Possible Mitigation Measures Developed by PIRO for the WPFMC Marine Mammal Advisory Committee in February 2007

Possible Mitigation Approaches to Reduce False Killer Whale Predation in Hawaii-based Longline Fishery

Description of the problem: False killer whales (*Pseudorca crassidens*) interact with the Hawai'i-based longline fishery in offshore Hawaiian waters. Interactions with fishing gear usually occur during depredation events on bait and/or catch. Many of the interactions involve false killer whales hooked in the mouth or with an ingested hook, presumably because they are taking catch or bait off the gear. Most of the animals are released when the line breaks or is cut, trailing variable amounts of gear ranging from approximately 1m of line to tens of meters of line with floats or weights. These interactions have the potential to seriously injure or kill the animals. Serious injuries and mortalities of false killer whales are currently above insignificant levels [they exceed the potential biological removal (PBR) calculated for the Hawaiian stock].

Between 1994 and 2005, twenty false killer whales were observed hooked or entangled in the Hawaii-based longline fishery, with approximately 4-26% of all effort observed (Draft SAR 2006). Two of the false killer whales were killed, and all others caught were considered seriously injured based upon an evaluation of the observer's description of the interaction and following established guidelines for assessing serious injury in marine mammals (Draft SAR 2006). In 2006, four false killer whales were observed to interact with the fishery; serious injury determinations have not yet been made for these interactions. Animals are considered seriously injured if one or more of the following applies: (1) they are hooked in the mouth/head or have ingested a hook; (2) they are released with trailing gear that is likely to impair feeding or locomotion (Angliss and DeMaster 1998). Serious injury determinations are made on a case-by-case basis using the observer's description of the interaction, the behavior and body size of the animal, the amount and types of gear attached when the animal was released, and where on the body the animal was hooked or entangled.

Depredation impacts both cetaceans and the fishery. Some impacts of depredation on cetaceans include: serious injury or mortality (hookings, entanglements); retaliation by fishermen (shooting, use of explosives, bottles filled with fuel); other associated injuries (vessel strikes, etc.); cetaceans switching to other prey sources; cetaceans becoming dependant upon vessels for food; changes in cetacean foraging behavior/distribution; and altering cetacean social structure. Some impacts of depredation on the fishery include: engaging in extra fishing effort (more time needed to replace lost catch, which may in turn increase the interactions and result in increased pressure on target species); increased costs of engaging in avoidance strategies; reduced product quality if catch left for period of time to avoid cetaceans; reduced window of opportunity for successful fishing (increased chance of poor weather, etc.); lost fishing gear; and safety concerns (untangling cetaceans hazardous, etc.).

Goal: To reduce false killer whale depredation in the Hawaii-based longline fishery, and likewise the whales' association between vessels and a "free meal." It is theorized that the transmission of depredation behaviors among whales occurs through social learning. It is therefore imperative to prevent the spread of these learned behaviors to new areas; it is very difficult to control behavior of whales that have become dependant upon depredation. Alleviating fishery interactions involving cetaceans requires a high level of effort and a long-term commitment to properly reshape, if possible, the depredation behavior.

Key Objectives: (1) defining the circumstances associated with false killer whale depredation in the longline fishery; (2) identifying potential mitigation measures to reduce depredation and false killer whale - longline fishery interactions; and (3) identifying research needs and assigning research tasks for both characterizing the causes of depredation and mitigating false killer whale take.

Three important factors to evaluate when considering methods to reduce or mitigate depredation are: (1) the adverse effect on the cetaceans; (2) the adverse effect to the fishery; and (3) the feasibility of the method being used in the fishery (gear, costs, etc.)

<u>Possible Mitigation Measures to Reduce Depredation</u>:

