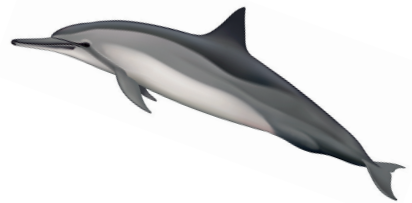


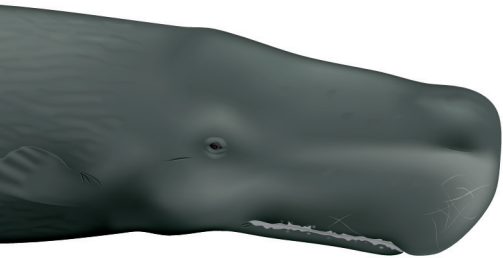
THE LIVES OF
HAWAI'I'S
DOLPHINS AND
WHALES



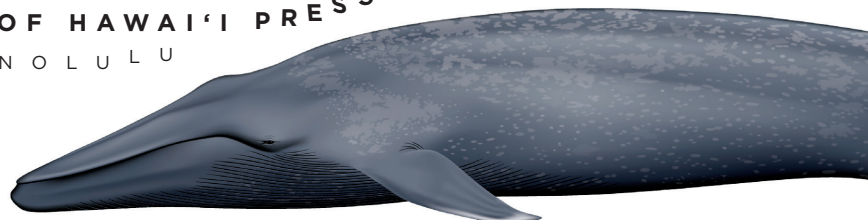
NATURAL HISTORY AND CONSERVATION



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H O N O L U L U



KILLER WHALES (*Orcinus orca*)

Killer whales are the largest member of the dolphin family, and they are perhaps the most distinctive and easily recognized cetacean in the world. Most boaters and members of the public today would recognize this species, yet despite this, other than reports by whalers in the 1800s, the first confirmed record from Hawai'i was a stranding at Ka Lae, Hawai'i Island, in 1950. In recent years there have been usually only one or two sightings in Hawaiian waters each year, reflecting both their use of offshore waters around the islands and their relative rarity in the area.

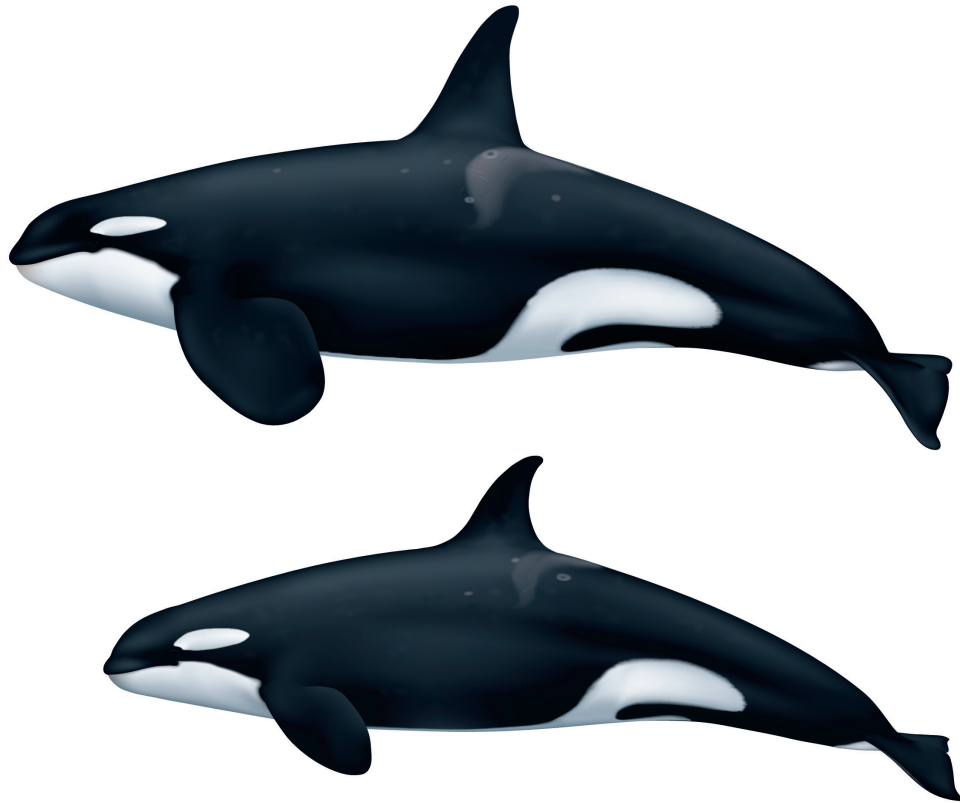
Killer whales are one of the best-studied species of whales or dolphins in the world, with documentation of behavior, ecology, and genetics, among other things. Although guidebooks will note that there is a single species of killer whale worldwide, all the evidence suggests there are at least two and probably more species that have just not yet been formally described. The two that have been reproductively isolated for the longest period, hundreds of thousands of years, are the well-known forms along the western coast of North America—the fish-eating so-called residents and the mammal-eating so-called transients—and these two behave as distinct species. Two of the “southern resident” killer whales, captured near Seattle in Washington State in 1968, were actually brought to Hawai'i by the U.S. Navy. Both of the whales were being trained for use in a deepwater object recovery program in 1971 when one of them, a male named Ishmael, decided to go AWOL off O'ahu. Whether Ishmael survived and had the opportunity to contribute to the genetic makeup of killer whales in Hawaiian waters is unknown, but if he was able to mate, his impact was probably small, as killer whales in Hawaiian waters do not appear to be either of these types. Instead they differ morphologically as well as behaviorally, suggesting they are part of a distinct population found throughout the central tropical Pacific.

