CALIFORNIA GRAY WHALE COALITION

PROTECTING THE MOST ANCIENT BALEEN WHALE ALIVE TODAY

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17th October, 2010

Eric Schwaab,
Assistant Administrator for Fisheries,
NOAA
1315 East-West Highway,
Silver Spring MD. 20910

Dear Mr Schwaab,

The California Gray Whale Coaltion hereby petitions the National Marine & Fisheries Agency to conduct a status review of the Eastern North Pacific Gray Whale (*Eschrichtius Robustus)* population for the purposes of determining whether to list the population as depleted under the Marine Mammal Protection Act.

Petitioners believe the evidence compiled in the formal petition demonstrates the population is depleted as specified under Section 3 (9) of the MMPA (16 U.S.C. 1362(9).

The Coalition represents economic and environmental concerns in relation to the Gray Whale. A list of member organizations is included in the petition.

Yours truly,

Sue Arnold
CEO
California Gray Whale Coalition
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Ph: 650 322 4729

PETITION TO DESIGNATE THE EASTERN NORTH PACIFIC GRAY WHALE (*Eschrichtius robustus*) AS A DEPLETED POPULATION UNDER THE MARINE MAMMAL PROTECTION ACT.

Submitted to: **Mr. Gary F. Locke**
Secretary of Commerce

Mr. Eric Schwaab
Assistant Administrator for Fisheries
National Oceanographic and Atmospheric Administration

Submitted by: **California Gray Whale Coalition**

Prepared by: **Sue Arnold on behalf of the California Gray** Whale Coalition

October 14th - 2010

PETITION

Pursuant to 16 U.S.C § 1383b and 5 U.S.C. § 553 (e), the California Gray Whale Coalition ("CGWC")[1] hereby petitions the National Marine & Fisheries Agency (NMFS) to conduct a status review of the Eastern North Pacific Gray Whale population (hereinafter Gray Whale) (*Eschrichtius robustus*) for the purposes of determining whether to list the population as depleted under the Marine Mammal Protection Act. (MMPA).

The purpose of the MMPA is to protect marine mammals " *to the greatest extent feasible*", consistent with sound resource management to " *maintain the health and stability of the marine ecosystem*". 16 U.S.C. § 1361 (6).

Section 3 (1) (A) of the MMPA (16 U.S.C. 1362 (1) (A) defines the term, " **depletion**" or "depleted", to include any case in which "*.... the Secretary, after consultation with the Marine Mammal Commission and the Committee of Scientific Advisors on Marine Mammals .... determines that a species or population stock is below its optimum sustainable population.*" Section 3 (9) of the MMPA (16 U.S.C. 1362 (9) defines " optimum sustainable population (OSP) .. *with respect to any population stock, (as) the number of animals which will result in the maximum productivity of the population of the species, keeping in mind the carrying capacity (K) of the habitat and the health of the ecosystem of which they form a constituent element.*" NMFS regulations at 50 CFR 216.3 clarify the definition of OSP as a population size that falls within a range from the population level of a given species or stock that is the largest supportable within the ecosystem (i,e K) to its maximum net productivity level (MNPL). MNPL is the population abundance that results in the greatest net annual increment in population numbers resulting from additions to the population from reproduction, less losses due to natural mortality.[2]

The numeric threshold for OSP has been interpreted by NMFS as being above 0.6 K (i.e greater than 60% of K, or carrying capacity). In other words, a stock that dropped in numbers to below 60% of K would qualify as " depleted" under the MMPA.

The petition is filed under 5.U.S.C. § 553(e) of the Administrative Procedure Act and 16 U.S.C. § 1383b of the MMPA. Section 115(a) (3) of the MMPA (16 U.S.C. 1383b(a) (3) requires NMFS to publish a notice in the Federal Register that such a petition has been received and is available for public review. Within 60 days of receiving a petition, NMFS must publish a finding in the Federal Register as to whether the petition presents substantial information indicating that the petition action may be warranted. [3]

If NMFS makes a positive 60 day finding, NMFS must promptly initiate a review of the status of the affected population stock of marine mammals. No later than 210 days after receipt of the petition, NMFS must publish a proposed rule as to the status of he species or stock, along with the reasons underlying the proposed status determination. Following a 60 day comment period on the proposed rule, NMFS must publish a final rule within 90 days of the close of the comment period on the proposed rule.[4]

Petitioners say that the Eastern North Pacific Gray Whale population (ENPGW) is in decline sufficient to classify the stock as depleted, as defined under the MMPA, thereby requiring the preparation of a conservation plan to restore stock to its optimum population.

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[1] http://www.californiagraywhalecoalition.org/memberslist.shtml
[2] Department of Commerce, NOAA (I.D. 111402C) Petition to designate AT1 group of killer whales as depleted stock under the MMPA.
[3] Center for Biological Diversity
[4] Ibid

CAUSES OF DECLINE

Petitioners believe Gray Whales are experiencing bottom up and top down controls ensuring a continuing decline of OSP and deterioration of their habitat and primary prey.

George Hunt Jr. (2006)[5] states:-

> " .. *climate variability affects bottom-up processes by altering nutrient availability and the timing or amount of primary and secondary production. Responses to food limitation include density-dependent changes in growth, weight at age, age at maturity, productivity, stress-related physiological changes and non-predation-related mortality.* "
>
> *And.. " Top down control occurs when the rate of predation is sufficient to limit the size of the population.* "

Petitioners will demonstrate that bottom up and top down controls as outlined by Hunt (2009) are entirely applicable to the Gray whale population.

The causes of the decline are as follows:-

* Potential Biological Removal (PBR) which has resulted in over-harvesting.
* Collapse of cow/calf numbers
* Predation by Transient orcas.
* Major changes in primary prey and habitat as a result of climate change
* Reduction in available prey species resulting in starvation

CARRYING CAPACITY.

Recent studies indicate that pre-whaling abundance is greater than previously believed. This point is best supported byrecent genetic research by Alter, Rynes & Palumbi (2007). Some statistical modelers, (Wade, Punt, et al) agree the carrying capacity may have been as high as 70,000.

References include:-

2007.

Genetic research undertaken by Dr Alter and Prof. Stephen Palumbi[6] indicate the population of Gray Whales once totalled 76,000 to 118,000 individuals (average 96,000 whales).

> *"Eastern Pacific gray whales play a key ecological role in their Arctic feeding grounds and are widely thought to have returned to their prewhaling abundance. Recent mortality spikes might signal that the population has reached long-term carrying capacity, but an alternative is that this decline was due to shifting climatic conditions on Arctic feeding grounds. We used a genetic*

[5] George L. Hunt,Jr. Evidence for Bottom-Up Control of Upper-Trophic-Level Marine Populations Is It Scale-Dependent. Whales, Whaling and Ocean Ecosystems. Edited by James Estes et al.

