

Agenda Item 5.3: Disturbance by high-speed ferries

The Conservation of the sperm whale in the Canary Islands

Submitted by: Secretariat



ASCOBANS

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The Conservation of the sperm whale in the Canary Islands

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Concerns about the effects of environmental degradation on marine mammals in general and on cetaceans in particular, have increased greatly in recent years. These concerns developed at about the same time as commercial hunting of marine cetaceans was in rapid decline.

At that point, most marine mammals were no longer in danger of extirpation by hunting, but there was increasing awareness that some populations might be susceptible to other human influences.

The most obvious problems remain today incidental take by fishing interactions and collisions with ships, as well as the effects of pollutants: oil spills, heavy metals, pesticides, sewage, etc. However, at the end of the 1970s, concerns about the effects of man-made noise and other forms of human disturbance have been added to the list and mentioned increasingly often.

Therefore, if any cetacean species is to be considered endangered in the next decade or two, it is more likely to be through changes to its habitat than to anything else. The species most affected are ones with restricted distributions, tied to coastal areas where their habitat requirements prevent them from escaping human activities.

This situation refers mostly to small cetacean species, but larger cetaceans may also have critical requirements during parts of their life cycle.

Harassment of cetaceans by increased boat traffic is a problem only recently recognised as potentially serious. Information on its possible effects is sparse and difficult to obtain without a continuous monitoring of the populations involved.

Nevertheless, some effects are obvious, such as the mortality from collisions with propellers that are often implicated in strandings of dolphins and whales.

Concerns have also been expressed recently over disturbance by whale-watchers to regular concentrations of whales and some studies do indicate possible detrimental effects to whales.

However, despite extensive work and research in many areas over the world, our knowledge of the long-term effects of human activities on marine mammals and on their habitat is still virtually zero.

From a scientific perspective, a multi-disciplinary approach is necessary to understand specific conservation problems and prevent further deterioration of the marine habitat.

A clear example of this former point is given by the conservation status of cetaceans in the Canary Islands. This region of the North Atlantic where the cetacean fauna has been found to be the most diversified and numerous of Europe and probably of the rest of the world, concentrates all the threats described previously from human activities.

Around 30 cetacean species have been listed in the Canary Islands, sharing their habitat with heavy shipping, mainly between the two most important harbours of the Archipelago, Santa Cruz de Tenerife and Las Palmas de Gran Canaria, where a daily average of more than 100 ships enter and leave the area.

During the last six years, it has been possible to monitor the populations of some species, principally the sperm whale, *Physeter macrocephalus*, which happened to be commonly encountered in the inshore waters of the Archipelago.

Further research has shown that this unique situation - sperm whales are usually found in offshore waters very far from the coast and their populations migrate great distances - is being threatened due to the rapid degradation of their habitat.

Although in other regions, collisions between odontocetes and boats are considered to be uncommon, it has been reported that sperm whales have been struck and killed by ships. Stranded animals have exhibited severe injuries and evidence of violent impacts.

Routine necropsies of the few animals made available to the Veterinary School of the University of La Palmas de Gran Canaria confirmed generally the causes of the death - the individuals were alive before the collision and apparently were not presenting other lesions nor specific pathology which could explain the lack of reaction before the impacts with the ships.

Sperm whales are highly vocal and their acoustic signals can be detected from quite a long distance. These sounds are used both for communication and bio-sonar or echolocation.

Through the physical properties of underwater sound applied to cetacean bio-acoustics, monthly acoustic surveys of the central Canary Islands were conducted in 1993 and 1994 to determine the seasonality of the local populations and precise the relationship with collision rates.

The results showed that groups of sperm whales were permanent residents in this very small region, with two peaks in density in spring and fall when visiting groups were probably joining the locals during their migration towards the Azores.

Another acoustic survey around the whole Archipelago conducted in 1995 and 1996 confirmed the previous results and completed the map of the presence of

sperm whales in the Canaries by postulating that this species presented the highest density of all the other cetacean species listed in this region.

These results may explain that the probability of collisions of this species with ferries could be directly related to the high density and the resident character of the sperm whale populations.

In order to move directly towards the conservation of this species by reducing the number of collisions, a series of experiments, including the playback of artificial sounds of different frequencies, was conducted to test a system designed to try and deter sperm whales from occupying the ferry routes.