Identifying Features and Similar Species

Killer whales have a striking black and white pattern that is difficult to confuse with any other species, including a bright white oval patch above and behind the eye, a gray “saddle” patch behind and below the dorsal fin, a white throat,



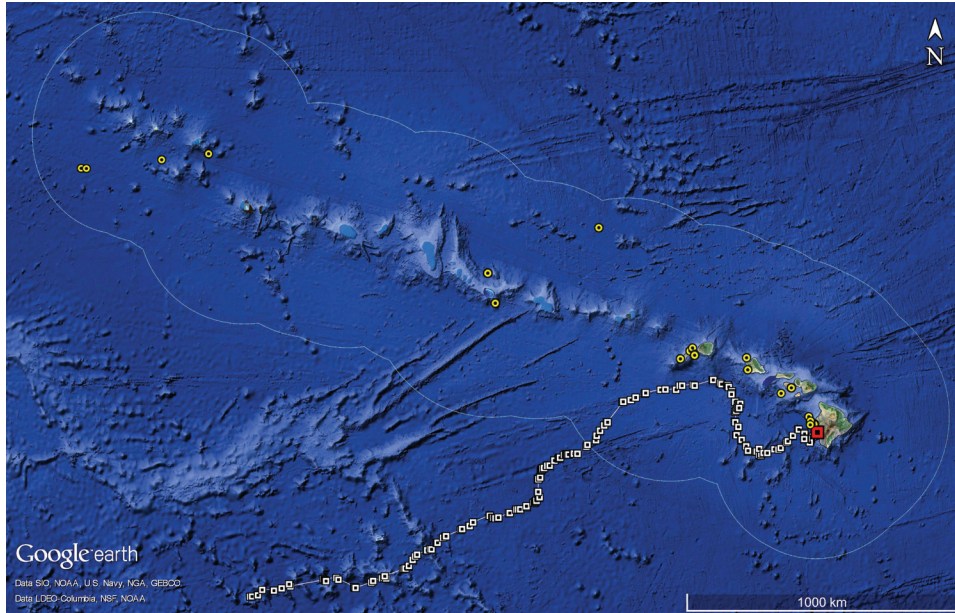
A killer whale off Kona carrying a bigeye thresher shark, November 2, 2013. Photo by Deron S. Verbeck/iamaquatic.com.



Killer whales are strongly sexually dimorphic, both in body size (males are larger than females) and in the relative size of the dorsal fin, tail flukes, and pectoral flippers. Male (top); female (bottom). Illustrations by Uko Gorter.

partially white belly and flanks, and white on the underside of the tail. The saddle patch on killer whales in Hawaiian waters is less distinct than on individuals from the so-called resident or so-called transient populations, and it is only really obvious in good lighting conditions. Killer whales are sexually dimorphic in both body size and appendage size, with adult males larger than adult females, and the dorsal fin, pectoral flippers, and tail flukes of adult male killer whales are all substantially larger in proportion to the body size than for adult females. The dorsal fin in particular can be twice as tall in an adult male as in an adult female. The tail

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Killer whale sighting records (yellow circles) along with the track and locations (white squares) of an individual killer whale satellite tagged off Hawai'i Island on November 1, 2013. The tagging location is indicated with a red symbol. Three individuals were tagged in the group and remained together. Over the twenty-five-day tracking period, they moved almost 2,000 km to the southwest, more than halfway toward the Marshall Islands in the western Pacific.

flukes of older adult males also tend to curve downward at the tips. The sexual dimorphism, at least in terms of the dorsal fin size, appears to be less extreme for killer whales in Hawaiian waters; the dorsal fin of adult males does not appear to be as obviously tall and straight as it does for killer whales elsewhere. That said, when an adult male is present the taller dorsal fin is diagnostic—there is no other species in Hawaiian waters that has such a large dorsal fin in relation to body size.

