BLUE CORRIDORS FOR TURTLES

June 2025

WWF

IUCN-SSC Marine Turtle Specialist Group

CMS

The University Of Queensland
AUSTRALIA

SHELLBANK
Global Marine Turtle Genetic Database

SWOT
THE STATE OF THE WORLD'S SEA TURTLES

CLS
COLLECTE LOCALISATION SATELLITES

WWF
WWF is one of the world's largest and most experienced independent conservation organisations, with over 5 million supporters and a global network active in more than 100 countries. WWF's mission is to stop the degradation of the planet's natural environment and to build a future in which humans live in harmony with nature by: conserving the world's biological diversity, ensuring that the use of renewable natural resources is sustainable, and promoting the reduction of pollution and wasteful consumption. Blue Corridors for Turtles was initiated by WWF as part of its Global Marine Turtle Program which is led by its Global Marine Turtle Conservation Lead from the WWF-Coral Triangle Programme, and is supported by 9 regional WWF officers spanning the globe.

IUCN-SSC MTSG
The IUCN SSC Marine Turtle Specialist Group (MTSG) is responsible for providing information on the seven species of marine turtles and is regarded as the global authority on marine turtles. MTSG focuses on developing and supporting strategies, setting priorities, and providing tools that promote and guide the conservation of marine turtles and their habitats. The Specialist Group envisions marine turtles fulfilling their ecological roles on a healthy Planet where all Peoples value and celebrate their continued survival.

CMS
An environmental treaty of the United Nations, the Convention on the Conservation of Migratory Species of Wild Animals (CMS) provides a global platform for the conservation and sustainable use of migratory animals and their habitats. This unique treaty with currently 133 Parties brings governments and wildlife experts together to address the conservation needs of terrestrial, aquatic, and avian migratory species and their habitats around the world. Several tailored regional instruments for the conservation of marine turtles and their habitats were developed under the Convention.

University of Queensland
The University of Queensland is a global top-50 university. Led by its top-ranked Centre for Biodiversity and Conservation Science, UQ is a world-wide leader in biodiversity and conservation science. The centre works in partnership with scientists, governments, non-governmental organisations, and industry to solve the most important conservation problems around the world. UQ leads development of the largest open-access system describing how migratory species use and connect the ocean: the Migratory Connectivity in the Ocean (MICO) system.

ShellBank
ShellBank is a global program dedicated to enhancing the conservation of marine turtles by using genetic tools to trace the origins of turtles or turtle products, thereby supporting wildlife crime enforcement and conservation management. Launched as a collaborative effort among WWF, the Australian Museum, NOAA, TRACE and other key partners, ShellBank is an important resource for addressing the illegal trade of marine turtle products and strengthening conservation strategies worldwide.

SWOT
The State of the World's Sea Turtles (SWOT) program, established in 2003 and led by the Oceanic Society, collaborates with a global network of researchers and institutions to compile and share sea turtle data that inform conservation efforts at all levels. Data are stored in the publicly accessible SWOT database, maintained in collaboration with Duke University's OBIS-SEAMAP. Widely used by scientists, educators, policymakers, and conservationists, the database supports global sea turtle research and management. Each year, the SWOT's annual magazine, SWOT Report, highlights the sea turtle community's achievements, innovations, and findings, and is distributed free to the network for outreach in local communities.

CLS
CLS, a subsidiary of the French Space Agency (CNES) and CNP, is a global leader in Earth monitoring and surveillance solutions. Since 1986, CLS has pioneered the use of satellite-based technologies to better understand and protect our planet, while promoting the sustainable management of its resources. With a team of 1,000 employees based at its headquarters in Toulouse, France, and across 32 offices worldwide, CLS processes environmental data and geolocation information from more than 100,000 beacons every month.

Supported by

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CONTENT

About the Blue Corridors for Turtles Project
Blue Corridors for Turtles is a global initiative bringing together research institutions, not-for-profits, for-profit organisations, government bodies and local communities in a shared mission to conserve marine turtles. Together we aim to compile spatial information to better understand distributions and connectivity, including often overlooked genetic connectivity. This effort leverages traceability technologies, including ShellBank and satellite tracking, to map transboundary movements (from nesting beaches, along migratory corridors, to foraging grounds), identify critical habitats, and assess exposure to threats. Global synthesis will support the identification of populations at highest risk and, ultimately, the delineation of Important Marine Turtle Areas via region-specific workshops with local knowledge and data holders. Blue Corridors for Turtles is a vehicle for data sharing and synthesis that will provide a basis to act at scale and with greater impact for marine turtle conservation. Led by a core partnership, the success of Blue Corridors for Turtles will be made possible through the contributions of collaborators worldwide. Our collective expertise and data will ensure that Blue Corridors for Turtles is a vital source of marine turtle connectivity information—creating a "seat at the policy table" for marine turtle conservation and protection into the future.

Foreword from WWF

Decades of conservation efforts have made important progress toward the recovery of marine turtles, yet many populations remain in decline, with some sliding toward extinction due to human activities. *How can turtle conservation impact be scaled-up and tip the trajectory of populations towards recovery?*

The **Blue Corridors for Turtles** project seeks to build on the vast existing knowledge base for marine turtles and scaffold new insights that can inform conservation at multiple scales, including within global, multinational commitments. In this vein, Blue Corridors for Turtles is anchored in the foundational principle that broad-scale collaboration and data sharing can produce products and insights that are greater than the sum of their parts. Indeed, the project was developed to be a nexus for collaborative data sharing among the marine turtle research community, with a goal of compiling comprehensive datasets **describing in-water movements, nesting and foraging distributions, and genetic connectivity**.

Beyond bringing scientific researchers together, Blue Corridors for Turtles has explicit objectives designed to serve as a conduit for engagement with local communities and regulatory bodies worldwide to **define Important Marine Turtle Areas**, and thus provide actionable knowledge to the delivery of Kunming-Montreal Global Biodiversity Framework targets and achievement of the Sustainable Development Goals.

We are proud to be part of the Blue Corridors for Turtles project as a generational opportunity to unite the incredible research and policy successes made by so many practitioners over many decades to build a more comprehensive understanding of turtle connectivity and address knowledge gaps. Blue Corridors for Turtles will **arm us all as a community** with synthesised products to **make important steps in migratory species conservation**, and participate as key players in broader, modern conservation initiatives, spatial planning, decision making, policy frameworks and tools.

The Blue Corridors for Turtles initiative aspires to be a **pivotal force for marine turtle conservation on a global scale**. By identifying critical habitats (as Important Marine Turtle Areas), understanding connectivity 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 marine turtle recovery efforts.** We are committed to supporting this initiative and look forward to seeing its progress over the next 5 years.

Dr Christine Madden
WWF's Global Marine Turtle Conservation Lead, ShellBank's Co-Founder and Director

Foreword from CMS

The Secretariat of the Convention on the Conservation of Migratory Species of Wild Animals (CMS) welcomes the Blue Corridors for Turtles project – an important step toward strengthening conservation of these iconic migratory species. By identifying Important Marine Turtle Areas (IMTAs) and the populations most at risk, this project will generate critical knowledge based on evidence-driven data to inform policy and action across borders.

The urgency of this work is underscored by the *State of the World's Migratory Species* report, which identifies marine turtles as among the most threatened migratory species, facing mounting pressures across their complex life cycles. The report also found that one of the most essential needs of migratory species is to conserve and restore ecological connectivity.

Ecological connectivity is also a key element of many of the commitments of the Kunming-Montreal Global Biodiversity Framework (GBF), including Target 3 on area-based conservation measures. The Samarkand Strategic Plan for Migratory Species (SPMS), adopted at CMS COP14, also includes ecological connectivity as one of its top priorities. This project will therefore directly contribute to achieving both the GBF and SPMS by enabling targeted, science-based conservation.

Amy Fraenkel
CMS Executive Secretary

KEY MESSAGES

Migratory marine species population declines are early warning indicators of extinction risk, loss of healthy ocean ecosystems and vital ecological functions, and are an economic risk, raising concern for human welfare.

There is an urgent need for innovative approaches to recover marine turtle populations.
The time to act is now.

Marine turtles play an essential role in ocean health, and in connecting nature and people.

They support ecosystem function and are deeply embedded in traditional knowledge systems, traditional practices and coastal economies worldwide.

While some marine turtle populations are recovering, many others are declining towards extinction and may do so within decades.

Despite decades of conservation efforts, six of the seven marine turtle species are globally threatened or data deficient. They face several simultaneous threats across their life stages and ranges, which continues to dampen recovery.

Major knowledge gaps continue to limit our understanding of marine turtle connectivity.

Available data are fragmented, unpublished or inaccessible. Conservation efforts remain biased towards certain species and regions, with most attention on nesting beaches and little focus on in-water habitats where turtles spend most of their lives. There is disconnect between communities, researchers and decision-makers who operate within different institutional cultures, timeframes, and incentives to collect and share data.

Genetic gaps hinder a global marine turtle connectivity approach.

Despite decades of genetic research, many genetically distinct populations (genetic stocks) and connections between nesting and foraging areas are still poorly understood. ShellBank has revealed these gaps and is working collaboratively to close them. For the first time, we will integrate movement data with ShellBank genetics - an essential tool that will be used to better assess threats, define population boundaries and connectivity and guide effective conservation.

We have the policy frameworks and platforms in place to recover marine turtle populations and protect important marine turtle areas.

Despite having more available data than most other marine taxa aside from seabirds, advancements in marine turtle connectivity science still lag behind. A major opportunity exists to bring marine turtle connectivity and Important Marine Turtle Areas (IMTAs) into the “policy seascape”. Synthesising how marine turtles use and connect ocean habitats can inform the designation of IMTAs and help deliver on global, regional and national policy targets such as the Global Biodiversity Framework, through inclusive, evidence-based action.

Marine turtle conservation must connect local knowledge with global action.

Too often, approaches are either top down and exclusive of communities, or too localised to influence regional and global frameworks. Despite what turtle movement clearly shows, local conservation efforts are rarely linked across ocean basins. A more inclusive and collaborative approach to bridge the gap between locally-led science and global policy is urgently needed.

The Blue Corridors for Turtles project can close the gap and drive real change.

This global project will identify the most at-risk populations and the marine turtle areas most in need of protection. As practitioners, policymakers and communities call for more integrated and collaborative approaches, Blue Corridors for Turtles responds with a clear path forward. Unlike other marine megafauna, marine turtles still lack formally defined “important areas”, a critical omission that continues to hinder conservation at regional and global scales.

THE ROAD MAP

A new global collaborative project is now underway to inform marine turtle conservation at scale, and meet national, regional, and international policy goals and targets that will help drive marine turtle recovery worldwide. **For the first time, Blue Corridors for Turtles will connect movement data with genetics (using ShellBank) and at a global scale, establish Important Marine Turtle Areas.**

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INTRODUCING

THE BLUE CORRIDORS FOR TURTLES PROJECT.

Blue Corridors for Turtles aspires to be a pivotal force for marine turtle conservation on a global scale—identifying the most at-risk populations and the Important Marine Turtle Areas most in need of urgent protection.

By connecting communities and turtles along their entire blue corridors—the interconnected nesting sites, migratory pathways and foraging areas of genetically distinct populations—and by undertaking spatial threat analyses at the population level, we will identify where conservation efforts are most needed.

We aim to give marine turtles and the communities connected to them a "seat at the policy table", bridging the gap between researchers and decision-makers with marine turtle connectivity data and Important Marine Turtle Areas.

This will require translating raw nesting, tracking and genetic data into aggregated connectivity layers and actionable knowledge. The current "policy seascape" presents a unique opportunity. Fundamentally, IMTAs are the best mechanism the world has to ensure the inclusion of these foundational species into global conservation frameworks. Until then, marine turtles remain a glaring omission at the conservation policy table compared to other marine megafauna.

Blue Corridors for Turtles will address and help achieve international, regional and national goals and targets, while promoting the long-term survival of marine turtles.

There is a strong momentum to reduce pressure on marine biodiversity given its crucial role in food production, livelihoods and economic activity. Marine turtles are sentinels for ocean health. Addressing gaps and biases in information on marine turtles, and particularly by synthesising spatial information on how turtles use and interconnect the ocean, will deliver on a range of policy targets and goals.

BLUE CORRIDORS FOR TURTLES

For the first time, Blue Corridors for Turtles will connect movement data with genetics, and at a global scale, help establish Important Marine Turtles Areas

The time to act is NOW!

BLUE CORRIDORS FOR TURTLES WILL

By end of 2025

Aggregate nesting, tracking and genetic data to establish a connectivity baseline

By end of 2026

Identify knowledge gaps, assess exposure to threats and identify populations most at risk

By end of 2027

Coordinate the delineation of Important Marine Turtle Areas

From 2028

Advocate for connectivity and IMTA integration into policy to enable more effective management and protection, and secure long-term survival of marine turtles

Call to Action

We call on everyone to get involved, from governments, to universities, civil society, community groups, for-profit organisations and funders. Since February 2025, we have begun compiling the largest spatial dataset of nesting, satellite tracking and genetic data across all marine turtle species. So far:

There are 4,069 nesting sites recorded (in SWOT), spanning all seven species across 147 countries, acknowledging these records are incomplete with many more to be added into the connectivity baseline.

There are currently 166 genetically distinct marine turtle populations across all species globally (from ShellBank), but there are many gaps to be filled.

More than 50 unique tracking datasets made up of >1,000 satellite tracks from all ocean basins have been compiled. This represents all 7 marine turtle species, from 122 contributing authors and organisations, and equates to ~8-10% of known global tracks. Approximately 60% of these are published in peer review, and 40% in grey literature or other platforms.

