

Killer Whales In Alaskan Waters

by **Craig Matkin and
John Durban**

Craig spent his undergraduate days roaming California with the renowned cetologist Ken Norris, so it was natural that killer whales grabbed his attention thirty-five years ago when they first surrounded his kayak in Prince William Sound. Working in the remote western Sound as a fisheries biologist, he was surprised and fascinated by his many encounters with killer whales, leading him to switch his focus to a long-term study of their population biology in Alaska. John began to work in Alaska ten years ago, leading NMFS field studies investigating the predatory impact of killer whales on endangered marine mammals, specifically Steller sea lions. Although an accurate picture of killer whale diet and predatory impacts is still emerging, these long-term and recently intense studies have gathered a wealth of information on Alaska's killer whales, which is informative in both a local and worldwide context. All three eastern North Pacific killer whale ecotypes are found here in Alaska, the fish-eating "residents," marine mammal-eating "transients," and shark/fish-eating "offshores." Some Alaskan waters, such as Prince William Sound/Kenai Fjords and particularly the waters of the Aleutian Islands and Bering Sea shelf edge, have some of the highest densities of killer whales in any of the world's oceans.



*Fish-eating "resident" killer whales frequently interact with fishing vessels in Alaskan waters, often helping themselves to discarded fish or even the catch.
Photo by Dave Ellifrit, North Gulf Oceanic Society*

It is the resident ecotype that is found in the greatest numbers in Alaska, reflecting the relatively healthy stocks of salmon and other fish. We have over 700 individual resident killer whales photographed and catalogued in the waters stretching from southern southeast Alaska to Kodiak Island and over 1,500 from the Aleutian Islands and Bering Sea shelf edge (and we are still discovering more with every field effort!). As in Washington and British Columbia, residents appear to travel in pods that are made up of stable matriline (a female and her offspring – both male and female), making it possible to accurately track the numbers of whales in areas where there are regular photo-identification programs. Overall, the numbers of resident killer whales in southeastern Alaska and the northern Gulf of Alaska has been increasing at rate of over 3% per year over the past 25 years, except for the whales involved in the Exxon Valdez oil spill in 1989. In great part this is likely the result of the rebound of salmon stocks throughout the region.

In the Gulf of Alaska, which includes our primary study sites in Prince William Sound and Kenai Fjords, resident killer whales are dependent on salmon for sustenance during spring, summer and fall; but not just any salmon. They seek out primarily the fatty Chinook and Coho salmon, some chum salmon, and little or no sockeye or pink salmon. In western Alaska, where the resident killer whales are likely a separate population, salmon are much less abundant, and they may feed on other fish species, such as Atka mackerel; however, we have little feeding data from this region. It is also around the

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Aleutians and Bering Sea that longline fishermen have the greatest problem with abundant resident killer whales that remove black cod, halibut, and turbot from hooks on their lines. This depredation has been occurring for decades, and the high abundance of resident killer whales in this region may be at least partly due to year-round “provisioning” with fish from longlines. Depredations are not limited to this region, the smaller Prince William Sound blackcod longline fishery also has had repeated trouble with killer whales. Some groups of resident whales in western Alaska (that we have dubbed “trawler trash”) also line up to eat the rich bycatch and unwanted fish that are dumped off the decks of the trawlers.

The fish-eating resident pods most frequently seen in southeastern Alaska (AG, AF5 and AF22 pods) also make regular, but unpredictable trips across the Gulf of Alaska to Prince William Sound and Kenai Fjords. These forays occur in both summer and winter and may extend as far west as Kachemak Bay and the Alaska Peninsula, over 1000 km (621 miles) from their home grounds. So much for the notion that resident whales are tied to one locality! Oddly, none of the resident pods regularly encountered in Prince William Sound have ever been seen in southeastern Alaska. The travel of southeastern Alaska pods is likely related to the potential to socialize and breed with more distantly related pods. And Prince William Sound/Kenai Fjords seems to be a central meeting place for pods that range from southeastern Alaska to near the Shumagin Islands off the Alaska Peninsula. When the AX pods that primarily range around Kodiak Island and the AW pod from the Shumagin Islands area all meet in Prince William Sound there may be 10 or more pods and 150 or more whales all feeding and socializing together. Although these “superpod” encounters seem more common in late summer, they may occur at other times from June

