9 RECOMMENDATIONS FOR ADDITIONAL RESEARCH AND DATA COLLECTION

9.1 Background

The Team's deliberations and development of a plan to reduce bycatch were constrained by considerable uncertainty in many areas. To better inform the development of long-term solutions to reduce interactions between FKW and pelagic longline gear (and the consequent mortalities and serious injuries), additional knowledge of the cues to interactions, mechanics of depredation, distribution, behavior and demographics of FKW, differences between the population as a whole and "depredators", and effects of fleet behavior on interactions is needed. Although the observer data is rich in some regards, these data do not inform the mechanics of interactions. Based on the available data the TRP proposes some measures to reduce bycatch. However, meeting the 5-year Zero-Mortality Rate Goal, and being able to evaluate the success of the plan are both facilitated by research that is concurrently launched to answer these basic questions.

The Team's deliberations highlighted numerous data gaps and information needs. These deliberations – both in full group and in a research-focused work group – centered around two broad areas: (1) longer-term research needs; and, (2) improvements to observer data collection. Other suggestions – focused around near-term data analysis necessary to support the Team's immediate deliberations - were undertaken (as possible) in real-time and summarized in Chapter 7.

The recommendations below reflect a consensus of the Team members present at the fourth Team meeting.

9.2 Research Needs

Recommendations for additional research
Recognizing there are both short-term and long-term goals of the Plan, and the need to evaluate the effectiveness of the Plan as well as reduce uncertainty in aspects of which populations are involved with bycatch, there is consensus that considerable research is needed. Uncertainty exists in aspects of false killer whale biology, behavior, abundance, and distribution of stocks; there is a lack of even basic information on the shortline and kaka line fisheries. Additionally, there is need for a better understanding of potential factors within the longline fleet that may influence depredation and/or bycatch, as well as how proposed methods to reduce bycatch might influence bycatch or target species catch rates.

The Team developed a list of 35 research recommendations over the course of four meetings and during several conference calls of a Research Needs Work Group that included broad representation of the Team. For each research question/activity, information was compiled on the approach and purpose or benefit, the feasibility, and relative costs. These research questions/activities were then grouped into one of four general categories: 1) false killer whale biology; 2) longline gear and fishing; 3) shortline and kaka line fishing; or 4) false killer whale assessment. With the exception of the shortline and kaka line fishing categories these groupings facilitate answering the "how, when, where, who" questions. The shortline and kaka fishing

category underscores the lack of information regarding this fishery and the Teams consensus that these gears likely have interactions.

During the 3rd Team meeting 14 Team members present scored each research question/activity within each of the four categories as one of high, medium or low priority. One Team member not present also provided scores. Scores were based primarily on the importance of the research activity in trying to address the Team's goals while also taking into account the feasibility and costs, and with an attempt to assign balanced scores (e.g., not everything within a category being scored "high" or "low").

In order to prioritize the research recommendations for the Team as a whole, the scores of high, medium and low were converted to numerical values of 2, 1, or 0 respectively, and values were summed. With this ranking scheme, the potential scores could range from 0 (if all scored a research activity as low) to 30 (if all scored a research activity as high). Because the scores were developed within categories the rankings should not be viewed as representing overall priorities. After discussion at the third Team meeting, two relatively high-ranked questions regarding shortline and kaka line fishing methods were aggregated into a single research question. The Team also recognized that some of the research activities span multiple research categories (e.g., could go under either falser killer whale biology or longline gear and fishing activity) and at the fourth Team meeting one of the recommendations was moved to a different category.

Within-category rankings of research priorities are presented in table 9.1 below. It should be noted that some of these research questions will be addressed with the existing observer program or are likely to be initiated prior to the implementation of the TRP based on assurances provided to the Team that funding will be available. These are highlighted with *.

Table 9.1. Ranking of research recommendations by category.