[6] Alter,S.E.,Rynes,E.,and S.R. Palumbi. 2007. DNA evidence for historical population size and past ecological impacts of gray whales.' Proceedings of the National Academy of Sciences

approach to estimate prewhaling abundance of gray whales and report DNA variability at 10 loci that is typical of a population of ≈76,000–118,000 individuals, approximately three to five times more numerous than today's average census size of 22,000. Coalescent simulations indicate these estimates may include the entire Pacific metapopulation, suggesting that our average measurement of ≈96,000 individuals was probably distributed between the eastern and currently endangered western Pacific populations. These levels of genetic variation suggest the eastern population is at most at 28–56% of its historical abundance and should be considered depleted. "

2004.

" *Gray whales have been taken as part of aboriginal hunts since before European arrival and have been exploited commercially on both sides of the North Pacific for the last two centuries. ..... However, the basic density-dependent model and its variants cannot reconcile the current abundance and continued increase of this population with the historical catch records; the population seems to have overshot its historical K by 200-300%. A consistent trajectory can be achieved only be assuming large historical " adjustments", such as under-reporting historical catches by a half to a third or by assuming density dependent selection on life-history parameters resulting in long-period oscillations in abundance.*

As an alternative to backward extrapolation using uncertain historical records, Wade considered only the " known" catch data available since the start of shore-based surveys during 1966-67 (ignoring all catches before this time), and the trend in the 21 years of abundance surveys. Using several modifications of the basic model and incorporating Bayesian statistical estimators, Wade concluded that the variance of the time series of abundance estimates was greater than was estimated previously. As a consequence, previous models have derived estimates for K and other population parameters (e.g. rates of increase) that were overly precise. Taking this additional variance into account, the 95% confidence intervals of predicted current carrying capacity (K) were much wider than calculated in previous models, extending from ***19.980 to 66,720****. Consequently, there was a moderately large probability (>0.20) that the current population is still below 50% of K.*" Trends in Ecology and Evolution Vol.19.No.7 July 2004 [7]

2004 A. Punt et al, [8]Tables 1 and 2 include K at 70,000.

1999. At the 1999 Status Review, a paper by Wade & DeMaster [9] supports the possibility of an historical abundance as high as **70,000.** " *Point estimates of the equilibrium population size ranged from 24,000 to 32,000 depending upon which model was used, but values as high as 70,000 still had some probability.* "

1998, " Based on a revised Bayesian analysis of Gray whale population dynamics, carrying capacity ranged from **25,130 to 30,140** depending upon the starting year of the trajectory, with the upper 95th percentile of **43,950 and 59,160** " [10]

Barlow et al.1995 wrote:- " *pre-exploitation abundance is generally used as the most readily available proxy for K.* "

The most recent estimate of the Gray Whale population by Laake et al (2009) of 19,126 in 2006/07 is significantly below the OSP, ie below 60% of K where K is 60,000 to 70,000 and therefore, by definition, the current Gray Whale population is depleted.

Modelling the past and future of whales and whaling. Scott Baker & Clapham.

[8] An examination of assessment models for the eastern North Pacific gray whale based on inertial dynamics. Andre Punt, Cherry Allison, Gavin Fay. J. Cetacean Res. Manage,6(2):121-132,2004

[9] A Bayesian Analysis of Eastern Pacific Gray Whale Population Dynamics. (unpublished)

Federal register notice April 6,1998 Vol.63, No. 65

The decline of the Gray whale population is evidenced by the graph below, based on Laake et al.,(2009) Table 9, Current and previous gray whale estimates.

MODEL. 1

We estimated the underlying time-specific trend in the NMFS gray whale abundance series over the 40 years (1967/1968-2006/2007) using a *loess* regression smooth (Hastie & Tibshirani 1990 implemented in the R statistical modeling program (Ihaka & Gentleman 1996). This nonparametric approach uses the data to determine the underlying linear or nonlinear trend without having to assume any specific functional form. We compared the 2 data series derived from the gray whales surveys undertaken by NOAA at Granite Canyon (Laake et al. 2009). It is apparent from Figure 1 (recent data series) that gray whale abundance on the southbound migration at Granite Canyon (California) was generally increasing from the late 1960s until the mid-1980s and then has been decreasing steadily ever since. The 2 data series differ substantially in the estimated peak in the abundance series Mid 1980s vs mid 1990s).

Hastie T, Tibshirani R (1990) Generalized additive models. Monographs on Statistics and Appl Probability 43, Chapman & Hall, London

Ihaka R, Gentleman R (1996) R: a language for data analysis and graphics. Journal of Computational and Graphical Statistics 5: 299-314