through October. Keeping track of the individuals in these mixed groups, by scrutinizing the fins and saddle patches is enough to make your head spin. Listening with hydrophones isn’t any less confusing, but it gives a strong indication of the level of social activity and communication that is occurring. Since each pod has its own vocal dialect the variety of calls is astounding, especially when mixed with the excited social calls and whistles that occur during these aggregations. It is likely that these vocal dialects and calls allow the whales to sort each other out as well and find distantly related whales to mate with. The more distantly related the whales are, the more different are their vocal dialects.

In Prince William Sound we were able to track the fate of the major resident pods before, during, and after the Exxon Valdez oil spill. We watched as AB pod, which lost 13 out of 36 individuals following the spill, traveled through passages full of oil and oil sheens days after the spill, sometimes surfacing in it. The deaths changed the social structure of the pod; many females that led matriline were lost, reducing their ability to recover. This apparently caused the pod to split, and 20 years later they are not fully recovered from the spill and still travel as two separate pods.

Another small population of transient whales, the AT1 group, lost 9 of 22 members following the spill, and has produced no new offspring in the two decades since. It will likely die out as only seven AT1 whales remain. This small, genetically and acoustically unique group may have been in decline prior to the spill, but the oil spill sealed its fate. The AT1s specialize in surprising seals along the rocky shorelines of Prince William Sound and in cornering the fast-swimming Dall’s porpoises in deep-water areas. Hunting the hundreds of seals that regularly haul out on ice floes in front of glaciers is another place you will find them. The AT1s seem as much a part of the waters of Prince William Sound and Kenai Fjords as the glaciers and rocky shorelines, and it is difficult to imagine the day when there will no longer be the possibility of being surprised by their sudden appearance.

The AT1 transients are one of those unique biological finds, that both puzzle and amaze biologists. Another unique twist to the Prince William Sound transient story, however, is the occasional presence of another, more widespread population of transient killer whales, called the Gulf of Alaska (GOA) transients. These transients are widely dispersed and infrequently seen,



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and we have identified less than 100 individuals although photographic recapture analysis suggests a stable population. It is a unique situation to find two transient populations that do not associate or interbreed, swimming regularly in the same waters. GOA transient individuals have been seen from southeast Alaska to the Shumagin Islands. On rare occasions, GOA transients are photographed in the inside waters of southeast Alaska and northern British Columbia. Once they were seen mingling with another discrete transient population, the West Coast (WC) transients.

The WC transients have been steadily increasing during photo-identification studies over the past 40 years and appear to number about 260 individuals across their range from northern Southeast Alaska south to Washington State. We estimate the density of WC transients in British Columbia to be nearly 18 times that of GOA transients in Kenai Fjords/ Prince William Sound. This probably has much to do with trends in harbor seal and Steller sea lion populations over the past forty years; increasing in British Columbia and southeast Alaska compared to a big decrease in the northern Gulf of Alaska.

Certainly the most challenging mammal prey for transient killer whales are the baleen whales. The smaller minke whales and migratory gray whales seem the favored species in Alaska, although we recently recorded predation on humpback whales and suspect there is a group of killer whales around Kodiak Island that specialize in preying on the steadily increasing population of humpback whales.

Our most dramatic and consistent observation of predation on whales has been at the western end of the Alaskan

Peninsula, near Unimak Pass, where migrating gray whales cross a shallow-water shelf as they make the turn northwards into the Bering Sea. This is a gathering ground for 100 or more transient killer whales each spring that come to intercept the grays. Essentially all of the shore-hugging gray whales that complete the migration to the Bering Sea must run this gauntlet. Since the waters are shallow, when a gray whale is killed and sinks (as they generally do), it remains within easy depth for the killer whales to return and feed on following days. The lips and tongue are the most tender and prized parts of the whale and these parts alone are more than enough food to fill the three to seven whales that generally make the kill. So the bulk of the whale remains uneaten after the initial gorging, but is generally revisited by the whales that killed it, or is fed upon by other killer whales roaming the area, and by Pacific sleeper sharks that take bowling ball-sized bites out of the carcass.

