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Marine Mammal Protection Act
Section 101(a)(5)(E) - Negligible Impact Determination
Central North Pacific Humpback Whale

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Protected Resources Division
Pacific Islands Regional Office and Alaska Regional Office
January 22, 2010

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2.0 Introduction

Section 101(a)(5)(E) of the Marine Mammal Protection Act (MMPA), 16 U.S.C. 1361 *et seq*., has provisions for NOAA's National Marine Fisheries Service (NMFS), as delegated by the Secretary of Commerce, to issue permits for the taking of marine mammals designated as depleted because of their listing under the Endangered Species Act (ESA), 16 U.S.C. 1531 *et seq.,* by U.S. vessels and those vessels which have valid fishing permits issued by the Secretary in accordance with section 204(b) of the Magnuson-Stevens Fishery Conservation and Management Act, 16 U.S.C. 1824(b), for a period of up to three years. NMFS may issue the authorization to take ESA-listed marine mammals incidental to these commercial fisheries only after the agency has determined, after notice and opportunity for public comment, that:

(1) the incidental mortality and serious injury from commercial fisheries will have a negligible impact on the affected species or stock;

(2) a recovery plan has been developed or is being developed for such species or stock under the ESA; and

(3) where required under section 118 of the MMPA, a monitoring program has been established, vessels engaged in such fisheries are registered in accordance with section 118 of the MMPA, and a take reduction plan has been developed or is being developed for such species or stock.

The purpose of this document is to explain the analysis and rationale for determining whether the mortality and serious injury incidental to U. S. commercial fisheries will have a negligible impact on the Central North Pacific (CNP) stock of humpback whales (*Megaptera novaeangliae*), which are listed as endangered under the ESA (*i.e.*, determination (1), above). One commercial fishery in Hawaii and several commercial fisheries in Alaska within the range of the CNP humpback whale population have been observed to interact with and, in some cases, cause incidental serious injury or mortality to, these whales. Determinations regarding (2) a recovery plan, and (3) the requirements of MMPA section 118, will be made in any subsequent proposal to issue the necessary permits under MMPA section 101(a)(5)(E).

2.1 History, Process and Criteria for Issuing a 101(a)(5)(E) Permit

Among the requirements of MMPA section 101(a)(5)(E) to issue a permit to take ESA-listed marine mammals incidental to commercial fishing, NMFS must determine whether the taking of marine mammals would have a negligible impact on the affected species or stock(s) of marine mammals. Such determinations are required only under MMPA section 101(a)(5) and are currently required in authorizing the take of small numbers of any stock of marine mammals incidental to activities other than commercial fishing (termed the "Small Take Program") (sections 101(a)(5)(A) & (D)) or in permitting the take of threatened or endangered marine mammals incidental to commercial fishing operations (section 101(a)(5)(E)).

Within the MMPA's provisions for the Small Take Program, NMFS must determine if the taking (by harassment, injury, or mortality – or a combination of these) incidental to specified activities will have a negligible impact on the affected species or stock(s) of marine mammals. For permitting the take of threatened or endangered marine mammals incidental to commercial fishing operations, NMFS must determine if mortality and serious injury incidental to commercial fisheries will have a negligible impact on the affected species or stock(s) of marine mammals.

NMFS has implemented these programs, including a qualitative definition of negligible impact, through regulations and has relied upon qualitative and quantitative approaches to quantify the levels of taking that would result in a negligible impact to affected stocks of marine mammals. The quantitative approach is easier to assess for serious injury and mortality than for non-lethal takes because mortality and serious injury are considered removals from the population and can be evaluated by well-documented models of population dynamics.

2.1.1 Qualitative Guidance to Initial Quantified Approach

The MMPA does not define the term “negligible impact.” There is, however, a reference to negligible impact in the House of Representatives committee report for the MMPA Amendments of 1981, which are the amendments that added the "negligible impact" provisions to the MMPA. The report states, "'negligible' is intended to mean an impact which is able to be disregarded. In this regard, the committee notes that Webster's Dictionary defines the term 'negligible' to mean 'so small or unimportant or of so little consequence as to warrant little or no attention'" (House of Representatives, Report 97-228, September 16, 1981). NMFS' implementation of the 1981 amendments included a regulatory definition:

> An impact resulting from the specified activity that cannot be reasonably expected to, and is not reasonably likely to, adversely affect the species or stock through effects on annual rates of recruitment or survival. 50 CFR 216.103.

This qualitative definition of negligible impact was the standard NMFS used to implement the Small Take Program from its beginning in 1981 through 1994, when additional amendments to the MMPA required a more quantitative approach for assessing what level of removals from a population stock of marine mammals could be considered a negligible impact. It remains the only formal definition of negligible impact for implementing the MMPA.

The MMPA Amendments of 1994 were enacted primarily to establish a regime to govern the taking of marine mammals incidental to commercial fishing operations. These amendments were based in large part on a legislative proposal NMFS submitted to Congress in 1992. This legislative proposal was, in turn, based in large part on recommended guidelines from the Marine Mammal Commission (Commission) in early

1990 (Recommended Guidelines to Govern the Incidental Taking of Marine Mammals in the Course of Commercial Fishing Operations after October 1993, transmitted to NMFS under a cover letter from John Twiss, dated July 12, 1990). The Commission's guidelines were required by MMPA section 114(l)(4). In these guidelines, the Commission recommended, among five other characteristics of a mechanism to govern the take of threatened and endangered marine mammals incidental to fishing, "…the authorized level of take would have a negligible effect on population size and recovery time..." The Commission provided quantitative guidance on negligible effect on population size and recovery time in the following:

> an effect that (a) will not cause or contribute to a further decline in distribution or size lasting more than twelve months [[1]]; and/or (b) will not cause greater than a 10% increase in the best available estimate of the time it will take the affected species or population to recover to its maximum net productivity level [MNPL].[2]

With the recommendation above, the Commission's guidelines for establishing the regime to govern interactions between marine mammals and commercial fishing contained the first quantitative approach for assessing whether a certain level of take could be considered negligible. The two-part recommendation suggests that a take would be negligible if it had an effect lasting no more than twelve months (that is, one that would be so small that it could not be detected from natural variability or would be expected to be alleviated by the next breeding season) or would delay the period of recovery by no more than 10%. The first of these quantitative approaches is likely more appropriate for the Small Take Program than for commercial fisheries. A specified activity would likely have a relatively short duration relative to the life expectancy of the affected stocks of marine mammals; thus, it could be considered an instantaneous perturbation.

The first recommended criterion would also be appropriate for mortality and serious injury incidental to commercial fishing in cases where the take of threatened or endangered marine mammals was a rare event (*i.e.*, occurred only once in a ten to twenty-year period). Where incidental mortality or serious injury is likely to occur on a more regular basis, as it does with most interactions with commercial fishing, the

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[1] "<u>Further Definition of Negligible Effect</u>. It can be argued that the take of a single animal from a population that is stable or declining will cause or contribute to a population decline. While this may be true in an absolute sense at a fixed point in time, the effect on population size of small removals may be less than the effect of natural fluctuations in individual survival and reproductive rates. The purpose of this criterion is to prevent a determination that any lethal take, no matter how small, will inevitably cause a population decline, and therefore cannot be authorized. At the same time, it is intended to prohibit taking that would cause or contribute to a further decline in population distribution or size" (Marine Mammal Commission 1990).

[2] MNPL is the population size that results in the greatest net annual increment in population numbers or biomass resulting from additions to the population due to reproduction and/or growth less losses due to natural mortality. [*See* maximum net productivity in the definition of Optimum Sustainable Population (OSP), 50 CFR 216.3]. MNPL is the lower limit of a population stock's OSP and is, thus, the major recovery goal for depleted stocks under the MMPA.

"instantaneous" approach would likely not be appropriate, and the delay-in-recovery standard would be favored.

2.1.2 A Quantitative Approach

The Commission's guidelines suggested the beginnings of a quantitative approach to distinguish between negligible and non-negligible impact, and NMFS has used the Commission's delay-in-recovery guideline consistently. To apply this criterion, however, NMFS had to estimate what annual levels of incidental mortality and serious injury would cause no more than a 10% delay in time to recovery. Such an effort was initiated at the NMFS-convened workshop (June 1994) to develop guidelines for preparing marine mammal stock assessment reports. Among the many items considered at that workshop, participants agreed that recovery factors (F_r) used in the calculation of Potential Biological Removal (PBR)[3] for each stock of marine mammals should compensate for uncertainty and possible unknown estimation errors. In discussing the recovery factor for stocks of endangered species of marine mammals, participants noted that an F_r of 0.1 would preserve 90% of net annual production for recovery of the stock, limiting the proportion of net annual production of the stock available for authorization of mortality or serious injury incidental to human-caused mortality. Participants also stated that reserving such a high proportion of net annual production of endangered species was appropriate to "…allow stocks to recover at near maximum rates, and to minimize the probability that naturally occurring stochastic mortality would result in extinction of the stock." (Barlow *et al*. 1995 at 10) Workshop participants also noted, "authorized levels of human-related mortality should increase recovery time of endangered stocks by no more than 10% (consistent with the goal stated in NMFS legislative proposal)." (Barlow *et al*. 1995 at 11, 12). Consequently, participants at the workshop recommended, and NMFS accepted (after public review and comment), that mortality and serious injury remaining at or below PBR for an endangered stock (with 0.1 as the F_r in the PBR calculation) would have a negligible impact on the affected stock.

In applying the negligible impact criterion to determinations made initially under the MMPA Amendments of 1994, NMFS understood that total human-caused mortality and serious injury limited to a level no greater than a PBR calculated with F_r of 0.1 would be negligible; however, MMPA section 101(a)(5)(E) required a determination related to the impact of mortality and serious injury incidental to commercial fishing rather than incidental to all human activities. Accordingly, NMFS proposed to use, and subsequently used, 10% of any stock's PBR as the upper limit of mortality and serious injury incidental to commercial fishing in making the first negligible impact determinations[4] (60 FR 31666, June 16, 1995 (proposed) and 65 FR 45399, August 31, 1995 (final)). A rationale supporting this approach was that a negligible (or insignificant) level of fishery-related

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[3] *See infra* page 24, for discussion of PBR.

[4] In 1995 NMFS used 10% of PBR as an upper limit of mortality and serious injury that could be considered negligible and that could also be considered an insignificant level of incidental mortality and serious injury approaching a zero mortality and serious injury rate. The latter of these is the "target" level of mortality and serious injury that NMFS applied to the MMPA's Zero Mortality Rate Goal (ZMRG) (69 FR 43338, July 20, 2004).

mortality and serious injury should be only a small portion of the maximum level of mortality and serious injury a stock could sustain. NMFS noted that the threshold value was a starting point; that is, the criterion should not be used rigidly, but should produce the first estimate, which, in turn, could be modified on a case-by-case basis according to existing information. Although 10% of PBR was used in 1995 in issuing permits to fisheries under MMPA section 101(a)(5)(E), NMFS removed this provision from the final rule when implementing the threshold level of mortality that would be considered insignificant levels approaching a zero mortality and serious injury rate from its implementation of the ZMRG.

In 1996, when NMFS marine mammal assessment scientists and managers, representatives of the U.S. Fish and Wildlife Service, representatives of the Commission, and members of regional Scientific Review Groups reviewed the guidelines for preparing marine mammal stock assessment reports, participants discussed F_rs and the use of 10% of PBR as an upper limit for insignificant levels of removals. Participants noted that the use of 0.1 as the F_r for many stocks of endangered species, especially some of the large whales, could be too conservative. The workshop did not recommend a new default F_r for large whales, but noted that the guidelines should be clarified to allow some flexibility to depart from default values when there is justification to do so.

Workshop participants also discussed the use of 10% of PBR as a threshold value for insignificant levels of mortality and serious injury of marine threatened and endangered species, which was at the time equated with a level of mortality and serious injury that would result in a negligible impact to the affected stock of marine mammals. Some of the participants at the workshop stated, "…the PBR for endangered stocks was already set at a level that was thought, in one sense, to be insignificant to the recovery of the stock, so that 10% of that level was perhaps an overly conservative number" (Wade and Angliss 1997 at 36). Although participants agreed that 10% of PBR was an appropriate threshold value for insignificant levels of mortality for stocks with an F_r of 0.5, there was not a general agreement on an appropriate quantitative value for endangered stocks with F_r of 0.1. Workshop participants suggested a possible alternative would be to use a case-specific approach for endangered whales with a starting point as a fixed percentage of the minimum population estimate.[5]

Wade (1998) summarized the robustness trials conducted in support of the PBR approach for marine mammal conservation, including an aspect that was missing from simulations conducted for the NMFS-convened workshop in 1994: exploring the maximum level of annual removals from a population that would result in no more than a 10% delay in the time a population would need for recovery to its MNPL. Wade (1998) found that an upper limit of annual removals equal to the value of a PBR calculation with an F_r of 0.15

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[5] Minimum population estimate is defined in the MMPA to mean an estimate of the number of animals in a stock that—

> (a) is based on the best available scientific information on abundance, incorporating the precision and variability associated with such information; and
> (b) provides reasonable assurance that the stock size is equal to or greater than the estimate. MMPA section 2(27).

would allow 95% of simulations to equilibrate at or above MNPL, which was an initial step in quantifying the maximum number of annual removals resulting in a negligible impact. However, the negligible impact standard as applied in the Small Take Program and for ZMRG must also address a performance criterion for marine mammal stocks that are not necessarily depleted. Wade (1998) also reported that an upper limit of annual mortality limited to a value equal to a PBR calculation with an F_r of 0.1 would allow 95% of simulations to equilibrate within 95% of the carrying capacity of the affected stock of marine mammals.

