mean clutch success was 83.24 %, and the hatching success rate was 67.48 %, reflecting favourable nesting conditions but also highlighting the loss from illegal egg collection, predation, and beach erosion, with averages of 8.6 %, 4.2 %, and 3 % respectively of all nests documented over the five seasons. The mean female size was 86.92 cm curved carapace length. Post-nesting migrations were monitored through satellite tracking (n=7) and in-situ tagging, revealing critical foraging grounds in Nicaragua and migratory routes essential for conservation policy developments. Overall, our study found that Gandoca Beach is now the most important nesting ground for hawksbill turtles in Caribbean Costa Rica, and continued research and conservation initiatives are crucial to ensuring the survival of this nesting population. Future work will focus on the long-term monitoring of population trends, the genetic origins of our population, and the exploration of adaptive strategies to combat the evolving challenges posed by global environmental changes. This study underscores the importance of long-term monitoring and our ongoing conservation efforts, including habitat protection and community engagement, to mitigate anthropogenic impacts such as illegal egg harvest and climate change effects on nesting habitats. Our findings contribute to a broader understanding of the reproductive biology of Caribbean hawksbill turtles and support the implementation of localized and international conservation strategies aimed at preserving these populations.

## FIRST INTER-SEASONAL RECAPTURE OF A GREEN TURTLE (*CHELONIA MYDAS*) AT AL WAJH LAGOON, SAUDI ARABIAN RED SEA

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This poster aims to report the recapture of a green turtle (*Chelonia mydas*) originally tagged in August 2021 and subsequently found in August 2024. The turtle was first flipper and satellite-tagged as part of a long-term monitoring effort to assess the post-nesting migratory movements and habitat use of marine turtles in the Red Sea. The recapture represents the first record of this nature within Al Wajh Lagoon, specifically at Breem Island. This evidence provides valuable insights into the green turtle growth, site fidelity, and potential migration patterns. Such findings contribute to the understanding of green turtle behavior and support ongoing long-term conservation strategies in the region.

## VALIDATION OF NESTING SAFE TETHERLESS, REAL-TIME IN SITU ENVIRONMENTAL DATA MONITORING TECHNOLOGY FOR SEA TURTLE NESTS AND BEACHES

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Monitoring environmental changes in sand, soil, and air is important to many research activities geared to understanding their implications on animal growth, metabolism, life cycles, and for oviparous species, in situ embryonic development. Monitoring environmental conditions in sea turtle nests is vital for understanding the impacts of temperature on hatchling sex determination and the influence of global climate change on nesting beaches, and resultant hatchling sex ratio dynamics globally. Numerous communication protocols provide reliable capability to wirelessly transmit real-time soil sensor data, facilitating remote monitoring of measured parameters. Nevertheless, cables are required between sensors installed below the soil surface and receivers above ground, potentially affecting measured parameters. Network receivers that integrate Long Range (LoRa), Radio Frequency Identification (RFID), Bluetooth (BLE), and Global System Mobile Communications (GSM) tend to lose data transmissivity when buried below 15 cm. The current experiments conducted between July 2023 and May 2024 tested the applicability of Nesting Safe's proprietary Tetherless Underground Surface Communication (TUSC) technology to transmit on-demand temperature and relative humidity; data required to monitor and model sea turtle nest parameters through the incubation period, without disruption to nests. Field experiments were conducted in air to test transmission from a sensor placed 1 m above ground in Quebec. We tested transmission

reliability from 2 sensors over a 41-hr period at 0 and 10 cm depth exposed to watering within 2 diurnal cycles in California. To test transmission of Temp/Rh data over distance between the hand-held receiver and sensor, we buried the sensor at 50, 103 and 125 cm depths in a sand quarry. To mimic Hawksbill nests, the sensor was buried and covered at 60 cm depth on a beach site in Thailand. To test data transmission within turtle clutches, the sensor was buried 8 m above waterline at 60 cm depth, surrounded by 90 live chicken eggs and covered with sand. For each test, we collected 12 - 15 readings, then moved to the next distance interval to confirm transmission at that position. Results from transmitting Temp/Rh data 1 m above ground showed data acquisition to at least 700 m until obstructed by thick vegetation. We demonstrated reliable transmission and high sensitivity for 2 sensors exposed to watering. Results from monitoring beach conditions in a sand quarry demonstrated quality transmissions up to 200 m from the sensor. When the sensor was positioned at comparable depths to turtle nests (60 cm), transmission reached 200 m from the buried sensor. When mimicking a clutch of turtle eggs, data transmission was 25 m at 5 radial angles (along the beach, up a 2 m slope through a dirt road, roots, and buildings). Results demonstrate the applicability of Nesting Safe tetherless sensors to monitor Temp/Rh data on beaches within egg clutches. The TUSC technology demonstrates that tetherless sensors provide reliable environmental data at greater depths and distances than prior technologies, validating the potential to access real-time in situ environmental data for turtle nesting beaches, exponentially expanding our understanding of environmental conditions, hatching predictability, and hatchling success.

## OLIVE RIDLEYS (*LEPIDOCHELYS OLIVACEA*) NESTING IN THE SEREIA PENINSULA AND PRAIA DOS POBRES, SOYO REGION, ANGOLA, AND THEIR ASSOCIATED PRODUCTIVITY*

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Angola has a coastline of 1650 km, of which approximately 1210 km are considered sea turtle nesting habitat. It supports the largest nesting population of olive ridley turtles in the East Atlantic, but nests are not homogeneously distributed along the coast, and therefore hatchling output varies among areas with the regions of the Sereia Peninsula (15 km) (6 ° 04' 38.62 " S and 6 ° 10' 22.37 " S) and Praia dos Pobres (1.5 km) (6 ° 07' 12.38 " S and 12 ° 20' 42.17 " E and, 6 ° 07' 07.17 " S and 12 ° 21' 37.21 " E) considered as the important nesting areas in Angola. The aim of this study is to present the size and productivity of the olive ridley turtle population nesting in the Sereia Peninsula and Praia dos Pobres. Kitabanga Project conducted a daily monitoring of Sereia Peninsula beaches (15 km) between 2014 and 2024 and of Praia dos Pobres between 2020 and 2024. An average annual density of 54 nests/km was estimated for the Sereia Peninsula and 111 nests/km for Praia dos Pobres. The estimated average annual number of nesting females was between 270 and 809 for the Sereia Peninsula and between 56 and 167 animals for Praia dos Pobres. The temporal variation in nesting showed seasonal oscillation in nest numbers every three years in the Sereia Peninsula, but in recent years a decline was recorded. At Praia dos Pobres, the variation in nest numbers followed a biannual oscillation and was considered stable. In the past 10 years, 713,426 hatchlings were born in the Sereia Peninsula with an annual average of 71,343 hatchlings. At Praia dos Pobres, in the past 4 years, 66,069 hatchlings were born, with an estimated annual average of 16,517 hatchlings. Due to human impacts and pressure in the region, some of the nests laid on both beaches are transferred to incubation centres, with hatching success rates exceeding 90%, which is not observed in situ. Despite conservation efforts, there is still strong pressure in the Sereia Peninsula region, especially from the fishing sector, which may explain the decrease in the number of nests on the Sereia Peninsula.

# ASSESSING THE RISK OF SEA TURTLE NEST FLOODING: THE ROLE OF BEACH GROUNDWATER DYNAMICS*

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Sea turtles depend on sandy beaches around the World for their nesting habitat. They face a major challenge in the flooding and erosion of their nesting beaches. The specific tolerance of turtle nests to inundation remains uncertain, but both the length and frequency of flooding events have been reported as key factors impacting egg viability. Flooding typically results from wave runup, storm surges, high tides, rainfall, or a combination of these, though the persistence of inundation often depends on the local beach groundwater dynamics. However, groundwater dynamics are strongly influenced by local hydrodynamics and beach characteristics, including slope, grain size, and permeability. Thus, understanding the factors driving groundwater variability in nesting areas is crucial for assessing the need for management actions like nest relocation and for developing nature-based solutions that can reduce the risk of nest flooding. Here, we present data collected during extensive field campaigns monitoring hydrodynamics, groundwater levels, and sediment characteristics at two nesting beaches in contrasting coastal environments: Galveston Island in Texas and Ostional in Costa Rica. Galveston Island's low-sloping, dissipative beaches serve as nesting habitat for the critically endangered Kemp's ridley sea turtle. Due to its conservation status and the risk of nest flooding, all nests are currently relocated to an incubation facility at Padre Island National Seashore. In contrast, Playa Ostional in Costa Rica hosts one of largest olive ridley arribada populations and is characterized by steeper, coarser beaches. At both sites we installed slotted groundwater wells along the cross-shore profile and measured elevation profiles and sediment characteristics. In Galveston we also measured near- and offshore water levels and waves. Our results show that the beaches on Galveston Island have a relatively high groundwater table (generally within 1 m of the sand surface), which can rise up to the surface quickly and for prolonged time periods during surge events or heavy rainfall. Incubating nests are therefore highly susceptible to repeated and prolonged inundation, suggesting these beaches are currently not optimal for nesting. Preliminary results in Ostional show that prolonged groundwater inundation of nests is much less likely. As the beach elevation and slope are higher, the mean groundwater table is lower and high groundwater levels decrease more quickly. The data from our field experiments helps us better understand groundwater processes on nesting beaches and how they relate to the flooding of nests. In the future, we plan to use the data to calibrate a predictive model which can be used (i) directly by coastal managers to make informed decisions regarding whether to relocate or leave turtle nests in situ; and (ii) in the long-term to help design and implement turtle-friendly beach nourishment strategies that provide optimal nesting habitat for these endangered species.

# SEARCHING FOR MALE PRODUCING AREAS: STUDYING SEX RATIOS IN NEW LOGGERHEAD SEA TURTLE (*CARETTA CARETTA*) NESTING SITES IN THE MEDITERRANEAN SEA

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The current apparent colonization of the western Mediterranean by the loggerhead sea turtle (*Caretta caretta*) provides an excellent opportunity to study the conditions under which this complex process takes place and the factors that modulate it. Many questions remain unanswered in the context of climate change and rising temperatures in the terrestrial and aquatic ecosystems that directly affect sea turtles. Aspects such as the origin of breeders, distribution, behavior, reproductive physiology and reproductive success are being studied to try to understand the process in depth, as well as to define the necessary conservation measures for the species in a likely scenario of constant change. One of the key parameters in studying the temperature-dependent reproductive biology of a species is the study of the sex production. In order to assess the sex production within this colonization phenomenon in the western Mediterranean, we identified the sex of 618 individuals from 47 loggerhead turtle nests along the Spanish Mediterranean coast in the period between 2014 and 2023. Sex identification was carried out by histological examination of formalin-preserved tissues from embryos and dead neonates, and by endoscopic examination of post-neonatal individuals maintained in head-starting programs. The results of a decade-long study of the sex ratio on the Spanish coast show a higher production of males (67% males vs. 33% females). Spatial and temporal analysis of nests and sex production shows a clear trend towards higher male production, with few exceptions, even in the last years of the study when the area experienced episodes of record temperatures. The incipient colonization of the area seems to be producing a greater number of males, which could allow for a more balanced sex ratio, unlike what has been observed in the main breeding areas of the planet, where population feminization is a concern. At the same time, females are being produced that could generate recruitment to favor an effective colonization of the area.

## ASSESSING MICROPLASTICS CONTAMINATION IN UNVIABLE LOGGERHEAD SEA TURTLE EGGS*

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Sea turtles, in comparison with marine mammals, sea birds, and fishes, are the most affected by microplastics in terms of number of individuals impacted and concentration within each organism. The ubiquitous nature and persistence of microplastics in the environment further compromises sea turtles as all seven species are currently threatened or endangered. Microplastic contamination was quantified in unviable loggerhead sea turtle eggs (*Caretta caretta*). Eggs were collected from seven locations along the northwest coast of Florida. A total of 70 nests and 350 eggs were examined. Microplastics (n = 510) were found in undeveloped loggerhead sea turtle eggs across all seven sites, suggesting that maternal transference and/or exchange between the internal and external environment were possible. Microplastics were categorized based on color, shape, size, and type of polymer. The predominant color of microplastics was blue/green (n = 236), shape was fibers (n = 369), and length was 10-300 µm (n = 191). Identified fragments, films, beads and one foam (n = 187) had the most common area of 1 - 10 µm² (n = 45). Micro-Fourier Transform Infrared (µ-FTIR) spectroscopy analysis demonstrated that polyethylene (11%) and polystyrene (7%) were the main polymer types. For the first time microplastics have been found in unviable, undeveloped loggerhead sea turtle eggs collected in Northwest Florida.

## EFFECTS OF HIGH TEMPERATURES ON HATCHING SUCCESS DURING THE SEASONS 2023 AND 2024 AT PUIPUY BEACH, SUCRE STATE, VENEZUELA

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The Akupara Sea Turtles Conservation Project has been working for nine years at Puipuy beach, located to the north-east of the Paria Peninsula, Sucre State, Venezuela (coordinates 10°38'44" latitude North and 63°2'20" longitude West, which is a nesting site of the Leatherback turtle (*Dermochelys coriacea*) and the Loggerhead turtle (*Caretta caretta*). The principal aims of the project are to promote the conservation of these species and their environment, to quantify the size of the nesting population, and to protect their nests. Among the main threats these animals face are by-catch, contamination, illegal take of eggs and climate change. During the 2023 season, the average hatching success for the nests transferred to the hatchery was 16%. Most of the eggs were cooked, there were interruptions in the first stages of embryonic

development, malformations, albino embryos and eggs apparently with no development of any kind, growth of bacteria, etc. The results from the hatchery nests were compared with those from the disinterment of nests left in situ, and low success rates were found there also, the conclusion being that the main cause could have been the high temperatures and also the constant flooding from the passing of tropical storms. To improve the results obtained, it was proposed that for the following season, in the year 2024,a polypropylene multifilament mesh should be used as well as protective netting to prevent looters entering the hatchery, transferring there most of the nests. Temperature monitoring was conducted using four HOBO temperature loggers (accuracy ± O.53 ºC; Onset Computer Corporation, Bourne, MA), which recorded temperature measurements at 10-minute intervals throughout the entire incubation period. The average hatching success increased to 74%, well over the low value of the previous year. The effect of the multifilament mesh in the hatchery was to reduce up to 12 ºC compared to the rest of the beach, which was confirmed by temperature readings (data loggers) at two control sites (outside and inside the hatchery). Multiple studies suggest that extreme incubation temperatures (above 34-35 ºC or below 24-25 ºC) have an adverse effect on the development and viability of sea turtle embryos. On the beach peaks of up to 48 ºC were recorded, while inside the hatchery the temperature stayed within the margin of 30 ºC to 35 ºC. The use of the mesh is indispensable for optimizing the work of nest protection and monitor temperature constantly. As part of conservation strategy there are regular talks to schools and tourists, as well as beach cleaning activities, and different activities for the recycling of materials, such as crafts and the creation of the first ecological mural with more than 5,000 bottle tops at the local school. A community library was also created, with donated books, open to the public in general.

## NESTING ECOLOGY OF THE LEATHERBACK TURTLE, *DERMOCHELYS CORIACEA*, AT ESTACIÓN LAS TORTUGAS, COSTA RICA: 2012-2021 AND 2024*

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Despite extensive monitoring and conservation efforts, some leatherback, (*Dermochelys coriacea*), populations are critically endangered and at risk of global extinction, while other populations are listed as vulnerable, or endangered, depending on the location. As such, this nesting beach data is essential to our understanding of population demography and critical to our evaluation of our conservation efforts. This is the first report of nesting data from leatherback turtles on the Estación las Tortugas project. Estación las Tortugas is a non-profit organization established in 1999 to protect sea turtles nesting on Mondonguillo beach, located on the Caribbean coast of Costa Rica, adjacent to the Pacuare Private Reserve. Here, we report night and morning patrols carried out from 2012 to 2021 and in 2024, during the leatherback nesting season (March to July). From these results, we identified 2248 adult female leatherbacks that nested during our study period. During this time, the nesting population declined from 424 adult females in 2012 to 86 in 2024, an 80% decrease. To investigate this further, we are currently analyzing additional trends—including the clutch frequency, inter-nesting periods, and re-migration intervals—in order to gain a more comprehensive understanding of this leatherback population and to improve targeted conservation efforts. Despite the reduction in localized poaching, the lasting effects of egg harvesting on population numbers is substantial in long-lived species; this, as well as fisheries bycatch, are known threats to this, and other, leatherback populations. This study presents the current status of the leatherback population at Estación las Tortugas, identifies unique threats facing the nesting environment of this population, and proposes targeted conservation efforts to promote the recovery and survival of this important population.

# WEAK EFFECT OF TEMPERATURE ON INTER-NESTING INTERVALS OF OLIVE RIDLEY TURTLES: IMPLICATIONS FOR ARRIBADA FORMATION*

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Climate change is having wide-ranging impacts on sea turtle populations worldwide; however, the effects of increased temperatures vary between species. One example of interspecific variation in response to temperature change in sea turtles is seen in the duration of the inter-nesting interval — the time between two consecutive nesting events in a single nesting season. Specifically, when water temperatures increase, green (*Chelonia mydas*), hawksbill (*Eretmochelys imbricata*), and loggerhead (*Caretta caretta*) turtles typically have shorter inter-nesting intervals. In contrast, previous studies in olive ridley turtles (*Lepidochelys olivacea*) have not observed any correlation between water temperature and inter-nesting intervals. Nevertheless, these observations require further validation as they were based on a relatively small number of individuals (n = 11). To address this, we used a combination of capture-mark-recapture data (for 96 different individuals) alongside remotely-sensed oceanographic data to assess the relationship between water temperatures and the duration of the inter-nesting interval for olive ridley turtles on the Pacific coast of Costa Rica. Specifically, we patrolled the beaches of Parque Nacional Marino Las Baulas and Playa Cabuyal nightly from October to March from 2010/2011 to 2023/2024 to encounter nesting turtles. When an olive ridley was encountered, it was checked for metal and/or PIT tags. If none were found, they were applied accordingly. From all turtles re-encountered within a single season, we calculated the duration of the inter-nesting interval. Next, we identified a 225 km$^2$ region immediately adjacent to the nesting beaches, as other satellite telemetry studies suggest this is the typical range for inter-nesting olive ridley turtles. For this area, we used data from NASA's multi-scale ultra-high-resolution (MUR) sensor to calculate mean daily sea surface temperature (SST). The mean observed inter-nesting interval was 22 d (range: 13 to 41 d) and mean SST was 27.96 °C (range: 26.16 to 29.54 °C). While a significant relationship between SST and inter-nesting interval duration was observed, this correlation was weaker than in other sea turtle species. This is likely driven by the capacity of olive ridley turtles to retain fertilized eggs for longer periods than other non-arribada nesting sea turtle species. The correlation between sea surface temperatures and olive ridley inter-nesting intervals suggests that increased temperatures under climate change could negatively affect the capacity of olive ridley turtles to synchronize nesting as required for arribada formation.

# DRIVER OF *ERETMOCHELYS IMBRICATA* HATCHLING SEAFINDING: LIGHT INTENSITY VERSUS WAVELENGTH*

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Hatchling sea turtles orient to the ocean based on lowest-lying brightness cues; typically the light of the moon and stars reflecting off the water. Anthropogenically generated lights are often brighter than natural light and may cause hatchlings to misorient towards these artificial lights. Significant efforts have been devoted to discerning possible light wavelength and intensity combinations that do not cause this misorientation in hatchling turtles. These two factors, in concert with the positioning and angling of lights, define turtle-safe lighting. Typically, turtle-safe lights employ Low-Pressure Sodium Vapor (LPS) bulbs, which generate light of 590 nm, or red LEDs (630+ nm). However, these lights were described as turtle-safe for only a small set of turtle species, with limited to no testing in our study species, hawksbills. More recent research has focused on isolating intensity and wavelength to better understand how these two factors influence phototactic responses, finding that in leatherbacks the main driver is intensity. We aimed to discern the main driver of hatchling phototaxis in hawksbill turtles, hypothesizing that, similar to leatherbacks, intensity is the main driver of the phototactic response. We presented hatchling hawksbill turtles with choices of two wavelengths of light in Y-maze choice experiments. In our first set of experiments, hatchlings were presented with different wavelengths at the same intensity relative to threshold; either 1.0 log unit or 0.25 log units above threshold. Hatchlings were presented with 590 nm vs. 660 nm, or 590 nm vs 535 nm. In our second set of experiments, hatchlings were presented with different wavelengths at equal intensity, both above threshold. Comparisons consisted of 590 nm vs. 660 nm, 590 nm vs 535 nm, and 535 nm vs 470 nm. Our first experiment showed that hatchlings oriented towards the light that was brighter, regardless of threshold. Our second experiment showed that hatchlings oriented randomly when lights were equally bright. These results suggest that hatchling hawksbills use intensity as the primary cue for seafinding at low intensities of light. This is in direct contrast to previous studies that suggest that hatchling sea turtles prefer to orient toward shorter wavelengths of light. Our results corroborate more recent findings in leatherbacks; that light intensity is the primary factor for seafinding. With light intensity as the primary cue for seafinding, turtle-safe lighting in the visual spectrum may not actually exist, as even low intensity light has been shown to attract hatchlings. This highlights the importance of turning off beachfront lighting during turtle nesting and hatching seasons as the best way to avoid misorientations.

# SEA TURTLE CONSERVATION ACTIVITIES IN TWO INDEX NESTING BEACHES FOR THE LEATHERBACK TURTLE AT MARGARITA ISLAND, NUEVA ESPARTA STATE, VENEZUELA

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El Agua (11°8′43.8″ N, 63°51′46.8″ W) and Parguito (11°8′43.8″ N, 63°51′46.8″ W) have been established as Index Beaches for the Leatherback turtle (*Dermochelys coriacea*) under the national sea turtle conservation programme of the Ministry of Ecosocialism (MINEC). They are located in the East coast of the Margarita Island, Nueva Esparta State (Venezuela). Although sea turtle monitoring activities have been reported since 1999, an important part of the information is not available to date. We are presenting here the results of the Turtle Point Project by 2024, to assess the conservation status of the leatherback turtle at both beaches. During the 2024 season, field work El Agua and Parguito Beaches included the identification and GPS mapping of sea turtle nests. Environmental educational activities were developed for children aged 4 to 17 years, in communities near the nesting beaches. During the 2024 nesting season we registered 78 nests at El Agua Beach (3.5 km in length) and 19 nests at Parguito Beach (1 km in length) with the cooperation of local volunteers in both beaches. The hatching success was extremely low in both localities for the leatherback turtles and the loggerhead turtle. Management procedures must be improved as well as the environmental conditions regarding invasive vegetation species and anthropogenic factor affecting the incubation. In addition, the results indicate that for a better data collection and protection of the nests in the following seasons a guide with standardised protocols must be prepared and the improvement of the environmental conditions of the sand should be guaranteed. A total of 157 children participated in the awareness workshops, and they learned about the importance of sea turtles, their life cycles and the threats they face. The activities included talks, educational games, art projects and the fostering a culture of conservation and respect for nature from an early age. The impact of the Turtle Point Project goes beyond education and monitoring. By raising awareness in the local community and providing tools to field assistants, the project aims to create a network of sea turtle guardians who contribute to long-term conservation. Community participation is crucial to the success of conservation initiatives, as is collaboration with different stakeholders (children, fishermen, local authorities and the tourism sector).

## DOES NESTING SITE FIDELITY IMPROVE WITH AGE?

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Climate change and anthropogenic disturbance is driving the continual loss and degradation of critical breeding habitats of marine species. Species that exhibit natal philopatry, such as sea turtles, may be of particular concern given their reliance on specific nesting beaches. We explore how nest site fidelity of individual green turtles (*Chelonia mydas*) changes over time, using a 30-year data set of tagged females from our study population in North Cyprus. We investigate how fidelity changes within a season, using two measures of fidelity; overall proximity of clutches to each other, and distance between consecutive clutches. Second, we investigate how these measures change with subsequent breeding seasons and how the geographic location varies across time. We found that fidelity increases with experience, both within and across breeding seasons and discuss whether females are learning from their previous nesting experience or whether nest site location may be heritable.

## USING VIDEOGRAPHY TO QUANTIFY NESTING SUCCESS AND HATCHLING SURVIVORSHIP OF FLATBACK TURTLES IN WESTERN AUSTRALIA

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Monitoring the nesting success of sea turtles and the survival of their hatchlings is vital for understanding population dynamics. A 20-year monitoring program for flatback turtles on Barrow Island in Western Australia has so far relied on tagging data and track counts to determine nesting abundance, but a richer dataset was collected over the 2023-24 nesting season using videography. Arrays of solar-powered cameras were attached to masts on movable trailers, and approximately 90,000 hours of continuous video of adult and hatchling turtles was captured between December 2023 and March 2024 across two index beaches. Over approximately 300 metres of beach, 608 nesting events were documented, and 1126 hatchlings were observed. Nesting success was estimated at 34.2%, meaning that most females that emerged were not observed laying eggs, and 95.2% of emergences occurred between 17:00 and 02:00 hours. Nesting success was negatively associated with luminosity, with the likelihood of success increasing as luminosity decreased. Nearly 80% of hatchlings that could be viewed clearly on camera avoided on-shore predation and reached the relative safety of the surf zone. Of those hatchlings that were predated, golden bandicoots (11.6%) and gulls (8.2%) were the main predators, and to a lesser extent water rats (2%) and brushtail possums (1%). On-shore mortality also decreased as hatchling group size increased ($R2=0.47$, $p<0.001$). While there were technical challenges maintaining continuous videography for an entire nesting season (i.e., first nester to last hatchling), video quality was sufficiently high to observe nesting behaviours and predator-prey interactions in detail. Further, determining nesting success via videography now allows estimation of the number of flatback turtle nests laid annually on Barrow Island based on track count data.

# IMPACTS OF STORM SURGE ON GREEN AND LOGGERHEAD TURTLE NESTS ON A LOW-LYING CARIBBEAN ISLAND

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Climate change, rising sea levels and the increasing intensity of storms are all contributing factors that could disrupt sea turtle life cycles, with some of these impacts already being observed globally. In the Cayman Islands, both loggerhead (*Caretta caretta*) and green (*Chelonia mydas*) turtle nesting populations are recovering from near-extinction due to over-harvesting and now face these emerging threats. Using data from 2020-2024, we report on the impacts of nest wash-over from tropical storms on hatching success for both species, with an aim to determine best management practices in the face of climate change. Variation was found year to year, but overall, a total of 584 of 2324 nests (19.6% of total loggerhead nests and 28.2% of total green turtle nests) were recorded as washed over from storm surge, from a total of 9 named storms. Overall, wash-over to nests that were left in-situ were found to have significantly lower hatching success than those unaffected; a reduction of 23.42% and 25.6% was recorded for loggerhead and green turtles, respectively. The incubation stage at the time of wash-over was found to have a significant impact on embryo survival for both species, with a greater effect on loggerhead turtles. Eggs washed over within the first 10 days of development had a lower hatch success and survival rate than those at a later stage. For loggerhead and green turtles, the mean hatch success of washed-over nests was 61% (N=69) and 48% (N=183) for nests that were at least 11 days post their lay date, but only 23% (N=12) and 22% (N=15) for nests washed over before this stage. Further analysis regarding timing of wash-over events and the impact on incubation duration and hatchling phenotype will also be presented. Washed over nests also had a greater chance of survival if they were laid more than 10m from the high-water mark. Nest relocation is undertaken as a last resort as it is known to lower hatching success and may have negative impacts on hatchling fitness. Relocating nests further from the water to drier sand also has potential to impact sex ratios unfavourably. More than 100 nests were relocated due to incoming storms at various stages of incubation and analysis of the success of these nests will also be reported. Although sea turtle eggs show some resilience to wash-over, our findings indicate that they are most vulnerable during the early stages of development for both species, and this should be considered when prioritising nests to relocate in the event of a tropical storm. We recommend continued data collection to assess of hatch success, particularly for nests impacted by wash-over. Monitoring of clutch temperatures should be implemented for in-situ and relocated nests so that climate change impacts to nests are considered in management plans, which must also ensure that interventions are indeed beneficial to the species.

## CHARACTERIZATION OF HYBRIDIZATION IN UNVIABLE LOGGERHEAD (*CARETTA CARETTA*) AND GREEN (*CHELONIA MYDAS*) SEA TURTLE EGGS IN NORTHWEST FLORIDA*

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Hybridization occurs in both plants and animals at varying rates, including sea turtles with six known hybrid combinations between five species. How hybridization affects smaller, more isolated populations and reproductive output of these vulnerable species is poorly studied. However, in other organisms hybridization can be beneficial, increasing immune responsiveness, or detrimental, causing genetic or demographic swamping. Although it is likely sea turtles have been hybridizing for a long period of time, anthropogenic impacts may increase the effects of hybridization due to decreased population sizes and reduced nesting sites. Unviable *Caretta caretta* and *Chelonia mydas* sea turtle eggs were collected from seven sites in northwest Florida in partnership with the United States Geological Survey and Florida Fish and Wildlife Conservation Commission. Yolk and tissue samples from sea turtle eggs have been collected and DNA was extracted. PCR was conducted using the COI gene. Sequences produced from sanger sequencing were compared to the Archie Carr Center for Sea Turtle Research database to determine if hybridization is present. Hybridization was compared with nest success rate and developmental stages of sampled eggs. These data could be used to aid in future management and conservation strategies of sea turtle species.

## INFLUENCE OF HABITAT UTILIZATION STRATEGIES ON TRACE ELEMENT SIGNATURES IN EGG CONTENTS OF GREEN TURTLES NESTING ON XISHA ISLANDS, SOUTH CHINA SEA

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Habitat utilization significantly influences the accumulation of chemical pollutants, including trace elements (TEs), in the tissues of large marine organisms. Previous research has demonstrated that sea turtles nesting in the same location may employ distinct foraging strategies. This study investigated the influence of habitat use strategies on the concentrations of 16 TEs in the eggs of green turtles (*Chelonia mydas*) nesting on the Xisha Islands. The analysis incorporated stable carbon (δ13C) and nitrogen (δ15N) isotopes, as well as characteristic elements. Additionally, inter-relationships between TEs were examined.

The nesting female green turtles were categorized into two foraging groups based on isotopic signatures, namely oceanic (δ13C values: 21.5 to 17.0 ‰; δ15N values: 7.10 to 12.5 ‰) and neritic (δ13C values: 14.4 to 9.95 ‰ and δ15N values: 5.10 to 10.0 ‰). Different TE patterns were observed in the egg contents of these two groups. The neritic group exhibited elevated levels of V and Cu, which positively corrected with δ13C values. Conversely, the oceanic group displayed higher levels of Zn, Cd, Se, Sn, As and Hg, which positively associated with δ15N values. This distribution pattern is attributed to variations in background TE concentrations in the respective foraging habitats. Additionally, prey items and trophic levels of green turtles may contribute to the observed inter-group differences in TE concentrations (e.g. Zn, As, Se, Sn) found in their eggs, warranting further research. This study provides valuable information about habitat utilization patterns and TE distribution in green turtles nesting on the Xisha Islands. The findings enhance our understanding of TE accumulation mechanisms in turtle tissues and eggs, which is significant for the conservation of this endangered species, the green sea turtle.