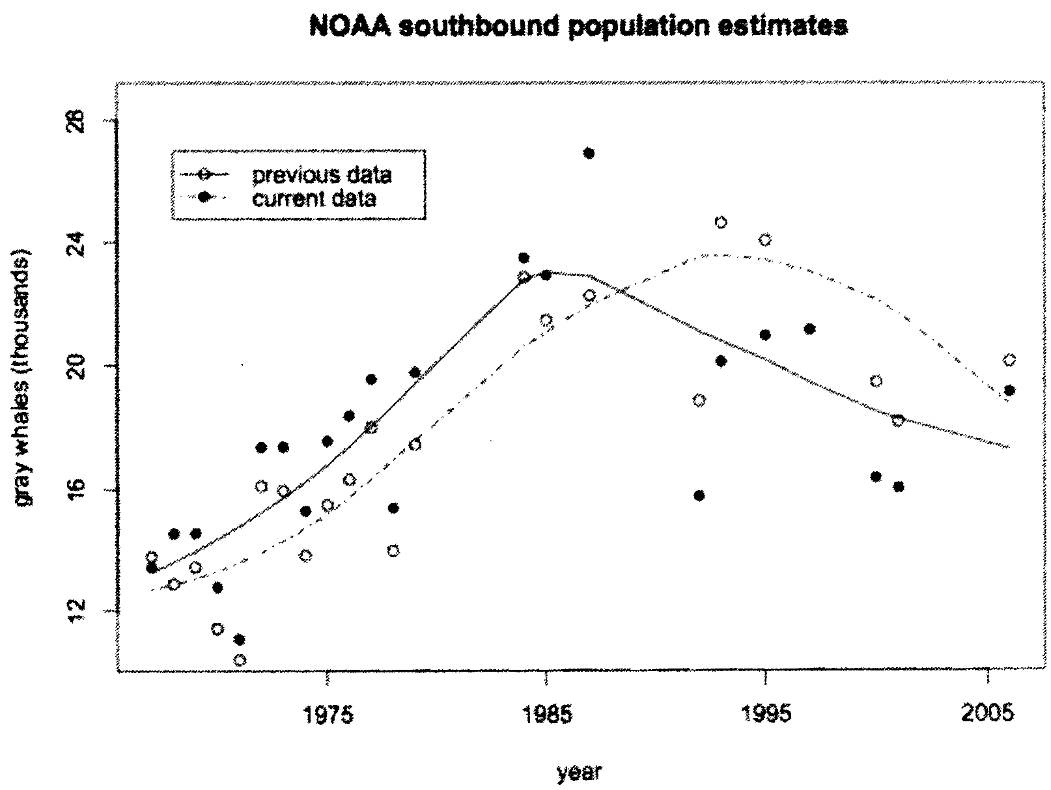

Figure 1 Time series plot of the estimated number of gray whales migrating each year since 1967/1968 southward past the NMFS study site at Granite Canyon (California). Data sourced from Laake et al. (2009). Open dots show previous NMFS-estimated gray whale abundance, dashed curve shows loess regression smooth fit to that time-specific abundance series. Sold dots show recent corrected NMFS-estimated gray whale abundance (Laake et al. 2009), solid curve shows loess regression smooth fit to the time-specific abundance series.

Model by Ecological Modelling, Brisbane, Australia.

Petitioners note the average abundance estimate according to Laake et al.(2009) from 1967-2006 is 17,819. This number is well below the population estimate when Gray whales were delisted in 1994 (20,103)- Laake et al.(2009) and below 60% of K where K is 60,000 to 70,000.

Furthermore, abundance estimates (Laake et al.(2009) since 2000 are below the population estimate at delisting in 1994. These estimates provide further evidence of the depleted status of the species.

BACKGROUND ANALYSIS

According to Laake et al., (2009):

> " .. *estimates for the surveys prior to 1987 in the trend analysis were scaled based on the abundance estimate from 1987/88. This meant that the first 16 abundance estimates used one set of correction factors , and the more recent 7 abundance estimates used different (and larger) correction factors which would influence the estimated trend and population trajectory.*

In the most recent effort to establish new abundance estimates from 1967-2006, significant changes have been made.

According to Laake et al.(2009) current gray whale abundance estimates are :-

1971-1972	11,079
1972-1973	17,365.

These figures indicate a 44% increase in the population.

Wade (2002) [11] notes;_

> " .. *the significant increase of greater than 30% from the 1992/93 estimate to the 1993/93 estimate is biologically implausible for gray whales.* "

Petitioners submit Laake et al.(2009) abundance estimates for 1971-1973 deserve an explanation noting that an increase of over 6,000 whales in one year significantly changes all future estimates. No other population increase of this size occurred in the years from 1967-2007.

Given the new set of population estimates and correction factors for 23 seasons from 1967 to 2006 as detailed in Laake et al.(2009) all previous trend analyses, methodologies, research, quotas and abundance estimates are now invalid.

DRAFT SAR 2010

Federal Register Notice [12] dated 8/4/2010, advising of the availability and soliciting public comments on Draft 2010 SAR's states :-

> " *SARs for marine mammals in the Alaska... regions were revised according to new information.* "

[11] Paul Wade, Bayesian stock assessment of the eastern Pacific gray whale using abundance and harvest data from 1967-1996. J. Cetacean Res.Manage.4 (1) 85-98 2002

[12] Federal Register/Vol.75 No. 149 August 4,2010 Notices Draft 2010 Marine Mall Stock Assessment Reports

...." A new abundance estimate for the 2006/2007 survey is reported in the eastern North Pacific gray whale SAR. After realizing that early estimates of abundance of this stock were calculated from models using different parameters, NMFS scientists re-analyzed the entire history of abundance estimates for this stock using consistent methods (Laake et al.2009). Punt and Wade (2009) used the new abundance estimates to evaluate the status and trend of the stock. These new analyses are included in the SAR and reaffirm that the stock remains within its Optimum Sustainable Population limits. "

NMFS fails to indicate the 2006/07 survey was not an abundance estimate as required under s. 117 of the MMPA. There are no provisions in the MMPA which support using the results of Field Studies to legitimise SARs.

The results of the most recent abundance estimate, (as required under s. 117 of the MMPA) undertaken in the 2009/2010 season, have not been published.

Ongoing Numbers Confusion.

A more recent Federal Register Notice 8/13/2010 [13] states:-

" Systematic counts of Eastern Pacific gray whales migration south along the central California coast have been conducted by shore based observers at Granite Canyon for most years since 1967. The most recent abundance estimates are based On counts made during the 1997/98, 2000-01 and 2001-02 southbound migrations. Analyses of these data resulted in abundance estimates of 29,758 for 1997/98, 19,448 for 2000-01 and 18,178 for 2001-02 (Rugh et al.2005).

Given this notice is published in August, 2010, (9 days after the Draft SAR for Gray Whales) using out of date trend analyses which are contradicted by Laake et al.(2009), any public comment will be based in invalid information provided by NMFS.

A further example can be found in Federal Register, 5/7/2010 [14]

TABLE 4-Abundance estimates, total proposed take estimates and percentage of Stock or population that may be taken for species that may occur in Shell's proposed Chukchi Sea drilling area.

Species	Abundance1
Gray Whale..	17,752

Unless stated otherwise, abundance estimates are taken from the 2009 Alaska SAR. Assumes 3.4 percent annual growth from the 2001 estimate of 10,545 individuals (Zeh and Punt, 2005).

There was no draft SAR for gray whales in 2009. The draft SAR 2008 relied on estimates from 1997/98, 2000-01 and 2001-02.

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[13] Federal; Register Vo. 75, No. 156 August, 13,2010 DEPARTMENT OF COMMERCE National Oceanic and Atmospheric Administration RIN 0648–XV09 Takes of Marine Mammals Incidental to Specified Activities; Taking Marine Mammals Incidental to Open Water Marine Seismic Survey in the Beaufort and Chukchi Seas, Alaska

[14] NOAA RIN 0648-XW14 Takes of Marine Mammals incidental to Specified Activities: Taking Marine Mammals Incidental to an Exploration Drilling Program in the Chukchi Sea.

"The most recent abundance estimates are based on counts made during the 1997-98, 2000-01, and 2001-02 southbound migrations. Analyses of these data resulted in abundance estimates of 29,758 for 1997-98, 19,448 for 2000-01, and 18,178 for 2001-02 (Rugh et al. 2005)."

Federal Register notices invite public comment on important issues highly relevant to the Gray Whale. Yet in spite of Laake et al.(2009), invalid estimates and information continues to be published in the Federal Register.