While killer whales are the largest member of the dolphin family, with individuals in some populations reaching lengths of 8 m (~26') or more, individuals in Hawaiian waters appear to be relatively small. One animal documented in an

aerial survey off Ni‘ihau in March 2000 was estimated using photogrammetry at 6.5 m (21‘4”) long, but an adult male that stranded and died on Kaua‘i in 2008 was measured at about 5.5 m (18’) long. One adult male that we closely approached in our work was estimated at only about 5 m (about 16‘5”) long, appearing smaller than some of the larger adult male pilot whales we’ve encountered.

Habitat Use, Movements, and Abundance

Killer whales have been documented off the Northwestern Hawaiian Islands, in offshore waters, and around the main Hawaiian Islands, although most sightings around the main islands have been relatively far from shore. In our work, with over two thousand sightings of odontocetes around the islands through the end of 2015, we had encountered killer whales on only three occasions, once in the channel between Kaua‘i and Ni‘ihau (in July 2011) and twice off Hawai‘i Island (in May 2003 and November 2013). Combining all the photos we’ve been able to obtain from other researchers and members of the public, we have only thirty-two individuals in our Hawai‘i photo-identification catalog, and with the exception of one group seen two days in a row, none have ever been resighted. Our photographs have been compared with an eastern tropical Pacific killer whale catalog held at the Southwest Fisheries Science Center, but there are no matches with that catalog. In our November 2013 encounter, we were able to deploy satellite tags on three individuals and track the movements of the group over a twenty-five-day period. This was the first time killer whales in the tropics had been satellite tagged. By the end of the tracking period they had moved almost 2,000 km from where they were tagged, following a meandering path and not approaching the islands again, bypassing Johnston Atoll to the southwest, and spending most of their time in water depths ranging from about 4,500 to almost 6,000 m deep. By the time the tags stopped transmitting, the whales were halfway to the Marshall Islands, in the western Pacific. During the time of overlap between the three tagged whales, all stayed close to each other.

Combining the information from photo identification, sightings, and our one satellite tagged group, we can say a few things about killer whales in Hawaiian waters. Unlike the majority of the other delphinids in Hawaiian waters, killer whales do not appear to have a resident population around the main Hawaiian



A subadult killer whale off Kona, November 1, 2013. Although the ribs are showing, this individual is actually quite robust. The groove down the middle of the back behind the blowhole reflects the large muscle masses built up on either side of the midline. Like many killer whales in the tropics, this individual has a number of hitchhiking remoras attached. A LIMPET satellite tag is visible on the dorsal fin. Photo by author.



Islands; those that are seen around the islands are likely part of a widely ranging open-ocean population. Given the morphological differences (small body size, very indistinct saddle patch, reduced sexual dimorphism), this population is probably restricted to the central tropical Pacific, not extending to coastal areas to the north or east, where multiple studies of killer whales have documented animals that are quite different in appearance.

Killer whales are top predators, and top predators (think lions, tigers, and bears) are naturally rare. There are two abundance estimates available for killer whales in Hawaiian waters: about 350 individuals from the 2002 NMFS survey and about 150 individuals from the 2010 NMFS survey. The estimate from the 2010 survey is the lowest for any species of odontocete in Hawaiian waters.

Predators and Prey

Killer whales certainly might be at some risk of attack from large sharks such as white or tiger sharks, but the reverse is probably more likely the case. While killer whale populations in many coastal areas are known to specialize on certain prey types, such as fish (particularly Chinook and chum salmon) along the west coast of the United States and Canada, in Hawaiian waters they have been seen attacking a diversity of prey. Surprisingly, there has been only one documented attack on a humpback whale calf, and there does not seem to be a particular peak in sightings of killer whales during the humpback whale calving and breeding period, suggesting that they don't seek out the islands when large numbers of humpback calves are available. In our July 2011 sighting between Kaua'i and Ni'ihau, the whales were first seen chasing a rough-toothed dolphin, and in our May 2003 sighting the first indication of killer whales being present was a large group of melon-headed whales scattering when killer whales appeared in the middle of them. Combined with sightings of an attack on pantropical spotted dolphins, it is clear that killer whales in Hawai'i do at least occasionally attack other species of toothed whales. But killer whales in Hawai'i do not seem to focus just on marine mammals. One killer whale that stranded on Lāna'i in 2004 had a number of squid in the stomach, one group was seen feeding on an "octopus," and there have been several observations of them feeding on large sharks, including both a hammerhead and a thresher shark. So all the evidence suggests that killer