FALSE KILLER WHALE BIOLOGY	**Scores**
Distinguish FKW calls from other odontocete species	22
Telemetry studies to examine range and movements of FKWs	20
Evaluate FKW acoustic behavior near longlines using recorders on fishing gear	18
Determine range at which a hook in a fish can be acoustically detected by FKW	16
Carry out underwater observations of FKW foraging behavior to understand mechanisms of depredation	16
Mine existing acoustic data from Cross Seamount and elsewhere to assess frequency of FKW occurrence	15
Evaluate acoustic differences between insular vs. pelagic FKWs	12
Assess impact of hook density on FKW ability to follow line	11
Understand FKW foraging and acoustic behavior using acoustic tags	10
Evaluate FKW capability to see floats, as well as monofilament line of different colors and width	7
Conduct vessel sound playbacks to FKWs to determine the distance of reaction and whether insular individuals react	7
Assess FKW response to compounds found in oil fish and other fish species that FKWs do not depredate	4
Test FKW visual acuity using different types of lights	3
Study adaptive learning, particularly by young FKW	2

LONGLINE GEAR AND FISHING	
Evaluate impact of weak hooks on FKW bycatch rates*	30
Understand impact of weak hooks on target species catch rates*	29
Develop methods for fleet to use acoustic recorders to determine FKW presence prior to setting	23
Survey all longline vessels to identify commonalities among those with high depredation rates	16
Evaluate effectiveness of wire loops on hooks as a method to reduce depredation on bait, catch and takes of FKWs (already completed during the deliberations of the Team)	15
Evaluate where FKWs are caught within a set and why	14
Record acoustic profile during setting, soaking, and hauling to assess potential cues to FKWs	11
Assess potential for hooks to be modified (foam coating, etc.) to increase or decrease detection range	10
Record individual sound profile of longline vessels	9
Evaluate potential to use killer whale/other playbacks as deterrents	5
Evaluate feasibility of using moored listening stations (FADs, etc) to determine FKW occurrence before a trip	5
SHORTLINE AND KAKA LINE FISHING	
Determine number of vessels that use shortline & kaka line gear	23
Begin data collection on when and how shortline and kaka line fishing occurs	20
Form an observer program to assess level of FKW and other cetacean bycatch in shortline and kaka line fisheries	18
FALSE KILLER WHALE STOCK ASSESSMENT	
Regular Hawaiian EEZ survey (at least every 5 years) to estimate abundance	29
Continue research into FKW abundance using towed and stationary acoustics	24
Collect additional FKW genetic samples to assess population structure	20
Evaluate alternative methods for estimating FKW abundance, with emphasis on improving precision	19
Develop methods to pro-rate "blackfish" bycatch	16
Develop predictive habitat models of FKW density	13
Evaluate degree of genetic differentiation between insular and pelagic FKW stocks	13

After the ranking exercise was completed during meeting #3 and during meeting #4 there were further discussions about research needs and the following additional items identified:

- The use of mark/recapture studies (either in terms of tags, photo identification, or genetic samples) to supplement information regarding abundance, stock structure, and injury categorization
- The role vessel light and noise profiles have on interactions. These potential cues are complicated and likely involve a combination of profiles and behaviors.
- Further studies to validate the current assignment of mortality and serious injury designations specific to FKW and the pelagic longline fishery.
- Utilize Kina, the UH captive killer whale, to facilitate research including testing of passive deterrence.

- Examine the role of bait type, size, and manner of threading on the hook, on bait depredation.

The team discussion underscored the iterative process inherent in research and the need to maintain this section of the plan in particular as a living document with changes and additions anticipated over the course of the TRT process.

Although the scores were given within each of the four categories noted above, for the purposes of assessing the highest ranked research priorities overall, the Team agreed that it would be appropriate to pool research questions from all four categories; those which received a score of at least two-thirds of the maximum (20) are presented below. This step then generated a list that included at least two questions from each of the four research categories (taking into account the pooling of the two shortline/kaka line questions). Each of these is discussed in more detail below.

Table 9.2. List of the top nine ranked research activities over all four research categories sorted by research category.