Wade's (1998) performance testing included removals to the threshold level for a period of 100 years and evaluated the robustness of each case over a range of bias or uncertainty in productivity rates, abundance estimation, and mortality estimation. Thus, the limits are appropriate for use on long-term average removals and do not indicate that a short-term level of removal exceeding the threshold would delay time to recovery by more than 10%.

In 1998, NMFS published a notice (63 FR 71894, December 30, 1998) advising the public that the agency was extending the 3-year permit issued to fisheries in 1995 to authorize the taking of threatened or endangered marine mammals. This notice also informed the public that NMFS considered the 6-month extension of the permit an opportunity to review existing criteria for the issuance of permits and to address issues that have arisen since the permits were first issued. NMFS solicited public comments to develop alternatives to 10% of PBR as a criterion for determining negligible impact. No public comments were received.

Having received no comments upon which to develop alternatives for determining negligible impact, NMFS published a notice proposing to issue permits under MMPA section 101(a)(5)(E) in 1999 (64 FR 28800, May 27, 1999). The notice contained a statement that NMFS, through internal deliberation, had adopted the following criteria for making negligible impact determinations for such permits:

> 1. The threshold for initial determination will remain at 0.1 PBR. If total human-related serious injuries and mortalities are less than 0.1 PBR, all fisheries may be permitted.
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> 2. If total human-related serious injuries and mortalities are greater than PBR, and fisheries-related mortality is less than 0.1 PBR, individual fisheries may be permitted if management measures are being taken to address non-fisheries-related serious injuries and mortalities. When fisheries-related serious injury and mortality is less than 10 percent of the total, the appropriate management action is to address components that account for the major portion of the total.
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> 3. If total fisheries-related serious injuries and mortalities are greater than 0.1 PBR and less than PBR and the population is stable or increasing, fisheries may be permitted subject to individual review and certainty of data. Although the PBR level has been set up as a conservative standard that will allow recovery of a stock, there are reasons for individually reviewing fisheries if serious injuries and

mortalities are above the threshold level. First, increases in permitted serious injuries and mortalities should be carefully considered. Second, as serious injuries and mortalities approach the PBR level, uncertainties in elements such as population size, reproductive rates, and fisheries-related mortalities become more important.

4. If the population abundance of a stock is declining, the threshold level of 0.1 PBR will continue to be used. If a population is declining despite limitations on human-related serious injuries and mortalities below the PBR level, a more conservative criterion is warranted.

5. If total fisheries-related serious injuries and mortalities are greater than PBR, permits may not be issued.

This set of criteria maintained 10% of PBR (from 1995) as the starting point in negligible impact determinations and explicitly noted ways in which determinations could deviate from the default. Criterion 3 notes that NMFS may give special consideration if the affected stock of marine mammals is stable or increasing and may permit take incidental to fishing even if incidental removals exceed 10% of PBR, but are below PBR.

2.1.3 ESA-Listed Marine Mammals Considered in this Analysis

Central North Pacific (CNP) humpback whales (*Megaptera novaeangliae*) were listed as endangered under the ESA in 1973. Their listing status has not changed since that date, nor has critical habitat since been designated. A marine mammal species or population stock which is listed under the ESA is by definition also considered depleted under the MMPA. U. S. commercial fisheries within the range of the CNP humpback whale population (*i.e*., those commercial fisheries occurring in Hawaii and Alaska) have been observed to interact with and, in some cases, cause incidental serious injury or mortality to these whales.

On August 31, 1995, NMFS issued a three-year permit for those commercial fisheries that were determined to have negligible impacts on ESA-listed marine mammal stocks, including the CNP stock of humpback whales (60 FR 45399). This permit was extended through June 30, 1999 (63 FR 71894, Dec. 30, 1998). On May 27, 1999, NMFS proposed issuing additional three-year permits for the incidental takes of this same stock in commercial fishing operations (64 FR 28800). That notice included the above-referenced 1999 criteria for making a negligible impact determination under section 101(a)(5)(E).

Using these criteria, the impact of commercial fisheries on specific stocks of endangered and threatened marine mammals can be divided into three groups: (1) stocks with no fisheries related mortalities for which permits are not necessary; (2) stocks ineligible for permits under criteria 4 and 5; and (3) stocks for which commercial fisheries are eligible for permits provided other provisions of section 101(a)(5)(E) of the MMPA are met. Based on 1999 criteria, the draft 2009 Marine Mammal Stock Assessment Reports (SAR;

Allen and Angliss 2009), and the best scientific information and data available, NMFS has determined that CNP humpback whales fall within group (3), above. Accordingly, NMFS is reevaluating whether issuance of a permit under section 101(a)(5)(E) is appropriate. The following is NMFS' analysis and determination of whether the impacts caused by the U.S. commercial fisheries within the CNP humpback whales' range may still be considered negligible. The time frame for the data used in this analysis is the five-year period from 2003 through 2007. Hawaii and Alaska are discussed separately, below.

3.0 Action Area (Hawaii)

The action area is the U.S. Exclusive Economic Zones (EEZs) around the U.S. Pacific Islands and the high seas waters where Hawaii-based fishing vessels using longline gear configurations managed under the Fishery Ecosystem Plan for Pacific Pelagic Fisheries of the Western Pacific Region (Pelagic FEP). These areas include the EEZs around the Hawaiian Islands, and the remote U.S. Pacific islands of Johnston Atoll, Kingman Reef, Palmyra, Jarvis, Howland, Baker, Midway, and Wake Islands.

4.0 Category I and II Fisheries in the Action Area- Hawaii

In the 2009 List of Fisheries (LOF), NMFS split the Category I[6] ''HI swordfish, tuna, billfish, mahi mahi, wahoo, oceanic sharks longline/set line fishery'' (the HI-based longline fishery) into two separately managed commercial fisheries: (1) The ''HI deep-set (tuna target) longline/set line fishery"; and (2) the ''HI shallowest (swordfish target) longline/set line fishery'' (73 FR 73032, December 1, 2008). This split was warranted because the shallow-set and deep-set fisheries have different target species, operating patterns, management regimes, and marine mammal interaction rates.

NMFS' split of the HI-based longline fishery into two fisheries for purposes of the LOF resulted in a Category I deep-set fishery and a Category II shallow-set fishery. The definitions for the fishery classification criteria can be found in the implementing regulations for section 118 of the MMPA (50 CFR 229.2) and in the preamble of the proposed rule for the 2009 LOF. The "HI deep-set (tuna target) longline/set line fishery" is listed as a Category I fishery as a result of the fishery's serious injuries or mortalities to the pelagic stock of false killer whales (*Pseudorca crassidens*), which currently exceed the stock's PBR. Observer coverage in the deep-set fishery is approximately 20 percent annually.

[6] Category I fisheries have frequent incidental mortality and serious injury of marine mammals, whereas Category II fisheries have occasional incidental mortality and serious injury of marine mammals. Category III fisheries have a remote likelihood of (or no known) incidental mortality and serious injury of marine mammals. There are no permits for Category III fisheries because Category III fisheries "take," but do not seriously injure marine mammals or cause mortality. Thus, takes by Category III fisheries are not included in this discussion.

The ‘‘HI shallow-set (swordfish target) longline/set line fishery’’ was closed from 2001 to 2004 as the result of Federal court order. Since 2004, this fishery has been subject to strict management measures to reduce sea turtle interactions, including: prescribed use of large circle hooks and fish bait, restricted annual effort, annual limits on turtle takes, and 100% onboard observer coverage. NMFS considered data from 2004 to 2007 in the tier analysis, which takes into account operation of the shallow-set fishery under this new management regime. There have been observed serious injuries or mortalities in the shallow-set fishery to the following marine mammal stocks: Risso’s dolphin (*Grampus griseus*); bottlenose dolphin (*Tursiops truncatus*); and humpback whale (*Megaptera novaeangliae*) (one serious injury in 2006)[7]. There was also an interaction with a Bryde’s whale (*Balaenoptera edeni*) in 2005 that did not result in a serious injury or mortality. Each of these serious injuries or mortalities occurred outside U.S. waters. Section 117(a) of the MMPA requires NMFS to prepare a draft stock assessment for each marine mammal stock which occurs in waters under the jurisdiction of the United States, generally consisting of the waters of the U.S. territorial sea and EEZ. Each draft stock assessment must include, among other things, an estimate of the PBR level for the stock.

There is a high degree of certainty that the humpback whale from the 2006 interaction was from the CNP stock of humpback whales. The PBR of this stock is 20.4 animals (Allen and Angliss 2009). The annual mortality and serious injury of this stock in the shallow set fishery is one animal during the five-year period 2003–2007, which is a rate of 0.2 animals/year. This is the same value as 1 percent of PBR, which is also 0.2 animals/year. Because the annual mortality and serious injury of this humpback whale stock is equal to 1 percent, and less than 50 percent of the PBR level, NMFS determined in the 2009 LOF that the shallow-set portion of the longline fishery merited re-categorization as a Category II fishery.

As stated in the 2009 LOF, these are the only Category I and II fisheries in Hawaii where the “CNP stock of humpback whales” is listed as a marine mammal species and stock incidentally killed/injured. Consequently, these are the only fisheries described below.

<u>Hawaii-based Longline Fishery</u>

The Hawaii-based longline fisheries consist of two separately managed fisheries: the deep-set (tuna-target) fishery and the shallow-set (swordfish-target) fishery. The fisheries' regulatory history is described in the Pelagics FEP (NMFS, 2009). They are limited access fisheries, with 164 permits that are transferable of which approximately 130 are currently active. Vessels active in these fisheries are limited to 101 ft in length.

Hawaii-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 the equator and 40°N and longitudes 140° and 180°W, however, the vast majority of deep-set fishing occurs south of 20ºN. The number of active vessels in the combined Hawaii-based deep-set and shallow-set longline fishery increased dramatically in the late 1980s and peaked at 141 vessels in 1991. The number of vessels in the combined longline fisheries has since ranged

[7] Forney (2009).

from 101 to 130. In 2007, 129 Hawaii-based longline vessels were active in the deep-set fishery. The deep-set fishery operates year-round, although vessel activity increases during the fall and is greatest during the winter and spring months.

The annual number of trips for the combined Hawaii-based longline fishery has remained relatively stable, but there has been a shift from mixed-target and swordfish-target trips to tuna-target trips from the early 1990s up to 2002. In the years 2000-2003, this shift reflected the regulatory closure of the shallow-set and mixed-target fisheries. In 2004, the shallow-set fishery was reopened but experienced limited participation with only six trips. Also, in 2007, there were 1,515 combined longline trips (1,426 deep-set and 89 shallow-set) which resulted in a combined total of 19,379 sets (17,809 deep-set and 1,570 shallow-set).

Effort in the combined longline fishery, measured by the number of hooks set, has increased in each of the past five years: 2003 (29,297,813); 2004 (31,868,290); 2005 (35,044,685); 2006 (35,192,344); and 2007 (40,197,926). The average annual increase in effort during this period was approximately 10 percent. This trend is also reflected in the total number of sets per year increasing at about the same rate.

Observer Information

NMFS' fishery observer program for the Hawaii-based longline fishery began in 1990, with the voluntary sampling of fishing operations in order to collect fishery data and to verify unconfirmed reports of interactions between swordfish vessel operations and protected species (Dollar 1991). A mandatory observer program was implemented in April 1994 to better characterize and understand the effects of the incidental take of sea turtles, seabirds, and marine mammals by the Hawaii-based longline fishery.

Since 2000, NMFS has maintained observer coverage levels of approximately 20% of all deep-set longline fishing vessels in Hawaii. In 2004, NMFS Pacific Islands Region restructured the observer program by separating the shallow-set and deep-set components. Current regulations require 100 percent observer coverage for shallow swordfish sets and 20 percent observer coverage for deep tuna sets. The annual observer coverage level for the deep-set fishery in 2007 was 20.1%; coverage for the shallow-set fishery 2007 was 100%.

5.0 Action Area (Alaska)

The action area includes all State of Alaska and Federally-managed fisheries that operate within the Alaskan Exclusive Economic Zone (EEZ) and state waters.