Status of Population

Further, petitioners assert, as described in greater detail below, that Gray Whale abundance estimate trends do not provide adequate evidence of the status of the population. A recent study on sea-turtles [15] underlines the importance of this statement.

> *"Wildlife and conservation researchers understand that using abundance measures for a single life-history stage can be misleading for diagnosing the status and trends of a population. (Van Horne, 1983; Thomson et al 1997; Brooks et al, 2004). Integrating abundance measures with demographic processes within a framework of modelling and data fitting provides a more robust basis for diagnosing trends, evaluating the impact of anthropogenic hazards and defining recovery criteria (Brooks et al, 2008).*
>
> *-models that are to be used for assessment, prediction, and management decisions require solid demographic data, preferably as time series of information that can be analysed for changes in response to stressors, population density, or environmental variability (Hilborn and Mangel, 1997)."*

Findings of a workshop sponsored by the U.S. Marine Mammal Commission and U.S. Fish and Wildlife Service in 2007 provide further support.

> *The status of a marine mammal species or stock is a function of both its population dynamics and the key factors that drive those dynamics, including behavior, health status, trophic dynamics, habitat, and the effects of human activities (Figure 1). With a few exceptions, previous assessments of arctic marine mammals have focused primarily on their population dynamics and have achieved only limited success (Table 2). Further, much of the existing information is outdated and provides only a snapshot of status rather than a robust assessment of long-term trends. (CAFF CBMP Report No.16 April, 2009)*

POPULATION COLLAPSE IGNORED

A major population collapse of the Gray Whale in 1999/2000 resulted in the death of up to one third of the species. Given that marine mammal populations can take up to a decade or more to recover, descriptions of the extent of collapse are an important component in the management of the species.

> *As far as we know, a Gray Whale takes at least five to six years to reach maturity which means at least a decade or more needs to pass before any improvement in the population will be secured.* [16]

Rugh et al (2002)[17] detailed the extent of collapse:

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[15] Ocean Studies Board, National Research Council of the National Academies of Science, Assessment of Sea-Turtle Status and Trends: Integrating Demography and Abundance, National Academies Press, 2010

[16] Declaration of Dr Milani Chaloupka, Hawaii County Green Party et al v. Donald L. Evans et al. US District Court for Northern District of California No. C-03-0078-SC

.. the 2001/02 provisional estimate is 17,414 whales... well below the previous (1997/98) estimate of 26,635 whales.

Rugh et al (2005) It is well documented from the central California census of the ENP gray whale population that following a population wide mortality event in 1999-2000 (Le Boeuf et al.,1999) the population declined by almost one-third from approximately 30,000 to 18,000 individuals by 2001-2002.

In fact, the major die-off was designated an Unusual Mortality Event under the MMPA.

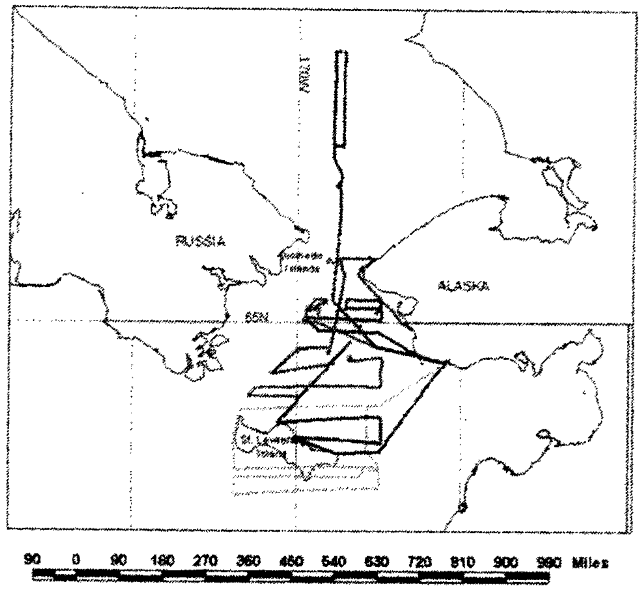
Rugh et. al reported that abundance estimates decreased from approximately 30,000 in 1997/1998 to under 20,000 in 2000/2001 and 2001/2002. NOAA Technical Memorandum NMFS-AFSC-150 Eastern North Pacific Gray Whale Unusual Mortality Event, 1999-2000 (March 2005)
http://www.afsc.noaa.gov/Publications/AFSC-TM/NOAA-TM-AFSC-150.pdf

To better understand the nature and size of the 1999/2000 collapse, mapping by Dr Sue Moore is instructive :-

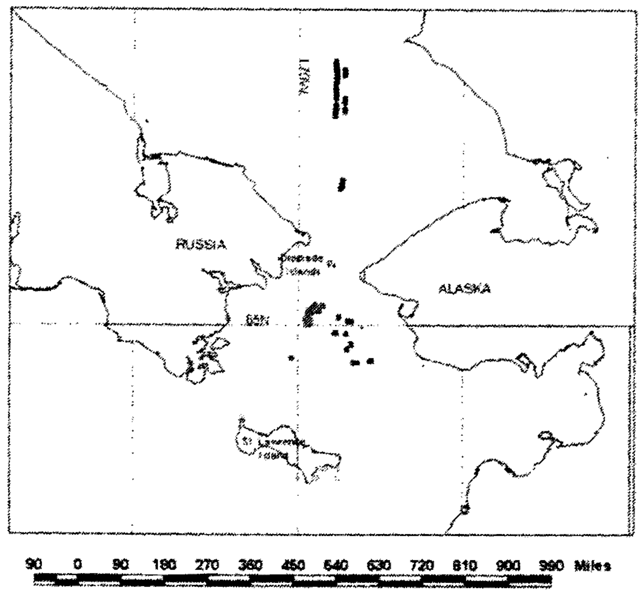
http://www.beringclimate.noaa.gov/essays_moore_maps.html

Table 1. Bering Sea Maps. NOAA Composite of gray whale distribution in 1980's

[17] David Rugh, Jeffrey Breiwick,Roderick Hobbs, James Lerczak, A Preliminary estimate of abundance of the Eastern North Pacific stock of gray whales in 2000/01 and 2001/02 SC/54/BRG6



Distribution in 2002



Return to essay What's happening to whales in the Bering Sea?

Table 4. Bering Sea Maps. NOAA. Gray whale distribution 2002

In the 2008 draft SAR , NMFS understated the extent of collapse of the Gray Whale population in 1999/2000. The 2008 SAR reports that:- " *A total of 273 Gray whale strandings were reported in 1999 and 355 in 2000 compared to an average of 38 per year in the previous four years.*" This information is contradicted by Laake et al.,(2009) which indicate a population crash of at least 5,102 in the current abundance estimate Table (9)p.36.