The main purpose of these preliminary tests was to observe the behavioural responses of the whales and try to assess the potential of this method to protect both the whales and the ferries. The results demonstrated that the whales did not react to low frequency playback which suggests that sperm whales from an area which has heavy vessel traffic have a high tolerance for noise.

However, we observed that the whales reacted strongly to high frequency playback when the whales were foraging, i.e. looking for food, but ignored the same stimuli when resting in compact groups at the surface. This interesting observation emphasises that an animal's response to a signal can change dramatically with time. It appears that the whales rapidly habituated to this sound. During a foraging process, in order to maintain a cohesive structure and enhance the efficiency of finding prey, whales remain in acoustic contact with their group. It is possible that the high frequency pulses had a more disturbing effect on those whales concentrated on other whale vocalisations, rather than when they gather at the surface in a compact structure and remain almost silent.

This latter point, which underlines the habituation or tolerance of this species to disturbing noises in an area already experiencing heavy vessel traffic, suggests that even this sound may have little long term value in avoiding vessel collisions.

It remains that some groups of sperm whales are resident on the ferry routes, apparently not affected by the noise generated by ships. However, 'the continued use of some areas with much boat traffic by feeding and travelling whales may reflect the value of these areas to the whales and should not be interpreted as meaning that the whales are undisturbed'.

From our experience and the first results of the experiments conducted with playbacks, we suspected that those whales may have lost sensitivity to the low frequencies generated by the engines and propellers of the ships and thus may not react quickly enough before an imminent collision. In our opinion, the solution to the problem of accidental collisions, lied in a better understanding of the hearing sensitivity of the local populations of whales. Do they actually "hear" the noise from shipping and other human activities?

To answer this question, analysis of inner ear structures is necessary to determine whether anyone whale has auditory damages. During this study, CT scans of those structures showed that there were no fractures or other overt evidence of impact, or ship strike related injuries; however, ears from the studied animals had reduced auditory nerve volumes. One animal also had patches of dense tissue in the inner ear. These findings are consistent with auditory nerve degeneration and fibrous growth in response to inner ear damage.

In combination with the results from the playback experiment, these results suggest that low frequency sounds from shipping may be affecting hearing and increasing collision rates.

Histologic analyses were conducted and it was determined that the primary cause of the ear changes seen with CT scans were noise induced. In other words, the long term impact of noise from shipping may have turned the resident population of sperm whales to deafness specifically concentrated on low frequencies.

The remaining question was to estimate whether and to what extend the depletion of individual sperm whales could affect the population dynamics of the species in this particular area.

The international Whaling Commission established during the whaling industry what has been termed the sperm whale model. This model explored the effect of stock depletion on the reproductive status of a population in order to maintain a sustainable reserve of whales available for hunting: how many animals could be killed without pushing the group to extinction in a medium term? The breeding cycle of a female sperm whale from a group where no depletion is observed is calculated to be from 5 to 6 years.

From the International Whaling Commission model it is biologically reasonable to assume that the reproduction rate grows in proportion with the population depletion. Further analysis of the Canaries populations of sperm whales showed a breeding cycle of under 3 years which could indicate that the number of sexually mature females is in decline in this part of the Atlantic.

If further investigation confirms the extension of the problem, the natural balance of the ocean in this region could suffer in a medium term from a serious threat. Sperm whale diet consists mainly of squids. An adult whale ingests daily about a ton of those cephalopods. Knowing that the size of the local population of sperm whale has been estimated to be around 300 individuals, it is easy to imagine the terrible environmental impact the departure of this population would suppose. This catastrophic conclusion is may be far from happening in the next future, but it should at least make us think that we might be still in time to undertake immediate actions.

And one immediate action should go through the development of a passive system able to locate the whales and follow their movements in real time,

allowing the direct transmission of the data to the ships navigating in the area, giving them enough time to avoid collisions.

The degradation of the marine habitat is a slow process, but its consequences have a long-term effect on the entire food chain, where cetaceans act as top bio-indicators. Human activities go obviously through commercial interests. It is our responsibility to ensure that those activities consider the welfare of wild species, spending a similar effort in monitoring population dynamics and in bringing immediately a clear diagnostic and applied solutions to a possible threat.