6.0 Category I and II Fisheries in the Action Area- Alaska

Federally-Managed Groundfish Fisheries

All fisheries below are listed as Category II fisheries in the 2009 List of Fisheries (73 FR 73032, December 1, 2008), based on the level of serious injury or mortality of marine mammals that occurs incidental to the fishery. There are no Category I fisheries in the action area. Full descriptions of the fisheries can be found in the June 2004 Alaska Groundfish Fisheries Final Supplemental Programmatic Environmental Impact Statement, which is incorporated herein.

<u>Bering Sea Aleutian Islands (BSAI) flatfish trawl</u>

In the BSAI, rock sole, flathead sole, and other flatfish fisheries are almost exclusively targeted by catcher processors using bottom trawl gear. Although the fisheries are open to other vessel categories and gear types, very few rock sole, flathead sole, other flatfish are harvested by other types of vessels. In 2001, 26 trawl catcher processors targeted rock sole, flathead sole, and other flatfish in the BSAI. In 2001, the directed fishery for flathead sole harvested about 10,000 mt with an additional 7,500 mt of these fish harvested incidentally in the other BSAI groundfish trawl fisheries. The directed fishery for rock sole harvested about 15,000 mt in 2001, with an additional 13,000 mt harvested incidentally. In 2002, the catch of rock sole in the BSAI was about 40,000 mt and the catch of flathead sole was about 15,000 mt.

Vessels participating in these fisheries generally fish for rock sole during the roe season until the first seasonal halibut bycatch cap is reached. Generally, after the rock sole roe fishery closes, these vessels shifted to several different targets; notably Atka mackerel, yellowfin sole, and Pacific cod. Vessels also can go into the Gulf of Alaska to fish for rex sole. In the BSAI, most of the rock sole, flathead sole, and other flatfish fisheries occur on the continental shelf in the eastern Bering Sea in water shallower than 200 m. Some effort follows the contour of the shelf to the northwest and extends as far north as Zhemchug Canyon. Very few rock sole, flathead sole, and other flatfish are taken in the Aleutian Islands due to the limited shallow water areas present.

<u>Bering Sea Aleutian Islands pollock trawl</u>

In 2002, almost 1,500,000 mt of pollock were harvested in the eastern Bering Sea (assuming that the full Total Allowable Catch (TAC) was taken) and about 1,000 mt (as of October 19, 2002) in the Aleutian Islands. In 2001, about 1,390,000 mt were harvested in the BSAI by 104 catcher vessels and 16 catcher processors. Of this catch, over 1,330,000 mt of pollock were taken by pelagic trawls in the directed fishery with about 16,000 mt taken by bottom trawls in the BSAI.

The pattern of the modern pollock fishery in the BSAI is to focus on a winter, spawning-aggregation fishery. This is termed the “A” fishery with an opening on January 20th. This season lasts about 4-6 weeks depending on the catch rates. Since 1992, the “B” season (typically September-October) fishery has been conducted to a greater extent west of 170/W longitude than previously. Fishing is closed for Pollock in all areas from November 1 to January 20. Fishing is also closed around designated rookeries and haulouts out to 20 nm in the Bering Sea. The Bering Sea pollock TAC is allocated 40 percent to the combined A/B seasons and 60 percent to the combined C/D seasons. Half of the 40 percent allocation to the A/B season (*i.e*., 20 percent) can be taken inside the Sea Lion Conservation Area (SCA) during the combined A and B seasons, with 15 percent allocated to the A and 5 percent to the B.

In addition to these allocations, under the American Fisheries Act (AFA), 10 percent of the Bering Sea annual pollock TAC is allocated to the Community Development Quota sector, 5 percent of the remainder is removed for bycatch allowance in other fisheries, and the remainder is subdivided among catcher processors (40 percent), motherships (10 percent), and the inshore sector (50 percent). To prevent competition among sectors, the allocation of pollock TAC to each sector is managed by season and area.

<u>Bering Sea Aleutian Islands Pacific cod longline</u>

In 2001, 72 catcher vessels and 42 catcher processors targeted Pacific cod with hook-and-line gear. In addition, 70 catcher vessels and 6 catcher processors used pot gear to target Pacific cod. In that year hook and line vessels harvested about 100,000 mt of Pacific cod while pot fisherman took about 16,000 mt. In 2002, TACs were set at about 62,000 mt for hook and line and about 11,000 mt for pot gear. In 2001, about 19,000 mt of Pacific cod were taken incidentally in the other groundfish trawl fisheries. Hook-and-line harvested cod are mostly taken along the slope of the continental shelf break and along the Aleutian Islands. Pacific cod harvested by pot gear is taken along the slope as well as north and west of Unimak Island and adjacent to the Aleutian Islands. The most common Pacific cod products for at-sea processors are headed and gutted fish and fillets. The most common products for shoreside processors are salted cod, fillets, and fish meal.

<u>Bering Sea sablefish pot</u>

Sablefish are harvested in relatively deep water along the continental slope (100–1,000 m) and along the Aleutian Islands. Since 1996, directed fisheries for sablefish have only been open to vessels using hook-and-line and pot gear in the BSAI. For federal and state fisheries combined, the total number of longline vessels targeting sablefish in 2001 was 438. In 2001, these vessels harvested about 12,000 mt of sablefish, 92 percent of which was taken in the Gulf of Alaska. In 1995, sablefish (as well as Pacific halibut) became a closed fishery based on historical participation. An individual fishing quota (IFQ) program was then implemented, which assigns quota shares on an annual basis to authorized fishermen (50 CFR 679(d)). The directed sablefish fishery is open only to IFQ shareholders who use fixed gear (hook-and line or pot gear).

Observer Program

Fishing vessels operating in the EEZ off Alaska are required to carry an observer according to vessel size. Vessels under 125 feet length overall (LOA) and over 60 ft LOA are required to carry an observer 30% of their fishing time for each quarter of the year. Vessels 125 ft LOA and above are required to carry an observer 100% of the time during fishing operations. Some vessels under certain circumstances, such as vessels fishing for pollock in the BSAI under the AFA, are required to carry two observers for 100% of their fishing time. Details of these requirements may be found at 50 CFR 679.50.

State of Alaska Fisheries

The NMFS/Alaska Regional Office operates a marine mammal observer program which collects information on marine mammal interactions in ten Category II state-managed commercial fisheries. All of those fisheries on the 2005 List of Fisheries target salmon. Due to the high cost of observing these fisheries, only one or two fisheries are observed at one time for one to two years. To date, six state fisheries have been observed in this way. Of those, two have been re-categorized to Category III due to minimal interactions with marine mammals.

Table 1. Permits, fishing activity, and catches for the ten Category II salmon fisheries in Alaska in 2003, according to the State of Alaska Commercial Fisheries Entry Commission website.

Fishery	Permit holders	Permits Issued	Permits Fished	Pounds of Fish Landed (millions)	Estimated Total Earnings ($million)	Year Observed
Bristol Bay Set Gillnet	996	1001	761	21.18	10.13	
Bristol Bay Drift Gillnet	1825	1867	1424	78.46	37.01	
Alaska Peninsula Set Gillnet	111	113	86	6.79	2.59	
Alaska Peninsula Drift Gillnet	152	160	109	9.99	4.61	1990
Cook Inlet Drift Gillnet	565	572	418	10.89	6.02	1999-2000
Kodiak Island Set Gillnet	188	188	161	14.43	4.90	2002, 2005
Prince William Sound Drift Gillnet	539	540	510	21.95	15.78	1990-91
Yakutat Set Gillnet	165	167	104	1.88	1.14	2007-08
Southeast Alaska Drift Gillnet	473	477	376	26.54	9.63	
Southeast Alaska Purse Seine	413	416	236	213.93	19.40	

Table 2. Summary of the Alaska State-Managed Category II Fisheries based on Angliss and Lodge's (2004) Appendix 3.

Fishery	Target Species	Soak Time	Landings Per Day	Sets Per Day	Season Duration	Fishery Trends
Bristol Bay Set Gillnet	Salmon	Continuous during opener but net dry during low tide; day and night.	1	Two or continuous	June 2 to August 13 in 2003	Catch variable, apparently declining
Bristol Bay Drift Gillnet	Salmon	Continuous soak part of the net while other part picked; day and night.	2	Continuous	June 2 to August 13 in 2003	Catch variable, apparently declining
Alaska Peninsula Set Gillnet	Salmon	Continuous during opener; day and night.	1	Every two hours	June 9 to October 10 in 2003	Catch variable, apparently declining
Alaska Peninsula Drift Gillnet	Salmon	109 Day and night, 2-5 hours.	1	3-8	June 9 to October 10 in 2003	Catch variable, apparently declining
Cook Inlet Drift Gillnet	Salmon	Day only, 15 minutes to 3 hours or continuous.	1	6-18	June 26 to August 7 in 2003	Number of vessels stable, catch variable
Kodiak Island Set Gillnet	Salmon	Day only, continuous during opener.	1 or 2	2 or more	June 5 to September 19 in 2003	Number of sites declining slightly, catch variable
Prince W illiam Sound Drift Gillnet	Salmon	Day and night, 15 minutes to 3 hours.	1 or 2	10-14	May 16 to September 15 in 2003	Number of vessels stable; catch stable
Yakutat Set Gillnet	Salmon	Day and night, continuous soak during openers.	1	Picked every 2-4 hours per day or continuous during peak	June 1 to October 24 in 2003	Number of sites declining slightly, catch variable
Southeast Alaska Drift Gillnet	Salmon	Day and night, 20 minutes to 3 hours.	1	6-20	June 15 to October 16 in 2003	Number of vessels and catch may be declining slightly
Southeast Alaska Purse Seine	Salmon	Mostly daylight fishing except at peak, 20-45 minutes.	1	6-20	22 Jun to 30 Sep in 2003	Number of vessels and catch may be declining slightly

Bristol Bay Set and Drift Gillnet Fisheries

The Bristol Bay management area includes all coastal and inland waters from Cape Newenham to Cape Menshikof and includes five management districts. There are eight major river systems in the area, and these form the largest commercial sockeye salmon fishery in the world. Although sockeye salmon is by far the most abundant salmon species that returns to Bristol Bay each year, chinook, chum, coho, and pink salmon returns are important as well. About 80% of the catch is with drift gillnets and 20% with set gillnets.

Alaska Peninsula Set Gillnet Fishery

The Alaska Peninsula set gillnet fishery takes place in two districts on the north of the peninsula (Northern and Northwestern), and four districts on the south of the peninsula (Unimak, Southwestern, Southcentral and Southeastern).

Cook Inlet Drift Gillnet Fishery

The Upper Cook Inlet contains two fisheries management districts, with salmon driftnet fishing in the Central District. This fishery and the set gillnet fishery, are the primary commercial fisheries in the Upper Cook Inlet. The fishery usually runs from June 25 until August 9. Currently driftnet fishing only occurs in the entire Central District areas for the two regular 12 hour openers on Mondays and Thursdays, with extra fishing restricted to another drift corridor, as detailed in the management plan. Fishing effort peaks in mid to late July for sockeye. The productive driftnet fishing season is relatively short in Cook Inlet, and many boats also fish other areas before and after the salmon driftnet season. Driftnet fishing accounts for about 60% of the average annual salmon harvest for the region. This fishery and the Cook Inlet set gillnet fishery were observed for marine mammal interactions in 1999 and 2000.

Notices of fishing openers are posted weekly and announced on regular radio channels. There are usually two regular openers a week of 12 hours each, but may be extended by Emergency Order. However, the fishing effort can change at any time because of alterations in management policy, the salmon run strength, the price of fish, and strikes within the industry. The duration of sets can vary from 20 minutes to four or more hours, depending on fishing conditions and other variables, with between four and 20 sets per day. In general, fishing only occurs during daylight hours.

Kodiak Island Set Gillnet Fishery

The fishery consists of the Northwest District, from Spruce Island to the south side Uyak Bay, and the Alitak Bay District, located on the southwestern corner of the island. In most years, the Northwest District is fished by about 100 permit holders and constitutes about 70% of the annual fishing effort, while the Alitak Bay District has about 70 permit holders and about 30% of the annual fishing effort.

The fishery begins between the 5^{th} and the 9^{th} of June. Traditionally, the Northwest District is open for the majority of June and July, while the Alitak Bay District typically fishes from five to seven out of every ten days. As the runs progress, changing from sockeye to pink salmon in late July, the Alaska Department of Fish and Game (ADFG) often reduces the length of openers if escapement goals have not been met. Fishing effort begins to reduce in mid to late August as runs begin to decline, and although many areas are open until early October, most fishers have pulled their nets by early September. Most nets are attached to a shore lead up to 80 fathoms long in a straight line to a king buoy offshore, with numerous anchor lines and buoys holding the net in place. The last 25 fathoms is usually formed into a fish trap, which is also called a hook.