Federal Register Notice Vol. 75, No. 156, 8/13/2010 [18] states:

[18] National Oceanic and Atmospheric Administration RIN 0648–XW13 Takes of Marine Mammals Incidental to Specified Activities; Taking Marine Mammals Incidental to Open Water Marine Seismic Survey in the Chukchi Sea, Alaska

' NMFS is aware of the 2000-1 and 2001-02 population drops in the gray whales, nevertheless, to a certain degree, variations in estimates may be due in part to undocumented sampling variation or to differences in the proportion of the gray whale stock migrating as far as the central California coast each year (Hobbs and Rugh 1999). The decline in the 2000-01 and 2001-02 abundance estimates may be an indication that the abundance was responding to environmental limitations as the population approaches the carrying capacity of its environment. Low encounter rates may have been due to an unusually high number of whales that did not migrate as far south as Granite Canyon or the abundance may have actually declined following high mortality rates observed in 1999 and 2000. (Gulland et al. 2005).

Using the previous abundance estimates by Laake et al.,(2009) (Table 9 p.36) for 1997/1998 of 29,758, and 19.448 for 2000-2001, at least **10,310** animals perished. In current abundance estimates (Laake et al. 2007) states 1997/98 population of 21,135 dropped to 16,033 in 2002-2002, that is **5,102** animals. These huge discrepancies have serious implications for any analyses, PBR, methodologies, and research.

The major collapse of 1999/2000 was not acknowledged in the Potential Biological Removal until 2005 Stock Assessment Report . Thus the PBR resulted in over-harvesting up until 2005 based in a highly inflated, invalid Nmin with profound impacts on the population.

Potential Biological Removal (PBR) has resulted in over-harvesting.

The following excerpt from the Eastern North Pacific Gray Whale Stock Assessment Report (SAR) of **2002** is an example of over-harvesting as a result of using the 1997/98 population estimate of 26,635 with Nmin of 24,477 in the PBR when the population has collapsed by at least one third.

Minimum Population Estimate

*Using the 1997/98 population estimate of **26,635** and its associated CV of 0.1006, Nmin for this stock is **24,477.***

POTENTIAL BIOLOGICAL REMOVAL
*Under the 1994 re-authorized Marine Mammal Protection Act (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 = NMIN x 0.5RMAX x FR. The recovery factor (FR) for this stock is 1.0, the upper limit of the range (0.5-1.0) of values for non-listed stocks which are increasing while undergoing removals due to subsistence hunters (Wade and Angliss 1997). Thus, for the Eastern North Pacific stock of gray whales, PBR **= 575 animals** (24,477 x 0.0235 x 1.0).*

2002 SAR using previous estimates establishes PBR = 575 whales.

According to Laake et al., (2009), the new abundance estimate for 2001-02 is 16,033 while the previous estimate was 18,178. These new estimates represent significant differences from the Nmin cited in the 2002 Eastern North Pacific Gray Whale SAR PBR.

As Laake et al. (2009)did not detail confidence limits for their new population estimates, the CGWC has conservatively used the new population estimate for 2001-02 (16,033) as the Nmin to recalculate the PBR.

The revised PBR is then PBR = Nmin x 0.0235 X 1.0 (16,033 x0.0235 x 1.0) **= 376 animals** thus representing a difference of 199 animals from the PBR referenced in the 2002 SAR.

2002 SAR using current estimates (Laake et al 2009) establishes PBR = 376 whales

This new PBR is, admittedly, an overestimate since the Nmin of the population estimate of 16,033 would be, by definition, less than the estimate used.

Inappropriate Recovery Factor

Setting the PBR recovery factor at 1.0 when the population had experienced a major crash ((a reduction of 5,102 animals according to Laake et al., (2009)- as opposed to 10,310 according to previous estimates)is of concern. If the recovery factor of 0.1 (which is more appropriate to a population which has suffered a major population crash) is used the PBR would be calculated as :-

" PBR = Nmin x 0.0235 x 0.1 (16,033 x 0.0235 x 0.1 = 37.) That is - **538 whales less** compared to the PBR in the 2002 SAR.

2002 SAR PBR with Recovery Factor of 0.1 based on current Laake et al (2009 estimates) = 37 whales

In other words, the PBR in the 2002 SAR set an unsustainable quota, far in excess of levels the Gray Whale population could sustain. Consequently the ramifications of over-harvesting Gray Whales as a result of past PBR's based on highly inflated population estimates from 2002 – 2005 needs to be taken into account when assessing the status of the population.

The recovery factor used in the PBR is also highly questionable in the light of a re-examination of 23 seasons by Laake et al., (2009).

Concern over the high recovery factor used in the Gray Whale PBR is well expressed by a number of scientists.

Dr Elizabeth Alter, past Marine Mammal Fellow, National Resources Defense Council, in a letter of support for Resolution AJR 49, California Assembly, March 31,2008 writes: -

> " *The assumption of full demographic recovery has been built into the recovery factor used in marine mammal management, a number used to calculate the acceptable level of anthropogenic mortality. Whereas all other baleen whales in the US waters are assigned a recovery factor of 0.1, Gray whales are assigned a recovery factor of 1.0 (Read and Wade 2000). This increase in the recovery factor effectively raises the annual acceptable mortality for Gray whales and thus can slow population growth.* "

> " *Alter et al (2007) show that Gray whales have likely not achieved full demographic recovery. Rather, this population may be at most at 28-56% of historical abundance, estimated to be between 76,000 and 118,000 whales. This analysis was based on genetic information gathered from 10 genetic markers from across the genome analzyed and incorporated the effects of migration from other populations (such as the western Pacific and extinct Atlantic population.) These data suggest that the recovery factor used to calculate potential biological removal should be changed from 1.0 to 0.5. This change would reduce allowable take from roughly 417 animals to 208 animals, a more appropriate number from a precautionary standpoint.* "

In a paper published by Science Direct [19] the following cite in relation to the PBR is revealing.

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[19] P.W.Dillingham and D. Fletcher. 2008 Estimating the ability of birds to sustain additional human-caused mortalities using a simple decision rule and allometric relationships.

'2.3 Selecting f

The value selected for f can be used to implement alternative management strategies. For example, a value of 0.1 can be used to provide a minimal increase in recovery time for a depleted population, to maintain a population close to its carrying capacity, or to minimize the extinction risk for a population with a limited range, while a value of 1 could be used to maintain a healthy, growing population at or above its maximum net productivity level (Wade, 1998: Taylor et al, 2000). Wade (1998) suggests a value of 0.5 for most healthy populations, as this provides protection against bias in population estimates, maximum growth rates, and mortality estimates. While this approach was designed to maintain a population at or above MNPL, a value of 1<f<2 could be used to control a population at a lower level, while f>2Nmin/N^ would be expected to reduce the population size no matter where it was in relation to its carrying capacity.

