FINAL
ENVIRONMENTAL ASSESSMENT

ISSUANCE OF SCIENTIFIC RESEARCH PERMIT #1303 TO THE NATIONAL MARINE FISHERIES SERVICE - HONOLULU LABORATORY

February 2002

Lead Agency: National Marine Fisheries Service - Office of Protected Resources

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The National Marine Fisheries Service, Office of Protected Resources proposes to issue a scientific research permit to the National Marine Fisheries Service - Honolulu Laboratory. If issued, the permit would authorize the Honolulu laboratory to conduct experiments on methods for reducing sea turtle take by longline fisheries in the Pacific Ocean and to allow import of living, deeply hooked sea turtles for treatment and rehabilitation. The permit would authorize these activities for three years beginning in January 2002.

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Summary

National Environmental Policy Act
The National Environmental Policy Act (NEPA) is our basic national charter for protection of the environment. NEPA procedures ensure that environmental information is available to the public and decision makers before decisions are made and before actions are taken. The NEPA process is intended to help public official make decisions that are based on understanding of environmental consequences and take actions that protect, restore, and enhance the environment.

As part of the NEPA process, an environmental analysis must be undertaken to determine whether the action in question will have a significant impact on the human environment and whether an Environmental Impact Statement (EIS) will be required.

Permits issued under Section 10(a)(1)(A) of the Endangered Species Act (ESA) and their modifications are, in general, categorically excluded from the requirement to prepare an Environmental Assessment (EA) or EIS (NOAA Administrative Order 216-6 Environmental Review Procedures) since, as a class, they do not have a significant effect on the human environment. In determining whether the effects are significant, certain factors relevant to the proposed activities were considered: (1) The degree to which the effects on the quality of the human environment are likely to be highly controversial, (2) the degree to which the possible effects on the human environment are highly uncertain or involve unique or unknown risks, (3) the degree to which the action establishes a precedent for future actions with significant effects or represents a decision in principle about future consideration, (4) individually insignificant but cumulatively significant impacts, and (5) the degree to which ESA-listed species or their habitat are adversely affected. However, where a proposed action is new, under extraordinary circumstances in which normally excluded actions may have significant environmental impacts, or the potential impacts are controversial, an EA or EIS is required. Consequently, due to the unusual and controversial nature of this research proposal, NMFS has chosen to prepare this EA to evaluate the need for an EIS, as well as to assist the agency in planning and decision making regarding the final decision to issue a scientific research permit pursuant to Section 10(a)(1)(A) of the ESA.

Section 10 Permits and the Endangered Species Act
Under section 10(a)(1)(A) of the ESA, individuals and organizations may apply for permits from the National Marine Fisheries Service (NMFS) to take ESA-listed species under the jurisdiction of NMFS if such taking is for scientific purposes or to enhance the propagation or survival of the affected species.

History of the Recent Litigation, EIS Development, Section 7 Consultation, Permit Application.
This permit action falls under the umbrella of a larger action undertaken by NMFS in 1999. NMFS developed an EIS for the implementation of the Fishery Management Plan for the Pelagic Fisheries of the Western Pacific Region (PFMP). The FEIS was completed on March 30, 2001.

This action has litigation associated with it. A complete history of the recent litigation and EIS development can be found in Section 1.2 of the FEIS entitled "Need for the Proposed Action" (NMFS, 2001a). Copies of the EIS are available from the Southwest Regional Office website (http://swr.nmfs.noaa.gov/piao/eisdocs.htm) or by contacting:

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Section 7(a)(2) of the ESA (16 U.S.C. § 1531 et seq.) requires that each federal agency shall ensure that any action authorized, funded, or carried out by such agency is not likely to jeopardize the continued existence of any endangered or threatened species or result in the destruction or adverse modification of critical habitat of such species. When the action of a federal agency may affect a protected species, that agency is required to consult with either the NMFS or the U.S. Fish and Wildlife Service, depending upon the protected species that may be affected. A complete consultation history for previous consultations under the Pelagics FMP can be found in the November 3, 1998, biological opinion on the reinitiated consultation for the Pelagics FMP Hawai'i North Central Pacific Longline Fishery (NMFS, 1998). That opinion found that the proposed action was not likely to jeopardize the continued existence of listed sea turtles or Hawaiian monk seals, and established anticipated incidental take levels for sea turtles captured by the Hawai'i-based longline fishery. The opinion also required continuation of the observer program for the fishery, handling procedures for incidentally captured sea turtles and review of the circumstances surrounding the observed capture of any leatherback turtle. In a May 18, 2000, memo to the Director of the NMFS Pacific Islands Area Office (PIAO), the Southwest Fisheries Science Center (SWFSC), which is responsible for calculating the estimates of incidental take occurring in the Hawai'i-based longline fishery, it was indicated that the Hawai'i-based longline fishery had likely exceeded anticipated incidental take levels of olive ridley turtles (NMFS, 2000a). On June 7, 2000, the Southwest Region reinitiated consultation on the fishery (NMFS 2000b). NMFS issued its Biological Opinion on the reinitiation on March 29, 2001 on the Authorization of Pelagic Fisheries under the PFMP.

On December 12, 2001, the NMFS Acting Regional Administrator, Southwest Region, Rodney McInnis, signed a memorandum to Donald Knowles, the Director of the NMFS Office of Protected Resources, reinitiating consultation on the effects of the Western Pelagic Fisheries on sea turtles under section 7(b) of the Endangered Species Act, 16 U.S.C. ' 1536(b). NMFS reinitiated the March 29, 2001, consultation because new information is available which may improve NMFS' ability to quantify and evaluate the effects of the pelagic fisheries under the Fishery Management Plan (FMP) for the Pelagic Fisheries of the Western Pacific Region and the reasonable and prudent alternative in the Biological Opinion on listed sea turtle populations. The new information available consists of an improved sex- and age- class structured stochastic simulation model of leatherback sea turtle population dynamics, recent eastern Pacific leatherback population censuses for the 2000/2001 season, fewer vessels are operating than what was anticipated under the March 29, 2001 Reasonable and Prudent Alternative, new observer data collected since 1999, and correction of a minor error to the anticipated take in the incidental take statement. If the evaluation of this new information and conclusions drawn as a result of this reinitiation of the March 29, 2001, biological opinion constitute significant new information that would change the evaluation and conclusions of the opinion issued for research permit #1301, NMFS will reinitiate this biological opinion and conduct further NEPA analysis if appropriate.

Under regulations promulgated for Section 7(a)(2), NMFS-OPR can include "conservation recommendations" in biological opinions. "Conservation recommendations" are defined at 50 CFR 402.02 as:

> ".. suggestions of the Service regarding discretionary measures to minimize or avoid adverse effects of a proposed action on listed species or critical habitat or regarding the development of information."

In its March 29, 2001, opinion, NMFS-OPR included the following conservation recommendation:

> "NMFS should research modifications to existing gear that (1) reduce the likelihood of gear interactions and (2) dramatically reduce the immediate and/or delayed mortality rates of captured turtles (e.g., visual or acoustic cues, dyed bait, hook type). All research funded and/or implemented by NMFS must be covered by a research and enhancement permit pursuant to section 10(a)(1)(a) of the ESA. The goal of any research should be to develop a technology or method, via a robust experimental assessment, which would achieve the above two goals and remain economically and technically feasible for fishermen to implement."

Several industry/academia/government workshops were held to address possible gear and or fishing tactic modifications with potential to reduce sea turtle interactions with pelagic longline gear (Williams et al., 1996; Kleiber and Boggs, 2000; Anon., 2000; Anon., 2001a; Anon., 2001b; Watson, 2001a). Pelagic longline observer data were analyzed to examine gear, environmental, and operating practices associated with sea turtle longline interactions (Kleiber, 1998; McCracken, 2000; Cramer and Adams, 2000; Hoey, 1998, 2000; Hoey and Moore, 1999; and Yeung, 2001). Data and information and recommendations from these reports are the basis for planned research to develop and evaluate longline gear modifications to reduce interactions with listed sea turtles.

The goal of this proposed research is to develop methods to reduce turtle take and retain viable fishing performance that may be adopted by the U.S. pelagic longline fleet as an alternative to more restrictive sea turtle protection measures, such as closures. The technologies developed through this research are expected to be transferrable to other nations' fleets as well, so this work will address the larger problem of sea turtle bycatch by pelagic longlines throughout the entire Pacific Ocean and in other regions where sea turtle bycatch is a concern. The researchers believe that the proposed work directly addresses one of the most pressing conservation research question facing sea turtles worldwide.

On May 1, 2001, NMFS' Office of Protected Resources (NMFS-OPR) received a complete application for a scientific research permit from Dr. R. Michael Laurs, NMFS-Southwest Fisheries Science Center - Honolulu Laboratory (NMFS-Honolulu). After making a preliminary determination that the application was complete and in compliance with section 10(a)(1)(A) issuance criteria, and as required by CFR 222.24 (a), NMFS published a notice of receipt in the Federal Register on May 10, 2001, (66 FR 23882). The 30-day public comment period closed on June 11, 2001.

During the development of the application and permit materials, it was determined by NMFS-OPR that a supplemental EA was necessary to assess the impacts of issuing a scientific research permit for the take of turtles associated with the research being conducted in Hawai'i-based longline fishery.

1.00 **Purpose of and Need for Action**

The purpose of this environmental assessment (EA) is to evaluate the potential environmental effects as a consequence of the NMFS-OPR action of issuing a permit (#1303) to NMFS-SWFSC-Honolulu Laboratory for an annual take of ESA-listed sea turtles under the jurisdiction of NMFS associated with the proposed research activities.

1.1 Need for the Proposed Action - The issuance of this permit is needed to address a priority one recovery goal cited in the Final Recovery Plans for the U.S. Pacific Populations of the Loggerhead, Leatherback, Olive Ridley and Green turtles issued by NMFS and the US Fish and Wildlife Service (FWS). NMFS and FWS specifically identify the monitoring and reduction of incidental mortality in commercial fisheries as a recovery action needed for all four species proposed to be taken if the permit is issued.

In a November 23, 1999 injunction, the Court stated that ...NMFS "conduct research into gear modification that would reduce incidental take."

In the March 29, 2001, opinion, NMFS identified Conservation Recommendations that NMFS can adopt to benefit the species by minimizing or avoiding adverse impacts of a proposed action, help implement recovery plans or develop additional information on the species. Conservation recommendation #1 specifically identified research to reduce or prevent turtle interactions with longline fishing gear.

> "NMFS SHOULD RESEARCH MODIFICATIONS TO EXISTING GEAR THAT (1) REDUCE THE LIKELIHOOD OF GEAR INTERACTIONS AND (2) DRAMATICALLY REDUCE THE IMMEDIATE AND/OR DELAYED MORTALITY RATES OF CAPTURED TURTLES (E.G., VISUAL OR ACOUSTIC CUES, DYED BAIT, HOOK TYPE). ALL RESEARCH FUNDED AND/OR IMPLEMENTED BY NMFS MUST BE COVERED BY A RESEARCH AND ENHANCEMENT PERMIT PURSUANT TO SECTION 10(A)(1)(A) OF THE ESA. THE GOAL OF ANY RESEARCH SHOULD BE TO DEVELOP A TECHNOLOGY OR METHOD, VIA A ROBUST EXPERIMENTAL ASSESSMENT, WHICH WOULD ACHIEVE THE ABOVE TWO GOALS AND REMAIN ECONOMICALLY AND TECHNICALLY FEASIBLE FOR FISHERMEN TO IMPLEMENT."

1.2 Objectives of the Proposed Action - The objective of the permit is to conduct research that will lead to a reduction in the number of sea turtles incidentally caught in the U.S. pelagic longline fishery in the Pacific ocean, and potentially in longline fisheries throughout the Pacific ocean that incidentally capture endangered and threatened sea turtles.

1.3 Related EISs/EAs that Influence the Scope of this EA - This EA was proceeded by an Environmental Impact Statement developed for the implementation of the Fishery Management Plan for the Pelagic Fisheries of the Western Pacific Ocean. The FEIS was completed on March 31, 2001. This permit, if issued, would take place with the boundaries of the Hawai'i-based longline fishery evaluated in that FEIS.

1.4 Relevant Federal, State, and Local government, and Public Involvement - The permit request underwent a 30-day public comment period following notification of receipt in the Federal Register. The application was also submitted to research professionals, University professors, and NMFS staff with expertise in endangered and threatened sea turtles.

1.5 Decision that Must be Made - The decision that must be made by NMFS-OPR is whether to issue the permit, and if the permit issued, whether to issue it as requested in the application materials.

1.6 Alternative design, evaluation, and selection criteria - The alternatives were developed by reviewing the permit application, March 2001 FEIS, March 2001 Biological Opinion, Final Recovery plans for Pacific populations of green, loggerhead, leatherback and olive ridley sea turtles. The preferred alternative should meet five selection criteria:

1.6.1 Respond to Conservation Recommendation #1 from the March 29, 2001 Biological opinion;
1.6.2 Responds to the Court's November 23, 1999 injunction that called for NMFS to conduct research into gear modification that would reduce incidental take;
1.6.3 Responds to the Priority 1 Recovery Goal calling for monitoring and reduction of incidental take in commercial fisheries for all four species of turtles covered by the proposed permit;
1.6.4 Must meet all Section 10(a)(1)(A) issuance criteria, and;
1.6.5 Must not result in a jeopardy finding under Section 7(a)(2) of the ESA.

1.7 Issuance criteria- NMFS can deny the permit if it does not meet the issuance criteria spelled out in the implementing regulations for permits issued under section 10(a)(1)(A) of the ESA. There are twelve criteria an application must meet before a permit can be issued for the proposed research. All of the criteria must be met. These criteria are:

1.7.1 Whether the permit was applied for in good faith;
1.7.2 Whether the permit, if granted and exercised, will not operate to the disadvantage of the listed species;
1.7.3 Whether the permit would be consistent with the purposes and policy set forth in section 2 of the Act;
1.7.4 Whether the permit would further a bona fide and necessary scientific purpose or enhance the propagation or survival of the species; taking in to account the benefits anticipated to be derived on behalf of the endangered species;
1.7.5 Review the status of the population of the requested species and the effect of the proposed action on the population, both direct and indirect;
1.7.6 Whether the applicant's qualifications for the proper care and maintenance

of the species and the adequacy of the applicant's facilities, if a live animal is to be taken, transported, or held in captivity;

1.7.7 Whether alternative non-endangered species or population stocks can and should be used;

1.7.8 Whether the animal was born in captivity or was (or will be) taken from the wild;

1.7.9 Provision for disposition of the species if and when the applicant's project or program terminates;

1.7.10 How the applicant's needs, program, and facilities compare and relate to proposed and ongoing projects and programs;

1.7.11 Whether the expertise, facilities, or other resources available to the applicant appear adequate to successfully accomplish the objectives stated in the application, and;

1.7.12 Opinions and views of scientists or other persons or organizations knowledgeable about the species which is the subject of the application or of other matters germane to the application.

2.0 Alternatives Including the Proposed Action

The proposed action and four alternatives considered in this EA are: (1) take no action (i.e. no permit issued); (2) issue the permit with conditions as requested in the permit application (proposed action); (3) permit based on a high confidence sampling for the minor gear modification (test use of blue-dyed bait and moving branch line); (4) issue the permit based on a one-year design; and (5) issue the permit without the stealth gear and deep-set daytime fishing CPUE. The following summary describes major aspects of the proposed action and alternatives.

2.1 Description of Alternative 1 - No Action (No Permit Issued)

Under this alternative, NMFS-OPR would not issue the scientific research permit to NMFS-SWFSC and the proposed research on turtle/fishery interaction would not be conducted and NMFS would not be able to obtain the data regarding differing gear configurations and turtle interactions. Due to the Reasonable and Prudent Alternatives listed in the March 29, 2001 opinion, the National Marine Fisheries Service - Office of Sustainable Fisheries (NMFS-SF) closed the fishing area north of the equator to swordfish style longline fishing to protect endangered leatherback, endangered and threatened green and threatened loggerhead turtles. NMFS-SF prepared an emergency rule closing this area on June 12, 2001 (66 FR 31561) and effective through December 10, 2001. NMFS extended the closure through June 8, 2002 (66 FR 63630, December 10, 2001). This alternative does not reach the objective of the proposed action: "to conduct research that will lead to a reduction in the number of sea turtles incidentally caught in the U.S. pelagic longline fishery in the Pacific ocean, and potentially in longline fisheries throughout the Pacific ocean that incidentally capture endangered and threatened sea turtles." The No-action alternative does not respond to Conservation Measure #1 placed in the March 29, 2001, opinion, or to the #1 priority recovery goal found in the final recovery plans for all four species of turtle covered by the permit.

2.2 Description of Alternative 2 (Proposed Action) - Issuance of the permit as requested by the applicant

The National Marine Fisheries Service's Office of Protected Resources proposes to issue a scientific research permit (#1303) under Section 10(a)(1)(A) of the ESA to the Southwest Fisheries Science Center, Honolulu, Hawaii, to: (1) take sea turtles while conducting experiments on fishing gear modifications for reducing sea turtle take by longline fisheries; (2) take sea turtles while conducting experiments to test the viability of fishing gear modifications for catching targeted fish species; and (3) import live, deeply hooked, hard-shelled sea turtles for treatment to alleviate hooking damage and to monitor the progression of ingested hooks. The goal of the first part of the experiment is to test modifications to fishing gear that evidence suggests should reduce sea turtle take by longliners, and which evidence also suggests will maintain viable fishing performance. The goal of the second part of the experiment (2) is to see if more radical gear modifications have viable fishing performance, without which there is no point in exposing turtle populations to further testing of those modifications. The ultimate purpose of both parts (1 and 2) is that (a) such measures can be used as an alternative to more restrictive sea turtle protection measures for the domestic longline fishery, such as time and area closures, and (b) foreign longline fisheries worldwide can be encouraged to adopt these fishing methods. Gear modification measures are believed to be the most easily and consistently adopted measures throughout the domestic and international longline fleets and therefore are expected to achieve the greatest conservation benefit for sea turtles. The research is in response to a Conservation Recommendation placed on NMFS in the March 29, 2001, biological opinion for the Pelagics FMP (NMFS, 2001). This research furthers NMFS' compliance with ESA section 7(a)(1) to utilize their authorities in furtherance of the pruposes of the ESA by carrying out programs for the conservation of endangered and threatened species.

The following description of the proposed research is taken from the May 1, 2001, permit application.

All research activity under this permit will be conducted by fishery biologists, biological technicians, fishery observers, vessel operators and crew of Hawaii-based longline fishing vessels. Fishery observers working for the National Marine Fisheries Service (NMFS) Pacific Islands Area Office (PIAO) will supervise most of the experiments which will be conducted on contracted fishing vessels. The principal investigator and principal field supervisor may also recruit fishery technicians to supervise some of the experiments. No experiments will be conducted by vessel operators without supervision by a NMFS employee or contracted fishery biologist, biological technician, or fishery observer.

Under the scientific research permit, fishing vessel operators will be contracted to use their fishing vessels to conduct the fishing experiment under the direction of field supervisors. Catch of target species will be sold to reduce the cost of the contracted fishing operations. In addition, catch sales data will be used to demonstrate the relative economic viability of modified fishing operations in comparison with unmodified fishing operations. Vessel operators will be chosen through an interview process conducted by NMFS that will focus on aptitude, adherence to rules, understanding of technical requirements, and motivation. Vessel operators under consideration will participate in a workshop covering the fishing technology and contract requirements of the experiments and will be tested on their comprehension to ensure understanding of the experiment, the terms and conditions of their contracts, and the role of their field supervisor. Field supervisors working for NMFS (fishery biologists, biological technicians, or fishery observers trained in turtle handling procedures) will oversee all turtle takes by each fishing vessel and terminate participation by any vessel operator or crew member who does not adhere to research protocols and turtle handling procedures. Furthermore, all measures that have been implemented by regulations in the commercial fishery to reduce the mortality of the bycatch will be used in the experiments (CFR §223.206(d)(1)), including the handling and release of turtles captured, resuscitation, etc. In addition, takes of sea turtles in the experiments will be reported to NMFS on a real-time basis using single sideband radio or the satellite vessel monitoring system. If at any time NMFS determines that the take levels for the experiment have been exceeded or are likely to be exceeded in the control and treatment fishing operations required by the experimental design, then NMFS will cease the experiment.

Vessels contracted for this experiment will fish in typical fishing areas and will strictly adhere to the general parameters presented in Table 1 for experiments with swordfish-style and tuna-style of fishing, respectively. As explained further below, the only experiment that is planned for both styles of fishing is the testing of stealth fishing gear for the viability of target species catch per unit effort (CPUE). Experiments will be conducted throughout the year, depending on the availability of contracted vessels. Tuna style fishing may occur during April and May, but will avoid the closed area established to protect sea turtles (50 CFR 660.34(c)).

If issued as requested in the application materials, the permit would authorize the taking (non-lethal and lethal) of endangered and threatened sea turtles in the Pacific ocean. Table #2 presents the proposed authorized take over the three-year life of the permit.

Table 1. Average of fishing gear parameters for the Hawaii-based longline fishery using two styles of fishing: Swordfish-style fishing and tuna-style fishing.

Gear/Trip Type	Swordfish Fishing	Tuna Fishing
Area Fished	North of Hawaiian Islands	South of Hawaiian Islands
Main line Length	42 miles	34 miles
Shooter Used	No	Yes
Vessel Speed	7.8 knots	6.8
Lightsticks Used	Yes	No
Branch Line Length	17 meters	13 meters
Float Line Length	8 meters	22 meters
Number of Hooks per Set	820 hooks	1,690 hooks
Number of Hooks per Float	4 hooks	27 hooks
Number of Floats	189 floats	66 floats
Type of Hook	J-shaped	Tuna
Type of Bait	Squid	Saury
Target Depth	28 meters	167 meters
Gear Soaks	Night	Day
Soak Time	20 hours	19 hours

Table #2 - Total Turtles Authorized over 3-year life of permit.

Species	Total Take of Turtles	Lethal Take of Turtles
Green	15	6
Leatherback	44	15
Loggerhead	233	87
Olive Ridley	24	9
Total	311	117

The permit would authorize NMFS-Honolulu to capture sea turtles using longline gear to determine methods to reduce the lethal and non-lethal take of turtles in the commercial Hawai'i-based longline fishery. The permit would authorize NMFS' researchers, operating aboard commercial longline vessels to capture, handle, measure, photograph, collect skin biopsies, flipper, PIT, radio/sonic and/or satellite tag and release turtles incidentally captured in the longline fishery. Turtles that have been deeply hooked and are small enough to be brought onboard the vessel would be brought back to Hawai'i for medical care and rehabilitation if the turtle is captured when the vessel is within 72 hours of returning to port (Table #3). Turtles brought back to port would be given medical care by a veterinarian trained in rehabilitating marine turtles. After rehabilitation, the turtles would be returned to the wild within a 72 hour radius of Honolulu. These turtles would be flipper & PIT tagged, have skin biopsies collected from them and have a satellite transmitter attached to them for long-term monitoring.

Table #3 - Deeply Hooked turtles returned to Honolulu for rehabilitation

Species	Annual Estimated Turtles Transported to Honolulu for Rehabilitation
Green	3
Loggerhead	12
Olive ridley	12

After evaluating the different gear modifications and their ability to reduce interactions between turtles and the longline fishery, NMFS plans to export the technology to foreign countries that have fisheries in the Pacific ocean that have been recorded to interact with sea turtles.

If NMFS issues the permit as requested in the application, a limited number of commercial longline vessel operators will be recruited by NMFS to conduct research activities, under the direct supervision of NMFS personnel or NMFS' contractors.

The U.S. longline fishery is a small segment of the total amount of longline fishing that occurs in the Pacific Ocean. Conducting fishing experiments on sea turtle take reduction methods may ultimately increase the likelihood of survival and recovery of the sea turtle populations by reducing takes and mortalities in domestic and international longline fisheries and by increasing sea turtle conservation awareness throughout the fishing community.

Fishing vessel operators participating in the experiments will receive training on the experimental protocols and data collection requirements and the terms and conditions of participating in the experiment. The NMFS principal investigators for these experiments will ensure and confirm that the participating vessel operators comprehend the experimental protocols and the terms and conditions under which they will be allowed to operate. There will be a written, signed agreement specifying cooperative participants responsibilities. Failure of vessel operators to comply with experiment protocols or the agreement will result in the termination of their participation in these experiments under the permit. Fishermen must agree to follow these instructions for setting their gear. NMFS observers will oversee the operations and record results.

2.2.1 Experimental Design

A. Gear modification (test use of blue-dyed bait and moving branch line)

Two modifications to fishing practices which have been determined to have promise for reducing turtle takes while having only minor impacts (if any) on fishing performance (target species CPUE) are the use of squid bait dyed blue with food coloring and the removal of branch lines attached to the main line closest to the float line attachment points. Therefore, the first portion of the proposed research would simultaneously test a combination of these two experimental gear modifications as a single experimental fishing treatment against a control. The experiment would test the effect of longlining for swordfish using blue-dyed bait and moving the nearest branchlines to at least 40 fathoms from the nearest floatline and comparing this method to standard (i.e. control) fishing operations. Data analyses and results, in combination with results of a similar study undertaken by NMFS in the Atlantic, would determine the efficacy of the combined method for reducing sea turtle bycatch compared to normal fishing operations. This portion of the experiment will involve the majority of time and effort (3 years) and will also have the most impact to turtles (i.e. higher turtle take than other portions of the experiment).

A limiting condition of the proposed experiment is the need to minimize the take of endangered and threatened sea turtles while retaining the statistical power necessary to detect a significant effect of the bycatch reduction treatment. Turtle takes are rare events in the Hawaii-based fishery and they have the statistical power of a Poisson distribution, in which the standard deviation is as large as the mean. In such circumstances, the statistical power of a controlled experiment depends on the number of turtles taken in control and treatment operations (see attachment 1 to the May 1, 2001, permit application) and not on the number of fishing operations (sets). Therefore, to increase the power of the experimental tests, it is best to use the fishing style with the greatest turtle take rate, which, in the Hawaii-based longline fishery, is swordfish-style fishing. This type of fishing is the best for testing sea turtle take reduction measures because, based on historical data, it will have a higher take rate and will provide more rapid statistical confirmation of bycatch reduction by contrasting control and treatment operations. This is also the type of fishing that has been prohibited by the March 29, 2001, biological opinion for non-research purposes because of the high take rates of sea turtles.