Prince William Sound Drift Gillnet Fishery

The Prince William Sound Fisheries Management Area consists of 11 districts. The fishing gear employed for salmon includes drift and set gillnets and purse seines. Drift gillnet fishing permits are most common. Six hatcheries contribute to the salmon fisheries. The management objective in all 11 districts is the achievement of salmon escapement goals for the major stocks while allowing for the orderly harvest of all fish that are surplus to the spawning requirements. The ADFG also follows regulatory plans to manage the fisheries, and to allow private non-profit hatcheries to achieve cost recovery and broodstock objectives.

Yakutat Set Gillnet Fishery

The Yakutat set gillnet fisheries are divided into two fishing districts, the Yakutat District and the Yakataga District. The Yakutat District fisheries primarily target sockeye salmon and coho salmon although all species of salmon are harvested. The Yakataga District fisheries target coho salmon. The bulk of the Yakutat salmon harvest is usually reported from a few fisheries, but as many as 25 different areas are open to commercial fishing each year. With few exceptions, gillnetting is confined to the intertidal area inside the mouths of the various rivers and streams, and to the ocean waters immediately adjacent to each. Due to the terminal nature of these fisheries, ADFG has been able to develop escapement goals for most of the major and several of the minor fisheries.

Southeast Alaska Drift Gillnet Fishery

There are five fishing areas in the Southeast Alaska drift gillnet fishery. In addition, some fishing is permitted in terminal harvest areas (THAs) that are adjacent to hatchery facilities, some is permitted for hatchery cost recovery, and some at Annette Island. Most salmon are caught by drift gillnets in the five main fishing areas (81% in 2003) and the THAs (13% in 2003), with small contributions from Annette Island (4% in 2003), and hatchery cost recovery (1.8% in 2003). Fishing generally continues from the middle of June through to early October.

Southeast Alaska Purse Seine Fishery

The purse seine fishery accounts for about 80% of the total salmon harvest in the Southeast Alaska region, with about 87% of the fish caught being pink salmon. Regulations allow purse seine fishing in certain fishing districts, and also in certain terminal harvest areas, hatchery cost recovery areas, and the Annette Island Fishery Reserve. In 2003, purse seine fishing ran from 1 June until 12 November in THAs, and from 22 June until 30 September in the Fishing Districts.

7.0 Central North Pacific Humpback Whales

For this assessment, NMFS considered the impact of serious injury and mortality to CNP humpback whales resulting from interactions with the above-described fisheries. The International Whaling Commission (IWC) first protected humpback whales in the North Pacific in 1965. Humpback whales were listed as endangered under the U.S. Endangered Species Act (ESA) in 1973. Critical habitat has not been designated for this species. Humpback whales are also protected by the Convention on International Trade in Endangered Species of Wild Flora and Fauna (CITES) and are designated as a depleted stock under the MMPA. This section discusses species information, the current status of CNP humpback whales, and threats to the stock.

7.1 Species Information [8]

The humpback whale is distributed worldwide in all ocean basins. In winter, most humpback whales occur in the temperate and tropical waters of the Northern and Southern Hemispheres (from 10°-23° latitude). Humpback whales in the high latitudes of the North Pacific are seasonal migrants that feed on zooplankton and small schooling fishes (Nemoto 1957, Clapham and Mead 1999). The humpback whale population was considerably reduced as a result of intensive commercial exploitation during the 20th century. A large-scale study of humpback whales throughout the North Pacific was conducted in 2004-06 (the Structure of Populations, Levels of Abundance, and Status of Humpbacks, or SPLASH, project). Initial results from this project (Calambokidis *et al*. 2008), including abundance estimates and movement information, were used in the draft 2009 SAR (Allen and Angliss 2009).

The historic summer feeding range of humpback whales in the North Pacific encompassed coastal and inland waters around the Pacific Rim from Point Conception, California, north to the Gulf of Alaska and the Bering Sea, and west along the Aleutian Islands to the Kamchatka Peninsula and into the Sea of Okhotsk and north of the Bering Strait (Zenkovich 1954, Nemoto 1957, Tomlin 1967, Johnson and Wolman 1984). Historically, the Asian wintering area extended from the South China Sea east through the Philippines, Ryukyu Retto, Ogasawara Gunto, Mariana Islands, and Marshall Islands (Rice 1998). Humpback whales are currently found throughout this historic range. Most of the current winter range of humpback whales in the North Pacific is relatively well known, with aggregations of whales in Japan, the Philippines, Hawaii, Mexico, and Central America. The winter range includes the main islands of the Hawaiian archipelago, with the greatest concentration along the west side of Maui. In Mexico, the winter range includes waters around the southern part of the Baja California peninsula, the central portions of the Pacific coast of mainland Mexico, and the Revillagigedos Islands off the mainland coast. The winter range also extends from southern Mexico into Central America, including Guatemala, El Salvador, Nicaragua, and Costa Rica (Calambokidis *et al*. 2008).

Photo-identification data, distribution information, and genetic analyses have indicated that in the North Pacific there are at least three breeding populations (Asia, Hawaii, and Mexico/Central America) that all migrate between their respective winter/spring calving and mating areas and

[8] The information in Section 7.1 is from Allen and Angliss (2009).

their summer/fall feeding areas (Calambokidis *et al*. 1997, Baker *et al*. 1998). Calambokidis *et al*. (2001) further suggested that there may be as many as six subpopulations on the wintering grounds. From photo-identification and Discovery tag mark information there are known connections between Asia and Russia, between Hawaii and Alaska, and between Mexico/Central America and California (Calambokidis *et al*. 1997, Baker *et al*. 1998, Darling 1991; 1993; Mizroch pers. comm., North Pacific Humpback Whale Working Group, unpublished data). This information led to the designation of three stocks of humpback whales in the North Pacific: 1) the California/Oregon/Washington and Mexico stock, consisting of winter/spring populations in coastal Central America and coastal Mexico which migrate to the coast of California to southern British Columbia in summer/fall (Calambokidis *et al*. 1989, Steiger *et al*. 1991, Calambokidis *et al*. 1993); 2) the Central North Pacific stock, consisting of winter/spring populations of the Hawaiian Islands which migrate primarily to northern British Columbia/Southeast Alaska, the Gulf of Alaska, and the Bering Sea/Aleutian Islands (Baker *et al*. 1990, Perry *et al*. 1990, Calambokidis *et al*. 1997); and 3) the Western North Pacific stock, consisting of winter/spring populations off Asia which migrate primarily to Russia and the Bering Sea/Aleutian Islands.

New information from the SPLASH project mostly confirms this view of humpback whale distribution and movements in the North Pacific. For example, the SPLASH results confirm low rates of interchange between the three principal wintering regions (Asia, Hawaii, and Mexico). However, the full SPLASH results suggest the current view of population structure is incomplete. The overall pattern of movements is complex but indicates a high degree of population structure. Whales from wintering areas at the extremes of their range on both sides of the Pacific migrate to coastal feeding areas on the same side: whales from Asia in the west migrate to Russia and whales from mainland Mexico and Central America in the east migrate to California-Oregon. Whales from Hawaii and Mexico's offshore islands in the Revillagigedo Archipelago migrate to more central- and northern-latitude feeding areas, with considerable overlap (Calambokidis *et al*. 2008). Humpback whales from the Revillagigedos have been previously documented migrating to feeding areas off California, British Columbia, southeastern Alaska, Prince William Sound, and the Kodiak Island area (Gabriele *et al*. 1996, Calambokidis *et al*. 1997), and more recently Witteveen *et al*. (2004) reported matches between whales photographed at the Shumagin Islands in the western Gulf of Alaska between 1999 and 2002 and whales photographed in the Revillagigedos.

The SPLASH data now show the Revillagigedos whales are seen in all sampled feeding areas except California-Oregon and the south side of the Aleutians, and are primarily distributed in the Bering Sea, Gulf of Alaska, and Southeast Alaska/northern British Columbia, but are also found in Russia and southern British Columbia/Washington. The migratory destinations of humpback whales from Hawaii were found to be quite similar, and a significant number of matches (14) were seen during SPLASH between Hawaii and the Revillagigedos (Calambokidis *et al*. 2008). This suggests a need for some modification to the current view of winter/breeding populations. A revision of population structure in the North Pacific, possibly similar to the structure based on summer feeding areas for the Atlantic population, will be considered when the full genetic results from the SPLASH project are available.

The winter distribution of the central North Pacific stock is primarily in the Hawaiian Island archipelago. In the SPLASH study sampling occurred on Kauai, Oahu, Penguin Bank (off the southwest tip of the island of Molokai), Maui and the island of Hawaii (the Big Island). Interchange within Hawaii was extensive. Although most of the Hawaii identifications came from the Maui sub-area, identifications from the Big Island and Kauai at the eastern and western end of the region showed a high rate of interchange with Maui.

A relevant finding from the SPLASH project is that whales from the Aleutian Islands have an unusually low re-sighting rate in winter areas compared to whales from other feeding areas. To a lesser extent this is also true of whales from the Gulf of Anadyr in Russia and the Bering Sea. One explanation for this result could be that some of these whales have a winter migratory destination that was not sampled during the SPLASH project. Given the location of these feeding areas, the most parsimonious explanation would be that some of these whales winter somewhere between Hawaii and Asia, which would include the possibility of the Marianas Islands (southwest of the Ogaswara Islands), the Marshall Islands (approximately half-way between the Marianas and Hawaiian Islands), and the Northwestern Hawaiian Islands. Indeed, humpback whales have been found to occur in the Northwestern Hawaiian Islands, though apparently at relatively low density (Johnston *et al*. 2007). No areas with high densities of humpback whales are known between the Hawaiian main islands and Ogasawara, but this could be due to a lack of search effort. Which stock whales found in these locations would belong to is currently unknown.

In summer the majority of whales from the central North Pacific stock are found in the Aleutian Islands, Bering Sea, Gulf of Alaska, and Southeast Alaska/northern British Columbia. High densities of humpback whales are found in the eastern Aleutian Islands, particularly along the north side of Unalaska Island, and along the Bering Sea shelf edge and break to the north towards the Pribilof Islands. Small numbers of humpback whales are known from a few locations not sampled during the SPLASH study, including northern Bristol Bay and the Chukchi and Beaufort Seas. In the Gulf of Alaska high densities of humpback whales are found in the Shumagin Islands, south and east of Kodiak Island, and from the Barren Islands through Prince William Sound. Although densities in any particular location are not high, humpback whales are also found in deep waters south of the continental shelf from the eastern Aleutians through the Gulf of Alaska. Relatively high densities of humpback whales occur throughout much of Southeast Alaska and northern British Columbia.

7.2 Status of the Stock[9]

Population Size

Prior to the SPLASH study, the most complete estimate of abundance for humpback whales in the North Pacific was from data collected in 1991-93, with a best mark-recapture estimate of 6,010 (CV = 0.08) for the entire North Pacific, using a winter-to-winter comparison (Calambokidis *et al*. 1997). Estimates for Hawaii and Mexico were higher using marks from summer feeding areas with recaptures on the winter grounds, and totaled almost 10,000 summed across all winter areas. In comparison, estimates of abundance for the entire North Pacific have been estimated from the SPLASH study using data pooled across all winter regions and across

[9] The information in Section 7.2 is from Allen and Angliss (2009).

all summer regions. Pair-wise Chapman-Petersen mark-recapture estimates from adjacent seasons (e.g., winter 2004 to summer 2004, summer 2004 to winter 2005, et cetera) result in estimates of abundance of 18,347, 18,525, 20,052, and 21,452, with analytical CVs from 0.06-0.07, and jackknife CVs from 0.13-0.53. The average of the four estimates is 19,594, and the four estimates of abundance are so consistent that the CV of the average is 0.04, relatively low (Calambokidis *et al*. 2008).

The central North Pacific stock of humpback whales winters in Hawaiian waters (Baker *et al*. 1986). Baker and Herman (1987) used capture-recapture methods in Hawaii to estimate the population at 1,407 (95% CI: 1,113-1,701), which they considered an estimate for the entire stock for 1980-83. Mobley *et al*. (2001) conducted aerial surveys throughout the main Hawaiian Islands during 1993, 1995, 1998, and 2000. Abundance during these line-transect surveys was estimated as 2,754 (95% CI: 2,044-3,468), 3,776 (95% CI: 2,925-4627), 4,358 (95% CI: 3,261-5,454), and 4,491 (95% CI: 3,146-5,836). Before the SPLASH study, the best estimate of abundance for Hawaii from photo-identification data was 4,005 (CV = 0.10) for the years 1991-93 (Calambokidis *et al*. 1997). Initial mark-recapture abundance estimates have been calculated from the SPLASH data. For abundance in winter or summer areas, a Hilborn mark-recapture model was used, which is a form of a spatially-stratified model that explicitly estimates movement rates between winter and summer areas. Two broad categories of models were used making different assumptions about the movement rates, and four different models were used for capture probability. Point estimates of abundance for Hawaii ranged from 7,469 to 10,103; the estimate from the best model (as chosen by AICc) was 10,103. Confidence limits or CVs have not yet been calculated for the SPLASH abundance estimates.