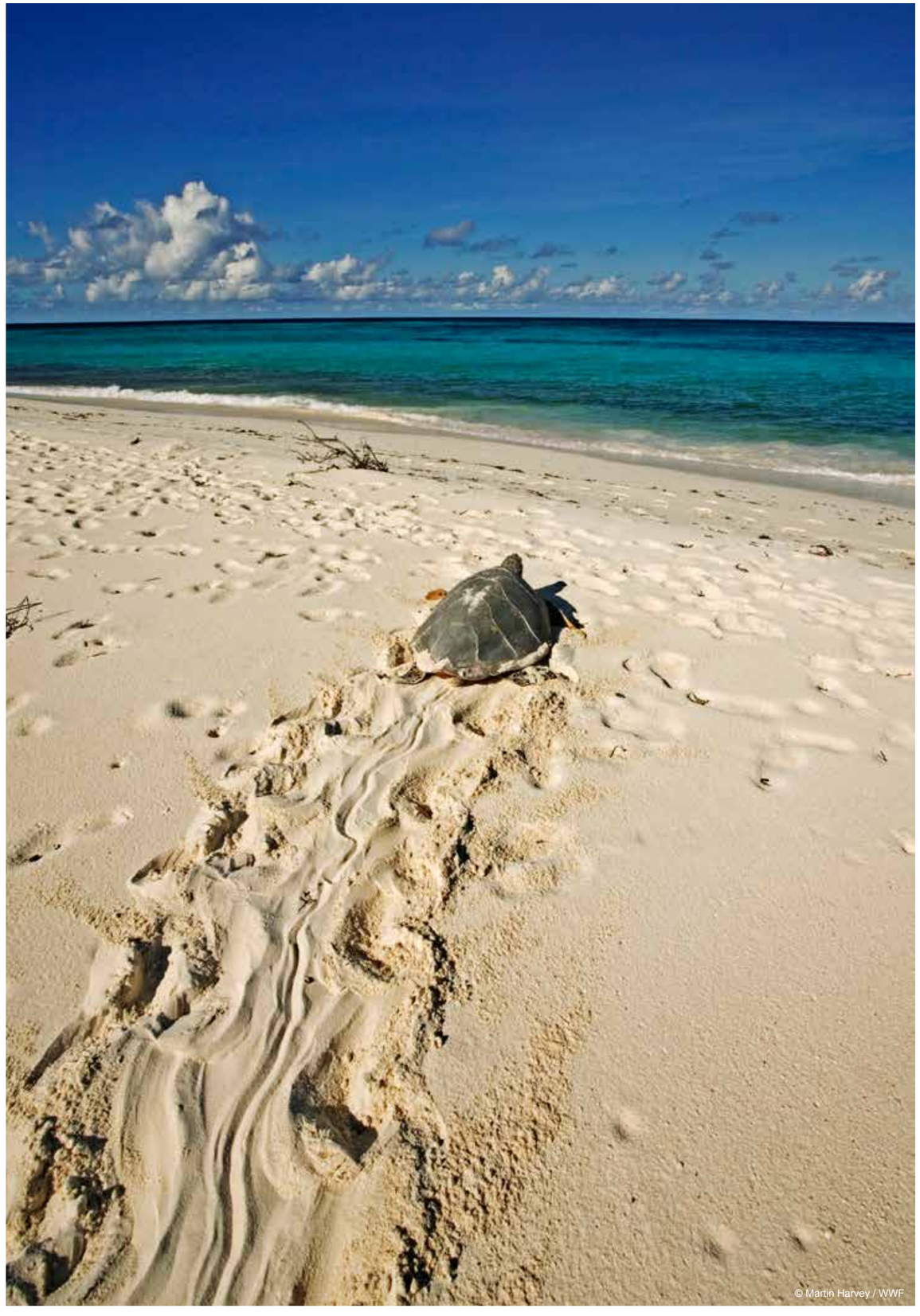
We invite data and knowledge holders to contribute.

We call on funders to help the turtle community fill data gaps.

We call on governments to engage in Blue Corridors for Turtles and drive action.

Help us build Blue Corridors for Turtles

✉ bluecorridorsforturtles@gmail.com



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INTRODUCTION

Migratory Marine Species Under Pressure

Biodiversity loss and ecosystem collapse are ranked by the World Economic Forum as the second most significant global risk over the next decade, with 50% of the global economy dependent on nature (The Global Risks Report, 2025). Our world is currently undergoing an intensifying mass extinction, driven by habitat loss and degradation, over-exploitation, climate change, pollution, invasive species, and disease (Barnosky et al., 2011; Ceballos et al., 2015, 2017; IPBES, 2019; Maxwell et al., 2016; Skerratt et al., 2007). There has been a catastrophic 73% decline in the average size of monitored wildlife populations over 50 years (1970-2020), with marine species experiencing a 56% decline (WWF, 2024). This biodiversity crisis is characterised by its unprecedented speed, intensity and global scale (Isbell et al., 2023), and is primarily the result of human activity and influences (Boivin et al., 2016). Major declines in wildlife populations are early warning signs of increasing extinction risk, the potential loss of healthy ecosystems and vital functions, and the resulting impact on human welfare and long-term survival (Pörtner et al., 2023).

Migratory marine species are increasingly under pressure in a globalised world (Liu et al., 2007), as evidenced by the expanding footprint of cumulative human activities in marine ecosystems (Halpern et al., 2008, 2015). Forty-four percent of migratory species are showing population declines, with extinction risks growing (Both et al., 2006; Wilcove & Wilkeski, 2008; Møller et al., 2008; UNEP-WCMC, 2024). Nearly half of all marine migratory species are categorised as threatened, near threatened, or data deficient (Lascelles et al., 2014), and >20% are at risk of extinction (UNEP-WCMC, 2024). For example, despite decades of conservation efforts, currently a quarter of marine mammal species (Davidson et al., 2012), 60% of assessed sharks and rays (Fowler, 2014), 66% of albatrosses and large petrels (Phillips et al., 2016), and 80% of assessed marine turtle species (Wallace et al., 2025) are considered globally threatened with extinction according to IUCN criteria. Of the five threatened marine turtle species, three are considered globally endangered or critically endangered—making these iconic animals one of the most endangered, imperiled and conservation-dependent groups in the world (Lovich et al., 2018; Purvis et al., 2019; Wallace et al., 2025).

Migratory marine species play an essential role in maintaining healthy and functioning ecosystems. Their dependence on a connected network of well-functioning habitats and safe passages between feeding, breeding, migratory and resting areas make them particularly vulnerable to threats across their range. These areas can be separated by thousands of kilometres and governed under highly different management regimes. To effectively conserve migratory species, it is essential to understand which habitats they rely on throughout their life cycles and how these areas are connected through their movements. Further, because these movements link different jurisdictions, countries can only ensure the survival of migratory species in their waters by working together, collaborating across borders.


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"Ecological connectivity is fundamental for ensuring the survival of marine migratory species. It is the unimpeded movement of species and the flow of natural processes that sustain life on Earth. Dispersal, migration and genetic exchange among marine species and their resilience to change, depends on the quality, extent, distribution and connectivity of marine habitats" (CMS, COP13, 2020)

In response to species declines and habitat loss, many countries have fixed ambitious conservation targets across a raft of global agreements and initiatives to set migratory marine species on the path to recovery by 2030. This includes a growing demand and urgency from practitioners, policymakers and communities for improved, coordinated and transboundary collaborations and actions on migratory marine species connectivity (e.g. the Global Biodiversity Framework Target 3 calls for a "well-connected" ecological network). Yet, marine migratory species are being left behind in the 2030 goals and targets. Efforts may be stalled from a lack of urgency, as there is no monitoring framework to indicate progress, or a reflection of not knowing where to start. A new collaborative approach, based on connectivity conservation called 'Protecting Blue Corridors' was developed for whales (Johnson et al. 2022). To keep moving forward for other marine species, we need action that meets the scale of the challenge—we need cooperation and collaboration across local, regional and global scales to develop data-driven evidence that underpins effective conservation efforts, married across jurisdictions. **The time to act is now.**

Why focus on marine turtles?

For thousands of years marine turtles have played an important role in ocean health, human cultures and economies—they have tremendous value for nature and people (Bjorndal & Jackson, 2003; Brander et al., 2021; Shum et al., 2023). Marine turtles are some of the ocean's most iconic species, yet while some populations are increasing due to decades of conservation efforts, there are many others that remain data deficient or continue to decline (Hays et al., 2025; Mazaris et al., 2017; Wallace et al., 2025). With uncertainty about whether marine turtles can survive in a world increasingly impacted by human activities, the conservation challenges and stakes are tremendous.

In the course of their life, marine turtles often migrate and disperse through many nations. A single marine turtle will pass through habitats on land and at sea, may traverse the jurisdictions of many countries and swim through international waters. Their life-history exposes them to a wide range of threats[1], to which they are particularly vulnerable at distinct life-stages in different geographical regions. Marine turtle conservation therefore presents a formidable challenge, as finding solutions that are effective across countries, at a regional scale or within areas beyond national jurisdiction (the high seas) is often complex and difficult to achieve. Only a concerted global effort will ensure the survival of these ancient mariners and the continued existence of the ecological, social, cultural and economic benefits they provide (Allen, 2007; Brander et al., 2021; Dickson et al., 2022; Shum et al., 2023).

While many threats to marine turtles are well understood, and there is extensive knowledge about the actions needed to support population recovery, many important data gaps remain (Hays et al., 2025; Wallace et al., 2025). Most turtle conservation efforts are local and focused on nesting beaches—we often overlook the oceanic habitats where they spend most of their lives (Hays et al., 2025; Robinson et al., 2023). Longstanding research biases have disproportionately focused on a specific sex (typically females), particular species (such as green turtles), and certain regions including the Northern Atlantic, Mediterranean, Eastern Pacific, or more generally the Global North (Bentley et al., 2025; Kot et al., 2023; Robinson et al., 2023). There are still substantial gaps in our understanding of the genetic population structure of marine turtles—specifically, which genetically distinct nesting populations exist and how they are connected to other nesting sites and foraging areas (Madden Hof & Jensen, 2022; ShellBank, 2024). Characterising genetically distinct populations, also referred to as genetic stocks or management units, remains limited for some species, such as hawksbill turtles, and in key regions, including the Asia-Pacific and both east and west Africa (www.shellbankproject.org).

Our scientific efforts, by nature, are often focused at spatial scales relevant to local jurisdictions, with research projects undertaken in isolation, overlooking the interconnected nature of marine turtle populations and the habitats they occur in. Thus, as a turtle community we frequently work in "silos," on only a fraction of our focal species' life history, without full understanding of genetic structure and connectivity. Despite what turtle movement clearly shows, local conservation efforts are rarely linked across ocean basins.

Persistent knowledge gaps, research biases and the inherent complexity of linking research and conservation efforts across the life history of these migratory species leave critical questions unanswered about the future of marine turtle conservation. Where are the gaps in our understanding of genetically distinct nesting populations? How are these populations connected via migrations to foraging grounds? Where are key areas of geographic overlap? More broadly, **how extensive is our knowledge about how marine turtles are connected globally?**

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[1]The main threats marine turtles face (Fuentes et al. 2023), include bycatch (Wallace et al., 2010b, 2013,), trade (Lopes et al., 2022; Miller et al., 2019; Senko et al., 2022) and climate change (Fuentes et al., 2024; Jensen et al., 2018; Laloë & Hays, 2023; Maurer et al., 2021). Other current anthropogenic pressures include habitat degradation and loss (Costa et al., 2023) and pollution—whether plastic (Caron et al., 2018), chemical (Camacho et al., 2014; Muñoz & Vermeiren, 2023) or artificial light (Di Bari et al., 2023).