The objective of the experiment will be to test whether a treatment reduces turtle takes versus a control. The experiment will continue until a fixed number of turtles are caught, often referred to as a "sequential" experiment. Because alternating treatments with controls along a single longline will not result in independence between control and treatment if the control sections (e.g. highly visible undyed squid) attract turtles to the adjacent treatment sections, full sets will serve as the experimental unit for testing any treatment that involves the attractiveness of the longline to turtles or to target species. The applicants have assumed that turtle takes come from two distributions (in the statistical, not the biological sense), a treatment group and a control group, and that within each group, turtle takes at the set level are independent identically distributed Poisson variates.

A power analysis was conducted to scope out a variety of sample sizes required to detect a bycatch method that has different degrees of effectiveness in comparison with the control fishing method (see attachment 1 in the May 1, 2001, permit application). Because leatherback turtles "arguably the species for which results are needed most badly due to the presumed dire status of the population," (see application p. 20) the applicants chose this species to focus on for the experimental design. Take numbers required to detect a 25% effective treatment are much higher than those required to detect a 50% effective treatment because of the lower signal-to-noise ratio when the treatment is closer to the control method (Table 4 in the permit application). The higher the type I (alpha, attachment 1 in the application) and type II (beta, attachment 1 in the application) error rates that can be accepted, the lower the sample sizes required.

The applicants have proposed a one-sided composite test where the null hypothesis is that the treatment reduces turtle takes by 50% or more versus the alternative hypothesis that the treatment reduces turtle takes by less than 50%. Using the highest level of type I and II error rates that the investigators can accept, and anticipating that the treatment will be at least 50% effective in reducing take of leatherbacks, the preferred design will take a total of 36 leatherbacks spread out over 3 years (Table 4). If the treatment is 50% effective, 12 of these turtles will be caught by treatment fishing operations and 24 will be caught by control operations and the results will be statistically significant at the alpha = 0.10 level and beta = 0.20 level . The required take is 12 leatherbacks per year (36 leatherbacks in 3 years), the number given in the summary of designs. Fractional numbers are raised to the nearest whole integer in summarizing annual takes.

Table 4. Sea turtle takes/mortalities per year in minor gear modification experiment, with significant (50% effective*) leather back findings in 3 years.

				Concomitant takes per year (other species)					
Error Levels		Leatherbacks/year		Loggerheads/year		Olive ridleys/ year		Greens/year	
Alpha	Beta	Takes	Morts	Takes	Morts	Takes	Morts	Takes	Morts
0.10	0.20	12	4	65	24	6	2	4	1

*treatment reduces leatherback take by 50% compared with control

Equal numbers of treatment and control operations (sets) will be conducted but the total number of sets listed is just an estimate based on historical capture rates of turtles by swordfish style fishing gear (leatherbacks - 0.0154/set; loggerheads - 0.0829/set; olive ridley - 0.0078/set; green - 0.0044/set). Again, the statistical properties of Poisson-distributed data are such that the number of sets is not critical to the test, and the experiment will be limited to the number of turtle takes required, not the number of sets estimated. If more sets are needed to reach the required number of observed turtle interactions, additional fishing operations will be contracted. The estimated total number of sets per year for this portion of the experiment will be 1,039, a third of the 3,117 sets that may be required over three years.

The estimated number of fishing operations required for finding a statistically significant effect of a bycatch reduction measure that is 50% effective for leatherback turtles will have a concomitant take of other turtle species, based on the historical rate of interactions with those species by the type of fishing operations that will be used in the experiment. The requisite number of operations for the preferred leatherback experimental design will probably result in a take of loggerhead turtles (65 per year, Table 4) sufficient at an alpha level of 0.05 and a beta level of 0.10 to find a significant effect of a 50% effective bycatch reduction method in only 1 year (61 per year, Table 5 in the permit application). If the experiment is conducted for the full three-year estimated time period, this take will reach 195 loggerhead turtles which is enough to find a significant effect of a treatment that is only 30% effective at a lower, but acceptable error level. Since this design dovetails so well with the leatherback design it is incorporated in the preferred design for leatherbacks.

B. Testing "stealth gear" and deep-set daytime fishing for CPUE viability

Because of sea turtles' association with floating objects and possible attraction to anomalies in what otherwise is a featureless ocean, the applicant proposes to test the use of "stealth" gear - longline gear that has been camouflaged in order to be less visible to sea turtles. Before determining whether this major gear modification may reduce sea turtle interactions, the applicants first want to ensure that CPUE of target species using these modifications is still comparable to standard longline fishing. Therefore, reducing the visibility of longline gear to sea turtles by using "stealth" longlines with major gear modifications is proposed for testing viability in maintaining target species CPUE in both swordfish-style (shallow set, nighttime) and tuna-style (deep-set, daytime) fishing operations and comparing to standard (i.e. controlled) swordfish- and tuna-style operations. Any information regarding sea turtle interaction rates will be secondary.

The treatment sets will utilize floats that are blue on the bottom and orange on top, and control sets will utilize typical floats that are orange all over. The treatment sets will also use dark grey monofilament for main line, float lines, and branch lines, while the control sets will use typical longline gear (i.e. visible). Battery powered, narrow-frequency, yellow light emitting diode- (LED) based, down-welling (shaded on the upper half) light sticks will be used on stealth gear (treatment), and regular yellow chemical light sticks will be used on standard gear (control). Lastly, for stealth gear (treatment), the metallic shine of the branch line and float line snaps will be removed or they will be painted, and the bait will be dyed blue (described in Boggs (2000)), while controls will use natural (i.e. un-dyed) squid and longline gear used by typical Hawaii-based longline fishers. The applicants have stated that they need at least 3 fishing trips (i.e. 30 sets) with controls for a credible demonstration in both types of fishing operations. Therefore, there will be 30 control sets and 30 treatment sets each for swordfish-style and for tuna-style fishing operations (120 sets total).

Information will be collected on sea turtle bycatch during this portion of the experiment, but because few sets will be needed to determine differences in CPUE, there will not be a sufficient number of sets to determine statistically whether stealth gear reduces sea turtle interactions. Based on the number of sets needed to test CPUE viability, and on historical catch rates of the four species of turtles likely to be encountered by both swordfish-style[1] and tuna-style[2] fishing, the applicants have estimated the number and species taken (and killed) during this portion of the experiment.

Similar testing of target species CPUE is proposed for deep-set daytime swordfish fishing. This proposed method would target swordfish deep, where they descend during the day, using swordfish-type bait and lightsticks in areas where near-surface nighttime swordfish abundance is high. Deep daytime fishing operations for swordfish will use a depth configuration comparable to that of tuna gear, which will be modified based upon results expected within the next few months from swordfish recently tagged with pop-up satellite transmitting archival tags (PSATs). These tags will report the typical daytime depth distribution of swordfish. Target depth will be achieved using a main line shooter and a much greater length of main line and greater number of hooks between floats while maintaining the standard swordfish-style number of branch lines per set. Depth will be measured with time-depth recorders to ensure target depths are achieved. The applicants have stated that 30 sets will be needed to demonstrate target species CPUE viability.

Information will be collected on sea turtle bycatch during this portion of the experiment, but because few sets will be needed to determine CPUE viability, there will not be a sufficient number of sets to determine statistically whether deep set daytime fishing for swordfish reduces sea turtle interactions. Based on the number of sets needed to test CPUE viability, and on historical catch rates of the four species of turtles likely to be encountered by swordfish-style fishing, the applicants have estimated the number and species taken (and killed) during this portion of the experiment. These take levels have been combined with the estimates for the "stealth" gear experiment and are presented in Table 5.

Every effort would be made to avoid taking any turtles in the stealth and deep swordfish fishing tests for target species CPUE. This will be accomplished by trying to schedule direct experimental fishing effort to times and areas where the target fish species CPUE was historically high and the turtle take rates were low. No sea turtle takes are needed for initial tests of these methods, which are intended to demonstrate CPUE, although some

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[1]Applicants have used the following sea turtle interaction rate based on historical takes in the Hawaii-based longline fishery using swordfish-style fishing: 0.0044 greens/set; 0.0154 leatherbacks/set; 0.0829 loggerheads/set; and 0.0078 olive ridleys/set.

[2]Applicants have used the following sea turtle interaction rate based on historical takes in the Hawaii-based longline fishery using tuna-style fishing: 0.0025 greens/set; 0.0055 leatherbacks/set; 0 loggerheads/set; and 0.0153 olive ridleys/set

loggerheads, a few leatherbacks, olive ridleys, and green turtle takes are anticipated, based on historical interaction rates in the Hawaii-based longline fishery.

The stealth and deep day swordfish experiments will be conducted at the same time, and in the same area, with three vessels: one conducting control operations to demonstrate high near-surface abundance of target species, another conducting stealth tests, and the third conducting deep daytime fishing for swordfish. Thus there will be some economizing of the control operations to serve two purposes. In testing the stealth gear with tuna style fishing there will be only two vessels, as both stealth and control fishing operations will be conducted deep during the day. The vessels would fish south of the Hawaiian Islands, in areas currently open to Hawaii-based tuna fishing operations. This portion of the experiment is estimated to last no longer than one year. In addition, with a low number of sets, these experiments are expected to have low levels of sea turtle take.

Table 5. Stealth gear and deep daytime swordfishing tests to demonstrate CPUE viability

Number of sets			**Synoptic Vessels**	**Total Turtle Takes/Mortalities (one year experiment)**							
Control	Stealth	Deep Day		Leatherback		Loggerhead		Olive ridley		Green	
60	60	30	3	2	1	8	3	2	1	1	1

C. Testing use of hook timers and hook type

Measuring trends in the time and depth of sea turtle captures could reveal particular time intervals or depths of longline operations for which sea turtles are most vulnerable, revealing possible modifications to fishing operations for future testing. The use of hook timers, in conjunction with time-depth recorders (Boggs, 1992) is proposed for this purpose. Hook timer experiments will be conducted using standard swordfish style gear fitted with hook timers as described by Boggs (1992). No controls are used, and the comparison is between different times and depths within the combined fishing operations. Based on research conducted on fish (Boggs, 1992), the applicants anticipate that 30 hook timer readers (i.e. 30 observations of a sea turtle species taken by longline) are needed in order to detect trends in turtle capture time or depth. Based on historical take levels in the swordfish fishery, the applicants anticipate that two years are needed for this portion of the experiment.

The testing of large (18/0) circle hooks for the viability of target species CPUE is proposed as a piggyback project during the hook timer measurements. Therefore, this experiment will utilize alternating "J" and 18/0 circle hooks on all hook timer operations. The applicants anticipate that this portion of the experiment will only require one year to demonstrate credible results. Experiments comparing 16/0 circle and J hooks in the Azores (Bolton and Bjorndal, 1999) and in the North Pacific (LaGrange, 2001) reduced the severity of injury of a hooked turtle; however the target species CPUE was reduced the by 30-50%. Both Bolton (personal communication) and LaGrange (personal communication) have suggested that larger (18/0) circle hooks could increase the viability of target species CPUE. Therefore testing larger circle hooks is proposed for this purpose. Because testing of different hook types differs only in their mechanical effects after a target species (or turtle, in the hook timer portion of the experiment) interacts with the hook, treatment and controls can be applied independently on the same set without pseudo-replication. If the 18/0 circle hooks are as effective at catching target species as the standard J hook, then the implementation of this gear modification in longline fisheries may reduce the severity of sea turtle injuries, thereby increasing post-release survivability.

Table 6 shows the number of sets anticipated per year to detect trends in loggerhead capture time or depth. Loggerheads have been chosen since, based on historical capture records, this is the species most likely to interact with the swordfish fishery north of the Hawaiian Islands. Other sea turtle species will be taken concomitantly with loggerheads, as shown in the table.

Table 6. Hook timer and hook type experiments, estimated effort, turtle take/mortality per year.

Total Years	Sets / year	# Full-time vessels	Loggerheads/yr		Leatherbacks/yr		Olive ridleys/yr		Greens/yr	
			Takes	Morts	Takes	Morts	Takes	Morts	Takes	Morts
2	181	2	15	6	3	1	2	1	1	1

Handling and research activities other than capture will be covered by permit #1190 issued to NMFS-Southwest Region on March 8, 1999. Permit #1190 and its modifications have qualified for categorical exclusion under the NOAA NEPA regulations and policies (NOAA Administrative Order 216-6 Environmental Review Procedures). However, since permit#1303 relies on permit #1190 for authorization to conduct sampling and other research activities, the effects of the activities authorized under permit #1190 are included here for clarification.

2.2.2 Turtle Handling Procedures

NMFS observers, technicians, fishing captains and crews will receive training on handling procedures for turtles encountered during the experiments under this permit. Training will be conducted by qualified NMFS personnel. Training will follow the guidelines and recommendations in Balazs *et.al.* (1995) and NMFS (2001: Manual for Sea Turtle Life History Form) and modified procedures using line and hook cutting and de-hooking devices (Anon, 2001b) being developed by NMFS. All vessels participating in these experiments will be equipped with dip nets, line and hook cutters, and de-hooking devices and training provided in the recommended procedures for using these devices to reduce post hooking or entanglement injury and mortality. A laminated instruction card will be provided to each observer and vessel to be prominently displayed near the gear hauling station for instant reference.

Captains, crews, and observers will be required to scan main line as far ahead as possible during gear retrieval to sight turtles in advance and not get ahead of the main line while retrieving gear. Upon sighting a turtle the vessel and main line reel speed will be slowed and the vessel direction will be adjusted to move toward the turtle to minimize tension on main line and branch line with turtle. When the snap of the branch line is in hand, the vessel will continue to move toward the turtle at a speed as slow as possible, if not possible vessel will stop with engine out of gear and turtle will be brought along side the vessel. Branch line will be retrieved slowly keeping a gentle consistent tension on the line. Slack will be maintained on the branch line to keep the turtle near the vessel and in the water.

Once the turtle is alongside the vessel the observer will assess the turtle condition and size and determine if it is hooked or entangled and if hooked whether the hook is ingested or external. If the turtle is small enough, and if conditions are such that it can be safely brought aboard the vessel, the observer will use a dip net (that meets standards specified in NMFS regulations) to carefully bring the turtle aboard by placing the net under the turtle and safely lifting it out of the water and onto the deck. If the turtle is determined to be too large to safely board without causing further injury to the turtle, or if conditions are such that the turtle cannot be safely brought aboard, then the turtle will be identified and photographed and, if possible, a tissue biopsy will be obtained using a 10 ft pole with a biopsy coring device attached to the end. The coring device is a sharp-edged, circular metal device about 6 mm in diameter with 3-4 teeth inside that point inward so as to trap the sample. Using this device the observer will target the shoulder region or carapace (leatherbacks) of the animal. Observers will be instructed to avoid trying to gather biopsies from the head region to avoid serous injury to the animal.

Line and/or hook cutters or de-hookers will be used to remove longline gear. If not hooked internally the hook will be removed using NMFS developed and approved de-hooking device. If the hook cannot be removed without causing further injury to the turtle, a hook-cutting device developed and approved by NMFS will be used to cut the exposed hook. If the turtle is hooked internally or in the mouth, the leader and any portion of the hook exposed will be cut using the line and /or hook cutting device as close to the turtle as possible without causing further injury. Line cutters will be used to clip and remove line to release the turtle; no line will be left attached to turtle if possible. When releasing a turtle the vessel shall be in neutral and the turtle eased into the water and observed to be safely out of the way before engaging the vessel propeller.

The condition of turtles brought aboard the vessel will be assessed by the observer. Turtles that appear comatose will be placed in a shaded, protected area covered with a moist cloth with the head in a down position. The hindquarter will be elevated several inches, and resuscitation attempted. The turtle will be checked periodically for up to 24 hours; the observer will touch the eye and pinch the tail periodically to see if there is any response. If there is no response after 24 hours, the turtle will be judged dead. The observer will leave any entangled line or hook in place and cut the line leaving about 2 feet of line remaining and tape it to the turtle. The observer will then collect standard life history data (see below) and write collection identification information on tag, attach tag securely to turtle and store turtle in a plastic bag on ice or in a freezer. Turtles successfully resuscitated will be treated as active turtles (see below).

If the turtle is alive then it is placed in a safe cool dry place out of direct sunlight away from the fishing activity. Animals that cannot be kept out of direct sunlight are covered with wet towels or carpeting in a safe place. The animal's movements are restricted by penning it up in a make-shift fashion using available resources, or the animal is turned on its back and supported with towels or carpeting to prevent rolling. Again, this is done to keep the animal safe. The observer records the date, time, set number, trip number, and position of incidental capture of the sea turtle and waits until the end of gear retrieval activities when the turtle can be further processed for data, tagged, and released. After gear retrieval activities have ceased, scute counts used in identification are done. Observers then take straight and curvilinear measurements of carapace length and width. Additional measurements taken are of the plastron and tail. All measurement are obtained with a set of two meter calipers and a measuring tape. The observer also notes abnormalities and epibiota associated with the specimen. After scute counts and measurements are taken biopsies used in DNA analysis are gathered.

Tagging - Inconnel nickel alloy tags are attached to each fore-flipper with a specifically designed applicator. The alloy tags are placed near the origin of the first large scale on the trailing edge of the fore-flipper leaving enough room for growth. If there are tags present prior to capture, the information from the tags is recorded. Previously present tags that are unreadable or not secure are removed and replaced.

The turtles will be scanned to determine if they have been previously tagged with a Passive Integrated Transponders (PIT) tags. If they have not, a PIT tag will be placed in the left front flipper of all turtles without PIT tags.

Tissue Sampling - Tissue samples will be taken on all turtles by a biopsy punch (6 mm) of the trailing edge of the rear flipper per standard protocol and preserved in a supersaturated salt DMSO solution. Turtles will be placed on their back and the trailing edge of the rear flipper swabbed with betadine. Placing the flipper against the plastron, the observer will press the biopsy punch firmly into the flesh as close to the posterior edge of the flipper as possible, cutting all the way through the flipper. A wooden skewer will be used to remove the tissue plug and it will be stored in labeled vials of preservative. To prevent infection, the area biopsied will be swabbed with betadine.

Satellite Transmitter Attachment - Satellite transmitters are attached to up to 50 hardshelled turtles over 45 cm in carapace straight length. These devices provide information on temporal-spatial movements, water temperature and depth of dives. Transmitters are placed on the carapace on second or third vertebral scute for optimum transmission during periods when the animal is surfaced. Two different types of transmitters will be used in this research: conventional tags and Pop-Up Satellite tags (PSATs). Each type of tag has a different attachment procedure.

Conventional Tags - For this project the proposed method of transmitter attachment will employ a towed, hydrodynamic transmitter package that trails passively behind the turtle on a short, flexible lanyard. This method is preferred because of the minimal handling time, and minimal stress to the turtle on the deck of a boat, along with the greatly reduced drag of the transmitter in this configuration, as compared to other common attachment techniques that stick the transmitter on the high point of the turtle's shell. The lanyard will be no more than 2/3 the length of the carapace, precluding entanglement with the flippers or any part of the turtles body. The trailing transmitter package is designed with two sets of breakaway systems: an in-line breakaway link, which prevents any problems for the turtle from potential entanglement of the transmitter; and 3 separate in-line corrodible links that eliminate the possibility of long-term encumbrance by dissolving steadily in salt water. The breakaway link is strong enough to hold the transmitter as it trails in the wake of the turtle, but weak enough that it pulls apart if the transmitter were to become entangled in fishing gear or other unforeseen manner. The corrodible links, made of brass, begin to disintegrate after approximately 1 year in seawater, leaving nothing attached to the turtle. The intervening lanyard will be 1 mm monofilament line, which will provide flexibility and better performance of the transmitter. The trailing hydrodynamic transmitters are all painted dull black to render them cryptic to other animals.

After a turtle is brought onboard the vessel, all handling for measuring, tagging and tissue sampling will be completed. After completion of these activities, the transmitter along with the lanyard, which will be fully assembled, will be attached simply and quickly using techniques well-established for juvenile loggerhead and Kemp's ridley turtles. First, one of the posterior-most marginal scutes along the midline of the carapace will be cleaned lightly with a clean towel, then cleansed with a Betadine wipe to prevent infection. At a position approximately 10 mm from the rear edge of the shell, a single 3 mm hole will be drilled through the carapace where it overhangs the rear of the turtle. This process takes from 1 to 2 seconds, and does not elicit a response from the turtle. For each turtle, a new drill bit will be used, and the bit will be in disinfectant until the time of its use. In addition, Betadine will be applied to the small hole as a general disinfectant afterward. Next the end of the lanyard will be threaded through the small hole, and the length will be adjusted according to the guideline of not longer than 2/3 the turtle's carapace length. Finally, the lanyard will be attached using a corrodible crimp, that will corrode in saltwater, thus allowing the turtle to shed the entire transmitter package at the end of the study. The entire process, at an unhurried pace, takes approximately 4 minutes, after which the turtle will be released back into the water.

PSATs - Attachment of the PSAT tag base (Wildlife Computer tags weigh less than 60 g) to the carapace will be via either fiberglass resin per above or by epoxy, the latter a technique being developed and tested by the SWFSC(Anon. 2001c). The procedures developed by the SWFSC use Marine Fix ® Fast (MFF) epoxy to attach a baseplate on a dry carapace on clean flat scutes toward the back of the turtle. The epoxy is mixed according to manufacturer's instructions and applied to the base plate of the satellite attachment system. The base plate is then pressed down firmly against the carapace for a few minutes to squeeze out any air pockets. Excess epoxy on the sides of the base plate are smoothed out with a wet gloved fingertip. The epoxy hardened completely in 30 minutes. The PSAT tag is then attached to the base plate using a short lanyard attachment. The turtles will be released following procedures detailed above.

Disentanglement - The observer attempts to remove hooks and as much entangling gear from the animal as possible without causing further serious injury to the turtle. Hooks are removed using decoking and line cutting devices pliers usually supplied by the vessel and bolt cutters supplied by NMFS. In those cases where hooks are deeply ingested and cannot be removed as much of the leader and hook are removed as possible. When the above are complete the turtle is ready for release back into the wild.

Release - The observer notifies the captain to come to a complete stop. When the vessel is stopped and out of gear the turtle is released by gently by sliding the animal head first through the boarding door of the vessel. The observer records the date, time, position, swimming behavior, and direction.

All biopsy samples will be analyzed by the National Sea Turtle Genetics Lab at the Southwest Fisheries Science Center (SWFSC) in La Jolla, California. All satellite tag data will be analyzed by the SWFSC - Honolulu and La Jolla, CA laboratories. Flipper and PIT tag release and recapture data will be archived with the Cooperative Marine Turtle Tagging Program maintained by the Archie Carr Center for Sea Turtle Research at the University of Florida. Necrosis on carcasses returned to shore will be done by qualified personnel at either the SWFSC. During necropsy, samples will be taken for life history studies: humeri for ageing, etc. All data will be recorded on forms specially developed to record the details of this experiment, and will be analyzed by the SWFSC or its contractors.

Transport back to shore for rehabilitation - The applicants propose to transport deeply hooked (defined as hook ingested past the mouth cavity - in esophagus or deeper) hard-shelled turtles taken in the experiments back to holding facilities for treatment and monitoring of hook progression. Permitting the development of treatments and rehabilitations for hooked turtles will also provide an opportunity to better understand the mode of injury and prognosis for recovery of deeply hooked turtles (i.e. mortality rate). Only hard shelled sea turtles of less than 70 cm straight carapace length will be transported, and only if they are captured within an estimated 72 hours return time to Honolulu.

Based on the raw observer data for sea turtles caught by shallow set swordfish and mixed target longline sets, the percentage of turtle species that are deeply hooked and alive, and caught within 72 hours of Honolulu (at a vessel speed of 8 knots) are: about 7% for loggerhead turtles, 53% for olive ridley turtles, and 20% for green turtles. The data on all turtle takes that have been measured by observers indicates that about 82% of loggerheads, 100% of olive ridleys, and 87% of greens are under 70 cm straight carapace length (attachment 4 in permit application). These percentages and the estimated number of turtles which may be taken in the experiments were used to estimate the number of turtles which might be transported to Honolulu (Table II-6). These estimates are likely to be higher than the number actually transported as the vessel may not always be prepared to depart immediately for Honolulu from the capture location. However, if more turtles of the appropriate size or condition for transport happen to be captured, the applicants state that there is no reason why they also should not also be returned to port, and therefore, the numbers in Table 7 are not intended to be a limit. The upper limit will be the total annual take shown in Table 2.

Table 7. Estimated annual number of deeply hooked but alive hard-shelled turtles less than 70 cm straight carapace length captured during the experiments within 72 hours of Honolulu that could be transported to Honolulu for treatment and monitoring of hook progression.

Species	Annual Estimated Turtles Transported		
	Year 1	Year 2	Year 3
Green	1	1	1
Loggerhead	5	5	4
Olive Ridley	5	4	3

2.2.3 Transportation of a Listed Species

a. The NMFS Honolulu Laboratory has been transporting injured and diseased turtles for many years as part of the Sea Turtle Stranding Network. Transportation from vessels to the veterinary clinic on Oahu by motor vehicle will follow the same procedure used in the Stranding Program to transport injured or diseased turtles on Oahu. Transportation at sea will be provided by captains of fishing vessels participating in the research under the supervision of on-board fishery observers, fishery biologists, or biological technicians.

b. Turtles must be caught within an estimated 72 hours from the port of Honolulu and will be brought to port within 8 hours of this estimated time or else they will be released at sea. The Protocol for Sea Turtle Stranding Response (attachment 5 in the permit application) calls for turtle transportation 24 hours a day 7 days a week with a typical response time of a few hours for remote Oahu locations during weekends and after hours. With the advantage of real time reporting from participating vessels and with a veterinarian contracted specifically for this project it should take no more than an hour to transport the turtles from the vessel to the veterinarian. Depending on the turtles condition and any necessary surgery or other treatment turtles will be kept at the clinic for as long as necessary and then be moved again to NMFS holding facility at Kewalo Basin. Turtles which appear to be rehabilitated will be released to the wild (1c, below) and some turtles may be euthanized when necessary in the opinion of the attending veterinarian (Section 3, below)

c. Turtles which eliminate hooks or have had them removed by surgery or other means developed by the veterinary work in this project, and which appear to be fully recovered may be transported back to a vessel and taken to sea for release within a 72 hour radius of Honolulu.

d. Turtles will be transported at sea and in Honolulu using Petmate Vari Kennels, giant size (48 inches long x 32 inches wide x 35 inches high) which will be supplied to each vessel participating in the research. These kennels are wide enough for the largest turtles that will be transported (70 cm straight carapace length = 28 inches).

e. Captured deeply-hooked turtles that will be returned to Honolulu will be handled according to the guidelines developed in NMFS workshops (*see* Guidelines for Handling Marine Turtles Hooked or Entangled in the Hawaii Long line Fishery, Balazs *et al.*, 1995). These include specified procedures for how to haul the main line, retrieve branch lines which catch turtles, assess turtle condition and hook location, removing lines, resuscitation, and care of turtles on board the vessel. The procedures are those mandated for use by all Hawaii-based longline captains and crew by court order and/or reasonable and prudent measures or conservation measures stated in relevant biological opinions, to de-hook and disentangle, and resuscitate turtles, as appropriate and possible. In this study the field supervisor (fishery observer, fishery biologist, or biological technician) will oversee or conduct these procedures, and instead of returning a recovering deeply-hooked turtle to the sea after 24 hours, the turtle will be retained on board, covered in a moist cloth in the pet carrier in a shaded area for the 72 hour transit period to Honolulu.