A sunken carcass may seep oil for days, and it can provide a nicely marked location for us to “stake out” and intercept the returning killer whales. However, if a whale is killed close to the shore and does not sink immediately, it may be washed up on the beach where it becomes not only food for brown bears, foxes and other wildlife, but provides clear “evidence” that the killer whales preferentially eat the lips and tongue. In reality, if the carcass were to remain accessible the killer whales would likely return to feed again on other parts of the whale, or another group of killer whales would move in and feed. Little of the beached carcasses are wasted, as the brown bears take full advantage of the windfall and clean the carcass down to the bones with help of the abundant foxes. These massive bears patrol the beaches looking for bits of blubber at this time of year: we have watched them run to the



A sub-adult male transient killer whale attacks a juvenile gray whale as it migrates around the western end of the Alaska Peninsula. This annual aggregation of killer whales represents a significant threat of mortality to young gray whales. Photo by John Durban, North Gulf Oceanic Society

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beach in anticipation when the killer whales make an attack along the shore.

Our initial assumption was that killer whales were so agile and strong that they could simply rip into the flesh of a living gray whale with their powerful jaws, making short work of dispatching the whale. This has proven not to be true. A gray whale is typically drowned by holding it beneath the surface before substantial chunks of flesh are removed. This is no small feat, but the gray whale skin and blubber is extremely tough and difficult to rip into, and much easier to accomplish if the whale is dead. If the target is a calf, as they mostly are, it must first be separated from its mother. This can also be a very difficult process as the killer whales are very cautious near an agitated, fluke-slashing gray whale cow, and it is the prowess of gray whale mothers that keep most calves safe. The gray whales will also seek shallow water when pursued by killer whales; if the water is shallow enough the killer whales cannot drown them. Also, the killer whales will not risk injury from being crushed on the bottom by thrashing gray whales. We have watched killer whales pushing gray whales backwards by latching on to the front of the pectoral flippers to keep them out of the shallows. To avoid this, gray whales will spiral on their long axis, to make their pectoral flippers less accessible. We have also seen gray whales strand themselves temporarily to avoid drowning by killer whales.

The killer whales take mostly calf gray whales, but also small juveniles. If about 60% of the carcass is actually consumed by killer whales, then 100 calves and 20 juvenile grays would be needed to satisfy the estimated feeding requirements of the killer whales that we see there during the five weeks of most intensive activity. In some years this might have a significant impact on the calf production since calves comprise 1-8% of the population of about 20,000 gray whales. On a given year, in this region alone, killer whales may remove anywhere from 5-50% of the calf production.

Our tagging with satellite LIMPET tags

suggests that some of these killer whales remain in the area after the bulk of the gray whales have passed, but most scatter across the Bering Sea. Some appear to follow the gray whales northward along the coast into the northern Bering and Chukchi Seas. One killer whale group traveled 1400 km (870 miles) north in eight days, right up to the ice edge north of the Bering Strait. None of the transient killer whales from the Unimak Pass area have been recorded east and south into the Gulf of Alaska, or further west along the Aleutian Islands. All this suggests that the western end of the Alaska Peninsula is a gathering ground for killer whales that at other times range over a wide areas of the Bering Sea, or perhaps pelagic waters of the North Pacific Ocean.



