

Workshop 8: Quantifying depredation and establishing documentation protocols

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Quantifying depredation rates is a crucial component for assessing the impacts of depredation of fishing gear by cetaceans. Quantifying depredation allows researchers to monitor trends in depredation, estimate economic losses to industry, assess and compare depredation levels from different regions, and help evaluate mitigation efforts. This workshop took advantage of the diverse knowledge of participants and focused on developing standardized methodologies for quantifying depredation. During this workshop participants identified four components to consider when quantifying depredation rates: 1) define depredation; 2) detect depredation; 3) measure depredation; 5) standardize and report depredation.

What is the definition of depredation

In 2002, a workshop in Samoa produced a report entitled Interactions between Cetaceans and Longline Fisheries. During the Samoa Workshop, participants defined depredation in the present context as “*the removal of hooked fish or bait from longlines by cetaceans.*”

While this definition of depredation is true for the majority of regions, participants in this workshop emphasized that depredation by cetaceans is not restricted to longline gear. Other capture methods, such as gillnet fisheries, have also documented depredation events.

Samoa Workshop participants concluded that the standard index of depredation rate should be defined as, “*damaged fish (number or weight) as a percentage of the total catch in a given fishery.*” It was noted, however, that “*this index may underestimate the true impact of depredation because, e.g. some fish that would have been caught are scared away from the longlines, some caught fish may be stripped away entirely leaving a bare hook and therefore no evidence of depredation. Alternatively, the index could be positively biased if damage by sharks and other organisms has been wrongly attributed to whales.*” Participants from this workshop suggested the index definition should be more robust and should be measured as total loss to the fishery rather than only damaged fish on the line. Total loss could be interpreted as physical loss such as damaged fish or broken hooks and/or economic loss such as value of catch or extra fishing effort.

How to detect depredation

Participants in this workshop shared their expertise and experiences to help identify indicators for detecting depredation. It was agreed that the standard index definition “*damaged fish (number or weight) as a percentage of the total catch in a given fishery*” is too limited because many depredation events do not leave evidence of damaged fish and are not easily detected.

In Alaska, killer whales often remove the entire fish from every hook or leave only lips on hooks making it easy to detect depredation. Sperm whales, however, rarely strip the entire line and evidence of depredation is mangled fish instead of bare hooks and occurs sporadically. Also, gear is occasionally interfered with and the only indicator of depredation is straightened hooks. Fishermen in Alaska also report bare hooks are commonly associated with depredation. In the Southern Oceans killer whales leave parts of toothfish on the hook but damaged fish are often not a good indicator of depredation. In pelagic longline fisheries, there is also the potential of cetaceans scaring targeted species away from the hooks and removing baits before the fish can be hooked. Discussions clearly indicated that detecting depredation is fundamental to accurately quantifying depredation. Participants agreed that most depredation estimates are likely

conservative because more depredation is likely occurring than what is evidenced by damaged fish left on the line.

Discussions focused on what observations may be helpful for detecting depredation. The most common signs of depredation are presence of cetaceans and evidence of depredation. However, evidence of depredation is not always present. Conversely, many observations have shown that presence of cetaceans is not necessarily correlated with depredation but cetacean behavior may be. Diving behavior and cetacean location in relation to the vessel may be correlated with depredation behavior and should be researched.

Participants came up with the following indicators as useful guidelines for detecting depredation:

- Presence of cetaceans
- Observed depredation (surface observations)
- Evidence of damaged fish on the line
- Evidence of damaged gear
- Gear/cetacean interactions (tugging, entanglement)
- Bare hooks
- Cetacean behavior (diving, location in relation to vessel)

How to measure depredation

Samoa workshop participants stated, *“There is a need for standard methods to quantify longline losses due to depredation caused not only by cetaceans but also by other organisms such as sharks, bony fish and squid.”* To effectively measure depredation an index of catch rate must be available. The most common measurement used in fisheries is catch-per-unit-effort calculations.