## REACTIVATION OF *CHELONIA MYDAS* MONITORING ON SAN JOSÉ BEACH, PARQUE NACIONAL SANTA ROSA, COSTA RICA: AN IMPORTANT NESTING SITE FOR EASTERN PACIFIC GREEN TURTLES

**Alba López Bobadilla, Oscar Brenes Arias**

*RPT (Reserva Playa Tortuga), Costa Rica*

This study takes place on Playa San José, located in Parque Nacional Santa Rosa within the Área de Conservación Guanacaste, in the northern Pacific region of Costa Rica. The research is conducted by Fundación Reserva Ojochal-Tortuga in collaboration with the "Costa Rica por Siempre" initiative and with technical support from the Sistema Nacional de Áreas de Conservación (SINAC). This beach hosts a significant population of green turtles (*Chelonia mydas*), contributing notably to the conservation of this species in the eastern Pacific. The monitoring aims to generate relevant data on the size and status of marine turtle populations nesting on Isla San José, promoting the implementation of management and conservation actions. The methodology follows the 2020 SINAC ecological monitoring protocol for turtle nesting beaches, which includes key indicators such as nesting area, number of nests per species, nest emergence percentage, nest fertility, and temperature. Additional variables characterize the female green turtle population; including biometric data, nesting behavior patterns, migration, nesting frequency, and oviposition dynamics. Data collection is conducted through nightly and morning patrols, nest tracking, and exhumations; with satellite tagging implemented to record migratory patterns and foraging areas. The results include both historical and current data from Isla San José. Between 2012 and 2016, Luis Fonseca monitored four seasons, tagging 1,232 females and recording an average of 1,077 nests per season—the highest in Costa Rica's Pacific region. A notable finding is the nest density, the second highest in the eastern Pacific, with an annual average of 3,264 nests/km. After a pause in monitoring, activities resumed on February 2, 2024, and will continue until March 2025. This will allow for comparisons of this season's results with historical data to update the green turtle population status on this beach. The reactivation of monitoring on Playa San José provides valuable insights, as it is one of the most important nesting sites for green turtles in Central America's northern Pacific region. The high nest density and geographic characteristics make it a key area for the species. In 2013, the Convención Interamericana para la Protección y Conservación de las Tortugas Marinas (CIT) designated it as an "index beach" for green turtles in the region. Current and future findings will help assess the population status and guide management and conservation strategies to ensure the future continuance of this turtle population."

# INTRODUCTION TO DIANI TURTLE WATCH AND THE PARTNERSHIP WITH TURTLEMAN FOUNDATION

**Dempsey Omukule Mai**

*Diani Turtle Watch*

Diani Turtle Watch (DTW), a program under Local Ocean Conservation (LOC), is dedicated to safeguarding endangered sea turtles and their habitats along a 30-kilometre stretch within the Diani-Chale Marine National Reserve. Operating from The Sands at Nomad, DTW implements a range of conservation strategies that include nest protection, mortality responses, bycatch rescue, education, public awareness, and anti-poaching initiatives. The coastal stretch of Diani hosts five of the seven sea turtle species: leatherback, loggerhead, green, olive ridley, and hawksbill turtles. Among these, the green, olive ridley, and hawksbill turtles have been confirmed as nesting species. However, natural and human-induced barriers render only 24% of the beach suitable for nesting. To address threats such as illegal egg collection and the slaughter of nesting females, DTW collaborates with beachfront property owners to establish and manage nest relocation sites. Currently, seven such sites ensure that vulnerable nests are relocated to safer areas where they are monitored until hatching, with post-hatch excavations conducted to assess success rates. Beyond nest protection, DTW addresses sea turtle mortality by responding to reports of dead turtles. Freshly deceased turtles undergo necropsy to determine causes of death, while decomposed carcasses are buried for environmental safety. Insights from these assessments inform strategies to mitigate future risks. DTW also works closely with local fishermen to rescue sea turtles accidentally caught in fishing nets. Fishermen are compensated for any net damage, fostering goodwill and strengthening collaboration. Rescued turtles are examined before being released, significantly mitigating the threat of bycatch while promoting responsible fishing practices. Education and awareness are at the heart of DTW's mission. Through school visits at the Marine Centre and community outreach programs, DTW fosters an understanding of marine conservation and promotes sustainable practices. These efforts extend to engaging tourists and locals, encouraging responsible human interactions with marine ecosystems. In collaboration with the Kenya Wildlife Service (KWS), DTW conducts regular anti-poaching patrols in identified hotspots. This partnership has significantly reduced poaching incidents, ensuring the protection of nesting females and their eggs. A critical element of DTW's success lies in its partnership with the Turtleman Foundation. The Foundation has funded vital initiatives, including training for turtle monitors, student marine education programs, and the development of beach signage. Additionally, their provision of satellite trackers will facilitate the study of migratory patterns and reproductive behaviours, emphasising the value of collaborative efforts in achieving conservation milestones. DTW operates under Local Ocean Conservation (LOC), formerly known as Watamu Turtle Watch, established in 1997. LOC's diverse conservation projects—ranging from nest protection to mangrove restoration—are driven by a commitment to community involvement and sustainable marine resource management across Kenya's coastline. Community support remains a cornerstone of DTW's efforts. Through initiatives like the Sea Turtle Nest Adoption Project, donation campaigns, and volunteering opportunities, DTW invites individuals to contribute to the protection of these endangered marine species and their habitats for future generations.

## TRACKING THE 23 YEARS OF LOGGERHEAD TURTLE COLONISATION IN SPAIN*

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Due to the current changing environmental conditions, many species change their distribution and migrate to new areas to avoid potential extinction. Long-lived animals, like the loggerhead sea turtle (*Caretta caretta*), are particularly vulnerable due to their temperature-dependent sex determination, habitat loss and challenges in relocating to new habitats because of philopatry. Despite these difficulties, the species has expanded its nesting range in the Mediterranean by colonising the western region. On the east coast of Spain, nesting has been continuously monitored showing an increase since 2001, providing a rare opportunity to characterise the early stages of colonisation and the foundation of a new population, a singular process with limited empirical evidence. To do so, we collected samples from 336 hatchlings and 15 nesting females from 59 nests along the Spanish Mediterranean coast between 2001 and 2023. For each nest, we constructed individual 2bRAD genomic libraries using a variable number of hatchlings per nest and sequenced the D-loop region of the mtDNA from one hatchling per nest, as well as the nesting females when samples were available. In addition, we collected reproductive data as clutch size, hatching success, viability and incubation duration. Using relatedness analyses, we identified a minimum of 10 females that laid more than one nest in the same nesting season (re-nesters). Importantly, for the first time, we detected remigrant individuals (breeding in the area in different nesting seasons). We identified six females that laid nests in different nesting seasons, predominantly in more recent years. Interestingly, two of the identified males sired distinct females in different nesting seasons since 2019, supporting the philopatric behaviour of males within and between years. The parentage analysis estimated a minimum effective breeding population of 36 females and 43 males over the entire period. We also assigned individuals to their populations of origin, by comparing our samples to a previously established genomic baseline that included individuals from three regional management units (RMUs): Northwest Atlantic, Northeast Atlantic, and Mediterranean. One nest was assigned to the Northwest Atlantic RMU, six nesting events were attributed to an admixed origin between the Northwest Atlantic and Mediterranean RMUs, and the remaining nests had an eastern Mediterranean origin, all of them could be attributed to specific subregional units, predominantly Greece or the Levantine region, with admixed nests from these two subregional units. We show that genomic approaches are powerful to study colonising events. Overall, our results support the hypothesis of an advancing colonisation process, providing evidence for the ongoing expansion and establishment of a new resident population in the Western Mediterranean. The presence of admixed nests indicates genetic exchange and connectivity between distinct RMUs, emphasizing the importance of global

studies for conservation purposes. Monitoring this ongoing colonisation offers us a virtually unique opportunity to witness in real time the colonization patterns of a species with long life cycles, which likely adjusts its philopatric behaviour to cope with the rapid changes induced by global warming. By understanding these patterns, we can derive effective conservation and management plans in response to environmental changes.

## MONITORING SEA TURTLE POPULATION TRENDS IN BAZARUTO ARCHIPELAGO NATIONAL PARK, A UNIQUE NESTING STRONGHOLD FOR ALL FIVE SPECIES IN THE WESTERN INDIAN OCEAN

**Lorena Michel da Encarnação Matos, Evan Trotzuk**

*African Parks, Mozambique*

Mozambique's Bazaruto Archipelago National Park (BANP), has protected and monitored nesting sea turtles since 1994. Every year, rangers have collected measurements such as total number of nests per year or average number of successful hatchlings per year. This type of robust, long-term dataset contains pertinent information for evaluating trends and the efficacy of conservation interventions. The aim of this research was thus to use this data to evaluate the trends of sea turtle nesting and hatching success over the past six years in BANP and inform management strategies. We present the data collected by these monitoring efforts from the past six years, stretching from October 2016 until March 2022. The results obtained in the last six years of monitoring showed that all five species that occur in the WIO also nest within BANP. During the 2021/22 season, we confirmed for the first time that all five turtle species nested in BANP during the same season. The total number of sea turtles species that nested in BANP per year ranged from three to five species. On average, loggerheads laid the most nests per annum (minimum: 8, maximum: 37), while leatherback turtles laid the least (minimum: 0, maximum: 3). Loggerhead (*Caretta caretta*) and green turtles (*Chelonia mydas*) nested at least once every year over the past six years, while hawksbill (*Eretmochelys imbricata*) and leatherback turtles (*Dermochelys coriacea*) were only recorded biannually. Over the past six years, the average proportion of successful nests and hatchlings per season was at 68% (± 11 SD) and 67% (± 13 SD), respectively. On an inter-annual scale, hatchling success appeared stable over the last six years from a low of 56% (± 47 SD) in 2016 to a high 71% (± 9 SD) in 2021/22. The high standard deviation of the values, though, makes any conclusion highly uncertain. However, while the hatchling success trends are positive, turtles nesting in BANP face natural (rising sea levels and erosion) and unnatural (anthropogenic) threats. On average, these natural pressures caused in average 8 nest (± 5.1 SD) per year to fail completely. Four turtles nests were reported to have been caught illegally in BANP over the past six years (only on 2016). Despite these seemingly positive results, suggests that conservation actions are possibly protecting resident population sufficiently, however, sea turtles in BANP continue to bet threatened by rising sea levels and erosion.

## PHYSICAL AND CHEMICAL CHARACTERIZATION OF NESTING BEACHES IN BATOKE AND BAKINGUILI ON THE NORTHERN COAST OF CAMEROON

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The hatching success of sea turtle eggs can be reduced by a variety of biotic and abiotic factors. The beaches of Batoke and Bakinguili on the northern coast of Cameroon serve as nesting sites for sea turtles. Through its annual sea turtle nesting monitoring program initiated in 2016, AMMCO records an average of 03 to 04 nests on these beaches each year, primarily olive ridley nests, and to a lesser extent, leatherback turtle nests (02 nests recorded so far). Poaching of females/nests, insufficient nest monitoring, flooding of the upper beach during exceptional tides, poorly identified nest locations, handling of eggs, and invasion of nests by roots from surrounding vegetation are the main causes attributed to the absence of egg hatching or hatchling emergence, consistently observed either during or after the incubation period. To address this issue, AMMCO began a study in March 2023 to analyze the impact of environmental factors and beach characteristics on the hatching success of sea turtle eggs. The study monitors the physical and chemical properties of the surface of Batoke and Bakinguili beaches, as well as tidal data to track water levels and calculate the average tidal range. The surface temperature of the beaches varies with seasonality (dry and rainy seasons) and the presence or absence of shade. Meanwhile, temperature data recorded by a data logger deployed inside a nest shows an increase reaching lethal levels for the survival of sea turtle eggs (t > 33°C), with a steady rise during the dry season. The volcanic nature of the sand on these beaches may contribute to the accumulation of significant heat fluxes. Studies on granulometric and mineralogical analysis could provide further insights. The annual average tidal range is 1.55 m during spring tides and 1.80 m during high tides. This average tidal range, depending on tidal regimes, is favorable for nest stability at Bakinguili, which has a steeper beach slope than Batoke. Since oceanic forcing is non-linear, it causes structural modifications to the beaches, making Batoke beach prone to erosion. The survival probabilities of the eggs on these beaches could be further exacerbated by the effects of climate change, particularly rising surface temperatures and sea levels. The identified vulnerabilities will be used to determine conservation actions to be implemented, such as establishing an egg incubation system.

## A COMPARISON OF LOW AND HIGH NEST RELOCATION EFFORTS DURING 11 SEASONS OF SEA TURTLE NESTING ON TOPSAIL ISLAND, NORTH CAROLINA, USA

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The Karen Beasley Sea Turtle Rescue and Rehabilitation Center (KBSTRRC) is a nonprofit sea turtle conservation organization in North Carolina, USA. KBSTRRC's Topsail Turtle Project (TTP) is permitted by the State of North Carolina to monitor the beaches of Topsail Island for nesting sea turtle activity. Nesting data has been collected consistently for 30 years. May 1 through August 31 is sea turtle nesting season in North Carolina. Each day, TTP volunteers survey the 41.8 km (26 miles) of Topsail Island looking for sea turtle nests. If eggs are deposited in an unsuitable location, volunteers will relocate the nest. Nest are monitored nightly during hatching season. Three days after hatchling emergence, the nest contents

are inventoried and additional data are collected. Nest relocation is a common conservation strategy for protecting sea turtle eggs from environmental threats such as tidal inundation, predation, and temperature extremes, however its impact on reproductive success and hatchling fitness continues to be studied. In the state of North Carolina, USA, management guidance limits nest relocation efforts to 30% or less of the total nests per season. The Topsail Turtle Project has historically relocated greater than 30% of nests based on the very dynamic beach front of a narrow barrier island, complicated by the differing sand conservation strategies of the three municipalities comprising Topsail Island (renourishment, inlet dredging, and mainland sand pit haul and dump). This study examines the effects of nest relocation efforts on Topsail Island loggerhead sea turtle (*Caretta caretta*) nests, assessing hatch and emergence success. We compared hatch success and emergence success between 2024, a low relocation year, with the prior ten-year period, all of which were high relocation years. From 2014 through 2023, the average relocation rate of loggerhead nests on Topsail Island was 54.4%. These are considered high relocation years. During the 2024 nesting season, 14.4% of nests were relocated - the lowest relocation rate in 30 years. Mean hatch success rates were 81.0% during high relocation years and 68.2 during the low relocation year, and mean emergence rates were 74.6% during high-relocation years compared to 64.4% during one low relocation year. Findings suggest that increased nest relocation may impact hatch success (12.8% higher) and emergence success (10.2% higher). This study contributes to the understanding of relocation as a conservation tool. Further research is necessary to determine whether the above trends hold over multiple years. It should be noted that this study did not consider sex ratios or hatchling fitness, which are also important areas of research. Context-specific nest management practices are important to optimize sea turtle reproductive outcomes.

## TOWARD AN EXPLANATORY MODEL OF SEA TURTLE NESTING BEHAVIOR: EXPLORING PATTERNS IN NIGHTLY NEST COUNT DATA USING AGENT-BASED MODELS

**Sheila Miller Edwards**

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The variability of nest count from one night to the next is well known to sea turtle biologists and conservationists. Indeed, the number of sea turtles that nest on a given beach can vary from the seasonal maximum to zero on consecutive nights. Such fluctuation poses obvious difficulties for those studying and protecting sea turtles. For beaches that cannot achieve 100% monitoring coverage or that have significant ecotourism components reliant on observing nesting turtles, the capacity to anticipate nights with high nesting activity would be very helpful operationally and financially. An ideal predictor might answer the question: How many turtles are likely to nest tonight? Before approaching that (admittedly aspirational) outcome, we first need to better understand the factors influencing potential nesting synchronicity. Existing studies on nest counts typically have the goal of estimating nesting numbers as a proxy for the total population. (See, for example: Whiting et al., 2014, doi: 10.3354/meps10832). When estimating total population, it is reasonable to smooth out the internight variability in nest counts, and those models perform their intended purpose. Precisely because of that smoothing, however, data simulated by such models do not exhibit the desired variability. In this work we explore three novel, individual-based sea turtle nesting models: one that simulates nightly nest counts with only environmental factors, one that simulates nightly nest counts with network hypotheses allowing coordination between turtles, and a third combining both environmental and behavior cues to nest. We examine simulated internight nest count variability for three different species (leatherback *Dermochelys coriacea*, green *Chelonia mydas*, and loggerhead *Caretta caretta*).

## COOLING SEA TURTLE NESTS VIA CLUTCH SPLITTING: OUTCOMES FOR THREE SPECIES, TWELVE ROOKERIES, AND THREE CLIMATES EXPLORED VIA FINITE ELEMENT ANALYSIS

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Trials that aim to cool sea turtle nests are underway across the globe and usually involve nest watering or shading. An alternative, barely tested intervention, is to divide egg clutches across two nest chambers to reduce metabolic heating. In this project we coupled engineering and biological modelling approaches (Finite Element Analysis and Dynamic Energy Budget Theory) to develop computer models of sea turtle nests that account for physical and biological sources of heat in space and time. We selected three sea turtle species (green, flatback and loggerheads), each with contrasting nest shapes, nest depths, egg sizes and clutch sizes, meshed a typical nest structure for each species, and simulated the temperatures of different sized egg clutches within each nest. We ran each model assuming the nest experienced typical sand temperatures across representative beaches in Western Australia (and one on the Cocos Keeling Islands) under a recent climate, and re-ran the same models assuming that the climate was either 2 or 4°C warmer. We successfully validated our model outputs against empirical temperature data collected from clutch splitting trials for flatback turtles in Western Australia, and for loggerhead turtles from the North Atlantic. We showed that a 'clutch splitting' manipulation is expected to have the greatest impact for the loggerhead sea turtle, which has the shallowest nest and a relatively large number of eggs. On average, the temperatures at which loggerhead embryos develop in split nests should be about 1.8°C lower under the current climate, and about 2.2 °C lower under future climates. Notably, we show that under future warmer climates, most eggs in whole (i.e. unmanipulated) loggerhead clutches would regularly experience temperatures above 34°C, which would likely be lethal, whereas most split clutches would survive and hatch as mixed sexes. Based on these promising simulations, we now have a generalised methodology that can be used to identify species and regions where clutch splitting could improve hatching success and reduce female biases. In particular, we expect this manipulation could be useful for enhancing recruitment at rookeries with consistently low hatching success due to high beach temperatures. Additionally, it could be deployed at regional scales in years when summer heatwaves are forecast.

## TEN YEARS OF CONSERVATION OF SEA TURTLES IN THE MANYANGE NA ELOMBO MARINE NATIONAL PARK: WHAT NEXT?*

**Rodric Xavier Ndounteng Ndjamo, Yves Maxime Mondjeli Ndjokou, Joël Wamba, Marlène Djoumessi, Cédrick Fogwan**

*Tube Awu, Cameroon*

Sea turtles are emblematic and culturally significant species for the iyasa communities in Cameroon. Four species are present: green, leatherback, olive ridley, and hawksbill turtles. This is evidenced by the presence of the turtle rock (Manyange), historically a village of coexistence between turtles and humans. However, these turtles face numerous anthropogenic and natural threats, including poaching, illegal egg harvesting,

pollution, habitat destruction, and climate change. The objective of marine turtle nesting monitoring is to contribute to the conservation and ensure the sustainability of these turtles. Specifically, it aims to locate nests and nesting frequencies, protect nesting habitats, improve knowledge on marine turtle identification, and strengthen collaboration with local communities to promote conservation. To achieve these goals, night and day patrols are employed. This method follows the B protocol of the SWOT minimum standard norms. Patrols involve walking on nesting beaches at night or early morning between 2 and 5 days per week, recording turtle nests using data collection applications such as Cyber Tracker and SIREN mobile App. The sandy stretch located in the extreme south of Cameroon, in the Ocean Department, Campo District, extends over 44 km of beach and is divided into two main nesting zones. The Campo zone (South) consists of two sub-zones or nesting transects (4 and 6 km long), and the Ebodje zone (North) comprises 5 sub-zones or nesting transects (4 to 6 km long), totaling 7 transects. Over the past ten years, 2237 patrols have been conducted, and three species have been observed: 611 olive ridley turtles (*Lepidochelys olivacea*), 86 leatherback turtles (*Dermochelys coriacea*), 17 green turtles (*Chelonia mydas*), and 17 unidentified turtles, making a total of 731 observed nesting marine turtles. The Ebodje South sub-zone recorded the highest number of nests, making it a priority site with 225 nests. It includes the beaches of Ebodje, Mbendji, and Pande. Conversely, the Mbondo sub-zone, with the beaches of Bouandjo, Mbondo, and Itondè, is considered the weakest transect with only 35 nests recorded. Surveys also helped to document threats, such as poaching with 190 poaching incidents recorded over the past decade. Additionally, the number of observed nests or nesting turtles does not increase with patrol efforts, highlighting the urgent need for effective conservation mechanisms. These data have led to the creation of the new entirely marine Manyange na Elombo Campo National Park, the initiation of tourism, and access for multiple researchers in the area.

## SHORESCAPE APPROACH TO SEA TURTLE NESTING BEACH MANAGEMENT IN THE RAPIDLY DEVELOPING RED SEA COASTLINE

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Sandy beaches are vital ecosystems that provide essential services such as storm buffering and water purification. Acting as transitional habitats between terrestrial and marine environments, they support functional connectivity and serve as important foraging and breeding grounds for species like sea turtles. Despite these ecological roles, beaches are often valued primarily for their economic and recreational benefits. However, with increasing coastal development and climate change, these natural habitats are becoming degraded or lost as processes essential to coastal health are disrupted. Coastal developments are frequently considered in isolation, with impacts seen as limited to the development footprint. Yet over time, these individual actions accumulate into a "tyranny of small decisions," resulting in widespread ecological effects such as coastal squeeze—a particularly urgent issue in the Red Sea—reducing beaches' resilience to sea-level rise. The Red Sea supports nesting populations of green (*Chelonia mydas*) and hawksbill turtles (*Eretmochelys imbricata*), with several key rookeries located along the Kingdom of Saudi Arabia (KSA) coastline. However, data collection along this coast has been limited, often constrained to short-term, project-specific monitoring, leaving the full distribution of nesting sites unknown. With Saudi Arabia's rapid infrastructural transformation toward Saudi Vision 2030—including large-scale coastal developments along the Red Sea—comprehensive mapping of nesting sites is needed to guide holistic shorescape management. To address these data gaps, the newly established General Organisation for Conservation of Coral Reefs and Turtles in the Red Sea (SHAMS) has consolidated historical nesting data,

engaged local stakeholders, and analysed remote sensing imagery to map known and potential nesting sites for green and hawksbill turtles. This initiative has identified over 1,800 beach sites along 1,760 km of coastline. For sites without current stakeholder monitoring, ground-truthing via track and nest counts, supplemented by drone surveys, was conducted over one year. From the resulting map of nesting sites a 200 m landward coastal buffer zone, consisting of a 150 m crawling distance and a 50 m disturbance buffer was established. This spatial layer is now publicly accessible across the Kingdom and will be a critical resource for SHAMS as it initiates long-term monitoring at index sites. Coupled with other layers such as habitat and threat mapping, this data will inform a detailed, multi-objective systematic conservation plan and coastal zonation for the KSA Red Sea coastline, balancing the protection of sea turtles and their habitats with developmental needs through adaptive management. This shorescape approach is a critical step toward sustainable coastal management for the Kingdom of Saudi Arabia's Red Sea coastline.

## ACOUSTIC INSIGHTS INTO SEA TURTLE HATCHLING NEST ESCAPE ACROSS DIFFERENT CLUTCH SIZES

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Sea turtle hatchlings must escape their sand-buried nests to begin their journey to the ocean, a process influenced by clutch size and critical for survival. This study investigates the effects of clutch size on the morphology, physiology, and digging behavior of *Chelonia mydas* hatchlings. Eggs were split into large (45–60 eggs) and small (15–20 eggs) groups, with experimental setups mimicking natural nest conditions. Morphological measurements, glucose levels, and self-righting performance were evaluated alongside digging behavior using acoustic monitoring at different nest depths. Hatchlings from small groups exhibited larger body and flipper sizes, higher blood glucose levels, and shorter self-righting times, indicating higher energy expenditure but enhanced locomotor performance. In contrast, large-group hatchlings demonstrated energy-saving benefits, shorter total nest escape durations, and lower glucose levels. Digging duration analysis revealed significant depth and group size effects, with larger groups achieving more efficient synchronization, especially near the sand surface. However, small groups displayed prolonged digging at middle depths, potentially due to reduced coordination and denser sand. These findings suggest that large clutch sizes facilitate energy-efficient nest escape, while small group hatchlings compensate with improved post-emergence performance. The study highlights the trade-offs between group size, energy use, and locomotor capabilities, emphasizing the need for careful management when splitting clutches for conservation purposes. Future research should explore long-term effects on hatchling survival and swimming performance to refine conservation strategies.

# GROWTH RATES OF THE EPIBIOTIC BARNACLE CHELONIBIA TESTUDINARIA ON GREEN TURTLES (*CHELONIA MYDAS*) IN COSTA RICA: IMPLICATIONS FOR USING BARNACLES AS INDICATORS OF HABITAT USE IN SEA TURTLES*

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The barnacle *Chelonibia testudinaria* is arguably the most common and conspicuous epibiont found on sea turtles. As C. testudinaria appears to settle in coastal habitats, this barnacle could serve as an indicator of sea turtle habitat use. The utility of *C. testudinaria* for this purpose is, however, limited by a lack of information on their growth rates. Here, we generated growth curves for *C. testudinaria* on green turtles (*Chelonia mydas*) by taking repeat measurements of barnacle sizes when turtles were encountered on successive nesting events in northwest Costa Rica during 2023/2024. We measured growth rates of 106 barnacles from 38 green turtles and fitted these measurements to a von Bertalanffy growth model. Our measured growth rates were double those reported for *C. testudinaria* on loggerhead turtles in Australia. We found a statistically significant effect of beach and turtle identity on growth rates. The models that best explained the variance in growth rates also included sea surface temperature even through this variable was not significant. Our results suggest that barnacles had settled, and thus turtles may have begun occupying coastal habitats, a mean of 76 days before the host turtle laid their first clutch for that nesting season. We also provide the first measurements of barnacle detachment rates in wild sea turtles with 24.1% of barnacles detaching after a single internesting period. Our study illustrates that *C. testudinaria* can serve as useful indicators of habitat use in sea turtles although further studies into the factors driving barnacle growth are still required.

# GREEN TURTLE NESTING AS A SOURCE OF NUTRIENT INPUT IN A WEST AFRICAN ISLAND AND ITS NEARSHORE ENVIRONMENT*

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Nutrients can be transported within and between ecosystems by physical (e.g., wind and water) or biotic (e.g., animals) vectors. Sea turtles are an example of such animals. Sea turtle nesting brings marine-derived nutrients into sandy beach ecosystems, potentially influencing their dynamics. This nutrient input is more readily detectable in high sea turtle nest density sites worldwide. We investigated nutrient input from green turtle *Chelonia mydas* eggs and hatchlings into coastal habitats in Guinea-Bissau, West Africa. The João Vieira-Poilão Marine National Park (JVPMNP), located in the Bijagós Archipelago, hosts one of the world's largest green turtle breeding aggregations at Poilão Island. We assessed two islands within the JVPMNP with contrasting sea turtle nesting density: João Vieira, with very low nest density, and Poilão, with very high nest density. On each island, we analysed stable isotopes of carbon and nitrogen in one pair of plant species (coinvine *Dalbergia ecastaphyllum* bush/baobab *Adansonia digitata* tree) and two pairs of predator species (tufted ghost crab *Ocypode cursor*/African rainbow crab *Cardisoma armatum* and sea catfish *Carlarius* spp./crevalle jack *Caranx hippos*). The first species in each pair is distributed closer to nesting sites, while the second is found further inland or offshore. We also conducted stomach content analysis for fishes. Our results supported nutrient input from turtle clutches benefiting the species living near nesting sites. Shoreline coinvines at Poilão had higher δ15N (5.1 ± 3.2‰) compared to João Vieira (approximately 0‰), suggesting assimilation of turtle-derived 15N. Shoreline tufted ghost crabs at Poilão had enriched δ15N (15.2 ± 0.7‰ vs. João Vieira's 12.2 ± 1.1‰) and δ13C (-13.4 ± 0.7‰ vs. João Vieira's -18.7 ± 1.4‰), likely reflecting predation upon eggs and hatchlings. Sea catfishes at Poilão frequently consumed unhatched turtle eggs washed into the sea (17% frequency of occurrence) and hatchlings (up to 27% frequency of occurrence). This study suggests that nutrient availability from turtle nests influences and supports shoreline plants and consumers at JVPMNP.

## SURVEYING JORDAN'S GULF OF AQABA COAST FOR SEA TURTLE NESTING POTENTIAL

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There are seven species of sea turtle around the globe, all of which are conservation concern and appear on the IUCN Red List of Threatened Species. The green turtle (*Chelonia mydas*) and hawksbill turtle (*Eretmochelys imbricata*) are the most common species found in the Red Sea with the hawksbill being the most common species found in Jordan's waters of the Gulf of Aqaba. Both green and hawksbill turtles are known to nest in Egypt and the Saudi Arabian Red Sea though little nesting has been recorded in their respective Gulf of Aqaba coasts. Neither species has been previously reported as nesting on the sandy beaches of Jordan. The Hashemite Kingdom of Jordan has ~25km coastline. Much of it is built up, though several stretches of sandy coast remain. The coastline has not been surveyed for nesting suitability or actual nesting in recent years. Given the range expansion sea turtle nesting is experiencing in other parts of the globe, it may be that sea turtles start to attempt nesting on Jordan's beaches in the future. The current survey aimed to classify Jordan's coastline for sea turtle nesting suitability. Potential beach areas were pre-identified using Google Earth. The survey was carried out by walking these areas of coast during the day. Beach substrate, width, slope and elevation were recorded to determine suitability. Existing anthropogenic impacts that might affect turtle reproductive success such and artificial lighting and beach obstructions were recorded at all sites with sea turtle nesting potential. Proposals for management to counter existing and potential threats will be produced for potential nesting areas. The surveys also sought to record any evidence of turtles in the area through noting any strandings. Fieldwork was completed during November 2024. We were unable to access approx. 1.25km of the 15.75km of preselected coast for security reasons. No areas of coast were assessed to have high potential for hawksbill turtle nesting and successful green turtle nesting potential is highly unlikely. Furthermore, no turtle strandings were observed along the coast. We conclude that the coast has little natural potential for sea turtle nesting, but with several coastal stretches experiencing beach nourishment for tourism purposes nesting potential may arise if the introduced sand is sufficiently deep.