Mitigation Measure	Implementation	Possible Pros	Possible Cons
Avoid dumping discards (offal, by-catch, and spent bait) in the presence of cetaceans. *Discards can attract and will likely habituate animals to longline operations. Food is one of the strongest rewards known for shaping animal behavior.*	▪Retain in catch basins, and dump outside of feeding grounds. ▪Grind discards in waste water. ▪Freeze discards, dump while underway to next set.	▪Does not offer positive reinforcement for depredation, which could significantly decrease depredation events. ▪Reduces number of birds around vessels, which may be another visual cue for cetaceans.	▪Lack of space of vessel to retain discards onboard. ▪Vessel stability and safety issues. ▪Must have 100% compliance or will not work. ▪Discards could represent sources of "free" food and could have the effect of deterring cetaceans from depredating the lines (many disagree with this assertion).
Reduce vessel noise (engine, hydraulic, propeller, gear). *Cetaceans develop familiarity with the sounds of longline vessels, especially hauling.*	▪Use quiet vessel technology. ▪Change way handle and maneuver vessel (gearshifts/haul = free meal).	▪Reducing vessel noise may prevent interactions, especially where cetaceans are sensitive to the sound of hydraulics. (Avoid "dinner bell" conditioning). ▪Cetacean depredation on pelagic longline gear is believed to most frequently occur during gear hauling, versus set and soak (but may occur at any time).	▪Noise reduction techniques can be cost prohibitive. ▪Cetaceans may learn to identify quieter vessels over time. ▪Cetaceans may associate the presence of fishing gear with opportunities for depredation, even when fishing vessel itself and the noise from hydraulics is absent. (Some whales reported to wait by buoys for vessel to return).
Detection and avoidance of cetaceans. *Be aware of cetaceans' presence in order to avoid them.*	<u>Detect cetaceans via use of</u>: ▪Hydrophone ▪Satellite tags ▪Radio tags ▪Acoustic tags ▪Tethered sonobuoys ▪Real time communication with other	▪"Passive" deterrence. ▪Sightings of cetaceans in Hawaii longline fishery are difficult due to low visibility, wind, and vessel noise. Vessel operators may not know there are/were cetaceans present until see damage on catch.	▪Detection devices can be expensive and not always reliable. ▪Re: avoidance: cetaceans known to follow vessels for quite a ways. When cetaceans detected, may need to steam $\geq$ 60 nmi away.

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	vessels ▪Monitoring/use of observers <u>Then</u>: ▪Avoid "hotspots," where cetaceans congregate. ▪Use false cues (set dummy gear or buoys). ▪Do not set or haul if cetaceans present.	Therefore, use of these detection devices may be very useful. ▪ Marketable hydrophone for listening (not recording) in $300-$500 range. BC Symposium participants thought worthwhile investment.	
Acoustic Deterrents *Scare cetaceans away from fishing vessels and create negative associations.*	▪Loud noises ("seal bombs," etc.) ▪Pingers ▪Scramblers ▪White noise ▪Acoustic duplication of other cetaceans ▪Play back own pod noises (distress or alarm calls) ▪Tying magnets to fishing line (not acoustic)	▪Acoustic deterrent devices have been tested in some fisheries with limited success. These devices may work initially, and over the short-term.	▪Acoustic deterrent devices are not likely a long-term solution. Cetaceans can quickly become habituated and deterrents lose efficacy. ▪Benefit of food > impact of the alarm. ▪ Acoustic deterrent devices must be variable, and loud enough to be aversive, but not injurious. ▪ Acoustic deterrent devices can become attractants ("dinner bell"). ▪Adding sound to marine environment has unknown ecological effects.
Gear modifications *Make it more difficult for cetaceans to depredate.*	▪Shorten mainline length (smaller segments of gear used at a time). ▪Place obstructions along line to stop cetaceans from "flossing." ▪Change set shape. ▪Reduce line slack. ▪Change hook shape, strength, and/or spacing.	▪The Atlantic PLTRT found that the most significant factor in reducing pilot whale interactions in the Mid-Atlantic Bight may be the mainline length. ▪Reducing the mainline length to 20 nmi or less could potentially reduce pilot whale interactions by 35%.	▪Shorter sets may decrease fishing efficiency (but get more catch back if not being depredated).

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	▪Set segments of the line without hooks.	▪This provision would not restrict the number of lines a vessel may deploy, as long as each of those lines is 20 nmi or less in length.	
Change fishing practices. *Continually make changes to "keep cetaceans guessing."*	▪Shorter sets ▪Haul at different times of day. ▪ If cetaceans in area, don't start fishing or hauling. ▪Stop fishing when cetaceans present. ▪Dropping hauled gear when cetaceans approach. ▪Changing target species. ▪Changing gear type. ▪Changing procedures (*e.g.*, reverse haulback)	▪Some changes may be effective and easy to implement. ▪Temporary cessation of fishing activities when cetaceans present could have great impact in reducing depredation. Breaks the link between whales' association of vessels with food.	▪Fishery may not be adaptable. ▪Changing target species and/or gear types may be more feasible in other fisheries (*e.g.*, to Pacific cod or to pot gear in Alaska). ▪Cetaceans may adapt to any changes fishery makes.
Avoidance of serious injury or mortality once entangled or hooked.	▪Development of equipment and methods for careful handling and release of entangled or hooked cetaceans.	▪Even though an interaction with a cetacean occurs, could be possible to avoid an otherwise serious injury or mortality in certain cases.	▪Hooked cetaceans are often very active, complicating release efforts. ▪Many animals break the line and swim away with varying amounts of gear attached.
Others?			

References:

Angliss, R. P. and D. P. DeMaster. 1998. Differentiating serious and non-serious injury of marine mammals taken incidental to commercial fishing operations: report of the serious injury workshop 1-2 April 1997, Silver Spring, Maryland. U.S. Department of Commerce, Silver Spring, MD. (NOAA Technical Memorandum NMFS-OPR-13) 48p.