Questions and debate still surround the extent and impact of transient killer whale predation on endangered Steller sea lions. Photo by Dave Ellifrit, NOAA Alaska Fisheries Science Center, NMFS Permit No. 782-1719

Another area where transient killer whales time their arrival with the migration of prey is the Pribilof Islands where thousands of Northern fur seals arrive in spring to pup and mate. The arrival of the fur seals in late May and June, coincides with the appearance of small groups of transient killer whales that focus on consuming fur seals. Much of the predation occurs within a few miles of rookeries, particularly in the evenings when the fur seals leave to feed offshore, and early mornings when they return to the rookeries. The primary target in this early season seems to be the juvenile and young adult males – these are among the largest of the seals with the highest fat content, preparing them to wait for several weeks in an attempt to access prime real-estate on breeding rookeries... and hopefully attract a harem. However, they are typically out-competed by the larger adult males and settle for sub-optimal breeding opportunities in the water around the rookeries. This exposes them to predators.

The transient killer whales operate in small groups and often seem to ignore the more abundant female fur seals, until suddenly a chase occurs, followed by breaching. Quickly a fur seal is dispatched, although sometimes juvenile whales seem to “play” with it before it is consumed, repeatedly whacking the hapless fur seal with their flukes. This may also serve to immobilize the fur seal, whose sharp teeth represent a potential danger to killer whales. The

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whales typically wander off to rest and socialize away from the islands during the middle of the day only to circle and return at dusk to hunt again. Although only around 50 individual transients have been identified around these islands, many of the same whales are seen repeatedly during the season and over the years. The whales seem to leave the islands by early July although the abundant fur seals remain apparently available, but return in fall, presumably to take the pups that are leaving the rookeries. A few of these Pribilof whales have been seen at other times in the Aleutian region, but genetic analysis of biopsy samples connects most of them with transients on the Russian coast of the Bering Sea. Just what they do when they leave the Pribilofs is not certain, but there is no doubt they travel substantial distances. One satellite-tagged whale headed southward more than 1800 km (1120 miles) into the subtropical transition region of the central North Pacific, nearly halfway to Hawaii.

In the last decade or so, Alan Springer, Jim Estes and colleagues have repeatedly suggested that transient killer whales have been eating their way down the food chain, causing a sequential megafaunal collapse of seals, sea lions and sea otters in Alaskan waters. Although there has been much disagreement and debate about the evidence for this hypothesis, it has inspired intense research into the current extent and impact of killer whale predation on endangered marine mammal species, specifically Steller sea lions and sea otters. Our photographic mark-recapture analyses estimated that approximately 350 transient killer whales currently use the coastal waters around haulouts and rookeries of the endangered western stock of Steller sea lions in the western Gulf of Alaska and Aleutian Islands. Energetic models suggest that this is more than enough killer whales to cause the observed declines of sea



An adult male transient killer whale photographed in the Central Aleutian Islands, with dark oval scars on the saddle patch, which are the healed bites from cookiecutter sharks. These small sharks only occur in warm, offshore waters, and these scars therefore imply movements to tropical or sub-tropical Pacific Ocean waters. Photo by Dave Ellifrit, NOAA Alaska Fisheries Science Center, NMFS Permit No. 782-1719

otters and sea lions, if they focused their predation on these species. However, this specialization does not appear to occur. Instead, our observations suggest some seasonal specialization (e.g., gray whales at migration time, or fur seals at breeding time). Furthermore, stable isotope analysis of skin biopsy samples has shown that the spring/summer diet of transient killer whales in the Aleutian Islands is not composed exclusively or even primarily of Steller sea lions or sea otters, a finding supported by field observation data indicating that gray whales, minke whales, and northern fur seals comprise a substantial portion of their diet. Additionally, transient killer whales sampled in the Bering Sea have stable isotope signatures consistent with a largely cetacean diet (e.g., Dall's porpoises, minke whales, and gray whales). We have not observed actual consumption of sea otters in this region, although there are a few accounts from other researchers.