## LESS SEAGRASS, MORE PLASTICS: CHANGES IN THE CARIBBEAN GREEN TURTLE (*CHELONIA MYDAS*) DIET BETWEEN FORAGING GROUNDS IN THE MISKITO CAYS, NICARAGUA, AND THE NESTING BEACH AT TORTUGUERO, COSTA RICA*

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Prior to a reproductive event, green turtles (*Chelonia mydas*) must forage for more than a year to accumulate the energy needed for long-distance migrations, courtship, mating, and egg production. Although it is commonly assumed that nesting females fast, this behavior has not been confirmed. To address this gap, we investigated whether female green turtles nesting at Tortuguero, Costa Rica, fast during the nesting season. Additionally, when nesting females were not fasting, we assessed whether the

diet at Tortuguero differed from that of green turtles at their main foraging ground in the Miskito Cays, Nicaragua. In 2020, we collected 71 diet samples from green turtles legally harvested from the Miskito Cays for human consumption. In 2021 and 2022, we collected gut contents from 15 green turtles preyed upon by jaguars (*Panthera onca*) at Tortuguero. We measured the proportional volume of food items in the samples. Of the 15 jaguar-killed green turtles we examined, 11 (73 %) presented food whereas 4 had empty digestive tracts. The green turtle diet at the foraging ground was composed of primarily seagrasses (>90% *Thalassia testudinum*) with smaller amounts of algae and animal matter. Food boli at the nesting beach were composed mainly of riparian vegetation, algae, and anthropogenic debris, especially plastics. Our findings indicate that some green turtles nesting at Tortuguero had foraged. Although food ingested was lower in quality and smaller in quantity compared to the diet of green turtles at the foraging ground. The decreased intake at the nesting beach may be due to the lack of forage and/or the reduced coelomic space available as egg clutches occupy much of the body cavity of nesting females. Moreover, the difference in green turtle diet composition we observed at the nesting ground can be attributed to the lack of seagrass meadows off Tortuguero. In the absence of their preferred forage, herbivorous green turtles adapt by consuming riparian vegetation that flows into the ocean through the numerous river mouths in the region. Additionally, the major river basins discharging into the Caribbean Sea near Tortuguero carry anthropogenic debris from urban areas in Costa Rica's Central Valley. This debris, transported with riparian vegetation, enters coastal waters where it becomes available to green turtles. Consequently, we observed elevated plastic ingestion among nesting green turtles in comparison to individuals at the Miskito Cays foraging ground where seagrass is widely available. This underscores the ecological impact of riverine pollution on endangered marine megafauna. In conclusion, our findings provide important insights into the feeding behavior and diet composition of green turtles at major nesting and foraging grounds in the Caribbean Sea. We demonstrated that many nesting females continue to forage, albeit with decreased ingestion of seagrass and increased ingestion of low-quality riparian vegetation and plastics. These results highlight the complexity of green turtle foraging ecology and underscore the need to consider the full spectrum of ecological pressures that sea turtles face across the different habitats used to inform conservation strategies.

## AN EVALUATION OF NEST RELOCATION AND HATCHING SUCCESS DURING HURRICANES IN FLORIDA*

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Tropical storms and hurricanes pose a significant threat to sea turtle nest success, as storm surge often results in nest flooding and sand accretion. In recent years, mid-season hurricanes have impacted sea turtle nests in Sarasota County, Florida - a high-density nesting beach in the Gulf of Mexico. These severe weather events put numerous nests at risk of damage or complete loss. In an attempt to combat these threats, emergency relocations are requested for research focused nests that are at highest risk. In the 2023 and 2024 nesting seasons, 37 total nests were approved to be relocated off the beach due to hurricanes Idalia and Debby. The study aims to investigate the effectiveness of nest relocation by comparing hatching success rates between relocated nests and those left in situ across multiple hurricane seasons.

## "CRACKING THE EGG" ON FUSARIUM SPP. IN LEATHERBACK NESTS, AN INVESTIGATION OF FUNGAL BURDEN*

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In recent years, there has been a significant rise in the prevalence of infectious diseases caused by fungi in marine ecosystems, presumably because of the rapid increase in ecological disturbances associated with anthropogenic climate change. Increasing temperatures and regional shifts in precipitation can foster fungal overgrowth within sea turtle nests, and reports of fungal infections of sea turtle eggs have increased around the globe. Fungal overgrowth by Fusarium spp. in sea turtle nests can cause sea turtle egg fusariosis (STEF). STEF causes embryo mortality and has been linked to decreased hatching success in all seven species of sea turtles. The leatherback sea turtle (*Dermochelys coriacea*), which has the lowest global average hatching success at ~50%, is at high risk of suffering negative impacts from STEF. While existing studies highlight the urgent need for research on the prevalence of Fusarium spp. in the sand where leatherbacks nest, we are not aware of any published research on this topic. Our work focused on the nesting assemblage in southeastern Florida, USA. To address the need for information on *Fusarium* spp. in the sand, we obtained samples from leatherback sea turtle nests at oviposition and excavation in Boca Raton, Juno Beach, and Jupiter Florida and used real-time polymerase chain reaction (qPCR) to measure the amount of *Fusarium* spp. present in nest sand. These quantitative data were used to determine whether the quantity of *Fusarium* spp. in the nest at each time point covaries with emergence success, hatching success, and environmental factors. This molecular approach sheds light on key factors contributing to the occurrence and abundance of *Fusarium* spp. and whether it is associated with the low hatching success observed in crucial Florida nesting hotspots and therefore stifling population recovery. Additionally, the knowledge gained from this research enhances our understanding of STEF and can help regulators plan mitigation strategies to improve hatching success.

## PROACTIVE CONSERVATION IN THE RED SEA: SAUDI ARABIA'S FOUR SISTERS ARCHIPELAGO AS A SEA TURTLE SANCTUARY

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Conservation actions are often reactive, typically driven by the need to address the negative consequences of anthropogenic alterations to ecosystems. It is rare that conservation efforts are proactively shaped by the environment itself or based on its intrinsic value. The Kingdom of Saudi Arabia faces unique conservation challenges as it undergoes rapid transformation under Vision 2030 initiatives, with large-scale development of coastal and island infrastructure imminent. In the past, conservation within the region has been fragmented and sporadic, and few sea turtle rookeries in the Red Sea remain unimpacted and in pristine condition due to anthropogenic pressures. These habitat changes are having profound impacts on the

nesting, hatching, and emergence success of the green (*Chelonia mydas*, Cm) and hawksbill (*Eretmochelys imbricata*, Ei) sea turtles utilizing these rookeries. A recent royal decree established the General Organization for the Conservation of Coral Reefs and Sea Turtles in the Red Sea (SHAMS)—whose mandate is to protect sea turtles and their habitats in the Red Sea in perpetuity. A primary output of this mandate was the identification of confirmed and potential sea turtle nesting sites within the region. The efforts, termed "rapid assessments", led to the discovery of an island archipelago—Malatu, Dohrab, Jadir, and Marmar—known anecdotally as "The Four Sisters.". Unrecorded previously in literature, the assessments recorded over 2,800 nesting events (Cm = 86%, Ei = 14%) on these islands collectively for both species, making it the largest known rookery for both green and hawksbill sea turtles in the Red Sea. The complementary occurrence of both species elevates the importance for conservation, particularly in light of the archipelago's notable isolation. This isolation fosters colonies of seven seabird species, supports a vibrant coral reef ecosystem, and serves as a migratory corridor for key megafaunal species, including the whale shark (*Rhincodon typus*). The site has now been designated as an IUCN Category IV Species Management Area since November 2024 and will be an index site for a long-term sea turtle monitoring program, set to begin in 2025. Although the islands remain in relatively pristine condition, they are facing significant threats due to increased anthropogenic pressures, necessitating immediate protective measures. A preliminary protection boundary has been established, encompassing a 5-kilometer radius around each island, covering approximately 222 square kilometers, to protect both nesting and in-water habitats. This will be the first species management area of its kind in the region, shielding the archipelago from commercially driven habitat disturbances such as development and commercial fishing, while permitting activities such as research, sustainable tourism, and regulated artisanal fishing. A management plan is being developed to balance ecological protection with sustainable use through conservation measures, zoning, monitoring, and community and stakeholder engagement. The Four Sisters Archipelago will serve as a flagship example of proactive conservation, demonstrating how protecting critical habitats can simultaneously preserve keystone species and support sustainable economic opportunities—setting a precedent for similar conservation efforts across the region.

## EASTERN INDIAN OCEAN LEATHERBACK ALLIANCE (EIOLA) – A TRANSBOUNDARY INITIATIVE TO PROTECT A THREATENED LEATHERBACK SUBPOPULATION

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Emerging from a collaboration between organisations in India and Indonesia, the Eastern Indian Ocean Leatherback Alliance (EIOLA) was established to address knowledge gaps in the Northeast Indian Ocean leatherback subpopulation, currently classified as Data Deficient by the International Union for Conservation of Nature (IUCN). EIOLA currently comprises three organizations: Yayasan Penyu Indonesia (Indonesia) and Ecosystem Impact (Indonesia), which have been monitoring nesting sites across the Western Sumatra province in Indonesia, and Dakshin Foundation (India), which is involved in monitoring nesting sites in India's Andaman and Nicobar Islands. Leatherback turtles nest in large numbers in India, with over 1,000 nests per season, and in smaller numbers in Sri Lanka, Thailand, and Indonesia.

Nesting sites in the Andaman and Nicobar Islands have been surveyed sporadically since the 1970s, with focused, long-term monitoring at key sites on Little Andaman Island and Great Nicobar Island over the past 25 years. The long-term data from Little Andaman Island (2008-2023) indicate a stable nesting population with some inter-annual fluctuations, ranging from ~80-173 nests per year with an average hatching success of 60.5% (n=32). In Indonesia, recent monitoring programs in Western Sumatra have recorded 250-300 nests per season, revealing more extensive leatherback nesting than previously documented, spanning beaches and islands from Aceh in the north to the Mentawai Islands in the south. In 2023, a leatherback turtle tagged on Great Nicobar Island was recorded nesting on Simeulue Island, Indonesia, indicating that these turtles use multiple nesting sites across the Northeast Indian Ocean. Satellite telemetry studies from India indicate that leatherbacks migrate and forage along Africa's eastern coast and Australia's western coast, while individuals from Sumatra were observed migrating to Western Australia. Leatherbacks have not faced significant direct threats in the Andaman and Nicobar Islands, resulting in only monitoring of nesting beaches with little intervention. However, in Western Sumatra, leatherback turtles are under pressure from egg and turtle poaching, leading to the initiation of hatchery programs at important rookeries. Since 2021, large infrastructure projects have been initiated to establish ports, greenfield airports, and townships in Great Nicobar and the Little Andaman Islands. These developments could significantly alter nesting habitats and disrupt nesting in the region. Consequently, the islands of Western Sumatra in Indonesia are likely to become increasingly critical for the survival of Northeast Indian Ocean leatherbacks. In this study, we present findings from conservation and monitoring efforts in the Eastern Indian Ocean, highlighting the urgent need for collective action to protect the Northeast Indian Ocean leatherback population. We emphasize the importance of developing reliable datasets to assess the current status of this subpopulation and establishing conservation programs at key nesting sites to ensure safe nesting conditions.

## FERTILITY RATES OF LEATHERBACK (*DERMOCHELYS CORIACEA*) EGGS IN SOUTHEAST FLORIDA, USA*

**Emily Turla, Jeanette Wyneken**

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Current research on egg failure in leatherback turtle nests in Southeast Florida, USA shows that approximately 55% of unhatched eggs have no signs of embryonic development when necropsied. Is the lack of detectable signs of development (e.g., embryonic tissues or blood) the result of infertile eggs that never formed an embryo, or dead early-stage embryos degrading in the nest before excavation and necropsy? To identify how infertility contributes to leatherback egg failure, 30 eggs from each of 19 nests (n=570 eggs) laid in Boca Raton and Juno Beach, Florida, USA were collected after oviposition for ex situ incubation. During incubation, eggs were monitored at least twice daily. To identify if an egg was fertile, two methods were used. The first method was to observe whether a white spot formed (i.e., egg chalking) on the eggshell surface within 14 days of incubation. In eggs that did not form a white spot, the second method was to use fluorescent microscopy to verify the presence or absence of embryonic cells in the perivitelline membrane, a technique that has recently been proven to work in sea turtle eggs. Using white spot formation as an indicator of fertility, we found 97.3% and 93.3% of eggs were fertile in 2023 and 2024, respectively. Employing fluorescent microscopy techniques increased the accuracy of fertility assessments compared to using white spot formation alone as an indicator of fertility. The combination of white spot observation and embryonic cell detection found a fertility rate of 98.3% in 2023. Microscopic analyses of 2024 eggs are ongoing. This experiment is the first to quantify fertility rates in sea turtle eggs using fluorescent microscopy techniques. Additionally, this is the first report of fertility rates of leatherback eggs in Florida, USA and these fertility rates are higher than most reported at nesting beaches globally

(~80%). Thus, fertility rates are high in leatherback sea turtle eggs in Southeast Florida, suggesting that infertility is not a major factor contributing to egg failure. Therefore, to understand most of the egg failure in leatherback nests in this region, the causes of early embryonic mortality require investigation.

## A NEW METHOD TO EVALUATE SEA TURTLE CAPITAL BREEDING STATUS USING STABLE ISOTOPE ANALYSIS

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Reproduction requires substantial investment of nutritional resources, and as a result, most sea turtle species do not nest annually. Reproductive investments have long thought to be financed from stored resources in sea turtles, and early studies classified them as capital breeders. A growing body of evidence suggests that sea turtles may be more flexible in their ability to rely on energy acquired during the reproductive period. However, the evidence is not always clear in establishing whether foraging occurs and if acquired nutrients are routed to the production of eggs. We addressed two objectives in a nesting population of loggerhead turtles to answer a long-standing question of where sea turtles fall on the capital vs. income breeding spectrum. First, we assessed whether loggerheads fast during the nesting season. Second, we assessed the source of nutritional allocations to the proteins in egg yolk and albumen. Samples of nesting female plasma and eggs (yolk and albumen) were collected at Wassaw Island, Georgia. Additionally, plasma was obtained from juvenile and adult loggerheads in the coastal waters off the coast of South Carolina and Georgia to represent foraging individuals. Amino acid carbon and nitrogen stable isotope analysis revealed that females were likely not feeding during the nesting season. Additionally, multivariate analysis of amino acid isotope data indicated that the yolk was synthesized while actively foraging prior to the reproductive period, but the albumen was synthesized while fasting. This approach provides a promising method for determining the nutritional status of reproduction in sea turtles.

## TOLERANCE TO INUNDATION MAY VARY BY POPULATION FOR LOGGERHEAD SEA TURTLES

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Incubation conditions play a critical role in sea turtle embryonic development. While much attention has been paid to incubation temperature, with respect to survival, moisture and gas exchange are equally important. Developing embryos must maintain osmotic balance and exchange respiratory gases with the surrounding environment. Inundation of the clutch by waves or groundwater may disrupt these exchanges and can increase mortality if detrimental conditions persist for a sufficient duration. Previous research on loggerhead turtles (*Caretta caretta*) in the northern Gulf of Mexico suggests that this threshold is around ≥2 wash-over events or ≥10 hours of submersion. However, beaches utilized by different nesting populations have different levels of inundation exposure based on their typical slope and elevation profiles, sand grain size and compaction, and hurricane frequency. Over evolutionary time, these exposure differences may select for differences in nest site selection and/or embryonic inundation tolerance. Preliminary analyses of nest productivity following wave exposure from two different southeastern US populations suggest this may be the case. From 2012 to 2022, loggerhead turtle nests that were washed over in Alabama (northern Gulf of Mexico Recovery Unit) but not otherwise disturbed had lower hatching success rates than those in North Carolina (Northern Recovery Unit). Nests that were washed over at least once in Alabama had an average hatching success of 36.9% ± 29.6% SD (n = 113), whereas those in North Carolina averaged 62.3% ± 43.8% (n = 124). This is despite washed over nests experiencing a greater frequency of inundation in North Carolina (2.6 wash-overs ± 2.1 SD) versus Alabama (1.7 wash-overs ± 1.1 SD). Additional analyses are underway to investigate other factors that may influence these rates. Considering the threats posed by sea level rise, hurricane intensification, and urban beach management, understanding differences in inundation tolerance is useful for population-level species management. The findings and conclusions in this abstract are those of the authors and do not necessarily represent the views of the U.S. Fish and Wildlife Service. Any use of trade, firm, or product names is for descriptive purposes only and does not imply endorsement by the United States Government.

## INTER-ANNUAL DIFFERENCES IN THE EFFECTIVENESS OF NEST SHADING ON INCUBATION TEMPERATURES AND HATCHING SUCCESS IN LEATHERBACKS*

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High and continuously rising atmospheric temperatures are altering ecosystems around the globe. On tropical and subtropical sea turtle nesting beaches, increased atmospheric temperatures are directly impacting sand temperature and, consequently, development in temperature-sensitive sea turtle eggs.

Increases in incubation temperature of eggs are known to influence the sex of hatchlings (female-skewed), though also have the potential to result in developmental failure at thermal extremes (33-35°C). Leatherbacks (*Dermochelys coriacea*) have low hatching success (~50%) and have been shown to experience further declines in hatching success in response to higher nest temperatures; despite this, temperature mortality thresholds continue to be poorly understood for this species. In partnership with Pacuare Nature Reserve (Caribbean Coast of Costa Rica), Leatherback nest temperatures were recorded to understand 1) if this species is exceeding previously proposed thermal limits, 2) how hatching success responds to temperature, and 3) whether nest-cooling (artificial shading) is an effective intervention. During the 2022 and 2023 nesting seasons, clutches of eggs were collected from females along 6 km of beach and relocated to a central hatchery. Nests were assigned to shaded or unshaded plots and HOBO temperature loggers were installed within the egg chamber (2022, n=34; 2023, n=28), measuring temperature at 30-minute intervals throughout the incubation period. Minimum, maximum, and mean temperatures were extracted for each nest, and the relationship between temperature and hatching success was investigated using a mixed modelling approach. Differences in nest temperatures and hatching success were observed between shaded and unshaded groups, as well as interannually, with shaded nests having higher success in 2023 but not 2022. Strengthening our understanding of how hatching success might be impacted by hotter incubation temperatures driven by climate change is vital for informing future conservation decisions and scaling of interventions to future warming predictions.

## A GEOSPATIAL APPROACH FOR MITIGATING EROSION-INDUCED NEST LOSS AT A KEY NESTING SITE IN TRINIDAD

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Sea level rise and coastal erosion continue to impact shorelines globally, endangering lives and livelihoods, especially in Small Island Developing States (SIDS). Trinidad stands out as a crucial habitat for one of the world's largest populations of leatherback turtles. With over 10,000 turtles nesting on the island, it accounts for 80% of the Caribbean's leatherback population. This study focuses on the Matura coastline in northeast Trinidad, a significant nesting site recording 5,000 to 7,000 crawls annually. The effects of erosion at Matura Beach are persistent throughout the year, with many nests being washed away or inundated, leading to low hatching and emergence success rates. This study aims to conduct drone surveys followed by post-flight image analysis to quantify nest loss due to erosion, assess shoreline changes over recent seasons, and identify suitable locations for establishing on-beach hatcheries for nest relocations. By determining which nests should be moved and where to relocate them, we aim to adopt a more targeted approach, thereby increasing emergence success at Matura Beach. Drone flights were conducted monthly over two years during low tide. Orthomosaics and Digital Surface Models (DSMs) were generated from the flight data, allowing us to identify the open sandy shores preferred by leatherbacks. Nest points were added for each period, and we tracked how the beach changed over time, and where the nests would be in comparison to where it was laid. Our analysis revealed that between 15% to 30% of buried nests could be threatened annually due to erosion patterns, and we were also able to isolate the best potential locations, based on shoreline changes, on the beach for nest relocations. These outputs will be employed in the coming season to further validate the study results.

# UPDATE ON THE FIRST NESTING SIZE OF THE SEA TURTLE *LEPIDOCHELYS KEMPII* FROM RANCHO NUEVO, TAMAULIPAS, MEXICO

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The Kemp's ridley turtle (*Lepidochelys kempii*) is an endemic species of the Gulf of Mexico, with approximately 90% of its population nesting at the Playa Rancho Nuevo Turtle Sanctuary in Tamaulipas. This species is classified as critically endangered by the International Union for Conservation of Nature (IUCN) due to multiple threats such as illegal fishing, marine pollution, habitat modification, and climate change. In response to the rapid decline of the population, a binational recovery plan was established between the United States and Mexico. In 2009, around 8,000 females were reported nesting, with projected growth of 19% annually between 2010 and 2020. Criteria were also established to remove the species from the endangered list (unlisting or delisting). However, various threats interrupted this trend, resulting in a population setback by 2017. This highlights the need for long-term monitoring to assess the recovery potential of the species, especially in long-lived organisms like sea turtles. Population behavior can be studied through the size of individuals, which is related to their fitness and sexual maturity. In recent years, a trend of decreasing turtle size has been observed, possibly in response to environmental and demographic changes. Factors such as the increase of neophyte turtles (smaller than remigrants), earlier sexual maturity, and decreased adult survival also contribute to this reduction in size. The objective of this study was to evaluate the trends in body size of Kemp's ridley turtles at the Playa Rancho Nuevo Sanctuary between 2018 and 2023. The sizes of 191 nesting turtles were recorded, finding an average size of 61.16±2.17 cm. Significant differences were observed between years, with the smallest average size recorded in 2020 (59.01±1.79 cm). Additionally, turtles were found to be smaller than previously reported for first nesting (61.8 ± 1.8 cm). This may be due to recovery efforts for the species, with the recruitment of smaller neophyte nesting turtles born after 2010 returning later to nest as remigrants at Rancho Nuevo, Tamaulipas. Recovery activities for the species are favorable, as if this good pace is maintained, the population may reach projected figures to downgrade its protection status or, even better, be removed from the endangered species lists.

# MICROPLASTIC POLLUTION AT QILIANYU, THE LARGEST GREEN SEA TURTLE NESTING GROUNDS IN THE NORTHERN SOUTH CHINA SEA

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Microplastics, new persistent pollutants, have recently attracted considerable attention. When present in beach sediments, microplastics may adversely affect the nesting and hatching of sea turtles on beaches. In this study, we investigate microplastic pollution at Qilianyu (northeastern Xisha Islands), the largest known nesting ground for green sea turtles (*Chelonia mydas*) in China. We found that the average abundance of microplastics in the beach surface sediments was 338.44 ±315.69 thousand pieces·m−3 or 1,353.78 ± 853.68 pieces·m−2, with foam and fragments as the main microplastic type identified. The microplastic particles were categorised as small and were predominantly within the 0.05–1 mm size category. Most microplastic particles were white (71.31%). Polystyrene and polyethylene were found to be the most common forms of plastic present. Microplastic pollution was not only observed on the beach surface but also at the bottom of nests approximately 60 cm may be harmful to the incubation of sea turtle eggs. We suggest removing plastic litter, especially small pieces of plastic, on beaches to reduce the threat of microplastic pollution to marine life, including sea turtles. Furthermore, the foam used in aquaculture should be recovered and replaced before it becomes fragmented due to age. In addition, regional cooperation between stakeholders in the South China Sea should be strengthened to collectively promote the reduction and cleanup of marine litter.

## POPULATION BIOLOGY AND MONITORING

# LONG-TERM CONSERVATION OF THE NESTING LEATHERBACK AND LOGGERHEAD TURTLES IN KWAZULU-NATAL, SOUTH AFRICA

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The discovery of nesting leatherback (*Dermochelys coriacea*) and loggerhead (*Caretta caretta*) turtles on the beaches of northern KwaZulu-Natal (KZN), South Africa, by the then Natal Parks Board (now Ezemvelo KZN Wildlife) in the early 1960s revealed that these turtles were being poached as they emerged to nest. A conservation monitoring programme was immediately implemented in 1963, with the primary objective to protect the nesting turtles, their nests, and progeny, and the secondary objective to monitor population recovery to evaluate the potential for sustainable harvesting. The secondary objective was abandoned following global declines in sea turtle populations, and the programme remained dedicated to protection and documenting the population response. It continued uninterrupted annually, having now entered its 61st year of implementation, taking its place amongst the longest-running conservation programmes of its kind in the world. Monitoring takes place annually from 15 October to 15 March of the following year along the 90km stretch of beach from Sodwana Bay to the South African/Mozambican border. Daily patrols (morning and night) are undertaken by teams of trained community monitors who document all nesting activity. Nesting turtles are measured and tagged when encountered. Long-term population trends are based on track counts in the 13km long index beach where consistent monitoring effort has been applied since programme inception. Conservation effort over this time has yielded variable success rates in the recovery of these nesting turtle populations. Both species exhibited rapid growth in the first decade of protection, with nesting trends deviating markedly for the 2 species thereafter. The nesting loggerheads exhibited exceptional recovery in the nesting trend, with individual numbers increasing from approximately 200 females to just under 800 individuals during the 2023/2024 nesting season. The nesting leatherbacks has shown a comparatively weaker yet positive response to conservation despite being subjected to identical beach protection protocols and possessing a reproductive strategy that theoretically surpasses that of the loggerheads. This population trend has stabilised over time, having recovered from an initial 5 individuals in the beginning to the current population size of approximately 80 individuals. The turtle conservation programme represents a complex interplay of successes and ongoing challenges. Despite this, South Africa ranks amongst the lowest for sea turtle poaching incidences in the region, thanks to robust legislation and the positive relationship between local communities and management authorities of the now iSimangaliso Wetland Park WHS which protects the turtle nesting beaches of South Africa. This programme is a model for sustainable, non-consumptive use of endangered species, having transformed the perception of turtles from a short-term food source to a long-term provider of economic opportunities via turtle-based tourism and employment opportunities as turtle monitors. This programme will continue to evaluate the latest population parameters for these two nesting species, their population trends and implementing adaptive management strategies where possible to enhance conservation outcomes. The IUCN statuses of these sub-populations demand a concerted effort to ensure their long-term survival, emphasizing the importance of both effective protected area management and broader collaborative conservation initiatives that extend beyond protected area boundaries.

# SOUTHWESTERN INDIAN OCEAN POPULATION GENETIC STRUCTURE AND JUVENILE ORIGIN OF THE HAWKSBILL TURTLE, *ERETMOCHELYS IMBRICATA*

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The Southwest Indian Ocean (SWIO), defined here as the waters bounded by the eastern coast of Africa between Kenya and South Africa to 74°E, and from 1°S in the north to 30°S in the south, is recognized as a key breeding and foraging area for hawksbill turtles (*Eretmochelys imbricata*). This species, whose populations have declined significantly worldwide in the past, is now listed as Critically Endangered by the International Union for Conservation of Nature (IUCN). Current knowledge of the population genetic structure and connectivity in the SWIO is restricted to the northern part of the region, where major breeding populations are located. However, genetic data from other, less important, nesting sites and, importantly, from developmental foraging areas throughout the rest of the SWIO remain limited. To fill this gap and understand population structure and connectivity within the SWIO and with the rest of the Indian Ocean, this study assessed genetic diversity within hawksbill rookeries and foraging aggregations and investigated the natal origin of juvenile foraging aggregations using mixed stock analysis (MSA). We analyzed the mitochondrial (mt)DNA control region (CR; 766-769 bp) sequenced from females and hatchlings across five rookeries, and foraging juveniles from nine developmental areas, sampled between 2004 and 2022. Data was further combined with previously published sequences from the wider Indo-Pacific, leading to a comprehensive genetic dataset for hawksbills throughout the Indian Ocean. Our analysis identified 32 haplotypes, including two new found in rookeries and six in foraging groups, and revealed a high haplotypic diversity. Results confirmed strong genetic differentiation between SWIO rookeries and those in the broader Indo-Pacific, with only two haplotypes shared between groups and the rest unique to the SWIO region. High genetic connectivity was also observed among SWIO rookeries, except for the small population in the northern Mozambique Channel, which showed low gene flow and slight genetic divergence from other rookeries. The MSA showed that juveniles (in all mixtures), originated mainly from the Southwest Indian Regional Management Unit (contributions > 75%), with minor contributions from other Indo-Pacific stocks, found particularly in the Mozambique Channel mixture. However, the presence of orphan haplotypes in our study suggests that there remain possible unknown or unsampled rookeries in the region, or incomplete sampling of known rookeries. This study is the first to provide a detailed insight into the genetic structure of nesting hawksbill populations and juvenile foraging groups across the SWIO. We reveal distinct genetic patterns along the Mozambique Channel, highlighting the critical role of this region in hawksbill turtle conservation. Further monitoring and sampling should be carried out in these small, isolated, and vulnerable populations to refine our understanding of their genetic structure and inform targeted management strategies. Genetic connectivity studies remain essential to ensure that effective conservation strategies are designed and implemented, particularly to identify and protect isolated or vulnerable populations.

## POPULATION TRENDS OF GREEN TURTLES ON THE ISOLATED ATLANTIC ISLAND OF FERNANDO DE NORONHA AFTER 35 YEARS OF PROTECTION

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Understanding ecological parameters and population trends is crucial for species of conservation concern. For marine turtles, annual nest counts are commonly used to estimate population size. However, reliable population estimates also require complementary information on reproductive parameters, such as clutch size, internesting intervals, clutch frequency, and remigration intervals. In Brazil, green turtles (*Chelonia mydas*) predominantly nest on oceanic islands. This study uses long-term beach monitoring data (1988-2022; 35 years) collected by TAMAR (the Brazilian Sea Turtle Conservation Programme) to describe the reproductive biology and population trends of green turtles in the Fernando de Noronha Archipelago. A significant increase in the annual number of green turtle nests over the study period was found. The average annual number of nests in the first five years of monitoring (1988-1992) was 39, compared to 286 nests in the last five years (2018-2022). This represents a 7.39-fold increase, from a total of 193 nests to 1428 nests. Internesting intervals ranged from 9 to 17 days (mean +- SD = 11.7 ± 1.3 days; median = 12, n = 1236). Remigration intervals of 3 years were the most frequent (range 2 to 16 years). The longest reproductive life span observed was 25 years. Average hatching success was 75.6% (SD = 24.8, range = 0-100, n = 2612 nests). The growth in the annual number of green turtle nests observed in Fernando de Noronha suggests that conservation efforts initiated by TAMAR in the 1980s have likely contributed to the recovery of this population. Despite this positive trend, the population remains a conservation concern due to its small size and restricted nesting distribution. The findings underscore the importance of continued and enhanced conservation efforts to ensure the long-term viability of green turtle populations in the region. Our study highlights the critical role of long-term monitoring in understanding population dynamics and informing conservation strategies. By maintaining and expanding these efforts, we can better support the recovery and sustainability of green turtle populations in Brazil and beyond.