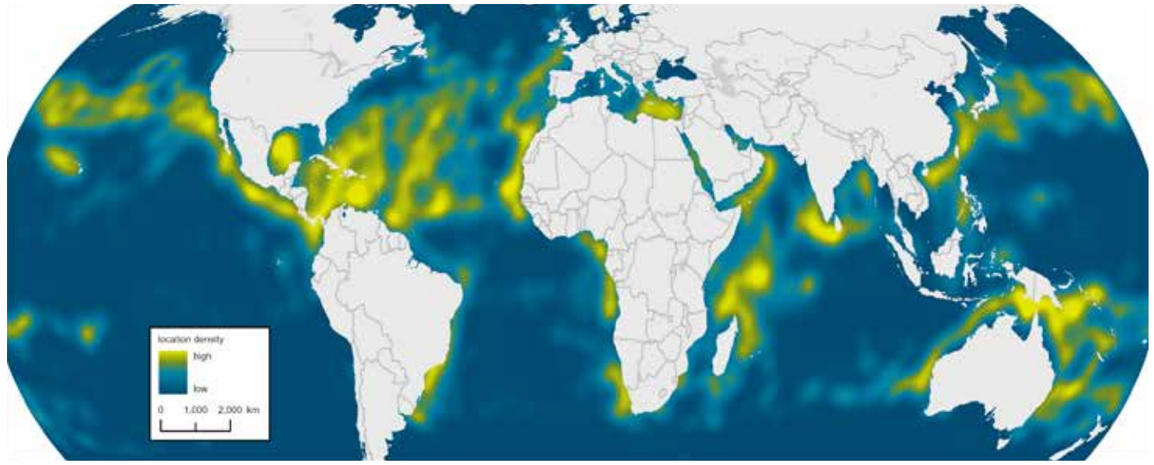
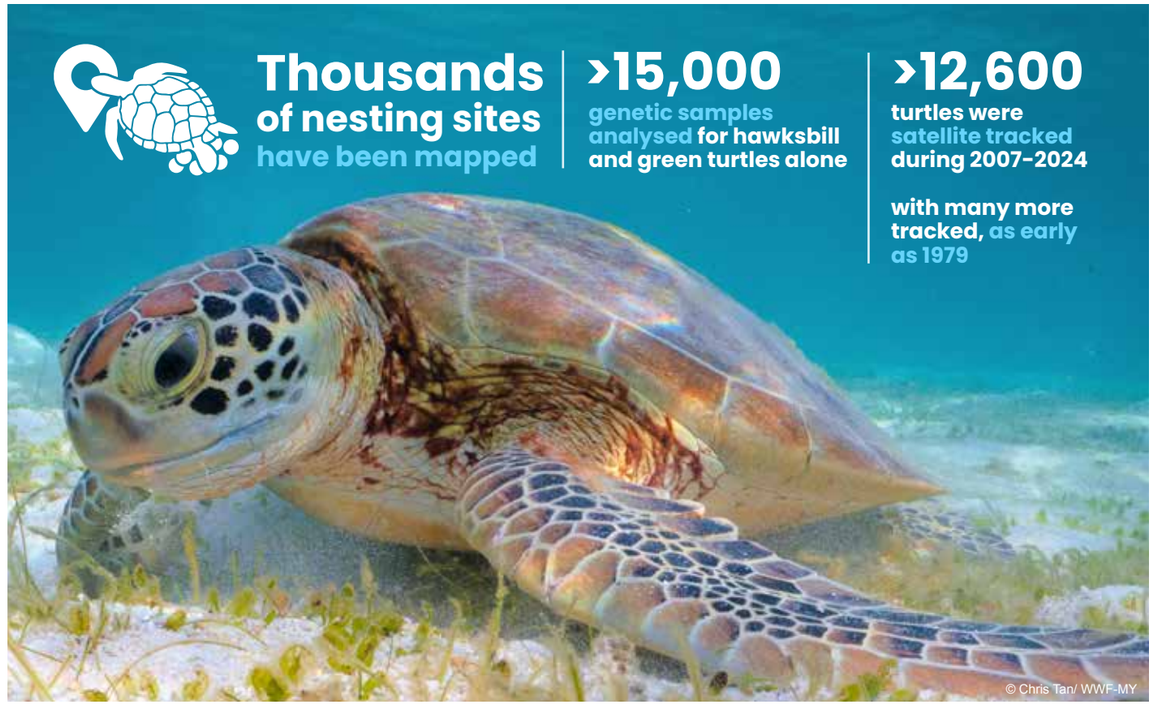


Figure 1: Representation of turtle telemetry distribution densities based on georeferenced CLS-Argos data of 12,600 satellite tracked marine turtles from October 2007 - September 2024, using Class 3 turtle doppler locations and smoothed under a 500km quartic kernel function. Credit: CLS-Argos/Blue Corridors for Turtles Team

The research and conservation community has amassed vast volumes of data describing marine turtle movements, connectivity, and distributions. Thousands of nesting sites have been mapped (e.g. Mazaris et al., 2014), over 15,000 genetic samples analysed for hawksbill and green turtles alone (ShellBank Impact Report, 2024), and more than 12,600 turtles were satellite tracked during 2007-2024 (CLS-Argos data; Figure 1), with many more tracked, as early as 1979 (Hays & Hawkes, 2018; Stoneburner, 1982). Although huge amounts of data clearly exist, accessibility and use of this information is complicated. Marine turtle data are frequently underused, inaccessible, unpublished, and are not always shared between partners (nor with other entities including conservation practitioners). Over 13 databases[2] currently house marine turtle datasets, many of which are incomplete and contain overlapping entries. For instance, The State of the World's Sea Turtles (SWOT) database, a leading global repository for marine turtle data, contains only around 10% of the 12,600 satellite tracks recorded by CLS-Argos during 2007-2024 (www.seaturtlestatus.org). A recent study on movement data of green turtles in the Asia-Pacific region showed that 68% of tracking references were found in grey literature, 17% were not in English, and 18% were not publicly accessible, which hindered regional marine connectivity synthesis for decision makers (Heng et al., 2024; Refer Box 1). Although some positive results are recognised across a broad range of taxa (Hays et al., 2019), other studies have found a continued disconnect between marine turtle satellite tracking research and actual policy outcomes (Jeffers & Godley, 2016). To overcome these barriers, there is a need for dedicated approaches to collaborate across broad scales, engage in effective data sharing, and disseminate findings more widely.

It is clear that **new approaches to synthesising and sharing marine turtle connectivity data are essential.** This will advance local to global conservation strategies and enforcement measures for targeted and effective interventions to support marine turtle recovery worldwide. Compared to other marine taxa such as seabirds (Donald et al., 2019), whales and dolphins (Hoyt & Notarbartolo di Sciara, 2021), and sharks and rays (Kyne et al., 2023), **advancements in marine turtle connectivity science are severely lagging behind,** despite greater data availability than any other taxa but seabirds. Addressing key gaps, better understanding marine turtle connectivity, and undertaking spatial threat analyses, will support identification of where conservation efforts are most needed, and underpin a raft of policy commitments. Specifically, there is a need to identify critical habitat as **Important Marine Turtle Areas (IMTAs)** along their entire blue corridors—the interconnected nesting sites, migratory pathways and foraging areas of genetically distinct populations. **But what are the next steps? What policy levers can help us achieve this?**

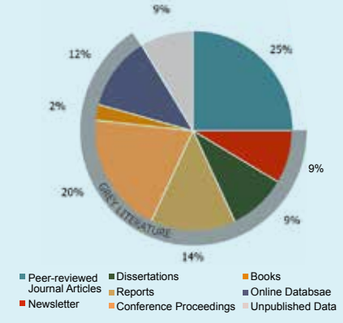
[2]For example, SWOT, MiCO, TurtleNet, Movebank, Megamove, OBIS-SEAMAP, seaturtle.org, ZoaTrack, Coral Triangle Atlas, TREDS, WIDECAST, NASTNet, MEDASSET among others.

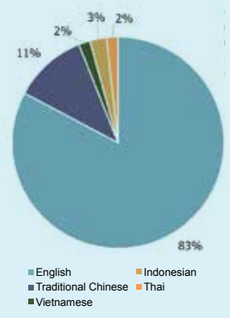


Box 1: Regional marine turtle connectivity synthesis shortfall due to inaccessible data

Harris Wei Khang Heng, Kristine Camille V. Buenafe, The Cuong Chu, Rose Ellis, ChiaLing Fong, Daphne Z. Ho, Sekar M.C. Herandarudewi, Connie Ka-Yan Ng, Janmanee Panyawai, Nguyen Trong Duc, and Daniel C. Dunn

Over the past four decades around Southeast Asia, the majority of green turtle (*Chelonia mydas*) movement and migratory connectivity information has been documented in grey literature, with 67.3% of references classified as such, and an additional 8% comprising unpublished data. Limited public access to these documents remains a significant obstacle, particularly for regional synthesis and assessments that inform conservation efforts. Based on our systematic review conducted across eight languages (Heng et al., 2025), we found that movement studies were largely confined to specific ocean basins or exclusive economic zones in Malaysia, Taiwan, Thailand and Indonesia. While movement data are being collected to varying degrees across countries, much of this information—particularly from government reports—remains inaccessible. Nearly 20% of the references were non-English. We suggest that these non-English studies are likely underrepresented in global syntheses due to accessibility and visibility barriers, including limited indexing in major scientific databases and language constraints faced by international audiences. These findings underscore the crucial role of grey literature in environmental evidence synthesis and highlight the need to overcome existing barriers. Key solutions include enhancing regional collaboration, adopting standardised data-sharing practices, improving access to governmental documents, publishing in open-access repositories, and building institutional capacity to better archive and index biodiversity data across the region.





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The Turtle Policy Seascape and Important Marine Turtle Areas

There are a number of well-defined international and regional conventions and agreements to protect marine turtles[3]. Many of these focus on reducing direct threats like bycatch, unsustainable take and trade, habitat loss and degradation, and predation, while others address assessment of population abundance and distribution with the aim to reverse declining trajectories.

[3]These include the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES), and Convention on Migratory Species of Wild Animals (CMS). At a regional level, there are five main policy instruments including, the Memorandum of Understanding on the Conservation and Management of Marine Turtles and their Habitats of the Indian Ocean and South-East Asia (IOSEA Marine Turtle MOU), the Memorandum of Understanding concerning Conservation Measures for Marine Turtles of the Atlantic Coast of Africa (African Atlantic Turtle MOU), the Memorandum of Understanding ASEAN Sea Turtle Conservation and Protection (MOU ASEAN), the Coral Triangle Initiative on Coral Reefs, Fisheries and Food Security (CTI-CFF), and the Inter-American Convention for the Protection and Conservation of Sea Turtles (IAC).

Yet, this focus on marine turtles as “species in need” can overlook how essential they are and the role they play as agents in delivering ocean health and a range of biodiversity outcomes. Indeed, marine turtles are “umbrella species” for conservation, entailing a cascade effect that ensures the protection of other species with which they co-occur, but they also support broader sustainability and conservation outcomes to deliver on marine protected areas, other effective area-based conservation measures, community livelihoods, sustainable fisheries, and help drive action on plastic pollution reduction and climate change adaptation and mitigation.

Over the last decade, there has been a strong and growing movement in international policy fora to protect oceans for the benefit of people and nature. From the first Sustainable Development Goal specifically focused on Life Below Water (SDG14) to the latest agreement of a new treaty for the Conservation and Sustainable Use of Biodiversity Beyond National Jurisdiction (BBNJ), there is strong momentum to deliver positive outcomes for coastal and marine systems. This has come about through a deeper understanding that marine biodiversity is crucial to not only the functioning and resilience of ecosystems, but also the continued provision of ecosystem services for people, such as clean air and clean water. There is a widely recognised need to reduce the direct pressures on marine biodiversity, promote sustainable use of marine resources, safeguard marine habitats, prevent further population declines or extinctions, and ensure that the wellbeing and livelihoods of human communities will not be compromised. As our oceans play a major role in food production, livelihoods and economic activity, so do marine turtles—they are an integral part of functioning marine ecosystems and sentinels for ocean health (Aguirre & Lutz, 2004; Leusch et al., 2021).

Given this modern context, we highlight some of the policy fora at the forefront of international discussions, underscoring how they could be shaped by addressing gaps and biases in information on marine turtles, and particularly by synthesised spatial information on how turtles use and interconnect the ocean (Refer Box 2). We include the International Union for the Conservation of Nature (IUCN), as they play a key role in providing evidence-based science and conservation strategies to support policy commitments directly relating to marine turtles, but acknowledge the many other entities and consortia that inform management of human activities affecting marine turtles within and beyond national jurisdictions (e.g. Regional Fisheries Management Organisations, International Seabed Authority among others). Reviewing the state of the “turtle policy seascape” makes it clear that a new, broad-scale approach to marine turtle connectivity would help achieve international, regional and national goals and targets, all while promoting the long-term survival of marine turtles.

The window for creating a “seat at the policy table” for marine turtles is NOW.

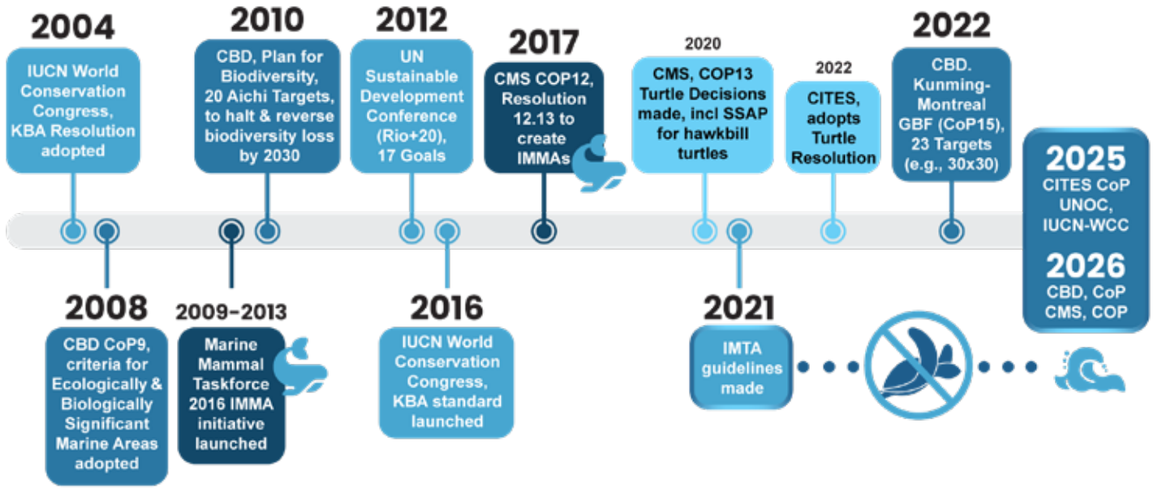

Figure 2: Timeline of international policy fora targets, goals, resolutions and decisions related to marine turtles (above the line), and spatial planning standards, guidelines, and important area processes (below the line). Whale IMMA process provided as an example.

