

Killer Whales and Water Pollution

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Killer whales are the top predators of the ocean. No other creature in the ocean matches the prowess of the killer whale. However, thanks to man's negligence with the ocean, these magnificent creatures are threatened. How the polluted oceans affect this species will be discussed, especially a pod in the Pacific Northwest.

Ecologically speaking, killer whales are on top of the food chain. They mostly eat fish, seals, sea lions, smaller cetaceans, and even larger whales. Now what does this fact have to do with water pollution affecting killer whales? The answer is quite simple. The pollutants that man has put into the oceans are consumed by small dinoflagellates and zooplankton. These microscopic creatures are then eaten by larger animals that in turn are eaten by larger fish. These larger fish are then eaten by even larger fish or larger animals. Ultimately the pollutants eaten by the dinoflagellates and zooplankton build up in concentration as they go up the food chain. Once the food chain reaches the top predator, in this case a killer whale, the concentrations of the pollutants are at extremely high levels. The pollutants found in bodies of killer whales, particularly in the Pacific Northwest, include PCBs and DDT. In fact, a study was conducted on killer whales that were found beached in Washington, Alaska, and British Columbia. This study looked into tissue samples from the killer whales' bodies. In three of the whales, DDT concentration levels were found to be at an alarming 400 parts per million while PCB levels exceeded 100 parts per million in other whales. How these pollutants really affect killer whales is unknown, but research is ongoing¹.

Although the pollutants' effects on killer whales are relatively unknown, it is believed that they may be partly to blame for the recent disappearance of five killer whales that regularly patrol the waters off British Columbia. It is feared that these whales

¹ <http://www.seaworld.org/animal-info/info-books/killer-whale/longevity.htm>

have died. If these whales have died, it will be hard for researchers to actually learn the cause of death for these whales. Researchers are really unsure what is wrong with this group of killer whales. They think the reasons could be that they are starving because of the lack of salmon in the region or they are being poisoned by high concentrations of PCBs that accumulate over time in their bodies². To add insult to injury for these killer whales, a sixth one has turned up missing, and it was a calf. The calf was believed to be a four-month old to one of the other five missing killer whales. It is believed that this calf was unable to find another female to serve as a surrogate mother³.

Among other chemicals found in the bodies of killer whales have included polybrominated diphenyl ethers (PBDEs), polybrominated biphenyls (PBBs), and polychlorinated naphthalenes (PCNs) when blubber biopsy samples were taken from male and female killer whales in the Pacific Northwest. Male killer whales from the Southern Resident groups were found to have a PBDE concentration of 942 ± 582 ng/g lw which is a very high concentration. For the same chemical, the concentration levels for male and female transient killer whales had concentrations of 1015 ± 605 and 885 ± 706 ng/g lw and male and female members of the Northern Resident groups had concentrations of 203 ± 116 and 415 ± 676 ng/g lw. Due to the large variation within sample groups, the PBDE concentration levels did not really differ in general statistically. The only exception was the male Northern Residents, which had lower concentration levels compared to male Southern Residents, male transients, and female transients. This is probably a reflection on their consumption of less contaminated prey. Transient males consume high trophic level prey that includes other cetaceans and they can occasionally be spotted spending

² “5 killer whales missing, feared dead along B.C. coast”

³ “Missing killer whale’s calf also feared dead”

time near populated areas, and they had PBDE concentration levels that were equal to those of the Southern Resident whales. Age related factors did not appear to be significant in the researchers' observations. PBDE concentrations levels were also found to be much higher than the concentration levels for both PBB which was at 3.0-31 ng/g lw and PCN which was at 20-167 ng/g lw. This could indicate that PBDEs could be a serious cause for concern for the killer whales⁴.