## UPDATED GLOBAL CONSERVATION STATUS AND PRIORITIES FOR MARINE TURTLES

**IUCN Marine Turtle Specialist Group Burning Issues Working Group**

*IUCN Marine Turtle Specialist Group*

Assessing conservation status and pursuing applicable management priorities for marine megafauna across multiple scales pose significant challenges. Because marine turtles exemplify these challenges, the IUCN Marine Turtle Specialist Group (MTSG) developed the ‘conservation priorities portfolio’ (CPP) framework

in 2011 to evaluate population risk and threats for regional management units (RMUs). Here, the MTSG updated the 2011 CPP framework through an inclusive assessment process. Expert elicitation results involving 145 individuals from 50 countries indicated that marine turtle conservation status appears to be improving, but significant challenges remain. Since the previous assessment, long-term trends increased on average, and threat impact scores improved for nearly twice as many RMUs (53%) as worsened (28%) (≥ 10% threshold for changes in numeric scores). While expert-assessed threat impacts have generally decreased, fisheries bycatch remains the highest scored threat across regions and species. Risk-Threat categories improved for a majority (54%) of RMUs. Over 40% of RMUs were scored as Low Risk-Low Threats, eight of which were green turtles (*Chelonia mydas*). Less than 20% of RMUs were scored as High Risk-High Threats, four of which were leatherback turtles (*Dermochelys coriacea*). Most High Risk-High Threats RMUs were in the Pacific Ocean, while most Low Risk-Low Threats RMUs were in the Atlantic Ocean. Eleven RMUs were evaluated as critical data needs. Our results—also provided through an interactive data dashboard—underscore the importance of context-specific planning to effectively target limited conservation resources. Future assessments should further prioritize inclusion of under-represented topics, researchers, and regions to better address multi-faceted conservation challenges.

## TRENDS IN SIZE AT MATURITY OF *CHELONIA MYDAS* (GREEN TURTLE) IN THE JOÃO VIEIRA AND POILÃO MARINE NATIONAL PARK, GUINEA-BISSAU, WEST AFRICA

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Over recent decades, a reduction in size at maturity has been reported among marine turtles. Such size reduction may result from factors like population growth dynamics and elevated adult mortality rates. Larger turtles have been shown to produce more extensive clutches and may experience advantages in both mate attraction and predation avoidance, suggesting that declining size at maturity could undermine reproductive success. Despite the fact that Poilão Island hosts the largest green turtle (*Chelonia mydas*) nesting population in the East Atlantic, among the largest globally, , there remains limited understanding of female size trends within this population. This study addresses this gap, aiming to evaluate the reproductive size of nesting green turtles at Poilão Island over the past two decades. We assessed the curved carapace length (CCL) of 1,535 nesting turtles, finding CCLs ranging from a minimum of 81.0 cm to a maximum of 118.0 cm, with a mean of 102 cm ± 5.70 cm. Clutch sizes were recorded for 989 turtles, ranging from 80 to 199 eggs, with a mean of 128 ± 24.2 eggs; notably, larger females consistently produced larger clutches. Over the 1994–2022 period, no statistically significant change in average size at maturity was observed among the nesting turtles. These findings contribute important baseline data, facilitating future conservation and management efforts within this globally significant green turtle population.

# SEXUALLY DIMOPRHIC TRANSCRIPTION AND DNA METHYLATION BLOOD PROFILES OF LOGGERHEAD (*CARETTA CARETTA*) HATCHLINGS INCUBATED AT CONTROLLED TEMPERATURES*

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Sea turtle populations are especially vulnerable to climate change due to the nest environment inducing hatchling sex via temperature-dependent sex determination (warm female-cool male). The rapid increase of global temperatures risk producing extremely female-biased hatchling sex ratios, potentially leading populations to extinction. The lack of exact quantification of primary sex ratios highlights the need to assess hatchling sex ratios broadly on nesting beaches. Currently, there are only two reliable methods of identifying hatchling sex: gonadal histology and laparoscopic examination of the gonads. The former requires sacrificing hatchlings, which is counterproductive to enhancing hatchling production, and the latter requires specialized surgical skills and aquaculture facilities as hatchlings need to be reared for several months prior to laparoscopy. The need for a non-lethal method to identify sex in hatchlings has led researchers to look for biomarkers in tissues obtained via minimally invasive methods. Because blood transports hundreds of signaling molecules and is nucleated in reptiles, it is an ideal target to search for diverse sex-specific biomarkers. Although sea turtles lack sex chromosomes, the incubation temperature induces sex-specific genetic cascades that determine the fate of the bipotential gonad. Thus, distinctive gene expression patterns occur in the gonads at specific embryonic stages. This dimorphic pattern likely is regulated, in part, by DNA methylation. Until now, it was unknown if sex-specific DNA methylation and gene expression patterns were also present in hatchlings and in non-gonadal tissue. Here, we used a multi-omics approach to examine red blood cells (RBCs) for sex-specific markers at DNA methylation and transcriptional levels in male and female loggerhead (*Caretta caretta*) hatchlings. Hatchlings were incubated at a male producing temperature (27°C), a mixed sex ratio temperature (30°C), and a female producing temperature (32°C), with sex verified through laparoscopy. Our genome-wide discovery studies identified sex-specific differential methylation at over 700 genomic loci and 11 differentially expressed genes, revealing a set of molecular biomarkers for hatchling sex identification. Next steps are to validate the top sex-specific biomarkers in in situ (natural nest) samples of known sex. Once validated, these biomarkers may be used to develop minimally invasive methods for identifying hatchling sex. Such techniques will enhance our ability to measure sex ratios across nesting beaches worldwide, a crucial step in assessing and mitigating the impacts of climate change on sea turtle populations threatened with extinction. Ultimately, the application of the novel technique will provide the opportunity to make informed management decisions based in science.

# MERGING THE FUTURE AND THE PRESENT OF TURTLE CONSERVATION GENOMICS

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The availability of sea turtle reference genomes and the price reduction of Whole Genome Sequencing (WGS) techniques coupled with the increased computing capabilities will lead to a near future where whole genome resequencing of hundreds of individuals will be available, even for species with large genomes. However, the budgets for population genomic studies are currently still limited and genome reduced representation sequencing techniques (RADseq) are generally used to unveil sea turtles' population differentiation, origin of stranded individuals, or foundation of new nesting areas among others. Different genome reduction techniques are being used in different species and laboratories rendering cross-studies difficult to compare. Moreover, samples will not always be available for comparisons across space and time and thus there is a need to develop a methodology to allow merging the present and the future of sea turtle genomics. In anticipation of that day, we used data from 11 *Caretta caretta* individuals from four Regional Management Units (RMUs), two from the Pacific, one from the North West Atlantic, five from the North East Atlantic and three from the Mediterranean. We sequenced each individual using both 2b-RAD and WGS to assess the potential of combining genomic data obtained using different methodologies. We evaluated the population structure inferred by the two types of data and how to merge them using four different strategies. As a preliminary step, we genotyped and filtered each methodology separately and observed the same pattern of genetic differentiation among individuals with 2b-RAD (4,523 SNPs) and WGS (8,062,514 SNPs), with the two first axes separating individuals according to their RMU. In the first strategy, we jointly genotyped the raw reads from both methodologies and kept all filtered SNPs (16,877 SNPs) resulting in the same pattern of genetic differentiation observed above in the first axis but the second axis separating methodology. In the second strategy, we genotyped and filtered separately both types of data and kept the 2bRAD SNPs in the WGS dataset (3,669 SNPs). We observed an overlap of the genotypes obtained with both methodologies, and separation according to RMU. In the third strategy, we jointly genotyped the raw data from both methodologies and kept the 2bRAD SNPs (4,539 SNPs) and observed the same pattern as in the second strategy but keeping higher SNP number, demonstrating the feasibility of combining RADseq and WGS data. Finally, we evaluate the percentage of concordant and discordant loci in the three strategies and discuss the nature of the discrepancies. The results obtained demonstrate that it is possible to combine RADseq and WGS data and we provide a method for optimal merging of the data. The integration of RAD and WGS data will be key for combining genetic analyses across laboratories and merging data across oceans. Sea turtles' conservation will be more effective if its wide distribution can be analysed globally, since they can migrate over long distances during their feeding period. Our results lay the foundations for future genomic investigations and ensure that the samples analysed currently will help refining the origin of unknown individuals.

# FROM GENOMES TO CONSERVATION: POPULATION STRUCTURE AND ADAPTIVE VARIATION IN LOGGERHEAD SEA TURTLES ACROSS RMUS*

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In an era of rapidly changing ocean conditions, understanding the evolutionary history and genetic diversity of marine species, such as sea turtles, is crucial for effective conservation strategies. The recent advances in Next-Generation Sequencing (NGS) and availability of reference genomes now allow for deeper investigation of within-species genetic diversity, population structure, and historical changes over time. However, a single genome cannot represent the diversity of a species and structural and sequence polymorphisms across populations may influence conservation strategies in different ways. We performed whole genome sequencing (> 30 Gb output) on 27 individuals of loggerhead sea turtle (*Caretta caretta*, Linnaeus 1758) from four different Regional Management Units (RMU): North Pacific (Mexico: 2), North-west Atlantic (Mexico: 2; USA: 2), Northeast Atlantic (Cabo Verde: 5) and Mediterranean (Italy: 2; Libya: 5; Greece: 4; Türkiye: 5). We genotyped all samples by mapping their reads against the reference genome (GCA_023653815.1) to produce a set of more than 10 million nuclear single-nucleotide polymorphisms (SNPs) across the individuals, with the number of SNPs per chromosome highly correlated to chromosome size. We conducted a multidimensional scaling analysis, which revealed that all individuals clustered according to their RMU. The genetic distances, measured by Fst values (a metric that quantifies population

genetic), confirmed this pattern, showing a high differentiation for the Pacific RMU, while the two Atlantic RMUs appeared less distinct from each other. In our pairwise Fst comparisons across chromosomes, we identified extreme values in certain genomic regions. Notably, we found that the Mediterranean RMUs exhibits common significant high differentiation in several chromosomal regions compared with the two North Atlantic RMUs, suggesting that these regions could be candidates for local adaptation. This differentiation may be influenced by distinct environmental factors or other selective pressures unique to the Mediterranean and Atlantic regions. We also analyzed Runs of Homozygosity (ROHs), genomic regions where identical haplotypes are inherited from each parent, to assess the level of inbreeding across populations, as inbreeding can generally increase the presence of rare deleterious variants in homozygous form. Our analysis of ROHs showed that the degree of inbreeding was uneven across RMUs. The individuals from the Mediterranean had genomes with longer ROHs and a higher portion of the genome in homozygosity, indicating higher inbreeding. Moreover, the ROHs distribution across the 28 chromosomes was not uniform, as macrochromosomes (chromosomes 1 to 11) had a higher proportion of their content in homozygosis than microchromosomes. Overall, using multiple genomes from different RMUs alongside the reference genome provides a robust framework to uncover the genetic basis of key traits and population differentiation in loggerhead sea turtles. Our findings on inbreeding and ROH distribution emphasize the importance of preserving genetic diversity to enhance population resilience. Whole-genome data provide valuable insights that guide conservation strategies aimed at preserving the genetic integrity and adaptive potential of sea turtles in response to multiple pressures.

## TRENDS IN NESTING PHENOLOGY OF GREEN AND LOGGERHEAD TURTLES IN THE CAYMAN ISLANDS: A 26-YEAR PERSPECTIVE

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Climate-driven shifts in the phenology of species are altering ecosystems worldwide, with marine turtles being particularly vulnerable to rising temperatures. Here, we present a 26-year analysis of nesting phenology and population trends for green (*Chelonia mydas*) and loggerhead (*Caretta caretta*) sea turtles in the Cayman Islands. For both species, the onset of nesting has significantly advanced, as has been observed at other sites ranging from the Atlantic (USA), Mediterranean (Northern Cyprus) to the Indopacific (Australia). In Cayman, the onset of green turtle nesting has significantly advanced at a rate of 0.6 days.yr-1, while the end of the nesting season has been delayed by 1.0 days.yr-1, leading to a significant extension in the overall duration of the nesting season by 1.6 days.yr-1. In contrast, loggerhead turtles have experienced a significant advancement in nesting onset at a rate of 0.7 days.yr-1, but no significant changes were observed in the end of the nesting season or its duration over the study period. The peak of nesting however, has not changed significantly over this period for either species, suggesting that the observed changes in the onset and duration of nesting may be driven by demographic factors, including population recovery as well as temperature change. SST in proximity to the nesting beaches was a better predictor of the onset of nesting than temperature at known foraging sites, with warmer temperatures strongly correlated with earlier nesting, with green turtles advancing their nesting by approximately 11.4 days for each 1°C increase in April SST and loggerhead turtles by 13.5 days for each 1°C increase in March SST. Understanding phenological responses to rising temperatures is important to ascertain the thermal window

for egg incubation and whether current levels of offspring sex ratios and hatching success will be maintained, thus mitigating some of the long-term effects of climate change on sea turtle populations.

## NEW INSIGHTS INTO THE HAPLOTYPE SEQUENCE ANALYSIS OF *CARETTA CARETTA* IN BCS, MEXICO: A COMPARATIVE STUDY WITH NEW AND PREVIOUSLY RECORDED SEQUENCES*

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The loggerhead sea turtle (*Caretta caretta*) is a globally distributed species, yet its populations are classified as vulnerable, with a clear trend of demographic decline. The North Pacific population is notably small and exhibits low genetic diversity. This preliminary study focuses on the genetic diversity of *C. caretta*, or loggerhead turtles, in Baja California Sur (BCS), Mexico. The research aimed to refine the genetic stock definition of loggerhead turtles in the Mexican Pacific and to estimate their genetic diversity. This region represents the most critical feeding ground for the North Pacific population and has the highest documented bycatch mortality rates. Despite its significance, it remains the least studied in terms of genetic research, making this investigation essential for future conservation efforts. To better define the genetic pool of Mexican Pacific loggerhead turtles, we analyzed the mitochondrial control region (CR) using previously reported sequences along with new ones from this study. Samples yielded fragments of 350 bp from nine individuals and 808 bp from six individuals. Analysis of the 350 bp fragments revealed two previously reported haplotypes (B and C) shared between Japan and Baja California Sur (BCS), along with one potential new haplotype. In the 808 bp fragments, six unique haplotypes exclusive to BCS were identified. The 350-bp fragments exhibited lower haplotype diversity compared to what was reported in 1995 in BCS. In contrast, the 808-bp fragment demonstrated higher haplotype diversity due to significant sequence variability among the six new haplotypes identified, which included 25 segregating sites. Increasing the sample size is likely to result in more redundant haplotypes in the 808-bp fragments and enhance the overall haplotype diversity in the 350-bp fragments.

# A BASELINE STUDY FOR SEA TURTLE NESTING SITES IN THE SAUDI ARABIA RED SEA

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Green turtles (*Chelonia mydas*) and hawksbills (*Eretmochelys imbricata*) are consistently present along the Red Sea, where they are considered to spend a significant portion, if not all, of their life cycle. Monitoring efforts on these populations in Saudi Arabia (KSA), extending from the early 1980s to the present, have provided valuable insights into nesting behavior and index of abundance for both species, particularly in the northern Red Sea. However, knowledge of these aspects remains limited for the central and southern regions, highlighting gaps in rookery distributions and nesting seasonality. In alignment with the mission of SHAMS (General Organization for the Conservation of Coral Reefs and Turtles in the Red Sea) to enhance the understanding of sea turtle ecology and populations dynamics in the region, this baseline study aims to systematically identify the nesting sites and establish the nesting seasons for both species along the different regions of the KSA Red Sea. To achieve this objective, we first conducted a detailed analysis of high-resolution satellite imagery to identify potential nesting areas, supported by an extensive literature review of previously documented sites. A total of 1,829 nesting sites (potential or confirmed) were identified along the 1,760 km coastline of the KSA Red Sea, with 1,176 on the mainland and 653 on islands. A rapid assessment methodology was employed to ground truth nesting activity; nests per species were recorded and geo-referenced through drone and/or on-foot surveys, while beach characterization, habitat assessment, and threat evaluation completed the site assessment. SHAMS has surveyed 679 of these sites to date, confirming nesting activity at 407 sites, with half located in the northern region. Among these, 108 sites support both species, 93 are exclusive to green turtles, and 85 solely to hawksbill turtles (species identification was not possible at the remaining confirmed nesting sites). Based on the nesting density and ecological significance of each site, we aim to identify index sites for focused monitoring, enabling accurate assessments of nesting season durations and other key reproductive and demographic parameters across the Red Sea. These index sites will also serve as references for establishing protected areas, such as the case of the Four Sister Islands, currently in the early stages of being proposed as an Important Marine Turtle Area (IMTA). This pristine archipelago, located in the Farasan Banks of the southern Red Sea, comprises four small islands with a combined nesting area of approximately 0.15 km². It has recorded 2,431 nesting events for green turtles and 401 for hawksbills, representing the largest combined rookery for both species documented in the Red Sea. A network of protected areas will contribute toward implementing harmonized conservation programs across the KSA. This is particularly important for the hawksbill turtle, a species listed as critically endangered on the IUCN Red List, as the southern waters of the Red Sea may serve as a vital ecological refuge, crucial for the species' long-term viability within the Northwest Indian RMU (Regional Management Unit).

# WHAT CAN 5.5-YEAR OF PHOTO-ID DATA TELL ABOUT THE SEA TURTLE POPULATION DYNAMICS AND HABITAT USE IN A COASTAL FORAGING GROUND? A CASE STUDY FROM SOUTHERN KENYA

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Kenya's coastline, a global biodiversity hotspot, provides critical habitat for sea turtles. To address knowledge gaps and inform effective conservation strategies within the Diani-Chale Marine National Reserve (DCMNR), a long-term photo-identification study was initiated in 2018. Over a 5.5-year period (July 2018-December 2023), 3,706 in-water sea turtle encounters were recorded during scuba diving surveys, primarily involving green turtles (*Chelonia mydas*, n=3,095) and hawksbill turtles (*Eretmochelys imbricata*, n=611). Photo-identification efforts led to the identification of 648 unique green turtles and 81 unique hawksbills. At their initial sighting, SCL was estimated for most of the observed turtles, with the majority of the green turtles classified as juveniles (n=582), followed by subadults (n=38) and adults (n=16). In contrast, most hawksbill turtles were subadults (n=65), followed by juveniles (n=19) and adults (n=1). During the study period, 377 green turtles (61.7%) and 50 hawksbills (61.7%) were re-sighted within the DCMNR. The maximum number of resightings for an individual green turtle was 86, and for a hawksbill turtle, it was 83. The longest resighting interval was 1957 days for both species. Using open capture-recapture models, we estimated population size, recruitment rates, and departure rates for both species. Additionally, we identified preferred foraging habitats and assessed site fidelity and residency durations. Key sea turtle hotspots within the DCMNR include Galu, Kisima Mungu, Milele, and Mwanamochi dive sites. Galu emerged as the most significant site, with 115 green turtles and 14 hawksbills identified (CPUE = 5.3 sightings per hour). Kisima Mungu followed with 89 green turtles and 13 hawksbills (CPUE = 2.3 sightings per hour). Milele recorded 85 green turtles and 7 hawksbills (CPUE = 3.9 per hour), while Mwanamochi had 93 green turtles and 9 hawksbills (CPUE = 4.0 per hour). Our results indicate that the DCMNR harbors a stable and significant green turtle population along Kenya's southern coast. We have identified key sea turtle hotspots within the reserve that would benefit from increased protection and management measures. By mapping these areas, we've created a valuable tool to inform future management decisions for the DCMNR. This comprehensive approach, utilizing photo-identification techniques, demonstrates the potential for broader-scale applications along the Kenyan coast to understand connectivity and habitat use among sea turtle populations.

# EXPLORING GENETIC DIVERSITY OF SEA TURTLES BY MITOGENOME ANALYSIS

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To conserve and protect organisms that are at risk or in danger of extinction, it is crucial to conduct genetic studies that provide insights into their genetic variability and evolutionary dynamics. These studies enhance our understanding of genetics and inform the development of conservation policies and management strategies. Analyzing the mitochondrial DNA of sea turtles is vital for creating effective conservation strategies and implementing protection policies. This analysis also aids in managing their ecosystems and populations whether as a whole or in isolation allowing us to strategically plan for the conservation of these species and their habitats for future generations. This study aims to analyze the genetic diversity of marine turtle species by mitogenomes available in GenBank. All accessible mitogenomes for seven marine turtle species were downloaded in FASTA format and organized into an Excel database. A total of 96 sequences were aligned using BioEdit and saved in FASTA format. The DnaSP software was employed to evaluate polymorphisms, determine the number of haplotypes, and assess haplotypic and nucleotide diversity. The optimal model was established using IQ-TREE software based on Bayesian Information Criterion (BIC), and base-binding parameters and frequencies were calculated. Lastly, FigTree software was used for editing and visualizing the phylogenetic trees. Out of 96 mitochondrial DNA sequences analyzed, seven were from *Chelonia mydas*, ten from *Lepidochelys kempii*, four from *Eretmochelys imbricata*, 67 from *Caretta caretta*, four from *Lepidochelys olivacea*, and two each from *Dermochelys coriacea* and *Natator depressus*. The alignment was 16, 050 base pairs in length. The IQ-TREE software identified the evolutionary model as GTR+F+G4. It also revealed base substitution rates and frequencies, with A-G and C-T substitutions being the most frequent. Notably, C-T had the highest substitution rate. Nucleotide frequency analysis showed that adenine was the most common base while guanine was the least common, potentially influencing mutation rates and evolutionary patterns. We identified a total of 3,667 parsimony-informative sites and 11,242 conserved sites. A total of 41 haplotypes were identified among the various species: 18 for *Caretta caretta*, 7 for *Chelonia mydas*, 8 for *Lepidochelys kempii*, 3 for both *Eretmochelys imbricata*, and *Lepidochelys olivacea*, 1 for *Dermochelys coriacea*, and 2 for *Natator depressus*. The haplotype ratio for these species stands at 0.42, based on the analysis of 41 haplotypes and 96 mitogenome sequences. The phylogram differentiated between species, showing distinct clades for each family, Cheloniidae and Dermochelyidae. As anticipated, *D. coriacea* stands out as the most distantly related species to the root node. Its short branches clearly indicate that it has not accumulated as many mutations as other species. With bootstrap values of 100, the application of maximum likelihood unequivocally provides strong statistical support for the illustrated phylogenetic relationships. This analysis demonstrates that mitogenome research yields multiple markers, serving as powerful tools for comparison across genera and species. In conclusion, a comprehensive examination of all available genes is an essential method for accurately assessing the genetic diversity of these species.

# LONG-TERM TREND OF THE NORTHEAST ATLANTIC LOGGERHEAD BREEDING COLONY NESTING IN CABO VERDE, WEST AFRICA

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Population abundance and trend analysis are essential to conduct conservation assessments at local and global scales, and for guiding conservation management strategies and policy. For sea turtles, monitoring population abundance is particularly challenging because of their scale of distribution, migratory nature, complex life cycles, long generation times and cryptic early life stages. For this reason, nesting beaches serve as a valuable focus, mainly because nests can be easily counted and evaluated, compared to the difficulty of counting individuals at sea. Even though nest numbers are an indirect representation of adult female abundance (only one part of the global population), any fluctuations observed in nest numbers are the cumulative result of events (threats, impacts, food abundance, etc.) that occurred prior, on the nesting beaches or in the water. These limitations notwithstanding, annual nest counts remain the most helpful index of sea turtle population abundance and trends, which can be widely and systematically obtained, compared among locations, and tracked over long time series. The Northeast Atlantic RMU, breeding in Cabo Verde (West Africa), has been categorized as "endangered" in the last IUCN Red List status review, mainly because their area of occupancy is relatively small (< 500km$^2$), and the rookery is subject to constant anthropogenic pressures causing a decline in habitat area, extent and quality. This RMU has been considered the third largest loggerhead nesting subpopulation in the world (after the Northwest Atlantic RMU (principally Florida, United States) and the Northwest Indian Ocean RMU (mainly on Masirah Island, Oman), both with more than 20,000 nest per year), based on first census conducted on Boa Vista Island (12,000 – 20,000 estimated nests per year from 2007 to 2009). Moreover, in the last 15 years different NGOs and local associations have been actively involved on sea turtle conservation in the entire archipelago, and relevant information about nesting female's abundance and nest trends has been obtained, demonstrating that the Cabo Verde breeding colony is considerably larger than previously estimated. Data from the four islands with more than 10 years of standardized beach surveys (Boa Vista, Sal, Maio and Santa Luzia) were exhaustively analyzed to obtain the first nest trend analysis of this important rookery, showing that the nest trend of the Cape Verde loggerhead colony has experienced a strong increase, unique in the world, turning Cabo Verde the nesting site with larger number of loggerhead nests in the world (average 150,000 estimated nest per year in the entire archipelago from 2019 to 2023). Different hypotheses were proposed and analyzed to try to understand and explain the main causes of this important increase.

# LOGGERHEAD SEA TURTLE GOES HOME: THE GENOMIC STRUCTURE OF CONSERVATION UNITS*

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Highly migratory species pose challenges in conservation and management due to the complexity of their life cycles. For these reason, different categories of conservation units have been defined for marine turtles at different geographical scales to cover the management needs. Management units (MUs) were first defined as population genetically isolated thus deserving an independent management. Mitochondrial DNA has been widely used to define MUs for all species, although the male component is not considered while using this maternally inherited marker. However, turtles from different MUs often share migratory routes and foraging habitats. Regional Management Units (RMUs) were thus defined by integrating habitat use with the already defined MUs to represent distinct regions for conservation and management purposes. Finally, an intermediate level of SubRegional Management Units (SubRMUs) has been proposed for the Mediterranean based on shared modelled hatchling trajectories among different MUs. To test the genomic signatures matching these potential levels of structuring for conservation in the loggerhead turtle, we sampled 278 individuals at 13 nesting populations from three regional management units: Mediterranean (MED RMU: 238 individuals from 3 SubRMUs (Greece, Libya and Levantine) including 11 populations), North-West Atlantic (NWA: 15 individuals from 2 populations) and North-East Atlantic (NEA: 25 individuals from 1 population). We genotyped all individuals using 2bRAD methodology resulting in 6,626 biparentally inherited SNPs distributed homogeneously across all chromosomes. All the individuals were clearly clustered in three groups using a DAPC that corresponded to the three RMUS. When plotting only the individuals from the Mediterranean RMU, three clusters were obtained with some overlap, corresponding to the three proposed SubRMUs. When performing pairwise comparison among populations, three different levels of Fst were detected from RMU (mean Fst 0.05294 ± 0.009, mean ± SD), SubRMU (mean Fst 0.01180 ± 0.005, mean ± SD) and MU (mean Fst 0.00438 ± 0.002, mean ± SD) confirming the hierarchical structure of the species. Within the Mediterranean, up to seven Management Units were defined 1) Zakynthos and Kyparissia, 2) Messara, 3) Rethymno, 4) Dalyan, Belek, Akamas and Alagadi, 5) Lebanon, 6) Israel and 7) Lybia. Considering that the RMU and SubRMU levels were initially defined using dispersal information on hatchlings, juveniles and adults, we can conclude that dispersal at these stages also influence the general patterns of gene flow leaving a footprint in the genome. Up to this point, we can confirm that despite the highly migratory behavior, the philopatry of the species is reflected in the genome of the species. Our findings demonstrate that genomic tools provide robust insights into the high genetic structuring of *Caretta caretta* at three different hierarchical levels: RMU, SubRMU and MU. These results have critical implications for conservation strategies, particularly in identifying individuals distributed across overlapping RMUs, ensuring more precise and effective management efforts.

## ADVANCING SEA TURTLE CONSERVATION THOUGH THE SHELLBANK GLOBAL DATABASE

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The ShellBank project is a global initiative aimed at enhancing marine turtle conservation through the development of an extensive, open-access genetic database. Available to researchers, NGOs, governments, students and more worldwide, this platform facilitates collaborative research and conservation efforts. By cataloguing mitochondrial DNA (mtDNA) haplotypes from diverse marine turtle populations, the ShellBank database serves as an essential tool for defining population structure and tracing the geographic origins of turtles encountered in conservation (e.g. foraging ground studies and fisheries by-catch) and enforcement scenarios (Illegal wildlife trade). The database supports efforts to combat illegal wildlife trade and informs conservation strategies by providing easy access to comprehensive, up-to-date reference data necessary for more advanced analysis such as mixed stock analysis. ShellBank's capabilities extend beyond genetic data storage. Users can search metadata from all published marine turtle studies with data in the database, including location, authors, country, regional management units (RMUs), stock information and more. The platform allows users to upload their data and download queried data, facilitating further research and analysis. ShellBank also standardizes haplotype data for marine turtles enabling direct comparison across studies. Haplotype data can be searched using haplotype names or sequence-based queries to find matching sequences within the database. Additionally, reporting tools provide data visualization and summaries on maps and in haplotype frequency tables based on user queries. We present the latest advancements in the ShellBank database, emphasising its expanded geographic and species coverage containing more than 15.000 data entries. We also demonstrate its use and applications through examples including tracing the origins of hawksbill turtles in illegal tortoiseshell trade seizures and collaborative efforts to fill critical data gaps. These applications underscore the importance of strengthening regional baselines for improved accuracy. This poster aims to engage the international sea turtle research community by showcasing the value of ShellBank in addressing key conservation challenges, fostering global partnerships, and shaping future strategies for identifying and bridging data gaps in marine turtle conservation.

## MARINA OBSERVATION OF SEA TURTLES: LESSONS LEARNED THROUGH FOUR YEARS OF PHOTOGRAPHS

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Juvenile green sea turtles are commonly seen in the Intracoastal Waterway in St. Augustine, FL, USA. Typically, these turtles would be feeding on submerged aquatic vegetation (SAV) but the turbidity of the local waters prevents the growth of adequate SAV. To compensate, juvenile turtles are seen feeding on the biofouling community growing on local docks. Starting 3 June 2020, two marinas: Camachee Cove Yacht

Harbor and Conch House Marina, were walked weekly and all sea turtles were photographed, specifically aiming for the head scales. Photographs were captured using a Canon EOS Rebel T7 digital camera and all photos were uploaded to Internet of Turtles (IoT). The IoT program uses machine learning and multiple computer assisted algorithms to determine matches between new observations and turtles already identified in the database. As of 30 June 2024, 459 turtles seen in the wild were identified as unique turtles. Of these 459 turtles, 287 were seen once, while one turtle was seen 60 times from June 2020 – April 2023. When calculating days between first and most recent sighting, 30 turtles were documented between 1 – 2 years, 17 were seen between 2 – 3 years, and seven were seen between 3 – 4 years. It appears there are two recruitment periods of new turtles to the Intracoastal Waterway based on the prevalence of new turtles to the database: May – June and October – November. These data indicate green sea turtles use this area as a foraging ground and have residence times lasting years while members of the population change throughout the year.