Important Marine Turtle Areas

Marine turtles remain a glaring omission at the conservation policy table compared to other marine megafauna, as they currently lack defined “important areas”, hindering their inclusion in global and regional conservation planning efforts that rely on such tools. Given the opportunities and needs identified across international conventions, treaties, regional policies and frameworks, we are at a pivotal point for marine turtle conservation—we need to develop synthesised, actionable information to support policies based on scientific evidence: **we need Important Marine Turtle Areas (IMTAs).**

The Marine Turtle Specialist Group established IMTA criteria and guidelines[4] in 2021 (Important Marine Turtle Area (IMTA) Working Group, 2021) but, to date, no IMTAs have been formally identified. We posit this is due to a lack of funding, aggregated connectivity data, and coordination required to establish IMTA networks—as integrating local knowledge into regionally and globally consistent, spatially explicit areas is no simple task. There is an opportunity to leverage the experiences of other marine species and birds and move the establishment of IMTAs forward at pace to meet the policy commitments of governments globally. IMTAs can: provide the foundation for Key Biodiversity Areas (KBAs) and Ecologically and Biologically Significant Areas (EBSAs); support national reporting and delivery of target and resolution action of the CBD (GBF), SDGs, CITES and CMS; inform development of protected areas, other effective area-based conservation measures (OECMs); transboundary conservation areas, areas requiring restoration, and, environmental impact assessments—all within and beyond national jurisdictions (Figure 2, refer Box 2 for specifics). Additionally, IMTAs have the potential to support delivery of national and regional commitments to the Coral Triangle Initiative on Coral Reefs, Fisheries and Food Security (CTI-CFF), IOSEA Marine Turtle MOU, African Atlantic Turtle MOU, the Inter-American Convention for the Protection and Conservation of Sea Turtles (IAC) and more.

Yet, how do we get there?

[4]These guidelines and criteria consider both biologically and culturally significant areas within RMUs to marine turtles.

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A major challenge stems from a disconnect between communities, researchers and decision-makers, who often operate within different institutional cultures, on unique timelines, and with distinct incentives. While many organisations have developed conservation plans and strategies that attempt to translate international mandates into national and local actions, this disconnect remains. Too often the approach is top down, with little inclusion of our communities, local knowledge and agendas, or too local and not connected into the global frameworks. These divides create barriers to the uptake of policy-relevant research, highlighting the need for more effective mechanisms to bridge the gap between science and policy (Dunn et al., 2019; Holmes & Clark, 2008; Jeffers & Godley, 2016).

In response to this challenge, new frameworks have emerged to facilitate the synthesis of information across taxonomic groups to support managers, planners and policymakers. The creation and designation of IMTAs provides a solution, and we can learn from other processes and species to deliver at scale (Jones et al., 2024; Figure 3). The establishment of Important Bird and Biodiversity Areas in the marine environment (IBAs; Donald et al., 2019) marked a shift toward structured approaches to aggregating movement data into easily digestible products. This initiative played a crucial role in identifying key habitats for marine megafauna, with mounting evidence of their successful incorporation into global conservation efforts (Donald et al., 2019, Davies et al., 2021). For instance, the availability of synthesised knowledge products for birds through the IBA tracking database (BirdLife International, 2022) led to greater inclusion of seabirds in EBSA descriptions (Waliczky et al., 2019). Seeing how these products were more easily consumed by managers and policy processes led to the development of Important Marine Mammal Areas (IMMAs; Notarbartolo di Sciara et al., 2016) and Important Shark and Ray Areas (ISRAs; Hyde et al., 2022). The EBSA process demonstrated the value of regional workshops in fostering community buy-in and bridging gaps between researchers and local stakeholders. These efforts not only produced important area designations, but also built networks of researchers and community advocates who can inform actions from the local to national scale.

While great progress has been made through these taxonomic “important area processes,” marine turtles have been overlooked. **Bridging the gap between researchers and decision-makers will require translating raw tracking, nesting and genetic data into aggregated connectivity layers and actionable knowledge** (Dunn et al., 2019; Madden Hof & Jensen, 2022; ShellBank Impact Report, 2024). The Blue Corridors for Turtles project offers a vehicle to bridge this gap and drive the IMTA process. Indeed, the current state of the “policy seascape” presents a massive opportunity for marine turtle conservation, as an array of national, regional, and global management frameworks are poised to integrate marine turtle conservation efforts and science-driven data. **Fundamentally, IMTAs are the best mechanism the world has to ensure the inclusion of these foundational species into global conservation frameworks.**

By mapping connectivity and spatial threats, we can link bottom-up science with top-down policy, ensuring IMTAs are grounded in science-based evidence and are used to reflect and protect the full life cycle of marine turtles and the diverse habitats they rely on.

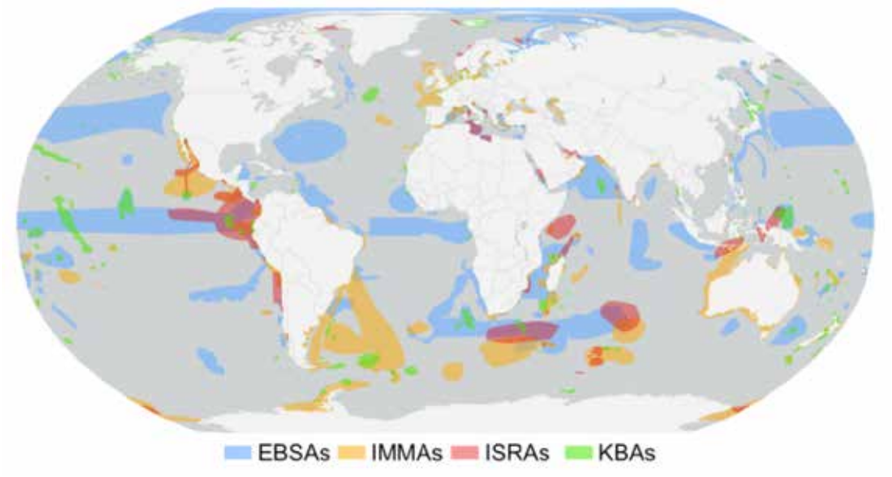

Figure 3: Important marine areas (except IMTAs) mapped under different approaches as of September 2024. Excerpt from Jones et al., 2024.

Box 2: Delivering International Policy Goals and Targets for Marine Turtles

Convention on Biological Diversity (CBD)
The Convention on Biological Diversity (CBD), ratified by 196 countries, is the "universal" treaty that first recognised (in 1992) our dependence on nature and the negative effects of biodiversity loss (United Nations, n.d.). The CBD has been at the forefront of setting the global biodiversity agenda—from the initial goals set under the 2010 Biodiversity Target, through to the Aichi Biodiversity Targets, and now the current Kunming-Montreal Global Biodiversity Framework (GBF). The targets under the GBF are interlinked and there is an urgent need to provide actionable knowledge (not just data) to drive progress simultaneously on multiple GBF targets. Synthesised products describing how species use and connect the ocean will support integrated spatial planning to reduce biodiversity loss (Target 1) and inform the selection of places to conserve (Target 3) and restore (Target 2). This will support the broader species-focused targets of preventing over-exploitation of wild fauna and flora (Target 5) and halting extinctions and restoring genetic diversity for the recovery of threatened species (Target 4).
The CBD has been a driving force in the aggregation of knowledge to inform the description of marine areas requiring enhanced management, notably through the process to describe ecologically and biologically significant areas (EBSAs). Since 2011, the CBD has run 15 regional workshops across >80% of the ocean, resulting in the description of 338 EBSAs (Dunn et al., 2025). Since 2011, the CBD has run 15 regional workshops across >80% of the ocean, resulting in the description of 338 EBSAs (Dunn et al., 2025). These efforts were heavily influenced by Important Bird and Biodiversity Areas (IBAs) and can be gap filled by Important Marine Mammal Areas (IMMAs) and Important Shark and Ray Areas (ISRAs). Lack of marine turtle representation remains a glaring omission. Synthesised products describing how marine turtles use and connect the ocean will not only support the IMTA process, but also deliver on many GBF targets. *Global Biodiversity Framework targets relevant to marine turtle conservation include: #1, 2, 3, 4, 5, 8, 9, 10, 14, 20, 21, 23*[5].

United Nations Sustainable Development Goals
In parallel, The United Nations Member States adopted the 2030 Agenda for Sustainable Development blueprint *'for peace and prosperity for people and the planet, now and into the future (2015).'* This agenda has been built on decades of work by countries and the UN's Department of Economic and Social Affairs, stemming from the Rio de Janeiro Earth Summit Agenda 21 and the various Summits that followed, to build a global partnership for sustainable development to improve human lives and protect the environment. It entails seventeen sustainable development goals (SDGs), with 169 targets signed by 191 countries. The SDGs are different from many other international agreements in that they represent policy commitments and are not legally binding and enforceable, nor do they have a step-by-step plan of action for how countries should implement them (Copernicus Institute of Sustainable Development, n.d.). Despite their legal limitations, these goals are important to consider within the context of marine turtle conservation and management given that in many countries, the livelihoods of coastal communities are dependent on small-scale fisheries, including marine turtles, for food security, livelihoods and customary practices (Batibasaga et al., 2025; Haskins et al., 2025; Stone et al., 2025).
Sustainable Development Goals relevant to marine turtle conservation include: #2, 6, 12, 13, 14,15, 17[6].

United Nations High Seas Treaty
Areas beyond national jurisdiction (ABNJ), generally comprising the areas outside the territorial waters and exclusive economic zones of coastal countries, make up almost half of the world sea surface. The legally binding Agreement under the United Nations Convention on the Law of the Sea on the Conservation and Sustainable Use of Marine Biological Diversity of Areas Beyond National Jurisdiction, also known as the High Seas Treaty, was adopted and opened for signature in 2023 after nearly 20 years of discussions and negotiations, but still requires 60 states to ratify it before it enters into force. The High Seas Treaty is the third implementing agreement to the United Nations Convention on the Law of the Sea and will help lay the foundation for the future governance of marine biodiversity in ABNJ. Its objective is "to ensure the conservation and sustainable use of marine biological diversity of areas beyond national jurisdiction, for the present and in the long term, through effective implementation of the relevant provisions of the Convention and further international cooperation and coordination." The treaty has four main components covering marine genetic resources, area-based management tools (including marine protected areas), environmental impact assessments (EIAs), and capacity development and technology transfer. An international treaty enabling the implementation of marine protected areas in ABNJ—and stipulating the rules determining by whom, why and when environmental impact assessments must be developed—would be groundbreaking for the conservation of marine turtles that traverse many jurisdictions and ABNJ. Aggregated marine turtle connectivity information, including the varying degrees of risk to which populations are exposed, will help drive and be vital to the development of High Seas MPAs and EIAs.


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Convention on Migratory Species
The Convention on the Conservation of Migratory Species of Wild Animals (CMS) is an international, legally binding UN Treaty that uniquely focuses on the conservation of migratory species, their habitats and migration routes. There are currently 133 countries party to this agreement. In 2024, the CMS adopted Resolution 14.16 on Ecological Connectivity. The Resolution calls on all Parties to identify, consider, incorporate and restore ecological networks essential for migratory species survival, extending into national and transboundary policies and planning, critical habitat designations, and aligned with other global biodiversity frameworks. It also specifies the needs for greater monitoring and research to understand migratory patterns, more engagement with indigenous peoples and local communities, and increased capacity building and knowledge sharing. Addressing marine turtle connectivity is an important area of work that is needed to fulfil this Resolution.

CMS has agreed on a number of instruments among range states for migratory species, including Memoranda of Understanding for marine turtles for the Atlantic coast of Africa and the Indian Ocean South-East Asia region, as well as a suite of Decisions that have resulted in the development of Single Species Action Plans (for loggerhead and hawksbill turtles) and recommendations to address take, trade and climate impacts to marine turtle populations. These are connected to other Resolutions on addressing aquatic wild meat (12.15) and joint initiatives on bycatch, among others. There is also an ongoing review of marine turtle legislation in the Asia-Pacific region (COP14/Inf.27.6.1). New recommendations for marine turtles are expected at COP15, 2026. To date, resolutions have been adopted for Important Marine Mammal Areas at COP12, 2017, and Important Shark and Ray Areas at COP14, 2024, but a lack of progress on description of Important Marine Turtle Areas has prevented their consideration by CMS. An opportunity exists to seek support from CMS Parties for Important Marine Turtle Areas at the upcoming COP15 in 2026.

Convention on International Trade in Endangered Species of Wild Fauna and Flora
The purpose of the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) is to ensure that international trade does not threaten the survival of wild fauna and flora. However, CITES does not focus on trade in isolation—it takes a broader approach to ensure species are safeguarded from overexploitation. CITES is a legally binding agreement with 185 parties (including the EU as a party alongside its 27 member states), demonstrating a widespread commitment to its objectives. This is relevant for marine turtles, and thus prompted the adoption of Resolution Conf. 19.5 on the *Conservation of and trade in marine turtles* (by the convention's 184 Parties at that time) at COP19 in 2022. The Resolution recognises that marine turtles face significant threats that might be undermining efforts to tackle illegal trade, and so outlines 18 actions to be implemented, including but not limited to, collecting genetic samples for research, investigation and prosecutions to determine population origin (paragraph 5); coordinating efforts to ensure effective fisheries management reduces bycatch (paragraph 6, 7); and undertaking, as appropriate, research that can support the development of protection and conservation measures for marine turtle foraging, nesting and migratory areas (paragraph 9). This last action (paragraph 9) is specifically applicable to defining marine turtle connectivity, noting the Resolution further welcomes initiatives to help combat the illegal trade in marine turtles by transferring genetic techniques, technologies, and building greater capacity for marine turtle genetic studies, a call which ShellBank helps answer. Focussing on and filling gaps in genetic connectivity is a key element missing in marine turtle connectivity outputs to date.