In summer feeding areas of the central North Pacific stock, photo-identification studies have been conducted in a number of locations in Alaska, but abundance estimates have been relatively modest. These include a catalogue of 315 individual humpback whales in Prince William Sound from 1977 to 2001 (von Ziegesar 1992, Waite *et al*. 1999, von Ziegesar *et al*. 2004), and mark-recapture estimates of 651 (95% CI: 356-1,523) for the Kodiak region (Waite *et al*. 1999) and 410 (95% CI: 241-683) for the Shumagin Islands from 1999-2002 (Witteveen *et al*. 2004). From line-transect surveys Moore *et al*. (2000) estimated abundance of humpback whales in the central Bering Sea as 1,175 humpback whales (95% CI: 197-7,009) in 1999, though Moore *et al*. (2002) suggested these sightings were too clumped in the central-eastern Bering Sea to be used to provide a reliable estimate for the area. Moore *et al*. (2002) estimated abundance as 102 (95% CI: 40-262) for humpback whales in the eastern Bering Sea in 2000. Zerbini *et al*. (2007) estimated abundance of humpback whales from line-transect surveys in 2001-03 as 2,644 (95% CI 1,899–3680) for coastal/shelf waters from the central Gulf of Alaska through the eastern Aleutian Islands. Although there is a small amount over overlap between this survey and the Bering Sea surveys (in the eastern Aleutian Islands), considering both surveys this suggests a combined total of about 4,000 whales. In the SPLASH study, the number of unique identifications in different regions included 63 in the Aleutian Islands (defined as everything on the south side of the Islands), 491 in the Bering Sea, 301 in the western Gulf of Alaska (including the Shumagin Islands), and 1,038 in the northern Gulf of Alaska (including Kodiak and Prince William Sound), with a few whales seen in more than one area (Calambokidis *et al*. 2008). The SPLASH abundance estimates ranged from 6,000 to 19,000 combined for the Aleutian Islands, Bering Sea, and Gulf of Alaska, a considerable increase from previous estimates that were available. However, the SPLASH surveys were more extensive in scope, including areas not covered in those surveys, such as parts of Russian waters (Gulf of Anadyr and Commander Islands), the western and central Aleutian Islands, offshore waters in the Gulf of Alaska and Aleutian Island, and Prince William Sound. Additionally, mark-recapture estimates can be higher than line-transect estimates because they estimate the total number of whales that have used the study area during the study period, whereas line-transect surveys provide a snapshot of average abundance in the survey area at the time of the survey. For the Aleutian Islands and Bering Sea, the SPLASH estimates ranged from 2,889 to 13,594. For the Gulf of Alaska, the SPLASH estimates ranged from 2,845 to 5,122.

The SPLASH study showed a relatively high rate of interchange between Southeast Alaska and northern British Columbia, so they are considered together. Humpback whale studies have been conducted for a relatively long time in Southeast Alaska. Baker *et al*. (1992) estimated an abundance of 547 (95% CI: 504-590) using data collected from 1979 to 1986. Straley (1994) recalculated the estimate using a different analytical approach (Jolly-Seber open model for capture-recapture data) and obtained a mean population estimate of 393 animals (95% CI: 331-455) using the same 1979 to 1986 data set. Using data from 1986 to 1992 and the Jolly-Seber approach, Straley *et al*. (1995) estimated that the annual abundance of humpback whales in Southeast Alaska was 404 animals (95% CI: 350-458). Straley *et al*. (in press) examined data for the northern portion of southeast Alaska from 1994 to 2000 and provided an updated abundance estimate of 961 (CV=0.12). In the northern British Columbia region (primarily near Langara Island), 275 humpback whales were photo-identified from 1992 to 1998 (G. Ellis, Pacific Biological Station, pers. comm.). As of 2003, approximately 850-1,000 humpback whales had been identified in British Columbia (J. Ford, Department of Fisheries and Oceans, Canada, pers. comm.). During the SPLASH study 1,115 unique identifications were made in Southeast Alaska and 583 in northern British Columbia, for a total of 1,669 individual whales, after subtracting whales seen in both areas (1,115+583-13-16=1,669) (Calambokidis *et al.* 2008). From the SPLASH study estimates of abundance for Southeast Alaska/northern British Columbia ranged from 2,883 to 6,414. The estimates from SPLASH are considerably larger than the estimate from Straley *et al.* (in press). The explanation for this may be that the SPLASH estimates included areas not part of the Straley *et al*. (in press) estimate, including southern Southeast Alaska, northern British Columbia, and offshore waters of both British Columbia and Southeast Alaska.

Minimum Population Estimate

A total of 2,367 unique individuals were seen in the Hawaiian wintering areas during the 2-year period (3 winter field seasons) of the SPLASH study. As discussed above, point estimates of abundance for Hawaii from SPLASH ranged from 7,469 to 10,103; the estimate from the best model was 10,103, but no associated CV has yet been calculated. The 1991-93 abundance estimate for Hawaii using similar (but less) data had a CV of 0.095. Therefore, it is unlikely the CV of the SPLASH estimate, once calculated, would be greater than 0.300. The minimum population estimate (N_{MIN}) for this stock is calculated according to Equation 1 from the PBR Guidelines (Wade and Angliss 1997): $N_{MIN} = N/\exp(0.842 \times [\ln(1+[CV(N)]^2)]^{½})$. As a worst case, using the lowest population estimate (N) of 7,469 and an assumed conservative CV(N) of 0.30 results in an N_{MIN} for this humpback whale stock of 5,833.

Current Population Trend

Comparison of the estimate for the entire stock provided by Calambokidis *et al.* (1997) with the 1981 estimate of 1,407 (95% CI: 1,113-1,701) from Baker and Herman (1987) suggests that abundance increased in Hawaii between the early 1980s and early 1990s. Mobley *et al*. (2001) estimated a trend of 7% per year for 1993-2000 using data from aerial surveys that were conducted in a consistent manner for several years across all of the Hawaiian Islands and were developed specifically to estimate a trend for the central North Pacific stock. Mizroch *et al.* (2004) estimated survival rates for North Pacific humpback whales using mark-recapture methods, and a Pradel model fit to data from Hawaii for the years 1980-1996 resulted in an estimated rate of increase of 10% per year (95% C.I. of 3-16%). For shelf waters of the northern Gulf of Alaska, Zerbini *et al*. (2007) estimated an annual rate of increase for humpback whales from 1987-2003 of 6.6% per year (95% CI: 5.2-8.6%). The SPLASH abundance estimate for the total North Pacific represents an annual increase of 4.9% over the most complete estimate for the North Pacific from 1991-93. Comparisons of SPLASH abundance estimates for Hawaii to estimates from 1991-93 gave estimates of annual increase that ranged from 5.5 to 6.0% (Calambokidis *et al*. 2008). No confidence limits were calculated for these rates of increase from SPLASH data. It is also clear that the abundance has increased in southeast Alaska, though a trend for the southeast Alaska portion of this stock cannot be estimated from the data because of differences in methods and areas covered.

Current and Maximum Net Productivity Rates

Estimated rates of increase for the central North Pacific stock include values for Hawaii of 7.0% (from aerial surveys), 5.5-6.0% (from mark-recapture abundance estimates), and 10% (95% CI 3-16%) (from a Pradel survival model fit to mark-recapture data), and for the northern Gulf of Alaska a value of 6.6% (95% CI 5.2-8.6%) (from ship surveys). Although there is no estimate of the maximum net productivity rate for the Western stock, it is reasonable to assume that R_{MAX} for this stock would be at least 7%. Hence, until additional data become available from the central North Pacific humpback whale stock, it is recommended that 7% be employed as the maximum net productivity rate (R_{MAX}) for this stock.

Potential Biological Removal

Under the 1994 reauthorized MMPA, the potential biological removal (PBR) is defined as the product of the minimum population estimate, one-half the maximum theoretical net productivity rate, and a recovery factor: $PBR = N_{MIN} \times 0.5R_{MAX} \times F_R$. The recovery factor ($F_R$) for this stock is 0.1, the recommended value for cetacean stocks listed as endangered under the ESA (Wade and Angliss 1997). The default value of 0.04 for the maximum net productivity rate is replaced by 0.07, which is the best estimate of the current rate of increase and is considered a conservative estimate of the maximum net productivity rate. For the CNP stock of humpback whale, using the smallest SPLASH study abundance estimate for 2004-06 for Hawaii of 7,469 with an assumed CV of 0.300 and its associated N_{MIN} of 5,833, PBR is calculated to be 20.4 animals (5,833 x 0.035 x 0.1).

7.3 Threats to CNP Humpback Whales

Currently, direct mortality from bycatch in commercial fisheries, injury and mortality from fishery entanglements, and ship strikes threaten individuals in the CNP population. In addition, the extent of impact to humpback whales from whale watching operations, underwater noise, and contaminants in the marine ecosystem is unknown. Although these human activities clearly have an adverse effect to individuals in the population, the population-level consequences of these anthropogenic stressors are not fully understood. Despite this, increasing population trends and protection from commercial whaling may mean that the probability of extinction has been reduced for this species since its ESA listing in 1973. NMFS recently announced the initiation of a humpback whale status review under the ESA, which is a periodic undertaking conducted to ensure that the listing classification of a species is accurate. (74 FR 40568, August 12, 2009).

7.3.1 Fishery Entanglements

Entanglement in fishing gear is a threat to humpback whales throughout the Pacific and especially to the CNP stock. Reports of entangled humpback whales found swimming, floating, or stranded with fishing gear attached occur in both Hawaiian and Alaskan waters.

Hawaii

The number of confirmed reports of entangled whales in Hawaiian waters has increased in recent years (Table 3). Most of the whales reported entangled in Hawaiian waters likely brought the gear with them from higher latitude feeding grounds, and none of the gear could be attributed to the Hawaii longline fisheries. While the whales are not typically at risk from drowning or immediate death, they are at increased risk of starvation, infection, physical trauma from the gear, and ship strikes as a result of the entanglement. However, taking the most conservative approach, of the confirmed entanglements from 2003-2007 in Hawaii waters, nine entanglements (i.e., those wherein the entangled whales were in Hawaiian waters, but not entangled in Hawaii-based longline fishery gear) can reasonably be considered to be "serious" for purposes of this document.[10] These are nine shaded in Table 3 below. Because the gear entangling these whales did not originate in Hawaii, these nine serious injuries may have been included in entanglements also observed in Alaska. Due to this uncertainty regarding possible duplication, these interactions are not reported in the 2009 SAR. This analysis is using a more precautionary approach than the SAR, which is based upon information subjected to peer review, and is including these entanglements as though no duplication occurs.

Table 3. Confirmed entanglements of humpback whales from 2003-2007.[11] Data compiled by the Hawaiian Islands Humpback Whale National Marine Sanctuary.

Date	Location/region	Description of entanglement	Response
2/24/2003	Auau Channel (W. Maui)	Line wrapped around pectoral fins; trailing 100-120 ft.	Successful release
2/02/2004	Auau Channel (W. Maui)		Unsuccessful disentanglement

[10] NMFS has not made serious injury or mortality determinations for these entanglements.
[11] The timeframe for the data used in this analysis is the five-year period from 2003 through 2007 (*see infra* section 9.1).