## GENOMIC INSIGHTS AND MORPHOMETRIC DIVERGENCE IN LOGGERHEAD TURTLES: THE ROLE OF HYBRIDIZATION IN EMERGING POPULATIONS*

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The increase in nesting activity in the Western Mediterranean of the loggerhead turtle (*Caretta caretta*) is considered to be a response to changing environmental conditions resulting from global warming. In this context, it is important to trace the origin of individuals nesting in the Western Mediterranean and to evaluate the associated possible fitness consequences. To do so, we analysed 87 samples of hatchlings belonging to 21 nests laid along the Spanish eastern coast in 2023. Samples were processed using the 2bRAD genotyping method, obtaining a total of 5,925 curated SNPs. First, we inferred the population of origin of the samples using Individual Assignments and a previously built baseline including nesting individuals from several populations in three regional management units (Northwest Atlantic, Northeast Atlantic and Mediterranean). The hatchlings of almost all nests (19) were assigned to the eastern Mediterranean region (predominantly Greece or the Levantine region), one nest associated to the Northwest Atlantic (indicating that both parents had the same Atlantic origin), and one was classified as an admixture of Northwest Atlantic and the Mediterranean regions. Second, we tested whether hatchlings had morphometric differences according to the origin of their parents and whether admixed individuals had higher bilateral asymmetry, an indicative of potential outbreeding depression. Nests were morphometrically studied according to the inferred origin of the breeders: Mediterranean, Atlantic and admixed. We also confirmed that there is no sexual dimorphism regarding the carapace of hatchlings for

the three types of nests, to ensure that there is no sex bias. The three groups showed statistically different carapace morphologies: the Atlantic group had a more hydrodynamic shape, the Mediterranean group had a rounder shape, and the hybrid group showed an intermediate morphology. These findings suggest that the size differences that are detected in adults from natural populations may have a genetic basis, as we detected shape differences already in hatchlings from different origins laid in the same region. Additionally, the effect of the centroid size on shape varied among the groups studied, raising the question whether different subpopulations have distinct strategies for survival in the premature stages. Furthermore, the hybrid nest presented higher values of fluctuating asymmetry (FA), which could be associated to outbreeding and potentially negatively affecting fitness. This study provides a foundation for future research concerning the effect of hybridization on reproductive fitness and highlights the need to evaluate the vulnerability of the rising establishment of a resident population in the Western Mediterranean.

## ASSESING TAG LOSS AND PIT TAG DETECTION RATES IN GREEN TURTLES (*CHELONIA MYDAS*) NESTING IN TORTUGUERO, COSTA RICA

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Monitoring sea turtle populations over time requires identification of unique individuals. For this purpose, metal flipper tags have been traditionally used to mark turtles on nesting beaches and foraging areas. Capture-mark-recapture models (CMR) can assess population numbers, site fidelity, and growth rates. Individuals that lose all external identification pose a problem for population assessments through CMR, since previously tagged turtles become indistinguishable from the rest of the individuals, often leading to population overestimation. Internal passive integrated transponder (PIT) tags are small, encapsulated microchips applied subcutaneously that have no reported effect on the behavior and biology of tagged turtles and can remain lodged under the turtle´s skin permanently. PIT tags offer a solution to the tag-loss problem, allowing continued identification despite the loss of external tags; however, PIT tags are also susceptible to detection failure or expulsion from the body. At Tortuguero, Costa Rica - home to the largest green turtle (*Chelonia mydas*) nesting colony in the Atlantic – flipper tagging with Inconel Tags has been conducted by the Sea Turtle Conservancy since 1995, with PIT tagging introduced only in 2019. This study aims to quantify the tag loss rate for green turtles nesting at Tortuguero. We assessed 35 years of CMR data from turtles tagged at Tortuguero, looking at tag retention for metal tags. We also investigated the role of PIT tags over the past five years in reducing neophyte overestimation and identification errors and examined detection issues based on placement, as well as multiple PIT tagging cases. These findings enhance the understanding of PIT tag reliability and retention in comparison with flipper tags, offering critical insights for optimizing long-term monitoring and conservation strategies.

## TRENDS AND CONSERVATION STATUS OF LEATHERBACKS (*DERMOCHELYS CORIACEA*) ALONG THE ANGOLAN COAST

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Angola supports the southernmost nesting beaches for leatherbacks (*Dermochelys coriacea*) in the eastern Atlantic. Nesting occurs during the rainy season, between September and April, with peak nesting in December and January. Despite conservation efforts, there is still some anthropogenic pressure on this population. In this study we provide an update on the trend and status of leatherback nesting along the Angolan coast. Kitabanga Project carried out surveys (aerial and terrestrial) along the entire coast of Angola between 2010 and 2015, and systematic daily beach monitoring during the nesting season between 2003 and 2023 at different latitudes. The southernmost nesting location was determined to be the Bentiaba region (14.1754S), although leatherbacks were reported (but not confirmed) to be present in the vicinity of Baía das Pipas (14.9179S) further south. Aerial surveys indicated that the regions of Onzo (9.2253S), Palmeirinhas (9.0857S), between Cabo Ledo (10.7086S) and Cabo das Três Pontas (11.3994S), Cabeça da Baleia (12.6142S) and Egipto Praia (12.9728S) had the largest numbers of nesting females. Between 2003 – 2023, the Palmeirinhas region had the highest density of leatherbacks nests in Angola, with 2.3 nests per km. The weighted average of densities found at all localities sampled in Angola in this period was 1.3 nests per km. Based on the average number of nests recorded at the different sampling sites of the Kitabanga project and the distribution of nesting along the coast, an average of c.850 females nested annually on the coast of Angola during 2010–2023, with a minimum of 426 females (assuming females lay three nests per season) and a maximum of 1,277 nesting females. However, in this period a decrease in the overall number of nests was observed which is primarily attributed to accidental captures in fishing gear.

## TRACING THE FOOTPRINT OF A WARMING CLIMATE ON SEA TURTLE POPULATION DYNAMICS*

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Global warming threatens biodiversity worldwide, with populations forced to either adapt or shift distribution, or otherwise face extinction. Poikilothermic species and those with temperature-dependent sex determination (TSD) are particularly vulnerable due to their direct link with environmental temperature. Sea turtles exemplify this risk, as increasing temperatures can lead to the over production of females at birth. Although the resulting female-biased sex ratios can contribute to population expansion in the short to medium term, they may represent an early warning sign of future population collapse and extinction. In this study, we focused on the rapidly growing loggerhead sea turtle (*Caretta caretta*)

population nesting on Sal Island, in the Cabo Verde Archipelago. To understand the complex link between population dynamics and the environment, we used a multifaceted approach that combines (i) 15 years of monitoring of the reproductive population, (ii) movement tracking to identify key habitat use, (iii) remote sensing to determine the key oceanic variables of those habitats, and (iv) drone surveys to determine adult sex ratios at the breeding site. Our findings suggest that rising incubation temperatures in the past have driven the recent population growth observed in Cabo Verde. This stems from increasing temperatures that have shifted sex ratio, which we confirmed by our drone surveys on the breeding grounds. Neither sea surface temperature, nor chlorophyll-a (used as a proxy for feeding ecology), correlated with population growth. Mechanistic simulations further confirmed that temperature-driven sex ratio shifts can influence population trend in the observed extent in loggerheads from Cabo Verde, hence revealing a strong link between population dynamics and local thermal regime. Building on these findings, we tested our predictions across 27 global loggerhead populations and found that lower latitude populations may face greater risk from global warming and sex ratio shift due to the rapid increase in temperature and reduced fluctuations. This study underscores the urgent need for effective conservation strategies to mitigate the impact of global warming on global sea turtle populations. Our work provides crucial insights into the complex interplay between climate change and population dynamics, offering a foundation for targeted conservation efforts.

## LONG-TERM RESIDENCY AND GROWTH RATES OF GREEN TURTLES (*CHELONIA MYDAS*) AT A FEEDING GROUND IN SOUTHEASTERN BRAZIL*

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Foraging grounds are crucial for the survival of juvenile green turtles (*Chelonia mydas*), a species classified as endangered by the IUCN Red List. These coastal areas provide food and shelter that are essential for individuals at this life stage. Long-term studies are necessary to monitor turtle populations, enabling the assessment of health status, growth rates, abundance, residency time, migrations rates, and other important ecological aspects. Since 2010, the Aruanã Project has been monitoring green turtles at Itaipu Beach, Niterói, Rio de Janeiro, Brazil, using the capture-mark-recapture methodology, initially conducted through the monitoring of bycatch individuals in beach seine carried out by fishermen (2010-2013) and then through intentional captures (2014-2024) using a beach seine similar to that of the fishermen, but smaller in size. This region, located within the Reserva Extrativista Marinha de Itaipu (RESEX-Mar Itaipu), a sustainable use conservation unit, is an important feeding ground for juvenile and sub-adult green turtles. Between January 2013 and April 2024, 176 individuals were tagged during 193 capture days, including 35 days through beach seines and 158 through intentional captures. From 2013 to 2015, four intentional capture seasons were conducted annually, reducing to two seasons per year from 2016. Due to the COVID-19 pandemic, monitoring was paused in 2020 and resumed mid-2021. The mean curved carapace length (CCL) of first captures was 56.6 ± 12.5 cm, ranging from 27.4 to 74.0 cm. Of these, 134 turtles (76,1%) were recaptured at least once, with a maximum of 18 recaptures for one individual. Residency time was estimated considering the minimum stay of individuals for at least one subsequent capture season. The minimum interval between first and second captures ranged from 65 days (≈ 2 months) to 3,967 days (≈ 130 months). Growth rates were calculated for 102 turtles with recapture intervals greater than 90 days,

categorized by CCL size classes (30-40 cm, 40-50 cm, 50-60 cm, 60-70 cm). The mean annual growth rate was 7.9 ± 3.7 cm/year, ranging from 1.1 to 18.4 cm/year. The peak growth rate was observed in the 50-60 cm class, followed by a gradual decline in the subsequent size classes. The growth rate obtained in this study is notably higher than those reported in other regions in Brazil, such as Ceará (6.7 cm/year), and other countries, such as Mexico (6.2 cm/year). These results underscore the importance of RESEX-Mar Itaipu, especially Itaipu beach, as a feeding area for juvenile green turtles. It has been proven that green turtles in Itaipu feed on fish remains that are filleted and discarded at sea by local fishermen. This highlights the importance of this relationship and the need to maintain socio-environmental actions in partnership with the fishing community, as has been carried out by the Aruanã Project since 2010. Continued monitoring and further research, including home range determination and genetic analysis, may shed light on other aspects related to the importance of this area for green turtle populations.

## INTEGRATING ENERGY BUDGET AND MIGRATION MODELS TO GUIDE CAPTIVE RELEASES OF LEATHERBACK TURTLES*

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The persistence of threatened species relies on successful reproduction, which is dependent on energy acquisition, constrained by access to suitable temperatures and sufficient resources. Leatherback turtles are highly migratory, vulnerable to numerous anthropogenic threats, and subject to dynamic environmental conditions throughout their life history. Leatherback energy acquisition in the wild is poorly understood, as existing knowledge is primarily derived from research on captive individuals. Physiological data derived from captive rearing can be applied to understand energy acquisition in the wild using Dynamic Energy Budget (DEB) theory. Here we apply DEB theory within a mechanistic modeling approach to demonstrate how temperature and food availability impact leatherback growth and reproductive potential – factors essential to population longevity. As hatchlings migrate from nesting beaches through oceanic habitats, their migratory movements may align with optimal temperature and food conditions, maximizing early life growth. We used the Sea Turtle Active Movement Model (STAMM) developed by Mercator Ocean International, to simulate the movements and migrations of individual turtles from emergence to adulthood, recording daily food and temperature conditions along their migratory routes. Here we present the first integration of DEB and STAMM models for East Pacific leatherbacks, revealing that nesting beach origin can result in variations in food and temperature conditions, which influence early life growth rates. These early differences persist into adulthood, with some individuals more likely to encounter sufficient food resources to reproduce earlier in life. In accordance with a recent IUCN-facilitated workshop that highlighted the need for more knowledge to support ex-situ conservation efforts, we hope that these findings offer actionable insights for conservation, with the potential to inform targeted release strategies to enhance early growth and ultimately contribute to the persistence of leatherback populations.

## INCREASING NESTING TRENDS OF SEA TURTLES ON THE OSA PENINSULA, COSTA RICA: A COMPARISON OF CONSERVATION EFFORTS FROM THE 90S TO THE PRESENT

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*COPROT Tortugas de Osa*

The Río Oro National Wildlife Refuge, located on the Osa Peninsula, Costa Rica, encompasses the Río Oro and Pejeperro beaches, with a length of 2.5 and 3.5 kilometers respectively. This is a crucial nesting area for four of the seven existing species of sea turtles. Over the last four years, an average of 4,658 nests per season have been recorded for the olive ridley turtles (*Lepidochelys olivacea*) and 213 nests for the pacific green turtles (*Chelonia mydas*), with sporadic nesting of hawksbill (*Eretmochelys imbricata*) and leatherback sea turtles (*Dermochelys coriacea*). These figures show the significance of this area as one of the most important beaches for intensive and solitary nesting on the Pacific Coast of Costa Rica. The aim of this study is to compare nesting trends by reviewing literature and existing data from the 1990s to the present. Databases from three nesting seasons since monitoring began in 1993, have been analysed, adapted and compared to current monitoring methods with the seasons between 2020 and 2024. The results indicate an increase in the nesting activity for the Pacific green and olive ridley species, with an increase of 163.07% in the average number of nests per season on both beaches. This increase could be explained, among other reasons, by a decrease in predation and poaching rates due to the progressive implementation of nest protection measures and their consequent positive impact on hatchling success and emergence. Additionally, increased monitoring efforts have allowed better recording and tracking of nesting female populations in recent years. This has been made possible thanks to the efforts of numerous organizations, who together with the local community have managed to conserve and preserve these species and their habitats over the years.

## POPULATION STRUCTURE OF GREEN TURTLES *CHELONIA MYDAS* AT A FORAGING GROUND IN THE SOUTHEASTERN PERSIAN GULF

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This study was conducted to determine population structure and genetic origin of green turtles in nearshore waters of Qeshm Island, Iran. Despite its extreme climate, the Persian Gulf host substantial sea turtle populations, which are unique due to their ability to survive in the hot, climate-challenged environment. Along the sandy and muddy shores of Qeshm Island fishers set arrow-head fish traps, locally known as moshta. We collected green turtles (*Chelonia mydas*) from these moshta during 2016, 2017 and 2018 to

investigate population structure and genetic origin. Curved carapace length was measured, and sex and age class were determined via laparoscopy. Tissue samples for genetic analysis were sequenced to identify unique mtDNA haplotypes of each turtle. An ~800 bp fragment of the mtDNA control region (d-loop) was amplified using primers LCM15382 and H950. PCR samples were sent to the Cardiogenetic Center in Iran (https://rhc.ac.ir) for clean-up and sequencing in both forward and reverse directions. Haplotypes were identified by running a search against the ShellBank haplotype database or the GenBank database (http://blast.ncbi.nlm.nih.gov/ Blast.cgi). If no matching haplotypes were found, the sequence was identified as unique and given a new haplotype name. A Bayesian approach using the program BAYES was used to estimate the contribution of the baseline rookeries to the Qeshm foraging ground turtles. Uniform (or flat) priors were applied, assuming an equal likelihood for all rookeries to contribute to the foraging aggregation. We captured 338 green turtles, which were predominantly juvenile (326, or 96.4%) with only ten subadult (3.0%) and two adult turtles (0.6%). The overall sex ratio was 66% Female : 33% Male (2F : 1M). This finding suggests climate is not leading to undue feminisation and that these turtles may be acclimated to the warmer Arabian region temperatures. A subset of 211 turtles were sampled for genetics. Unfortunately, some samples were not identifiable, resulting in 118 turtles for which sex and age class were known, and 93 samples from individuals of unknown sex and age-class. There were no significant differences between male and female stock origin and these were combined for an overall genetic stock determination. The MSA estimated that the majority (96.36% ± 0.048) of all green turtles originated from the Oman nesting stock located just outside of the Persian Gulf, with negligible contributions from Kuwait or Saudi Arabia which lie within the Gulf – a surprising finding given the proximity of these rookeries. Despite regional climate extremes, this population appears resilient to climate change and is not overtly feminised. This study underscores the critical role of the Oman nesting stock in sustaining the juvenile green turtle population in Qeshm, highlighting the importance of regional conservation efforts, and the protection of sea turtles on Oman's nesting beaches. These data contribute to our understanding of the population structure and connectivity of sea turtles in a particularly data-sparse and yet important (climate-wise) sea turtle habitat in the NW Indian Ocean.

## RECENT RECORDS OF LEATHERBACK TURTLES IN CUBA

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The leatherback turtle (*Dermochelys coriacea*) is rarely observed in Cuba, so any new specimen reported contributes to expanding knowledge about its presence and distribution on the Cuban shelf, and also in the Caribbean Sea region. This paper provides information on seven new records in different areas of Cuba in the last three years obtained from different sources that provided different data on these species taken in the possible cases, such as: curved length, method, date and distance from the coast and condition of the animal (alive or dead). Three specimens were reported as caught: two from bycatch in coastal waters of Las Tunas and Holguín in the northeastern region (one of them tagged from Panama) and the other from poaching on the northwest coast of Havana, confirmed by the remains found. Another three specimens, tracked by satellite from Puerto Rico, were reported to Cuba transiting the southern seas of the Cuban shelf. On the other hand, a nest of this species was recently found on a beach in the Maisí-Caleta protected area in the easternmost region of Cuba, reported by the National Company for the Protection of Flora and Fauna Flora, which constitutes an even rarer occurrence on the beaches of the Cuban archipelago.

# GENETIC STRUCTURE OF THE GREEN SEA TURTLE (*CHELONIA MYDAS*) IN THE RED SEA: EVIDENCE OF ENDEMISM AND MULTIPLE MANAGEMENT UNITS*

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The green sea turtle (*Chelonia mydas*) inhabits tropical and warm-temperate seas worldwide. The population dynamics of this species are complex and molecular tools are often required to delineate the spatial boundaries of distinct populations. The Red Sea hosts approximately 5000 nesting female green turtles, but research in this region is limited. As a semi-enclosed basin with high endemism due to both geographic barriers and extreme environmental conditions, the Red Sea may foster isolated and genetically distinct populations within this widely distributed species. Previous genetic analysis of only 16 individuals from a single rookery, revealed a unique haplotype, suggesting genetic isolation among Red Sea green turtles. Here, we expanded the sample size to ~200 tissue samples collected from five rookeries along the Saudi Arabian Red Sea coast. We extracted mitochondrial DNA and sequenced a 670 bp fragment of the mitochondrial DNA d-loop from each sample, revealing five haplotypes within the Red Sea that clustered into two highly divergent haplogroups. Group one contained four haplotypes (CmP71.1 - CmP71.4), three of which were previously unreported. Group two, comprising a single novel haplotype (CmP62.1), was more closely related to haplotypes in the Arabian Gulf. These two divergent groups likely reflect separate colonisation events: an initial event ~2.5 million years ago during the formation of the Red Sea and a subsequent recolonisation ~0.5 million years ago due to eustatic sea level changes, resulting in divergence from other Indo-Pacific clades. Haplotype distribution varied across rookeries, with a slight north-to-south gradient indicated by an increasing prevalence of the CmP62.2 haplotype in southern rookeries, although further sampling is needed to confirm this pattern. Pairwise Fst analysis showed high genetic differentiation between rookeries Ras al Baridi and Jazirat Mashabah and Jazirat Waqqadi, suggesting limited gene flow between these sites. This finding has direct implications for conservation management, as these populations may require separate management strategies. Overall, the data suggests that the isolation of the Red Sea, combined with various geologic and climatic events, has led to the divergence of four endemic haplotypes, underscoring the Red Sea as a unique ocean basin. Moreover, these unique haplotypes may represent evolutionary adaptations to the basin's historically elevated temperatures. Such adaptations could be broadly relevant across sea turtle populations and species in the face of global climate change.

# A DECADE OF SEA TURTLE CONSERVATION EFFORTS AT BESAR ISLANDS CLUSTER, JOHOR MARINE PARK, MALAYSIA: SPATIAL AND TEMPORAL INSIGHTS

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This study investigates the spatial and temporal patterns of sea turtle nesting in the Besar Islands Cluster, Johor Marine Park, Malaysia, over a decade of conservation efforts (2015–2024). The research focuses on two species of sea turtles: Green (*Chelonia mydas*) and Hawksbill (*Eretmochelys imbricata*). The monitoring area spans 85 km², covering 10 beaches across six islands. Data were collected annually from March, following the end of the monsoon season, through October, prior to the onset of the next monsoon. Across the 10 nesting seasons, a total of 429 nests were recorded, including 117 Green Turtle nests and 312 Hawksbill Turtle nests. Both in-situ and ex-situ (relocated nests) data were gathered to document nest counts, hatching success rates, and incidents of predation and poaching. Spatial clustering of nests was identified using GIS-based spatial distribution analysis, which revealed areas with consistently high nesting activity, particularly on Tengah and Mensirip Islands. Temporal analysis also highlighted distinct seasonal peaks in nesting, predominantly from May to August, coinciding with the inter-monsoon period in the southeast of Peninsular Malaysia. Hatching success fluctuated over the study period, ranging from 64% in 2015 to a peak of 94% in 2020 and 91% in 2023. These improvements were attributed to enhanced hatchery management practices, including minimizing egg handling, timely relocation, ensuring proper nest spacing, protecting nests from predators, regulating nest temperatures, conducting daily inspections, and maintaining detailed records. Moreover, community outreach and volunteer training initiatives played a crucial role in raising awareness and fostering greater participation in conservation efforts. Despite these successes, challenges such as nest predation and poaching continue to threaten the population, varying across different islands. This underscores the need for continued protective measures and improved management strategies. Based on the findings, future recommendations include activating Marine Protected Areas (MPAs) through zoning, implementing the OECM (Other Effective Area-based Conservation Measures) approach for MPA access in collaboration with local communities, and appointing and training Sea Turtle Wardens from the local population. Additionally, establishing a "Sea Turtle Management and Hatchery Workshop" is recommended to strengthen community engagement and improve conservation practices.

# MITOGENOMIC ANALYSIS PROVIDES FURTHER INSIGHTS INTO THE GLOBAL PHYLOGEOGRAPHY OF *CARETTA CARETTA* AND FOR STUDIES ON MITOCHONDRIAL ADAPTATION*

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Unveiling the phylogeography of populations throughout evolutionary history is a challenging task, especially for widely distributed, highly migratory species such as sea turtles. Previous studies on the loggerhead (*Caretta caretta*) based on control region sequences of mitochondrial DNA (mtDNA) identified three major haplogroups. Haplogroup IA is exclusively found in the Pacific Ocean, haplogroup IB occurs primarily in the Atlantic Ocean and in only one rookery of the Northwest Indian Ocean and haplogroup II is widely spread in the Atlantic Ocean, in all rookeries of the Mediterranean Sea and in one rookery of the Southwest Indian Ocean. Recently, a new mtDNA sub-haplogroup specific to the Southwestern Atlantic was identified. The dynamics that led to the present distribution of the main haplogroups are still under debate. Additionally, the western Atlantic rookeries, which host haplogroups IB and II, display a peculiar latitudinal gradient in the relative frequency of these two haplogroups, suggesting that selection may play a role in maintaining this distribution pattern. The aims of our study were i) to define the most consistent global phylogeographic reconstruction for *C. caretta*, and ii) to investigate the genetic diversity of sympatric haplogroups II and IB under the hypothesis of thermal adaptation in the western Atlantic. We used samples collected in the Mediterranean basin (Greece, Turkey, Libya, Calabria), Atlantic (Florida, Mexico, Cape Verde) and Pacific Ocean (Hawaii, Perù) for a total of 27 complete mitochondrial genomes,

of which 21 assembled in this study and six downloaded from public databases. Using Maximum Likelihood and Bayesian phylogenies, we assessed whether the topology based on complete mitogenomes and the consensus tree built using individual gene trees were different from the topology obtained by mtDNA control region only. Our well-supported phylogenetic trees indicated that haplogroup IB separated from the other haplogroups and colonized the Atlantic Ocean during the closure of the Panama Isthmus (13-2.5 million years ago). The colonization of the Mediterranean Sea occurred later in the Pleistocene via a South African route by haplogroup II coming from the Indo-Pacific and recolonizing some Atlantic rookeries where IB had settled before. A further refinement of this phylogeographic reconstruction would be possible with more mitogenomic sequences from under-sampled areas (e.g. Indian, South Pacific and South Atlantic oceans). We found strong relations between the increase in frequency of haplogroup IB and the decrease of temperatures in western Atlantic. We found a relaxation of purifying selection on haplogroup IB, but no statistical significance for positive selection between haplogroups IB and II. This could be due to the intrinsic, very conserved nature of the mitochondrion. Nevertheless, protein models showed that the fixed non-synonymous mutations between haplogroups IB and II may affect the functionality of the mitochondrion membrane for haplogroup IB. Mitochondrial thermal adaptation has been found in anchovies, sardines, salmons, penguins and our results may suggest a similar pattern in sea turtles. Overall, whole mitogenomes have a potential for better understanding the evolutionary history of sea turtles, which is crucial to foresee future trends and implement conservation strategies.

## MIXED-STOCK ANALYSES HELP CLARIFYING *CHELONIA MYDAS* GENETIC STRUCTURE IN THE GULF OF GUINEA*

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Marine turtles often migrate long distances across the oceans, sometimes foraging hundreds of kilometres away from the natal rookery. This high mobility makes it challenging to determine their origins, which is crucial for conservation efforts. Characterizing the composition of stocks at sea in terms of contributions from known populations is fundamental for planning protection measures. Mixed stock analysis (MSA) based mainly on mitochondrial DNA (mtDNA) control region haplotype variation has been used for decades for this purpose. The green turtle, *Chelonia mydas*, lives in tropical and subtropical waters of the world and is globally classified as Endangered by the IUCN. Green turtles in the Atlantic have lower genetic diversity compared to those in the Indo-Pacific. Major nesting sites are found in the western and Central Atlantic, while the eastern Atlantic hosts a prolific rookery in Poilão (Guinea Bissau) and smaller ones in Sao Tome, Principe and Bioko islands. However, little is known about turtles foraging and moving across the Gulf of Guinea. This study aims at improving the characterization of turtles at sea in this region using a large dataset. Additionally, since mixed stock analysis is hampered by shared haplotypes and more informative markers are desirable, we assessed the potential of whole mtDNA genome sequences to better resolve the genetic diversity of *C. mydas* in the southeastern Atlantic. Between 1998 and 2015, tissue biopsies were collected from captured, bycaught and stranded green turtles in the Gulf of Guinea: 640 in the Corisco Bay foraging ground (Equatorial Guinea/Gabon) and 64 in West African countries (Benin, Togo, Ghana, Ivory Coast, Liberia). We sequenced a 488 bp fragment of the mtDNA control region and selected a subset of six individuals carrying control region haplotype CMA8 for whole mtDNA sequencing, looking for mitogenomic variants that could further differentiate this common haplotype. We then performed foraging ground-centric mixed-stock analysis for individuals from Corisco Bay and West African captures using available rookeries baseline data. We found 20 control region haplotypes and three new mitogenomic haplotypes were described in the subgroup of six CMA8 samples. The rookeries that

contributed most to the Corisco foraging aggregate were Ascension Island (35%, c.i. 18 – 57%), Sao Tomé (34%, c.i. 7 – 60%) and Guinea Bissau (10 %, c.i. 0 – 32%). We also found Indo-Pacific haplotypes indicating a small but noticeable contribution from rookeries in the Southwest Indian Ocean. The rookeries that contributed most to the West African bycatch were Bioko (46%, c.i. 0 – 90%), Ascension Island (28%, 0 – 88%) and Principe Island (7%, 0 – 23%). Overall, our results suggest that green turtle mixed stocks in the Gulf of Guinea originate from both local and distant Atlantic and Indo Pacific rookeries. We advocate that more powerful genetic markers such as complete mitogenomes can provide high resolution in describing genetic lineages and population connectivity to help conservation efforts.

## TEN YEARS OF LOGGERHEAD SEA TURTLE NEST PROTECTION AND MANAGEMENT IN EASTERN SPAIN (VALENCIA REGION)

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Loggerhead sea turtle (*Caretta caretta*) nesting activity on the Spanish Mediterranean coast seems to have stabilized, with events recorded yearly since 2014, although still in low numbers. Western Mediterranean countries, with Spain included, can be considered an emerging nesting area for this species nowadays. In Spain, nesting events have been recorded in all regions, but the Valencia region (eastern Spain) stood out in the last two years with 17 nests (9 in 2023 and 8 in 2024) and several unsuccessful events. From 2014 to 2021, only one nest and/or few unsuccessful events per year were detected. In 2022 the Valencian Region recorded the only two nests laid in Spain. Nevertheless, the number of nests and nesting attempts in the latter years suggests an increasing trend and highlights the importance of this region for loggerhead turtle nesting activity, with 33% of the total number of nests recorded in Spain since 2001 and 40% of the nests recorded in the last 2 years. However, although some beaches are beginning to record nests in consecutive years, nesting is still scattered and nest detection is vital for their protection, as many of these events occur on anthropized beaches with multiple threats to nesting females, clutches, and hatchlings. The success of nest detection in the Valencia Region probably lies in the existence of a cetacean and sea turtle stranding network that has been well-established for more than 30 years and covers over 470 km of coastline in the region. This network, coordinated through a hotline by the University of Valencia in collaboration with the regional government, has facilitated effective coordination between universities, public and private institutions, and NGOs. All this has allowed the effective detection of nests, as well as the tagging of 15 nesting turtles with satellite transmitters, and therefore the detection and protection of some of the turtles' second and third clutches, both in the Valencian Region and in other regions of the Spanish Mediterranean. The various research and conservation projects carried out by the institutions involved in the latter years have also enabled to carry out many conferences and training workshops held for local authorities and other stakeholders. This has contributed to an increase in the number of nests found on beaches, particularly by local authorities, passers-by, and beach cleaning services. The protection of nests in this region has resulted in the release of more than 1,000 hatchlings into the sea or into a head-starting program for subsequent release one year after hatching. Furthermore, the protection of these nests has enabled the

organization of volunteer camps (with almost 1700 volunteers involved) to disseminate information on the conservation of this species to beach visitors and tourists. This has had a significant impact on raising awareness of the nesting activity of loggerhead turtles on these coasts.