Wade 1998 ' 0.5 *for most healthy populations, as this provides protection against bias in population estimates, maximum growth rates and mortality estimates'.*

Clearly, the new analysis by Laake et al (2009) demonstrate that previous methodologies and associated estimates are of dubious accuracy and, more importantly, ignored the ramifications of setting PBR levels based on inflated population estimates.

Further, the Rmax which is defined as one half of the maximum theoretical or estimated net productivity of the stock is likely to be incorrect. The recovery factor continues to be set at 1.0 which has allowed the PBR to remain at an unsustainable level

Ramifications of a PBR which has resulted in over-harvesting combined with mortality rates from transient orca predation, anthropogenic mortality and the IWC quota are demonstrated in the model below.

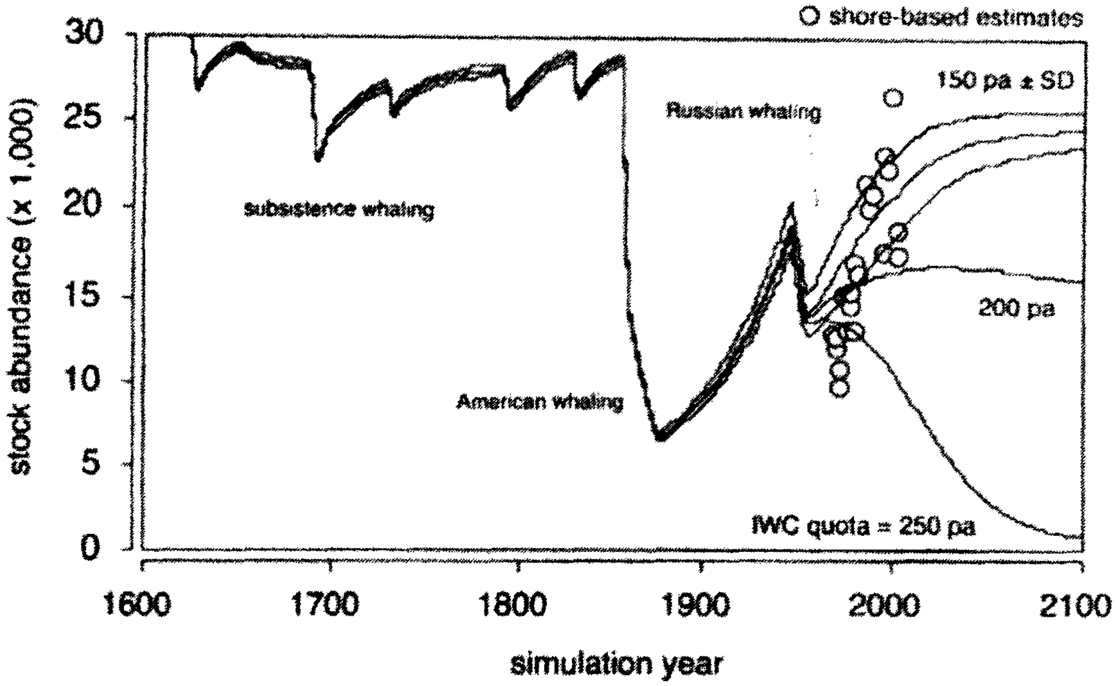

Figure 1 Expected California gray whale stock abundance derived from a stochastic sex- and ageclass structured simulation model that includes both environmental and demographic stochasticity as well as density-dependent compensatory and depensatory processes. Model based on best available scientific information reagrding gray whale ecology and demographic processes. Simulated gray whale stock was subject to a low level of indigenous whaling from 1600–1800 followed by the American whaling period from 1846–1874, the Russian whaling period from 1933-1946 and then by the IWC subsistence quota period from 1947- present. The fluctuations in the expected abundance evident during the subsistence whaling period (prior to the 1800s) result from the stock response to major ENSO events and the affect of such events on the major gray whale food stock (amphipod) abundance in the Bering Sea. ENSO = El Nino-Southern Oscillation, which relates to a major recurrent climate-ocean anomaly in the Pacific that can have a profound effect on marine ecological processes. The model suggests that both the American and Russian takes were grossly under-reported. Filled circles = shore-based stock abundance estimates. Three IWC quota scenarios shown with either a 150, 200 or 250 post-yearling take per annum (predominately larger females). The curves show the expected stock abundance from 1000 Monte Carlo trials. The 150 pa scenario also includes the expected ± 1 standard deviation curves — not shown for the 2 other scenarios to avoid visual clutter. Given model assumptions, it is apparent that the current IWC quota of 150 whales pa would slow recovery. On the other hand, a take of 200 pa (i.,e 50 more than the current quota of 150) would stop the recovery and probably result in a slowly declining stock while a take of 250 pa (or 100 more than the current quota) would most likely result in a stock well on the way to extinction.

Prepared January 10, 2003

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ALL GRAY WHALE POPULATION ESTIMATES AND PREVIOUS ANALYSES NEED TO BE RE-EXAMINED.

Petitioners attach two tables (Appendices 1 and 2) relevant to this petition highlighting the confusing number of population estimates. The first table is a compilation of various estimates from various sources including NMFS. The second table represents the new current estimates by Laake et al (2009).

The relevant population estimates from both Tables have major discrepancies .
These discrepancies further underline the need for an independent analysis and examination of all estimates, methodologies and subsequent outcomes.

PBR – AN INADEQUATE TOOL FOR MANAGEMENT

In the National Academies Press, Marine Mammal Populations & Ocean Noise, 2005, two relevant criteria used for the PBR model and relevant to the Gray Whale population are :- (Taylor et al., 2000):

> * *Input parameters are based on available data.*
> * *Uncertainty is incorporated into the model. Managers must make decisions despite uncertainty but decisions grow more conservative with greater uncertainty.*

Petitioners contend these criteria have been ignored by NMFS.