Research Category	Research Activity
Longline gear	Evaluate impact of weak hooks/circle hooks on FKW bycatch rates
Longline gear	Understand impact of weak hooks on target species catch rates
Longline gear	Develop methods for fleet to use acoustic recorders to determine FKW presence prior to setting
Shortline/ kaka line fishery	Assess shortline and kaka line fishing: number of vessels, location, timing and method of fishing
FKW biology	Distinguish FKW calls from other odontocete species
FKW biology	Telemetry studies to examine range and movements of FKWs
FKW assessment	Regular Hawaiian EEZ survey (at least every 5 years) to estimate abundance
FKW assessment	Continue research into FKW abundance using towed and stationary acoustics
FKW assessment	Collect additional FKW genetic samples to assess population structure

Evaluate impact of weak hooks/circle hooks on FKW bycatch rates. Since depredating false killer whales frequently leave the head of the fish on the line, the use of circle hooks (which typically embed in the mouth of the fish) should reduce false killer whale bycatch rates. If a FKW is hooked , if hooks that straighten with less force are used (‘weak hooks’) this should increase the likelihood that a hooked false killer whale will straighten the hook and end up being released without gear attached (i.e., reducing the likelihood of serious injury). Long-term

evaluation of bycatch rates using the observer data will be required to evaluate the effectiveness of weak hooks and circle hooks on false killer whale bycatch and serious injury rates.

Understand impact of weak hooks on target species catch rates. Weak hooks have the potential to reduce the false killer whale serious injury rate, but may also influence the catch rates of target species or other non-target species. Assessment of the impact of using weak hooks on the catch rates and size of target species caught, as well as the catch rates of other bycatch (e.g., sharks) needs to be assessed. A controlled experiment with alternating hook types would allow for the assessment of using weak hooks on target species catch rates. A pilot experiment has been funded in cooperation with NMFS, HLA, and the New England Aquarium, that will use 4 vessels and 8 trips to evaluate the difference between 4.5 diameter wire circle hooks and 4.0 diameter wire circle hooks in catch per unit effort of bigeye tuna. Research is expected to commence in the fall of 2010.

Develop methods for fleet to use acoustic recorders to determine FKW presence prior to setting. Minimizing overlap of fishing efforts with false killer whale presence will both reduce depredation of catch and bycatch of false killer whales. Methods need to be developed to use remote radio buoys to alert fishermen of the presence of false killer whales in the area prior to and during setting of gear.

Assess shortline & kaka line fishing: number of vessels, location, timing and method of fishing. There is considerable uncertainty regarding the potential role for false killer whale bycatch in shortline or kaka line fishing, due to a lack of information on the number of vessels using these gear types, where and when they are fishing, and the methods of fishing, including the species of fish being targeted, the amount of gear in the water, hooks being used etc. However it is reasonable to assume that these fisheries likely have interactions with FKW. These fisheries have no observer coverage. Accumulating information on these fisheries is necessary to evaluate their potential role in false killer whale bycatch.

Distinguish FKW calls from other odontocete species. Acoustic methods (e.g., moored acoustic monitors or towed systems from boats) can be used to detect vocalizing false killer whales. Being able to consistently and accurately distinguish false killer whale calls (whistles and clicks) from other species of toothed whales is critical if these methods are to be used in abundance estimation and/or fishery avoidance of false killer whales. False killer whale whistles can be readily distinguished from most other odontocetes in the eastern tropical Pacific (Oswald *et al.* 2003); however, anecdotal reports suggest that discrimination among species in other regions is not as accurate. Further, discrimination of false killer whale echolocation clicks versus those of other odontocetes has not been widely studied.

Telemetry studies to examine range and movements of FKWs. Information on movements of tagged false killer whales can be used to assess which populations are involved in fisheries interactions within or outside of the Hawaiian EEZ as well as assess movements relative to fisheries activity. For example, tag deployments on pelagic animals could be used to assess whether individuals from the Hawaiian EEZ move to the Palmyra or Johnston EEZ; tags on insular animals will help to assess overlap between the insular population and the fishery area.

Efforts to deploy tags on both pelagic and insular individuals will reduce uncertainty in population structure and populations potentially impacted by longline fishing.

Regular Hawaiian EEZ survey (at least every 5 years) to estimate abundance. Potential Biological Removal (PBR) levels are based on EEZ-wide abundance surveys. After 8 years NMFS considers such abundance estimates "stale" and these surveys must be repeated on a regular basis to assess abundance and allow for understanding of changes in abundance over time. Prior to 2010 only one such abundance survey has been undertaken in the Hawaiian EEZ (in 2002). In order to estimate abundance, the Team recommends conducting large-scale surveys (two vessels, at least 175 days at-sea) covering the entire Hawaiian EEZ with both visual and acoustic observations at least every five years.

