A New Coat of Paint for Sea Turtle RMUs

By Bryan P. Wallace, Roderic Mast, Zach Posnik, Brendan Hurley, Lucy Meyer, Hannah Brenner, Andrew DiMatteo, Sara Maxwell, Isabel Rodriguez, Ashleigh Bandimere, Brian Hutchinson, and Paolo Casale

Because they range over vast oceans, countless ecological niches, and multiple political jurisdictions during their decades-long lifespans, sea turtles present an array of challenges for monitoring, assessment, and conservation. A fundamental first step in devising management strategies is to understand the units for assessment, which for sea turtles makes most sense at a scale that is finer than species, yet broader than nesting sites, and which includes biological and demographic processes that span time and space. Such subpopulations are called regional management units (RMUs), a framework that has been in use for more than a decade.

An olive ridley turtle swims in the Pacific Ocean off the coast of Costa Rica.
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Why Are RMUs Useful?

Imagine you work for a grant-giving authority whose priority is to save sea turtles from extinction globally. Where to begin? Granted, you only have seven sea turtle species to worry about, unlike a fish (about 34,800 species) or bird (about 10,000 species) conservationist, or someone concerned with saving mollusks (maybe 50,000 to 200,000 species)—yikes! So you're feeling lucky. But still, if you were the person tasked with doing this on a limited budget just a little over a decade ago, you would have had very few tools to help you choose where to invest in projects. You likely would have started by checking the IUCN Red List of Threatened Species global assessments for sea turtles.

For instance, let's consider just one of the seven species, the leatherback: The Red List would have told you that the species was "Critically Endangered throughout its range." And knowing that the leatherback is found in every major ocean basin on Earth and is arguably the most widely ranging animal on the planet, you'd still have been hard-pressed to choose where to make strategic grant investments to prevent its extinction. Would you target nesting beaches, foraging areas, or migratory routes? Would you prioritize hatchlings, subadults, or adults? Males or females? And which of the many ocean basins that are home to leatherbacks would you have chosen?

This was the situation back in 2003, when the IUCN Marine Turtle Specialist Group (MTSG) decided to launch a series of Burning Issues (BI) Workshops to help set global priorities that would assist sea turtle conservationists in making such difficult choices. By the time Burning Issues Workshop #6 (BI-6) rolled around in 2009, the group had determined to develop a framework to organize marine turtles globally into units above the level of nesting populations, but below the level of species. Thus, RMUs integrate biogeographical information from multiple scales and tools, including nesting sites, genetic stocks, satellite telemetry, and geographic distributions based on long-term monitoring research.

The first assessment of RMUs was published in 2010, and it has been used widely by the sea turtle community ever since to identify data gaps, assess high diversity areas for multiple species and genetic stocks, evaluate relative impacts of threats, and generally improve our understanding of the conservation status of marine turtles worldwide. RMUs also provide valuable guidance to marine spatial planning initiatives such as the creation of marine protected areas, as well as monitoring, protection, and data gap analysis. Designed from the outset to be dynamic and to evolve over time as our understanding of sea turtle biogeography improves, the RMU tools—including maps and supporting metadata—were made publicly available through the SWOT database in an online application for comments, improvements, downloads, and analyses.

By 2019, given the many improvements in our understanding of sea turtles during the decade since BI-6, the MTSG felt it was time to refresh the concept and framework, and to reconsider RMU boundaries. Thus, RMU 2.0 was under way. Burning Issues Workshop #7 (BI-7) was scheduled to take place at the renowned Monaco Oceanographic Museum in June 2020, but the gathering had to be postponed because of the COVID-19 pandemic. It was subsequently moved online in a series of virtual meetings that were conducted between 2019 and 2022 by small, thematically focused expert teams of MTSG volunteers from around the world.

How Was RMU 2.0 Developed?

The RMU 2.0 redefinition process began with scientists amassing decades of published and unpublished data, reference articles, and reports, as well as focused literature searches and entirely new compiled data platforms, including the following:

- The State of the World's Sea Turtles (SWOT) database of sea turtle biogeography—which contains more than 760,000 data records—and SWOT's existing national, regional, and global scale maps of biogeography for all sea turtle species.
- An overview of published data about sea turtle biogeography published through 2019 and used in the first RMU definition process.
- The MTSG's regional reports, compiled through an ongoing process launched in 2016 that aspires to produce a set of regularly updated and comprehensive lists of literature pertaining to sea turtle biology, biogeography, and conservation.
- A database of 500 pertinent publications since 2009 that focus specifically on sea turtle telemetry, genetics, threats, and population status.
- A powerful geospatial data management platform that includes nearly 1,000 georeferenced maps from published papers and the updated Geographic Information System shapefiles for RMUs that are based on the most current sea turtle telemetry data, SWOT resources, and more.