The blubber biopsy experiment as described in the previous paragraph was conducted on thirty-nine killer whales between 1993 and 1996. The whales were of both sexes and their ages ranged from 1 to 69 years. There were two ecotypes of killer whales tested, the residents and the transients, and comprised of three individual communities. The sampling work on the Southern Resident killer whales was limited due to heavy vessel traffic in the whales' summer feeding grounds in the Straits of Georgia and Juan de Fuca. The researchers involved got better numbers with the Northern Resident and transient individuals. The biopsies consisted of about 0.2-0.4 grams of skin and blubber. These samples of skin and blubber were collected from small boats at a distance of about 5-25 m. Using the photographic catalog for the residents and transients, researchers were able to confirm the identity of each individual killer whale. The samples, once collected, were put into pesticide-grade hexane-rinsed glass vials that were covered with aluminum foil caps. The samples were then frozen at -20°C until analysis on the samples could be done⁴.

The blubber samples were then subjected to a series of tests to find what kind of contaminants and their concentrations were in the whales. Blubber samples from nineteen males out of the thirty-nine whales were then taken for further tests and analysis.

⁴ "PBDEs, PBBs, and PCNs in Three Communities of Free Ranging Killer Whales..."

Researchers were looking for the concentration levels of PCN and PBB in the whales' bodies. Some samples had to be omitted from the data sets due to unreliable data being obtained in a couple of the tests. They found elevated concentration levels of PCN and PBB in the samples⁴.

The levels of contamination for these killer whales varied from one ecotype of whales to another because of their diets. Both the Northern Resident and Southern Resident whales have a diet consisting of fish that are mostly salmon-like. However, the Southern Resident whales also spend a lot of their time in the more industrialized southern Georgia Basin and in the Puget Sound. The transient killer whales mostly prey on marine mammals like seals and other cetaceans and tend to roam around the British Columbia and Washington State area on an irregular basis⁴.

When all of the data in all of the tests were collected, the researchers found a couple of trends. On one data set, they found that the concentration of PBDE increased in order from Southern Residents to Northern Residents to transients for BDE 47. However, they found that PBDE BDE 100 decreased in the same order. They did not find any other similar trends for any kind of PBDE. When looking at PCN concentration, the transients had less levels and the concentration generally decreased in order from Southern Residents to Northern Residents to transients. PBB concentration levels were also looked into and there were no real particular trends for any of them. Most PBB compounds were actually banned in the 1970's, but the compounds are still present in the whales' surrounding environment. With the PBBs still floating around, the whales continue to be exposed to them and thus they end up absorbed in their bodies⁴.

The researchers also compared ratios of PBDE/PBB, PBDE/PCN, and PCN/PBB among the transient and resident killer whales. When looking at these ratios, they actually looked at the male whales' samples that the researchers collected. For the ratio of PBDE/PBB, the Northern Resident whales had a higher ratio while the transients had the second highest ratio and the Southern Resident whales had the lowest ratio. In comparing the PBDE/PCN ratio among the three groups, The Southern Resident whales had the highest ratio, and it decreased in order with the Northern Resident whales having the second highest ratio and the transients had the lowest ratio. In comparing the PCN/PBB ratio among the three groups, the transient whales had the highest ratio and it decreased in order with the Northern Resident whales and Southern Resident whales⁴.

The researchers finally compared the concentration levels of PCB, PBDE, PCDD/F in killer whales with crab, sole, and porpoise. In general, all three groups of killer whales had higher PCB levels than any of the other animals they were compared to in the data. PCB levels were also higher in the transient whales than in the Southern and Northern Resident whales. Crabs actually had a higher PCDD/F level when compared to the other animals. Transient killer whales also had a higher PCDD/F level than the Southern and Northern Resident whales. Porpoise and transient killer whales had higher PBDE levels compared to the other animals. When comparing the killer whale levels among each group, the males generally had higher levels than the females⁴.

Researchers involved in this study came to the conclusion that in the Pacific Northwest, PBDEs pose the greatest threat to the ecosystem. Their findings provided additional evidence to help prove the hypothesis that high trophic marine mammals like killer whales are vulnerable to accumulate high concentrations of bioaccumulative

compounds. This then brings a cause for concern about any adverse effects on their health. Although there is little known about how much of an effect these chemicals have on the whales' health, there is a possible health risk that these chemicals present⁴.