Treatment by the veterinarian in Honolulu will include all measures possible at a fully equipped clinical facility including x-rays, surgery, anesthetics, antibiotics, etc. as deemed best by the project veterinarian (to be named). The veterinarian contracted for the project will have a minimum of 5 years experience in the first hand assessment and treatment of injured and diseased sea turtles and will operate from a clinic provided with complete veterinary instrumentation required to treat injured and diseased sea turtles. When a turtle's condition has stabilized and/or all treatments which may improve its chances for survival have been carried out, it will be moved to NMFS holding facility at Kewalo Basin. If the turtle is to be returned to the sea for release, the release procedure will again be as specified in the "Guidelines for Handling Marine Turtles Hooked or Entangled in the Hawaii Long line Fishery" (Balazs et al., 1995).

2.2.4 Holding of a Listed Species

a. Dimensions of pools used to hold sea turtles at NMFS Kewalo Facility and water supply:

2 fiberglass tanks, 2 m diameter, 1 m deep, 20 gal/h, 2 turtles/tank maximum.

2 fiberglass tanks, 2 m diameter, 1.5 m deep, 20 gal/h, 2 turtles/tank maximum

3 fiberglass tanks, 7 m diameter 2 m deep, 200-300 gal/h, 10 turtles/tank maximum

Turtles will be less than 70 cm straight carapace length, of both sexes, and unknown age. Within these broad categories, the size and species of individuals held at any given time will vary and cannot be predicted since incidental captures are involved. The maximum number of turtles per tank listed above is based on assuming a 70 cm carapace length, whereas a larger number of smaller turtles could be kept. Assuming 70 cm carapace length, the capacity of the 7 tanks is 38 turtles. The total number and mix of species may be as estimated in Table 2, with a maximum of 11 turtles in the first year, but it would be extremely unlikely that such numbers of turtles would need to be held at one time. Delayed mortality of the deeply hooked turtles is assumed in the Western Pelagics FMP biological opinion (NMFS, 2001) to be 42% so it would be unlikely that even the total annual numbers estimated to be transported (8 to 11 turtles) would ever need to be maintained at one time.

b. Water quality. Water supply is from a filtered sea water well, no temperature control is needed since ambient temperature is maintained at 25 ± 1°C. Oxygen levels are irrelevant as turtles are air breathers.

c. Frozen squid (*Loligo*), and or herring (*Clupea*) packed for human consumption, is maintained frozen until day of use, then thawed and fed to turtles once a day *add libitum* (Protocol for care and feeding of Kewalo turtles, attachment 6 in the permit application). Depending on appetite and size feeding turtles are fed 1-15 squid or fish weighing around 100 grams apiece per day.

d. Sanitation practices include regular tank cleaning and quarantine of diseased turtles (Protocol for care and feeding of Kewalo turtles, attachment 6 in the permit application). Green sea turtles affected by fibropapilloma tumors are held in separate tanks, fed and cared for after non-tumored turtles have been fed and cared for, and are cleaned with separate brushes. Tanks and brushes used with tumored turtles are disinfected prior to use with non-tumored turtles.

2.2.5 Emergency contingencies

Euthanasia will be used when necessary according to the procedure given under University of Hawaii - Institutional Animal Care permits (attachment 7 in the permit application).

NMFS Kewalo Facility has a second sea water well with its own pump as a backup to the primary seawater supply. The facility also has an automated alarm system that notifies key personnel in case of fire or power failure. Emergency power generation and saltwater pumping equipment is available.

D. Annual Evaluation and Reauthorization

Permit #1303 is proposed to be issued for up to three years. However under specified circumstances the permit's authority will be withdrawn and the experiment terminated. At the end of the first year of the experiment, an evaluation of all results, including the results of a risk assessment to determine the costs and benefits of revising the experimental design to incorporate newly discovered or developed take reduction measures, will occur in consultation with the Office of Protected Resources. Currently, the first evaluation is expected to occur in June or July of 2002. During this evaluation, the applicants will determine whether the modifications to longline gear successfully reduced loggerhead interactions by 50%. The applicants have stated that they would be able to determine success for loggerheads within the first year due to the high interaction rates loggerheads have had with swordfish sets and the number of sets needed to obtain first-year results for leatherback interactions. If the applicants determine that the experiment has not successfully reduced interactions with loggerheads by 50%, they may re-evaluate their experiment and, based on the results of other lab or field experiments, request a modification to their permit. If no other information is available, the experiment will cease in order to avoid unnecessary takes of turtles. This Opinion will evaluate the effects of issuing a 3-year permit for the experiment as it is currently proposed. However, any takes that are anticipated for a modified experiment to be approved by OPR will not exceed anticipated takes for this initial proposal.

If after one year the applicants show that minor gear modifications have had a 50% or greater reduction in loggerhead interactions, the Office of Protected Resources will evaluate whether or not the experiment should continue another year in order to evaluate success for leatherbacks. Their determination will be based on: 1) the status of loggerheads; and 2) initial results with leatherbacks during the first year of testing. Continuing the experiments for another 2 years in order to prove effectiveness for leatherbacks might unnecessarily affect loggerheads after the point when the effectiveness of a measure has been determined for these species. Therefore, it is important to re-evaluate the status of loggerhead populations in order to determine whether or not they can withstand additional takes and possible mortalities. It is also important to determine whether results from the first year of testing show any positive results for leatherbacks.

If the initial results are anywhere within a fairly broad range, they might still average out to show 50% effectiveness after the full three year experiment due to the very high variance in turtle take rate. Therefore statistical analyses conducted at an interim point in the experiment will have to indicate a very unsuccessful preliminary result (e.g. bycatch increase using the modified gear) to be almost certain that a continued experiment would not eventually show 50% successful bycatch reduction at acceptable confidence levels. A lack of interim positive results will have to be detected at a very high probability (e.g. $p < 0.05$) to be conclusive. For example, assuming Poisson distributed data, after 12 leatherback turtle takes the distribution would have to be 5 in the control treatment and 7 in the modified gear treatment to conclude with 95% confidence that the treatment was not having a 50% reducing effect on bycatch.

Without conclusive findings that the results are negative, and in the absence of other considerations, the leatherback experiment would continue in order to reach significant conclusions within the general levels of statistical confidence selected in the original power analysis. Also, interim testing will alter the power analysis. All tests and probabilities after the first year will have to be re-derived conditional on the experiment continuing to the year of interest.

If the Office of Protected Resources determines that the modified gear experiments show initial success with leatherbacks and that loggerhead status has not declined, the experiment will continue for a second year. If the status of loggerheads has declined below the status of the species reviewed in this opinion (e.g. if additional information indicates new threats, higher rates of decline, or a worsening population structure), NMFS must either take measures to improve the baseline such that positive benefits will offset the negative consequences of the experiment, or the experiment must be discontinued. If the experiment does not show initial success for leatherbacks, the applicants will need to re-evaluate potential changes to the experiment (e.g. use of stealth gear, deep daytime sets, use of 18/0 circle hooks) that might prove successful for reducing leatherback interactions before continuing with the experiment. If the Office of Protected Resources determines that one year of modified gear experiments have not shown success for leatherbacks and the status of loggerheads is worse than anticipated in the Opinion (i.e. baseline conditions have worsened), then methods will have to be revised and improvements to the baseline of loggerheads will have to be implemented if the experiments are to continue.

If the experiments continue for a second year, another risk assessment and evaluation as described above will take place after the second year before the final year of experiments can proceed.

2.3 Description of Alternative 3 - Issue the permit based on a high confidence sampling for the minor gear modification (test use of blue-dyed bait and moving branch line)

Under this alternative all of the methodologies would remain the same as described in the Proposed Action (Alternative 2) except the minor gear modification (test use of blue-dyed bait and moving branch line) sampling level will be more consistent with conventional experimental design. Scientific experiments typically test hypotheses using a type I error rate (alpha level) of 0.01 to 0.05, to achieve results with 99 to 95% confidence. It is conventional to accept higher type II (beta) error levels (e.g. 0.05 to 0.10). Alternative 3 would simultaneously test the combined use of squid bait dyed blue with food coloring and the removal of branch lines attached to the main line closest to the float line attachment points in swordfish-style fishing against a control as described in the Proposed Action (Alternative 2). Again, the objective will be to test whether the treatment reduces turtle takes versus a control, based on the fixed number of leatherback turtle takes expected for Poisson-distributed variates as required to detect a 50% effective treatment with a conventional alpha level of 0.05 and a beta level of 0.10. This would decrease the probability of making an erroneous conclusion about the effectiveness of the treatments. This alternative design would take a total of 63 leatherbacks spread out over 3 years (see Table 5 for comparison of takes between the Proposed Action (Alternative 2) and Alternative 3). If the treatment is 50% effective, 21 of these turtles would be caught by treatment fishing operations and 42 would be caught by control operations. The estimated number of fishing operations required for this alternative would have a concomitant take of other turtle species (Table 5), based on the historical rate of interactions with those species by the type of fishing operations that will be used in the experiment.

The take levels required by this alternative are much higher than for the Proposed Action (Alternative 2), because the lower type I (alpha, attachment 1 in the application) and type II (beta, attachment 1 in the application) error rates require larger sample sizes. A power analysis was conducted to scope out a variety of sample sizes required to detect a bycatch method that has different degrees of effectiveness in comparison with the control fishing method at different error levels (see attachment 1 in the May 5, 2001, permit application). A large range of additional alternatives were evaluated in the application, including experimental designs to test for 25% effective bycatch reduction methods. Take numbers required to detect a 25% effective treatment are much higher than those required to detect 50% effective treatments because of the lower signal-to-noise ratio when the treatment is closer to the control method (Table 4 in the permit application).

This alternative would call for an estimated 880 control sets and 880 treatment sets per year for three years (total of 5,281 sets. However, the total number of estimated sets is just an estimate based on historical capture rates of turtles by swordfish style fishing gear. Again, the statistical properties of Poisson-distributed data are such that the number of sets is not critical to the test, and the experiment will be limited to the number of turtle takes required, not the number of sets estimated. The cost of contracting this number of sets would be about 70% greater than for the minor gear modification (blue bait and moved branch line) portion of the Proposed Action (Alternative 2). In order to achieve the higher confidence in sampling, the number of leatherbacks taken would increase by 75% (27/36) in the minor gear modification portion of the experiment and by about 35% (27/44) overall between the two alternatives. Given the critical status of the leatherback population in the Pacific, the decrease in the level of error must be balanced by the increased sample size. The alpha and beta levels of 0.10 and 0.20 described in the Proposed Action (Alternative 2) are sufficient for identifying the most likely measures that would be effective at reducing sea turtle interactions in longline gear.

Table 5. Sea turtle takes/mortalities per year in minor gear modification experiment, with significant (50% effective*) leatherback findings in 3 years. Mortalities are included in the takes.

	Error Levels		Sets/ year	Leatherbacks/ year		Loggerheads/ year		Olive ridleys/ year		Greens/year	
						Concomitant takes per year (other species)					
	Alpha	Beta		Takes	Morts	Takes	Morts	Takes	Morts	Takes	Morts
Proposed Action (2)	0.10	0.20	1,039	12	4	65	24	6	2	4	1
This Alternative (3)	0.05	0.10	1,760	21	7	110	40	11	4	6	2

*treatment reduces leatherback take by 50% compared with control

2.4 Description of Alternative 4- Issue the permit based on a one-year design

Under this alternative the methodologies described in the Proposed Action (Alternative 2) would remain the same except for the minor gear modification (2.2 A) would be based on a one-year sampling for loggerheads and the hook timer and hook type (2.2 C) components would be eliminated . This alternative is based on historical bycatch data indicating that the likelihood of taking a loggerhead is much greater than encountering a leatherback. Given the higher capture rate, a loggerhead experiment can be conducted for one year at an alpha and beta level of 0.05 and 0.10, respectively. The sampling would yield enough data to analyze significance of the treatments for loggerheads assuming a 50% effective fishing method (Table 6 below; Table 5 in the permit application). The expected leatherback takes would not be sufficient to analyze significance of the treatments for this species. Under this alternative the hook timer and piggyback hook experiments would not be conducted. Based on research conducted on fish (Boggs, 1992), the applicants anticipate that 30 hook timer readers (i.e. 30 observations of a sea turtle species taken by longline) are needed in order to detect trends in turtle capture time or depth. Based on historical take levels in the swordfish fishery, the applicants anticipate that two years are needed for this portion of the experimen using 2 full-time vessels. It would be impossible to equip more vessels with hook timers in the available time (the manufacturing capacity for these custom-built instruments has been fully contracted through March 2002).

This is not the preferred alternative because the leatherback is the species of greatest concern. Under this alternative, the minor gear modification (blue-dyed bait and move branch line) could not be analyzed for significance in reducing leatherback interactions due to the insufficient sampling. In addition, the hook timer and hook type testing would not be conducted. This alternative would unnecessarily delay testing to reduce leatherback takes.

Table 6. Sea turtle takes/mortalities per year in minor gear modification experiment, with significant (50% effective*) loggerhead findings in 1 year. Mortalities are included in the takes.

							Concomitant takes (other species)			
Error Levels		**Sets**	**Loggerheads**		**Leatherbacks**		**Olive ridleys**		**Greens**	
Alpha	Beta		Takes	Morts	Takes	Morts	Takes	Morts	Takes	Morts
0.05	0.10	981	61	22	12	4	6	2	4	1

*treatment reduces leatherback take by 50% compared with control

2.5 Description of Alternative 5 - Issue the permit without the stealth gear and deep-set daytime fishing CPUE

Under this alternative all of the permit methodologies described in the Proposed Alternative 2 would be included except for the testing "stealth gear" and deep-set daytime fishing for CPUE viability (2.2 B). This alternative is not the preferred because testing major gear modifications for target species CPUE is a critical first step in determining the feasibility of implementing these modifications in the fishery. Modifications to gear or fishing practices that result in extremely low catch of the intended target species likely would not be used by the industry. The loss in revenue from the decrease in catch may not cover the cost of the operation. Tests conducted on the efficacy of stealth fishing gear and daytime deep sets to reduce sea turtle interactions without first determining target species CPUE would result in unnecessary turtle takes. Eliminating the stealth fishing gear and deep-set daytime for target CPUE would delay testing for these potential turtle bycatch reduction methods. These potential methods are our best hope for reducing bycatch if the minor gear modification experiments are determined not to be effective after the first year of the experiment.

3.0 Affected Environment

3.1 Introduction

The affected environment is the Pacific Ocean for swordfish and tuna managed under the PFMP.

3.2 Physical Resource Issues

The physical environment of the Pacific ocean north of Hawaii is oceanic and pelagic in nature. The affected environment is all the areas that will be affected directly or indirectly by the domestic Hawai'i-based longline fishery for swordfish and tuna managed under the Pelagics Fishery Management Plan. The Hawai'i longline fishery operates inside and outside of the main Hawaiian islands' and Northwestern Hawaiian Islands' EEZ (see Figure 1). Hawai'i-based longline vessels vary their fishing grounds depending on their target species. Most effort is to the north and south of the Hawaiian Islands between latitudes 5^{O} and 40^{O} N and longitudes 140^{O} and 180^{O} W. Figure 2 shows the maximum historical boundaries of the Hawai'i-based longline fishery using 5^{O} increments. A complete description of the affected environment is incorporated by reference in Chapter 3 of the Final Environmental Impact Statement for the Fishery Management Plan: Pelagics Fisheries of the Pacific Region dated March 1, 2001 (NMFS, 2001a).

3.3 Biological Resource Issues

Pelagic longline fisheries encounter many species of fish; some of those captured are marketable and thus are retained, others are discarded for economic or regulatory reasons. Species frequently encountered are swordfish, tunas, and sharks, as well as billfish, dolphin, wahoo, king mackerel, and other finfish species. Detailed descriptions of the life histories and population status of these species are given in the PFMP and the EIS prepared on that fishery and are not repeated here. The status of the stocks of Pacific swordfish and tunas, are summarized in chapter 2 of the 2001 SAFE Report (NMFS 2001b), and are not repeated here. Sometimes pelagic longline fisheries also catch sea turtles, marine mammals and sea birds known collectively as "protected" species. All of these species are Federally protected and managed, and NMFS seeks to control the mortality that results from fishing effort. Detailed descriptions of life histories and population status of marine mammals and sea birds known to interact with pelagic longline gear is detailed in the PFMP, the March 29, 2001 opinion and is not repeated here.

Although blue whales, fin whales, northern right whales, and sei whales are found within the action area and could potentially interact with the longline vessels involved in the experiment, there have been no reported or observed incidental takes of these species in the Hawaii-based longline fisheries.

In 1991, one humpback was reported by an observer entangled in the mainline of a Hawaii-based longline vessel. The animal was released with trailing gear (Dollar, 1991). The interaction occurred inside what is now the protected species zone (50 nautical miles) of the islands and atolls of the Northwestern Hawaiian Islands (Bob Harman, NMFS, personal communication, November, 2000). Another humpback whale was reported entangled in longline gear off Lanai (Nitta and Henderson, 1993) and by whalewatch operators off Maui in 1993 (Hill and DeMaster, 1999). Confirmation was not made as to whether the gear type was pelagic longline gear, and it is believed to be the same whale.

Humpback whales favor waters less than 100 fathoms (183 meters) around the main Hawaiian Islands. The highest densities of humpback whales occur in the shallow-water, inter-island channels of the four-island region (Maui, Lāna'i, Moloka'i, and Kaho'olawe) and Penguin Bank (Hudnall, 1978, Baker and Herman, 1981, Mobley and Bauer, 1991 *in* Mazzuca *et al*., 1998). The 1991 interaction occurred inside the 50 nautical mile area now closed to longline fishing, and vessels fishing under the scientific research permit will be fishing far north of where humpbacks are normally concentrated. Therefore, NMFS considers the likelihood of an interaction to be very low, and does not expect that longliners fishing under the scientific research permit will interact with a humpback whale.

NMFS has observed one sperm whale interaction by the Hawaii-based longline fishery. The event occurred in May, 1999 inside the Northwestern Hawaiian Islands EEZ (about 140 nautical miles north of Raita Bank), and the vessel was targeting swordfish (gear was set at night, lightsticks were used, and no line shooter was used). According to the observer report, the sperm whale's pectoral fin was entangled in the mainline. The captain stopped the boat, let out more mainline, and then backed up until he could reach the other end of the mainline. At this point, both ends of the mainline, on each side of the sperm whale, were secured on the vessel. During this time, the whale broke the mainline and swam away without trailing gear. This is the first reported interaction by the observer program since the Hawaii-based longline fleet has been monitored (1991). In addition, there have been no reported sperm whale interactions by fishers in their logbook submissions.

NMFS has observed 3,251 sets, representing approximately 3,874,635 hooks (data from February 1994 through December 31, 1999), since the implementation of the mandatory observer program. Based on this information, the observed entanglement rate for sperm whales would equal approximately 0.31 whales per 1,000 sets. However, with only one sperm whale entanglement, NMFS believes that this estimated entanglement rate does not represent the actual entanglement rate. One whale entanglement cannot provide a reliable estimate of the true entanglement rate with any certainty. At this time, there is insufficient data to suggest that a sperm whale interaction with longline gear is anything more than a one time random event. Nevertheless, NMFS recognizes the potential that sperm whales could interact with longline gear set in the open water but without more accurate data is unable to predict with any level of confidence the likelihood of an interaction. Therefore, without additional information to support the frequency of entanglements, NMFS does not anticipate that there will be a sperm whale interaction in the foreseeable future by longliners fishing under the scientific research permit.

The endangered Hawaiian monk seal is currently found throughout the NWHI, specifically: Kure Atoll, Midway Islands, Pearl and Hermes Reef, Lisianki Island, Laysan Island, French Frigate Shoals, Gardner Pinnacles, Necker Island and Nihoa Island. These islands form a chain approximately 1,840 km long. Hawaiian monk seals are also occasionally found in the main Hawaiian Islands. The longline area closure around the NWHI instituted in 1991 (longline fishing prohibited within 50 nm of the NWHI and in 100 nm closed corridors connecting the non-contiguous closed circles) appears to have eliminated monk seal interactions with the Hawaii-based longline fleet, as there have been no observed or reported interactions with this fishery since then.

Although hawksbill turtles are known to nest on the Main Hawaiian Islands (Molokai and Hawaii), they are not known to interact with the Hawaii-based longline fishery, as there have been no reported or observed interactions between these pelagic longliners and hawksbills. As hawksbills become adults, evidence suggests that they switch foraging behaviors from pelagic surface feeding to benthic reef feeding. The maturing turtle establishes foraging territory and will remain in this territory until it is displaced. If Hawaiian hawksbills forage close to their known nesting sites, they are probably benefitting from the protected species zone instituted by the Council in 1991, where longliners are prohibited from fishing within 50 nm of the NWHI and within 100 nm closed corridors connecting the non-contiguous closed circles. Further longline exclusion zones prohibit longline fishing in specific areas around the MHI (depending on the time of year and location, the exclusion zones around the MHI range from 25-75 nm). Because adult hawksbills are most likely foraging primarily in nearshore waters, and the majority of the experiments will take place north of 28°N, the likelihood of an interaction with a longliner fishing under the scientific research permit is very low.

3.3.1 Short-tailed Albatross

In the March 30, 2001, EIS NMFS stated that the short-tailed albatross has been shown to be extremely vulnerable to longline fisheries worldwide. NMFS initiated consultation with the United States Fish and Wildlife Service (FWS) on April 29, 2000 concerning effects of the Hawaii-based longline fishery on the short-tailed albatross. On November 20, 2000, FWS released its biological opinion on the effects of the fishery on the albatross. The November 20, 2000 opinion concluded that the level of take in the Hawaii longline fishery is not likely to jeopardize the continued existence of the short-tailed albatross, but did specify a number of reasonable and prudent measures to be implemented by the fleet to minimize and monitor takes and to ensure survivability of any injured birds (NMFS, 2001a). On December 12, 2001, FWS issued a biological opinion on the effects on the short-tailed albatross (*Phoebastria albatrus*) of the proposed NMFS longline research permit activities. The December 12, 2001 biological opinion concluded that the proposed permit activities would not likely jeopardize the continued existence of the short-tailed albatross.

Species Description

George Steller provided the first record of the short-tailed albatross in the 1740s. The type specimen for the species was collected offshore of Kamchatka, Russia, and was described in 1769 by P.S. Pallas in Specilegia Zoological (AOU 1998). In the order of tubenose marine birds, Procellariiformes, the short-tailed albatross is classified within the family Diomedeidae. Until recently, it was assigned to the genus *Diomedea*. Following results of the genetic studies by Nunn *et al*. (1996), the family Diomedeidae was arranged in four genera. The genus *Phoebastria*, North Pacific albatrosses, now includes the short-tailed albatross, the Laysan albatross (*P. immutabilis*), the black-footed albatross (*P. nigripes*), and the waved albatross (*P. irrorata*) (AOU 1998).

The short-tailed albatross is a large pelagic bird with long narrow wings adapted for soaring just above the water surface. The bill is disproportionately large compared to other northern hemisphere albatrosses; it is pink and hooked with a bluish tip, has external tubular nostrils, and has a thin but conspicuous black line extending around the base. Adult short-tailed albatrosses are the only northern Pacific albatross with an entirely white back. The white head develops a yellow-gold crown and nape over several years. Newly fledged birds are dark brown-black, but soon obtain pale bills and legs that distinguish them from black-footed albatross (Tuck 1978, Robertson 1980). Subadult birds have mixed white and brown-black areas of plumage, gradually getting more white feathers at each molt until reaching fully mature plumage.

Life History

Available evidence from historical accounts and from current breeding sites indicates that short-tailed albatross nesting habitat is characterized by flat or sloped sites with sparse or full vegetation on isolated windswept offshore islands with restricted human access (Arnoff 1960, Sherburne 1993, DeGange 1981). Current nesting habitat on Torishima Island is steep sites on soil containing loose volcanic ash; the island is dominated by a grass, *Miscanthus sinensis* var. *condensatus*, but a composite, *Chrysanthemum pacificum*, and a nettle, *Boehmeria biloba*, are also present (Hasegawa 1977). The grass probably stabilizes the soil, provides protection from weather, and minimizes mutual interference between nesting pairs while allowing for safe, open take-offs and landings (Hasegawa 1978). The nest is a grass or moss-lined concave scoop about 2 ft (0.75 m) in diameter (Tickell 1975).

Short-tailed albatrosses are long-lived and slow to mature; the average age at first breeding is about 6 years (Service 1999). As many as 25 percent of breeding age adults may not return to the colony in a given year (Service 1999; Cochrane and Starfield, in press). Females lay a single egg each year, which is not replaced if destroyed (Austin 1949). Adult and juvenile survival rates are high (96 percent), and an average of 0.24 chicks per adult bird in the colony survive to fledge at six months of age (Cochrane and Starfield, in press.). However, chick survival can be reduced severely in years when catastrophic volcanic or weather events occur during the breeding season.

At Torishima, birds arrive at the breeding colony in October and begin nest building. Egg-laying begins in late October and continues through late November. The female lays a single egg; incubation involves both parents and lasts for 64-65 days. Eggs hatch in late December and January, and by late May or early June the chicks are almost fully grown and the adults begin abandoning their nests (Service 1999; Hasegawa and DeGange 1982). The only known currently active breeding colonies of short-tailed albatross are on Torishima and Minami-kojima islands, Japan. The chicks fledge soon after the adults leave the colony, and by mid-July, the colony is deserted (Austin 1949). Non-breeders and failed breeders disperse from the breeding colony in late winter through spring (Hasegawa and DeGange 1982). There is no detailed information on phenology on Minami-kojima, but it is believed to be similar to that on Torishima.

Short-tailed albatrosses are monogamous and highly philopatric to breeding sites. Chicks hatched at Torishima return there to breed. However, young birds may occasionally disperse from their natal colonies to breed, as evidenced by the appearance of adult birds displaying courtship behavior on Midway Atoll that were banded as chicks on Torishima (Service 1999, Richardson 1994).

The diet of short-tailed albatrosses includes squid, fish, flying fish eggs, shrimp and other crustaceans (Hattori in Austin 1949, Service 1999). There is currently no infomation on variation of diet by season, habitat, or environmental condition.