[5]TARGET 1: Plan and Manage all Areas To Reduce Biodiversity Loss; TARGET 2: Restore 30% of all Degraded Ecosystems; TARGET 3: Conserve 30% of Land, Waters and Seas; TARGET 4: Halt Species Extinction, Protect Genetic Diversity, and Manage Human-Wildlife Conflicts; TARGET 5: Ensure Sustainable, Safe and Legal Harvesting and Trade of Wild Species; TARGET 8: Minimize the Impacts of Climate Change on Biodiversity and Build Resilience; TARGET 9: Manage Wild Species Sustainably To Benefit People; TARGET 10: Enhance Biodiversity and Sustainability in Agriculture, Aquaculture, Fisheries, and Forestry; TARGET 14: Integrate Biodiversity in Decision-Making at Every Level; TARGET 20: Strengthen Capacity-Building, Technology Transfer, and Scientific and Technical Cooperation for Biodiversity; TARGET 21: Ensure That Knowledge Is Available and Accessible To Guide Biodiversity Action; TARGET 23: Ensure Gender Equality and a Gender-Responsive Approach for Biodiversity Action

[6]SDG 2: Zero Hunger; SDG 6: Clean water and sanitation; SDG 12: Responsible consumption and production; SDG 13: Climate action; SDG 14: Life below water; SDG 15: Life on Land and SDG 17: Partnerships for the goals.

International Union for the Conservation of Nature (IUCN)

The IUCN is at the global front in the fight to save species from extinction. Its policies support nature conservation and sustainable development. The IUCN operates through many preeminent conservation levers, such as the Red List of Threatened Species assessments and various task forces (e.g. International Marine Mammal Protected Area Taskforce; the World Commission on Protected Areas) and Species Survival Commission (SSC) Specialist Groups (e.g. Marine Turtle Specialist Group, MTSG). Outside of these, the IUCN World Conservation Congress adopted a resolution on the development of Key Biodiversity Areas (KBAs) at its World Conservation Congress in 2004. Subsequently, the global standard for the identification of KBAs was published in 2016. KBAs are defined as the most important places in the world for species and their habitats, and the KBA Programme and Partnership has supported the identification, mapping, monitoring and conservation of these areas. Per the KBA database, few are specified for marine turtle habitat and most are terrestrially driven to date (i.e. nesting locations) (BirdLife International, 2025). There is a distinct opportunity to identify and incorporate IMTAs into the KBA framework, where those IMTAs meet the KBA criteria. The IUCN-SSC Marine Turtle Specialist Group (MTSG) is tasked with providing information on the seven species of marine turtles and is recognised as the global authority on marine turtles. One of their flagship initiatives is the establishment of Regional Management Units (RMUs)—a globally consistent framework for grouping marine turtle populations above the level of individual nesting rookeries but below the level of species, at a regionally relevant scale in support of conservation management and action (Wallace et al., 2010, 2011, 2023, 2025). RMUs were created by combining data from nesting sites, satellite telemetry, genetic stocks (MUs), and expert knowledge. The IUCN adopted RMUs for Red List assessments, and the concept has been uptaken widely within the marine turtle community. In total, 48 RMUs are currently defined for six species (Wallace et al., 2023). The MTSG also published the “Conservation Priorities Portfolio” (Wallace et al., 2011, 2025), which identifies the greatest threats, risks, and data gaps in each RMU. Although RMUs provide a framework for broadly defining groupings of “connected” marine turtle populations, and the CPP identifies conservation priorities within them, the broad scale of RMU bounds does not appropriately represent spatially explicit important areas, which require delineation at finer scales. A robust process integrating data with expert elicitation and local knowledge is required to derive these areas (i.e. IMTAs) for inclusion in global conservation frameworks.

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INTRODUCING THE BLUE CORRIDORS FOR TURTLES PROJECT

Our Plan

Blue Corridors for Turtles seeks to scale up marine turtle conservation by identifying and mapping *blue corridors* of marine turtle connectivity—that is, genetically distinct nesting and feeding areas plus the migratory pathways that connect them. The project is a global community partnership, with coordination from the World Wide Fund for Nature (WWF), Secretariat of the Convention on Migratory Species (CMS), the University of Queensland (UQ), The State of the World's Sea Turtles (SWOT) program, and Collecte Localisation Satellites - Argos system (CLS-Argos), in support of the International Union for Conservation of Nature - Species Survival Commission Marine Turtle Specialist Group (IUCN-SSC MTSG) mission.

Blue Corridors for Turtles aims to **synthesise and assess connectivity data at a global scale and support the identification of IMTAs** (under the auspices of the MTSG). Outside of migratory corridor identification in important area processes (e.g. IMMAs or ISRAs), no information has been maintained on the connection between important areas, although efforts are ongoing through the Migratory Connectivity in the Ocean (MiCO) system. Blue Corridors for Turtles directly addresses the RMU-specific Conservation Priorities Portfolio (Wallace et al., 2025) by providing spatially explicit, actionable information on connectivity and risk for turtle populations within RMU boundaries. Blue Corridors for Turtles was born out of the ShellBank project--the world's first marine turtle traceability toolkit and global DNA database (Refer ShellBank Box 3) and, **for the first time at this scale,** will use that foundation to delineate **movement data by genetic stock**. Integrating spatial and genetic data at a global scale will create a better understanding of geographic links across entire life-cycles and genetic stocks, with the collated data underpinning risk assessments to identify population-level susceptibility to key environmental threats and, ultimately, those populations most at-risk.

The end products produced by Blue Corridors for Turtles (e.g. marine connectivity spatial data and boundaries depicting important area delineations) will be made publicly available on existing online databases, such as SWOT and MiCO, and as otherwise decided by the MTSG. As with IBAs, IMMAs and ISRAs, the products will be used to drive action and support the delivery of multilateral global conservation measures and initiatives, **giving marine turtles and our wider turtle community a "seat at the policy table."** We will work with governments to apply the insights and data-driven science to deliver on their commitments under various conventions including the Global Biodiversity Framework (GBF) and its 30x30 agenda, SDG 14, and the High Seas Treaty, as well as to target local and national conservation efforts for the species, populations and habitats most vulnerable, for long-term recovery.

Our goal is to pinpoint populations most at risk, their spatial hotspots, and the management interventions and policy solutions required to support global recovery of marine turtles.

We Will:

Aggregate data to establish a connectivity baseline and identify gaps:

By December 2025, we will collate spatially explicit data, including nesting locations, satellite telemetry and genetic assignments, with data processing and quality assurance by an industry-leading team of analysts. Genetic data are being sourced (and continue to be data mined) through ShellBank. Simultaneous to the compilation of collaborator-provided data, the Blue Corridors team will complete a thorough review of published and grey literature to provide a baseline for what connectivity information exists. This data aggregation will support the identification of key data gaps for future on-the-ground efforts, create a platform for establishing a marine turtle connectivity baseline, and help to launch the development of a directory of active turtle conservation communities.

Assess threats and identify populations most at-risk:

By June 2026, we will launch on-the-ground projects needed to address traceability gaps, and by December 2026, have conducted a connectivity analysis propelled by the expertise of world leaders in connectivity science at the University of Queensland, Australia. We will leverage publicly available spatial data representing threats to marine megafauna (e.g. use, trade, fisheries and climate) to derive insights into which populations are at highest risk.

Define Important Marine Turtle Areas for greater effective protection:

By December 2027, we will work under the guidance of the MTSG to coordinate regional workshops for data and knowledge holders and facilitate the designation of IMTAs per IUCN guidelines. Aggregated and derived data products will be presented to workshop participants but, ultimately, IMTA lines will be drawn by participants via an inclusive approach. Blue Corridors products will be used to propose "superhighways" for protection under frameworks such as 30x30, OECM, the High Seas Treaty that deliver on the GBF and other international and regional agreements.

Blue Corridors for Turtles outlines a new collaborative approach to identify the most critical habitats and migratory corridors (IMTAs), supporting management plans, informing policy and providing solutions to governments and industry to mitigate threats.

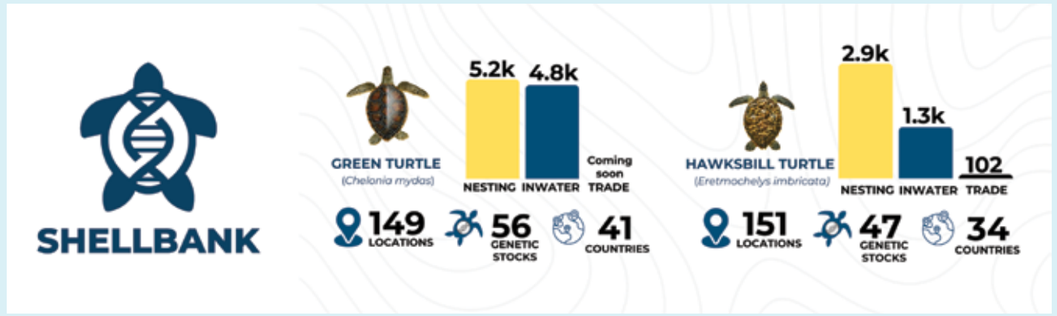
Box 3: Shellbank – A Global Genetic Toolkit For Traceability And Connectivity

Why genetics matters for marine turtle connectivity

Genetic tracking offers a powerful, cost-effective and flexible approach to understanding marine turtle connectivity. Unlike flipper tagging or satellite telemetry which often only enables partial life history insights, genetics can identify a turtle population origin from any life stage, source (e.g. from products like meat, eggs, or jewellery) or even turtles caught as bycatch.

By analysing mitochondrial DNA (mtDNA), we can trace a turtle's lineage back to its natal nesting population or area, providing essential information about genetic population structure and transboundary linkages between nesting beaches, migratory pathways, and foraging areas. These insights help define genetically distinct populations and biologically meaningful management units—something critical for conservation action. Yet, genetic baselines remain sparse for several key species and regions, and in many areas, genetically distinct populations are still undefined. This limits our ability to identify which populations are most at risk, and where interventions should be prioritised.
ShellBank was created to close this gap. It is the world's first dedicated traceability toolkit and global mtDNA reference database for marine turtles. Developed by WWF and its partners, ShellBank provides the tools needed to determine population origin, resolve migratory connectivity, and support targeted conservation and enforcement action. Since its inception in 2018 and global launch in 2022, ShellBank has helped define genetic stocks for hawksbill and green turtles, mapped population-level movements between nesting and foraging areas, and enabled research and forensic traceability of harvested turtles, and traded products. These capabilities are now being expanded to include all seven marine turtle species by 2030.

ShellBank is centered around three overarching data categories: a nesting baseline from known rookeries (nesting populations), in-water samples collected from foraging grounds including harvested turtles and bycatch, and a trade database with genetic profiles from seized or donated items. Together, they enable mixed stock analysis (MSA), a statistical method that estimates the proportion of different nesting populations contributing to mixed turtle aggregations.



Integrating ShellBank into Blue Corridors

ShellBank contributes a critical layer to the Blue Corridors for Turtles initiative by adding population identity to connectivity assessments. This distinction is central to effective conservation, allowing actions to be tailored not just to habitats, but to the specific reproductive units that sustain populations. As a cornerstone component, by embedding ShellBank into Blue Corridors, the project will— for the first time at this scale—align movement data with genetic stocks. This integration allows us to map the connectivity of marine turtles, identify source populations affected by fisheries, overexploitation or trade, and validate inferred movement patterns from tracking data.

ShellBank contributes a fundamental layer to the Blue Corridors initiative: the genetic delineation of populations and their connectivity across life stages and jurisdictions. While satellite telemetry defines spatial use and migratory pathways, mtDNA analysis reveals the natal origins of turtles using those routes.

When combined, these datasets:

- Confirm population boundaries inferred from genetics using movement data.
- Map the transboundary movements of specific genetic stocks.
- Identify source populations most affected by threats such as trade, overexploitation, or fisheries.
- Inform the delineation of Important Marine Turtle Areas (IMTAs) with both ecological and evolutionary context.

This integrated framework enables management actions to be focused not only on habitats but on the reproductive units that sustain global turtle populations.

Our Collective Approach

A core philosophy driving synthesis projects like Blue Corridors for Turtles is that the whole is greater than the sum of its parts. That is, through data sharing and collaborative meta-analysis, we can gain access to new, unique insights that were unavailable when datasets were kept in isolation. Indeed, meta-analyses are required to scale up from individual projects to wider inference relevant for conservation at broader scales and extents. To generate these greater insights, **Blue Corridors for Turtles will rely on the turtle community coming together in a collaborative approach.**

Since its inception, Blue Corridors for Turtles has been a collective effort. Various MTSG members were engaged since 2024. After securing initial funding from WWF, the global community of marine turtle scientists and conservationists was engaged in late 2024 and early 2025, with the first data call for satellite tracking released in February 2025. Pivotal examples of community engagement have also taken place via presentations during regional and global forums, workshops and symposia—for example, the North African Network for the Conservation of Marine Turtles (NASTNet) Annual Meeting (Tunisia, December 2024); the Coral Triangle Initiative for Coral Reefs, Food Security and Fisheries 19th Senior Officials' Meeting and the 9th Ministerial Meeting (Timor-Leste, December 2024); the 43rd International Sea Turtle Symposium (Accra, Ghana, March 2025); the Wider Caribbean Sea Turtle Network (WIDECAST) Annual General Meeting (St. Kitts, March 2025); and the Secretariat of the Pacific Regional Environment Programme Regional Pacific Turtle Forum (Fiji, April 2025). In June 2025, Blue Corridors for Turtles was formally launched at the Third United Nations Oceans Conference (UNOC3, Nice, France), representing the project's first global introduction and a forum to advocate for government uptake.