Additionally, it doesn't appear that transient killer whales spend all (or perhaps not even the majority) of their time in near-shore waters where Steller sea lions or sea otters forage. Transients photographed around the Aleutian Islands and in Bering Sea typically have oval scars on their bodies, caused by bites from small cookiecutter sharks that live only in warm, deep and pelagic waters of the tropical and sub-tropical oceans. This indirect evidence of movement away from cold Alaskan waters has been supported by direct evidence from satellite telemetry. Three whales tracked with satellite tags (including two tagged in the central Aleutian Islands and one previously mentioned from the Pribilofs) moved rapidly away from Alaskan waters, south into sub-tropical waters of the central North Pacific. It is currently not clear how frequent these movements are, or the proportion of time whales spend in those pelagic waters, but it is clear that these transients are not always present to prey on coastal marine mammals in Alaska.

Some Gulf of Alaska transients do appear to specialize in preying on Steller sea lions at times. In Kenai Fjords, a female we named "Matushka," traveled alone

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for years after her son died. She made regular visits to the Chiswell Island Steller sea lion rookery when the new pups started entering the water. The bellowing of the agitated sea lions could be heard from miles away when they spotted her fin or when she was able to grab an adventurous pup. Later she joined with another female whale that produced a new calf. The Chiswell rookery became a training ground for the youngster, although they started him out on puffins and cormorants. After the adults stunned an unsuspecting bird with their flukes, the yearling whale would come in and practice its fluke slaps and carry the bird in its mouth until it vanished or was left maimed at the surface. Although occasionally reported as prey, sea otters don't seem to be preferred by GOA transients, but provide an excellent opportunity for training young whales. They may be abandoned alive after training is over. Learning to handle mammal prey appears a serious business that requires gradual training steps.

Although offshore killer whales are much less frequently encountered in Alaska than the other ecotypes, their appearance is often dramatic when they arrive in fast-moving groups of over 100 whales. Physically, they appear a bit smaller and seem quicker than other North Pacific killer whales and never seem to stop moving or changing traveling companions and groups. When feeding they may have long dive times of 5 minutes or more and appear to be deep divers. The limited tagging data we have for them also indicates they travel faster and over greater distances each day than do residents or transients. Tracklines show them spending time out on the shelf break in our area, which may be 80 km (50 miles) or more offshore, with forays to inshore waters. Tagging data also indicates 125 km (78 miles) is just an average days movement for these whales, so it is not surprising that they are the most well-traveled of

the three ecotypes. From the photographic resighting data, we know that the same offshore whales show up off California, Washington State, British Columbia and Alaska, including the waters of the Bering Sea.

It was known from stomach contents, observations and chemical analyses of biopsy samples that offshore whales ate fish, including sharks and halibut, but recently we developed additional insight into their feeding habits. While attempting to photograph a spread out and erratically moving bunch of offshores in Montague Strait, Prince William Sound, we began to notice big flocks of gulls circling well back in the wake of the whales. It seemed that some sort of feed had suddenly shown up for the gulls. What was it? We dropped back to investigate and found chunks of what appeared to be liver (later determined by genetics to be liver from Pacific sleeper sharks) that the gulls were squabbling over. Apparently the offshore whales were killing sleeper sharks and eating their huge oil-rich livers deep below the surface. After the whales had continued on, the buoyant leftover liver bits popped up at the surface to provide an oil-rich bonanza for the gulls. This occurred time and time again as the afternoon wore on, as we traveled in the wake of the whales, grabbing samples before the hungry gulls got to them.

Although our knowledge of killer whales in Alaska has advanced dramatically in recent decades, it is still based on relatively limited research in this vast and remote region. The details of genetic relationships across the regions are just being deciphered; we have only scratched the surface of the killer whale story in western Alaska and we know very little about what occurs in much of the Bering and Chukchi seas. Killer whales may be using far northern waters to a greater degree now that ice cover has been reduced by a warming climate. Certainly there are still many surprises in store for intrepid researchers in these far northern waters.



Another day at the office for Craig Matkin – renowned killer whale researcher and professional model (Bob Pitman using editorial license). Photo by Flip Nicklin

Whalewatcher

Killer Whale:

The Top, Top Predator



Special Guest Editor
Robert L. Pitman