Population Dynamics

Breeding-age population estimates come primarily from egg counts and breeding bird observations. There were 440 breeding adults present at the beginning of the 1999-2000 breeding season on Torishima, assuming 2 adults are present for each of the 220 eggs counted (H. Hasegawa, pers. commun. 2000). The most recent population estimate on Minami-kojima is 25 breeding pairs, or 50 breeding adults. Therefore, the unadjusted total worldwide estimate is 490. It has been noted that an average of approximately 25 percent of breeding adults may not return to breed each year. It is reasonable, therefore, to estimate that approximately 122 additional breeding-aged birds may not be observed on the breeding grounds. Therefore, 612 birds is the adjusted worldwide estimate of breeding age birds.

Numbers of immature birds are more difficult to estimate because these individuals do not congregate between fledgling and returning to breed at approximately 6 years of age. An estimate can be calculated by totaling the number of known fledged chicks in the last 6 years, and the average juvenile survival rate of 96 percent (Service 1999; Cochrane and Starfield, in press). Dr. Hiroshi Hasegawa of Toho University, Japan, reported that 655 chicks were fledged from the Tsubamesaki colony on Torishima between 1994 and 2000 (H. Hasegawa, pers. commun. 2000). Based on an average juvenile survival rate of 96 percent, there are an estimated 629 birds in the immature population from Torishima Island. In 1998, Hasegawa estimated the total population at Minami-kojima to be 150 birds, containing an estimate of 100 immature birds. Combining the estimated number of immature birds from Torishima Island and the estimated number of immature birds from Minami-kojima yields a worldwide immature population estimate of about 729 individuals (based on data through the 1999-2000 breeding season at Torishima and 1997-98 breeding season at Minami-kojima).

The estimated world population of short-tailed albatrosses, calculated by combining estimated breeding age birds (612) and estimated immature birds (about 750), is therefore about 1,362 birds. No measures of uncertainty are available for this estimate.

Distribution and Population Status

The species once ranged throughout most of the North Pacific Ocean and Bering Sea, with known nesting colonies on numerous western Pacific Islands in Japan and Taiwan (Hasegawa 1979, King 1981). Though other undocumented nesting colonies may have existed, there is no conclusive proof that short-tailed albatross once nested at locations beyond the Japanese and Taiwanese colonies. Short-tailed albatross courtship behavior and reproductive activities have been observed at Midway Atoll NWR. The question of the future potential of Midway Atoll NWR to serve as a successful nesting colony, through either natural colonization or propagation efforts, remains unknown (Service 1999).

At the beginning of the 20th century, the species declined in population numbers to near extinction, primarily as a result of hunting at breeding colonies in Japan. Albatross were killed for their feathers and various other body parts. The feathers were used for writing quills, their bodies were processed for fertilizer, their fat was rendered, and their eggs were collected for food (Austin 1949). Hattori (in Austin 1949) commented that short-tailed albatrosses were "...killed by striking them on the head with a club, and it is not difficult for a man to kill between 100 and 200 birds daily." He also noted that the birds were "very rich in fat, each bird yielding over a pint."

Pre-exploration worldwide population estimates of short-tailed albatrosses are not known; the total number of birds harvested may provide the best estimate, as the harvest drove the species nearly to extinction. Between approximately 1885 and 1903, an estimated 5 million short-tailed albatrosses were harvested from the breeding colony on Torishima (Yamashina in Austin 1949), and harvest continued until the early 1930s, except for a few years following the 1903 volcanic eruption. One of the residents on the island, a schoolteacher, reported 3,000 albatrosses killed in December 1932 and January 1933. Yamashina (in Austin 1949) stated that "This last great slaughter was undoubtedly perpetrated by the inhabitants in anticipation of the island's soon becoming a bird sanctuary." By 1949, there were no short-tailed albatrosses breeding at any of the historically known breeding sites, including Torishima, and the species was thought to be extinct (Austin 1949).

In 1950, the chief of the weather station at Torishima, M. Yamamoto, reported nesting of the short-tailed albatross (Tickell 1973, 1975), and by 1954 there were 25 birds and at least 6 breeding pairs present on Torishima (Ono 1955). These were presumably juvenile birds that had been wandering the northern Pacific during the final several years of slaughter. Since then, as a result of habitat management projects, stringent protection, and the absence of any significant volcanic eruption events, the population has gradually increased. The average growth of the colony on Torishima Island (the colony is called "Tsubamesaki") between 1950 and 1977 was 2.5 adults per year; between 1978 and 1991 the average population growth was 11 adults per year. An average annual population growth of at least 6 percent per year (Hasegawa 1982; Cochrane and Starfield, in press) has resulted in a continuing increase in the breeding population to an estimated 440 breeding birds on Torishima in 1999 (Service 1999). Torishima Island is under Japanese government ownership and management and is managed for the conservation of wildlife. There is no evidence that the breeding population on Torishima is nest site-limited at this point; therefore, ongoing management efforts focus on maintaining high rates of breeding success.

Two management projects have been undertaken to enhance breeding success on Torishima. First, erosion control efforts at the Tsubamesaki colony have improved nesting success. Second, there are continuing attempts to establish a second breeding colony on Torishima by luring breeding birds to the opposite side of the island from the Tsubamesaki colony through the use of decoys and recorded colony sounds. Preliminary results of this experiment are promising; the first chick was fledged from this site in 1997. The expectation is that, absent a volcanic eruption or some other catastrophic event, the population on Torishima will continue to grow, and it will be many years before the breeding sites are limited (Service 1999).

In 1971, 12 adult short-tailed albatrosses were discovered on Minami-kojima in the Senkaku Islands, one of the former breeding colony sites (Hasegawa 1984). Aerial surveys in 1979 and 1980 resulted in observations of between 16 and 35 adults. In April 1988, the first confirmed chicks on Minami-kojima were observed, and in March 1991, 10 chicks were observed. In 1991, the estimate for the population on Minami-kojima was 75 birds, including 15 breeding pairs (Hasegawa 1991).

At-sea sightings since the 1940s indicate that the short-tailed albatross, while very few in number today, is distributed widely throughout its historical foraging range of the temperate and subarctic North Pacific Ocean (Sanger 1972; Service unpublished data) and is found close to the U.S. west coast. Recent satellite tracking of black-footed and Laysan albatrosses revealed that individuals of these species travel hundreds of miles from breeding colonies during the breeding season (Service 1999). If short-tailed albatrosses are similar in behavior to black-footed and Laysan albatrosses, short-tailed albatross foraging trips may extend hundreds of miles or more from colony sites.

In summer (i.e., non-breeding season), individuals appear to disperse widely throughout the historical range of the temperate and subarctic North Pacific Ocean (Sanger 1972), with observations concentrated in the northern Gulf of Alaska, Aleutian Islands, and Bering Sea (McDermond and Morgan 1993; Sherburne 1993; Service unpublished data). Individuals have been recorded along the west coast of North America as far south as the Baja Peninsula, Mexico (Palmer 1962).

Short-tailed albatrosses have been observed on Midway Atoll since the early 1930s (Berger 1972, Hadden 1941, Fisher in Tickell 1973, Robbins in Hasegawa and DeGange 1982). There is one unconfirmed report of a short-tailed albatross breeding on Midway in the 1960s (Service 1999), but no subsequent reports of successful breeding exist. In the years following the reported observation, tens of thousands of albatrosses were exterminated from Midway Atoll to construct an aircraft runway for the Department of the Navy, and to provide safe conditions for aircraft landings and departures. It is possible that short-tailed albatrosses on the island could have been killed during this process (Service 1999). Since the mid-1970s, approximately thirty-five sightings of short-tailed albatrosses have occurred during the breeding season on Midway Atoll. In March 1994, a courtship dance was observed between two short-tailed albatrosses (Richardson 1994), and one lone bird has occupied a nest site and laid eggs in 1993, 1995, and 1997, none of which has hatched (Service 1999). A dancing ritual was observed by Service biologists between two short-tailed albatrosses (band numbers 015 yellow and 057 blue) on Sand islet, Midway Atoll, on November 17, 1999. The U.S. Government transferred Midway Atoll from the Navy to the Department of the Interior in 1996, and has designated the Service as the conservation agency to manage Midway Atoll National Wildlife Refuge (NWR).

Observations of short-tailed albatross have also been made during the breeding season on Laysan Island, Green Island at Kure Atoll, and French Frigate Shoals, but there is no indication that these occurrences represent breeding attempts (Sekora 1977, Fefer 1989). Between 1976 and 1994, approximately six short-tailed albatross have been sighted from these islands. It is possible that short-tailed albatross could have occurred at these locations during the latter part of the 19^{th} century and first part of the 20^{th} century. If so, they would have been vulnerable to Japanese egg and feather collectors as thousands of black-footed and Laysan albatross were killed to support this trade during this period. In 1909, the Hawaiian Islands Bird Reservation was established by President Theodore Roosevelt (Executive Order 1019) for reasons including the protection of birds and their habitat.

On January 23, 2000, a NMFS observer reported seeing a juvenile short-tailed albatross flying near a Hawaii-based longline vessel during haulback of longline gear. The bird was sighted at 0837 hrs., at 33°09'2" north latitude and 147°49'6" west longitude. The bird was flying in a group of about 10-15 black-footed albatrosses and was in sight of the longline vessel for approximately one and one half hours.

Population Status

Between the 1950s and 1970, there were few records of the species away from the breeding grounds, according to the AOU Handbooks of North American Birds (Vol. 1, 1962) and the Red Data Book (Vol. 2, Aves, International Union for the Conservation of Nature, Morges, Switzerland, 1966) (Tramontano 1970). In the northern Pacific, there were 12 reported marine sightings in the 1970s, 55 sightings in the 1980s, and over 250 sightings reported in the 1990s to date (Sanger 1972; Hasegawa and DeGange 1982, unpublished data). This observed increase in opportunistic sightings should be interpreted cautiously, however, because of the potential temporal, spatial, and numerical biases introduced by opportunistic shipboard observations. Observation effort, total number of vessels present, and location of vessels may have affected the number of observations independent of an increase in total numbers of birds present.

The short-tailed albatross is not on the State of Hawaii's list of threatened and endangered species. However, the short-tailed albatross is considered endangered by the State of Alaska (Alaska Statutes, Article 4, Sec.16.20.19). This classification was supported by a letter to Commissioner Noerenberg from J.C. Bartonek, in which he recommended endangered status because the short-tailed albatross occurs, or was likely to occur, in State waters within the 3-nautical mile (5.6-km) limit of State jurisdiction (Sherburne 1993).

The Japanese government designated the short-tailed albatross as a protected species in 1958, as a Special National Monument in 1962 (Hasegawa and DeGange 1982), and as a Special Bird for Protection in 1972 (King 1981). Torishima was declared a National Monument in 1965 (King 1981). These designations have resulted in tight restrictions on human activities and disturbance on Torishima (Service 1999). In 1992, the species was classified as "endangered" under the then-newly implemented "Species Preservation Act" in Japan, which makes Federal funds available for conservation programs and requires that a 10-year plan be in place, which sets forth conservation goals for the species. The current Japanese "Short-tailed Albatross Conservation and Management Master Plan" outlines general goals for continuing management and monitoring of the species, and future conservation needs (Environment Agency 1996). The principal management practices used on Torishima are legal protection, habitat enhancement, and population monitoring. Since 1976, Hasegawa has systematically monitored the breeding success and population numbers of short-tailed albatrosses breeding on Torishima.

Prior to its current listing as endangered throughout its range, the short-tailed albatross was listed as endangered under the Act, throughout its range, except in the U.S. During this period, the Service considered the short-tailed albatross to be afforded protection under the Act in all portions of its range farther than 3 nautical miles (5.6 km) from U.S. shores, and included those waters of the EEZ (3-200 mi [5.6-370 km] from shore). A final rule was published on July 31, 2000 (65 FR 46643), listing the species as endangered throughout its range.

3.3.2 Sea Turtles

Based on observed and reported interactions between the Hawaii-based longline fishery (including both swordfish-style, mixed-style, and tuna-style sets) and four species of sea turtles, NMFS has determined that the proposed experiments are likely to adversely affect green, leatherback, loggerhead, and olive ridley turtles. Many sea turtle populations are slow to recover from increased fishing mortality because their reproductive potential is low (late sexual maturation, low juvenile survival). General information about the biology and status of sea turtles can be found in the Recovery Plans for each species (available through the Office of Protected Resources, NMFS); a summary of the status of the loggerhead, leatherback, green and olive ridley sea turtle populations are discussed below. A complete review of the status of each of the four species can be found in the March 29, 2001 Biological Opinion and in the biological opinions drafted on the issuance of this permit.

All stocks/populations of sea turtles adversely affected by the proposed action are in decline, except for olive ridleys and Hawaiian green turtles, which appear to be increasing. Impacts to sea turtles in the Pacific Ocean are primarily due to the composite effect of human activities which include: the legal harvest and illegal poaching of adults, immatures, and eggs; incidental capture in fisheries (coastal and high-seas); and loss and degradation of nesting and foraging habitat as a result of coastal development, including predation by domestic dogs and pigs foraging on nesting beaches (associated with human settlement). Increased environmental contaminants (e.g. sewage, industrial discharge) and marine debris, which adversely impact nearshore ecosystems that turtles depend on for food and shelter, including sea grass and coral reef communities, also contribute to the overall decline. While it is generally accepted by turtle biologists and others that these factors are the primary cause of turtle population declines, in many cases there is little quantitative data on the magnitude of human-caused mortality. These four species of sea turtles are highly migratory or have a highly migratory phase in their life history, which makes them susceptible to being incidentally caught by fisheries operating throughout the

Pacific Ocean. Because this experiment will take place in an area where the Hawaii-based longline fishery typically fishes, using standard fishing gear and strategy, and using typical longline vessels, this proposed action is anticipated to interact with all four species of sea turtles. In addition to anthropogenic factors, natural threats to the nesting beaches and pelagic-phase turtles such as coastal erosion, seasonal storms, predators, temperature variations, and phenomena such as El Niño also affect the survival and recovery of sea turtle populations. More information on the status of these species along with an assessment of overall impacts are found in this section as well as the Pacific Sea Turtle Recovery Plans (NMFS and USFWS, 1998a-d) and are reviewed extensively in Eckert (1993).

Loggerhead Sea Turtles
The loggerhead turtle is listed as threatened under the ESA throughout its range, primarily due to direct take, incidental capture in various fisheries, and the alteration and destruction of its habitat. The loggerhead is categorized as Endangered, by the IUCN where taxa so classified are considered to be facing a very high risk of extinction in the wild in the near future. Loggerheads are a cosmopolitan species, found in temperate and subtropical waters and inhabiting pelagic waters, continental shelves, bays, estuaries and lagoons. In the Pacific Ocean, major nesting grounds are generally located in temperate and subtropical regions, with scattered nesting in the tropics (*in* NMFS and USFWS, 1998c).

The loggerhead is characterized by a reddish brown, bony carapace, with a comparatively large head, up to 25 cm wide in some adults. Adults typically weigh between 80 and 150 kg, with average CCL measurements for adult females worldwide between 95-100 cm CCL (*in* Dodd, 1988) and adult males in Australia averaging around 97 cm CCL (Limpus, 1985, *in* Eckert, 1993). Juveniles found off California and Mexico measured between 20 and 80 cm (average 60 cm) in length (Bartlett, 1989, *in* Eckert, 1993). Skeletochronological age estimates and growth rates were derived from small loggerheads caught in the high-seas driftnet fishery. Loggerheads less than 20 cm were estimated to be 3 years or less, while those greater than 36 cm were estimated to be 6 years or more. Age-specific growth rates for the first 10 years were estimated to be 4.2 cm/year (Zug, *et al.*, 1995).

Nesting of loggerheads in the Pacific Basin are restricted to the western and southern region (Japan and Australia, primarily); there are no reported loggerhead nesting sites in the eastern or central Pacific. Upon reaching maturity, adult females migrate long distances from resident foraging grounds to their preferred nesting beaches. The average re-migration interval is between 2.6 and 3.5 years, in Queensland, Australia (*in* NMFS and USFWS, 1998c). Nesting is preceded by offshore courting, and individuals return faithfully to the same nesting area over many years. Clutch size averages 110 to 130 eggs, and one to six clutches of eggs are deposited during the nesting season (Dodd, 1988). Based on skeletochronological and mark-recapture studies, mean age at sexual maturity for loggerheads ranges between 25 to 35 years of age, depending on the stock (*in* Chaloupka and Musick, 1997), although Frazer *et al*. (1994 *in* NMFS and USFWS, 1998c) determined that maturity of loggerheads in Australia occurs between 34.3 and 37.4 years of age.

The transition from hatchling to young juvenile occurs in the open sea, and evidence is accumulating that this part of the loggerhead life cycle may involve trans-Pacific developmental migration (Bowen, *et al*., 1995). The size structure of loggerheads in coastal and nearshore waters of the eastern and western Pacific suggest that Pacific loggerheads have a pelagic stage similar to the Atlantic. This is supported by the fact that the high seas driftnet fishery, which operated in the Central North Pacific in the 1980s and early 1990s, incidentally caught juvenile loggerheads (mostly 40-70 cm in length) (Wetherall, *et al*., 1993). In addition, large aggregations of mainly juveniles and subadult loggerheads, numbering in the thousands, are found off the southwestern coast of Baja California, over 10,000 km from the nearest significant nesting beaches (Pitman, 1990; Nichols, *et al*., 2000). Genetic studies have shown these animals originate from Japanese nesting stock (Bowen *et al*., 1995), and their presence reflects a migration pattern probably related to their feeding habits (Cruz, *et al*., 1991, *in* Eckert, 1993). These loggerheads are primarily juveniles, although carapace length measurements indicate that some of them are 10 years old or older. Loggerheads tagged in Mexico and California with flipper and/or satellite transmitters have been monitored returning to Japanese waters (Resendiz, *et al*., 1998a-b).

Tagging programs to study migration and movement of sea turtles provide evidence that loggerhead turtles are highly migratory and capable of trans-Pacific movement. Satellite telemetry studies show that loggerhead turtles tend to follow 17° and 20°C sea surface isotherms north of the Hawaiian islands (Polovina, *et al*., 2000; Eckert, unpublished data). Relationships between other turtle species and sea surface temperatures have also been demonstrated, with most species preferring distinct thermal regimes (Stinson, 1984). After capture in the Hawaii-based longline fishery, six satellite transmitter-equipped loggerheads traveled westward along two convergent oceanic fronts, against prevailing currents and associated with a "cool" front characterized by sea surface temperature (17°C), surface chlorophyll and an eastward geostrophic current of about 4 centimeters/second (cm/sec). Three others were associated with a warmer front (20°C), lower chlorophyll levels, and an eastward geostrophic flow of about 7 cm/sec. This study supports a theory that fronts are important juvenile habitat (Polovina, *et al*., 2000). Genetic analyses of 124 loggerheads caught in the Hawaii-based longline fishery indicated that the majority (nearly 100 percent) originated from Japanese nesting stock (P. Dutton, NMFS, personal communication, January, 2001). Loggerheads are not commonly found in U.S. Pacific waters, and there have been no documented strandings of loggerheads off the Hawaiian Islands in nearly 20 years (1982-1999 stranding data, G. Balazs, NMFS, personal communication, 2000).

For their first years of life, loggerheads forage in open ocean pelagic habitats. Both juvenile and subadult loggerheads feed on pelagic crustaceans, mollusks, fish, and algae. The large aggregations of juveniles off Baja California have been observed foraging on dense concentrations of the pelagic red crab, *Pleuronocodes planipes* (Pitman, 1990; Nichols, *et al*., 2000). Data collected from stomach samples of turtles captured in North Pacific driftnets indicate a diet of gastropods (*Janthina* sp.), heteropods (*Carinaria* sp.), gooseneck barnacles (*Lepas* sp.), pelagic purple snails (*Janthina* sp.), medusae (*Vellela* sp.), and pyrosomas (tunicate zooids). Other common components include fish eggs, amphipods, and plastics (Parker, *et al*., in press). These loggerheads in the north Pacific are opportunistic feeders that target items floating at or near the surface, and if high densities of prey are present, they will actively forage at depth (Parker, *et al*., in press). As they age, some loggerheads begin to move into shallower waters, where, as adults, they forage over a variety of benthic hard- and soft-bottom habitats (reviewed *in* Dodd, 1988). Subadults and adults are found in nearshore benthic habitats around southern Japan, in the East China Sea and the South China Sea (e.g. Philippines, Taiwan, and Viet Nam).

Studies of loggerhead diving behavior indicate varying mean depths and surface intervals, depending on whether they were located in shallow coastal areas (short surface intervals) or in deeper, offshore areas (longer surface intervals). Loggerheads appear to spend a longer portion of their dive time on the bottom (or suspended at depth), which may be related to foraging and refuge. Unlike the leatherback, to the loggerhead foraging in the benthos, bottom time may be more important than absolute depth (Eckert, *et al*., 1989). The maximum recorded dive depth for a post-nesting female was 211-233 meters, while mean dive depths for both a post-nesting female and a subadult were 9-22 meters. Routine dive times for a post-nesting female were between 15 and 30 minutes, and for a subadult, between 19 and 30 minutes (Sakamoto, *et al*., 1990 *in* Lutcavage and Lutz, 1997).

Leatherback Sea Turtles

The leatherback turtle is listed as endangered under the ESA throughout its global range. Furthermore, the Red List 2000 of the IUCN has classified the leatherback as "critically endangered"[3] due to "an observed, estimated, inferred or suspected reduction of at least 80% over the last 10 years or three generations, whichever is the longer," based on: (a) direct observation; (b) an index of abundance appropriate for the taxon; and (c) actual or potential levels of exploitation. Increases in the number of nesting females have been noted at some sites *in the Atlantic*. The Florida and the U.S. Caribbean nesting populations have been increasing at about 10.3% and 7.5%, respectively, per year since the early 1980's but the magnitude of nesting is much smaller than that along the French Guiana coast (see NMFS SEFSC 2001). The nesting aggregation in French Guiana has been

[3]Taxa are categorized as critically endangered when they are facing an extremely high risk of extinction in the wild in the immediate future.

declining at about 15% per year since 1987. From the period 1979-1986, the number of nests was increasing at about 15% annually.

Genetic analyses of leatherbacks to date indicate that within the Atlantic basin significant genetic differences occur among St. Croix, U.S. Virgin Islands, and mainland Caribbean populations (Florida, Costa Rica, Suriname/French Guiana) and between Trinidad and the same mainland populations, (Dutton *et al*. 1999) leading to the conclusion that there are at least 3 separate subpopulations of leatherbacks in the Atlantic. Much of the genetic diversity is in the relatively small insular subpopulations. The analysis of mitochondrial DNA (mtDNA) indicate that the loss of the nesting populations from the St. Croix region and Trinidad would essentially eliminate most of the detected mtDNA variation throughout the Atlantic (Dutton *et al*. 1999). The Trinidad nesting population may be at a high risk. An estimated 1,000 mature female leatherback sea turtles are caught annually off of Trinidad and Tobago with mortality estimated to be between 50-95% (Eckert and Lien 1999). To date, no studies have been published on the genetic make-up of pelagic or benthic leatherbacks in the Atlantic. Compared to current knowledge regarding loggerhead populations, the genetic distinctness of leatherback populations is less clear and populations or subpopulations of leatherback sea turtles have not been formally recognized based on genetic studies.

The demise of once large populations *throughout the Pacific*, such as in Malaysia and Mexico. Spotila *et al.* (1996) estimated the global population of female leatherback turtles to be only 34,500 (confidence limits: 26,200 to 42,900) nesting females; however, the eastern Pacific population has continued to decline since that estimate, leading some researchers to conclude that the leatherback is now on the verge of extinction in the Pacific Ocean (e.g. Spotila, *et al*., 1996; Spotila, *et al*., 2000). The loss of the Pacific nesting aggregations in addition to losses of key nesting aggregations in the Atlantic would appreciably reduce population viability buy severely reducing genetic diversity, reproduction, distribution, and numbers.

Leatherback turtles are the largest of the marine turtles, with a CCL often exceeding 150 cm and front flippers that are proportionately larger than in other sea turtles and may span 270 cm in an adult (NMFS and USFWS, 1998b). In view of its unusual ecology, the leatherback is morphologically and physiologically distinct from other sea turtles. Its streamlined body, with a smooth, dermis-sheathed carapace and dorso-longitudinal ridges may improve laminar flow of this highly pelagic species. Adult females nesting in Michoacán, Mexico averaged 145 cm CCL (L. Sarti, Universidad Naçional Autonoma de Mexico, unpublished data, *in* NMFS and USFWS, 1998b), while adult female leatherback turtles nesting in eastern Australia averaged 162 cm CCL (Limpus, *et al*., 1984, *in* NMFS and USFWS, 1998b).

Leatherback turtles have the most extensive range of any living reptile and have been reported circumglobally from 71°N to 42°S latitude in the pelagic Pacific and in all other major pelagic ocean habitats (NMFS and USFWS, 1998b). For this reason, however, studies of their abundance, life history and ecology, and pelagic distribution are exceedingly difficult. Similar to the olive ridley turtle, leatherback turtles lead a completely pelagic existence, foraging widely in temperate waters except during the nesting season, when gravid females return to tropical beaches to lay eggs. Males are only rarely observed near nesting areas, and it has been proposed that mating most likely takes place outside of the tropical waters, before females move to their nesting beaches (Eckert and Eckert, 1988). They are highly migratory, exploiting convergence zones and upwelling areas in the open ocean, along continental margins, and in archipelagic waters (Morreale, *et al*., 1994; Eckert, 1998; Eckert, 1999a). In a single year, a leatherback may swim more than 10,000 kilometers (Eckert, 1998).

Recent satellite telemetry studies indicate that adult leatherback turtles follow bathymetric contours over their long pelagic migrations and typically feed on cnidarians (jellyfish and siphonophores) and tunicates (pyrosomas and salps), and their commensals, parasites and prey (NMFS and USFWS, 1998b). Because of the low nutritive value of jellyfish and tunicates, it has been estimated that an adult leatherback would need to eat about 50 large jellyfish (equivalent to approximately 200 liters) per day to maintain its nutritional needs (Duron, 1978, *in* Bjorndal, 1997). Compared to greens and loggerheads, who consume approximately 3-5% of their body weight per day, leatherback turtles may consume perhaps 20-30% of their body weight per day (Davenport and Balazs, 1991). Surface feeding has been reported in U.S. waters, especially off the west coast (Eisenberg and Frazier, 1983), but foraging may also occur at depth. Based on offshore studies of diving by adult females nesting on St. Croix, U.S. Virgin Islands, Eckert *et al*. (1989) proposed that observed internesting[4] dive behavior reflected nocturnal feeding within the deep scattering layer (strata comprised primarily of vertically migrating zooplankton, chiefly siphonophore and salp colonies, as well as medusae). Hartog (1980, *in* NMFS and USFWS, 1998b) also speculated that foraging may occur at depth, when nematocysts from deep water siphonophores were found in leatherback stomach samples. Davenport (1988, *in* Davenport and Balazs, 1991) speculated that leatherback turtles may locate pyrosomas at night due to their bioluminescence; however direct evidence is lacking.

