

# Hawaiian Nesting Range Shift Offers Rare Learning Opportunity

By PETER H. DUTTON, GEORGE H. BALAZS, and AMY FREY







Green turtles are among the most iconic species in the Hawaiian Islands, and they have been the subject of scientific study for more than four decades. Extensive research on the Hawaiian green turtle population has shown that it is genetically isolated from other sea turtle populations. This demographic isolation, combined with its confinement to limited available habitats, offers a relatively controlled environment for studies of population dynamics and trends that would be more complex in other areas. These conditions have enabled us to observe and document recent changes in Hawaiian green turtle nesting distribution that may suggest the foundation of a new, distinct nesting population, thus offering a unique learning opportunity. While the drivers of this range expansion are undetermined, we hypothesize that the new population could offer an evolutionary “buffer” that would protect against prospective loss of low-lying nesting habitat at the current primary nesting grounds.

More than 90 percent of all green turtle nesting in Hawaii occurs at French Frigate Shoals (FFS), a low-lying cluster of islands in the remote Northwestern Hawaiian Islands. The nesting population has been monitored since 1973 and has steadily increased in size over that time. Nesting has been almost nonexistent around the main Hawaiian Islands in the southern part of the archipelago, despite the many suitable beaches that are available. Recently, sporadic nesting scattered around these southern beaches has also been on the rise, but the origin of these nesting turtles has been unclear. Nests are almost always discovered after being laid at remote locations, so the mothers’ identities are unknown. Is it just one female that is responsible for all the nests at a given beach? Are they turtles that also nest at FFS? Are they related to captive-born turtles that were released on Oahu? Or do they represent a new “founder” population, made up of the offspring of a few pioneers colonizing this unclaimed nesting habitat? Using genetic analysis, we set out to solve this mystery in hopes that we might explain this rise in nesting in the main Hawaiian Islands.

More than 90 percent of all sea turtle nesting in Hawaii occurs at French Frigate Shoals, seen here. Recently, nesting has been increasing in the main Hawaiian Islands, where it was formerly nonexistent.  
© MARK SULLIVAN, NOAA AFFILIATE

Using samples from 55 clutches laid by unknown females on the main Hawaiian Islands between 2000 and 2010, and from 15 clutches by a known female, we analyzed genetic information (from mtDNA and nDNA microsatellite markers) to deduce the genetic fingerprints of the mothers and determine relatedness to each other and to turtles from FFS. We were able to determine that at least 15 different females are nesting on the main Hawaiian Islands and that, based on their mtDNA haplotype frequencies, they are a breeding population that is demographically distinct from the FFS population. Finally, our analysis revealed that the main Hawaiian Islands females are closely related to one another, and suggests that these turtles are recent founders of a new population and not adults that also nested at FFS and switched beaches. But where did they come from? (For details of our analysis see our April 2013 article in the *Journal of Experimental Marine Biology and Ecology*).

One possible origin of the main Hawaiian Islands founders is Sea Life Park on Oahu, where several hundred captive-reared juvenile green turtles and about 14,000 newly emerged hatchlings from the park’s artificial nesting beach have been released into local waters since 1976. Although some of the available evidence makes this a likely explanation, inadequate records and absence of historical samples make interpretation difficult. It is also possible that the colonization is a natural consequence of (1) the steady nesting population growth at FFS and (2) a corresponding increase in the foraging population around the main Hawaiian Islands.

Regardless of its source, the new nesting colony in the main Hawaiian Islands may provide a buffer against the effects of climate change on Hawaiian green turtles. With most of the islands in FFS rising no more than 2 meters (6.6 feet) above sea level, they are especially vulnerable to sea level rise. This increase may lead to a reduction of available nesting habitat in FFS, making the turtles’ colonization of new nesting areas advantageous for the population’s future viability. Whatever the future may bring, this emerging case study allows us to gain new insight into how new nesting habitats are colonized, a topic of great relevance in many sea turtle nesting areas where populations are growing, nesting habitat is shrinking, or both. ■