Our Blue Corridors for Turtles approach is anchored in several core principles:

A Singular Focus on Marine Turtles

Unlike other global-scale megafauna data syntheses that have incorporated turtle data in the past, Blue Corridors for Turtles is focused entirely on the marine turtle species group. This singular emphasis will produce a more focused message for conservation and provide a pathway to an ultimate goal of facilitating the delineation of Important Marine Turtle Areas.

A Backbone of Genetics

The Blue Corridors project will be genetically explicit. That is, connectivity information will be extended to include genetic stock, which is a fundamental unit for conservation but is often overlooked in connectivity meta-analyses. This "backbone" of genetics will rely upon and leverage the ShellBank project and ensure that Blue Corridors for Turtles supports comprehensively informed conservation action not only focused on habitats, but also on the reproductive units that sustain global turtle populations.

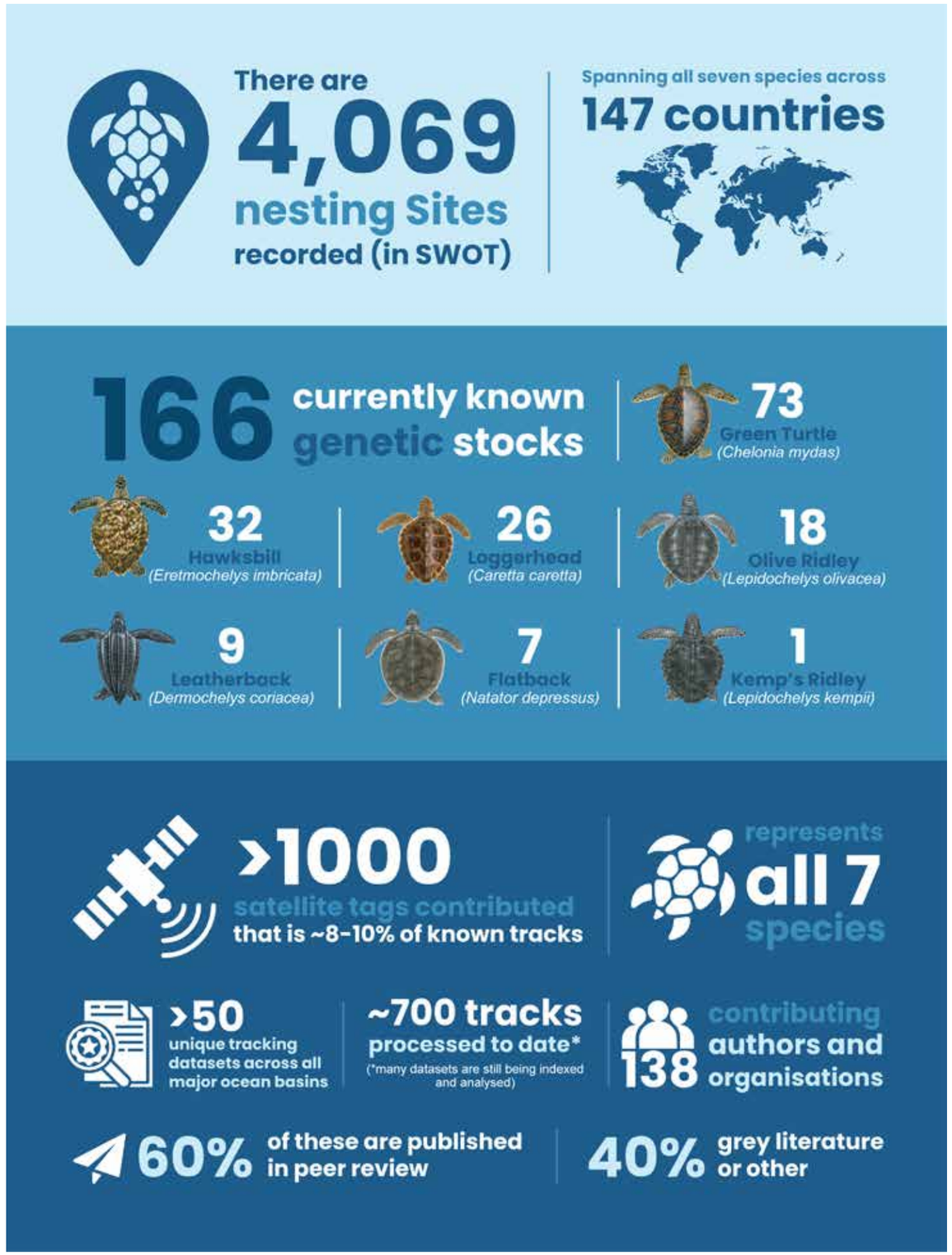
A Commitment to Data Completeness and Accessibility

Blue Corridors for Turtles was designed to overcome barriers to data accessibility in terms of both data collection and dissemination. CLS-Argos is a core project partner—greatly simplifying the process of compiling telemetry data by enabling data owners to simply authorise the release of their data (in a standardised format). Additionally, through painstaking literature review, including grey literature sources, in collaboration with data owners, Blue Corridors for Turtles is in the midst of enumerating the most comprehensive account of marine turtle satellite tracking information ever assembled, to accompany comprehensive nesting and genetic information. This will provide a baseline understanding of what information exists where, thereby allowing for the identification of true knowledge gaps. Last but not least, Blue Corridors for Turtles pledges to make synthesised end products available to all by placing them in public online databases.

Ties to Turtle-Connected Communities

The project serves as a nexus linking diverse stakeholders across conservation, science, policy and local communities. Identifying, expanding and connecting communities that are ecologically linked by shared turtle populations will help foster cross-border collaboration, mutual understanding and more inclusive marine turtle conservation. Acknowledging many local communities face barriers to participating in conservation decision making, including limited access to scientific data or technical resources, a key strength lies in ensuring the broader collaborative network of local community stakeholderand plays a central role in shaping the identification and designation of IMTAs.

Blue Corridors by Numbers



Progress to Date

Each dataset (nesting, genetics, satellite telemetry) has been built with its own workflow. Below is a brief description of what has been achieved over the past 3 months, since the introduction of Blue Corridors for Turtles to the turtle community.

Nesting Data

Mapping is underway on nesting distributions—an essential “node” for understanding connectivity (Figure 4). The nesting database already compiled by SWOT plays a significant role, and future work within Blue Corridors for Turtles will build on this database to integrate other sources, including local knowledge, and to fill in gaps.

A comprehensive and spatially explicit nesting database can provide the foundation to begin to understand knowledge gaps for distinct genetic populations, as genetic stocks are typically delineated by source rookeries. The ShellBank core team uses empirical information on known genetic stocks (using mitochondrial DNA, or mtDNA, haplotypes) to determine where significant knowledge gaps exist. That is, by integrating ShellBank data with the SWOT nesting database, we can point to gaps in genetic structure or composition and target them for future research (Refer Targeting Data Gaps section below; Figure 12). This Blue Corridors tool will improve as we work to grow and quality-assure the dataset of known nesting locations.

Figure 4: Compiled global nesting sites across the seven species of marine turtles.

Genetic Data

ShellBank has already amassed over 15,000 quality-assured data points for green and hawksbill turtles on its online database. Additional datasets for these two species are currently being curated for entry in 2025. Beyond the online database, ShellBank also holds a significant offline repository of unpublished records and reference citations, encompassing thousands of additional data points across all seven marine turtle species. As a cornerstone of the Blue Corridors for Turtles project, ShellBank aims to include all offline data for all marine turtle species in its open access database by 2030. Expansion will begin with the inclusion of leatherback turtles in 2025, followed by olive ridleys in 2026, loggerheads in 2027, with remaining species to follow.

To date, most genetic data have focused on nesting populations. However, critical gaps remain, especially in our understanding of stock boundaries and how these populations are connected to foraging grounds. Genetic analysis offers an important complement to satellite tracking, helping to trace turtles across ocean basins and clarify transboundary movement. Genetic analyses of the entire ShellBank database (public and offline) will be conducted in 2025 to identify marine turtle connectivity. These will be published by the ShellBank core team and available online as “country summaries” in early 2026.

Satellite Tracking Data

As nesting data are aggregated and satellite telemetry data are incorporated into the Blue Corridors for Turtles project, ShellBank will assign a genetic stock to each nesting data point and each track where origin is known, further integrating genetic and movement data into a unified framework defining IMTAs. The Blue Corridors analyst team has initiated the integration of satellite tracking datasets from multiple research institutions, NGOs, and regional programs. The telemetry data ingestion and processing component of the Blue Corridors for Turtles project began in February 2025 (Figure 5). These efforts have focused on standardising disparate data formats, harmonising metadata fields, and consolidating migration tracks across multiple ocean basins. While some data has already been shared and more data are being accumulated, the aggregated mapping product is beginning to take shape (Figure 6).

Accomplished in just under 3 months, we have so far:

Acquired: 50-60 satellite tracking datasets. These have been acquired from collaborating partners, representing all seven marine turtle species across all major ocean basins and the Mediterranean and Red Seas.

Processed: almost 700 tracks from ~25 datasets, including cleaning of location errors, removal of duplicates, and resampling of track intervals for consistency, with another 500-900 in the production queue.

Unified metadata: common schemas have been adopted for tagging metadata (e.g. deployment location, tag type, sex/stage class of turtles) to support downstream connectivity analysis and integration with ShellBank genetic datasets.

Satellite tracking data to be produced includes:

Cleaned and Interoperable Tracks: Finalised, QA/QC'd datasets for each species and region, ready for use in connectivity modeling and to inform IMTA designation.

Derived Movement Metrics: Generation of movement summaries (e.g. mean travel distance, seasonal site fidelity, corridor overlap) to support population risk assessment and spatial prioritisation.

Integration with Genetic and Community Data: Merging tracking outputs with ShellBank genetic data and georeferenced coastal community layers for multidimensional conservation planning.

Gap Identification: A spatial analysis of current telemetry coverage to identify underrepresented regions, especially across high seas corridors and lesser-known foraging areas, guiding future deployments and regional engagement.

Open Data Products: Preparation of publicly shareable data layers (subject to partner agreements), accessible via global marine spatial platforms and regional conservation hubs.

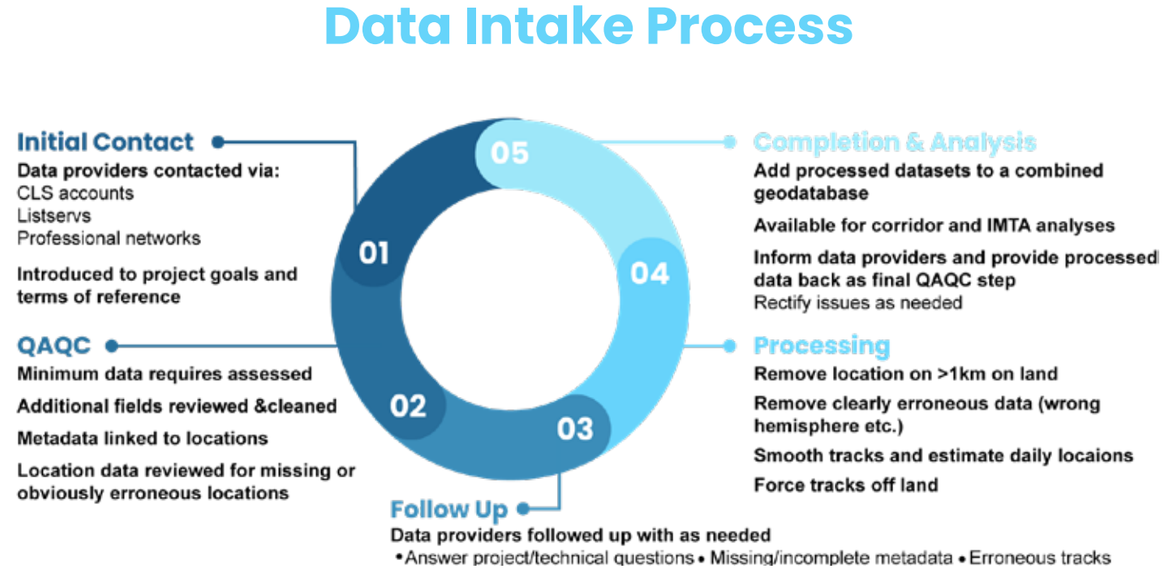


Figure 5. Data intake process for satellite telemetry

Figure 6. Telemetry data contributed to the Blue Corridors for Turtles project comprising seven species, 21 datasets, and 696 animal tracks, highlighting the interconnected nature of marine turtles. Here, daily animal locations have been aggregated into hexagons, colored by species richness and the number of locations present (small numbers within legend hexagons). Data processing is ongoing and many more datasets, both contributed and extant, remain to be ingested. Credit: The Blue Corridors for Turtles Research Consortium, Esri, Garmin, and HERE.

Blue Corridors for Turtles In Practice

Hawksbills in the Northwest Atlantic – a Case Study

Andrew S. Maurer, Kathryn Audroing, Gina Belle, Quintin D. Bergman, Rhema Bjorkland, Annette C. Broderick, Darren C. Brown, Kenrith D. Carter, Kate E. Charles, Eduardo Cuevas, Carlos E. Diez, Andrea Donaldson, Stephen G. Dunbar, Chelsea E. Durr, Lindsey R. Eggers, Nicole Esteban, Luis G. Fonseca, Miquel Garcia, Brendan J. Godley, Kafi Gumbs, Kristen M. Hart, Lucy Hawkes, Julia A. Horrocks, Yolanda M. León, David P. Marancik, Raúl Diaz Mirón, Félix Moncada-Gavilán, Farah Mukhida, Frank V. Paladino, Alwyn Ponteen, Ohiana Revuelta, Lidia Salinas, Kaj Schut, Louise M. Soanes, Seth P. Stapleton, Jesús Tomás, Abigail Uribe-Martínez, Robert P. van Dam, Julian Walcott, Jack Wiggins, Daan Zeegers, Kimberly M. Stewart, and Karen L. Eckert.