A killer whale carrying a bigeye thresher shark off Kona, November 2, 2013. Photo by Russel D. Andrews.

whales found around the Hawaiian Islands are generalists, not specialists, unlike the better-studied populations along the west coast of North America. This is not surprising, really, given the overall low productivity of the waters around the Hawaiian Islands. Specializing on a certain prey type makes sense only where there are enough of one type of prey to make it worthwhile; in areas with low productivity such as Hawai'i, being a generalist is a much better strategy. As generalists, they would probably attack a Hawaiian monk seal if they came across one, but such attacks are likely extremely rare given that killer whales in Hawai'i tend to be found offshore in deeper waters, while monk seals are usually closer to shore unless they are transiting between islands. This is obviously a good thing for Hawaiian monk seals, as they are critically endangered.

Life History and Behavior

Like the other blackfish, killer whales take a long time to mature—females are probably not sexually mature until ten to twelve years of age—and are slow to reproduce. Calving intervals for the so-called resident populations along the west coast of the United States and Canada tend to be about one calf every five years, although it is not known what the calving interval might be for killer whales in the less-productive central tropical Pacific. They are one of several species of whales whose females go through menopause and stop reproducing, usually by their late thirties or early forties, but continue to live for a long time afterward. Some females may live into their eighties or even nineties. Males, on the other hand, live much shorter lives—their maximum longevity is closer to fifty years.

Killer whales are well known for their strong and enduring social bonds, with individuals in some populations remaining together for life. Group sizes in Hawai'i are relatively small; lone individuals are occasionally seen, and the largest reported group was of ten individuals, with average group sizes of about five individuals. Most of the smaller groups, two to four individuals, likely represent a mother and her offspring. Like the so-called transient killer whales off the west coast of the United States and Canada, males may stay with their mothers for life, while females probably disperse and form their own groups when they are sexually mature. Most sightings of larger killer whale groups in Hawai'i probably represent temporary associations of individuals that come together for foraging.

On November 1, 2013, we encountered a group of four killer whales off Kona and satellite tagged three. Using information from the tag data, Russ Andrews relocated the group the next day, and there were seven individuals present; that day they were feeding on a large bigeye thresher shark. Cooperative hunting—the practice of hunting with familiar hunting partners when trying to attack dangerous or difficult-to-capture prey—is likely one of the main reasons killer whales form such stable groups.

With only three encounters of killer whales in Hawaiian waters, it is difficult to generalize how this species behaves toward boats. During our first encounter,



A killer whale off Kona, November 1, 2013. This individual can be identified as an adult male by the large size of the appendages and the downward curvature of the tail flukes. The saddle patch is indistinct, typical of killer whales in the central tropical Pacific. Photo by Deron S. Verbeck/iamaquatic.com.

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off Hawai'i Island in 2003, the group appeared to avoid our vessel, although just before we approached, another boat had rapidly approached the group at close quarters, and perhaps we were considered guilty by association. During our second encounter, off Kaua'i in 2011, the group approached our boat as if curious but then went on a long dive and was not seen again. Our most recent encounter, off Hawai'i Island in November 2013, was the opposite of the first, with three of the four individuals showing considerable interest in our boat and no avoidance. Several photographers on another boat got in the water with the whales on that occasion, and the whales were largely indifferent to the people in the water.

Conservation

Top predators are typically more at risk from impacts of human activities than other species for a couple of reasons. Top predators are naturally rare, and with smaller numbers of individuals they are more subject to the impacts of inbreeding. If populations decline due to some human activity or environmental factor, there is less potential for recovery. In the case of killer whales and other top predators such as false killer whales, as they feed at the top of the food web they accumulate higher levels of persistent organic pollutants such as pesticides (for example, DDT) and industrial chemicals such as PCBs and flame retardants. High levels of contaminants, particularly PCBs, are known to cause suppression of the immune system and other health issues. The male killer whale that stranded on Kaua'i in 2008 had the highest levels of pesticides and PCBs of any of the forty-two individuals of sixteen different species from Hawai'i analyzed in a recent study. This individual had a variety of adrenal and kidney lesions, and the authors of that study noted that the high levels of contaminants may have contributed to the animal's poor health.