Killer whales in the Pacific Northwest, because of the pollutants in the ocean, have actually been projected to become extinct within the next 150 years. This is of course if the measures that have been proposed to improve their habitat are not taken into effect. They are regarded as the most vulnerable species to pollution in the Pacific Northwest. Studies have shown that female killer whales often have lower levels in concentration of any chemicals because the chemicals are actually transferred to their offspring from the placenta and through nursing, both of which contain the dangerous chemicals⁵.

In the Pacific Northwest, the killer whale population has recently been given a depleted designation. This mostly applies the killer whales that live in the Puget Sound area. The whales that this designation particularly refers to are the Southern Residents. The Southern Residents are known to researchers as the J, K, and L pods. Each whale is identified by a number that refers to which pod they belong to and birth order. These pods are also the most notable pods when it comes to captive killer whales. Between 1965 and 1975, marine parks like Sea World got their killer whales from these pods causing a significant reduction in their respective populations. The population of the Southern Resident killer whales has been studied for over thirty years, and has fluctuated in number over that period of time. In 1974, there were seventy-one individuals in the population. In 1996, the population peaked with ninety-seven individuals. In 2001, the population dropped to seventy-nine individuals. The population is currently in the high

⁵ <http://www.panda.org>

eighties when it comes to individuals. NOAA Fisheries Service gave the depleted status to these whales in May 2003⁶. The Committee on the Status of Wildlife in Canada actually had killer whales in that area designated as endangered because they felt that the whales faced imminent extinction. Other killer whales in the Pacific Northwest have been given a threatened status⁵. They have announced a conservation plan that will bring the stock of killer whales back to an optimal sustainable population. The reason for this designation is that there are a small number of Southern Resident males that are at reproductive age and some females that are at reproductive age that have not had calves. Among the possible causes for having a depleted population is that the pollutants in the ocean have caused the whales to have a weaker immune system or reproductive system dysfunction⁶.

The conservation plan for the Southern Resident killer whales was put in place last year. This plan incorporated previous efforts to preserve the population with new methods. Among these methods are to restore the salmon population in the Puget Sound to a high enough population and to a good quality. NOAA believes that in doing so, it would improve the number and overall health of the killer whale population in the Puget Sound. Another factor that the conservation plan noted as a cause to the killer whale population depletion was oil spills. Their bodies end up absorbing the toxic chemicals found in oil which also affects them⁶.

The plan to give killer whales in the Pacific Northwest a protected zone has not gone without resistance. There have been farmers and industrial groups who have argued that the restrictions on land use put in place to benefit killer whales are unnecessary. It is not the whales that they have an issue with, but they do believe the whales' present

⁶ <http://www.nwr.noaa.gov/Marine-Mammals/Whales-Dolphins/Whales-Dolphins-Porpoise/Killer-Whales>

situation constitutes an “endangered” label that would thus give them a protected zone. This zone would be right where industrial groups would want to operate on and farmers want to use the land to cultivate their crops. The reasoning for farmers to be upset is that their activities could disturb the salmon that live there. Since the whales feed on the salmon, the areas where the salmon are get protected. The debate is ongoing about whether the killer whales need the protection that has been proposed⁷.

Killer whales deserve to be protected because they are the top predator of the ocean and they have never been known to attack people at will. One measure to protect these wonderful creatures is to stop polluting the oceans and doing whatever possible to clean the waters. Limiting the amount of salmon taken for human consumption is another measure that can and should be taken to help restore the killer whales’ numbers. Although the whales in the Pacific Northwest were strictly discussed, there are other areas in the world where killer whales are threatened. Some areas have killer whales that face similar conditions to the Pacific Northwest. Other areas have killer whales threatened by the continued hunting of these creatures. There is hardly a place on this earth where killer whales are perfectly safe. Wherever man’s presence is felt, the killer whales are in danger. The only place where man’s influence has kept these whales safe has been Sea World with their continued conservation efforts. In conclusion, killer whales are threatened by man’s abuse of the oceans and it is up to man to make things right again.

⁷ “Are killer whales endangered?”

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