Furthermore, Taylor et al. (2000) provide additional information of relevance to this petition. Specifically, they conclude that: -

> *" However, as currently implemented, the PBR mechanism cannot adequately protect marine mammals from all sources of human-induced mortality until all such mortality is included in a revised and expanded PBR regime.*
>
> *Recommendation: Improvements to PBR are needed to reflect total mortality losses and other cumulative impacts more accurately:*
>
> ** NOAA Fisheries should devise a revised PBR regime in which all sources of mortality and serious injury can be authorized, monitored, regulated and reported in much the same manner as is currently done by commercial fisheries under Section 118 of the MMPA.*
>
> ** NOAA Fisheries should expand the PBR model to include injury and behavioural disturbance with appropriate weighting factors for severity of injury or significance of behavioural response. (cf NRC, 1994) p. 35.*
>
> ** The PBR is intended as a mechanism to trigger regulatory action when the cumulative effects of taking reach some threshold. It uses the number of individuals removed from the population as a unit for assess cumulative effect. Individuals are taken when they are killed, but taking also includes serious injury, minor injury and behavioural disturbance. Rather than the current practice of counting serious injury as equal to death and injury as equivalent to no effect, it would be appropriate to develop a severity score for each kind of take defined by the MMPA. A severity score estimates the proportional effect of a given take activity compared with that of a lethal take."*

Collapse of cow/calf numbers

Baseline data from 1978 to 2010 from research undertaken in Baja Lagunas San Ignacio and Ojo de Liebre, critical breeding and nursery areas, demonstrate a major collapse is occurring in the Gray Whale population. Urban et al.,2010-[20] in a paper submitted to IWC 62 provides evidence of the lowest cow-calf pairs counted in the last 15 years in Lagunas San Ignacio and Ojo de Liebre, Baja, California.

[20] Urban J. Gomez-Gallardo A., Lorenzo Rojas-Bracho and Steven L. Swartz, IWC Scientific Paper SC-62-BRG. Historical Changes of Gray Whale Abundance in San Ignacio Laguna and Ojo de Liebre,

•

Petitioners submit a number of graphs and raw counts illustrating the extent of the collapse.

Raw counts from San Ignacio Laguna demonstrate the extent of collapse.

Gray Whale Counts from San Ignacio Lagoon
From Arturo Zaragoza. Gray Whale Program Manager of the Reserva de la Biosfera El Vizcaino.

B./CRIA is pairs of whales of mother and baby, so count them by 2 whales.
B. SOLAS is single whales

FECHA	B./CRÍA	B. SOLAS	TOTAL
02-feb-06	24	32	80
09-feb-06	56	43	155
23-feb-06	74	138	286
02-mar-06	53	182	288
17-mar-06	82	53	217
24-mar-06	95	9	199
30-mar-06	33	4	70

FECHA	B./CRÍA	B. SOLAS	TOTAL
18-ene-07	2	11	15
25-ene-07	5	13	23
01-feb-07	13	53	79
08-feb-07	25	69	119
22-feb-07	46	113	205
10-mar-07	36	74	146
15-mar-07	15	12	42
22-mar-07	38	15	91
05-abr-07	3	0	6

FECHA	B./CRÍA	B. SOLAS	TOTAL
17-ene-08	0	2	2
24-ene-08	4	2	10
07-feb-08	25	32	82
15-feb-08	43	28	114
22-feb-08	56	43	155
28-feb-08	54	117	225
13-mar-08	62	124	248
18-mar-08	53	66	172
27-mar-08	47	14	108
09-abr-08	51	1	103

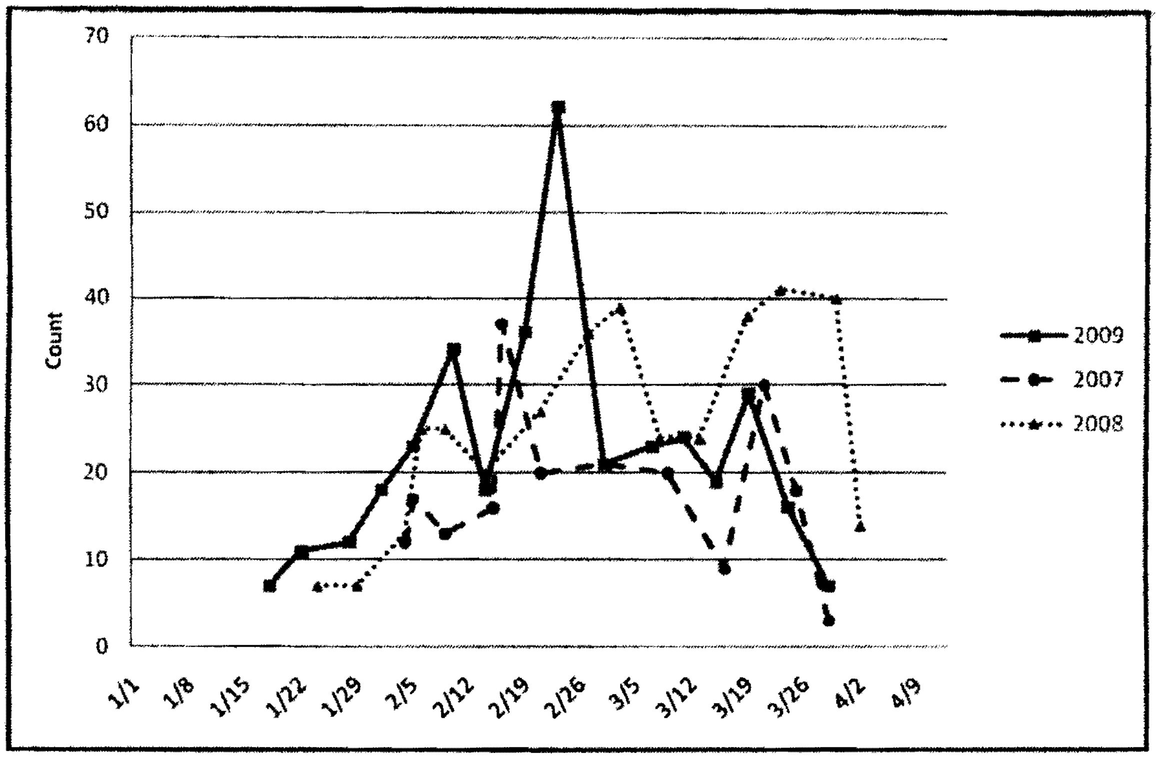
FECHA	B./CRÍA	B. SOLAS	TOTAL
22-ene-09	9	15	33
29-ene-09	11	49	71
05-feb-09	33	85	151
13-feb-09	79	144	302
17-feb-09	29	117	175
12-mar-09	40	46	126
19-mar-09	37	10	84
25-mar-09	17	5	39
03-abr-09	12	3	27

FECHA	B./CRÍA	B. SOLAS	TOTAL
04-feb-10	15	90	125
18-feb-10	8	192	208
19-mar-10	5	18	28
09-abr-10	1	0	2

Petitioners note a loss of 73% in total numbers since 2006 and a 93% drop in cow /calf numbers since

2006.

(Swartz et al., 2009) graph[21] below demonstrates the collapse of cows and calves in San Ignacio Laguna from 2007-2009.



A second graph[22] demonstrates trends between 1978 and 2008.

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[21] Steven L. Swartz, Jorge Urban, Alejandro Gomez-Gallardo, Sergio Gonzales, Benjamin Troyo, Mauricio Najera. Preliminary comparison of winter counts of gray whales in Laguna San Ignacio, B.C.S., Mexico from 1978 to 2008.

