The Genetics Of Fishing Hooks

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Since 2010, the Southwest Fisheries Science Center's Marine Mammal Genetics Group (MMGG) has been conducting genetic studies of false killer whales around the Hawaiian Archipelago. Though the Main Hawaiian Islands (MHI) insular population has been very well sampled, our sample size for the pelagic waters surrounding the archipelago is low, despite an extensive research survey conducted in 2010 that focused on false killer whales.

The Hawai`i deep-set longline fishery now uses weak circle hooks designed to straighten when a large animal becomes hooked, thereby releasing the animal with no attached gear. During the Pacific Scientific Review Group meeting in La Jolla in April, 2013, it was suggested that we might be able to obtain genetic samples from these straightened hooks. MMGG is now pursuing this possibility and has secured funding for a pilot project. Our goal is not only to identify and utilize false killer whale samples, but also to identify the species of origin of all samples collected from straightened hooks, including all marine mammal and fish species. If successful, this approach would be very helpful in providing information to the fishers and fishery managers regarding the species involved in hook straightening events (whether potential depredators or target species) as well as greatly increasing the sample size for our false killer whale genetic work.

The first step in the pilot project is to develop a sampling plan and sampling protocol. We must decide which hooks should be collected, how they should be collected, and what information should be gathered about each hook. Below, I briefly summarize the ideas and recommendations we have come up with so far. I hope that this document and discussion generate more ideas and enable us to begin to settle on a protocol.

<u>Which hooks?</u>

We have funding to genetically analyze 20 straightened hooks as part of our pilot project. Assuming that collecting and properly storing hooks (see below) is not a substantial burden, I recommend that we collect many more than 20 hooks so that we can choose the most promising hooks for laboratory analysis.

Any hook that has been in an animal is a potential source of DNA from that animal. However, extracting and amplifying trace amounts of DNA from a hook that has been dragged through seawater will be extremely challenging. It was mentioned at the PSRG that straightened hooks sometimes have visible tissue stuck to them. For the pilot project, we would like to focus on those hooks, recognizing that the tissue could come from the bait, a hooked target fish, or a bycaught animal. Any straightened hook with tissue attached should be collected. When selecting hooks for laboratory analysis, priority will be given to hooks from sets where false killer whales or blackfish were acoustically or visually detected, and hooks from observed blackfish/false killer whale interactions, and hooks from sets with marine mammal damage (depredation) to catch and/or bait.

<u>How to collect and store hooks</u>

Because we are unfamiliar with fishing operations and the tools and equipment available onboard a typical boat, our ability to determine how best to collect hooks is extremely limited. This is the aspect of the project for which input from the fishers would be most helpful. The goal is to develop a hook collection protocol that is easy to follow, does not interfere with normal fishing operations, and minimizes handling of the straightened hook. This last point is critical, as handling can result in attached tissue being knocked off or the hook/tissue becoming contaminated, either with DNA from a species not involved in the hooking event or with a substance that interferes with genetic laboratory processes. When examining straightened hooks to see whether there is any tissue present on them, the observer or fisher should only handle the branch line above the hook or, if necessary, the very top of the hook where the branch line attaches.

I'm guessing that straightened hooks are removed by cutting the branch line. If this is true, a good approach may be to first place a sterile plastic bag (provided by MMGG) over the hook and then cut the branch line. The first bag can then be placed inside of a second, larger sterile plastic bag. Double bagging in this manner reduces the risk of a hook poking all of the way through the bags. The bagged hook can then be placed in a small cardboard box (roughly half the size of a shoe box; also provided by MMGG) and placed in the freezer. What temperature are the freezers on fishing boats kept at? If possible, collected hooks should be stored at -20 °C.

Another possibility would be to collect hooks in plastic vials. This approach would be preferable, as there would be no risk of hooks puncturing the vials and the vials are easier for us to store and archive. However, we doubt that the hooks would fit into our vials. It would be helpful to have some example hooks (unfished and varying degrees of straightening) sent to MMGG so that we can try putting them in various vials.

<u>What information should be collected?</u>

When a straightened hook is collected, as much information should be gathered as possible about the hook and the set. This information will help us to select hooks to take forward into the laboratory process, will help us troubleshoot problems we encounter in the lab, and, if the project proves successful, may be useful when analyzing the resulting data to look for patterns in when specific species (e.g., blackfish, sharks, large fish) engage in depredation. Examples of relevant information are:

- Were any marine mammals observed in the area of the set?
- Were blackfish detected acoustically?
- What bait type was used (may affect laboratory methods)?
- What was the position of the hook along the set?
- How long was the hook in the water?