RMU 2.0 Definition Process

The results of that exhaustive literature review were presented to hundreds of expert reviewers—many of whom were also involved in the first RMU assessment—in a way that would facilitate robust, inclusive, and thoughtful consideration of all new information.

Despite the broad uptake of RMUs, valid questions were raised about whether RMUs had been defined clearly enough in 2010 to avoid confusion with other types of conservation unit frameworks, such as genetically defined management units or evolutionarily significant units. As such, before reviewers embarked on the time-intensive process of updating RMUs, an online discussion ensued to revisit the definition of RMUs and to provide guidance for the update process. The new and improved RMU definition that resulted is as follows:

- Regional management units are assemblages of marine turtles from the same species that share areas critical to life history requirements. Their overlapping geographic distributions expose these turtles to similar environmental and anthropogenic factors, placing them on similar demographic trajectories. These spatially explicit marine turtle RMUs, which include all life history stages, are similar to IUCN "subpopulations" because they are directly below the level of global species and can encompass finer-scale population structuring (e.g., unique genetic stock management units).
- In practice, RMUs provide a globally applicable assessment framework that (1) can account for influences of environmental and anthropogenic factors on geographically widespread, complex marine turtle assemblages and (2) allow for conservation and management priorities to be designed for appropriate geographic scales.

With this guidance in place, an inclusive virtual review process to update RMUs ensued in several stages:

- In early 2019 (in preparation for the Monaco Workshop that was ultimately canceled), a BI-7 Workshop team was formed of about 50 volunteer experts with broad regional and thematic expertise.
- All 300 or so MTSG members were invited to participate in online surveys in March 2019 to review and validate the criteria for RMUs and to gather feedback about the strengths of, weaknesses of, and opportunities for improvements to the methods used in the first RMU definition process.
- From November 2020 to June 2021, MTSG members and others convened online to fine-tune the online platform that would be used to revise and finalize all sea turtle RMUs.
- Following two formal one-month review periods in March and August 2022, the platform was launched in August 2022, and the system remained open for comments throughout the year.

Behold, RMU 2.0

The new RMUs reflect a significant expansion of our understanding of marine turtle biogeography and provide added clarity about the RMU concept and its potential applications. A total of 48 RMUs and 166 genetic stocks of six sea turtle species globally (all except the flatback) are presented in the maps on p. 14, and the supporting files have been made open-access to empower research and conservation initiatives around the world. Flatback turtles nest only in Australia and have a relatively restricted geographic range; thus, the MTSG decided not to redefine flatback RMUs because of potential confusion with the existing seven management units officially recognized for the species that are already the focus of ongoing management efforts in Australia.