Date	Location/region	Description of entanglement	Response
1/24/2005	Oahu (E)	Gillnetting over head, rope across jaw, and debris wrapped around pectoral fin.	Unsuccessful/Unable to respond
2/09/2005	Oahu (N)	Buoy line of local fish trap gear around tail with a 50 lb anchor, 2 round, and 1 bullet buoy.	Unsuccessful/Animal not found
2/11/2005	Auau Channel (W. Maui)	Line around pectoral and entering mouth trailing 150 ft.	Assessed/ Not in need of assistance/disentanglement
2/28/2005	Auau Channel (W. Maui)	At least one, perhaps two, lines in mouth; line under the body between left and right flippers with gear 6-8 ft from fluke.	Partially successful disentanglement
12/27/2005	Kauai (E)	Rope with float trails 10-15 ft.	Assessed/Not in need of assistance/disentanglement
1/29/2006	Kawaiihae Bay, Big Island	Line wrapped around tailstock in 6” wound; trailed aft 20-25 ft; terminated in a ball of gear.	Animal completely disentangled. Over 357 ft of gear recovered.
2/9/2006	Kawaiihae Bay, Big Island	Heavy gauge lines exited animal's mouth along side to 20 ft; 2 large red polyballs part of gear	Tagged with VHF transmitter; animal completely disentangled and gear recovered. Biopsy obtained.
3/5/2006	Auau Channel (W. Maui)	Over 100 lbs/357 ft. of line around fluke and tail and trailed 20 ft with a ball of line.	Successful disentanglement
11/1/2006	Barbers Point, Oahu	Entangled in marine debris, possibly wrapped pectoral flipper; line around body; not certain	Animal self released from debris. May have been playing with gear. Not life threatening. No further action required.
12/17/2006	Kepuhi Point, Oahu	Entangled in line trailing behind with a medium-sized, orange polyball buoy.	No re-sight.
1/11/2007	Kihei, Maui	Over 160 ft of braided line from mouth, with a pair of bullet buoys wedged; trails along right side of body; ends in knot approximately 130 ft behind animal.	Partially disentangled. Approx. 112 ft gear removed/recovered. Life threatening. Animal was emaciated and in poor condition.
2/06/2007	Mano Point, Big Island	Line through mouth trailed aft on both sides; one wrap around body, across left flipper and pinned left flipper to animal's side; then formed bundle of gear 30-40 ft behind. Two metal bars were part of the gear trailing.	Partially disentangled Over 300 feet of line removed and recovered. Biopsy taken. Though all trailing gear was removed, the animal was severally emaciated and in poor health. Several lines left trailing from animal's mouth.
2/23/2007	Lanai	Small gauge line around tail stock and base of fluke; bridle of twisted line trailed 60 ft to pair of red, trawl buoys; then continued a single line for 240 ft. Line around tailstock and fluke were cutting in several inches in some places.	Totally disentangled. Nearly 400 ft cut free and recovered. Biopsy taken.
3/02/2007	Lahaina, Maui	Heavy gauge line through mouth, under flippers twisted together behind dorsal fin forming a bridle; lines	Totally disentangled. Approximately 150 ft recovered. Biopsy taken.

Date	Location/region	Description of entanglement	Response
		continued 40-50 ft with two polyballs.	
3/17/2007	Honolua Bay, Maui	Wrapped in heavy gauge line aft of midsection; cut in 6-12 inches. Several pieces of line or cargo netting hanging.	No re-sighting. Animal's status and extent of entanglement unknown.
12/9/2007	Lahaina, Maui	Undetermined amount of line around tailstock and trailing aft.	No response mounted.

Alaska

In recent years, an increasing number of entangled humpback whales have also been reported in Alaska. Seventy-nine humpbacks were reported entangled in Alaska from 1997-2007, and 40 of these involved southeast Alaska humpbacks (Neilson *et al*. 2005, NMFS stranding data). In 2005, 22 entangled humpback whales were reported to the NMFS Alaska stranding program. Twelve of these were reported in southeast Alaska, and nine in southcentral Alaska in the Kodiak, Homer, and Seward regions.

To understand more about the prevalence of these entanglement incidents, a study in 2003 and 2004 documented entanglement scarring in the humpback population in northern southeast Alaska. Using methodology developed in the Gulf of Maine to investigate scarring in Atlantic large whales, Neilson *et al*. (2005) photographed the caudal peduncle of individual humpbacks as they dove and examined them for scars indicative of previous entanglement. Their results indicate that, based on caudal peduncle scarring, 71% (95% CI: 62%-78%) of the humpback whales in northern southeast Alaska have been entangled at least once. The study also found that eight percent of the whales photographed in Icy Strait/Glacier Bay acquired new entanglement scars between the two years that they were sampled. Calves were less likely to have entanglement scars than older whales, and there was no significant difference in scarring percentages between males and females. Overall, the percentage of whales with entanglement scars in northern southeast Alaska is comparable to Gulf of Maine humpback whales (48%-65% entanglement percentage). Based on similar scarring investigations conducted in Hawaii, 14% of the humpbacks there appear to have been entangled (Robbins and Mattila 2004).

For entanglements that do not result in immediate or discernable mortality, it is difficult to determine the extent of impact to the animal. The effects of trailing fishing gear on large whale species are largely unknown. Most entangled whales reported to the marine mammal stranding network are not re-sighted. Without further information, it is unclear which types of entanglements are ultimately life-threatening. Data such as that collected by Neilson *et al.* (2005), however, leads to the conclusion that many humpback whales survive their entanglements. Some, it would appear, survive multiple entanglement incidents.

NMFS sponsored a workshop to discuss methods for differentiating serious and non-serious injury of marine mammals taken in commercial fishing operations. Results of this workshop indicate that some, but not all, entanglements may result in serious injury or mortality (Angliss and DeMaster 1997). Available evidence from entangled North Atlantic right whales indicates that while it is not possible to predict whether an animal will free itself of gear, a high proportion are believed to lose or extricate themselves based on scarring observed among apparently healthy animals. Predicting the survivability of individual animals that are entangled was determined to be unreliable. Some whales have been observed to carry gear for over five years. The workgroup was in agreement that entanglement that impedes locomotion or feeding, and entanglement of young whales, should be considered a serious injury (Angliss and DeMaster 1997).

7.3.2 Non-fishery Vessel Interactions in Hawaii

Humpback whales, especially calves and juveniles, are highly vulnerable to ship strikes and other interactions with non-fishing vessels. Younger whales spend more time at the surface, are less visible, and remain closer to shore (Herman *et al*. 1980; Mobley, Jr. *et al*. 1999), thereby making them more susceptible to collisions. There appears to be an increased frequency at which collisions with humpback whales and vessels are occurring in Hawaiian waters (Table 4), especially in the shallow waters (less than 100 fathoms) of the four-island region of Maui county and Penguin Banks, the preferred habitat of humpback whales wintering in Hawaii (Lammers *et al*. 2003). Three types of collision reports were documented: collisions with little/no forewarning; collisions resulting from effort to avoid whales; circumstantial collisions not reported but evidence of trauma known. The majority of the collisions are with boats from 19-80 feet in length, including both slow and fast moving vessels. Also, the highest incidents of collisions were documented from the island of Maui, and the lowest number documented was from the island of Kauai. None of these ship strikes resulted in a confirmed mortality.

Table 4. Humpback whale-vessel interacations from 2003-2007[12] compiled from Jensen and Silber 2003; Lammers *et al*. 2003; and NMFS and Hawaiian Islands Humpback Whale National Marine Sanctuary databases.

Date	Location	Description of Collision
02/10/03	Maalaea, Maui	Subadult whale-vessel interaction; no reported injuries
03/07/03	Maalaea, Maui	Whale-vessel interaction; no reported injuries
-/-/03		Whale-vessel interaction
01/05/04	Maui	Whale-vessel interaction
02/08/04	Lahaina, Maui	Subadult whale-vessel interaction; injuries reported
02/06/05	Lanai	Subadult whale-vessel interaction
01/04/06	Maui	Whale-vessel interaction
01/07/06	Kauai	Whale-vessel interaction
01/17/06	Kauai	Whale-vessel interaction
02/13/06	Maalaea, Maui	Whale-vessel interaction
03/09/06	Maalaea, Maui	Subadult whale-vessel interaction; injuries reported
03/25/06	Lahaina, Maui	Whale-vessel interaction; no reported injuries
12/28/2006	Salt Pond Beach, Kauai	Whale-vessel interaction; no reported injuries
2/07/2007	Lahaina, Maui	Whale-vessel interaction; possible injuries
3/06/2007	Big Beach. Maui	Subadult whale-vessel interaction; no injuries reported
4/01/2007	Nohili Point, Kauai	Subadult whale-vessel interaction; no injuries reported

The increasing rate of whale and vessel collisions may have a number of contributing factors, the most important of which may be that the population of humpback whales in Hawaii is increasing

[12] The timeframe for the data used in this analysis is the five-year period from 2003 through 2007 (*see infra* section 9.1).

(Lammers *et al.* 2003). In addition, there is a corresponding rise in the number of vessels in the preferred habitat for humpback whales, a direct result of the growing popularity of eco-tourism in Maui and the surrounding areas. Efforts to reduce these interactions include: a regulation prohibiting approach within 100 yards (90m) of humpback whales in Hawaiian waters (50 CFR 224.103(a)); improved technological research into mapping models and radar and sonar detection systems; and a NOAA hotline to report humpback whale interactions.

7.3.3 Non-fishery Vessel Interactions in Alaska

Although there is no official reporting system for ship strikes, numerous incidents of vessel collisions have been documented in Alaska. Fifty-five reports from 1986 to 2007 representing confirmed, unconfirmed and suspected ship strikes with humpback whales exist in the NMFS stranding database. This is a minimum estimate, as not all whales struck are reported and not all whales struck are identified to species or cause of mortality. The fate of struck animals is also not always determined unless the whale dies immediately upon impact or it can be determined that the strike was the cause of death.

Humpback whale distribution overlaps significantly with the transit routes of large commercial vessels that ply the waters off Alaska. The larger vessels are cruise ships, large tug and barge transport vessels, and oil transport tankers. Cruise ships frequent the inside waters of southeast Alaska, passing through areas used by humpback whales for feeding, such as Glacier Bay National Park and Preserve, Point Adolphus and, adjacent to the action area, the waters of Lynn Canal en route to Skagway and Haines. Tug and barge transport follows much of the traffic pattern of the cruise ships, as they frequent the same coastal communities. Oil transport tankers are generally operating farther offshore where there are presumably fewer concentrations of humpback whales, except for transit through Prince William Sound. Collisions in Alaska can generally occur throughout the region, peaking during the summer season.

Records of vessel collisions with large whales in Alaska indicate that strikes have involved cruise ships, recreational cruisers, whale watching catamarans, fishing vessels, and skiffs. Vessel lengths associated with these records ranged from approximately 20 ft to over 250 ft, indicating that all types and sizes of watercraft pose a threat of collision for whales (Jensen and Silber 2003). Cruise ships are of particular concern, as they operate at considerably high speeds and frequent the inside waters of southeast Alaska with routes passing through areas of humpback whale abundance such as Glacier Bay National Park and Preserve, Point Adolphus, and the waters of Lynn Canal. In addition to large ships, which are most likely to cause significant injury or death to humpback whales, smaller tour, charter and private vessels also significantly overlap with inshore humpback whale distribution in Alaska waters. Smaller ships also have the potential to cause disturbance, serious injury, and possibly mortality.

Several incidents of vessel interactions with humpback whales in Glacier Bay have been documented in recent years. In 2003, a humpback whale was necropsied that had been first seen at Pt. Manby, Yakutat Bay. The results of that necropsy also indicated that the whale had been killed by blunt trauma as a result of large vessel collision. In 2004, a humpback whale calf in Glacier Bay was necropsied on Strawberry Island. Severe dislocation of six ribs caused massive bleeding and tissue damage; blunt trauma indicated injury consistent with vessel collision. A second incident in 2004 involved a humpback (nursing calf) necropsied on the south end of Douglas Island outside of Juneau. Results of this necropsy showed a severe scapular fracture and again indicated likely collision with a vessel based on evidence of blunt trauma to the animal.

Between 2003 and 2007, opportunistic reports of vessel collisions with humpback whales indicate an average of seven humpback whales struck per year in Alaska. During this time, approximately one vessel strike per year has resulted in a known mortality to a humpback whale in southeast Alaska. In 2005, twelve humpback whale ship strikes were reported, a significant increase over previous years. It is unclear whether this reflects an increase in the incidence of collisions, or a greater awareness about reporting such events. The higher number of whale and vessel collisions in 2005 may be a result of the increasing abundance of humpback whales foraging in Alaska, as well as the growing presence of marine-based tourism in Alaska's coastal waters. While reported ship strikes in 2006 and 2007 were down to pre-2005 levels, NMFS assumes that injury and mortality of humpback whales will continue into the future as a result of vessel interactions.

To minimize the possibility of collision and the potential for harassment, NMFS implemented regulations on July 2, 2001 that imposed vessel restrictions on approaching humpback whales closer than 100 yards. Operating at a "slow, safe speed" when near humpback whales is also required. The National Park Service has implemented even greater minimum approach distances in Glacier Bay National Park (1/4 mile in all Park waters) for humpback whales, which likely reduces the whales' underwater noise exposure and potential for behavioral disturbance. In addition, the Park has implemented new vessel management measures that allow speed restrictions of 13 knots to be imposed by Park management on an as-warranted basis in the bay.

Table 5. Collisions between humpbacks and vessels in Alaska, 2003-2007 (from NMFS database). This table reflects opportunistic data collection, with the level of confidence varying from thoroughly investigated to unconfirmed reports involving animals positively identified as humpback whales to animals likely to have been humpback whales.