## NESTING POPULATION TREND OF THE LEATHERBACK SEA TURTLE IN BOCAS DEL TORO PROVINCE AND COMARCA NGÄBE-BUGLÉ, PANAMA FOR THE PERIOD 2002-2022

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Sea turtle biologists have made sustained efforts to understand the global status of leatherback sea turtle populations. However, despite progress in assessments, demographics, and ecology, key uncertainties persist in tracking leatherback population trends. Trend analyses have historically focused on nesting beaches, with nest counts providing a widely used index for population abundance. Here, we analysed 20 years of annual nest abundance at four main nesting beaches (Soropta, Bluff, Playa Larga and Chiriquí) in Bocas del Toro province and the Comarca Ngäbe-Buglé, Panama, which constitute the largest nesting leatherback sea turtle population in Central America. We conducted daily nest counts during the leatherback season. We standardized the Soropta nest counts, as the survey extent varied over time. We calculated catch per unit effort (CPUE) to account for sampling effort differences. We used the Information-Theoretic approach for model selection, based on Akaike's Information Criterion correction for small sample sizes, using linear regression to assess population trends and discrete rate of population growth (λ). Soropta exhibited a positive nesting trend (8.9% year-1; λ = 1.089; 1.076 – 1.10 95% CI). Bluff (- 8.8% year-1; λ = 0.911; 0.892 - 0.930 95% CI) and Playa Larga (- 8.3% year-1; λ = 0.917; 0.9045 - 0.930% CI) indicated declining nesting populations, while Chiriquí had a stable population (λ =0.993; 0.982 - 1.004 95% CI). For CPUE, the data yielded a stable population for all beaches combined (λ = 0.997; 0.995 – 0.999 95% CI). Overall, distinct nesting trends were observed at each leatherback sea turtle nesting beach. Given that females from different nesting sites mix at shared foraging grounds, this suggests that local factors may be influencing beach-specific nesting trends. The delicate balance of leatherback nesting in Bocas del Toro archipelago, along with its critical importance within the Western Caribbean, makes continuous monitoring and conservation efforts essential in this region, as well as increased protection from governmental agencies.

## REHABILITATION

# CASE REPORT: SEVERE LORDOSIS IN A JUVENILE GREEN SEA TURTLE (*CHELONIA MYDAS*) VICTIM OF ILEGAL PET TRADE IN THE MALDIVES

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This case report documents severe lordosis in a juvenile green sea turtle (*Chelonia mydas*), named Hope, rescued by the Atoll Marine Conservation Centre (AMC) in Naifaru, Maldives, following illegal captivity as part of the pet trade. Green sea turtles are particularly vulnerable to poaching in the Maldives due to high nesting rates, leading to frequent illegal collection of hatchlings for pet ownership. AMC has received hundreds of young turtles from the pet trade, many displaying physical abnormalities likely resulting from inadequate care during captivity, including inappropriate confinement, handling, and feeding. Hope, a juvenile with an extreme spinal curvature, exemplifies the impact of mistreatment. Her vertebral scutes 1 and 5 are close together, forming an acute angle. This severe lordosis has significantly deformed her shell, creating a "U"-shaped plastron in profile. Although she is able to dive and often rests at the bottom of her tank, she spends most of her time at the surface and sometimes struggles to swim. Due to these impairments, she is not currently a candidate for release. Despite her non-releasable condition, Hope exhibits good health indicators, including consistent weight gain, a strong appetite, and blood values within normal ranges for wild green turtles. However, her shell deformity limits understanding of her internal organ arrangement, apart from her lungs, which are visible through conventional radiography. AMC is located on a remote island, where access to advanced imaging technologies or contrast methods is limited. While euthanasia is a common outcome for wild animals deemed non-releasable, it is essential to consider the social context and societal beliefs. Euthanasia is not widely practiced in the Maldives, and there are no clear guidelines, particularly concerning protected species. Additionally, access to euthanasia drugs is limited. Hope's care regimen at AMC includes weekly calcium and multivitamin supplements, a diet of freshly collected seagrass, seafood, and weekly live prey for environmental enrichment, all aimed at enhancing her quality of life in captivity. This case highlights the long-term physiological consequences of the illegal pet trade on green sea turtles. Severe lordosis restricts the coelomic cavity, potentially impairing future organ development and ultimately affecting systemic health. However, AMC's targeted husbandry practices reflect best efforts to mitigate captivity's limitations and sustain Hope's well-being. This report underscores the urgent need for stricter wildlife protection measures and education efforts to prevent the continued exploitation of sea turtles in the Maldives.

# FROM INJURY TO RELEASE: SUCCESSFUL NON-INVASIVE TREATMENT OF A LIMB FRACTURE IN A LOGGERHEAD SEA TURTLE (*CARETTA CARETTA*): A CASE REPORT

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Injuries involving limbs are quite common in sea turtles. In addition to natural injury, common causes include entanglement in fishing gear, vessel strikes, or improper handling during capture or physical restraint. However, there are few data in the literature on the treatment of long bone fractures and subsequent repair processes in sea turtle flippers. This report presents a documented case of humeral flipper fracture repair in a sea turtle treated with physiotherapy, without the need for surgical stabilization. A juvenile loggerhead sea turtle (*Caretta caretta*) was found stranded in a critical condition on the coast of Cádiz, Andalusia (Spain), exhibiting respiratory and swimming difficulties. It was immediately brought to the Andalusian Marine Species Recovery Centre, CEGMA, where a complete examination revealed a fractured left humerus, pneumonia, severe dehydration, weakness and cachexia. Given its critical the aim was to stabilize the animal's health and preserve limb function, avoiding surgical intervention and amputation. There is a lack of documented similar cases and consequently, a conservative approach was chosen, immobilizing the limb externally with a bandage. X-rays were conducted twice a week, and the bandage was changed weekly, as the animal was still growing. Clinically, the turtle showed daily improvement, particularly three weeks later, when it began to eat. A month later, a weekly physiotherapy treatment was initiated to prevent elbow ankylosis due to the bandage, with X-ray monitoring to ensure proper alignment of the bone fragments. This physiotherapy included passive kinesitherapy, involving joint mobilization and muscle stretching without active involvement from the patient; and thermotherapy to relieve pain, improve circulation and promote healing in injured tissues. After about eighteen months of treatment, the humeral fracture resolved, and the turtle was transferred to a muscle-building tank. Finally, following a nineteen-month rehabilitation, the turtle regained full limb function and was successfully released back into the ocean. This conservative approach to the management of humeral fractures in sea turtles allows for the complete preservation of the flipper's integrity, promoting faster recovery compared to invasive surgery, while eliminating the need for extended postoperative care. Moreover, this method reduces the risks associated with surgical interventions, optimizing the recovery process and improving overall outcomes for the animal. Although based on a single case, this report provides valuable insights into non-invasive treatment methods and contributes to the broader field of sea turtle rehabilitation.

# USE OF COMPREHENSIVE LIMB SALVAGING PROTOCOL TO REDUCE INCIDENCE OF AMPUTATION IN OLIVE RIDLEY SEA TURTLES (*LEPIDOCHELYS OLIVACEA*) ENTANGLED IN GHOST GEAR IN THE INDIAN OCEAN*

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Olive ridley sea turtles in the Indian Ocean face a pressing threat from ghost nets, abandoned or discarded fishing gear that remains in the ocean, trapping marine life indiscriminately. Ghost nets are a leading cause of injury for olive ridleys, which are often entangled while migrating or foraging. At the Marine Turtle Rescue Centre, Baa Atoll, Republic of the Maldives, ghost net entanglements account for the majority of patient admissions, frequently resulting in severe injuries to the flippers and neck. Limb injuries, in particular, can lead to partial or complete loss of function, compromising the animal's ability to swim, forage, mate, and avoid predators. In order to avoid amputation, our veterinary team has developed a comprehensive Limb Salvaging Protocol (LSP) aimed at minimising the need for amputating injured limbs, preserving the functionality of affected limbs, and enhancing the quality of life for affected patients. The LSP is a multimodal, holistic approach to saving and restoring function to damaged limbs through rapid assessment and diagnosis, complete physical examinations, bloodwork and imaging studies, and diagnostic testing to determine injury severity and overall health status. Following assessment, supportive care is provided to stabilise the patient, combining pain management, wound care, nutritional support, and other medical therapy essential for addressing immediate clinical needs. In cases of severe injuries, surgical intervention can be indicated, followed by physical rehabilitation designed to promote recovery and improve limb function, including specialised methods such as Targeted External Weight Therapy and Kinetic Buoy Training. A critical feature of the LSP is the use of integrative and regenerative medical therapies to optimise healing and restoration of function. These advanced clinical therapies include photobiomodulation therapy, which utilises specialised lasers to promote tissue healing and is thought to alleviate pain based on evidence from other species, platelet-rich plasma and stem cell therapy, which accelerates wound healing by leveraging the restorative properties of the patient's own blood components, and acupuncture to improve mobility. Intensive monitoring allows for ongoing assessment and therapeutic adjustments, ensuring that each patient's progress is closely tracked and adjusted where indicated. To date, eleven olive ridley patients have undergone treatment with the LSP, resulting in positive outcomes in limb mobility and an average hospital stay of 165 days. These cases underscore the effectiveness of the LSP in preserving flipper function in turtles that could otherwise face amputation. This multimodal, holistic protocol represents a significant advancement in sea turtle medical care within the Indian Ocean, where entanglement injuries are a primary admitting condition.

## BETWEEN SHORES: A UNIQUE CASE OF OESOPHAGEAL DIVERTICULITIS IN A MIGRATORY LOGGERHEAD TURTLE

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To the best of our knowledge, oesophageal diverticulitis has not been previously documented in marine reptiles, including loggerhead sea turtles. Recently, a female loggerhead (*Caretta caretta*) was rescued off the coast of Lampedusa in the southern Mediterranean Sea, Italy, by local fishermen who observed her weakened condition and a large cervical mass. The turtle had been initially tagged by Archelon in Greece in 2008, where she was regularly observed nesting until 2016, but she had not been sighted in the past eight years. Upon admission to our rescue center, clinical examination and diagnostic imaging revealed a substantial oesophageal mass. Surgical intervention was deemed necessary, and ventral cervical access revealed the mass to be an oesophageal diverticulum firmly connected to the oesophageal walls. In our understanding, this represents the first documented case of this condition in a sea turtle. The primary objective of the surgery was to alleviate the symptoms of the oesophageal pathology, which impeded normal feeding, and to restore oesophageal function. Surgical exploration revealed a large diverticulum containing a 2.6 kg accumulation of sand and debris. The diverticular pocket and its contents were carefully removed, and the oesophageal wall was stabilized to restore its structural integrity and function. Following surgery, the turtle underwent a month-long rehabilitation program, during which her recovery was closely monitored. Key assessments included her feeding ability, swimming performance, and overall health. Over the course of rehabilitation, the turtle demonstrated significant improvement: she gained weight, exhibited a strong interest in feeding, and showed enhanced swimming ability and energy levels. After the application of new flipper tags, the turtle was successfully released back into the Mediterranean Sea. This case underscores the remarkable resilience of sea turtles in adapting to complex anatomical abnormalities and highlights the potentially life-threatening consequences of oesophageal diverticulitis, particularly when diverticula become impacted with foreign materials such as sand and debris. In our view, the successful surgical management of this condition underscores once more the critical importance of targeted veterinary skills in the rescue and rehabilitation of marine wildlife. Moreover, this case emphasizes the need for increased post-release monitoring to assess the long-term outcomes of rehabilitated turtles and to inform conservation strategies. It also highlights the importance of raising awareness among fishing communities regarding oesophageal injuries caused by foreign body ingestion, promoting preventive measures and improved outcomes for marine species.

# VENOUS BLOOD GAS OF STRANDED GREEN TURTLES (*CHELONIA MYDAS*) IN THE REGIÃO DOS LAGOS, RJ, BRAZIL

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Although the conservation status of the green sea turtle (*Chelonia mydas*) in the Southwest Atlantic Ocean has been recently revised to "Least Concern" on the IUCN Red List and "Near Threatened" in Brazil's Red Book of Fauna, it is important to note that juveniles of this species are the most frequent to be found stranded and deceased along the Brazilian coast. To evaluate the clinical condition of these stranded green turtles, blood gas analyses were conducted immediately upon their arrival at Instituto Albatroz Rehabilitation Center, in Cabo Frio, Rio de Janeiro. After undergoing a clinical examination, 25 turtles were weighed, and 0.5 ml of blood was withdrawn from the occipital sinus. Samples were immediately analyzed using a handheld veterinary blood gas electrolyte analyzer, SG1 Blood Gas & Electrolyte Analyzer from Seamaty©. The analyzer, set to human body temperature at 37°C, was adjusted to the turtle's body temperature to accurately determine pH, partial pressure of oxygen (pO2), and partial pressure of carbon dioxide (pCO2). Additional manual corrections, based on prior studies, were applied due to concerns about the analyzer's temperature accuracy. All turtles were juveniles, ranging from 30.5 to 62.7 cm curved carapace length. Results were expressed as mean values with their respective standard deviations: PCV (13.6±6.11%), pH (7.22±0.18), corrected pH (7.31±0.10) lactate (Lac) (5.13±3.17mmol/L), pO2 (65.08±15.68), corrected PO2 (55,37±12.36), pCO2 (57.13±14.98), corrected PCO2 (33,79±8,53) bicarbonate (HCO3–) (29.51±11.47mmol/L), sodium (Na) (162.1±7.37mmol/L), potassium (K) (4.9±1.09mmol/L), chloride (Cl-) (115.7±8.87mmol/L) ionized calcium (iCa) (1.08±0.16mmol/L), glucose (Glu) (67,49±37,4 mg/dL), tcO2 (39.86±6.88mmol/L). This comprehensive profile provided a detailed assessment of their physiological status, offering insights into their metabolic functions and overall health. Most turtles examined were found to be in poor body condition and exhibited signs of either metabolic or respiratory acidosis, reflecting severe health complications. The values for pCO2 were notably high, particularly when considering the average cloacal temperature of 25°C in the turtles, suggesting a disrupted respiratory function. Additionally, the mean PCV values were low across most individuals, indicating potential anemia or chronic disease states. Sodium, potassium, and chloride levels were elevated, possibly due to dehydration and/or impaired kidney function. Ionized calcium levels were within range, likely due to calcium being mobilized from bones to maintain calcemia. Most turtles were hypoglycemic, suggesting malnutrition. In this study, base excess and oxygen saturation measurements were omitted due to limitations in the applicability of standard mammal-based calculation methods when applied to sea turtles. Blood gas data are crucial in the diagnosis and management of debilitated sea turtles, providing essential insights into the respiratory efficiency and metabolic status of these animals. Measurements of parameters such as pH, partial pressures of oxygen and carbon dioxide, and bicarbonate levels help veterinarians assess the turtles' acid-base balance and respiratory function. Additionally, the utilization of a handheld veterinary blood gas and electrolyte analyzer significantly enhances diagnostic accuracy and treatment efficacy, thereby improving rehabilitation success rates in veterinary practice.

## DISASTER MANAGEMENT DURING A MASS STRANDING OF LOGGERHEAD (*CARETTA CARETTA*) POST-HATCHLINGS ALONG THE COAST OF SOUTH AFRICA

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The Turtle Conservation Centre (TCC) at the Two Oceans Aquarium annually treat and rehabilitate between 60 and 150 Loggerhead (*Caretta caretta*) post-hatchlings that strand along the coast of South Africa. During April 2024 unseasonably severe swell and onshore winds around the coast of South Africa resulted in the mass stranding of Loggerhead post-hatchlings. More than 240 post-hatchlings were received at the Turtle Conservation Centre at Two Oceans Aquarium over a period of just four days. A total of over 600 Loggerhead post-hatchlings were received during the stranding season of 2024 which stretched from April to end of May. The unprecedented influx of post-hatchlings far exceeded the normal capacity of our rehabilitation facility and staff. Emergency measures dictated changes in operational procedures, housing set-up, triage and treatment protocols. Turtles were triaged upon admission according to mental alertness, physical strength/weakness, respiratory capabilities, the presence of wounds, blood values (haematocrit and blood glucose), and body condition scores. Collaboration between the three primary sea turtle rehabilitation facilities in South Africa (TCC, South African Association of Marine Biological Research and Bayworld Oceanarium) were crucial in the successful management of the stranding disaster and required ongoing close partnerships for the duration of 2024. A joint effort facilitated the release of 480 post-hatchlings in 2024, aligning with the facility's median annual release rate of 78 %. Twelve were satellite-tagged pre-release to track movements and assess post release survival. This poster provides and overview of the unprecedented mass stranding episode, emergency measures required and instigated, and collaborative efforts between the primary sea turtle rehabilitation facilities in South Africa.

## ISOLATION, IDENTIFICATION AND RECOMBINANT PRODUCTION OF ANTIMICROBIAL PEPTIDES OF CLOACAL FLUID FROM LOGGERHEAD TURTLES TO CONTROL BACTERIAL INFECTIONS

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Many microbial pathogens have been reported to cause reduction in the effectiveness of sea turtles in producing hatchlings and thereby increased the number of deaths. The host defense peptides, also referred to as the antimicrobial peptides (AMP), are used to combat these pathogens and prevent infectious diseases. They act by inhibiting the growth of microorganisms and thereby controlling the host immunological reactions. Numerous antimicrobial peptides are widely dispersed in various vertebrate animals including, amphibians, birds, fishes, reptiles and mammals; invertebrates such as, insects, molluscs, marine worms, sea urchins, as well as many microbes, such as fungi, virus and bacteria, with powerful effect against the growth of gram-negative and gram- positive bacteria. Animal sourced AMPs account for the highest total, with reptiles representing a comparatively small proportion. Results from a recent study have shown that the cloacal fluid of loggerhead turtle has antimicrobial properties against Pseudomonas aeruginosa, Serratia marcescens, and Morganella morganii, however, there is little knowledge about the identification of the

AMPs present in loggerhead turtle. This study aims to isolate and identify the antimicrobial agents present in the cloacal fluid of loggerhead turtles by testing their effect on Gram-negative bacterial strains and to further investigate their potential recombinant production. Results from this study have identified several fractions from the size-exclusion chromatography of cloacal fluid from loggerhead turtle that have antimicrobial activity against E. coli. Mass spectrometry analysis was used to analyze these fractions to identify the active antimicrobial components. This study contributes to the discovery of novel compounds that can be further developed and optimized for use in combating bacterial pathogens.

## FROM REHAB TO RELEASE: THE POWER OF ENVIRONMENTAL ENRICHMENT IN SEA TURTLE RECOVERY*

**{Eva-Maria} Alexandra Panagiotou[1,2]**

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All seven sea turtle species face conservation challenges, with three classified as Critically Endangered and three as Endangered. Rescue and rehabilitation centres are critical to conservation efforts, offering medical treatment, nutritional support, environmental enrichment and eventual re-introduction and release back into the wild. However, the role of environmental enrichment in accelerating sea turtle recovery remains underexplored. This study aimed to assess the potential of various types of enrichment—cognitive, feeding, social, physical, sensory, and structural—as a tool to improve recovery outcomes for juvenile and sub-adult Green Sea Turtles (*Chelonia mydas*) undergoing rehabilitation. Behavioural observations, morphometric data, and physiological indicators (blood glucose and haematocrit levels) were collected and analysed to evaluate the impact of enrichment. Results indicated that enrichment significantly influenced species-specific behaviours, promoting exploratory swimming and diving while reducing negative stereotypic behaviours, such as repetitive pattern swimming and habituation. Morphometric changes and physiological improvements observed over time reflected both the benefits of enrichment and overall health gains associated with prolonged rehabilitation. These findings highlight the potential of enrichment to improve not only physical health but also psychological well-being, facilitating a more comprehensive approach to sea turtle recovery. As conservation programmes increasingly emphasize holistic care, incorporating structured enrichment strategies could enhance rehabilitation outcomes and ensure the successful release of healthier individuals into the wild. This study underscores the importance of integrating enrichment into standard rehabilitative practices, advocating for its adoption as a critical tool in sea turtle rehabilitation and welfare.

## THE EFFECTIVENESS OF USING SARGASSUM SPP. AS ENVIRONMENTAL ENRICHMENT FOR POST-HATCHLING LOGGERHEAD (*CARETTA CARETTA*) SEA TURTLE RECOVERY*

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All seven sea turtle species are considered species of conservation concern, with three species being classified as Critically Endangered, three as Endangered and the last species not having enough information on its population to classify. In order to truly protect sea turtle species and their habitats conservations efforts all around the world need to be implemented. Sea turtle rescue and rehabilitation centres operate worldwide and play a critical role in conservation, as they allow for the treatments, nutrition, enrichment, recovery, and eventual release of sea turtles back into the wild, thus helping maintain, or perhaps even increase, sea turtle populations. The purpose of this study is to evaluate whether environmental enrichment could be used as a valuable tool in sea turtle rehabilitation and recovery, specifically is post-hatchling loggerhead sea turtles (*Caretta caretta*). The study demonstrated that Sargassum spp. enrichment can positively influence species-specific behaviours, promoting rest and hiding while reducing swimming and diving in rehabilitating post-hatchling loggerheads. These behavioural modifications mirror natural tendencies, which may aid energy conservation and lower stress levels, supporting recovery. Blood glucose and hematocrit changes observed over time likely reflected both enrichment impacts and general health improvements associated with longer rehabilitation durations, indicating that physiological responses may not solely depend on enrichment factors. Overall, the findings underscore the value of environmental enrichment in rehabilitative care, with Sargassum playing a potentially significant role in post-hatchling well-being and recovery.

## FIRST COMPREHENSIVE CLINICAL ASSESSMENTS OF SEA TURTLES IN THE KINGDOM OF SAUDI ARABIA: EARLY INSIGHTS INTO THE HEALTH STATUS OF *CHELONIA MYDAS* AND *ERETMOCHELYS IMBRICATA* IN THE RED SEA

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The health status of endangered sea turtles in the Kingdom of Saudi Arabia (KSA) is unknown as no clinical or health studies have been performed on these populations. SHAMS has established the first marine animal hospital in KSA in collaboration with KAUST to provide specialized medical treatment to debilitated sea turtles from the Saudi Red Sea in a university-level, teaching hospital environment. Insights into the health status of these species can reveal stressors that are not available by other monitoring and assessment techniques and can add valuable guidance in designing conservation measures in this critically vulnerable region. Between 3 June and 20 November 2024, 27 sea turtles were admitted to the SHAMS/KAUST Center for Veterinary Care. Full clinical examinations (physical, morphometric, neurological,

cardiopulmonary, bloodwork, gut microbiome, proteomic and imaging studies) were performed on each animal upon admission, and weekly until release. Analytes included CBC with Manual Differentiation, PCV, Total Solids, Glucose, Symmetric Dimethylarginine, Creatinine, Blood Urea Nitrogen, Uric Acid, Phosphorus, Calcium, Total Protein, Albumin, Globulin, Albumin:Globulin, Alkaline Phosphatase, Aspartate Aminotransferase, Gamma-Glutamyl Transferase, Beta Hydroxybutyrate, Total Bilirubin, Cholesterol, Amylase, Lipase, C-reactive Protein, Calgranulin MRP-126, Serum Amyloid A, Heat Shock Protein 70, Haptoglobulin, and C1q-like Protein. Imaging included ultrasonic and radiographic studies where indicated. Medical therapies, including antimicrobial, nutritional, regenerative (stem cell and platelet rich plasma), intensive (total parenteral nutrition, nebulization), integrative (acupuncture) and surgical therapies, including entero- and coelmocenteses, blood pleurodesis and fracture repair, were performed where indicated. Targeted External Weight Therapy and Behavioral Modification Therapy were administered to buoyant animals. 20 hawksbills (1 adult, 2 subadults, 17 juveniles; 6 males, 14 females) and seven greens (2 adults, 2 subadults, 3 juveniles; 2 males, 5 females) were admitted during the reported interval. Ninety-three percent (25/27) presented with Chronic Debilitation Syndrome (CDS), 63% (17/27) with Buoyancy Syndrome (BS), 4% (1/27) with blunt force trauma and 7% (2/27) and decompression sickness (DCS). Sixteen were successfully released (60%) and 4 deceased (16%), with an average length of hospital stay of 3.5 months. Seven are currently under care. Among the CDS and BS patients, clinical biochemical and haematological analytes revealed marked hyperuricemia, hypoproteinemia, anemia, heterophilia with toxicity, eosinophilia with toxicity, monocytosis, elevated BHB, elevated acute phase and heat shock proteins. Imaging studies in these two groups revealed mild to severe renal, enteric, and pulmonary disease. Two patients (blunt force trauma and DCS) displayed severe neurological derangements. Body condition index was normal in 80% of patients (20/25). Gut microbiome evaluation is pending. Profound physiologic stressors and clinical evidence of renal, enteric, and pulmonary disease were evident in most admitted patients, independent of life stage and species. Determining the causes of CDS and BS in Saudi waters requires further investigation. Acute phase and heat shock proteomic analyses revealed both clinical and subclinical markers of health deterioration, which may provide useful in identifying habitat contributions to overall health in this region and serve as clinical surveillance tools. This report represents the first comprehensive clinical assessment of sea turtles in the Middle East.

## SUCCESSFUL TREATMENT OF PULMONARY PNEUMOCOELEM AND BUOYANCY SYNDROME WITH AUTOLOGOUS BLOOD PLEURODESIS IN GREEN (*CHELONIA MYDAS*) AND HAWKSBILL (*ERETMOCHELYS IMBRICATA*) SEA TURTLES

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Buoyancy control is essential for sea turtles to successfully forage, ventilate, mate, avoid threats and migrate. Buoyancy Syndrome occurs when a sea turtle is unable to maintain its control of movement in the water and can be caused by respiratory or gastrointestinal disease, systemic infection, trauma, pneumocoelom, dysbiosis, malnutrition, neurological disorders, and cold-stunning, among others. BS is among the most frequent causes worldwide of sea turtle hospital admissions and pulmonary trauma resulting from fishery and bycatch interaction is among the most frequent contributors to this form of Buoyancy Syndrome. We report a novel surgical technique to treat Buoyancy Syndrome resulting from pneumocoelem secondary to pulmonary trauma in green and hawksbill sea turtles in the Saudi Red Sea.

Nine sea turtles (7 hawksbills; 6 juveniles, 1 adult) and two juvenile greens presented to the SHAMS/KAUST Center for Veterinary Care Hospital between 3 June and 3 November 2024 with pneumocoelem secondary to pulmonary tears as diagnosed by clinical examinations, imaging studies and complete blood biochemistries and hematology. Seven patients had direct evidence of fishery interaction indicated by trauma and abrasions to the integument. After initial stabilization, all animals underwent ultrasound-guided coelomocentesis to reduce the degree of pneuomocoelem and patient discomfort. For autologous blood pleurodesis, all animals were sedated with dexmedetomidine (25-30mcg/kg IM) and 3-3.5ml/kg of whole blood was aseptically removed from the external jugular vein and immediately introduced into the coelomic cavity at the level of the pulmonary defects during celioscopy. Postoperative antimicrobial and supportive therapies were applied where indicated and total parenteral nutrition was administered in 4 cases (2 hawksbills, 2 greens). Two patients received postoperative targeted external weight therapy (TEWT – the application of selected weights in precise locations on the patient's carapace as therapy for Buoyancy Syndrome). All patients recovered without complications and were returned to their hospital tanks in shallow water for postoperative observation. Seven of nine patients returned to normal buoyancy within 7 days of pleurodesis. Two required TEWT postoperatively, and both returned to normal buoyancy within 14 days of pleurodesis. One patient died related to severe blunt force trauma to the head, but this was unrelated to the pleurodesis procedure. Eight patients were released within 63 +/- 7 days of admission. Clinical strategies to treat trauma related to Buoyancy Syndrome resulting from entrainment in fishing debris or bycatch are important in returning injured sea turtles to health. Blood pleurodesis is a novel therapy to apply in cases of pulmonary pneumocoelem with potential excellent outcomes and reduced length of hospital stay.

## SURGICAL MANAGEMENT OF SEPTIC ARTHRITIS IN AN ADULT LOGGERHEAD (*CARETTA CARETTA*) SEA TURTLE

**Bernice van Huyssteen**

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In July 2021, a 50 kg adult female Loggerhead (*Caretta caretta*) Sea Turtle stranded on the southern coast of South Africa entangled in a ghost net. Weak and injured, she was transported to the Turtle Conservation Centre (TCC) at the Two Oceans Aquarium Foundation (TOAF) (Cape Town) for stabilisation. The turtle remained inappetant and she was started on supportive treatment and antibiotic therapy for an elevated white cell count. A couple of months after admission a noticeable swelling developed in her right elbow joint. Radiographs identified a potential septic arthritis. A joint aspirate was sent off for bacterial and fungal culture, and the results indicated an Enterococcus sp infection. Targeted antibiotic therapy was started based on culture results. A mild improvement was observed, however infection did not resolve completely. A second joint aspirate and PCR performed 3 months later identified Acromobacter denitrificans with a slightly altered resistance pattern. A CT scan was subsequently performed. It revealed a sequestrum and clumps of infected tissue in the joint space, serving as a nidus of infection and halting resolution of the infection. An arthrotomy was performed, the joint lavaged and all visible infected material physically removed. This procedure finally resulted in the infection successfully being resolved. At this point the turtle had been on multiple systemic antibiotic treatment for an extended period of time. She started to develop severe bone marrow suppression, reduced kidney function and secondary fungal skin infection with severe plastron sloughing. This required many months of supportive care, antifungal topical and targeted systemic treatment and immune support before the turtle finally started improving clinically. Four months after the initial right elbow surgery, septic arthritis was also diagnosed in the left elbow through radiographs and joint aspirate and culture. Targeted antibiotic therapy again did not resolve the infection in isolation, and she underwent a second arthrotomy, this time of the left elbow, to lavage and remove

necrotic material. Finally, 19 months after admission, all infection was finally deemed resolved, with no evidence of active infection on repeat CT scans. The turtle underwent another 8 months of rehabilitation and monitoring before she was finally successfully released back into her ocean home off the Cape Peninsula in South Africa.

