

# The Internet of Turtles

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“One of the greatest challenges we face in conserving leatherbacks is seeing the big picture and taking local actions that can have global significance,”

wrote Brian Hutchinson and María Fernanda Pérez in 2006 in the first *SWOT Report*, vol. I, p. 17. This truth still applies, not only to leatherbacks, but also to all marine turtle populations. Yet that challenge has been partly overcome by the SWOT Program and its hundreds of contributors over the past 12 years. Those efforts—a global-scale database and nesting maps for all marine turtle species—are revolutionizing the way we see, analyze, and use marine turtle data and are aiding conservation decisionmaking worldwide.

Still, many challenges remain that impede our ability to understand turtle population dynamics and to monitor long-term trends. One significant challenge is the lack of a global database of information about marine turtle foraging grounds. Collecting data, however, is hindered by difficulties in identifying and reidentifying individual turtles over time. To date, researchers have typically relied on using metal flipper tags or other physical markers to identify individual turtles while they nest or when they are caught and released at sea.

Flipper tagging of marine turtles started in the 1950s and, for many years, was the only cost-effective, widely available technology. However, flipper tagging has a few important limitations. One problem is that tags seldom stay attached throughout the turtle's life. The process of affixing metal tags, although usually harmless, can require researchers to capture and thereby stress a turtle, and can also cause localized necrosis or infection. Moreover, permitting requirements to physically tag turtles are often cumbersome, thus limiting the number of tags that are deployed and preventing participation by untrained volunteers and citizen scientists. With such concerns, it is clear that a better method for identifying individual turtles would have substantial benefits for research and conservation.

Fortunately, advances in technology are opening up possibilities for improved turtle identification. For instance, molecular markers, which are obtained from turtle blood, tissue, or eggs, have been used to successfully identify turtles in various locations and contexts. They are highly effective, but samples are costly to analyze and generally require special permits to obtain. Photographic identification, however, has become very cost effective and generally requires no special permits. Although photo ID has been unreliable in the past, it is becoming an increasingly effective tool for identifying individual turtles and is gaining traction among sea turtle researchers. A global system for managing photographic identification data is urgently needed to help this technique realize its full potential.

One new conservation tool with the potential to greatly improve and facilitate data gathering for marine turtles uses photo identification data.

The Image Based Ecological Information System (IBEIS) is a platform that combines data analytics with individual animal tracking for many species. It starts with a database of photographs contributed by both researchers and citizens. The user can enter a photograph and the system can identify an individual animal in minutes. If properly managed, the platform can put information about demographics, species distributions, individual interactions, and movement patterns at researchers' fingertips

for the first time. World Wildlife Fund (WWF) is currently working with IBEIS to build and test a version of its system for marine turtle photo identification, and the results to date are extremely promising.

Another example is TOORSOI (*Tortues marines du Sud Ouest de l'Océan Indien*), a database created by IFREMER (*Institut Français pour l'Exploitation de la Mer*) and Kélonia for use by turtle conservation projects in the Southwest Indian Ocean. The database helps store and organize information on tags, nesting data, and individual photos for identification, as well as biological information and threat data. TOORSOI also helps standardize data management and promote collaboration among areas connected by turtles' movements and activities.

WWF is joining efforts with SWOT, IBEIS, TOORSOI, and others to develop a unique, open source set of global marine turtle monitoring and analytical tools. The “Internet of Turtles” will provide the marine turtle conservation community at large with the following:

- A computer-assisted photo identification system that recognizes individual animals in minutes
- Standardized data management and advanced population analytics to bridge the gaps from science to conservation to management

- An interface and mobile application that incentivizes input from wildlife conservation professionals and citizen scientists and that facilitates field data collection

Projects that contribute to the Internet of Turtles will be able to (a) digitally collect and share data among entities and across countries and languages; (b) extract and analyze relevant turtle data at different scales, such as population and subpopulation, from all life stages, and from turtles dead or alive; (c) contribute to the regional management unit delineation and assessment process of the International Union for Conservation of Nature's Marine Turtle Specialist Group; and (d) provide up-to-the-moment clarity on the status of turtles wherever they are (in water or on land).

By joining hands in a community-driven, collaborative effort to understand how to recover turtle populations locally, nationally, and globally, we hope to have a greater effect than ever. Once built, the web-based photo ID system and global toolkit for turtles will help revolutionize the collection, analysis, and sharing of information for turtle conservation and management. Join the revolution. ■



A diver photographs a loggerhead turtle near Los Gigantes in Tenerife, Canary Islands.  
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