Leatherback turtles also appear to spend almost the entire portion of each dive traveling to and from maximum depth, suggesting that maximum exploitation of the water column is of paramount importance to the leatherback (Eckert, *et al*., 1989). Maximum dive depths for post-nesting females in the Carribean have been recorded at 475 meters and over 1,000 meters, with routine dives recorded at between 50 and 84 meters. The maximum dive length recorded for such female leatherback turtles was 37.4 minutes, while routine dives ranged from 4-14.5 minutes (*in* Lutcavage and Lutz, 1997). A total of six adult female leatherback turtles from Playa Grande, Costa Rica were monitored at sea during their internesting intervals and during the 1995 through 1998 nesting seasons. The turtles dived continuously for the majority of their time at sea, spending 57-68% of their time submerged. Mean dive depth was 19 ± 1 meters and the mean dive duration was 7.4 ± 0.6 minutes (Southwood, *et al*., 1999). Migrating leatherback turtles also spend a majority of

[4]Internesting – time spent between laying clutches of eggs during a single nesting season.

time at sea submerged, and they display a pattern of continual diving (Standora, *et al*., 1984, *in* Southwood, *et al*., 1999). Eckert (1999a) placed transmitters on nine leatherback females nesting at Mexiquillo Beach and recorded dive behavior during the nesting season. The majority of the dives were less than 150 meters depth, although maximum depths ranged from 132 meters to over 750 meters. Although the dive durations varied between individuals, the majority of them made a large proportion of very short dives (less than two minutes), although Eckert speculates that the short duration dives most likely represent surfacing activity after each dives. Excluding these short dives, five of the turtles preferred dive durations greater than 24 minutes, while three others preferred dive durations between 12-16 minutes.

On the Pacific coast of Mexico, female leatherback turtles lay an average of 4 clutches per season with clutch size averaging 64 yolked eggs per clutch (García and Sarti, 2000) (each clutch contains a complement of yolkless eggs, sometimes comprising as much as 50 percent of total clutch size, a unique phenomenon among leatherback turtles and some hawksbills (Hirth and Ogren, 1987)). Each clutch is laid within a 9.3 day interval (García and Sarti, 2000). Clutch sizes in Terengganu, Malaysia, and in Pacific Australia were larger, averaging around 85-95 yolked eggs and 83 yolked eggs, respectively (*in* Eckert, 1993). Females are believed to migrate long distances between foraging and breeding grounds, at intervals of typically two or three years (García and Sarti, 2000). Spotila *et al*. (2000), found the mean re-nesting interval of females on Playa Grande, Costa Rica to be 3.7 years, while in Mexico, 3 years was the typical reported interval (L. Sarti, personal communication, 2000). In Mexico, the nesting season generally extends from November to February, although some females arrive as early as August (Sarti *et al*., 1989). In the western Pacific, nesting peaks on Jamursba-Medi Beach (Irian Jaya) from May to August, on War Mon Beach (also Irian Jaya) from November to January (Starbird and Suarez, 1994), in peninsular Malaysia in June and July (Chan and Liew, 1989), and in Queensland, Australia in December and January (Limpus and Riemer, 1984).

Migratory routes of leatherback turtles originating from eastern and western Pacific nesting beaches are not entirely known. However, satellite tracking of post-nesting females and genetic analyses of leatherback turtles caught in U.S. Pacific fisheries or stranded on the west coast of the U.S. present some strong insight into at least a portion of their routes and the importance of particular foraging areas. Current data from genetic research suggest that Pacific leatherback stock structure (natal origins) may vary by region. Because leatherback turtles are highly migratory and stocks mix in high seas foraging areas, and based on genetic analyses of samples collected by Hawaii-based longline observers, leatherback turtles inhabiting the action area are comprised of individuals originating from nesting assemblages located south of the equator in Indonesia and in the eastern Pacific along the Americas (e.g., Mexico, Costa Rica) (Dutton, *et al*., 2000).

Green Sea Turtles

Green turtles are thought to be declining throughout the Pacific Ocean, with the exception of Hawaii, as a direct consequence of a historical combination of overexploitation and habitat loss (Eckert, 1993). The species is listed as threatened under the ESA, except for breeding populations found in Florida and the Pacific coast of Mexico, which are listed as endangered. The International Union for Conservation of Nature and Natural Resources (IUCN) has classified the green turtle as "endangered"[5] due to an "observed, estimated, inferred or suspected reduction of at least 50% over the last 10 years or three generations, whichever is longer," based on: (a) direct observation; (b) an index of abundance appropriate for the species; and (c) actual or potential levels of exploitation.

The genus *Chelonia* is composed of two taxonomic units at the population level, the eastern Pacific green turtle (referred to by some as "black turtle," *C. mydas agassizii*), which ranges (including nesting) from Baja California south to Peru and west to the Galapagos Islands, and the nominate *C. m. mydas* in the rest of the range (insular tropical Pacific, including Hawaii).

Green turtles are distinguished from other sea turtles by their smooth carapace with four pairs of lateral scutes, a single pair of prefrontal scutes, and a lower jaw-edge that is coarsely serrated. Adult green turtles have a light to dark brown carapace, sometimes shaded with olive, and can exceed one meter in carapace length and 100 kilograms (kg) in body mass. Females nesting in Hawaii averaged 92 cm in straight carapace length (SCL), while at the Olimarao Atoll in Yap, females averaged 104 cm in curved carapace length (CCL) and approximately 140 kg. In the rookeries of Michoacán, Mexico, females averaged 82 cm in CCL, while males averaged 77 cm CCL (*in* NMFS and USFWS, 1998a).

Green turtles are a circumglobal and highly migratory species, nesting mainly in tropical and subtropical regions. Based on growth rates observed in wild green turtles, skeletochronological studies, and capture-recapture studies, all in Hawaii, it is estimated that green turtles attain sexual maturity at an average age of at least 25 years (*in* Eckert, 1993). Growth rates and age to first reproduction in other north Pacific populations remain unquantified (Eckert, 1993). In Hawaii, green turtles lay up to six clutches of eggs per year (mean of 3.7), and clutches consist of about 100 eggs each. Females migrate to breed only once every two or possibly many more years. Eastern Pacific green turtles have reported nesting between two and six times during a season, laying a mean of between 65 and 86 eggs per clutch, depending on the area studied (Michoacan, Mexico and Playa Naranjo, Costa Rica (*in* Eckert, 1993 and NMFS and USFWS, 1998a).

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[5] Under the IUCN, taxa are classified as endangered when they are not "critically endangered, but are facing a very high risk of extinction in the wild in the near future.

The nonbreeding range of green turtles is generally tropical, and can extend approximately 500-800 miles from shore in certain regions (Eckert, 1993). They appear to prefer waters that usually remain around 20°C in the coldest month; for example, during warm spells (e.g., El Niño), green turtles may be found considerably north of their normal distribution. Stinson (1984) found green turtles to appear most frequently in U.S. coastal waters with temperatures exceeding 18°C. An east Pacific green turtle equipped with a satellite transmitter was tracked along the California coast and showed a distinct preference for waters with temperatures above 20°C (Eckert, unpublished data). Hawaiian green turtles monitored through satellite transmitters were found to travel more than 1,100 km from their nesting beach in the French Frigate Shoals, south and southwest against prevailing currents to numerous distant foraging grounds within the 2,400 kilometer span of the archipelago (Balazs, 1994; Balazs, *et al*., 1994; Balazs and Ellis, 1996). Three green turtles outfitted with satellite tags on the Rose Atoll (the easternmost island at the Samoan Archipelago) traveled on a southwesterly course to Fiji, approximately 1,500 km distance (Balazs, *et al*., 1994).

Olive Ridley Sea Turtles

Although the olive ridley is regarded as the most abundant sea turtle in the world, olive ridley populations on the Pacific coast of Mexico are listed as endangered under the ESA; all other populations are listed as threatened. The olive ridley is categorized as endangered by the IUCN, where taxa so classified are considered to be facing a very high risk of extinction in the wild in the near future (IUCN Red List, 2000). They are the smallest living sea turtle, with an adult carapace length between 60 and 70 cm, and rarely weighing over 50 kg. They are olive or grayish green above, with a greenish white underpart, and adults are moderately sexually dimorphic (NMFS and USFWS, 1998d).

Like leatherback turtles, most olive ridley turtles lead a primarily pelagic existence (Plotkin *et al*., 1993), migrating throughout the Pacific, from their nesting grounds in Mexico and Central America to the north Pacific. While olive ridleys generally have a tropical range, with a distribution from Baja California, Mexico to Chile (Silva-Batiz, *et al*., 1996), individuals do occasionally venture north, some as far as the Gulf of Alaska (Hodge and Wing, 2000). Surprisingly little is known of their oceanic distribution and critical foraging areas, despite being the most populous of north Pacific sea turtles. The post-nesting migration routes of olive ridleys tracked via satellite from Costa Rica traversed thousands of kilometers of deep oceanic waters, ranging from Mexico to Peru, and more than 3,000 kilometers out into the central Pacific (Plotkin, *et al*., 1993). The turtles appeared to occupy a series of foraging areas geographically distributed over a very broad range within their oceanic habitat (Plotkin, *et al*., 1994). The species appears to forage throughout the eastern tropical Pacific Ocean, often in large groups, or flotillas, and are occasionally found entangled in scraps of net or other floating debris. In a three year study of communities associated with floating objects in the eastern tropical Pacific, Arenas and Hall (1992) found sea turtles, present in 15 percent of observations and suggested that flotsam may provide the turtles with food, shelter, and/or orientation cues in an otherwise featureless landscape. Olive ridleys comprised the vast majority (75%) of these sea turtle sightings. Small crabs, barnacles and other marine life often reside on the debris and likely serve as food attractants to turtles. Thus, it is possible that young turtles move offshore and occupy areas of surface current convergences to find food and shelter among aggregated floating objects until they are large enough to recruit to benthic feeding grounds of the adults. Olive ridleys feed on tunicates, salps, crustaceans, other invertebrates and small fish. Although they are generally thought to be surface feeders, olive ridleys have been caught in trawls at depths of 80-110 meters (NMFS and USFWS, 1998d), and a post-nesting female reportedly dove to a maximum depth of 290 meters. The average dive length for an adult female and adult male is reported to be 54.3 and 28.5 minutes, respectively (Plotkin, 1994, *in* Lutcavage and Lutz, 1997).

Olive ridley turtles begin to aggregate near the nesting beach two months before the nesting season, and most mating is generally assumed to occur in the vicinity of the nesting beaches, although copulating pairs have been reported over 100 km from the nearest nesting beach. Olive ridleys are considered to reach sexual maturity between 8 and 10 years of age, and approximately 3 percent of the number of hatchlings recruit to the reproductive population (Marquez, 1982 and Marquez, 1992, *in* Salazar, *et al*., 1998). The mean clutch size for females nesting on Mexican beaches is 105.3 eggs, in Costa Rica, clutch size averages between 100 and 107 eggs (*in* NMFS and USFWS, 1998d). Females generally lay 1.6 clutches of eggs per season by Mexico (Salazar, *et al*., 1998) and two clutches of eggs per season in Costa Rica (Eckert, 1993). Data on the remigration intervals of olive ridleys in the eastern Pacific are scarce; however, in the western Pacific (Orissa, India), females showed an annual mean remigration interval of 1.1 years. Reproductive span in females of this area was shown to be up to 21 years (Pandav and Kar, 2000).

Historically, an estimated 10 million olive ridleys inhabited the waters in the eastern Pacific off Mexico (Cliffton, *et al*., 1982 *in* NMFS and USFWS, 1998d). However, human-induced mortality led to declines in this population. Beginning in the 1960s, and lasting over the next 15 years, several million adult olive ridleys were harvested by Mexico for commercial trade with Europe and Japan. (NMFS and USFWS, 1998d). Although olive ridley meat is palatable, it was not widely sought after; its eggs, however, are considered a delicacy. Fisheries for olive ridley turtles were also established in Ecuador during the 1960s and 1970s to supply Europe with leather. (Green and Ortiz-Crespo, 1982).

3.4 <u>Economic Issues</u>

The only economic issue that must be evaluated in the review of this action is how the issuance of the permit will allow longline fisherman, currently unable to fish in their traditional fishing grounds north of the equator, to fish in that area.

4.0 **Environmental Consequences**

4.1 Introduction

The alternatives in this EA present options for conducting research on reducing fishery interactions with endangered and threatened turtles in the Pacific Ocean.

4.2 Effects of All Alternatives on Physical Resource Issues

4.2.1 Alternative 1 - No Action (No Permit Issued)

Although the area north of the equator is closed, it is believed that some of the vessels that have historically fished that area have relocated to California and to American Samoa (Peterson, 2001. pers. comm).

4.2.2 Alternative 2 (Proposed Action) - Issuance of the permit as requested by the applicant

Even without the research being conducted, the affected vessels have an opportunity to relocate and no net loss of fishing activity, for the basin as a whole, would be anticipated. The impact to the physical environment from the proposed action alternative would be similar to that of the no-action alternative.

4.2.3 Alternative 3 - Issue the permit based on a high confidence sampling for the minor gear modification (test use of blue-dyed bait and moving branch line)

This alternative would increase the number of vessels operating under the permit. However, even without the research being conducted, the affected vessels have an opportunity to relocate and no net loss of fishing activity, for the basin as a whole, would be anticipated. The impact to the physical environment from this alternative would be similar to that of the no-action alternative.

4.2.4 Alternative 4- Issue the permit based on a one-year design

This alternative would decrease the number of vessels operating under the permit. However, even without the research being conducted, the affected vessels have an opportunity to relocate and no net loss of fishing activity, for the basin as a whole, would be anticipated. The impact to the physical environment from this alternative would be similar to that of the no-action alternative.

4.2.5 Alternative 5- Issue the permit without the stealth gear and deep-set daytime fishing CPUE

Three vessels would not be contracted under this alternative. However, even without the research being conducted, the affected vessels have an opportunity to relocate and no net loss of fishing activity, for the basin as a whole, would be anticipated. The impact to the physical environment from this alternative would be similar to that of the no-action alternative.

4.3 Effects of All Alternatives on Biological Resource Issues

4.3.1 Alternative 1 - No Action (No Permit Issued)

Under this alternative, the proposed research would not be conducted and there would be no effect on biological resources. However, data regarding differing gear configurations and turtle interactions would not be obtained. This alternative does not reach the objective of the proposed action: "to conduct research that will lead to a reduction in the number of sea turtles incidentally caught in the U.S. pelagic longline fishery in the Pacific ocean, and potentially in longline fisheries throughout the Pacific ocean that incidentally capture endangered and threatened sea turtles." Fishing experiments are critical to developing gear technologies and fishing strategies for reducing sea turtle capture rates throughout the Pacific Ocean. Developing a gear technology or fishing strategy that is capable of significantly reducing sea turtle capture rates by longline vessels is essential if the U.S. is going to cultivate an open dialogue between the international community to formulate collaborative efforts to address the incidental sea turtle interaction problem. The no action alternative may have potential long-term costs to the recovery of sea turtles species if measures are not developed to reduce sea turtle bycatch both domestically and abroad.

4.3.2 Alternative 2 (Proposed Action) - Issuance of the permit as requested in the application

The proposed action is the issuance of a scientific research permit to conduct experiments to evaluate the effectiveness of modifications to longline fishing gear to reduce the bycatch of sea turtles using swordfish- and tuna-style fishing operations under an ESA Section 10 permit for scientific research.

Sea Turtles

The proposed experiment provided in the application would take 233 threatened loggerhead turtles, 24 threatened/endangered olive ridley turtles, 15 threatened/endangered green turtles and 44 endangered leatherback turtles over the life of the permit. These direct takes will be the only take of sea turtles in the Pacific Ocean by swordfish style fishing, however, they are in addition to the incidental take expected in the commercial fishery operating in other areas authorized in the Incidental Take Statement of the March 29, 2001, opinion.

The March 29, 2001, opinion and the biological opinion prepared on the issuance of this permit comprehensively describe the effects of capture in longline fishing gear on sea turtles. The discussion includes the effects of forced submergence, entanglement, hooking, trailing gear and transportation of deeply hooked turtles. That discussion is presented here to ensure clarity between the documents. Additionally, the research activities proposed to be performed on the turtles including handling for the collection of standard measurements, flipper and PIT tagging, collection of tissue samples and attachment of satellite transmitters is also presented.

Detailed analysis of the effects on each of the individual sea turtle species proposed to be taken under permit #1303 are evaluated in the biological opinion prepared on the issuance of this proposed permit, and are not repeated here.

Effects of Forced Submergence

Sea turtles can be forcibly submerged by longline gear either through a hooking or entanglement event, where the turtle is unable to reach the surface to breathe. This can occur at any time during the set, including the setting and hauling of the gear, and generally occurs when the sea turtle encounters a line that is too short to reach the surface or is too heavy to be brought up to the surface by a swimming sea turtle. For example, a sea turtle that is hooked on a 3 meter branchline attached to a mainline set at depth by a 6 meter floatline will generally not be able to swim to the surface unless it has the strength to drag the mainline approximately 3 more meters (discussed further below).

Turtles hooked by longline gear will sometimes drag the clip, attached to the branch line, along the main line. If this happens, the potential exists for a turtle to become entangled in an adjacent branch line which may have another species hooked such as a shark, swordfish, or tuna. According to observer reports, most of the sharks and some of the larger tuna such as bigeye are still alive when they are retrieved aboard the vessel, whereas most of the swordfish are dead. If a turtle were to drag the branch line up against a branch line with a live shark or bigeye tuna attached, the likelihood of the turtle becoming entangled in the branch line is greater. If the turtle becomes entangled in the gear, then the turtle may be prevented from reaching the surface. The potential also exists, that if a turtle drags the dropper line next to a float line, the turtle may wrap itself around the float line and become entangled.

Sea turtles that are forcibly submerged by longline gear undergo respiratory and metabolic stress that can lead to severe disturbance of their acid-base balance. While most voluntary dives by sea turtles appear to be aerobic, showing little if any increases in blood lactate and only minor changes in acid-base status (pH level of the blood), sea turtles that are stressed as a result of being forcibly submerged through hooking or entanglement in a line rapidly consume oxygen stores, triggering an activation of anaerobic glycolysis, and subsequently disturbing their acid-base balance, sometimes to lethal levels. It is likely that the rapidity and extent of the physiological changes that occur during forced submergence are functions of the intensity of struggling as well as the length of submergence (Lutcavage and Lutz, 1997). In a field study examining the effects of shrimp trawl tow times and sea turtle deaths, there was a strong positive correlation between the length of time of the tow and sea turtle deaths (Henwood and Stuntz, 1987, *in* Lutcavage and Lutz, 1997).

Sea turtles forcibly submerged for extended periods of time show marked, even severe, metabolic acidosis as a result of high blood lactate levels. With such increased lactate levels, lactate recovery times are long (even as much as 20 hours), indicating that turtles are probably more susceptible to lethal metabolic acidosis if they experience multiple captures in a short period of time, because they would not have had time to process lactic acid loads (*in* Lutcavage and Lutz, 1997). Presumably, however, a sea turtle recovering from a forced submergence would most likely remain resting on the surface (given that it had the energy stores to do so), which would reduce the likelihood of being recaptured by a submerged longline. Recapture would also depend on the condition of the turtle and the intensity of fishing pressure in the area. NMFS has no information on the likelihood of recapture of sea turtles by the Hawaii-based longline fishery or other fisheries. However, in the Atlantic Ocean, turtles have been reported as captured more than once by longliners (on subsequent days), as observers reported clean hooks already in the jaw of captured turtles. Such multiple captures were thought to be most likely on three or four trips that had the highest number of interactions (Hoey, 1998).

Respiratory and metabolic stress due to forcible submergence is also correlated with additional factors such as size and activity of the sea turtle (including dive limits), water temperature, and biological and behavioral differences between species and will therefore also affect the survivability on a longline. For example, larger sea turtles are capable of longer voluntary dives than small turtles, so juveniles may be more vulnerable to the stress of forced submergence than adults. During the warmer months, routine metabolic rates are higher, so the impacts of the stress due to entanglement or hooking may be magnified. In addition, disease factors and hormonal status may also play a role in anoxic survival during forced submergence. Any disease that causes a reduction in the blood oxygen transport capacity could severely reduce a sea turtle's endurance on a longline, and since thyroid hormones appear to have a role in setting metabolic rate, they may also play a role in increasing or reducing the survival rate of an entangled sea turtle (*in* Lutz and Lutcavage, 1997). Turtles necropsied following capture (and subsequent death) by longliners in the Hawaii-based longline fishery were found to have pathologic lesions. Two of the seven turtles (both leatherbacks) had lesions severe enough to cause probable organ dysfunction, although whether or not the lesions predisposed these turtles to being hooked could not be determined (Work, 2000). As discussed further in the leatherback and loggerhead subsections below, some sea turtle species are better equipped to deal with forced submergence.

Although a low percentage of turtles that are captured by longliners actually are reported dead, sea turtles can drown from being forcibly submerged. Such drowning may be either "wet" or "dry." In the case of dry drowning, a reflex spasm seals the lungs from both air and water. With wet drowning, water enters the lungs, causing damage to the organs and/or causing asphyxiation, leading to death. Before death due to drowning occurs, sea turtles may become comatose or unconscious. Studies have shown that sea turtles that are allowed time to stabilize after being forcibly submerged have a higher survival rate. This of course depends on the physiological condition of the turtle (e.g. overall health, age, size), time of last breath, time of submergence, environmental conditions (e.g. sea surface temperature, wave action, etc.), and the nature of any sustained injuries at the time of submergence (NRC, 1990).

Effects of entanglement

Sea turtles are particularly prone to entanglement as a result of their body configuration and behavior. Records of stranded or entangled sea turtles reveal that fishing debris can wrap around the neck or flipper, or body of a sea turtle and severely restrict swimming or feeding. Over time, if the sea turtle is entangled when young, the fishing line will become tighter and more constricting as the sea turtle grows, cutting off blood flow, causing deep gashes, some severe enough to remove an appendage. Sea turtles have also been found trailing gear that has been snagged on the bottom, thus causing them to be anchored in place (Balazs, 1985).

Sea turtles have been found entangled in branchlines (gangions), mainlines and float lines. Longline gear is fluid and can move according to oceanographic conditions determined by wind and waves, surface and subsurface currents, etc.; therefore, depending on both sea turtle behavior, environmental conditions, and location of the set, turtles could be entangled in longline gear. Entanglement in monofilament line (mainline or gangion) or polypropylene (float line) could result in substantial wounds, including cuts, constriction, or bleeding on any body part. In addition entanglement could directly or indirectly interfere with mobility, causing impairment in feeding, breeding, or migration. Sea turtles entangled by longline gear are most often entangled around their neck and foreflippers, and, often in the case of leatherback entanglements, turtles have been found snarled in the mainline, floatline, and the branchline (Hoey, 2000).

<u>Effects of hooking</u>

In addition to being entangled in a longline, sea turtles are also injured and killed by being hooked. Hooking can occur as a result of a variety of scenarios, some of which will depend on foraging strategies and diving and swimming behavior of the various species of sea turtles. For example, olive ridleys that were killed by the Hawaii-based longline fishery and were necropsied have been found with bait in their stomachs after being hooked; therefore, they most likely were attracted to the bait and attacked the hook. In addition, leatherbacks, loggerheads and olive ridleys have all been found foraging on pyrosomas which bioluminesce at night. If lightsticks are used on a swordfish set at night to attract the target species, the turtles could mistake the lightsticks for their preferred prey and get hooked externally or internally by a nearby hook. Similarly, a turtle could concurrently be foraging in or migrating through an area where the longline is set and could be hooked at any time during the setting, hauling, or soaking process.

Sea turtles are either hooked externally - generally in the flippers, head, beak, or mouth - or internally, where the animal has attempted to forage on the bait, and the hook is ingested into the gastro-intestinal tract, often a major site of hooking (E. Jacobson, *in* Balazs, *et al*., 1995). Even if the hook is removed, which is often possible with a lightly hooked (i.e. externally hooked) turtle, the hooking interaction is believed to be a significant event. Like most vertebrates, the digestive tract of the sea turtle begins in the mouth, through the esophagus, and then dilates into the stomach. The esophagus is lined by strong conical papillae, which are directed caudally towards the stomach (White, 1994). The existence of these papillae, coupled with the fact that the esophagus snakes into an s-shaped bend further towards the tail make it difficult to see hooks, especially when deeply ingested. Not surprisingly, and for those same reasons, a deeply ingested hook is also very difficult to remove from a turtle's mouth without significant injury to the animal. The esophagus is attached fairly firmly to underlying tissue; therefore, when a hook is ingested, the process of movement, either by the turtle's attempt to get free of the hook or by being hauled in by the vessel, can traumatize the internal organs of the turtle, either by piercing the esophagus, stomach, or other organs, or by pulling the organs from their connective tissue. Once the hook is set and pierces an organ, infection may ensue, which may result in death to the animal.

If a hook does not become lodged or pierce an organ, it can pass through to the colon, or even expelled through the turtle (E. Jacobson *in* Balazs, *et al*., 1995). In such cases, sea turtles are able to pass hooks through the digestive track with little damage (Work, 2000). Of 38 loggerheads deeply hooked by the Spanish Mediterranean longline fleet and subsequently held in captivity, six loggerheads expelled hooks after 53 to 285 days (average 118 days) (Aguilar, *et al*., 1995) . If a hook passes through a turtle's digestive tract without getting lodged, the chances are good that less damage has been done. Tissue necrosis that may have developed around the hook may also get passed along through the turtle as a foreign body (E. Jacobson, *in* Balazs, *et al*., 1995).

<u>Effects of trailing gear</u>
Trailing line (i.e. line that is left on a turtle after it has been captured and released), particularly line trailing from an ingested hook, poses a serious risk to sea turtles. Line trailing from an ingested hook is likely to be swallowed, which may occlude the gastrointestinal tract, preventing or hampering foraging, leading to eventual death. Trailing line may also become snagged on a floating or fixed object, resulting in further entanglement, with potential loss of appendages, which may affect mobility, feeding, predator evasion, or reproduction. For the scientific research conducted under this permit, all sets will be supervised by NMFS employees or contracted biologists, technicians, or fishery observers. In the event that a hook cannot be removed from a turtle, these personnel will be responsible for and are directed to clip the line as close to the hook as possible in order to minimize the amount of trailing gear. This is difficult with larger turtles, such as the leatherback, which often cannot practicably be brought on board the vessel, or in inclement weather, when such action might place the observer or the vessel and its crew at risk. Clipping and/or removing the trailing gear should reduce effects to sea turtles.

