

## Depredation by small cetaceans

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Our lab has a long standing interest in cetacean-fishery interactions. Recently we have been examining interactions between bottlenose dolphins and coastal gillnets, and pilot whales and pelagic longlines.

We studied interactions between bottlenose dolphins and Spanish mackerel coastal gillnets in North Carolina from 2003-2005. During this period we used a variety of methods to examine these interactions. We placed an observer aboard commercial boats and made observations of dolphins and their activities around nets, evidence of depredation and the catch of Spanish mackerel for each set. We also observed dolphins from an independent research vessel. From this platform we photographed the dorsal fins of individuals for photo-identification, conducted focal follows and deployed a hydrophone to record dolphin echolocation.

Dolphins encountered more than a quarter (26%) of all gillnets we monitored while aboard commercial gill net vessels (136 sets) and interacted with nets on most (64%) of these occasions. We observed a 38% reduction in Spanish mackerel catch when dolphins interacted with nets. Dolphins engaged in depredation typically approached the nets very rapidly and often from a distance. They spent a brief time with the net (rapid surfacing along the net's length, jumping over the net, pulling fish out of the net) and left just as quickly. The interaction typically took only several minutes. We analyzed acoustic recordings made during the focal follows and found no significant difference in the occurrence of echolocation behavior as a function of distance from the net.

In 2004 and 2005 we assessed the efficacy of Save Wave® acoustic alarms designed to reduce dolphin depredation. This was the first test of SaveWave® acoustic alarms in the U.S. We used the same methods previously described: observations from commercial boats, focal follows and acoustic recordings. The observer placed active or inactive (control) SaveWaves® on all nets each fishing day. We observed 151 sets (83 active and 68 control) and found no significant difference in total Spanish mackerel CPUE between active and control sets ( $p = 0.23$ ). Observations from the commercial vessel showed that dolphins encountered control nets more frequently than active nets

(31% vs 5% respectively). Dolphins echolocation increased significantly within 500m of nets equipped with active devices ( $p = 0.003$ ). Within this 500 m zone, echolocation was more frequent with active devices ( $p = 0.0003$ ). Unfortunately, during the two years we tested the SaveWaves® we saw no incidences of dolphin depredation. Fishing was poor in both years and depredation occurred rarely, limiting our ability to draw conclusions about the effectiveness of the SaveWaves®. During both our commercial vessel observations and our focal follows we did observe dolphins interacting closely with both control and active nets. Given the data at hand, we cannot yet conclude that the SaveWaves® will deter dolphin depredation on Spanish mackerel gill nets.

The objective of the second project is to characterize the nature of pilot whale interactions with pelagic longlines. The longline fishermen we are working with in North Carolina primarily target yellowfin and bigeye tuna. Our work is multi-faceted. We are obtaining photo-id images to determine whether particular individuals consistently engage in depredation. We also are collecting skin samples from pilot whales to determine which of the two species (short or long-finned) interacts with the longline gear. We also plan to conduct focal follows of pilot whales around longline gear. A major component of our research involves placing acoustic recording equipment on longlines to document when in the fishing process pilot whales engage in depredation.

We completed a successful two-day trial research cruise in September 2006. There were no longline vessels working in proximity to us during these two days, so we were not able observe whales in association with fishing gear. We had three sightings of pilot whales and made acoustic recordings of each group. We collected six biopsy samples; all the whales were short-finned pilot whales. In addition, we took 590 digital images for photo-identification; many of the whales had very distinctive fins. Finally, five longline vessels are currently deploying acoustic recorders on their gear. To date we have analyzed acoustic recordings from two longline sets. We recorded pilot whales during the soak time of one set in which depredation occurred, as evidenced by two tuna which had been mostly consumed by pilot whales, leaving just the heads on the line.

Throughout the fall, winter and spring we will continue to work with fishermen to deploy recorders on their gear. We also plan to provide digital cameras to fishermen, so that they can document pilot whales that interact with their gear and perhaps provide dorsal fin images for photo-identification. Most of our remaining field work will be conducted in a ten-day research cruise during the spring of 2007. During this cruise we plan to record the vocalizations of pilot whales in the vicinity of longline

gear and obtain acoustic recordings of pelagic longline vessels during setting and haul-back for future playback experiments.

During the course of these projects we have learned several valuable lessons. The first is the importance of working directly with commercial fishermen. Their experiences and observations are invaluable in planning, conducting and interpreting experimental results. Secondly, not all animals in a population appear to engage in depredation. This is certainly true for bottlenose dolphins and it will be interesting to see if the same holds true for the pilot whales, animals with a very different social structure than bottlenose dolphins. Finally we learned the importance of using a variety of complementary methods to address these complex and logistically challenging questions.