## DISASTER MANAGEMENT: CRITICAL CARE FOR LOGGERHEAD (*CARETTA CARETTA*) POST-HATCHLINGS DURING A MASS STRANDING EPISODE ALONG THE COAST OF SOUTH AFRICA

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The Turtle Conservation Centre (TCC) at the Two Oceans Aquarium in Cape Town serves as one of the primary sea turtle rehabilitation facilities in South Africa. Annually the TCC receives on average between 60 to 150 Loggerhead (*Caretta caretta*) post-hatchlings during what is known as the "stranding season" that stretches from late March until the end of May. During early April 2024 mass strandings of post-hatchling loggerheads occurred due to unseasonably strong weather conditions, and over 600 hatchlings were received at the TCC over a very short period of time. Post-hatchlings will usually present to the TCC as weak and injured or systemically ill, often with a low haematocrit and hypoglycaemia. The 2024 post-hatchlings mostly presented with normo- or hyperglycaemia. Those who presented with a haematocrit higher than 20% (range 5% - 28.5%) was double that of the preceding years. Many of the initial arrivals also exhibited little sign of disease or predation, and the conclusion was that these turtles were likely washed out accidently due to the stormy ocean weather conditions. Due to the high volume of turtles received, intensive critical care for the weak and sick hatchlings proved challenging. Creative means of providing adequate intensive care measures for such a large number of patients. Large oxygen boxes able to house multiple turtles at once were created using large plastic containers, heating pads, humidifiers and oxygen generators. Nutritional support was provided via daily tube feeding of a high energy recovery diet, fish oil and added vitamins. Valuable new protocols were established to deal with mass admission of turtles, and streamlining critical care. Turtles were triaged upon admission according to mental alertness, physical strength/weakness, respiratory capabilities, the presence of wounds, blood values (haematocrit and blood glucose), and body condition scores. Turtles were then colour-coded (red, yellow, or blue) and individually marked and housed accordingly. This presentation provides an overview of the findings regarding initial health parameter of hatchlings, the critical care provided and ultimate outcome of treatment in the post-hatchlings received during the mass stranding of 2024.

## THE QUESTION OF EUTHANASIA IN OUR SEA TURTLE CLINICS

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The aim of our work is to determine whether it is possible to implement a decision tree in order to aid in the decision-making surrounding the euthanasia of injured or debilitated sea turtles. Although this is often a difficult discussion to have with multiple different stakeholders involved it is a very important question to provide a framework to work from to give objectivity to the very subjective topic. The final goal is to encourage everyone involved to have these difficult discussions and highlight the key areas of concern so that in the long-term compromises to welfare don't occur. Where euthanasia is not permitted this can still be used to understand if current treatment plans are working and heading in a positive direction rather than stagnating to then encourage changes to be made. We explored data from 2000 to 2024 at the Lampedusa sea turtle rescue to analyse how this framework may be beneficial and what more information is needed going forwards. The very nature of sea turtles makes it difficult to judge if their welfare is compromised as we would for our companion animals. Sea turtles often make seemingly miraculous recoveries from severe injuries but this can take months to years. The current literature surrounding this topic is very limited. Many of the studies focus on the causes of admission to rehabilitation centres and rarely look at the long-term consequences. There are case studies available looking into individual cases and highlighting euthanasia as a question but none go into a set of criteria to consider when asking this question. This is something that is very well rehearsed in the private veterinary sector when considering companion animals. There is a key set of welfare considerations to take into account in order to aid not only owners but also clinicians in their decisions surrounding the topic of euthanasia. By using this decision tree, it provides a starting point for these discussions so that all aspects of the patients welfare are being discussed taking into account all of the relevant stakeholders. The decision tree is a collection of pathways to be followed from the moment of admission to the start of treatment. At each stage of the pathway a score is given and this will amount to a final recommendation. By having a score system, it allows for dynamic assessment of a patient throughout its rehabilitation journey.

## CAUSES OF ADMISSION AND CHANGES OVER TIME AT THE KAREN BEASLEY SEA TURTLE RESCUE AND REHABILITATION CENTER, NORTH CAROLINA, USA

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The Karen Beasley Sea Turtle Rescue and Rehabilitation Center (KBSTRRC) is nonprofit sea turtle conservation organization in North Carolina, USA whose mission includes rescuing, rehabilitating, and releasing stranded sea turtles. Founded in 1997, KBSTRRC offers a long-term data set of sea turtles in

rehabilitation. The 2019 implementation of RaptorMed, a medical records database, is allowing exploration of the organization's rehabilitation trends over time. Since 1997, KBSTRRC has admitted 1,524 sea turtles, including greens (*Chelonia mydas*), loggerheads (*Caretta caretta*), and Kemp's ridleys (*Lepidochelys kempii*). Overall strandings are increasing. Causes of stranding include anthropogenic factors such as boat strikes, fish hooks, and entanglement; as well as natural conditions such as cold stunning, debilitated turtle syndrome, and shark bite injury. Admissions due to cold stunning have increased since KBSTRRC was founded. In the organization's first decade of operation, between 1997 and 2006, a total of nine turtles were documented to have been admitted due to cold stunning. In the organization's second decade, a total of 206 turtles were admitted due to cold stunning, and over the past eight years, a total of 377 turtles were admitted due to cold stunning. Debilitated turtle syndrome (DTS) admissions have also increased. DTS is a nonspecific diagnosis for turtles that present suffering from malnourishment, dehydration, anemia, and a heavy parasite load. In North Carolina, DTS may often be related to past cold stunning events in which a turtle survived cold stunning but didn't fully recover. An increasing number of turtles are admitted due to being incidentally hooked in recreational fisheries. In 2024, the highest number of turtles to date – 41 turtles – were hooked. The increase in hooked turtles may be related to increasing education and outreach efforts that encourage anglers to report hooked turtles. Human interactions include hooked turtles, entanglement, and dredge. The percent of admissions caused by human interaction has decreased over time, however the overall numbers of admissions caused by human interaction has increased over time. Currently, admissions due to human interaction represent 24% of all admissions. This summary presents our first in depth review of sea turtle causes of admission over time. We hope continued data examination will offer additional insight into stranding and admissions trends.

## SOCIAL, ECONOMIC AND CULTURAL STUDIES

# DRIVERS OF GEAR DISCARDING AND REPORTED SEA TURTLE ENTANGLEMENT INCIDENCES IN PRINCIPE, GULF OF GUINEA: IMPLICATIONS FOR FISHING NET MANAGEMENT

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Abandoned, lost or otherwise discarded fishing gear (ALDFG) represents a substantial proportion of global marine plastic pollution and contributes to the under-reported issue of marine turtle entanglement. The lack of formal waste management in many areas where fishing is prevalent likely contributes significantly to overall marine plastic pollution and poses a threat to megafauna species. Yet little is known about the behavioural drivers behind discarding gear, particularly in Small Island Developing States (SIDS). To address this, a fishers' questionnaire was employed within communities in Príncipe, Gulf of Guinea. Adapting the 'Theory of Planned Behaviour', this tool was used to explore attitudes, subjective norms and perceived behavioural control specifically focusing on the behaviour of discarding nets within the communities. Questions were asked on: the use and management of different types of nets, the drivers of gear discarding, suggestions for potential solutions, and the incidences of marine megafauna entanglement. Information on how often different types of nets were repaired, replaced, their alternative uses, and discarding methods was also obtained. A total of 51 participants took part in the questionnaire, representing a large portion of net owners in Príncipe (total n=97). Regarding marine turtle entanglement, 28% (n=46) of sightings were in discarded gear (ghost nets), with the remaining being reported as bycatch in active nets. Overall, sea turtles were most often sighted in active or discarded by net owners annually (50%; sightings n=36), alive (68%; n=50) and were released (91%; n=35), in comparison to other megafauna species, owing to an island-wide awareness programme. In participants' opinion, the most impactful initiatives to stop the discarding of fishing nets within the communities included raising awareness, better storage/ management of nets or a collection of old/broken nets for a re-use project. The majority agreed that a net collection scheme would be a good idea, with a few commenting on the need to be financially imbursed from old or broken net collection. Gathering such knowledge is essential for developing effective management strategies to address ALDFG within SIDS, involving communities in the design of solutions that could feed into policy or legislative change. Additionally, such reporting can aid in understanding the impacts of ALDFG on vulnerable marine species, such as marine turtles, in areas where knowledge is currently highly limited.

# SUSTAINING SEA TURTLES, SUPPORTING COMMUNITIES: A HOLISTIC APPROACH IN SÃO TOMÉ

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Effective conservation goes beyond protecting biodiversity — it demands the active participation and empowerment of local communities. In São Tomé and Príncipe, Programa Tatô has pioneered a community-centered approach to sea turtle conservation, integrating social development and economic empowerment into its conservation strategies. This holistic model ensures that the needs of both nature and people are met, fostering long-term sustainability. A key element of this approach is the inclusion of local communities in conservation activities. Programa Tatô hires and trains local agents to participate in ecological monitoring and environmental education, transforming them into stewards of marine conservation. Additionally, tailored programs empower former sea turtle traders and women fishmongers to shift towards sustainable livelihoods. One such initiative, the Artisanal Fish Preserves Pilot Project, supports women in developing value-added fish products, such as sterilized glass jar preserves. The project addresses food security, reduces fish waste, and generates income for local women, while promoting gender equality and sustainable economic development. Ecotourism also plays a vital role in linking conservation with community benefits. At Praia Jalé, São Tomé's most important sea turtle nesting beach, a Memorandum of Understanding (MoU) unites stakeholders—including local communities, government entities, tourism operators — to balance ecotourism growth with species protection. Visitor fees support conservation activities and fund social projects, such as school transportation for children, water infrastructure repairs, and community facility improvements. This initiative highlights how conservation efforts, combined with sustainable tourism, can drive economic growth for local communities while safeguarding fragile ecosystems for future generations. To ensure the long-term impact of these efforts, Programa Tatô invests in the professional development of its staff. Local guides, conservation agents, and project leaders receive training and capacity-building opportunities, empowering them to become future leaders in conservation. This commitment extends to the National Internship Program, which provides young Santomeans with paid opportunities to gain practical experience in conservation-related fields, fostering the next generation of environmental leaders. Interns actively participate in activities such as sea turtle monitoring, education and awareness, and community outreach, with some internships developed in collaboration with partner organizations. Through its integrative approach, Programa Tatô has demonstrated that conservation and community development are not only compatible but also mutually reinforcing. By creating new sources of income, supporting social projects, and empowering local communities, Programa Tatô is building a sustainable framework for protecting sea turtles while improving the quality of life for the people of São Tomé and Príncipe.

# MARES COMUNIDAD: FISHERIES LEARNING EXCHANGES SUPPORT SUSTAINABLE FISHING AND BYCATCH REDUCTION IN COASTAL MEXICAN COMMUNITIES

**Agnese Mancini[1,2], Raquel Briseño Dueñas[1,3], Diana Arely Ramos de la Torre[1,4], Maria Isabel Miranda Marín[1], Luis Angel Tello Sahagun[1,11], Carlos Delagado Trejo[1,5], Katherine Comer Santos[1,6], Catherine E. Hart[1,2], Alan Zavala-Norzagaray[1,7], Yadira Trejo Hernández[1], Anibal Murillo López[1], Karen Oceguera Camacho[1,2], Helga Oceguera Camacho[1,2], Jesus Salvador Lucero[1,2], Heriberto Santana[1], Joana Alfaro Shigueto[1,8], Jeffrey A. Seminoff[1,9], Bryan P. Wallace[1,10]**

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MARES Comunidad is a binational conservation initiative focused on enhancing the well-being of Mexican fishing communities along the Pacific coast while actively reducing the bycatch of endangered marine turtles. Addressing the growing threats posed by artisanal fishing practices to marine biodiversity. MARES Comunidad's holistic approach emphasizes the engagement of fishers and local communities in sustainable practices and conservation efforts. Central to this initiative are the Fisheries Learning Exchanges (FLEs), innovative knowledge-sharing spaces where fishers can exchange experiences, strategies, and peer-to-peer support to advance sustainable fishing practices and alternative livelihoods. From 2022 to 2024, we conducted 27 exchanges, reaching 419 participants across 51 coastal communities. FLEs solicited input from fishers on a variety of topics such as 1) gear modification to reduce turtle bycatch, 2) development of fisher-designed tools for safe release of turtles from gear, and 3) economic diversification via ecotourism and artisanal craft sales. A series of FLEs also occurred in communities where previous rapid bycatch assessments (RBAs) had occurred to share survey results with local fishers. Key findings from the project highlighted the socio-economic challenges faced by artisanal fishers, who work in precarious conditions due to declining fish stocks, high operational costs, and limited governmental support. We also highlighted the role of women—both as fishers and supplemental income earners—in community activities. Too often, artisanal fisheries are considered a man-only business, yet the role of women in fortifying community resilience is significant, and should be explicitly accounted for in fisheries sustainability strategies. Through the FLEs, we learned the importance of amplifying fishers' voices in the decision-making process and fishery governance. Ongoing community engagement and knowledge-sharing are critical to strengthening sustainable fishing practices that protect both marine turtles and local livelihoods. While FLEs have proven invaluable, they represent just one step in a larger process to foster long-term sustainability in artisanal fishing communities, and follow-up activities (e.g. promoting sustainable fisheries management, supporting gender-inclusive initiatives) should be implemented to reinforce the progress achieved.

## CONSUMPTION OF SEA TURTLES IN BATA CITY, FAD OR TRADITION?*

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The Atlantic coast of Africa is vital for sea turtles, with five of the seven known species nesting in the region. However, populations face serious threats, such as intentional capture for human consumption, incidental capture in fisheries and oil exploration in the Gulf of Guinea. In Equatorial Guinea, the island of Bioko is an important nesting colony, but turtle populations have declined dramatically due to overexploitation. Despite laws protecting turtles since 1988, the capture of eggs and adult turtles remains a common practice. Turtles also face indirect threats such as marine pollution, nest predation and coastal erosion. Although conservation projects exist, lack of resources and political instability hinder their effectiveness. This research seeks to analyze the demand for sea turtle consumption and the impact of the increase in per capita income on this demand, highlighting that this is not a traditional consumption. The research focused on the consumption of sea turtles in the city of Bata, especially in coastal neighborhoods and local markets. The methodology included observations in key areas such as Ekuku, Ukomba and Mondoasi, and interviews with fishermen, vendors and consumers. 290 surveys were conducted between November 2016 and December 2023, focusing on the type of consumers, the origin of the catches, the price of "pepesup" (traditional turtle dish) and the days of greatest demand. Participants were classified into categories such as specialized fishermen, transporters, sellers and final consumers. In addition, data on trade and consumption were collected; cultural, economic and social factors were considered, and complemented by photographs and visual observations of turtles in markets. Results from our surveys in bars and restaurants confirmed that sea turtles are an important resource for local communities, used both in gastronomy and in the informal economy. Turtle meat and viscera, especially of *Chelonia mydas* and *Eretmochelys imbricata*, are the most traded products, while consumption increases on weekends. Demand is high, especially among the inhabitants of the Fang ethnic group, who have adopted the consumption of turtles despite their tradition of not including them in their diet. The study also revealed that turtle capture is common, and is carried out mainly in areas close to the city such as Asonga, Utonde or from the island of Corisco. Captured turtles are transported to the city, often facing obstacles such as military patrols and road barriers, which drives up prices. Although laws exist to protect sea turtles, their enforcement is weak, and illegal hunting persists due to a lack of awareness about the importance of conservation of these species. Several difficulties were identified, such as the refusal of the population to provide information on turtle consumption, corruption and poor controls in the capture areas. In addition, the fashion of consuming pepesup as a status symbol and the economic crisis make it difficult to implement sustainable conservation initiatives. Finally, we propose regulatory, educational and tourism measures, such as strengthening the law with its implementing regulations and promoting ecotourism, to improve the protection of turtles and their habitat.

# ADVANCING SUSTAINABILITY THROUGH SEA TURTLE CONSERVATION: INSIGHTS FROM THE WESTERN SOUTH ATLANTIC

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Our Blue Marble faces significant, intersecting environmental challenges, including climate change, biodiversity loss, and ecological health collapse, all deeply intertwined with environmental injustice. Underserved or vulnerable human and nonhuman systems disproportionately bear the burdens of these crises while receiving fewer benefits, highlighting the urgent need for sustainability, an interdisciplinary approach to meet the needs of current and future generations equitably. The United Nations' 2030 Agenda for Sustainable Development provides a blueprint for a better future through 17 Sustainable Development Goals (SDGs) that balance social, economic, and environmental factors. These aims, while aspirational, may serve as useful frameworks for governments and other stakeholders, including non-governmental organizations. This research investigates connections between the SDGs and organizations managing and protecting sea turtles in the Western South Atlantic (WSA) through a questionnaire, website and literature surveys, and personal interviews. Regional marine reptiles disperse and migrate along the coastline, in territorial waters, and through connected areas. As globally endangered, highly migratory, transboundary, and charismatic species, sea turtles represent challenges and opportunities in sustainable marine conservation. This study analyzes the actions of different conservation projects developed in Brazil, Uruguay, and Argentina. These organizations are renowned for community-based conservation centered on all three pillars of sustainability—social, economic, and environmental—through their research, conservation, education, and social inclusion missions. Together with regional academic and other groups, they form La Red ASO -Tortugas, the South Atlantic Sea Turtle Network. The data reveal that these groups individually and jointly advance SDG Goals 14 and 15, focusing on Life Below Water and On Land, by protecting and researching nesting beach and foraging ground populations along the Western South American coastline. Their work has reversed formerly declining national and regional population trends. For example, of the five sea turtle species in Brazil, four have improved in conservation status, although the leatherback turtle remains critically endangered. The projects are beginning to address Goal 13, Climate Action, and the challenges of rising sea levels, increasingly severe storms, and temperature-dependent sex ratio changes, through research and ensuing management actions. The groups' extensive educational outreach also enhances environmental literacy at various levels, contributing to Goal 4, Quality Education. The programs create jobs and support local culture by engaging fishermen and former poachers as protectors, involving community members in artisanal and artistic production, and developing educational work opportunities, supporting Goals 1: No Poverty; 2: Zero Hunger; 3: Good Health and Well-being; 8 Decent Work and Economic Growth, and 11 Sustainable (Cities and) Communities. The conservation models developed by these groups go well beyond protecting endangered species to enhance the economic and social welfare of surrounding communities, offering valuable insights for conservation organizations worldwide and promoting sustainability one turtle at a time.

# SOCIOECOLOGICAL PERSPECTIVE OF SEA TURTLE CONSERVATION IN AFRO-DESCENDANT COMMUNITIES IN GUERRERO STATE, MEXICO*

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Sea turtles have traditionally been used for different purposes, such as medicine, cultural symbols, ornaments and above all as a food resource, so they play an important role in the subsistence of coastal communities. Therefore, it has been shown that using the ancestral knowledge of coastal communities, together with biological data, allows for a comprehensive analysis of the problems and improves the legitimacy of coastal governance. However, the change in habits of the population, where the use of natural resources is a vital source of income and essential for survival, has been a great challenge, so they have gradually been attracted to conservation and research programs, which generate different direct and indirect benefits for the population. Objective: To determine the sociocultural aspects and evaluate the impact that the actions of protection and conservation of sea turtles have on Afro-descendant communities in the state of Guerrero in Mexico. Methodology: Three communities were selected where there are Community Turtle Groups carrying out activities of protection and conservation of sea turtles for several years. These were: Barra de Tecoanapa, Playa Ventura and Punta Maldonado. Semi-structured surveys were conducted at random to the inhabitants of these coastal communities. Some of the questions asked were; Are sea turtle products consumed in your community? What sea turtle products are consumed? Do you think that the activities carried out by Turtle Groups benefit sea turtles and their community? Do you think it is still necessary to maintain the ban on sea turtle consumption? among others. A database was created and the corresponding statistical analyses were carried out using the IBM SPSS V.23 program. Results: 194 surveys were applied (66 in Barra de Tecoanapa, 64 in Playa Ventura, 64 in Punta Maldonado). 80.9% of the population surveyed maintains that sea turtle products are still consumed in their community; eggs, meat, blood and oil. It was found that 100% of the population surveyed agrees that the protection and conservation actions carried out at each site benefit sea turtles and the inhabitants of the community, and they are in favor of continuing the ban on sea turtles. Conclusion: Some inhabitants of Afro-descendant communities continue to consume products derived from sea turtles as part of their traditions; however, the conservation and protection actions of sea turtles carried out in different communities through turtle groups have economically benefited the population through the increase in tourists, which increases their sales in stores, and ecologically benefited sea turtles, since they have observed a notable increase in sea turtle populations on these beaches and, likewise, the consumption of products derived from sea turtles has decreased. It should be noted that this is the first research focused on the socio-ecological perspective of the community in Guerrero state, since the other research has been focused only on the protection and conservation of sea turtle populations.

# CRAFTING A SUSTAINABLE FUTURE FOR PEOPLE AND SEA TURTLES: A THEORY OF CHANGE APPROACH TO PROJETO TAMAR'S SOCIOENVIRONMENTAL IMPACT BUSINESS IN BRAZIL

**Valéria Rocha[1], Maria A. Marcovaldi[1], João Carlos A. Thomé[2], César Coelho[1], Gustavo Stahelin[1], Bruno de Barros Giffoni[1], Clarice Burtet[1], Jaqueline Castilhos[1], Luciana S. Brondízio[3]**

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The long-term recovery and maintenance of healthy sea turtle populations require innovative strategies that promote environmental sustainability and local development. Since its creation in 1980, Projeto Tamar has been a pioneer in this regard, developing and implementing innovative educational and socioeconomic activities that have significantly contributed to the protection of sea turtles in Brazil. This extensive experience and the positive results obtained leave a legacy of lessons that can be shared and serve as a reference for other organizations. The Theory of Change is a method used to show and measure the positive impacts brought by projects and businesses and can be applied to the development, management, and evaluation of organizational interventions. The focus of this study is to analyze, through the Theory of Change approach, Fundação Projeto Tamar's clothing factory, implemented in the early 1990s, in two main nesting areas for sea turtle conservation: Regência/ES and Pirambu/SE. This initiative was created with the clear purpose of creating employment and income opportunities for women from the local community and their families, and as a means of generating resources for maintaining the conservation and research program. Based on the Theory of Change framework, this case study mapped the process and illustrated the results and value chain of this initiative. Key factors contributing to the positive impacts were also identified. Using secondary data, we consolidated the tangible outcomes, or quantitative data, from 32 years of Fundação Projeto Tamar's clothing factory activities. To identify the intangible outcomes, or qualitative information, and impacts of the initiative, we used sixteen unstructured interviews with two groups of stakeholders: women from the communities of Regência/ES and Pirambu/SE who worked and/or still work in Tamar´s clothing factory, and people who work and/or has worked in the implementation of this initiative. Our results emphasized some attributes that contributed to the success of the initiative: a clear purpose; the choice of a business aligned with the local culture; motivated and engaged people to implement the clothing factory and make it work; access to continuous training; knowledge of the market and the existence of demand (Tamar´s stores in touristic locations). The tangible outcomes highlighted are; 60 job opportunities generated per year, support to six craft groups involving 90 people/year, financial sustainability of the conservation and research program (currently representing 45% of Fundação Projeto Tamar's stores' revenue), and the recovery trend of populations of five turtle species (*Caretta caretta*, *Dermochelys coriacea*, *Chelonia mydas*, *Eretmochelys imbricata*, and *Lepidochelys olivacea*). Interviews highlighted that Fundação Projeto Tamar's clothing factory significantly promoted women's empowerment and leadership through increased self-esteem, personal and financial autonomy, training, labor market integration, and entrepreneurship. In addition to reducing threats to sea turtles, this initiative has contributed to reducing threats to women and families in vulnerable situations. This study indicates that socio-environmental impact business initiative models can contribute to the long-term sustainability of conservation initiatives and build resilient and sustainable communities.

# CATTLE OF THE SEA: PERCEPTIONS ON ILLEGAL SEA TURTLE TAKE IN PANAMA*

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In Panama, sea turtles have been exploited for generations to supply local, national, and international markets. During the 1960s, hawksbill turtles were the most affected species. However, after the species was listed in the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) and international trade was prohibited, exploitation decreased. Around the same time, conservation projects began sea turtle conservation and monitoring efforts in the area. However, by then, many coastal communities had become accustomed to consuming sea turtles. Today, the use of sea turtles in Bocas del Toro and local perceptions regarding the consumption of these reptiles remain unknown. Understanding the extent of illegal take and the social and economic drivers behind it is crucial to develop and implement effective conservation strategies for sea turtles. Accordingly, during May of 2024, we conducted twenty-five semi-structured interviews with key informants (e.g., members of native families, consumers, fishers, local authorities, and ex-turtle hunters) by target sampling and snowball" sampling. Our preliminary results show that sea turtle consumption persists and that there is a clandestine network to sell turtle meat in Bocas del Toro. Most key informants affirm that they use and consume sea turtles because it is a custom passed on by generations. The price ranges from $2 to $4 per pound for meat, although prices can fluctuate based on the season and the person who catches the turtle. Additionally, some interviewees mentioned that sea turtles have aphrodisiac properties, and they considered it an honor to be recognized as a "Tortugueros" (Turtle catcher). Taken together, this study provides a preliminary assessment of local perceptions of sea turtle consumption and trade distribution in Bocas del Toro and regional insights into illegal take.

# MARES COMUNIDAD: SUSTAINABLE FISHING THROUGH SUSTAINABLE LIVELIHOODS: SUPPORTING COMMUNITY-LED ALTERNATIVE ECONOMIC ACTIVITIES TO REDUCE TURTLE BYCATCH IN COASTAL MEXICO

**Yadira Trejo Hernández[1], Anibal López Murillo[1], María Isabel Miranda Marín[1], Agnese Mancini[1,2], Diana Arely Ramos de la Torre[1,3], Raquel Briseño Dueñas[1,4], Karen Oceguera Camacho[1,2], Jesus Salvador Lucero[1,2], Helga Oceguera Camacho[1,2], Carlos Delagado Trejo[1,5], Luis Angel Tello Sahagún[1,11], Catherine E. Hart[1,2], Alan Zavala Norzagaray[1,6], Katherine Comer Santos[1,7], Heriberto Santana[1], Joana Alfaro Shigueto[1,8], Jeffrey A. Seminoff[1,9], Bryan P. Wallace[1,10]**

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MARES Comunidad is a binational conservation initiative aimed at promoting fishing community well-being while reducing bycatch of endangered species, like marine turtles, along the Mexican Pacific coast. Led by a diverse and dynamic team, composed, among others, of artisanal fishers and community leaders, MARES Comunidad addressed challenges faced by artisanal fishers by promoting several complementary activities, including the fostering of alternative economic activities to reduce dependence on fishing, which is another way to reduce incidental capture of turtles in fishing gear. These community-led activities have included ecotourism, aquaculture, artisanal crafts, and mangrove restoration. Here, we summarize the results and achievements obtained since 2021. The planning phase was crucial for achieving important results; during this phase, separate meetings were held with each group to identify their goals and create a roadmap to achieve them, including identifying gaps and needs. The subsequent phase was focused mainly on addressing those gaps and needs through targeted capacity building events, specific for each group. Based on community input the project delivered training in business management, fiscal practices, sustainable fishing practices, and diversified handicraft techniques. The final phase included implementing and evaluating each activity. Key results included a measurable reduction in fishing pressure through expanded job opportunities, and increased local capacity to manage sustainable enterprises. This model highlighted the importance of cross-sector partnerships, continuous engagement with the groups, and community interest to build long-lasting environmental and economic resilience. This community-centered approach can be replicated in other coastal regions facing similar challenges, to impulse conservation and sustainable development.

# EXPLORING MOTIVATIONS FOR PARTICIPATION IN COMMUNITY-BASED SEA TURTLE CONSERVATION IN TANZANIA*

**Lindsey West**[1,2]

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Values serve as guiding principles in life and play a key role in motivating action. Therefore, tackling biodiversity loss requires an understanding of the diverse ways in which people value nature and the types of nature connections that can motivate local stewardship. Recent attention to relational values has helped address the narrow conceptualization of environmental values as either intrinsic or instrumental, and challenged the notion of a 'rational actor' motivated by self-interest. Thus, a focus on the social and cultural context in which conservation occurs can provide further insights into the factors that motivate local participation in biodiversity conservation. This study adopts a socio-cultural understanding of human action to explore the motivations of community Conservation Officers who have been leading sea turtle conservation efforts in Tanzania for more than 20 years. Several of the Conservation Officers hunted turtles in the past and therefore, participation in sea turtle conservation represents a significant change in behaviour. Over time, Conservation Officers have become well respected and trusted members of their communities, and many have been elected to local leadership positions. However, their underlying motivations for participation in sea turtle conservation are not well understood. Furthermore, it is unclear how the different elements of participation have interacted to shape the actions, outcomes, and legitimacy of the Conservation Officer network over the past 20 years. In-depth interviews were conducted with 22 Conservation Officers situated across five coastal districts, which focused on motivational factors and lived experiences of participation. All interviews were recorded, transcribed, and translated from Kiswahili to English, and analysed using Reflexive Thematic Analysis. The analysis revealed that the Conservation Officer's motivations were influenced by both personal and contextual factors, and changed over time. Initially, value-based motives contributed to the Conservation Officer's decision to participate. However, their motivation was sustained over time as the tangible benefits of participation were realised in the form of improved social status and multi-dimensional wellbeing outcomes. These benefits were sufficient to offset the costs of participation including acts of resistance and negative impacts on valued social relationships. This study highlights the complex interactions between cognitive, social, and cultural drivers of participation, which are often overlooked in the design and implementation of conservation programmes. Recognition of the diverse value-systems of local actors, as well as the importance of social and cultural contexts, is crucial for designing conservation programmes that respect the rights, values, and priorities of people living alongside biodiversity. Leveraging diverse values can avoid over reliance on economic incentives for participation, foreground conservation approaches that enhance human wellbeing, and increase the long-term sustainability of conservation initiatives. We recommend that sea turtle conservation programmes are designed in collaboration with coastal communities to enable expression of diverse values and to provide a pathway for non-material values to be more fully considered in decision-making processes.