For longline fisheries the unit of effort may be individual hooks or entire sets. Catch can be measured in numbers or weight and catch rates can be computed using the ratio of catch to total effort. Participants stressed caution about the problems associated with estimating total catch loss when there are difficulties in identifying depredation. This clearly supports the importance of being able to measure depredation effects. CPUE indices are not reliable if there are problems with detecting depredation. Ideally, CPUE indices should be done for sets when depredation is occurring and for sets when depredation isn't occurring to allow for comparison tests.

Participants agreed CPUE analyses are useful for measuring depredation and are preferable over more rudimentary techniques.

Defining a standard measurement of depredation is challenging due to the diversity of fisheries that are affected by depredation. Ideally, gear is standardized and catch is recorded by hook such as in research studies in Alaska. More often, however, gear is not standardized and catch is subsampled or data is obtained through logbook information or skipper's estimates. Dedicated research cruises will often have better quality data than observer collected or fishermen reported data. Data analyses and measurements of depredation will be dependent on the fishery, the type of data collected, and the quality of the data. Participants agreed a standard measurement is desirable and should be pursued but is unlikely.

Discussions instead focused on utilizing ongoing studies and current data collections to help identify information necessary for measuring depredation. Depredation observations are being made in many fisheries around the world and many data collections have been developed to record depredation. Group recommendations were to make these forms available on the depredation website so interested parties could review a variety of sampling forms from a diverse set of fisheries and identify important data fields that were relevant and achievable for

their respective studies. For example, forms used for SEASWAP are for fishermen and are designed to be simple and quick and are likely adaptable to many fisheries. Several of the forms discussed in the workshop were:

<u>Contact Person</u>	<u>Type of Form</u>
Jan Straley	Alaska sperm whale
Vicki Cornish	Southeast US small cetaceans
Luciano Dalla Rosa	Brazil killer whales
James Clark	South Georgia sperm/killer whales

These should be available on the web site (www.depredation.org).

Participants reviewed several forms and came up with necessary data fields which could be used to help measure depredation:

- Cetacean presence (Y/N) and numbers present
- Measure of effort – e.g. # hooks hauled, # sets made, days of fishing
- Measure of catch – e.g. # fish caught/ weight of fish caught
- Suspected depredation and when/where it occurred during fishing operations
- Evidence of depredation – e.g. # of damaged fish, # of damaged hooks

Additional fields that should be considered and may provide valuable information to help understand depredation include:

- Deterrent techniques employed and depredation response
- Cetacean behavior during depredation
- Cetacean pictures for identification
- Gear modifications in response to depredation such as hook size or hauling speed
- Fishing locations and depredation response
- Oceanographic observations such as sea state or water temperature
- Acoustic behavior and hydrophone observations
- Fishing practices – e.g. offal discharge

To ensure the appropriate data is collected the group suggested canvassing experienced observers of depredation such as fishermen and researchers and conducting informal surveys. Proper training and experience of depredation observers was also mentioned as important components for accurately measuring depredation.

Workshop participants briefly discussed how to estimate the magnitude of loss when fish are removed or damaged. Several groups, such as the South Georgia Observers and the International Pacific Halibut Commission, have developed relationships between head size or lip width to body size to help address how much fish was lost. Incorporating these types of methods are innovative techniques for reducing the uncertainty associated with estimating losses to depredation.

Finally, the Samoa workshop *identified “There is a lack of baseline data and statistics to corroborate alleged increases in depredation rates as a fishery develops. Therefore, it is important to monitor meticulously the development of any new fishery for interactions with cetaceans.”* Participants from this workshop strongly agreed and want to stress the importance of measuring catch and effort in regards to depredation even if the fishery currently has no interactions with cetaceans. Baseline data is integral to measuring the effect of depredation.

Standardizing and reporting depredation globally

Workshop participants agreed that reporting standards are necessary due to the global extent and diversity of studies addressing depredation. Measurements of depredation should be presented so conclusions can be drawn and comparisons to other studies can be made. CPUE analyses are preferable but numerous methodologies will suffice if properly defined data and information accompany the estimates. Suggested measurements for quantifying depredation and reporting reduction in catch due to depredation may include:

- catch numbers
- catch weight
- proportion of catch
- catch rates
- economic value

To successfully quantify depredation studies should define what depredation is, explain how depredation was detected, express how depredation was measured, and report all findings in a standardized format similar to other depredation literature.