Year	Area	Vessel			Details
		Type	Length (ft)	Speed (knots)	
2003	Auke Bay	-	-	-	Fate unknown (possible humpback)
2003	Baranof Island	Cruise ship	780' LOA	19 knot (avg.)	Fate unknown (suspected collision, possible humpback)
2003	Bering Sea open water	-	-	-	Fate unknown (possible humpback)
2003	Icy Bay (SE AK)	-	-	-	Necropsy: Injury consistent with strike
2003	Sitka Sound (SE AK)	-	-	-	Fate unknown
2003	Wrangell (SE AK)	Cruise ship	754' LOA	Entering harbor	Fate unknown (suspected collision)
2004	Benjamin Island (SE AK)	-	-	Drifting	Fate unknown
2004	Glacier Bay (SE AK)	-	-	-	Necropsy: Injury consistent with strike

2004	Douglas Island (SE AK)	-	-	-	Necropsy: Injury consistent with strike
2005	George Inlet, Ketchikan (SE AK)	Whalewatch	48'		Fate unknown
2005	Glacier Bay (SE AK)	Cruise ship			Fate unknown
2005	Kachemak Bay (Cook Inlet, S Central AK)	Charter boat	28'		Blood in water, whale swam away; fate unknown (possible humpback)
2005	Sitka Sound (SE AK)	Cruise ship	936'	10 knots	Fate unknown
2005	Prince William Sound (S Central AK)	Recreational vessel	26'	19 knots	Whale surfaced and swam away; fate unknown (vessel sank)
2005	Icy Strait (SE AK)	Whalewatch charter	26'		Fate unknown (humpback calf)
2005	Juneau area (SE AK)	Tour vessel	143'		Whale swam away after strike; fate unknown
2005	Kake area Frederick Sound (SE AK)	skiff	28'	25 knots	Whale dove after strike; fate unknown
2005	Stephens Passage south of Taku Inlet (SE AK)	Small tour vessel			Fate unknown
2005	Stephens Passage (SE AK)	Tour vessel		10 knots	Fate unknown
2005	Brothers Islands Frederick Sound (SE AK)	Cruise ship	294'	20 knots	Fate unknown
2005	Peril Strait (SE AK)	unknown			Dead/ Necropsy: Blunt trauma consistent with strike
2006	Saginaw Channel (SE AK)	ferry		< 14 knots	Fate unknown
2006	Auke Bay (SE AK)	Whale watch charter		< 2 knots	Fate unknown
2007	Prince William Sound (S Central AK)	Charter vessel			Animal bleeding, fate unknown
2007	Sitka (SE AK)	Fishing/Wildlifeviewing Charter vessel		15 knots	Fate unknown
2007	Port Snettisham (SE AK)	Skiff	26’	20 knots	Fate unknown
2007	Chatham Strait	unknown			Dead/ Necropsy; trauma consistent with strike
2007	Spasski (SE AK)	Loaded Landing craft	32’	17 knots	Whale resurfaced; fate unknown

7.3.4 Other Threats

Whale Watching

The CNP humpback whale stock is the focus of a large whale watching industry in its wintering grounds (Hawaii) and a growing whale watching industry in its summering grounds (Alaska). NOAA has issued regulations concerning minimum approach distances and vessel operations around humpback whales in Hawaii and Alaska in order to minimize the impact of whale watching and other activities. Vessels are prohibited from approaching humpback whales closer than 100 yards (90 m) (50 CFR 224.103).

The growth of the whale watching industry is a concern for CNP humpback whales not only because of the increasing potential for ship strikes (discussed above), but also because harassment of whales may occur, their preferred habitats may be abandoned, and their fitness or survivability may be compromised if disturbance levels are too high. Despite these impacts, the effects of which are not completely understood, the CNP stock is still increasing at approximately 7% (Allen and Angliss 2009).

Underwater Noise

Noise from the Acoustic Thermometry of Ocean Climate (ATOC) program, military sonar, and other anthropogenic sources (*i.e.*, shipping and whale watching) in Hawaiian waters is another concern for this stock. Results from experiments in 1996 off Hawaii indicated only subtle responses of humpback whales to ATOC-like transmissions (Frankel and Clark 1998). A 1996 study in Hawaii measured the acoustic noise of various whale-watching boats and determined that the sound levels were unlikely to produce grave effects on the humpback whale auditory system (Au and Green 2000). Frankel and Clark (2002) also indicated that there were slight shifts in humpback whale distribution in response to ATOC. It was later confirmed (Mobley, Jr. 2005) that the numbers and patterns of humpback whales returning to winter in the waters off Kauai did not change after four years of exposure to the transmissions of ATOC (which recommenced in 2002 as a part of the North Pacific Acoustic Laboratory program [NPAL]). Efforts are underway to evaluate the relative contribution of noise (*e.g.*, experiments with Low Frequency Active sound sources) to Hawaii's marine environment, although reports summarizing the results of recent research are not available (Allen and Angliss 2009).

8.0 Interaction with Category I and II Fisheries in Hawaii and Alaska

This section evaluates the available information to determine the likelihood of a CNP humpback whale interacting with the U.S. commercial fisheries in Hawaii and Alaska described in this document. Of the fisheries occurring in either the Hawaii and Alaska portions of the action area, serious injury or mortality of CNP humpback whales are only known to have occurred in the following fisheries since 2003: Hawaii shallow-set (swordfish target) longline/set line fishery; Yakutat, Alaska salmon set gillnet; Bering Sea sablefish pot; Southeast Alaska salmon drift gillnet; Kodiak, Alaska salmon purse seine; Cook Inlet, Alaska salmon purse seine; and the Cook Inlet, Alaska salmon set gillnet fisheries, SE AK halibut longline.

Additional serious injuries and mortalities of humpbacks entangled in fishing gear in Alaska have been documented through strandings reports. In cases where the specific fishery that caused the serious injury or mortality cannot be definitively identified, the serious injury or mortality has been attributed to "unknown fishery" with the general gear type identified as possible. Those serious injuries and mortalities are not used to categorize fisheries under the annual MMPA List of Fisheries, but are included in this analysis to determine whether all commercial U.S. fisheries collectively have a negligible impact on the CNP stock. Information available for this analysis includes reports of actual interactions between the fisheries and humpback whales derived from observer programs, vessel logbooks, strandings data, and self-reports.

8.1 Impacts of the Hawaii-based Longline Fisheries

Observed[13] humpback whale interactions in the Hawaii-based longline fisheries are sporadic events. From 1995 through 2008,[14] there were five total observed interactions between the stock and the entire Hawaii-based longline fleet. Humpback whales occur in the Hawaii portion of the action area only in the winter months, and the stock does not uniformly occur across the spatial distribution of the longline fisheries. Such interactions may be considered extremely rare events when viewed in relation to the steadily increasing abundance of CNP humpback whales and the amount of fishing effort that has occurred in the longline fisheries during this period of time.

Deep-Set Fishery

One interaction per year with adult humpback whales was observed in the deep-set longline fishery in 2001, 2002, and 2004 (Table 6). The 2001 interaction occurred within the U.S. EEZ, and the other two interactions occurred outside of the U.S. EEZ. In each instance, efforts were taken to disentangle the whale, and all three whales were either released or able to break free from the gear without noticeable impairment to the animals' ability to swim or feed. Further analyses of these interactions by NMFS using the serious injury guidelines determined that these events resulted in non-serious injuries.

Shallow-Set Fishery

One interaction with a humpback whale was observed in the shallow-set longline fishery in 2006 outside the U.S. EEZ. According to NMFS observer characterizations of the event, the whale was entangled several times in the main longline and branchline, around the body and flukes. The main lines were cut on either side of the whale to release the animal. This interaction was later determined to be a serious injury (Forney 2009). Additionally, one interaction was observed in the shallow-set longline fishery in 2008 outside the U.S. EEZ. Further analysis of this interaction by NMFS using the serious injury guidelines determined that this event resulted in non-serious injuries.

Table 6. Summary of observed interactions between humpback whales and the Hawaii-based longline fisheries from 1995-2007. Seriousness of injuries was assessed under MMPA serious injury guidelines (Angliss and DeMaster 1998).

Hawaii Longline Fishery	Date	EEZ	NMFS-Determined Severity
Deep Set	2/11/2001	Hawaii	Not serious
Deep Set	10/12/2002	Outside	Not serious
Deep Set	2/16/2004	Outside	Not serious
Shallow Set	2/19/2006	Outside	Serious
Shallow Set	12/29/2007	Outside	Not serious

[13] Observer coverage in the deep- and shallow-set fisheries is ~20% and 100% respectively (*see supra* section 4.0).
[14] The timeframe for the data used in this analysis is the five-year period from 2003 through 2007 (*see infra* section 9.1). Information outside of this time period is solely provided for reference purposes.

8.2 Impacts of Alaska Fisheries

The primary impacts of the Alaska-based fisheries on CNP humpback whales are likely result from direct interactions with the fishing gear. Known fishery effects on humpback whales result from entanglement and subsequent injury or death of individuals that interact with the fishing gear. Humpback whales are present in the action area as they migrate to and from and occur in Alaskan waters during the summer feeding months.

Since 2003, there have been 15 known serious injuries or mortalities and an additional 44 non-serious interactions between the stock and commercial fisheries' operations in Alaska. During this same time period the CNP stock of humpback whales has been steadily increasing in abundance (*see* Section 7.2, Status of the Stock). These interactions have been primarily with the state-managed coastal fisheries, but a number of entanglements have been recorded with gear that could not be positively identified to a specific fishery's region (*e.g.*, drift gillnet gear that could not be linked to a specific regional fishery such as the Southeast Alaska drift gillnet fishery). Only interactions that resulted in serious injuries or mortalities are applied against the PBR for this analysis (*see* Table 7 for details).

9.0 Negligible Impact Analysis

9.1 Incidental Takes in Commercial Fisheries

Individual incidental serious injuries and mortalities to the CNP stock of humpback whales caused by commercial fisheries in Hawaii and Alaska are summarized in Table 7. Further information on known humpback entanglements in fishing gear that did not result in serious injury or mortality is also provided. However, only serious injuries and mortalities were used in making the negligible impact determination.

The time frame for the data used in this analysis is the five-year period from 2003 through 2007. The Guidelines for the Assessment of Marine Mammal Stocks (GAMMS) and the subsequent GAMMS II provide guidance that, when available, the most recent five-year time frame of commercial fishery incidental serious injury and mortality data is an appropriate measure of effects of fishing operations on marine mammals (Wade and Angliss 1997). This time frame provides enough data to adequately, though likely minimally, capture year to year variations in take levels, while better reflecting current environmental and fishing conditions as they may change over time.

Data for serious injury and mortality incidental to commercial fishing operations includes observer data and stranded or entangled whales reported to NMFS through various sources. Stranding data are opportunistic data that are reported to NMFS from various sources, including the general public, authorized members of the NMFS' marine mammal stranding networks, commercial fishermen, NMFS Enforcement, the U.S. Coast Guard, and others. Verification of some reports is often difficult, due to a lack of detailed information accompanying the report (such as positive species identification, location, indication of human interaction, etc.), resulting in reports that range from confirmed to unconfirmed. NMFS Alaska Region has developed guidelines for use in determining the types of strandings information that is considered sufficiently reliable to be used in assessments of the impacts of fisheries-related incidents on a marine mammal population. Serious injuries and mortalities that are included in the annual List of Fisheries may be included in the total serious injury/mortality across all fisheries where commercial fishing gear was seen attached to an animal or other specific indications of fishery interaction, but may not be attributable to a particular fishery. Only those serious injuries and mortalities in which the specific fishery can be positively identified are used in assessing the impacts of specific individual fisheries on marine mammal populations. Such fishery identification is made through identification of the associated gear type, gear registration number, or communication between NMFS staff, NMFS Enforcement, or the U.S. Coast Guard and the individual fishermen whose gear entangled the animal, or other compelling evidence.

Seriousness of injuries was assessed using guidelines developed for marine mammal stock assessments under the MMPA (Angliss and DeMaster 1997). This estimate is considered a minimum because not all entangled animals die and not all dead animals are found, reported, or cause of death determined. A Serious Injury Workshop was held in 2007 to re-evaluate 1999 NMFS guidelines used to determine if fishery entanglements, ship strikes, or other human interactions with a marine mammal results in serious injury. Revised guidelines for determining serious injury are expected to be finalized in the near future.

Mortalities or serious injuries sometimes occur in an area of known overlap with the Western North Pacific stock of humpback whales. Where there is considerable uncertainty regarding to which stock an individual serious injury or mortality should be assigned, NMFS exercises a conservative approach by considering the possible effects of such serious injuries and mortalities under separate scenarios for each possible source stock. For each such assessment, all the serious injuries or mortalities that occurred in the overlap area are assigned to a single stock that occurs in the overlap area, and the total serious injuries and mortalities from that stock, (those within the overlap area plus those outside the overlap area, but within the range of that stock) are assessed against the PBR for that stock. This results in a maximum level of possible serious injuries or mortalities that may have been taken from each stock, based on known serious injury or mortality and, therefore, the maximum possible impact to the population from the known incidents. This assessment is completed for each of the stocks that occur in the overlap area. This approach does not cause any individual serious injury or mortality to be counted twice in assessing the impact of the serious injuries and mortalities, since the assessments for each stock are done independently and are not added together. Where information is available regarding the location of the take, genetics of the animal taken, or other information that would conclusively link mortality to a specific stock, NMFS uses that information to assign the take to a specific stock.