The Blue Corridors for Turtles project aims to bring together multiple data types to generate unique insights on connectivity, threats, remaining knowledge gaps, and possible important areas. The question of how this process will work is perhaps best addressed with an example. Collaborators from throughout the Northwest Atlantic RMU (Figure 7) for the hawksbill turtle provided data to facilitate a hypothetical case study for the Blue Corridors process, building on previous efforts (Maurer & Eckert, 2024).

Figure 7. The Northwest Atlantic Regional Management Unit (RMU) for the hawksbill sea turtle (Wallace et al., 2023)

First, we pooled satellite tracks for 200 adult female turtles sampled in 18 countries and territories (Becking et al., 2016; Cuevas et al., 2022; Dunbar et al., 2025; Esteban et al., 2015; Hart et al., 2019; Hawkes et al., 2012; Horrocks et al., 2001; Maurer et al., 2022, 2024; Moncada et al., 2012; Revuelta et al., 2015; Soanes et al., 2022; Uribe-Martínez et al., 2021; van Dam et al., 2008; Wiggins et al., 2024). We assumed that with a high sample size, adult females provide an unbiased reflection of habitat use in the region. Raw data were used to fit a correlated random walk model to estimate “true” turtle locations at regular time intervals, which serves to greatly reduce the “noise” in raw telemetry data that can result from satellite fix inaccuracies. We then integrated modeled movements with SWOT nesting data, with the results mapped below (Figure 8). Looking ahead, the next step will be to assign genetic stocks by leveraging ShellBank insights.

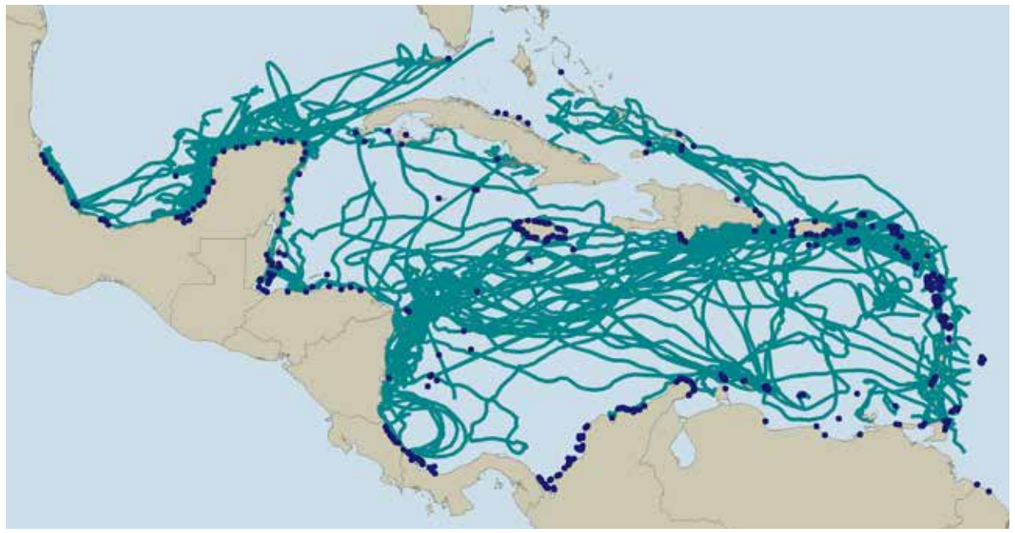


Figure 8. Satellite tracks (green lines) and known nesting sites (blue dots) for hawksbill turtles in the Northwest Atlantic region.

To provide a foundation for assessing important areas, we next synthesised the satellite tracks into aggregated products that are more readily usable by managers and policymakers. We segmented satellite tracks by turtle behavioral state to separate migratory and foraging periods (Figure 9). For each state, we used kernel density estimation to in effect produce a “heat map” showing where foraging areas and migratory corridors were most densely concentrated. These distributional patterns share strong similarity because hawksbills commonly migrated relatively short distances, thereby concentrating hotspots around nesting beaches.

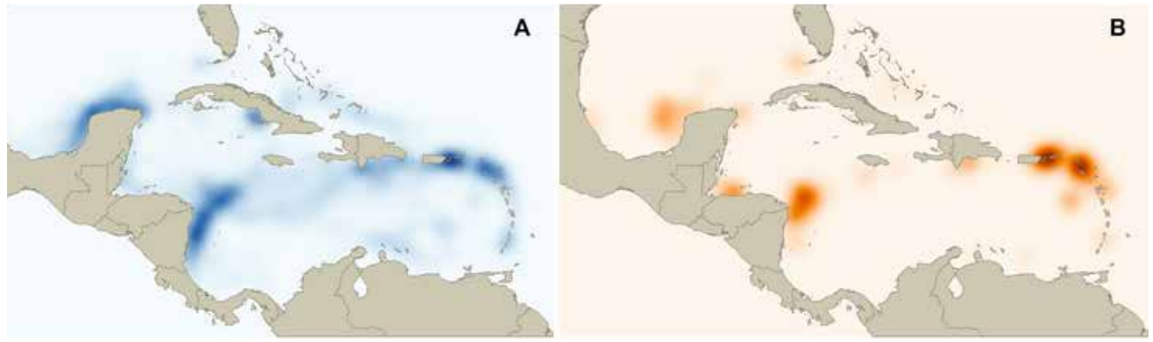


Figure 9. Migratory corridors (A) and foraging distributions (B) as computed via kernel density estimation for 200 adult female hawksbills.

The next step in the Blue Corridors for Turtles process is to assess overlap with various threats, ranging from commercial shipping to fisheries interactions. For one example, we mapped coastal and domestic fisheries sourced from Dunn et al. (2010) (Figure 10).

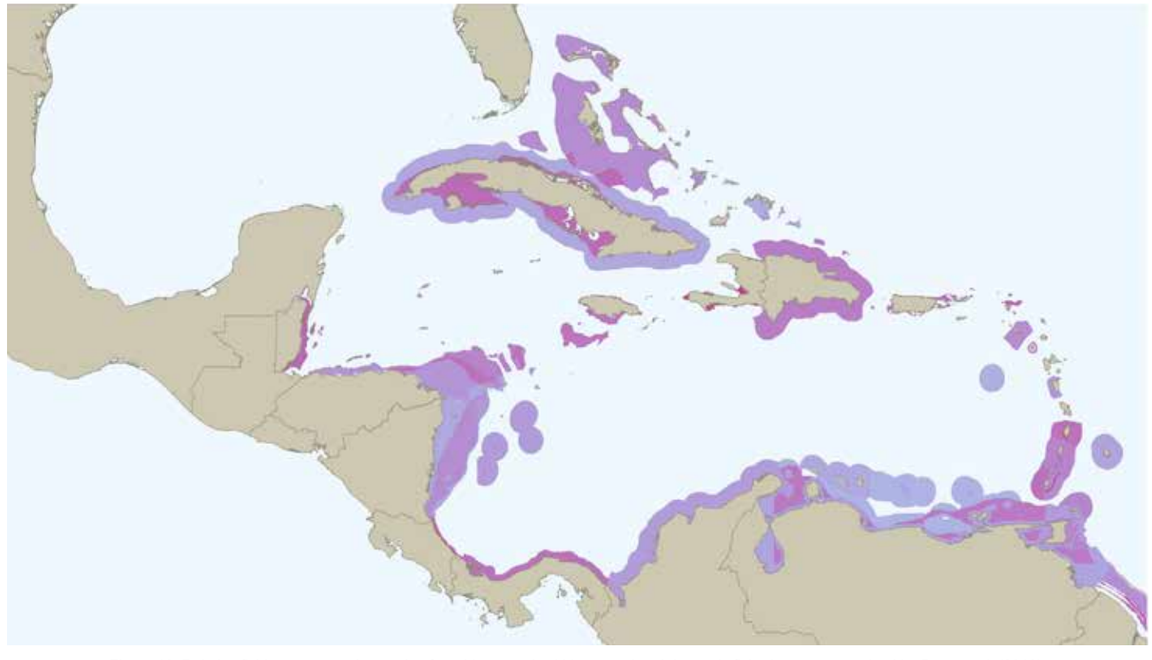


Figure 10. Relative fishing pressure, increasing from blue to red, within coastal and domestic fisheries as summarised by Dunn et al. (2010).

When data types have been combined into a single, cohesive framework, the final phases of the Blue Corridors for Turtles project will entail assessing populations most at risk and, ultimately, facilitate the delineation of Important Marine Turtle Areas via regional workshops. Below, we provide a potential scenario for important area designations based on the empirical information presented above (Figure 11). *We emphasise that this is preliminary and hypothetical*—we will revisit this regional context later, with more data, in an inclusive, community approach.

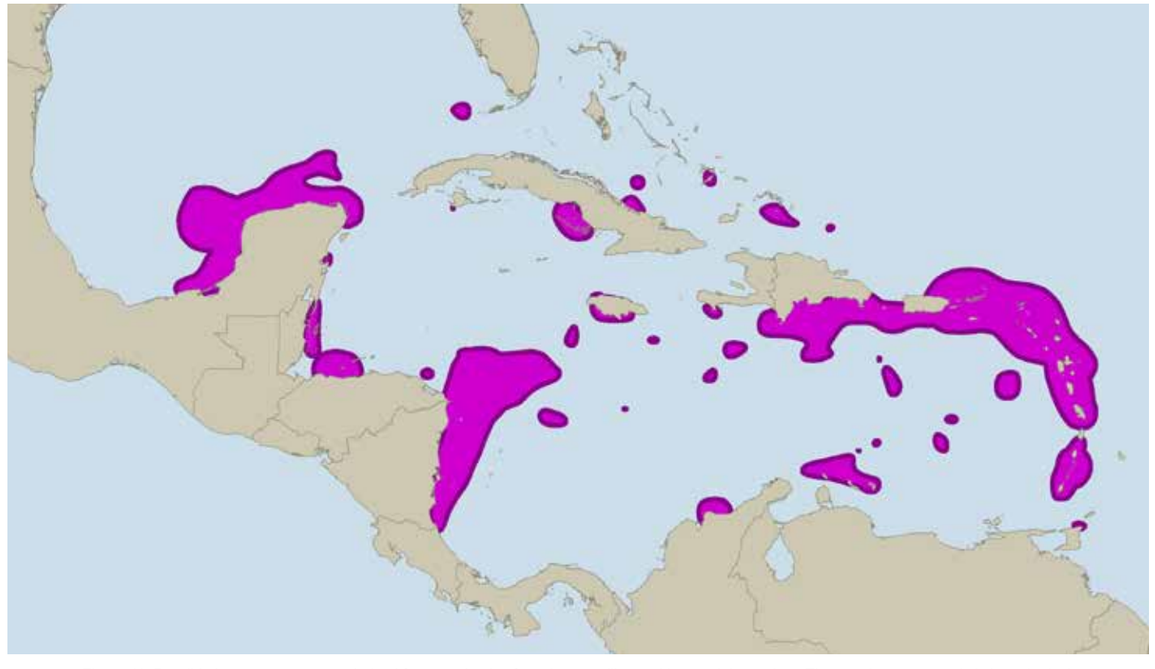
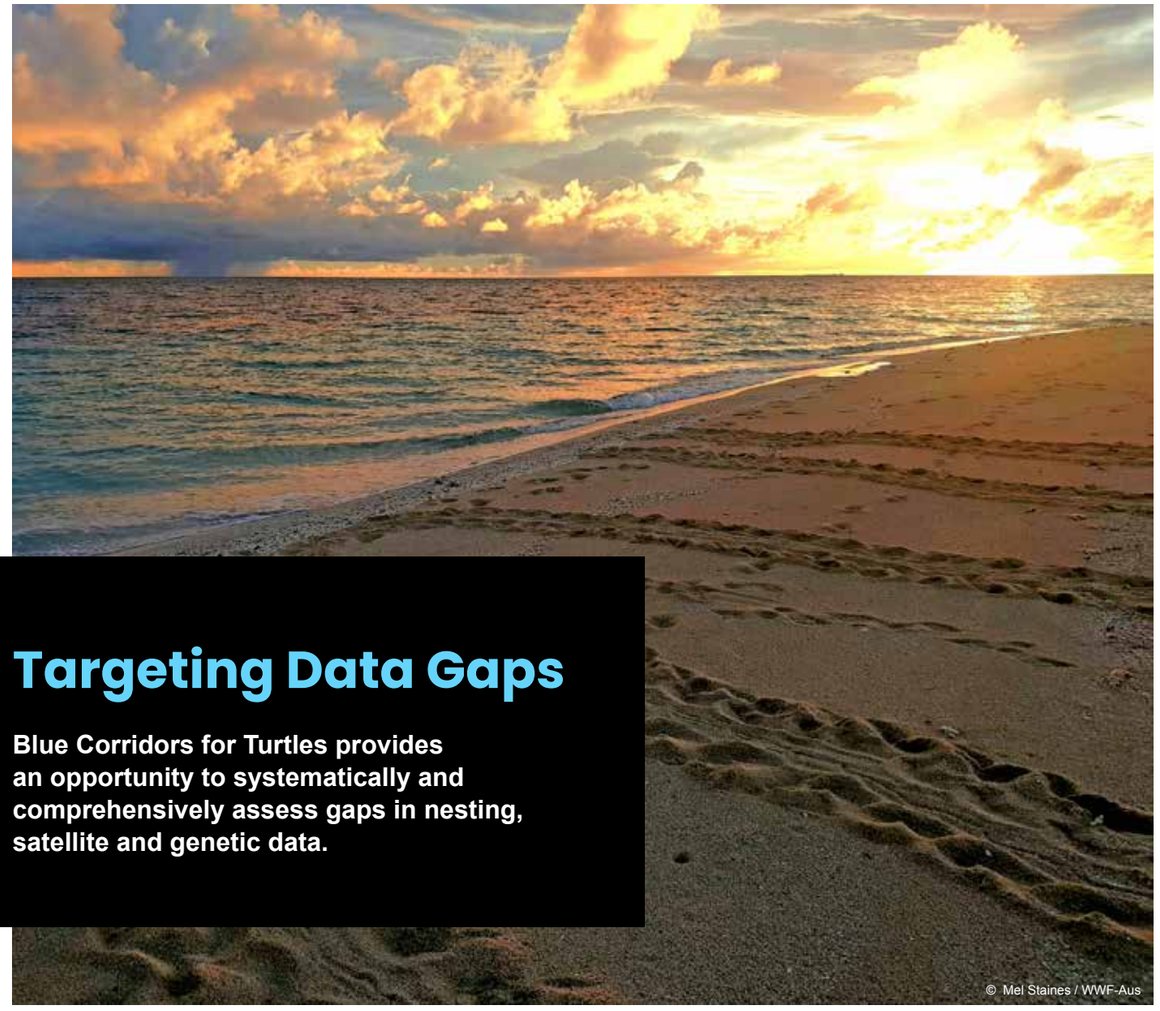