<u>Effects of transportation of turtles</u>
After capture, some deeply-hooked hard-shelled turtles will be brought onboard fishing vessels contracted for this experiment and transported to the dock (those captured within a 72 hour journey to port). The turtles will be treated in accordance with conditions outlined in the permit (also described in the *Description of the Proposed Action* section) and in accordance with CFR §223.206(d)(1) - NMFS handling and resuscitation requirements for incidentally taken sea turtles. The applicants anticipate that a total of 3 greens, 14 loggerheads, and 12 olive ridleys will be transported to a facility in Honolulu.

Turtles are to be transported via a climate-controlled environment, protected from temperature extremes of heat and cold, and kept moist. The turtle will be placed on pads for cushioning and the area surrounding the turtle will be free of any materials that could be accidentally ingested. Turtles have been transported using these methods for 30 years by stranding network participants without any adverse effect to the turtles.

Turtles transported to a facility for rehabilitation will be maintained and cared for under the "Care and Maintenance Guidelines for Sea Turtles Held in Captivity" issued by the U.S. Fish and Wildlife Service dated August 1997. While held at the facility, turtles will have plentiful food, shelter, and antibiotics. In addition, if necessary, turtles will be fed supplements and vitamins to take care of any deficiencies (Walsh, 1999).

Based on past experience with stranding and salvage network participants using these transport and holding techniques, NMFS does not expect that the transport and holding of sea turtles, in accordance with the special conditions of the permit, will cause any additional stress or discomfort to the turtle. In fact, because of the close care, treatment, and supervision the turtles will receive once they arrive at the facility, NMFS believes that the survival rate of the deeply hooked turtles will be higher than if the turtles had been released into the ocean soon after being captured.

Effects of Standard Measurement Collection

Standard measurements and weight are collected and associated with the tag number assigned to the turtle. Should the turtle be recaptured, weight and measurements of the two captured can be compared to measure growth. The effects of this harassment of the turtles during capture and handling, can result in raised levels of stressor hormones, and can cause some discomfort during tagging procedures. Based on past observations of similar research, these effects are expected to dissipate within a day (Stabenau and Vietti, 1999).

Effects of Flipper Tagging and Injection of PIT Tags

The purpose of flipper and PIT tagging is to enable re-identification of individual turtles over the life of the study, and during any other research studies that may be conducted during the future in the action area. Tag numbers are entered into a central database so that they can be retrieved by other researchers. This is consistent with section 10 permit special conditions requiring information sharing among researchers in the action area.

Flipper tags are commonly made of either plastic or titanium. Flipper tagging has been used for more than 20 years (Balazs, 1999) to track sea turtle movement and growth. All tag types have negatives associated with them, especially concerning tag retention. Plastic tags can become brittle, break and fall off underwater, and titanium tags can bend during implantation and thus not close properly, leading to tag loss. The small wound-site resulting from a tag applied to the flipper should heal completely in a short period of time, similar to what happens when a person's ear is pierced for an earring. The risk of infection is low, because the equipment and tag are sterilized prior to tagging of each turtle.

PIT tags are small inert microprocessors sealed in glass that can transmit a unique identification number to a hand-held reader when the reader briefly activates that tag with a low frequency radio signal at close range. PIT tags range in size from 11.5 x 2.1 mm to 20.0 x 3.2 mm. Over time, PIT tags can migrate within body tissue making it necessary to scan the entire surface of the implantation area. PIT tags have the advantage of being encased in glass, which makes them inert, and are positioned inside the turtle where loss or damage over time due to abrasion, breakage, corrosion or age over time is virtually non-existent (Balazs, 1999).

The application of all types of tags will produce some level of pain to the turtle receiving the tag (Balazs, 1999). The discomfort displayed is usually short and highly variable between individuals. Balazs (1999) states that most turtles barely seem to notice, while others exhibit a marked response. No post-tagging infection has been noted. NMFS does not anticipate any mortality or long term adverse effect to the turtle with the attachment of flipper tags or insertion of PIT tags.

Effects of Tissue Samples Collection

Tissue sampling is done with a sterile tissue punch. The sample location will depend on the species of turtle and wether the turtle is brought aboard the vessel. If the turtle is brought aboard the vessel, the turtle will have a tissue sample collected from the fleshy area between the rear flippers and below the plastron. If the turtle is too large to bring aboard the vessel (e.g. a leatherback turtle), the sample will be collected from the location most easily accessed by the researcher/observer (usually the flipper). Samples will be collected from anywhere on the limbs or neck, avoiding the head. Samples may be collected from the carapace of the leatherback turtle if necessary. For all tissue sample collections, a sterile 6mm punch sampler is used. If the animal is able to be landed onboard the vessel, the sample area is swabbed with alcohol to clean it before the sample is collected. Researchers who examined turtles caught two to three weeks after sample collection noted the sample collection site was almost completely healed (Witzel, pers. comm.). NMFS does not expect that the collection of a tissue sample will cause any additional stress or discomfort to the turtle beyond what was experienced during capture, collection of measurements and tagging.

Effects of Satellite Transmitter Attachment

Satellite tags are attached to turtles to track their movements in an attempt to locate areas of high use (i.e. feeding areas). As discussed earlier - two different types of satellite transmitters will be used during the experiment. Satellite transmitters will be attached using a polyester resin to the uppermost vertebral scute of the carapace. This area of the carapace is almost completely flat and provides a good base for the transmitter. The adhesive area of the carapace is to be cleaned of barnacles, algae and any other foreign materials and scrubbed with sandpaper. No chemical solvents will be used. The transmitters will be oriented so that the antennae points away from the turtle’s head. The turtles are held for a short period of time to ensure that the adhesive has cured sufficiently.

NMFS observer guidelines and procedures require that turtles receiving transmitters be held for an additional two hours after processing to allow the turtle to recover from the stress of the entanglement or hooking in the fishery. During this time, turtles are kept in a shaded area and are kept cool and moist to prevent dehydration and overheating.

The proposed permit also requires that the applicants provide adequate ventilation around the turtle's head during the attachment of all transmitters. To prevent skin or eye injury due to the chemicals in the resin during transmitter the application process, the transmitter attachment process must not take place in the water.

The permit also requires that the total weight of transmitter attachments for any one turtle must not exceed 5% of the body mass of the animal. Each attachment must be made so that there is no risk of entanglement. The transmitter attachment must either contain a weak link or have no gap between the transmitter and the turtle that could result in entanglement.

Based on past experience with these techniques used by turtle researchers and the documented effects of transmitter attachment, NMFS does not expect that attaching satellite transmitters to turtles taken during this research cause more than minor increases in stress or discomfort to the turtle beyond what was experienced during capture, collection of measurements and tagging.

<u>Effects of Having Observers/Researchers on Every Participating Vessel</u>
50 CFR §222.206(d)(1) (i)(B) requires commercial fisherman to attempt resuscitation of non-responsive turtles captured during commercial fishing operations. When NMFS observers are placed on board commercial vessels, these resuscitation efforts will be undertaken by the observer. In some cases, non-responsive turtles can be brought back to consciousness by placing the turtle on its bottom shell (plastron) so that the turtle is right side up and elevating its hindquarters at least 6 inches (15.2 cm) for a period of 4 up to 24 hours. The amount of the elevation depends on the size of the turtle; greater elevations are needed for larger turtles. Periodically, rock the turtle gently left to right and right to left by holding the outer edge of the shell (carapace) and lifting one side about 3 inches (7.6 cm) then alternate to the other side. It draws oxygen into the lungs and also can allow water to drain out of the lungs. Gently touch the eye and pinch the tail (reflex test) periodically to see if there is a response. The effect of these attempts can be deemed beneficial to the species. Increasing observer coverage of the fishery, and thus the numbers of observers on boats will also increase the effectiveness of this technique and ensure that it is being correctly implemented.

The proposed research requires that a NMFS observer or NMFS-trained contractor be onboard any vessel operating under the permit. They are intended to serve as both trained handlers for removing lines, hooks and nets, resuscitation (if needed), and collectors of information on the species being caught, how they were hooked/entangled, where they were captured, degree of injury (if any), and other important demographic information. NMFS believes that the presence of trained observers onboard commercial fishing vessels will ensure that injured turtles are properly resuscitated when needed. The Magnuson-Stevens Fisheries Act requires fisherman to dehook and untangle any turtles incidentally taken in these fisheries, however, NMFS has no independent verification that this is occurring, and believes that having trained observers onboard is a direct benefit to the species.

<u>Summary of Effects - Research Activities on Sea Turtles</u>
It is likely that all of the turtles which the observers handle will at least be stressed from

the encounter of being captured or hooked by the longline gear, and then brought aboard the vessel. Based on previous information obtained by NMFS observers operating onboard pelagic longline fishing vessels, NMFS expects that some of the turtles brought onboard will be injured, and some will have died. Injuries are likely to vary from lightly entangled turtles with good chances for survival to deeply hooked or gut-hooked turtles with significantly reduced survival prospects. Although all of the turtles will be disentangled or dehooked and treated for their injuries prior to release, the proposed research activities which will be authorized in this permit, will occur on turtles which have already experienced some level of recent trauma. Although the effects of handling, measuring, examining, tagging, and collecting tissue samples by observers previously described will occur in addition to any effects and/or injuries experienced by turtles due to fishing activities and could exacerbate any of these effects, NMFS believes the treatment provided by observers will minimize these effect of the fisheries.

Although all of the turtles will have already been stressed or injured due to their being entangled or hooked by longline gear, the conditions concerning animal handling and follow-up monitoring which will be followed by the observers is expected to minimize the risk of additional stress or injury. Turtles which are brought onboard and have the gear removed are likely to have much improved chances for survival and recovery in both the short and long-term than turtles which are not treated and retain the hooks for indefinite periods. In addition, NMFS does not expect any delayed injury or mortality of turtles following their release based on past research efforts by other researchers and adherence to certain protocols identified in the proposed action.

Shorttailed Albatross

NMFS began estimating the number of Laysan and black-footed albatross killed in the Hawaiian longline fishery in 1994. Since then, several thousand Laysan and black-footed albatross are estimated to be killed each year by fishing gear deployed by the Hawaiian longline fishery. Sighting data indicate that short-tailed albatross have been observed in the Northwest Hawaiian Islands since the 1930s. Recent information indicates that short-tailed albatross have been observed at sea where the proposed research will take place, where the Hawaiian longline fishery has historically conducted fishing operations, and where Laysan and black-footed albatross have been reported to be killed by Hawaiian longline fishing gear. The short-tailed albatross population is very low compared to historical estimates (current estimate: 1,362 birds; historical estimate: about 5,000,000 birds). Furthermore, an unknown fraction of the short-tailed albatross population temporarily resides at or passes through the Hawaiian archipelago and areas where the proposed research operations will be conducted.

To date, observations of short-tailed albatross and records of the accidental take of short-tailed albatross in fishery operations have been very few, and none of the observations of take have come from the Hawaii-based fishery. This is because very little time has been spent observing seabird interactions with the fishery, and only a few short-tailed albatross have been observed to occur in the vicinity of the fishing grounds. However, it is still possible that take may occur as a result of the fishing operations conducted for this proposed research.

Therefore, in an effort to ensure the long-term sustainability and survival of the species, NMFS formally consulted with the Service under section 7 of the Act on this proposed research and the anticipated take that may occur as a result of interaction with short-tailed albatross.

A. Factors to Be Considered

The probability of short-tailed albatross being taken on research longline gear and reported is a function of many factors, including: (1) temporal and spatial overlap of the distribution of short-tailed albatross at sea and the distribution of longline vessels' research fishing operations, (2) albatross foraging behavior, (3) total number of baited hooks set per unit time, and the species targeted by the longline fishing vessels (*i.e.*, swordfish, in this case), and (4) use and effectiveness of seabird deterrent devices. Additional factors that contribute to the probability that individual birds will be hooked include: (1) type of research fishing operation and gear used, (2) length of time longline gear is at or near the surface of the water during the set, and to a lesser degree during the haulback, (3) behavior of the individual bird, (4) water and weather conditions (e.g., sea state), (5) availability of food (including bait and offal), and (6) physical condition of the bird. The number of birds affected by the research fishing operations is also a function of population size; as the short-tailed albatross population increases, an increase is expected in the number of birds killed. The probability of a hooked short-tailed albatross being reported is a function of (1) observer coverage (100% in the case of the proposed research), (2) the duties of the field supervisors observing the operations on vessels contracted to conduct the research and the training they receive, and (3) the observation skills and reporting accuracy of these individuals.

<u>Temporal and Spatial Overlap</u>
Short-tailed albatrosses have been observed in the vicinity of the NWHI between November and March. Since 1938, approximately 46 observations of about 15 different birds have been sighted from land. Short-tailed albatross have been observed from Midway Atoll (Sand and Eastern Islets), Laysan Islet, French Frigate Shoals (Tern Islet) and Kure Atoll (Green Islet). Sightings of short-tailed albatross from land represent the majority of all sightings. The Pacific Ocean Biological Survey Program produced no at-sea observations of short-tailed albatross in the vicinity of the NWHI, but this survey program was conducted at a time (1960s) when the short-tailed albatross population was very low. Only two marine observations of short-tailed albatross have been recently recorded by NMFS employees.

On March 28, 1997, a short-tailed albatross was observed during haulback operations by a NMFS fishery biologist aboard the NOAA R/V Townsend-Cromwell . In the early morning hours, the short-tailed albatross was observed to be flying in a clockwise circle over the baited hooks which were being hauled back at the starboard/stern area of the vessel. The biologist noted that the "short-tail was actively looking for bait on hooks in the haulback." The biologist noted that at least 30 black-footed albatross and one Laysan albatross were also observed flying over baited hooks during haulback operations. The time and position of the vessel during haulback was: haulback began at 8:04am - 30°28'070" north latitude and 153°43'570" west longitude; haulback ended at 9:21am - 30°28'822" north latitude and 153°37'952" west longitude. About 150 hooks were deployed during the set.

The biologist was undertaking a study to test the effectiveness of the "Tori Pole," a device to haze seabirds from baited hooks deployed by fishing vessels. However, the Tori Pole was not deployed at the time of the sighting. During the course of the cruise, the biologist documented the behavior of at least 91 black-footed albatrosses and 6 Laysan albatrosses during five experimental sets during the period of 24-28 March 1997. The average number of hooks set per observation was 140, with a total of 700 hooks observed.

This was the first documented sighting of a short-tailed albatross from a vessel in the vicinity of the Hawaiian Islands. This was the first time staff on a research vessel cruise in the vicinity of the NWHI included a biologist trained specifically to identify seabirds and record their behavior. In the past, NOAA Corps Officers untrained in seabird identification have recorded opportunistic sightings of seabird species. Since 1989, the R/V Townsend-Cromwell has conducted about 21 longline research cruises that typically last about 15-30 days each.

On this particular cruise (Cruise TC-97-03 [TC-281], March 20 - April 18, 1997), the R/V Townsend-Cromwell operated about 480 to 780 nautical miles (889 to 1445 km) off the island of Oahu, Hawaii. Longline fishing operations were conducted using monofilament longline gear in conjunction with hook timers and time-depth recorders to study the habitat utilization, hooked longevity, and vulnerability to fishing gear of broadbill swordfish (*Xiphias gladius*). During the cruise, the crew of the R/V Townsend-Cromwell tagged, released and sampled about 76 fish. The types of fish caught during the cruise included: 26 blue sharks (*Prionace glauca*), 12 broadbill swordfish (*Xiphias gladius*), 20 mahimahi (*Coryphaena hippurus*), 16 longsnout lancetfish (*Alepisaurus borealis*), 1 albacore tuna (*Thunnus alalunga*), and 1 snake mackerel (*Gempylus serpens*).

In February 1999, fishery scientists aboard the R/V Townsend-Cromwell conducted a study to test the effectiveness of several techniques to reduce seabird interaction with swordfish longline fishing gear. A portion of the experiment was conducted within 50 nautical miles (nm) (91.45 kilometers) of French Frigate Shoals, a breeding colony for black-footed and Laysan albatross and where two short-tailed albatross have been observed. The experiment was also conducted in close proximity to Laysan Island where Laysan and black-footed albatross occur. Normally, longline fishing vessels are prohibited from entering waters closer than 50 nm (91.45 kilometers) from the islands and atolls that comprise the NWHI to avoid interaction with marine mammals. However the risk to seabirds and other protected species was considered negligible, because this was an experiment to test the effectiveness of certain seabird deterrent devices. Also, large safety pins were substituted for hooks to hold the bait (squid - *Illex sp.*) on the line, thereby significantly reducing potential impacts to seabirds. There were no reported impacts to protected species during this experiment. Data from 24 experimental sets indicate that researchers made about 5,143 observations of black-footed albatross and about 5,178 observations of Laysan albatross, among other seabird species, trailing the vessel during the study (Boggs 2001). Observations of seabirds were recorded as far back as 980 ft (327 m) from the stern of the vessel. Observers spent approximately 100 hours documenting seabird observations as part of the study, but did not observe any short-tailed albatross. No other species of seabirds besides black-footed or Laysan albatross were observed to have interacted with the longline baits or gear.

On January 23, 2000, a short-tailed albatross was observed flying near a Hawaii-based longline fishing vessel while hauling back longline gear. The observation was recorded by a NMFS fishery observer. The sighting occurred at 0837 at 33°9'2" north latitude and 147°49'6" west longitude.

The bird was observed flying in a group of about 10 to 15 black-footed albatrosses and was in sight of the longline vessel, circling it for approximately one and a half hours. Although some of the black-footed albatrosses in this group were feeding on discarded bait, the short-tailed albatross was not observed feeding on bait. The observer judged the bird to be a juvenile. It had a bright pink and large bill with completely brown plumage. No seabird mitigation methods were employed at the time of the sighting.

On March 28, 2000, a juvenile short-tailed albatross was observed by a private citizen at the Pacific Missile Range Facility, Barking Sands, Kauai, HI (PMRF). The bird was observed at 17:30, and was observed to be resting in the grass on the mountain side of the PMRF runway.

A short-tailed albatross with band "white 000" was banded as a chick at Torishima in 1978. It was first recorded at Midway Atoll on 15 December 1984 (Tables 15 and 16). After that, it returned each year in December and left each spring, usually in April, until its disappearance in the fall of 1994. The bird was almost always seen in the same area on the south side of Sand Islet. Its pattern of behavior in the breeding season was to sit in the colony except for occasional trips of 2 or 3 days length out to sea. In March 1994, "white 000" was observed and video-taped dancing with Yellow 015, a female short-tailed albatross hatched at Torishima in 1983 that had been coming to another part of Sand Islet since 1989. "White 000" returned again in the fall of 1994 but failed to return after a routine foraging trip soon thereafter. There was heavy longline fishing activity and high black-footed and Laysan albatross mortality as measured by the observer program north of Midway Atoll during 1994. The bird has never been sighted again in any of the NWHI nor at Torishima. This bird was a young adult that had consistently established a territory over 10 years at Midway Atoll, and short-tailed albatross have no natural at-sea predators while foraging. Therefore, the Service maintains that "white 000" may have been taken in the Hawaiian longline fishery.

Foraging Behavior

Similar to Laysan and black-footed albatross, short-tailed albatross are able to locate food using well-developed eyesight and sense of smell. All three species of albatross feed at the ocean surface or within the upper three feet (one meter) by seizing, dipping or scavenging (Austin 1949, Harrison *et al*. 1983). Their diet consists primarily of squid, fish and flying fish eggs (Harrison *et al*. 1983, Austin 1949).

As demonstrated in the Alaska fishery, short-tailed, Laysan and black-footed albatross have been documented by NMFS to be killed as a result of interaction with demersal longline gear (Shannon Fitzgerald, NMFS, pers. commun. 1999). Birds attempting to steal bait may be hooked, pulled underwater as the mainline is set at its fishing depth, and drowned. In a similar manner, birds may also be killed during haulback operations. Also, if birds that attempt to steal bait are not hooked, they may be injured during the process of attempting to steal bait either from the hook, branch-line or mainline.

<u>Hooks set per unit time and trip type</u>
NMFS has documented the number of killed Laysan and black-footed albatross observed during haulbacks since 1994 through its Observer Program. The methodology used to estimate the number of birds killed, at 95% confidence intervals, is described in the NOAA Technical Memorandum NOAA-TM-NMFS-SWRSC-257 (NMFS 1998b).

Between 30% to 95% of birds caught on the fishing gear during deployment and haulback may fall off the hook as a result of gear deployment/haulback operations, strong currents, scavenged by predators during the soak, or cut-off by fishers during the haulback (Gales *et al.* 1998, Brian McNamara, pers. commun. 2000). Therefore, the minimum rate at which birds are estimated killed per 1,000 hooks for the years 1994 - 1998 respectively was: for Laysan albatross - 0.1523 (1994), 0.1026 (1995), 0.0727 (1996), 0.0739 (1997), and 0.0887 (1998); and for black-footed albatross - 0.1662 (1994), 0.1394 (1995), 0.1063 (1996), 0.0739 (1997) and 0.1177 (1998) (K. Foster, Service, pers. commun., 1999). Actual rates at which seabirds interact with Hawaiian longline gear maybe higher.

This information can be further refined by reporting bycatch ratios by set type , based on information from the NMFS observer database (1994 - 1998). When fishers targeted swordfish, about 370 birds were observed caught after 488 observed sets which results in a 0.758 bird catch per set ratio. When fishers targeted both tuna and swordfish, known as a mixed set, about 472 birds were caught after 946 observed sets which results in a 0.499 bird catch per set ratio. When fishers targeted tuna, about 16 birds were observed caught after 1,250 observed sets which results in a 0.01 bird catch per set ratio. Clearly, when fishers conducted swordfish or mixed sets, they experienced a higher bird catch ratio which is likely attributed to the methodology employed. However, it is evident that the risk of interaction persists when fishers target tuna, albeit at a much reduced rate.

Information in this biological opinion demonstrates that lethal interaction between Laysan and black-footed albatross species and the Hawaiian longline vessels occurs within the range of the short-tailed albatross. Because Laysan, black-footed and short-tailed albatross species exhibit similar feeding behavior and have been documented to be killed in other U.S. fisheries, it is reasonable to assume that short-tailed albatross are at risk of injury or mortality through contact with longline fishing gear where the proposed research activities overlap with the range of the short-tailed albatross.

Seabird Deterrent Measures

NMFS' October 1999 amended proposed action (not the action under consultation here, see "Description of the Proposed Action") specified use of seabird deterrent measures and includes most of the measures that should be implemented to reduce the interaction between short-tailed albatross and Hawaiian longline vessels. However, minor modifications to that proposed action were effected in the November 2000 Opinion to better ensure that: a) seabird deterrent strategies would be implemented in areas where the short-tailed albatross foraging range may overlap with the fishery; b) the performance of the various combinations of seabird deterrent strategies would be measurable, thus providing the Service and NMFS with information to refine and improve upon seabird deterrent measures in the future; and c) the implementation of seabird deterrent strategies were consistent with recommendations from enforcement officers.

NMFS' proposal to require seabird deterrent measures for all Hawaii-based longline vessels operating north of 25° north latitude did not adequately cover areas where the short-tailed albatross may occur. A short-tailed albatross (band: yellow 047) was observed for nine days on Tern Islet, French Frigate Shoals Atoll, Hawaiian Islands NWR during the winter of 1994. The foraging range for the short-tailed albatross that visit Midway Atoll NWR, and the unknown number of short-tailed albatross that transit through the Hawaiian archipelago, may include French Frigate Shoals Atoll.

The Service reviewed the Garcia and Associates (1999) report, "Final Report, Hawaii Longline Seabird Mortality Mitigation Project, September 1999," commissioned and funded by WPRFMC, and the NMFS study conducted by C. Boggs, "Deterring Albatrosses from Contacting Baits During Swordfish Longline Sets" (Boggs 2001). These reports provided the best available scientific information regarding deterrence of seabird interactions, injuries, and mortalities associated with the Hawaiian longline fishery. These reports supported reasonable measures that the fishery should implement to reduce the potential interaction between the fishing gear and the short-tailed albatross. Furthermore, the Service concurred with NMFS that "night setting, blue-dyed and thawed bait, towed deterrent, weighted branch lines, line-setting machine and weighted branch lines, and discharge offal strategically" are, to various degrees, successful in reducing interaction and mortalities between longline gear and seabirds (Attachment K). Many of these measures will be applied in the research fishing operations, as described in the "Description of the Proposed Action."

Observer Coverage

NMFS observers have been deployed aboard industry fishing vessels since 1994 to collect fishery-related information and to record sightings of marine mammals and turtles (on Protected Species Interactions and Sighting Record forms). Observers are currently instructed to record seabirds only if they interact with the fishing gear. With the exception of short-tailed albatross, they are specifically instructed not to record seabird sightings, only interactions (Lewis Van Fossen, NMFS, pers. commun. 1999, NMFS field manual for fishery observers, 2001). Because observers have not historically allotted a portion of their time to seabird observations, and because short-tailed albatrosses are rare, the probability is remote that a short-tailed albatross would be observed through casual sightings.

NMFS defines interaction to be contact with the gear including leaders trailing off the stern of the vessel within 300 ft (100 m) of the boat. Evidence of this contact includes observations of animals at the gear; animals stealing fish from the gear or coming in contact with the gear; and evidence of fresh marine mammal or seabird damage to the catch (not by presence of damaged fish only). Protected species retrieved during haulback are documented on a separate form, called the Protected Species Tally Sheet.

Between 1994 and 1996, observers had three options for describing deterrents that might be used by fishermen to keep birds away from fishing gear. Observers could record "yes" or "no" under "streamer," "bomb," or "other." They then were asked to describe the use of this deterrent and the results in the narrative section of their data form. In 1997, the data form was amended to include 12 different bird-catch reduction devices and techniques that could be checked off. Along with interaction and deterrent data, observers collect a suite of other information about environmental conditions, time, type of gear, technique, and location of fishing effort, which could be related to levels of bird catch. These procedures will be followed in the proposed action.

On 17 November 1998 a new instruction was issued for observers to collect and return to port any short-tailed albatross retrieved dead during longline fishing operations. The same memorandum asked that any seabirds that are retrieved alive have any line and hook removed if possible, be described and the characteristics recorded, have their leg band data recorded, be photographed, and released. These procedures will be followed in the proposed action.

The Service has provided training in seabird identification for NMFS observers on three occasions since the mandatory observer program started. An hour of instruction in seabird identification using slides was provided for the first group of observers in February of 1994. Again in 1996, the Service presented classroom instruction in identification techniques and then assisted at a session at the Bishop Museum, where new observers were able to look at actual specimens of the seabirds in question. At this time the Service also provided copies of field guides for the observers to use while at sea. The classroom and museum instruction were repeated in the fall of 1999, and again in 2000 and 2001 for new cohorts of observers. The field supervisors of the proposed experiments will all receive this training.

