

# HOW IN-WATER **TURTLE OBSERVATIONS** GENERATE VALUABLE NEW INSIGHTS

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There are few places in the world where people can swim with turtles in calm, clear coastal waters. In many places, the sea is too turbid or dangerous, with waves, strong currents, or dangerous animals such as sharks and crocodiles. However, coming face to face with a living fossil underwater is a unique experience, and prolonged in-water sea turtle observation can teach us new and unexpected things about turtles that will help us to conserve them and their ocean habitats.

Laganas Bay, on the Greek island of Zakynthos, is one of the most northerly reproductive sites on Earth for sea turtles and is home to one of the most important nesting sites for loggerheads in the Mediterranean (see *SWOT Report*, vol. X, p. 25). Migratory male and female loggerheads enter Laganas Bay starting in March of each year. Mating peaks in April, males depart by the end of May, and females leave primarily between July and August after laying several clutches of eggs on nearby beaches. What makes this site ideal for in-water behavioral observations is that females aggregate close to shore to occupy warmer waters while they develop their eggs before nesting. Furthermore, several year-round resident turtles occupy the bay, so one can see turtles at almost any time of year.

Since 2000, we have been gathering in-water photographic and video observations of many individual sea turtles at this site through snorkeling surveys. Because we see the same male and female turtles year after year, we have learned that every single turtle is unique, not just in the shape and arrangement of its facial scutes, but also in its individual behavior and response to humans.

Through photographic identification of facial scutes, we have distinguished more than 500 individuals over the past 15 years of surveys. We have observed that most migratory males return every

year, and most females return every two years, with a few females returning annually or in three-year cycles. The knowledge gained from our in-water surveys augments and contrasts with beach-based tagging programs because we obtain information not only about females, but also about male, subadult, and juvenile loggerheads. We even saw one juvenile green turtle, a member of a species that generally is not thought to occur in Laganas Bay. (It may have been visiting from the nearby Greek mainland, the Peloponnese, where greens are known to forage.)

For some individuals, our records date back the full 15 years, such as a resident male we named Sotiris, who takes advantage of fishermen's scraps at the local port. The locals claim he has been around even longer, although at least 10 resident males live in this part of the bay with whom he could be confused. We have observed several females who have been around for at least 15 years, one example being a female with a highly recognizable underbite. The long-term records demonstrate the importance of photo ID as a noninvasive mark-recapture method, which has many advantages over traditional flipper tags. The high loss rates of tags often prevent researchers from compiling complete life histories. Our records also provide insights about the frequency of injury to turtles, changes in barnacle loads across years,

and an array of other in-water behavioral traits that could never be seen from traditional nesting-beach tagging alone.

Through our work, we have documented a number of solitary and interactive behaviors of both male and female turtles, including male-male fights over females, male search efforts for mates, courtship, mating and mate-avoidance behaviors, and attacks by satellite males on mating males. Females are generally solitary during the breeding season, when they rest in the warm nearshore waters before and during the early nesting period. Warm water sites are rare at the start of the season until late June, when sea temperature exceeds 25 °C, which is optimal for egg development before laying. During this time, females compete for access to such sites, and fighting is a common occurrence between females that enter each other's visual range.

However, we have seen up to three females using the same fish-cleaning station at once. Such tolerance may indicate the importance of the cleaning behavior in preventing a buildup of epibionts such as barnacles and algae, which can hinder the animals' movements, cause disease, or have other negative effects. One particular female remained at the same cleaning station for more than six days but was not cleaned by cleaner fish, maybe because she was not in the correct pose or possibly because the fish had consumed all edible items from her body surface. We have not yet documented a male at a fish-cleaning station, although both males and females bear evidence of self-cleaning activity: scratches on their carapaces from rubbing against rocks and anchors.

The year-round residents, primarily males, tend to react more strongly to the presence of other turtles. For example, at one location where we have observed residents foraging, fights often ensue, with

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resident males aggressively biting the body, neck, and tail of other turtles entering the foraging area until the visitors retreat.

Furthermore, we have gained insights into how turtles respond to human presence. Overall, it is much harder for snorkelers to approach turtles in the morning, when sea temperatures are cooler (below 25 °C) or when underwater visibility is poor. Some individual turtles, however, will always swim away when approached, regardless of conditions, whereas others will remain, appearing to be undisturbed. During April and May, reproductively active males who are searching for females will either swim away quickly or make aggressive advances, appearing to view snorkelers as potential competitors. Furthermore, turtles are more likely to swim away if approached from different sides by more than one person. The turtles' preference to keep the person in view makes photographing both sides of a turtle's head frustrating.

Understanding the ecology and behavior of turtles in Laganas Bay has helped local stakeholders to develop and monitor strategies and practices that will minimize the impact of tourism activities. Most visitors view the bay's sea turtles from turtle-spotting boats that operate during the nesting season. About 20 such boats operate in Laganas Bay, and most follow the code of conduct prescribed by the National Marine Park of Zakynthos, which includes the bay.

Volunteers from the Greek nongovernmental organization Archelon are on board to provide educational information. During the nesting season, enough turtles can be seen in the bay to satisfy tourist demand, but outside the nesting season (from mid-August until tourism stops in mid-October), the fewer resident (mostly male) turtles are intensively pursued by spotters. While we have found that the population-level effect of such tourism is minimal, we are currently investigating the potential effects on individuals, particularly late-season breeding females. Such females require sufficient energy reserves to return to distant foraging grounds (around 1,000 kilometers away, or about 620 miles) after completing nesting.

It is not always possible for researchers to directly observe turtles as we have been fortunate to do while snorkeling in Laganas Bay's clear waters. However, technology is providing new ways of observing individuals, such as by attaching animal-borne cameras or by setting camera or video traps at fixed locations. In whatever way the data are gathered, in-water surveys provide a unique glimpse into how both male and female turtles from all age classes behave in relation to each other, to their habitats, and to their human and nonhuman (camera) observers. To protect sea turtles and their habitats wisely, we must improve our understanding of these magnificent animals. Ultimately, we still have much to learn, and one of the best ways to start to discover their mysteries is simply to dive in. ■



AT LEFT: In-water observation allows researchers to observe sea turtles' social interactions. © SEA TURTLE PHOTOGRAPHY / KOSTAS PAPAITSOROS; Researcher Kostas Papafitsoros photographs a feeding loggerhead in Laganas Bay, Zakynthos, Greece. © GAIL SCHOFIELD PREVIOUS SPREAD: A loggerhead turtle forages for mollusks during behavioral observations in Laganas Bay, Zakynthos, Greece. © SEA TURTLE PHOTOGRAPHY / KOSTAS PAPAITSOROS