Figure 11. Possible important areas, as derived from synthesis of nesting, satellite tracking, and threat data. These polygons are strictly hypothetical, with the sole purpose of exemplifying the Blue Corridors process; they may not reflect important areas eventually designated in the region.



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Targeting Data Gaps

Blue Corridors for Turtles provides an opportunity to systematically and comprehensively assess gaps in nesting, satellite and genetic data.

While data contributions are ongoing, early assessments already highlight key geographic and taxonomic blind spots that require urgent attention. These insights can already directly inform fundraising and donor communities to support genetic and telemetry research proposals that target identified data deficiencies. Gaps will be identified on a rolling basis as Blue Corridors builds and more data data are contributed. The Blue Corridors for Turtles partnership will help facilitate efforts to direct research funding to address documented gaps.

ShellBank and the IUCN-SSC MTSG Regional Management Unit (RMU) framework offer strong initial guidance on where genetic data are limited or entirely missing.

Under the RMU framework, priority gaps are primarily within the Pacific and eastern Indian Ocean basin with the most critical data needs in the following RMUs (refer Figure 12; Wallace et al. 2025): The conservation capacity gaps (that is, the enabling conditions for, and/or obstacles to, marine turtle conservation) were greatest for leatherback and hawksbill turtles (Wallace et al., 2025). The RMU dashboard created by the MTSG showcases the results of the recent RMU assessment (https://www.seaturtlestatus.org/cpp-dashboard).

Critical RMU Data Gaps

Hawksbill turtles
of Northeast Indian Ocean,Pacific Southeast Asia, South Central Pacific, and West Central Pacific

Loggerhead turtles
of the Northeast Atlantic, Northeast Indian Ocean, and Northwest Indian Ocean

Green turtles
of the West Central Pacific

Leatherbacks
of the West Pacific

Olive ridleys
of the West Indian Ocean and the West Pacific

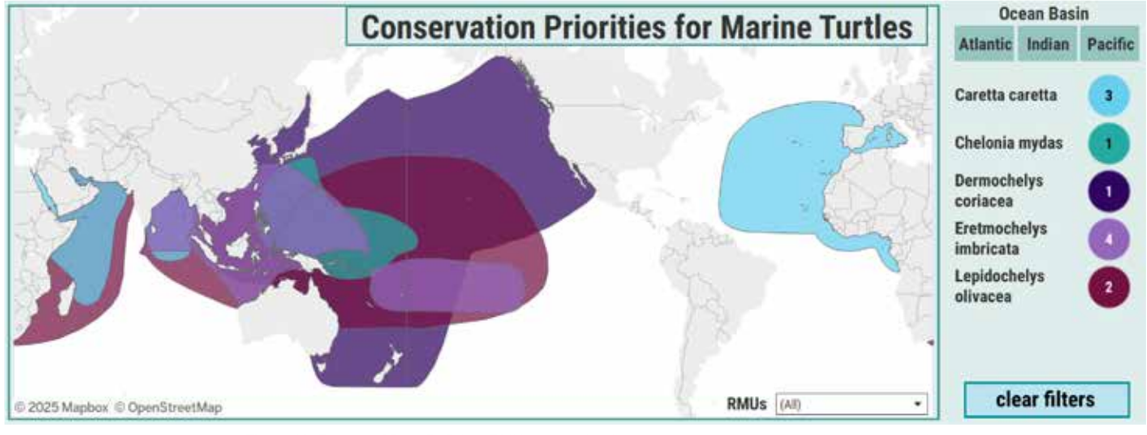

Figure 12. Excerpt of Data Deficient RMU per species (https://www.seaturtlestatus.org/cpp-dashboard)

ShellBank has also identified missing genetic baselines through its own nesting database assessments and comparison with SWOT nesting data.

These comparisons, while still in development, reveal countries and regions where data remain scarce and where additional sampling could significantly strengthen our understanding of connectivity (see Figure 13). These areas include:

Northern Indian ocean
Red Sea, Yemen, large parts of the Persian Gulf, Pakistan, Maldives, India, Sri Lanka, Bangladesh including Andaman and Nicobar Islands, Myanmar, west coast of Thailand, Peninsula Malaysia and Indonesia including Sumatra

South West Indian ocean
East Coast of Africa including Kenya, Tanzania, Mozambique, South Africa, Madagascar

South East Asia
Most of Indonesia and western Papua, Cambodia, Viet Nam, east coast Thailand, certain sites in Peninsula Malaysia and Sabah, Timor-Leste, and Philippines

Central and Western Pacific
Northern Palau, Micronesia, northern Papua New Guinea and the Solomon Sea, Vanuatu, Cook Islands, Tonga, French Polynesia, and part of Fiji

Eastern Pacific
Parts of Mexico, Peru and Colombia

Caribbean
Parts of Mexico, Costa Rica, Belize, Nicaragua, Colombia, Panama, Honduras and Jamaica, and various smaller islands throughout eastern Caribbean

Atlantic
Parts of west Africa

These do not reflect all known nesting areas or the full scope of foraging grounds where genetic assignment remains unresolved. As Blue Corridors for Turtles progresses, ShellBank's country-level genetic summaries will help refine and expand this picture, highlighting specific gaps and priorities for future sampling and analysis.

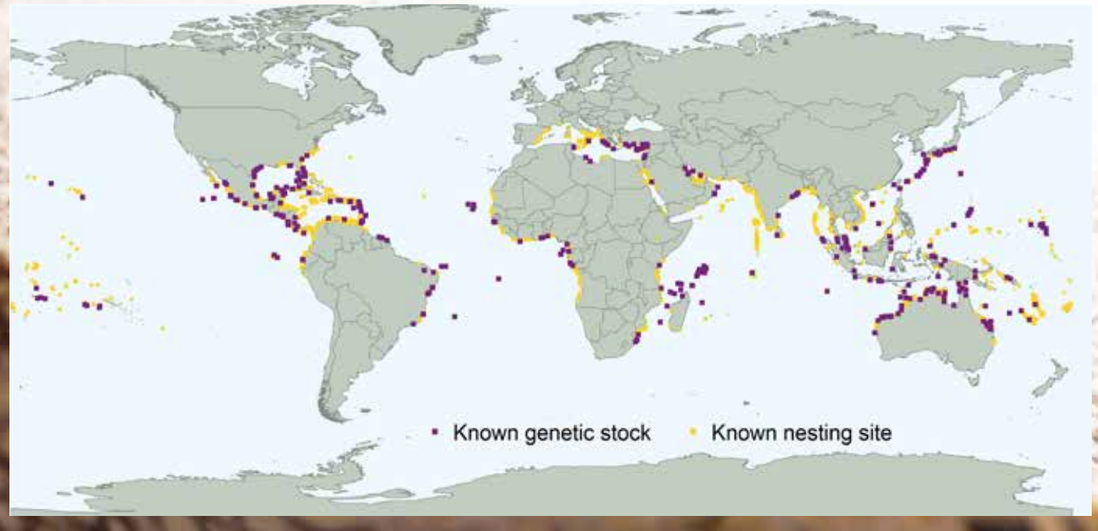

Figure 13. Discordance between the geographic spread of known nesting sites and genetic stocks highlights where genetic gaps remain. Regions with key gaps per ShellBank data are detailed above.

Looking Forward

There are many steps ahead as we build a marine turtle connectivity framework and engage with governments and international and engage with governments and international bodies seeking to contribute to the Blue Corridors for Turtles project, or seize on opportunities presented to meet policy commitments.

Key Blue Corridors Milestones

Blue Corridors for Turtles is an ambitious project with a timeline designed to meet governmental commitments and ensure marine turtles have a seat at the policy table. Figure 14 below summarises the key milestones.

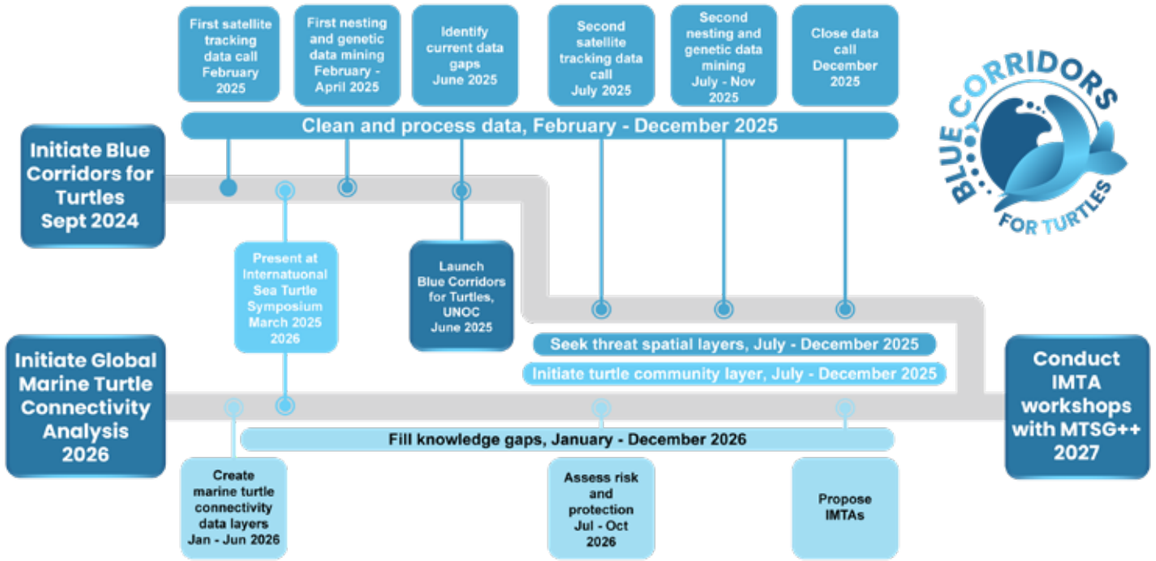

Figure 14. Anticipated timeline of the Blue Corridors for Turtle project.

Help Build Blue Corridors for Turtles

Everyone can get involved, from governments, to universities, community groups, donors and fundraisers.

We invite contributions
We are collecting data on nesting populations, satellite tracking, and genetics in 2025.

With collaboration as the foundation of the project, Blue Corridors for Turtles invites the participation of data and knowledge holders worldwide. Collaborators are afforded the benefits of centralisation and cleaning by an expert analyst team, acknowledgement on Blue Corridors outputs (including publication co-authorship within an author consortium), and opportunities to be involved in Blue Corridors-facilitated workshops during regional IMTA processes. Data will be stored securely and only shared with third parties when authorised by data owners, as stipulated in project terms of reference released in February 2025.
Please reach out to the Blue Corridors for Turtles Team if you wish to share data, ask questions, or be involved in any way, at: bluecorridorsforturtles@gmail.com

We call on funders to fill the gaps
Blue Corridors aims to support local communities, research groups and others to fill data gaps. We call on donors, fundraisers, sponsors and others willing to help contribute resources (i.e. funding, satellite transmitters, genetic sample kits and field equipment) to ensure these materials get to the people and turtle populations that need them most.

We call on governments to drive action
We call on governments to advance marine turtle conservation efforts and, through the Blue Corridors for Turtles project, facilitate data access and make way for IMTA uptake into policy processes to help drive national, regional and international commitments.

Blue Corridors for Turtles calls on our global community to be prepared and get involved—this is for our turtles, to be their voice, and finally create a "seat at the policy table," which marine turtles deserve.


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Blue Corridors for Turtles Consortium

We extend our deepest gratitude to all who have already joined the Blue Corridors project and contributed data at this early stage. The data used in this launch report were collected by scientists and conservationists across the globe. Not all datasets contributed have been processed yet but all collaborators have been included in the consortium.

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