# IMPORTANCE OF INDIRECT CONSERVATION MEASURES ON THE PROTECTION OF LOGGERHEAD TURTLES IN BOA VISTA, CABO VERDE

**Kathryn Yeoman[1], Euclides Resende[1], Thomas Reischig[2], Hiltrud Cordes[2]**

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Conventional sea turtle conservation strategies like beach patrols, hatchery management, and data collection are core activities of Fundação Tartaruga to protect endangered loggerhead turtles (*Caretta caretta*) on Boa Vista, Cabo Verde. However, persistent threats—poaching, unregulated tourism, marine plastic pollution, and habitat degradation—highlight the need for complementary approaches. To address these challenges, since 2012, we have implemented non-conventional strategies that align with Sustainable Development Goals (SDGs) and international biodiversity targets, enhancing the long-term protection of this critical loggerhead population. Annual poaching levels on the island of Boa Vista have been successfully reduced from 1,253 (2007) to just 20 (2024). We believe that this has only been possible through the holistic approach used. Our expanded efforts focus on education, community development, innovative technology, and partnerships, addressing root causes of threats while building local capacity for conservation. Education programs, aligned with SDG 4 (Quality Education) and SDG 14 (Life Below Water), engage children and young adults to instil a conservation ethic. Activities like conservation-themed swimming lessons and our ambassador dog, Kelo, foster environmental awareness and address local behaviours contributing to turtle population decline. By cultivating a culture of marine conservation, we align with Target 14.1 (reducing marine pollution) and promote sustainable practices. Community development plays a pivotal role in reducing financial dependence on harmful activities like turtle poaching. By supporting SDG 8 (Decent Work and Economic Growth) and Target 14.b (small-scale sustainable fisheries), we provide sustainable employment alternatives and invest in community programs, sports, and education. This approach empowers local populations to take an active role in conservation, creating long-term stewards of the loggerhead population while delivering positive social impacts. Innovative technologies further strengthen our conservation efforts. Drones and night-vision binoculars enhance monitoring of nesting sites and poaching hotspots, supporting Target 15.5 (reducing biodiversity loss). Drone surveillance improves the effectiveness of traditional beach patrols by expanding nocturnal and morning monitoring capacity and allowing for proactive responses to threats. By integrating advanced technology, we provide cutting-edge training to local rangers and establish a model for modernized wildlife protection. Partnerships with local authorities and community leaders underpin our conservation strategy, supporting SDG 17 (Partnerships for the Goals) and Aichi Biodiversity Target 18. Across Cabo Verde, NGOs have successfully lobbied to impose stricter protection laws meaning that law enforcement on damaging practices could now be applied since 2018. Through collaborating with the Ministry of Environment, other NGOs and the national police, we are working to improve the management of protected areas and integrate conservation into cultural and community governance. This ecosystem-level approach focuses on safeguarding habitats rather than individual turtles, fostering community ownership of conservation outcomes. Collectively, these strategies address socio-economic and cultural factors influencing local behaviours, reinforcing loggerhead protection. By combining traditional methods with innovative approaches, we build ecological resilience and secure long-term species protection. Our model demonstrates the value of non-traditional conservation methods, offering scalable solutions for other endangered populations worldwide.

# INDEX I: SESSION DESCRIPTIONS

## ANATOMY & PHYSIOLOGY / REHABILITATION AND HEALTH

This session includes research on all aspects of sea turtle form and function, as well as the causes and consequences of individual and population-wide health problems, and how these relate to the environment. Relevant topics include studies and reports on anatomy, physiology, reproductive biology, thermoregulation, osmoregulation, functional morphology, diseases, veterinary care, rehabilitation, epibionts, parasites, health assessment, embryology, and pathology.

## IN-WATER BIOLOGY (BEHAVIOR, ECOLOGY, MIGRATION, TELEMETRY, FORAGING)

After entering the ocean as hatchlings, sea turtles do not leave the sea again except to nest (or occasionally to bask). This session broadly encompasses the biology of sea turtles in the ocean. It includes research on turtles of all life-history stages, with the goal of better understanding the biology and ecology of turtles in their underwater habitats. Suitable topics include behavioural or observational studies related to migration, diving, foraging, or navigation, as well as sightings, surveys and monitoring of turtles at sea (e.g., in developmental habitats or foraging areas), conservation status evaluations, and the structure and dynamics of populations, subpopulations, and metapopulations. Other topics include telemetry and movements, patterns of resource use and residency, mating behaviour and social interactions, feeding behaviour and diet composition, the ecological role turtles play in their diverse habitats, and the implications of habitat condition on the health and sustainability of turtles.

## NESTING BIOLOGY (ECOLOGY, BEHAVIOR, AND REPRODUCTIVE SUCCESS)

This session will focus on nesting beaches, nesting females, nests, hatchlings, eggs, and closely related topics. Relevant subjects include assessments of nesting population size, modelling of population parameters, long-term monitoring of nesting trends, forecasting population change, behaviour of turtles on nesting beaches, hatching/emergence success and hatchling production, sea-finding behaviour, environmental impacts on egg viability or nesting, newly discovered or newly colonized nesting areas, and related topics. Reports of nesting activity for short-term periods (<10 years) may be included in the poster session; studies revealing long-term nesting trends may be suitable for oral presentation if they reveal lessons relevant to other geographic areas.

## POPULATION BIOLOGY AND MONITORING (STATUS, MODELING, DEMOGRAPHY, GENETICS, NESTING TRENDS, IN-WATER TRENDS)

This session focuses on sea turtle population assessments and related topics. Specific topics include population demography (i.e. survival probabilities, growth rates and reproductive rates); abundance and trends; population structure and population connectivity; population genetics (e.g., mixed stock analysis); and management unit/population segment definitions. Studies from both nesting and foraging habitats are welcomed, as are modelling approaches to population biology in which mathematical or simulation models are used to elucidate marine turtle population parameters and vital rates.

## FISHERIES AND THREATS

This session focuses on the evaluation of natural and anthropogenic threats that degrade the condition of critical sea turtle habitats, or which increase the risk of mortality and major population declines of sea turtles on any geographic scale. Topics include fisheries bycatch, characterization of fishing gear and fishing effort, directed take, strandings due to any factor (including cold-stunning), impact of degradation of nesting and feeding habitats, impacts of urban development in coastal areas, and emerging threats from climate change, among others. Presentations may also include evaluation of potential impacts of either known or newly discovered threats, as well as proposed or actual measures taken to reduce risks to turtle populations.

## CONSERVATION, MANAGEMENT AND POLICY

This session will highlight work on economic, legal, policy, and management aspects of sea turtles and their conservation. Topics include studies and reports that address issues of legislative support and enforcement, policies and programs that safeguard sea turtles and their habitats, management issues related to sea turtle monitoring and conservation, and related matters. This session will also include reports on the implementation, results, and impact of initiatives and international agreements pertaining to sea turtle protection.

## EDUCATION, OUTREACH AND ADVOCACY

Sea turtles cannot be protected or conserved unless people take an interest in their continued survival. This session focuses on innovative educational methods for raising awareness of sea turtles and promoting their conservation in different parts of the world, as well as efforts to develop and enhance advocacy efforts on behalf of sea turtles at any level of community or government. Topics include a broad range of approaches to educational outreach and to advocacy, as well as strategies for influencing decision-makers and efforts to convert potential adversaries (e.g., fishermen or egg poachers) into allies.

## SOCIAL, ECONOMIC AND CULTURAL STUDIES

Sea turtles play a crucial role not only in marine ecosystems, but also in human societies. This session includes presentations that broadly explore the human dimension of sea turtles and the importance of turtles in diverse cultures and societies around the world. Some presentations focus on research projects, but others highlight initiatives related to the conservation of sea turtles and their habitats, or efforts to understand local attitudes toward sea turtles and conservation. Topics include but are not limited to: social science and/or anthropological research; discussions of cultural considerations related to conservation and management; sea turtles in local folklore, mythology, and culture; examinations of conflict and conflict resolution; studies of information and/or technology transfer between local peoples and other experts.

# INDEX II: WORKSHOP DESCRIPTIONS

## WORKSHOP 1: HARNESSING THE POWER OF SOCIAL MEDIA FOR NON-PROFITS & INDIVIDUAL RESEARCHERS

Organizer: *Christine Figgener*

In today's digital landscape, social media has become a powerful tool for non-profit organizations and individual researchers to amplify their work, connect with diverse audiences, and inspire meaningful action. This session is designed to equip participants with practical skills and strategic insights to effectively leverage social media in support of their missions and research goals.

Through interactive discussions and real-world examples, participants will explore how different social media platforms can be used to enhance visibility, communicate impact, and build engaged communities.

**Objectives:**

- Provide an overview of key social media platforms and their distinct advantages
- Equip participants with practical strategies for creating engaging, audience-centred content
- Share best practices for growing reach, engagement, and online influence
- Introduce tools and approaches for measuring social media impact and refining strategies
- Encourage collaboration, peer learning, and exchange of ideas among participants

## WORKSHOP 2: CREATING BEHAVIOR CHANGE CAMPAIGNS FOR SEA TURTLE CONSERVATION

Organizers: *Ashleigh Bandimere, Roderic Mast, Brian Hutchinson, Lindsay Mosher, Rachel Smith, Kelley Anderson*

Team BEACH (BE A CHangemaker) is an initiative started 0n 2020 by the State of the World's Sea Turtles (SWOT) Program at Oceanic Society and Disney Conservation with the support of AZA-SAFE and USFWS that aims to encourage human behavior change campaigns and education programs that will result in successful conservation of sea turtles and their habitats. While many sea turtle conservation organizations implement outreach programs in their communities, not all of them are designed with tangible behavior change goals and evaluation plans. The goal of this workshop is to bridge the gap between sea turtle conservationists and behavior change theory and methodology to give them the necessary tools to make positive changes in their local communities where humans and turtles share space.

**WORKSHOP 3: SEA TURTLE REHABILITATION, CARE AND MEDICINE**
Organizers: *Daniela Freggi, Mariluz Parga*

Now in its 14th edition since 2010, this workshop addresses the growing role of sea turtle rescue and rehabilitation centers in global conservation. As these centers expand, often under emergency conditions and with limited specialized support, there is an increasing need for shared expertise, standardized practices, and sustainable approaches to care. The session brings together professionals involved in sea turtle rehabilitation to exchange knowledge on diagnostics, critical care, husbandry, injury management, anesthesia, and surgical procedures. It also explores future directions for improving effectiveness and sustainability through resource sharing, targeted training, technological standardization, and strengthened international collaboration.

Participants are encouraged to contribute their experience and insights to advance best practices in sea turtle rehabilitation and conservation.

**WORKSHOP 4: TOWARD HOLISTIC STRATEGIES FOR FISHERIES SUSTAINABILITY AND BYCATCH REDUCTION**
Organizers: *Bryan Wallace, Joanna Alfaro-Shigueto, Agnese Mancini*

Incidental capture of sea turtles and other species of conservation priority in artisanal fisheries has negative impacts on these taxa and on fishers themselves. Thus, conservation strategies must balance reducing bycatch impacts on sea turtle populations with supporting the well-being of the small-scale fishing sector. Despite the fundamental importance of this challenge, many bycatch reduction initiatives often base their strategies primarily on scientific studies and experiments, focusing on species-specific gear modifications or bycatch reduction technologies, with little or no emphasis on the needs, challenges, and perceptions of fishers and the socio-economic conditions of their communities. In contrast, a truly holistic perspective recognizes that there are many possible activities–not just experiments–that can and should be implemented to reduce bycatch AND promote sustainable fisheries. However, the connections and influences between these activities, and how to effectively design and implement such holistic strategies, must be understood to achieve these ‘win-win’ goals.

The goal of this workshop is to identify, discuss, and encourage holistic initiatives that seek to promote long-term community well-being through strengthening sustainable fishing, which involves reducing negative impacts on marine ecosystems and their biodiversity. This workshop will roll out a newly developed ‘best practices’ manual that provides a clear roadmap for creating holistic solutions to address bycatch, and will feature a dynamic mix of expert presentations, sharing real-world experiences and lessons learned, alongside interactive discussion groups on successful collaborative strategies from across the globe. Participants will engage in activities fostering exchange with like-minded professionals, exploring best practices for designing and implementing comprehensive bycatch reduction strategies that build from the bottom-up, focusing on the human components. This workshop will promote visioning and initiatives that emerge from meaningful engagement with fishers and their communities, centering their interests, ideas, and needs.

## WORKSHOP 5: 5TH ENVIRONMENTAL EDUCATION WORKSHOP: INTERDISCIPLINARY AND COLLABORATIVE ENVIRONMENTAL EDUCATION PROJECTS

Organizers: *Antonio Trujillo, Alba Lopez, Eneida Fajardo*

For a long time there has been talk of the need for environmental education to become transversal and interdisciplinary, in order to create projects that are not only innovative, but also have a greater impact on the beneficiaries and the different institutions that work with sea turtles. The reality is that environmental education continues to be very isolated and often disconnected from research processes. This is why it is important to analyze the circumstances and actions of those educational projects that have managed to involve more than one turtle conservation stakeholder in order to replicate them, as well as any other tool or field of action that they have employed. Learning about other experiences will allow us to implement the most appropriate actions to achieve networking and increase the impact on sea turtle conservation. During the workshop, collaborative educational projects from around the world will be presented and we will seek to underpin the future actions of the nascent Sea Turtle Environmental Education Network (REATOMA), which will not only be the pillar of future educational actions, but will also become a turning point between researchers, conservationists and educators in view of much more transversal processes for the benefit of the communities and sea turtles. During the four previous workshops, different tools have been used to strengthen, create connections, diversify, evaluate and provide greater pedagogical capacities to the participants, so that the solidification of the network of educators is the necessary step to take the challenges of environmental education in these new times beyond the symposium space.

## WORKSHOP 6: MALE SEA TURTLES: GLOBAL RESEARCH UPDATE & METHODOLOGY DEVELOPMENT FOR GUIDING CONSERVATION EFFORTS

Organizers: *Marco García Cruz, Renato Bruno, Hector Barrios*

Much of what we know about the ecology and biology of sea turtles comes from studies on nesting females, and to a lesser extent, from juveniles in foraging and developmental habitats. These studies have primarily focused on understanding nest site fidelity, migratory movements, somatic growth rates, survival rates, and population structure. In comparison, little effort has been invested in understanding the ecology of male sea turtles, and even less in their management and conservation. Unlike females, males rarely come ashore, and the challenges involved in capturing them at sea have made it difficult to locate their feeding, courtship, and mating areas. Studying males in their foraging and mating areas across the globe is vital to better understand their habits, reproductive strategies, operational sex ratios, population dynamics, and habitat needs. After holding three previous workshops focused on male sea turtles, it is now time to continue promoting interest in including males in research and conservation efforts.

The main objective of this workshop is not only to review the status of global research and conservation efforts for male sea turtles but also to explore data collection methods that can address priority questions concerning male sea turtles.

## WORKSHOP 7: STUDENT WORKSHOP: CAREER PATHS AND TECHNIQUES IN SEA TURTLE CONSERVATION

Organizer: *Janie Reavis*

Each year, the student committee develops a Workshop presenting information on how to find jobs or funding, current available jobs, and other career advice. This year we will also add a technique demonstration component to the workshop, which will enable students to walk away from the workshop with applicable skills or at least exposure to different research methods. We will have guest speakers from a variety of fields who are qualified to offer advice on these subjects. We will also discuss the key skills that you need at each of those jobs and resources to begin preparing for them. More specifically, this workshop will focus on the wide breadth of sea turtle-related career paths and advice for students and new graduates to succeed in each one. This will range from governmental jobs, academia, nonprofit and for-profit careers.

# INDEX III: SPECIAL SESSIONS DESCRIPTION

## DECOLONIZING SEA TURTLE CONSERVATION

Chairs: *Amanda Robbins, Aileen Lavelle*

The *Decolonizing Conservation* special session offered a unique and critical space within the Symposium to examine sea turtle conservation through the lenses of power, history, culture, and equity. Centered on the realities of a globally endangered and highly migratory species, the session highlighted how effective conservation must move beyond traditional Western scientific frameworks to meaningfully integrate local knowledge, lived experience, and diverse cultural values. Through interactive engagement, case studies, and voices from the Global South, the session emphasized that inclusive, respectful, and collaborative approaches, balancing ecological and socioeconomic needs, are essential for long-term conservation success. This session stood out for elevating underrepresented perspectives and advancing a truly global vision for sea turtle conservation.

## LUNCH & LEARN: PROTECTING AFRICA'S TORTOISES AND FRESHWATER TURTLES

Organizer: *Turtle Survival Alliance*

Hosted for the first time at an International Sea Turtle Society (ISTS) Symposium, this Lunch & Learn session drew attention to the conservation needs of Africa's 66 species of tortoises and freshwater turtles, many of which are threatened or data deficient. The session provided a comprehensive overview of African chelonians while uniquely fostering collaboration between marine turtle initiatives and non-marine turtle conservation efforts. By encouraging cross-disciplinary partnerships and Africa-focused project development, the session marked an important step toward more integrated and inclusive turtle conservation within ISTS.

## INDEX IV: VIDEO PRESENTATION DESCRIPTION

### ARRIBA

**Location/Country:** French Guiana
**Presenter/Organization:** Michel Nalovic / Marine Turtle Specialist Group

This video explores the mass nesting (arribada) behavior of olive ridley turtles in French Guiana, a reproductive strategy that reduces individual predation risk but increases vulnerability to fisheries interactions near nesting beaches. In response, CRPMEM, WWF, CNRS, and KWATA launched the ARRIBA project to engage fishers on Cayenne Island through awareness campaigns and consultations. A voluntary no-fishing zone during nesting events was proposed and scientifically validated to reduce bycatch risks. Despite improved local collaboration and professional support for conservation, illegal fishing by foreign fleets from Brazil, Suriname, and Guyana continues to undermine efforts to protect turtles and other marine megafauna across the Guianas Shield Marine Ecoregion.

### COMMUNITY ENGAGEMENT & ENVIRONMENTAL EDUCATION

**Location/Country:** Mediterranean Region
**Presenter/Organization:** Nikolaos Simantiris / Mediterranean Association to Save the Sea Turtles (MEDASSET)

This video highlights MEDASSET's long-standing environmental education and outreach initiatives across the Mediterranean. It showcases school-based programs, public awareness campaigns, and stakeholder engagement activities designed to foster stewardship of marine ecosystems. By targeting youth, educators, and coastal communities, MEDASSET strengthens local capacity and builds long-term support for sea turtle conservation.

### GAMECHANGERS: THE FOOTBALL TEAM SCORING CONSERVATION GOALS

**Location/Country:** Gomoa Fetteh, Ghana
**Presenter/Organization:** Sofija Korf / Environmental Justice Foundation

This documentary tells the inspiring story of a Ghanaian football team in Gomoa Fetteh that has taken a stand to protect sea turtles in their community. In a region where turtles have long been used for food and income, compounded by declining fish stocks and illegal fishing, the team promotes dialogue and behavioral change. Facing complex social ties between patrollers and poachers, they use sport as a unifying platform to encourage conservation awareness, compliance with national laws, and alternative community perspectives on marine resource use. https://youtu.be/lD6GXYMxJAI

## LAVAVOLO TORTOISE CENTER

**Location/Country:** Lavavolo, Madagascar
**Presenter/Organization:** Jordan Gray / Turtle Survival Alliance

The Lavavolo Tortoise Center is a critical facility in global tortoise conservation, currently housing nearly 12,000 tortoises. Following historic confiscations of Radiated Tortoises in 2018, the center underwent significant expansion and renovation to manage the influx of rescued animals. Supported by international partnerships, the facility provides veterinary care, husbandry, and long-term rehabilitation. In May 2024, the successful reintroduction of the first 1,000 tortoises marked a major milestone in Turtle Survival Alliance's Confiscation to Reintroduction Strategy, demonstrating tangible progress in species recovery.

## LEATHERBACK

**Location/Country:** Ghana & The Netherlands
**Presenter/Organization:** Mirthe Dokter / Pollif Projects

This award-winning documentary follows Dutch artist and filmmaker Mirthe Dokter as she travels to Ghana to explore the conservation challenges facing leatherback sea turtles. Through artistic storytelling and personal reflection, the film documents her engagement with local conservation leader "Uncle Raf" and his team. It examines the intersections of poverty, climate change, and community conservation, while questioning the role of art in scientific communication and global conservation discourse. The film highlights how storytelling can bridge gaps between research, policy, and lived experience.
https://youtu.be/uY_xlpf6xL8

## LOOKING FOR LEATHERBACKS: COLLABORATING TO PROTECT TURTLES AT SEA

**Location/Country:** California, USA
**Presenter/Organization:** Kayla Sargent / Upwell Turtles

This video documents aerial and vessel-based surveys conducted by Upwell and NOAA Fisheries in 2024 to monitor leatherback sea turtles along the U.S. West Coast. Using systematic survey techniques and real-time data collection, the team identifies turtle presence in key foraging habitats. The findings directly inform dynamic ocean management strategies aimed at reducing bycatch and protecting the critically endangered West Pacific leatherback population. https://www.youtube.com/watch?v=Gqr9Wdwoe0M&t=2s

## NADOGO DISTRICT'S HISTORIC MARINE PROTECTED AREA & TURTLE SANCTUARY DECLARATION

**Location/Country:** Fiji
**Presenter/Organization:** Ravai Vafo'ou / WWF-Pacific Fiji Office

This video captures a landmark conservation achievement in Fiji, where 22 tribes united to declare Nukuvadra and Katawaqa islands as community-managed marine protected areas and turtle sanctuaries. The initiative reflects strong traditional leadership and indigenous stewardship, focusing on safeguarding hawksbill turtles and strengthening ecosystem resilience in the face of climate change. The project demonstrates the effectiveness of community-led conservation supported by international partnerships.
https://www.youtube.com/watch?v=vEznGcM6vvY

## PROJECTO KITABANGA: 20+ YEARS

**Location/Country:** Angola
**Presenter/Organization:** Débora de Carvalho / Projecto Kitabanga

Established in 2003, Projecto Kitabanga monitors over 102 km of Angola's coastline across seven provinces, contributing significantly to national sea turtle research and conservation. Over two decades, the project has facilitated the release of more than five billion hatchlings, strengthened data collection, and supported local employment and education. Its work aligns with multiple Sustainable Development Goals, integrating biodiversity protection with poverty reduction, gender inclusion, and sustainable coastal development.

## PROTECTING TURTLES, EMPOWERING COMMUNITIES: PROGRAMA TATÔ STORY

**Location/Country:** São Tomé Island, São Tomé and Príncipe
**Presenter/Organization:** Betania Ferreira Airaud / Programa Tatô

Programa Tatô adopts an integrated conservation model that combines scientific research, ecological monitoring, and community-based protection. Working closely with former hunters, fish traders, and coastal residents, the program promotes alternative livelihoods and a sustainable blue economy to reduce pressure on marine resources. Environmental education initiatives and stakeholder collaboration strengthen long-term conservation outcomes while enhancing community well-being.

## PROTETUGA – SEA TURTLE FOCUSED ENVIRONMENTAL EDUCATION IN PRÍNCIPE

**Location/Country:** Príncipe Island, São Tomé and Príncipe
**Presenter/Organization:** Asiem Sanyal / Fundação Príncipe & Fauna & Flora

ProTetuga is Fundação Príncipe's flagship conservation program dedicated to sea turtle protection through nesting beach patrols, research, and strong environmental education outreach. The video emphasizes the role of local leadership, particularly educator Jormicilesa ("Jormi") Dias, in engaging schools and communities. By targeting children and youth, the program fosters long-term conservation values and strengthens community understanding of marine biodiversity. The initiative highlights the importance of education as a foundational tool for sustainable conservation outcomes on small island ecosystems.

## S.O.S CARETTA: FISHERS FOR BIODIVERSITY

**Location/Country:** Andalusia, Spain
**Presenter/Organization:** Daniel Gonzalez-Paredes / S.O.S Caretta

This video showcases efforts to reduce sea turtle bycatch through direct collaboration with fishing communities in Andalusia. The S.O.S Caretta project provides fishers with training on safe turtle handling, rescue protocols, and reporting systems, transforming them into active partners in biodiversity conservation. By integrating scientific monitoring with local knowledge, the initiative strengthens trust between conservationists and the fisheries sector. The project demonstrates how cooperative approaches can mitigate bycatch impacts while maintaining livelihoods and promoting marine ecosystem sustainability.

## SEA TURTLE CONSERVATION IN WEST AFRICA

**Location/Country:** Cabo Verde, Mauritania, Guinea-Bissau
**Presenter/Organization:** Ana Rita Patrício / CE3C, Faculty of Sciences, University of Lisbon

This regional video presents coordinated sea turtle conservation efforts across three important West African countries. It highlights nesting beach monitoring, in situ nest protection, research initiatives, and environmental education campaigns supported by the STM project and the Regional Partnership for Coastal and Marine Conservation (PRCM). The video underscores the importance of transboundary collaboration, standardized data collection, and regional partnerships to protect shared marine turtle populations in the Eastern Atlantic.

## SEA TURTLE WEEK MINI SERIES: INSIDE THE WORLD OF WORKING WITH SEA TURTLES

**Location/Country:** Multiple Countries
**Presenter/Organization:** Brad Nahill / SEE Turtles & Sea Turtle Week

This mini-series provides an inside look at the daily realities of sea turtle conservation worldwide. Featuring researchers, veterinarians, educators, and conservation practitioners, the series highlights nesting beach patrols, hatchling protection, rehabilitation techniques, satellite tagging, and public outreach efforts. By showcasing the dedication and challenges faced by conservation teams, the series emphasizes the importance of global collaboration, technical expertise, and community engagement in ensuring the long-term survival of sea turtles. https://www.youtube.com/watch?v=Vo1netWzRXk

## SEASONAL PROTECTED AREAS

**Location/Country:** Mahé, Seychelles
**Presenter/Organization:** Christophe Mason-Parker / Marine Conservation Society Seychelles

Drawing on over two decades of nesting data collected along Mahé's southern beaches, this video introduces the concept of seasonal protected areas as a targeted conservation strategy. Rather than implementing permanent closures, the approach focuses on restricting human activity during peak nesting periods. This adaptive management strategy balances conservation priorities with socio-economic considerations, demonstrating how evidence-based policy can protect critical habitats while maintaining community support.

## STC IN PANAMA: SIGNALS FROM THE SEA & TRAINING THE NEXT GENERATION

**Location/Country:** Bocas del Toro, Panama
**Presenter/Organization:** Daniel Evans / Sea Turtle Conservancy

This video provides an overview of Sea Turtle Conservancy's research and training activities in Panama. It highlights the use of satellite telemetry to track leatherback migrations, revealing critical information about foraging grounds and migratory corridors. Additionally, the project prioritizes capacity building by offering field training opportunities for young biologists and students, ensuring the development of future conservation leaders while strengthening scientific research in the region.

## THE FIRST EVER SEA TURTLE SURVEY IN CARRIACOU, GRENADA

**Location/Country:** Carriacou, Grenada
**Presenter/Organization:** Scott Thomas Eanes / The Hawksbill Project

This collaborative project documents the first in-water sea turtle population survey conducted around Carriacou. Partnering with regional organizations and universities, researchers collected baseline data critical for informing management decisions in a context where legal turtle hunting continues without clear stock assessments. The survey aims to establish population estimates and support science-based conservation policy in Grenada's coastal waters. https://www.youtube.com/watch?v=8SiYv1mnNHo&t=22s

## THE HISTORY OF ARUANÃ PROJECT

**Location/Country:** Rio de Janeiro, Brazil
**Presenter/Organization:** Suzana Machado Guimarães / Projeto Aruanã

This video chronicles the establishment and evolution of Projeto Aruanã in Brazil. It outlines the project's objectives, including nesting beach monitoring, research, and environmental education. By combining scientific study with community engagement, the initiative has strengthened sea turtle conservation awareness and contributed to long-term species protection in Rio de Janeiro's coastal region.
https://www.youtube.com/watch?v=SeL8CqqndYo

## THE TURTLEMAN

**Location/Country:** Mafia Island, Tanzania
**Presenter/Organization:** Lindsey West / Sea Sense

This documentary follows Nasorro, a former turtle hunter who became a conservation advocate on Mafia Island. Through personal storytelling, the film highlights how alternative livelihood support and community engagement can shift local attitudes toward conservation. Nasorro's journey illustrates the transformative potential of inclusive conservation programs that address socio-economic realities while protecting endangered species. https://www.youtube.com/watch?v=VYuq4ZAJvrU

## TOWARDS EFFECTIVE RESTORATION OF MARINE TURTLES IN JORDAN'S AQABA COASTLINE

**Location/Country:** Aqaba, Jordan
**Presenter/Organization:** Abeer Bilbeisi / Jordan Society for the Conservation of Turtles & Tortoises

This project addresses multiple threats to endangered marine turtles in the Gulf of Aqaba, including marine debris, light pollution, fisheries interactions, and coastal development. Through training workshops, rescue and rehabilitation programs, public awareness campaigns, and policy advocacy, the initiative seeks to establish a national action plan aligned with CITES obligations. The video emphasizes capacity building and interagency collaboration to enhance regional conservation outcomes.

## TRACKING TURTLES INTO THEIR LOST YEARS

**Location/Country:** Cape Town, South Africa
**Presenter/Organization:** Talitha Noble-Trull / Two Oceans Aquarium Foundation

This collaborative initiative documents the first satellite tagging of post-hatchling loggerhead turtles in South Africa. By tracking juvenile turtles during their early oceanic phase, commonly referred to as the "lost years", researchers aim to better understand dispersal patterns, survival challenges, and habitat use. The findings contribute to improved management strategies and fill critical knowledge gaps in turtle life history research.
https://youtu.be/KU95L4mr1Z8?si=H7p22w34z9_JPF95

## TURTLE CONSERVATION PROJECT PANADURA BEACH

**Location/Country:** Panadura, Sri Lanka
**Presenter/Organization:** Thushan Kapurusinghe / Turtle Conservation Project

This video highlights seasonal nesting protection efforts conducted from November to April, including nightly beach patrols, nest relocation to protected hatcheries, and coordinated hatchling releases. Working alongside the Sri Lankan Coast Guard and police, the project has significantly improved nest survival rates. Volunteer participation plays a key role in strengthening conservation capacity and public awareness.

## TURTLE NESTING MONITORING ON TETIAROA ATOLL

**Location/Country:** French Polynesia
**Presenter/Organization:** Gaspar Cecile / Te Mana o Te Moana

Documenting 18 years of green sea turtle nesting monitoring on Tetiaroa Atoll, this video examines long-term ecological trends within the context of global environmental change. Continuous data collection enables researchers to assess nesting frequency, hatchling success, and climate-related impacts, contributing valuable insights to Pacific regional conservation strategies.

## TURTLE WATCH EGYPT 2.0: PROTECTING SEA TURTLES IN THE RED SEA

**Location/Country:** Red Sea Coast, Egypt
**Presenter/Organization:** Micol Montagna / Marine Life Watch & Marine Life Conservation and Preservation Foundation

This initiative combines scientific monitoring, in-water surveys, dive center training, public education workshops, and beach clean-ups to strengthen turtle conservation in the Red Sea. The project emphasizes partnerships with tourism operators and local stakeholders, ensuring that conservation strategies are both science-based and community-driven. The video showcases an integrated approach that blends research, awareness, and collaboration.

## WELCOME TO ATOLL MARINE CONSERVATION CENTRE

**Location/Country:** Naifaru, Maldives
**Presenter/Organization:** Daniela Caballero / Atoll Marine Conservation Centre

This video introduces the Maldives' only locally operated sea turtle rescue and rehabilitation center. Originally focused on rescuing hatchlings kept as pets, the center now rehabilitates juvenile and adult turtles affected by injury and habitat threats. In addition to clinical care, the center conducts coral gardening, community outreach, and volunteer engagement programs, contributing to broader marine ecosystem conservation.

## WHAT A WONDERFUL LIFE

**Location/Country:** Mexican Pacific Ocean
**Presenter/Organization:** Mildred Alpizar Quezada / Kutzari A.C.

This reflective documentary provides a personal account of life as a sea turtle biologist working along Mexico's Pacific coast. It documents field patrols, nest protection, hatchling releases, and the challenges of conserving endangered species under changing environmental conditions. The video highlights dedication, teamwork, and passion as essential components of successful conservation practice.

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