Continue research into FKW abundance using towed and stationary acoustics. Visual methods for detecting false killer whales in abundance surveys are limited by sea conditions and distance from the vessel. Acoustic methods allow for detecting vocalizing false killer whales at a greater distance than is possible with visual methods, but determination of the probability that any particular group is vocalizing, how vocalization rates may change with group size or time of day, and how the probability of detecting a vocalizing group varies with distance are all needed to accurately assess abundance using acoustics.

Collect additional FKW genetic samples to assess population structure. Genetic analyses of biopsy samples allow for distinguishing stock and range of stocks, as well as assessment of population structure and estimation of effective population size. Additional samples of the pelagic stock in particular are needed in the areas offshore within the Hawaiian EEZ as well as in international waters. These samples should be collected when possible by observers as well as through dedicated research efforts.

9.3 Improvements to Observer Data Collection

On numerous occasions, Team members acknowledged the breadth and value of existing observer data. Unlike other fisheries in the United States, the Hawaii longline fleet has extensive observer coverage (100% in the shallow set and 20% in the deep set), as well as data going back 16 years.

Still, the Team's discussions over the course of the six months of deliberations highlighted several opportunities to further strengthen the focus and approach to current observer data collection. These recommendations, listed below, are intended to provide more detailed data to support future Team deliberations. Some of these recommendations involve recording additional data during interactions, collection of gear or additional samples, or involve activities outside of recording interactions (e.g., collection of biopsy samples or photographs from false killer whales observed when not actively fishing).Those activities requiring changes in data recording protocols should involve appropriate changes to data sheets as well as electronic databases allowing for long-term analyses of collected data.

- Differentiate among mouth hooking types (lip, jaw, internal, ingested, other) when possible.
- Provide more detail on handling of caught animals and any efforts made to release it without gear.
- Record hook type and terminal tackle configuration for caught animals when possible.
- Record when sets are split and the configuration of split sets.
- Record details of vessel light configurations (sodium, spot lights etc) and how these lights are utilized (prior to and during setting and haulback).
- Record presence/absence of FKW during setting and haulback.
- Record FKW sighting data such as location, group size, and behavior, not associated with active fishing (e.g., during transits), as well as visual sighting effort data (e.g., hours of on-deck observation) so that sighting rates can be quantified.
- Retain gear from interactions (gangions/leaders even in the absence of hook).
- If hooks or gear involved in marine mammal interactions are recovered the gear should be closely examined to determine if any marine mammal tissue (abraded skin on leaders or tissue on hooks) is present and if so such gear should be retained in a way would facilitate genetic analyses of tissue samples.
- Provide better photographic equipment and photo-identification training to more experienced observers to support the development of a more robust false killer whale photo-identification catalogue, facilitate mark/recapture abundance estimates, and document animals involved in depredation.
- A sub-set of observers who are specifically trained and qualified, after authorization through a research permit, should attempt to obtain biopsy samples from bowriding false killer whales when possible for stock assessment studies.
- Provide space on observer form(s) to record injuries to crewmen that are incurred associated with gear changes and release of protected species. The data collected should include the nature and severity of the injury and a description of how the injury occurred.

9.4 Collaborative Photo-Identification Research with the Fishery

Photographs of distinctive individual false killer whales can be used to produce abundance estimates using mark-recapture methods, inform delineation of stock boundaries when individuals from known populations are documented, and can be used to assess survival of

individuals, for example, individuals hooked and released that otherwise might be considered seriously injured. Assessment of survival in such circumstances has the potential to contribute to re-assessment of the criteria NMFS uses to determine serious versus non-serious injuries. To date photo-identification research has primarily been undertaken from dedicated research platforms. The Team recognizes that the fishing fleet potentially provides a unique opportunity for obtaining large numbers of photographs of distinctive false killer whales in the waters offshore of the main Hawaiian Islands, and that such photos could contribute to improving stock assessments as well as assessing serious injury criteria.

The Team recommends that NMFS and a subgroup of the Team (e.g., academic and industry) collaborate on developing research protocols to implement a photo-identification research project in conjunction with the fishery (both deep-set and shallow-set) to train interested captains/crew, provide equipment, develop a process for transferring data/images, and determine how data analysis should be completed. This effort would be voluntary and – given equipment expense and training needs – should be targeted only at captains seriously interested in participating in the photo-identification research effort.