There was an annual average of 1,078 longline trips during the period 1994-1999. Of this, there was an annual average of 46 observed fishing trips (4.3 percent). NMFS observers work about 10 hours per day, and reserve enough time to observe about 10% of each set during tuna trips and 3% of each set (gear deployment) during swordfish trips (L. Van Fossen, NMFS, pers. commun. 1999). The peak interaction period when seabirds interact with longline gear is during the set, although some interaction does occur during the haulback (Garcia and Associates 1999). Very little time has been dedicated to looking for short-tailed albatross during the set, when seabirds are most likely to interact with longline fishing gear. At least twice as much time will be spent observing the sets during the research fishing operations (at least 10% of each set will be observed).

Synthesis of Effects

Sea Turtles

Research activities which will be authorized under Permit # 1303 are expected to result in the take of a total of 311 (15 green, 44 leatherback, 233 loggerhead, and 24 olive ridley) turtles. Activities that will be conducted under the permit include capture using experimentally-modified commercial pelagic longline fishing gear, handling, examination, flipper and PIT tagging, tissue sampling, resuscitation (if necessary), transport of deeply hooked turtles to rehabilitation and subsequent release of these listed turtles. Conventional satellite tags and PSAT tags will be applied to up to 50 hardshelled turtles. Handling of the turtles has been limited to minimize harm. Due to the expected effectiveness of research protocols proposed by the applicant to minimize harm, the applicants' experience with these protocols and listed turtles, and special conditions placed on the permit, it is anticipated that all of the turtles will experience only short-term, non-lethal increases in stress during the handling, examination, tissue sampling, and tagging activities. NMFS does not believe that the additional activities being conducted by the observers on the turtles after they are brought aboard the vessel will cause any additional detectable adverse effects to the listed turtles. In most cases, NMFS believes the turtles will be in better condition than when they were brought aboard because they will have entangling gear and/or hooks removed, and will have additional recovery time before release. Up to 7 loggerheads, 2 leatherbacks, 2 olive ridleys and 2 green turtles may be boated dead. For the turtles that are released, injuries sustained from the capture are estimated, using precautionary assumptions, to lead to the subsequent death of up to 6 green, 15 leatherback, 87 loggerhead and 9 olive ridley turtles. Animals recorded as being boated dead are not counted in this post-release mortality estimate.

The level of mortality on greens and olive ridleys is very small and not expected to be a significant effect on the populations of any of these three species, should that take and mortality occur. The level of take and mortality of loggerhead and leatherback turtles is not trivial, though, and begins to approach the levels seen for annual takes in major fisheries. In contrast to the major fisheries, though, the proposed action has a finite period of performance, strict limits on the total level of take, and 100% observer coverage as a means to monitor and enforce those limits, rather than being a continuous activity with a limited ability to track and control sea turtle take and mortality as it occurs. Long-lived species such as sea turtles have a much greater ability to withstand periodic, limited reductions in numbers than they do to sustain a heavier, continuous elevation of total mortality. Were the level of mortality proposed in this permit continuing on an extended (e.g. sea turtle generation time) basis, the risk posed to the species would be very much greater.

Currently, some species are already heavily impacted. As previously discussed, the Pacific population of loggerheads is declining or stable and failing to progress toward recovery goals, and the leatherback sea turtle is declining worldwide. Bycatch and mortality in fisheries are high for these species and are significant historical and ongoing contributors to their current imperilled status. Commercial pelagic longline fishing has been developing and expanding worldwide over the past several decades and, as the extent of the take of sea turtles in those fisheries has become better understood in recent years, has become a source of major concern for sea turtle conservation. In the case of the U.S. Atlantic and Hawaii-based pelagic longline fisheries, NMFS has concluded that the continued long-term operation of the fisheries, without reasonable and prudent alternatives to reduce total take, are likely to jeopardize the continued existence of species of sea turtles in the Atlantic and Pacific Oceans (Biological Opinions dated June 8, 2001 and March 31, 2001). Even with take reductions in those domestic fisheries that limit their impact to a level that would no longer represent an appreciable reduction in the species' likelihood of survival and recovery, some species of turtles still may not survive and recover, due to continuing threats in the environmental baseline, particularly fisheries bycatch.

The U.S. fleet is a small part of the international fleet that competes on the high seas for catches of tunas and swordfish. Within the area where the U.S. fleet operates in the Atlantic, the U.S. portion of fishing effort, in numbers of hooks fished is less than 10% (5-8% of hooks sampled) of the entire international fleet's effort, and likely less than that due to differences in reporting effort between ICCAT countries (NMFS SEFSC 2001, Part III, Chap. 1). Relative to foreign fishing effort and turtle impact, thus, the U.S. domestic fleet represents only a fraction. Without methods to reduce longline fishery bycatch of turtles in the U.S. and foreign fleets, the survival and recovery of endangered and threatened sea turtles may not be possible. In order to achieve comprehensive sea turtle take reductions in pelagic longline fisheries that will have a long-term significant effect on sea turtle survival and recovery, measures must be found that can be implemented by the large, international fleets that fish the entire Pacific Ocean. Fishing tactics and modified gear configurations – technical solutions – that allow longline vessels from all fleets to continue to catch target species effectively are likely to be exportable solutions that meet that requirement.

The purpose of the proposed research is to develop such technical solutions to reduce sea turtle bycatch in commercial longline fisheries while still maintaining the ability to catch target species. Very little research has been accomplished to date to address this issue. The proposed research addresses one of the most pressing conservation research questions facing sea turtles worldwide. The rapid and promising results expected from this research will provide greater benefit to sea turtle survival and recovery, before population declines continue even further.

In addition to the expected benefits towards the conservation os sea turtles, NMFS also expects to gain invaluable information about sea turtles from these experiments. NMFS expects that this information will help determine a more accurate post-hooking survival rate estimate, establish a clearer picture of loggerhead and leatherback distribution in the Pacific Ocean, and increase the available information on sea turtle life history and population demographics.

To determine the likelihood that conservation measures developed by these experiments will be adopted in domestic and foreign longline fleets, NMFS reviewed case studies of protected species conservation techniques that had been adopted by other fisheries. NMFS expects that adoption of these types of techniques in domestic fisheries will be a relatively quick process once the results are available. As necessary, NMFS may also require the adoption of these techniques to ensure that the fisheries NMFS manages are not likely to jeopardize the continued existence of sea turtles. NMFS and the United States (U.S.) have less direct influence over foreign fleets, therefore NMFS' review of the adoption of conservation measures focused on adoption by foreign nations. The reduction in the mortality of protected species caused by unintentional capture in fisheries can be attained by limiting fishing effort at some times and places, closing a fishery, reducing tow times or soak times, or modifying fishing gear to either exclude animals or prevent injuries and mortalities. Two programs that have shown success in significantly reducing injury and mortality of protected species through adoption of alternative techniques and gear by domestic and international fisheries include the “dolphin-safe” tuna program and the development and use of turtle excluder devices in trawl fisheries. A complete discussion of these two fisheries and the adoption of new techniques developed by the U.S. fishery is available in the Biological opinion prepared on the issuance of this proposed permit and is not repeated here.

The essential analysis in this EA is whether the proposed research will affect sea turtles in a way that, in combination with the environmental baseline and probable cumulative effects, is likely to appreciably reduce the likelihood of any species’ survival and recovery in the wild. The level of mortality for loggerheads and leatherbacks from the proposed research is not insignificant. Because of the limited duration of the permit and its 100% monitoring, however, the taking is not expected to continue for the length of time that would be expected to produce significant population level effects. More importantly, the proposed research is expected to address a critical issue in sea turtle conservation worldwide, and sea turtle bycatch reduction techniques developed from this research will actually be used to reduce sea turtle takes that are contributing to the environmental baseline that is adversely affecting loggerheads and leatherbacks. Therefore, the effects of this proposed research are actually to appreciably *increase* the likelihood of survival and recovery in the wild for loggerhead and leatherback sea turtles.

Short-tailed Albatross

Section 9 of the Act and Federal regulations pursuant to section 4(d) of the Act prohibit the take of endangered and threatened species, respectively, without special exemption. Take is defined as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or to attempt to engage in any such conduct. Harm is further defined by the

Service to include significant habitat modification or degradation that results in death or injury to listed species by significantly impairing essential behavior patterns, including breeding, feeding, or sheltering. Harass is defined by the US Fish and Wildlife Service (Service) as intentional or negligent actions that create the likelihood of injury to listed species to such an extent as to significantly disrupt normal behavior patterns which include, but are not limited to, breeding, feeding or sheltering. Incidental take is defined as take that is incidental to, and not the purpose of, the carrying out of an otherwise lawful activity. Under the terms of sections 7(b)(4) and 7(o)(2), taking that is incidental to and not intended as part of the agency action is not considered to be prohibited taking under the Act provided that such taking is in compliance with the terms and conditions of this Incidental Take Statement.

The measures described below are non-discretionary, and must be undertaken by NMFS so that they become binding conditions of any authorization of the proposed research as appropriate, for the exemption in section 7(o)(2) to apply. NMFS has a continuing duty to regulate the activity covered by this incidental take statement. If NMFS (1) fails to adhere to the terms and conditions of the incidental take statement through enforceable terms that are added to the permit or grant document, and/or (2) fails to retain oversight to ensure compliance with these terms and conditions, the protective coverage of section 7(o)(2) may lapse. In order to monitor the impact of incidental take, NMFS must report the progress of the action and its impact on the species to the Service as specified in the incidental take statement [50 CFR §402.14(I)(3)].

Amount or Extent of Take Anticipated

The Service anticipates that 3 short-tailed albatross may be taken during the three-year period addressed in this consultation, based on an estimate of 1 bird per year, from 2001 through 2004, as a result of the experimental fishing activities conducted by NMFS. The incidental take is expected to be in the form of mortality or injury. The Service expects that documentation of this take will be likely because of the 100% observer coverage described for the proposed action. The Service considers the observation of a short-tailed albatross in the vicinity of the vessel, actively looking for food, to represent an unknown number or index of short-tailed albatross that may occur within the range of the research activities. Given NMFS's historically low level of observer coverage and the absence of reported observed takes of short-tailed albatross by the Hawaii longline fishery, the Service is not able to calculate the rate at which short-tailed albatross forage for bait on hooks or "strike a hook," and the number that these observations may represent in terms of birds actually killed or injured. To better understand the rate at which birds strike at hooks and are killed or injured, such taking will be considered in compliance with this Incidental Take Statement.

The Service defines "interaction" as observation of a short-tailed albatross striking at the baited hooks or mainline gear when the vessel conducts setting or haulback operations. Because an interaction is a behavior that has been documented to precede take in the form of injury or mortality in Laysan and black-footed albatrosses, for the purposes of this biological opinion, an interaction will be considered to represent a take of a short-tailed albatross. To summarize, either an interaction or an observed injury or mortality constitutes the take of a short-tailed albatross for this biological opinion only.

The Service will not refer the incidental take of any migratory bird (in this case, short-tailed albatross) for prosecution under the Migratory Bird Treaty Act of 1918, as amended (16 U.S.C. §§703-712), if such take is in compliance with the terms and conditions (including amount and/or number) specified herein.

Effect of the Take

The Service has estimated that 1 short-tailed albatross per year (or 3 for the duration of this consultation) may be taken as a result of the proposed action from the year 2001 through 2004. However, this is only an estimate, based on certain assumptions relative to the bird's behavior and appearance within the area of the Hawaiian islands and its possible interaction with the longline fishery activities.

The Service does not believe that this level of take is likely to result in jeopardy to the species, nor will it result in destruction or adverse modification of critical habitat, as critical habitat is not designated in the project area.

Reasonable and Prudent Measures

The Service believes that the following reasonable and prudent measures are necessary and appropriate to minimize the impact of the incidental take of short-tailed albatrosses:

1.00 Minimize attraction of short-tailed albatross to fishing gear used in the proposed research.
1.00 Monitor the level of take and measures to minimize take.
1.00 Ensure survivability of injured short-tailed albatrosses.

Terms and Conditions

In order to be exempt from the prohibitions of section 9 of the Act, NMFS must comply with the following terms and conditions, which implement the reasonable and prudent measures described above and specify reporting requirements. These terms and conditions are non-discretionary.

In order to implement reasonable and prudent measure I above, the following terms and conditions apply:

I.A. Implementation Timeframe: NMFS shall require longline fishing activities conducted in connection with this research to comply with seabird deterrent-related measures as stated in the Proposed Action and in the terms and conditions of this biological opinion, where said fishing activities overlap with the known range of the short-tailed albatross, whether fishing activities occur within the EEZ or in international waters (*e.g.,* high seas).

I.B. Seabird Deterrent Measures: NMFS shall implement the following mandatory seabird-deterrent measures for all research fishing activities north of 23° north latitude. For the purposes of this opinion, the Service adopts the NMFS definition of shallow sets when deploying longline gear. This definition is described in the *Federal Register* (Vol.. 65, No. 214, November 3, 2000, pages 66186 - 66188).

Summary (by experiment) of seabird deterrent measures to be implemented in the proposed research

Experiment	No. of Sets/Year	Blue-Dyed Bait	Thawed Bait	Strategic Offal Discharge	Night Sets	Line Setting Machine & Weighted Branch Lines
A. Swordfish-style control fishing	1: 550 2: 520 3: 520	no	yes	yes	yes	no
B. Swordfish-style fishing w/blue-dyed bait and 40-fathom distance between float lines and nearest branch lines	1: 520 2: 520 3: 520	yes	yes	yes	yes	no
C. Swordfish-style fishing with "stealth" gear	1: 30	yes	yes	yes	yes	no
D. Deep longline sets w/light sticks	1: 30	no	yes	yes	no	yes
E. Swordfish-style fishing with hook timers	1: 180 2: 180	no	yes	yes	yes	no

The number of sets in A, B, and E may be greater or less than these approximations, which are the estimated number of sets required to obtain an expected number of sea turtle takes (121 turtles per year for the three years of the proposed research; see NMFS' section 10 permit application, Table 7, for breakdown of takes by species). If the required number of turtle takes occurs on fewer sets the experiments will be terminated, and fishing operations will cease regardless of the number of contracted sets. If the required number of sea turtles are not taken, more sets may be undertaken, so long as the incidental take limit of one short-tailed albatross per year is not exceeded.

I.B.(1). The proposed research must employ the following mandatory measures when setting and hauling the longline gear north of 23° north latitude:

a). <u>Blue-dyed and thawed bait</u>:
An adequate quantity of blue dye must be maintained on board, and only bait dyed a color that conforms to WPRFMC/NMFS standards may be used. **All bait** must be completely thawed. All bait used in Experiments B and C, above, must be dyed blue before the longline is set.

b). <u>Discharge offal strategically (Mandatory For All Sets)</u>:

While gear is being set or hauled, fish, fish parts or bait must be discharged on the opposite side of the vessel or vessel's stern from which the longline is being set or hauled. All hooks must be removed from offal and spent baits prior to discharge. If a swordfish is landed, the liver must be removed and the head must be severed from the trunk, the bill removed and the head cut in half vertically. The heads and livers must be periodically thrown overboard from which the longline is being set or hauled. Because the supply of offal may be low when fish catch rates are low or tuna are the target species, this mitigation method requires the preparation and storage of offal for use during the longline set. The strategic discharge of offal will be employed by all fishing operations connected with the proposed research. This deterrent measure will be especially important in Experiment D., which does not employ dyed bait or night setting.

c). Night setting (Mandatory For Shallow Sets Only):
The longline set must begin at least one hour after sunset and the set must be completed by sunrise, using only the minimum vessel lights necessary for safety. Night Setting shall be employed in all sets in Experiments A, B, C, and E.

d). Setting Machine with weighted branchlines (Mandatory For Deep Sets Only):
The longline must be set with a line-setting machine (line shooter) so that the longline is set faster than the vessel's speed. In addition, weights of at least 45 grams must be attached to branch lines within one meter of each baited hook. Setting Machine with weighted branchlines shall be employed in all sets in Experiment D.

I.B.(2). Hawaii-based longline fishers may employ the following measures when setting and hauling the longline gear north of 23° north latitude:

a). Weighted Branch Lines (Optional):
At least 45 grams of weight may be attached to branchlines within one meter of each baited hook. Weighted branchlines may be employed in all research sets.

b). Towed Deterrents (Optional):
A line with suspended streamers (tori line) or a buoy that may conform to Council/NMFS standards may be deployed when the longline is being set and hauled. Towed deterrents may be employed in all research sets.

I.C. Annual Workshops: Operators, captains, and personnel of vessels involved in the proposed research must attend NMFS annual Protected Species workshops to inform fishers of the risk of mortalities in the Hawaiian longline fishery to short-tailed albatross. At least one annual workshop is conducted each year. The workshops include: information exchange between NMFS, the WPRFMC, and fishers about: (1) the use of effective seabird deterrent devices in the fishery, and (2) status of the short-tailed albatross population and observations of the bird in the vicinity of the Hawaiian longline fishing area. Translations are provided to Vietnamese and Korean speaking fishers with regards to all educational materials distributed to vessel captains.

I.D. Albatross Species Identification Card: Plastic-coated, weatherproof, cards that illustrate albatross species (e.g., short-tailed, Laysan and black-footed albatross) for identification purposes, shall be distributed to all fishers participating in the proposed research. Cards translated into the Korean and Vietnamese languages should be distributed to those fishers whose first language is either Korean or Vietnamese.

In order to implement reasonable and prudent measure II above, the following terms and conditions apply:

II.A. (1). Notification of Permit Changes: Because this research will take place under a section 10 permit issued by NMFS for the take of sea turtles in scientific research, and because there exist no regulations to implement the Terms and Conditions of the November 2000 Opinion for shallow-set longline activities, NMFS will notify the Service immediately if any change is made to the field design of the proposed research (e.g., the number of sets conducted) or if any changes to the permit are made that in any way affect the proposed action.

(2). Annual Reporting: NMFS shall report annually the observed and estimated total number of interactions of Laysan and black-footed albatross, and observed take of short-tailed albatross in the longline fishing experiments, by fishing set type (i.e., deep sets [tuna] or shallow sets [swordfish/mixed] as defined by NMFS). The information about interactions between only short-tailed albatross and longline gear in the proposed research would not provide us or NMFS with sufficient information to gauge the effectiveness of the various combinations of seabird deterrent measures/devices. Therefore, to gauge the effectiveness of these seabird deterrents it is appropriate to collect data from surrogate species (*e.g.* Laysan and black-footed albatross) that exhibit similar foraging behavior to the short-tailed albatross. NMFS currently records observed interactions and estimates total number of interactions for these species.

In addition to reporting interactions and any take as noted above, NMFS shall evaluate the effectiveness of seabird deterrent measures in reducing interactions with short-tailed albatross by measuring the rate at which Laysan and black-footed (and short-tailed, if any) albatross are caught by longline vessels participating in the research. NMFS shall evaluate and report on the effectiveness of the seabird deterrent regime on an annual basis.

Within two months from the end of each fishing season for the three years of the experiment, NMFS will report to the Service on the effectiveness of seabird deterrent measures (example: if the seasonal duration of the proposed research is December 2001 through May 2002, the report would be due by August 1, 2002). The report will include (by each trip and summarized over all trips) all reported observations and mortalities of Laysan, black-footed, and short-tailed albatross, including date, time, location, vessel, vessel type, vessel size, trip type (i.e., swordfish, tuna, or mixed), gear description, total number of hooks deployed, total number of trips, and all observer or reported comments. These annual reports will be submitted by August 1 following each fishing season to: Field Supervisor, U.S. Fish and Wildlife Service; Pacific Islands Fish and Wildlife Office; 300 Ala Moana Boulevard; Room 3-122, Box 50088; Honolulu, Hawaii 96850; telephone (808) 541-3441, facsimile (808) 541-3470.

In the event a NMFS observer sights a short-tailed albatross during a trip, NMFS shall make arrangements for the Service to interview the observer. The interview will occur no later than 30 days from the time the fishing trip ended. NMFS shall make available to the Service copies of all information (*e.g.* records, pictures) collected by the observer about the sighting.

II.B. (1). <u>Observer coverage:</u> Observer coverage of the proposed research will be 100%. Every trip will have aboard a field supervisor whose primary duties will be to observe endangered species during sets and haulbacks. Fishery related activities will be considered a secondary duty and will be limited to ensuring that vessel crew tag fish carcasses in Experiments A and B. The observer may participate in this activity when the haul is completed or when observer duties for endangered species are completed. The satellite tagging and release of live fish during haulback operations may be undertaken for no longer than 30 minutes per haulback operation, or when the observer deems that albatross are no longer observed in the vicinity of the fishing gear being retrieved.

(2). <u>Observer training:</u> Field supervisors for the field experiments will receive training in seabird identification as part of their training as fishery observers.

II.C. <u>Short-tailed albatross observer duties</u>: NMFS shall deploy field supervisors/observers aboard all longline vessels conducting research. These observers are responsible for recording data directly connected with the experiments to test the effectiveness of sea turtle deterrents and recording data on seabird behavior and interaction with longline gear during the period of this consultation.

Field supervisors shall record sightings and behavior of short-tailed, Laysan and black-footed albatross during the set and haulback of the main line. Observers will record seabird sightings and behavior in the vicinity of the longline gear during at least 10% of each longline setting operation, or until the observer deems that seabirds are no longer observed in the vicinity of the deployed fishing gear, or in the case of night sets, that the observer can no longer distinguish between seabird species. Similarly, observers will record seabird sightings and behavior in the vicinity of longline gear during longline haulback operations, until the observer deems that seabirds are no longer observed in the vicinity of the fishing gear being retrieved.

Field supervisors shall monitor sightings of short-tailed, Laysan and black-footed albatross on or near longline gear. Field supervisors will consider observations and takes of short-tailed albatross, and other endangered species including sea turtles, to be the top priorities over other observer duties. The observer will record the behavior of the short-tailed albatross and other seabirds observed, describing their location in relation to the longline gear, and whether they attempt to strike at the gear to "steal bait," whether they swallowed bait, and whether they are either hooked onto or injured by the gear. The observer will record their behavior, the species of each bird that attempts to strike at fishing gear, and record the number of birds striking at the fishing gear per set and per haulback. The observer will record the number of albatross, by species, that are hauled back on longline gear. The observer will record whether the albatross was killed or injured during the haulback. If the albatross was recorded as injured, the observer will describe the extent of the injury to the best of their ability. In addition to the above-mentioned information, written reports will include: the date of the set, the type(s) of seabird deterrent measures used, weather conditions (wind velocity, precipitation, visibility and sea state), time set began and ended, latitude and longitude the set began and ended, number of hooks set, bait type (and whether it was frozen or thawed), amount of weight on hooks, number of birds within the vicinity of the vessel at the beginning of the set, bird behavior before and during set, time haulback began and ended, latitude and longitude haulback began and ended, a record of the number of birds, by species, touching the gear and their fate and condition. These data will be included as an appendix to the annual report as identified in Term and Condition II.A. (2), above.

In order to implement reasonable and prudent measure III above, and as incidental take is permitted for this listed species, the following terms and conditions apply:

III.A. NMFS shall advise fishers and observers that every reasonable effort must be made to save injured short-tailed albatross. See Appendix C for the complete U.S. Fish and Wildlife Service *Handling & Release Guidelines for Short-tailed Albatross Hooked or Entangled in the Hawaiian Longline Fishery*. If a short-tailed albatross is recovered alive, it must be retained unless it exhibits all of the following traits:

1. head is held erect and bird responds to noise and motion stimuli;
2. bird breathes without noise;
3. both wings can flap and retract to normal folded position on back;
4. bird can stand on both feet with toes pointed in the proper direction (forward); and
5. bird's plumage is completely dry.

If a recovered albatross exhibits all of these traits, it should released overboard. If the recovered bird fails to exhibit even one of the above traits, it must, by law, be retained aboard and the NMFS contacted immediately. The U.S. Coast Guard may be contacted to facilitate communication between the vessel and the NMFS. The appropriate NMFS personnel will be contacted at any one of the following telephone numbers (by availability, in the order listed):

Lewis Van Fossen	808/973-2935 extension 214
Kevin Busscher	808/973-2935 extension 215
Charles Karnella	808/973-2937

III.B. NMFS shall instruct field supervisors and fishers that every effort must be made to recover any dead short-tailed albatross. Specimens shall be frozen immediately, with identification tags attached directly to the carcass, and a duplicate identification tag attached to the bag or container holding the carcass. Identification tags shall include species, date of mortality, name of vessel, location (latitude and longitude) of mortality, observer or captain's name (or both), and any band numbers if the specimen has a leg band. Leg bands must remain attached to the bird.

III.C. NMFS shall inform field supervisors and fishers that specimens must be surrendered, as soon as possible to a NMFS or Service office. Specimens must remain frozen and must be shipped as soon as possible to: Vertebrate Conservation Coordinator, Ecological Services, Pacific Islands Fish and Wildlife Office, US Fish and Wildlife Service, Room 3-122, Honolulu, Hawaii 96850. The contact numbers for the Pacific Islands Fish and Wildlife Office are: 808/541-3441(telephone), 808/541-3470 (facsimile).

Summary of Reporting Requirements

Please note that the following is only a summary and reporting details are included in the terms and conditions above.

NMFS shall report immediately any changes to the design of the field research or the section 10 permit (from Term and Condition II.A. (1)).

NMFS shall report annually by August 1 the observed and estimated total number of interactions of Laysan and black-footed albatross, and observed take of short-tailed albatross, by fishing set type (i.e., deep set [tuna] or shallow set [swordfish/mixed] as defined by NMFS) (from Term and Condition II.A (2)).

NMFS shall evaluate annually the effectiveness of all required seabird deterrent devices by measuring the rate at which Laysan, black-footed, and short-tailed albatrosses are caught by Hawaiian longline vessels participating in the proposed research, by set type (from Term and Condition II.A).

NMFS observers shall record sightings of Laysan, black-footed, and short-tailed albatrosses during the set and haulback of the main line (from Term and Condition II.C).

4.3.3 Alternative 3 - Issue the permit based on a high confidence sampling for the minor gear modification (test use of blue-dyed bait and moving branch line)

Sea Turtles

The number of sea turtle takes would be higher then anticipated for the Proposed Action (Alternative 2) and are 330 threatened loggerhead turtles, 33 threatened/endangered olive ridley turtles, 18 threatened/endangered green turtles and 63 endangered leatherback turtles over the life of the permit. These direct takes will be the only take of sea turtles in the Pacific Ocean by swordfish style fishing, however, they are in addition to the incidental take expected in the commercial fishery operating in other areas authorized in the Incidental Take Statement of the March 29, 2001, opinion.