The total of all known serious injury and mortalities to the CNP stock as a result of commercial fishing operations for the time period from 2003 through 2007 is 17 whales (16 in Alaska, 1 in Hawaii), resulting in an annual average take of 3.6 animals. To this total, 9 whales were observed entangled in Hawaiian waters with injuries that could be serious (Table 3), which is an annual mean of 1.8 over the 5-year period. The gear entangling these whales did not originate in Hawaiian waters; therefore, some these whales may be included among the entangled humpback whales seen and documented in Alaska. Consequently, some duplication of documentation may have occurred. For purposes of this analysis, NMFS adds all of these whales to the annual mean of

3.6 reported in Table 7 for a potential of 5.4 commercial fishery-caused mortalities or serious injuries of CNP humpback whales per year over the period 2003-2007. In its analysis under ESA section 7, NMFS estimated that expanded effort in the shallow-set longline fishery could increase the number of humpback whales killed or seriously injured incidental to their fishing up to one whale every one or two years.

The current PBR for this stock is 20.4 animals. Therefore, the total annual average incidental take in commercial fisheries for this timeframe is 26.5% of the PBR.

9.2 Other Human-Caused Injuries and Mortalities

The total number mortalities attributed to ship strikes for the same five-year period is 8 with an annual average take of 1.6 animals/year attributed ship strikes. One mortality of a CNP humpback whale was attributed to recreational crab pot gear in 2004 (5-year mean is 0.2 mortalities or serious injuries per year) as indicated in Alaska stranding information.

9.3 Total Human-Caused Mortality and Serious Injury

An estimated annual total human-caused mortality and serious injury rate for the entire CNP stock of humpback whales for the 2003-2007 time period is 7.2 (5.4 fishery-related + 1.8 from vessel strikes and recreational fishing). Accordingly, total human-caused mortality and serious injury is well below the PBR (20.4) of this stock.

Table 7. Serious Injuries and Mortalities Incidental to Commercial Fisheries and Ship Strikes

Year	Fishery	Observed Mortality & Serious Injury	Entanglement Mortality & Serious Injury	Total Fishery Mortality & Serious Injury	Non-serious Observed Estimate (Obs est) or Entanglement (Ent)	Ship Strike Mortality & Serious Injury (all in AK)	Ship strike w/o Mortality or Serious Injury (in AK & HI)
2003	AK - Unspecified net gear	--	1 M	**2**	4 (AK Ent)	1 M	8
	AK - Crab pot gear		1 SI				
2004	AK - Unspecified fishing gear	--	2 SI	**3**	2 (AK Ent) 4 (HI Obs Est) 6 Total	2 M 1 SI	2
	AK - Crab pot	--	1 SI				
	HI - tuna deep set longline	--	--				
2005	AK - SE salmon drift gillnet	--	1 M	**8**	13 (AK Ent)	2 M 1 SI	12
	AK - Kodiak salmon purse seine	--	1 M				
	AK - Lower Cook Inlet salmon purse seine	--	1 M				
	AK - Unspecified drift gillnet	--	1 SI				
	AK - Cook Inlet salmon set gillnet	--	1 SI				
	AK - Unspecified set gillnet	--	1 SI				
	AK - Crab pot gear	--	2 SI				
2006	AK - Halibut Longline	--	1 SI	**5**	16 (AK Ent)	0	2
	AK - Dutch Harbor unknown pot gear	--	1 M				
	AK - Cook Inlet unspecified net gear	--	1 SI				
	AK – Unspecified fishing gear	--	1 M				
	HI – shallow set swordfish longline	1 SI	--				
2007	--	--	--	**0**	9 (AK Ent)	1 M	4
Total **2003-2007**	ALL AK and HI fisheries	1	17	**18**	n/a	8	n/a
Average Annual SI/M **2003-2007**		0.2	3.4	**3.6**		1.6	
Ratio of Average Annual SI/M to PBR (PBR=20.4)		n/a	n/a	**17.6%**		7.8%	

* includes entanglements which may have resulted in serious injury, but the degree of injury could not be determined with any confidence.

10. Application of Negligible Impact Determination Criteria

In applying the 1999 criteria (64 FR 28800, May 27, 1999; *see* page 8) to determine whether mortality and serious injury incidental to commercial fisheries will have a negligible impact on a stock, criterion 1 is the starting point for analyses. If this criterion is satisfied, the analysis would be concluded. The remaining criteria describe alternatives applicable under certain conditions (such as fishery mortality below the negligible threshold but other human-caused mortality above the threshold, or fishery and other human caused mortality between the negligible threshold and PBR for a stock that is increasing or stable). If criterion 1 is not satisfied, NMFS may use one of the other criteria as appropriate.

Criterion 1 states: "The threshold for initial determination will remain at 0.1 PBR. If total human-related serious injuries and mortalities are less than 0.1 PBR, all fisheries may be permitted." In this case, Criterion 1 was not satisfied because the total human-related serious injuries are not less than 0.1 PBR. The overall PBR calculated for this stock is 20.4 animals (Allen and Angliss 2009). The annual average serious injury and mortality to the CNP stock of humpback whales from all human-caused sources is 5.4 animals, which is 26.5% of this stock's PBR [above the 0.1 PBR (2.0 animals) threshold]. As a result, the other criteria must be examined.

Only the mortality and serious injury incidental to commercial fishing is subject to the negligible impact determination; however, total human-caused mortality and serious injury of CNP humpback whales should be below PBR. The total of 7.2 potential mortalities and serious injuries per year is below the stock's PBR of 20.4.

Because the CNP stock of humpback whales is *increasing* (Allen and Angliss 2009; Calambokidis et al. 2008), Criterion 3 is the appropriate criterion. The total annual fisheries-related serious injury and mortality is 3.2 animals, which is greater than 0.1 PBR (2.0 animals) and less than this stock's PBR (20.4 animals). Therefore, U.S. commercial fisheries within the range of CNP humpback whales may be permitted subject to their individual review and the certainty of relevant data, and provided that the other provisions of section 101(a)(5)(E) are met.

Criterion 3 states: "If total fisheries-related serious injuries and mortalities are greater than 0.1 PBR and less than PBR and the population is stable or increasing, fisheries may be permitted subject to individual review and certainty of data. Although the PBR level has been set up as a conservative standard that will allow recovery of a stock, there are reasons for individually reviewing fisheries if serious injuries and mortalities are above the threshold level. First, increases in permitted serious injuries and mortalities should be carefully considered. Second, as serious injuries and mortalities approach the PBR level, uncertainties in elements such as population size, reproductive rates, and fisheries-related mortalities become more important."

Although there are uncertainties in information regarding CNP humpback whales, such as abundance and mortality/serious injury estimates, the level of human-caused mortality and serious injury is well below the estimated PBR. However, even with the current levels of human-caused mortality and serious injury, the population continues to increase at a rate estimated to be 7% per year and fishery-related mortality and serious injury is a small portion of the stock's PBR, which is calculated using a recovery factor of 0.1 (with a long term-average mortality and serious injury equal to PBR, 90% of the stock's net annual production would be reserved for recovery). Increases in mortality and serious injury of CNP humpback whales due to the expanded fishing effort due to the modifications in the fishery are estimated to be 1 whale every one or two years. These increases would not cause human-caused mortality and serious injury to exceed or even approach the stock's PBR. The population size is relatively large (about 7,500 to 10,000, depending upon which model is used for the abundance estimate) and is growing at a rate that is nearly double the maximum rate of growth for cetaceans (4%). Accordingly, Criterion 3 is satisfied in determining that mortality and serious injuries of the CNP humpback stock incidental to commercial fishing would have a negligible impact on the stock because of individual review of data regarding the stock, including increased growth rate of the stock, limited increases in serious injury and mortality due to the relevant fisheries, and the level of human-caused mortality and serious injury is well below the estimated PBR.

11.0 Negligible Impact Determination

Based on the review of the best available scientific and commercial data and the applicability of the criteria for making a negligible impact determination under MMPA Section 101(a)(5)(E), all conditions of criterion 3 (64 FR 28800, May 27, 1999) are met by the available serious injury and mortality data for the CNP stock of humpback whales. NMFS has determined that the annual mortality and serious injury incidental to commercial fisheries in Hawaii (0.2) and Alaska (5.2), with a total annual mortality and serious injury of 5.4 animals, will have a negligible impact for purposes of issuing a permit under section 101(a)(5)(E) of the MMPA because this level is below PBR for this endangered stock (using 0.1 as the F_r in the PBR calculation). Accordingly, then, the expected level of mortality and serious injury incidental to commercial fisheries will not cause more than a 10% increase in the time to recovery of CNP humpback whales. NMFS will revaluate this determination as new information becomes available.

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13.0 Appendix 1

Acronym List

The following is a list of acronyms used throughout this document:

AFA	American Fisheries Act
ATOC	Acoustic Thermometry of Ocean Climate
BSAI	Bering Strait Aleutian Islands
CITES	Convention on International Trade in Endangered Species
CNP	Central North Pacific
EEZ	Exclusive Economic Zone
ESA	Endangered Species Act
FEIS	Final Environmental Impact Statement
FMP	Fishery Management Plan
GAMMS	Guidelines for the Assessment of Marine Mammal Stocks
IFQ	Individual fishing quota
IWC	International Whaling Commission
MMPA	Marine Mammal Protection Act
MNPL	Maximum Net Productivity Level
NMML	National Marine Mammal Laboratory
NOAA	National Ocean and Atmospheric Administration
NPAL	North Pacific Acoustic Laboratory
NMFS	National Marine Fisheries Service
OSP	Optimum sustainable population
PBR	Potential biological removal
SAR	Stock Assessment Report
SCA	Sea Lion Conservation Area
TAC	Total allowable catch
THA	Terminal harvest area
ZMRG	Zero Mortality Rate Goal

14.0 Appendix 2

Marine Mammal Stock Assessment Terminology

Under section 117 of the Marine Mammal Protection Act (MMPA), NMFS and the U.S. Fish and Wildlife Service are required to publish stock assessment reports for all stocks of marine mammals within U.S. waters, to review new information every year for strategic stocks and every three years for non-strategic stocks, and to update the stock assessment reports when significant new information becomes available. A strategic stock is:

a. A marine mammal species that is listed as endangered or threatened under the ESA;
b. A marine mammal stock for which the human-caused mortality exceeds the potential biological removal (PBR) level; or
c. A marine mammal stock which is declining and likely to become listed as a threatened species under the Endangered Species Act (ESA).

The PBR level is the maximum number of animals, not including natural mortalities, that may be annually removed from a marine mammal stock while allowing that stock to reach or maintain its optimal sustainable population level (OSP). Optimum sustainable population means the number of animals which will result in the maximum productivity of the population or species. The PBR level is the product of the following factors: 1) The minimum population estimate of the stock (N_{MIN}); 2) One-half the maximum theoretical or estimated net productivity rate of the stock at a small population size, where net productivity is the annual per capita rate of increase in a stock resulting from additions due to reproduction, less losses due to mortality (½ R_{MAX}); and 3) A recovery factor (R_F) or "safety factor" of between 0.1 and 1.0 to hasten the recovery of depleted populations and to account for additional uncertainties. The use of PBR as a management scheme is a conservative approach that will allow populations to recover to or remain above OSP. Wade (1998), using simulation models, demonstrated that a PBR calculated with a recovery factor of 0.1 would meet two performance goals: 1) 95% of simulations would equilibrate within 95% of carrying capacity (K), and 2) there would be no more than a 10% delay in recovery. Mortality limits were evaluated based on whether at least 95% of the simulated populations met two criteria: 1) the populations starting at the maximum net productivity levels (MNPL) stayed there or above after 20 years, and 2) that populations starting at 30% of K recovered to at least MNPL after 100 years (Wade 1998).

When calculating PBRs, NMFS chose to use a value of 0.1 for the safety factor for species listed as endangered under the ESA, based partly on the rationale that this would not cause more than a 10% increase in the time to recovery (Barlow *et al*. 1995). Using 0.1 as a safety factor in the PBR equation would allow a large fraction of the net production of the population to contribute to population increase and eventual recovery, and thus, have a relatively insignificant negative impact upon the population (Wade 1998). For depleted and threatened stocks and stocks of unknown status, a recovery factor of 0.5 is used, and for stocks thought to be within OSP, a recovery factor of 1.0 is used (Barlow *et al*. 1995). However, before the recovery factor is set as high as 1.0, reasonable scientific justification needs to be provided that the estimates of abundance and mortality are not severely biased and have estimated coefficients of variation

(CVs) less than or equal to 0.8 for the abundance estimate and 0.3 for the mortality estimates (Barlow *et al*. 1995).

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