A male loggerhead turtle swims off the coast of Zakynthos island in Greece.
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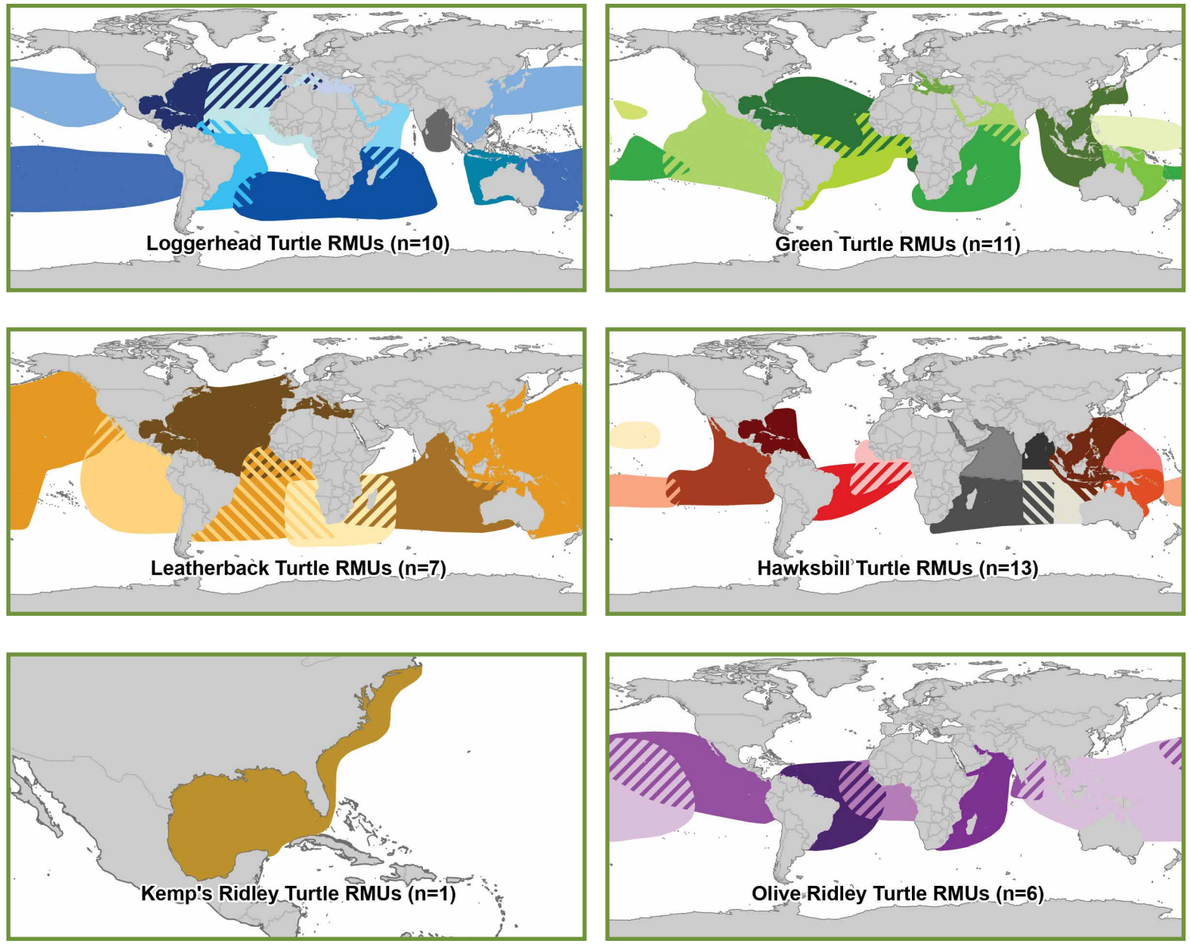
How RMUs Affect Conservation

Since their introduction in 2010, RMUs have provided a framework for evaluating threats and conservation status in numerous published overviews and in countless research projects relating to conservation status and priorities for marine turtles. RMUs have even provided a conceptual model for conservation planning among specialists working on other taxonomic groups. Originally developed to help the MTSG address perennial challenges when performing Red List assessments, RMUs now provide a basis for subpopulation-level assessments, which have been widely recognized as more appropriate for conservation because they focus on more conservation-relevant population units.

For example, RMUs have now been used to conduct finer-scale subpopulation Red List assessments for loggerheads, leatherbacks, and green turtles, which, when those assessments are coupled with improved data about regional status and threats, are strengthening efforts to set conservation priorities for those species. In addition, the next step in the MTSG BI-7 Workshop process will be to revamp the conservation priorities portfolio framework to assess population viability and threat impacts and to allow identification of conservation opportunities for all RMUs globally. As time goes on and more information becomes available, RMUs should be updated so that they stay current and useful for various conservation and research applications.

And for the ill-equipped sea turtle conservation grant-giver who was referenced earlier and was tasked with preventing sea turtle extinctions before 2010, RMUs should help give a more focused perspective about how, where, and when to assign limited conservation resources for the biggest effect. ●



Forty-eight regional management units (RMUs) for six sea turtle species were recently updated by the IUCN Species Survival Commission (SSC) Marine Turtle Specialist Group and Oceanic Society. From the original RMU analysis published in 2010, 11 of these have remained unchanged, 2 have been removed (the flatback was not included in this analysis), and the rest were modified on the basis of new data. RMUs may overlap (lined areas) but are anchored to nesting sites where females share a common genetic lineage and the best-known in-water distributions for those subpopulations. Putative RMUs (dark gray) were created as placeholders in cases where in-water distributions are poorly known.