Detailed analysis of the effects on each of the individual sea turtle species proposed to be taken under permit #1303 are evaluated in the biological opinion prepared on the issuance of this proposed permit, and are not repeated here. A similar analysis on population effects for each of the species was not conducted under this alternative because it was rejected during the development of the proposed research plan due to the increase in sampling especially the critically endangered leatherback (36 taken in Alternative 2 Proposed Action; 63 taken under Alternative 3). The description of effects on individual sea turtles (i.e. forced submergence, entanglement, trailing gear, hooking, transportation, tagging, tissue sampling, attachment of satellite transmitters, presence of observers and researchers) described in the Proposed Action (4.2.3) on individual sea turtles is the same under this alternative.

Short-tailed Albatross

A detailed description of the effects on short-tailed albatross as a result of the proposed activities to be taken under permit #1303 are evaluated in the USFWS biological opinion issued on December 12, 2001 and are not repeated here. A similar analysis on population effects for this species was not conducted under this alternative because it was rejected during the development of the proposed research plan due to the increase in sampling especially the critically endangered leatherback. This alternative would approximately double the number of sets and thus, would increase the chance of an interaction.

4.3.4 Alternative 4 - Issue the permit based on a one-year design

Sea Turtles

The number of sea turtle takes would be lower then anticipated for the Proposed Action (Alternative 2) and are 61 threatened loggerhead turtles, 6 threatened/endangered olive ridley turtles, 4 threatened/endangered green turtles and 12 endangered leatherback turtles over the life of the permit. These direct takes will be the only take of sea turtles in the Pacific Ocean by swordfish style fishing, however, they are in addition to the incidental take expected in the commercial fishery operating in other areas authorized in the Incidental Take Statement of the March 29, 2001, opinion.

Detailed analysis of the effects on each of the individual sea turtle species proposed to be taken under permit #1303 are evaluated in the biological opinion prepared on the issuance of this proposed permit, and are not repeated here. A similar analysis on population effects for each of the species was not conducted under this alternative because it was rejected during the development of the proposed research plan due to the insufficient data that would be collected on leatherbacks. Under this alternative, the minor gear modification (blue-dyed bait and moving branch line) could not be analyzed for significance in reducing leatherback interactions due to the insufficient sampling. Under this alternative the hook timer and piggyback hook experiments would not be conducted. Based on research conducted on fish (Boggs, 1992), the applicants anticipate that 30 hook timer readers (i.e. 30 observations of a sea turtle species taken by longline) are needed in order to detect trends in turtle capture time or depth. Based on historical take levels in the swordfish fishery, the applicants anticipate that two years are needed for this portion of the experiment. This alternative would unnecessarily delay the testing of treatments for leatherback takes.

The effects on individual sea turtles (i.e. forced submergence, entanglement, trailing gear, hooking, transportation, tagging, tissue sampling, attachment of satellite transmitters, presence of observers and researchers) described in the Proposed Action (4.2.3) is the same under this alternative.

Short-tailed Albatross
A detailed description of the effects on short-tailed albatross as a result of the proposed activities to be taken under permit #1303 are evaluated in the USFWS biological opinion issued on December 12, 2001 and are not repeated here. A similar analysis on population effects for this species was not conducted under this alternative because it was rejected during the development of the proposed research plan. The effects on individual animals described in the Proposed Action (Alternative 2 - 4.2.3) is the same under this alternative. This alternative would reduce the number of sets and thus, would decrease the chance of an interaction.

4.3.5 Alternative 5 - Issue the permit without the stealth gear and deep-set daytime fishing CPUE

Sea Turtles
The 'stealth gear' and deep-set daytime fishing takes (8 threatened loggerheads, 2 threatened/endangered olive ridleys, 1 threatened/endangered greens, and 2 endangered leatherback turtles would not occur under this alternative. The remaining takes in the minor gear (blue-dyed bait and moving the branch line) and the hook timer testing will be the only take of sea turtles in the Pacific Ocean by swordfish style fishing, however, they are in addition to the incidental take expected in the commercial fishery operating in other areas authorized in the Incidental Take Statement of the March 29, 2001, opinion.

Detailed analysis of the effects on each of the individual sea turtle species proposed to be taken under permit #1303 are evaluated in the biological opinion prepared on the issuance of this proposed permit, and are not repeated here. A similar analysis on population effects for each of the species was not conducted under this alternative because it was rejected during the development of the proposed research plan. Testing major gear modifications for target species CPUE is a critical first step in determining the feasibility of implementing these modifications in the fishery. Modifications to gear or fishing practices that result in extremely low catch of the intended target species likely would not be used by the industry given the decreased catch may not cover the cost of the operation. Conducting tests on the efficacy of stealth fishing gear and daytime deep sets to reduce sea turtle interactions without first determining target species CPUE would result in unnecessary turtle takes. Eliminating the stealth fishing gear and deep-set daytime for target CPUE would delay testing for turtle bycatch if the minor gear modification experiments are determined not to be effective after the first year of the experiment.

The effects on individual sea turtles (i.e. forced submergence, entanglement, trailing gear, hooking, transportation, tagging, tissue sampling, attachment of satellite transmitters, presence of observers and researchers) described in the Proposed Action (Alternative 2 - 4.2.3) is the same under this alternative.

Short-tailed Albatross
A detailed description of the effects on short-tailed albatross as a result of the proposed activities to be taken under permit #1303 are evaluated in the USFWS biological opinion issued on December 12, 2001 and are not repeated here. A similar analysis on population effects for this species was not conducted under this alternative because it was rejected during the development of the proposed research plan. The effects on individual animals described in the Proposed Action (Alternative 2 - 4.2.3) is the same under this alternative. This alternative would reduce the number of sets and thus, would decrease the chance of an interaction.

4.4 Effects of all alternatives on economic resource issues.

4.4.1 Alternative 1 - No Action (No Permit Issued)

In the March 30, 2001 EIS, NMFS evaluated the economic effects of preventing vessels managed under the PFMP from using sword-fish style longline fishing methods north of the Equator as the preferred alternative (Alternative #10 in the EIS). If NMFS-OPR denies the permit, the current status quo will remain the same and there will be no swordfish style fishing conducted north of Hawaii in the closed area by U.S. flag vessels.

4.4.2 Alternative 2 (Proposed Action) - Issuance of the permit as requested by the applicant

The research project calls for conducting 1,370 longline sets in the first year and 1,220 and 1,040 sets in the second and third years using commercial longline vessels contracted to conduct the turtle bycatch reduction experiments. The numbers of sets needed each year are estimates that will vary as needed to achieve the target number of turtle take observations required for the chosen level statistical power. NMFS Honolulu Laboratory has contracted 16 longline vessels to conduct the first years work, pending issuance of the ESA Section 10(a)(1)(A) permit. Contracts were awarded via a competitive procurement process which included negotiations. Offers were made under the condition that vessels would keep and sell the fish catch. Funding has been secured for CY2001 and this funding is expected to occur at this level in FY2002 and FY 2003. The proposed research permit will expire on January 31, 2005.

Vessels that participate in the research under the research permit will be allowed to use commercially banned swordfish-style longline fishing gear as well as tuna-style fishing gear in controlled experiments to test whether certain changes to the appearance or configuration of the gear reduce turtle bycatch and or reduce target species catch rates and revenues. The collection of revenue data from the sale of the fish catch is an essential aspect of the experiment. A majority of the contracted vessels have historically fished in the Hawaii-based fishery using fishing gear that is now banned for commercial fishing.

The negative economic effects of preventing vessels managed under the FMP from using swordfish-style fishing methods north of the equator (March 30, 2001 EIS) would be reduced by about 1/3 through the proposed action because that is about the proportion between the swordfish longline operations in the proposed action and the commercial swordfish longline operations that were banned. The proposed action will restore about 1/3 of the economic activity lost under the swordfish gear ban.

A. Gear modification (test use of blue-dyed bait and moving branch line)

Two modifications to fishing practices which have been determined to have promise for reducing turtle takes while having only minor impacts (if any) on fishing performance (target species CPUE) are the use of squid bait dyed blue with food coloring and the removal of branch lines attached to the main line closest to the float line attachment points. Therefore, the first portion of the proposed research would simultaneously test a combination of these two experimental gear modifications as a single experimental fishing treatment against a control. The experiment would test the effect of longlining for swordfish using blue-dyed bait and moving the nearest branchlines to at least 40 fathoms from the nearest floatline and comparing this method to standard (i.e. control) fishing operations. Data analyses and results would determine the efficacy of the combined method for reducing sea turtle bycatch, compared to normal fishing operations. This portion of the experiment will involve the majority of time and effort (3 years) and will employ 8 full-time vessels. Equal numbers of treatment and control operations (sets) will be conducted but the total number of sets listed is just an estimate based on historical capture rates of turtles by swordfish style fishing gear (leatherbacks - 0.0154/set;

loggerheads - 0.0829/set; olive ridley - 0.0078/set; green - 0.0044/set). Again, the statistical properties of Poisson-distributed data are such that the number of sets is not critical to the test, and the experiment will be limited to the number of turtle takes required, not the number of sets estimated. If more sets are needed to reach the required number of observed turtle interactions, additional fishing operations will be contracted. The estimated total number of sets per year for this portion of the experiment will be 1,039, a third of the 3,117 sets that may be required over three years.

B. Testing "stealth gear" and deep-set daytime fishing for CPUE viability

Because of sea turtles' association with floating objects and possible attraction to anomalies in what otherwise is a featureless ocean, the applicant proposes to test the use of "stealth" gear - longline gear that has been camouflaged in order to be less visible to sea turtles. Before determining whether this major gear modification may reduce sea turtle interactions, the applicants first want to ensure that CPUE of target species using these modifications is still comparable to standard longline fishing. Therefore, reducing the visibility of longline gear to sea turtles by using "stealth" longlines with major gear modifications is proposed for testing viability in maintaining target species CPUE in both swordfish-style (shallow set, nighttime) and tuna-style (deep-set, daytime) fishing operations and comparing to standard (i.e. controlled) swordfish- and tuna-style operations. Any information regarding sea turtle interaction rates will be secondary.

The treatment sets will utilize floats that are blue on the bottom and orange on top, and control sets will utilize typical floats that are orange all over. The treatment sets will also use dark grey monofilament for main line, float lines, and branch lines, while the control sets will use typical longline gear (i.e. visible). Battery powered, narrow-frequency, yellow light emitting diode- (LED) based, down-welling (shaded on the upper half) light sticks will be used on stealth gear (treatment), and regular yellow chemical light sticks will be used on standard gear (control). Lastly, for stealth gear (treatment), the metallic shine of the branch line and float line snaps will be removed or they will be painted, and the bait will be dyed blue (described in Boggs (2000)), while controls will use natural (i.e. un-dyed) squid and longline gear used by typical Hawaii-based longline fishers. The applicants have stated that they need at least 3 fishing trips (i.e. 30 sets) with controls for a credible demonstration in both types of fishing operations. Therefore, there will be 30 control sets and 30 treatment sets each for swordfish-style and for tuna-style fishing operations (120 sets total).

Information will be collected on sea turtle bycatch during this portion of the experiment, but because few sets will be needed to determine differences in CPUE, there will not be a sufficient number of sets to determine statistically whether stealth gear reduces sea turtle interactions. Based on the number of sets needed to test CPUE viability, and on historical catch rates of the four species of turtles likely to be encountered by both swordfish-style[6] and tuna-style[7] fishing, the applicants have estimated the number and species taken (and killed) during this portion of the experiment.

Similar testing of target species CPUE is proposed for deep-set daytime swordfish fishing. This proposed method would target swordfish deep, where they descend during the day, using swordfish-type bait and lightsticks in areas where near-surface nighttime swordfish abundance is high. Deep daytime fishing operations for swordfish will use a depth configuration comparable to that of tuna gear, which will be modified based upon results expected within the next few months from swordfish recently tagged with pop-up satellite transmitting archival tags (PSATs). These tags will report the typical daytime depth distribution of swordfish. Target depth will be achieved using a main line shooter and a much greater length of main line and greater number of hooks between floats while maintaining the standard swordfish-style number of branch lines per set. Depth will be measured with time-depth recorders to ensure target depths are achieved. The applicants have stated that 30 sets will be needed to demonstrate target species CPUE viability.

Information will be collected on sea turtle bycatch during this portion of the experiment, but because few sets will be needed to determine CPUE viability, there will not be a sufficient number of sets to determine statistically whether deep set daytime fishing for swordfish reduces sea turtle interactions. Based on the number of sets needed to test CPUE viability, and on historical catch rates of the four species of turtles likely to be encountered by swordfish-style fishing, the applicants have estimated the number and species taken (and killed) during this portion of the experiment. These take levels have been combined with the estimates for the "stealth" gear experiment and are presented in Table 5.

Every effort would be made to avoid taking any turtles in the stealth and deep swordfish fishing tests for target species CPUE. This will be accomplished by trying to schedule direct experimental fishing effort to times and areas where the target fish species CPUE was historically high and the turtle take rates were low. No sea turtle takes are needed for initial tests of these methods, which are intended to demonstrate CPUE, although some loggerheads, a few leatherbacks, olive ridleys, and green turtle takes are anticipated, based on historical interaction rates in the Hawaii-based longline fishery.

[6]Applicants have used the following sea turtle interaction rate based on historical takes in the Hawaii-based longline fishery using swordfish-style fishing: 0.0044 greens/set; 0.0154 leatherbacks/set; 0.0829 loggerheads/set; and 0.0078 olive ridleys/set.

[7]Applicants have used the following sea turtle interaction rate based on historical takes in the Hawaii-based longline fishery using tuna-style fishing: 0.0025 greens/set; 0.0055 leatherbacks/set; 0 loggerheads/set; and 0.0153 olive ridleys/set

The stealth and deep day swordfish experiments will be conducted at the same time, and in the same area, with three vessels: one conducting control operations to demonstrate high near-surface abundance of target species, another conducting stealth tests, and the third conducting deep daytime fishing for swordfish. Thus there will be some economizing of the control operations to serve two purposes. In testing the stealth gear with tuna style fishing there will be only two vessels, as both stealth and control fishing operations will be conducted deep during the day. The vessels would fish south of the Hawaiian Islands, in areas currently open to Hawaii-based tuna fishing operations. This portion of the experiment is estimated to last no longer than one year. In addition, with a low number of sets, these experiments are expected to have low levels of sea turtle take.

Table 5. Stealth gear and deep daytime swordfishing tests to demonstrate CPUE viability

Number of sets			Synoptic Vessels	Total Turtle Takes/Mortalities (one year experiment)							
Control	Stealth	Deep Day		Leatherback		Loggerhead		Olive ridley		Green	
60	60	30	3	2	1	8	3	2	1	1	1

C. Testing use of hook timers and hook type

Measuring trends in the time and depth of sea turtle captures could reveal particular time intervals or depths of longline operations for which sea turtles are most vulnerable, revealing possible modifications to fishing operations for future testing. The use of hook timers, in conjunction with time-depth recorders (Boggs, 1992) is proposed for this purpose. Hook timer experiments will be conducted using standard swordfish style gear fitted with hook timers as described by Boggs (1992). No controls are used, and the comparison is between different times and depths within the combined fishing operations. Based on research conducted on fish (Boggs, 1992), the applicants anticipate that 30 hook timer readers (i.e. 30 observations of a sea turtle species taken by longline) are needed in order to detect trends in turtle capture time or depth. Based on historical take levels in the swordfish fishery, the applicants anticipate that two years are needed for this portion of the experiment.

The testing of large (18/0) circle hooks for the viability of target species CPUE is proposed as a piggyback project during the hook timer measurements. Therefore, this experiment will utilize alternating "J" and 18/0 circle hooks on all hook timer operations. The applicants anticipate that this portion of the experiment will only require one year to demonstrate credible results. Experiments comparing 16/0 circle and J hooks in the Azores (Bolton and Bjorndal, 1999) and in the North Pacific (LaGrange, 2001) reduced the severity of injury of a hooked turtle; however the target species CPUE was reduced the by 30-50%. Both Bolton (personal communication) and LaGrange (personal communication) have suggested that larger (18/0) circle hooks could increase the viability of target species CPUE. Therefore testing larger circle hooks is proposed for this purpose. Because testing of different hook types differs only in their mechanical effects after a target species (or turtle, in the hook timer portion of the experiment) interacts with the hook, treatment and controls can be applied independently on the same set without pseudo-replication. If the 18/0 circle hooks are as effective at catching target species as the standard J hook, then the implementation of this gear modification in longline fisheries may reduce the severity of sea turtle injuries, thereby increasing post-release survivability.

4.4.3 Alternative 3 - Issue the permit based on a high confidence sampling for the minor gear modification (test use of blue-dyed bait and moving branch line)

Vessels that participate in the research under this alternative will be allowed to use commercially banned swordfish-style longline fishing gear as well as tuna-style fishing gear in controlled experiments to test whether certain changes to the appearance or configuration of the gear reduce turtle bycatch and or reduce target species catch rates and revenues. The collection of revenue data from the sale of the fish catch is an essential aspect of the experiment. A majority of the contracted vessels have historically fished in the Hawaii-based fishery using fishing gear that is now banned for commercial fishing.

Under this alternative, an additional 9 vessels will participate and be able to collect revenue from the sale of the fish caught under the experiment. The cost of contracting the additional vessels would be about 50% greater than for the Proposed Alternative (2). The negative economic effects of preventing vessels managed under the FMP from using swordfish-style fishing methods north of the equator (March 30, 2001 EIS) would be reduced by about one-half because that is about the proportion between the swordfish longline operations in this alternative and the commercial swordfish longline operations that were banned. This alternative would restore about one-half of the economic activity lost under the swordfish gear ban.

4.4.4 Alternative 4 - Issue the permit based on a one-year design

Vessels that participate in this will be allowed to use commercially banned swordfish-style longline fishing gear as well as tuna-style fishing gear in controlled experiments to test whether certain changes to the appearance or configuration of the gear reduce turtle bycatch and or reduce target species catch rates and revenues. The collection of revenue data from the sale of the fish catch is an essential aspect of the experiment. A majority of the contracted vessels have historically fished in the Hawaii-based fishery using fishing gear that is now banned for commercial fishing.

Under this alternative, the same numnber of vessels would initially participate compared to the Proposed Action (Alternative 2) and collect revenue from the sale of the fish caught under the experiment. However, under this alternative, the vessels will collect revenue over a one year period compared to three years in the Proposed Action (Alternative 2).

Assuming similar revenue between years, vessels would lose 2/3 of their revenue under this alternative compared to the Proposed Action (Alternative 2). The negative economic effects of preventing vessels managed under the FMP from using swordfish-style fishing methods north of the equator (March 30, 2001 EIS) would be reduced by about 1/3 in one year because that is about the proportion between the swordfish longline operations in this alternative and the commercial swordfish longline operations that were banned. However, over three years, this alternative will restore only about 1/9 of the economic activity lost under the swordfish gear ban.

4.4.5 Alternative 5 - Issue the permit without the stealth gear and deep-set daytime fishing CPUE

Vessels that participate in the research under this alternative will be allowed to use commercially banned swordfish-style longline fishing gear in controlled experiments to test whether certain changes to the appearance or configuration of the gear reduce turtle bycatch. The collection of revenue data from the sale of the fish catch is an essential aspect of the experiment. A majority of the contracted vessels have historically fished in the Hawaii-based fishery using fishing gear that is now banned for commercial fishing.

Under this alternative, approximately 3 vessels would not be able to participate compared to the Proposed Action (Alternative 2) and collect revenue from the sale of the fish caught under the experiment. The negative economic effects of preventing vessels managed under the FMP from using swordfish-style fishing methods north of the equator (March 30, 2001 EIS) would still be reduced by about 1/3 because that is about the proportion between the swordfish longline operations in this alternative and the commercial swordfish longline operations that were banned. Two of the three vessels that would be eliminated in this alternative are contracted to use tuna-style gear and would continue to fish legally in the fishery. Moreover they would have the same or higher probability of catching the estimated number of turtles in the commercial fishery. This alternative will restore about 1/3 of the economic activity lost under the swordfish gear ban.

5.0 **List of Preparers**

1.00 Terri Jordan - Fishery Biologist, National Marine Fisheries Service, Office of Protected Resources

1.00 Lilllian Becker - Fishery Biologist, National Marine Fisheries Service, Office of Protected Resources

6.0 Other Applicable Laws

6.1 Endangered Species Act of 1973 - Section 7(a)(2) of the ESA requires federal agencies to ensure that their actions are not likely to jeopardize endangered or threatened species or harm their critical habitat. Federal agencies must consult either FWS or NMFS depending on the species involved. A biological opinion analyzing the impact of a proposed action on listed species is issued by FWS or NMFS. Management documents must list endangered or threatened species occurring in the area under management and discuss potential impacts to them stemming from the proposed management measures. NMFS determined the proposed issuance of Permit #1303 may adversely affect shorttailed albatross, and initated consultation with the U.S. Fish and Wildlife Service (FWS). On December 2001, FWS issued its biological opinion that the issuance of permit #1303 would not jeopardize the continued existence of the short-tailed albatross.

6.2 Essential Fish Habitat - Section 305(b)(2) of the Magnuson-Stevens Fishery Conservation and Management Act requires NMFS to complete an EFH consultation for any action authorized, funded, or undertaken, or proposed to be authorized, funded, or undertaken by the agency that may adversely affect EFH. Consultation is required for renewals, reviews or substantial revisions of actions. The issuance of the proposed permit will not impact designated EFH. As a result, no consultation was conducted.

6.3 Magnuson-Stevens Act - Scientific Research Permit (SRP) - SRPs are issued for scientific research conducted by NOAA vessels or under contract to NMFS in order to consider all requirements of law. The Magnuson-Stvens Act exempts scientific research conducted from scientific research vessels from regulation under the Act. For the conduct of this research, the participating vessels are considered scientific research vessels and will be issued SRPs. For more information on scientific research, see the definitions and at 50 CFR 600.10 and the implementing regulations at 50 CFR 600.745.

7.0 Finding of No Significant Impact

For the reasons discussed in the Environmental Assessment for the issuance of an ESA section 10(a)(1)(A) permit to the NMFS-Honolulu Laboratory for takes of ESA-listed sea turtles associated with scientific research to reduce interactions between listed sea turtles and the Hawai'i-based longline fishery as described in the proposed action section and within the permit application, the National Marine Fisheries Service has determined that issuance of the proposed permit, with all of its mitigating special conditions, would not significantly affect the quality of the human environment. The permit authorizes two of the three proposed research activities to proceed immediately, with special conditions requiring research to immediately stop upon observed or projected estimated post-hooking mortality of 1 leatherback or 4 loggerhead sea turtles, at which point ESA section 7 consultation would be reinitiated and NEPA analysis would be conducted, if appropriate. In addition, the permit would require intermediate review of to-date research activities, any new information, and sea turtle captures and mortality , and a determination by NMFS that the benefits from continuation of the experiments in the third category of proposed research activities would outweigh any detrimental effects to sea turtles, before these later-in-time elements of the experiment occurs. These permit conditions place strict evaluation criteria on research activities. Therefore, preparation of an Environmental Impact Statement on this action is not required by section 102(2) of the National Environmental Policy Act or its implementing regulations.

Date:_______________________________

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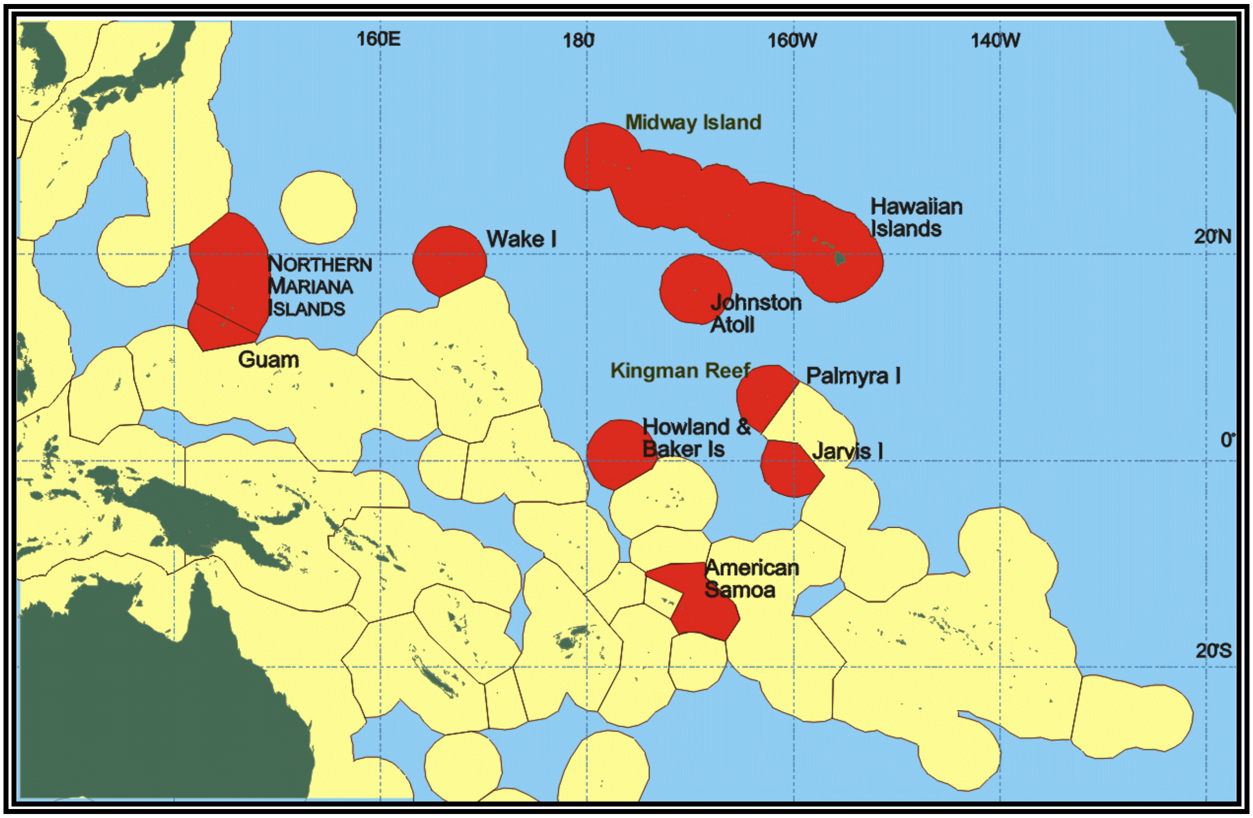
Figure 2 Exclusive Economic Zones (EEZs) of the Pacific Islands. Source, NMFS Pacific Islands Area Office.



Note:
Map of the North Pacific not translatable to PDF.

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