[22] Steven L. Swartz, Jorge Urban, Alejandro Gomez-Gallardo, Sergio Martinez, Hiram Nanduca, Anaid Lopez, Ana Liria Del Monte, Mauricio Najera and Hector Perez. Comparison of 2007-2009 Winter Counts of Gray Whales and Changes in Distribution from 1978-2009 in Laguna San Ignacio, B.C.S., Mexico from 2007-2009. San Ignacio Ecosystem Research.

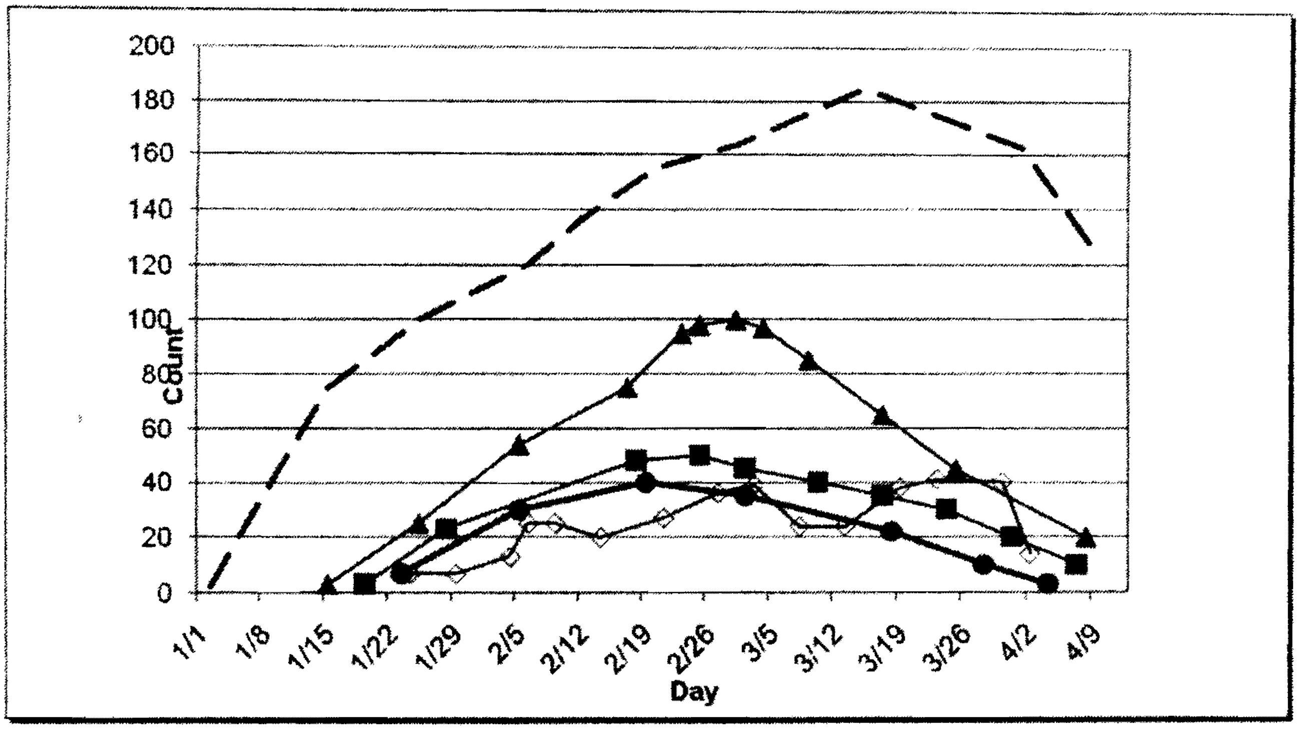


Figure 8. Trends in the number of mother-calf pairs of gray whales counted within Laguna San Ignaci between 1978 and 2008. Broken line = 1978-1982: Black triangles = 1995-1997; Black squares = 199
Black squares = 1998-2000, Black circles= 2003-2008 and White diamonds=2008 counts.

The implications of such low calf counts are expressed in Swartz, Urban et al.,[23] 2008.

> " *Low gray whale calf counts in Laguna San Ignacio and during their northward spring migration are especially troublesome as they could indicate a reduction in the reproductive potential of the population. Perryman et al (200) observed that gray whale calf production appears linked to summer ice conditions in the Arctic which may limit pregnant female whales' access to prey resources in some years and subsequently lower calf survivorship. Their observation suggest that short-term annual changes in oceanic sea ice conditions along with longer-term basin scale changes may ultimately affect gray whale productivity. Our observations of " skinny" gray whales in Laguna San Ignacio also suggest that prey resource limitation is a factor in the health and status of the population. Vulnerability to parasites and disease associated with prey switching and overall stress could affect gray whale productivity and survivorship. (F. Gulland, S.E. Moore and T. Rowles, pers.Comm.)* ."
>
> *The calf count in 2007 was the lowest mid point count in 30 years in the San Ignacio Lagoon according to Steven Swartz.* [24]

In his paper *on Changes in the Eastern North Pacific Gray Whale population Status: Monitoring a " Sentential" Population, May 2007*, Dr Swartz states:-

> " *Counts of gray whales utilizing the winter breeding lagoons in Baja California at the peak of the reproductive season have declined by 50% since the 1980's, and counts of newborn calves in the lagoons have declined by 73%.* "

Furthermore, Dr Swartz concludes that:-

---

[23] **Preliminary comparison of winter counts of gray whale in Laguna San Ignacio, B.C.S., Mexico from 1978** to. **2008**. SC/60/BRG30. **SWARTZ**, S.L., **URBAN** R, J., GOMEZ-GALLARDO, A., MARTINEZ, S., ... MONTE, A.L., NAJERA, M. and PEREZ P, H.

[24] Pers.com.

" Observations of " skinny " whales suggest that some gray whales are experiencing stress and declining health possibly related to resource limitation and/or disease, especially in the winter breeding lagoons. "

In an article written by Dr. Swartz in Misterios de Laguna Baja Enero – Abril de 2008, the following insightful comments are made: -

" In the past, large numbers of Gray whales gathered in the northern Bering Sea's Chirikov Basin which was known as a primary Arctic feeding ground for Gray whales. Spring time and summer plankton blooms resulted in rich colonies of amphipods, a nutritious Gray whale food source, on the sea floor. However, dramatic changes in the oceanography of the Arctic associated with global climate change have occurred in recent decades and specifically in the Bering Sea. During the 1990's the Arctic air and water temperature warmed, polar sea ice began to melt faster than any other time in history, and the ocean currents that supported the rich communities of amphipods changed. One result was that the former productivity of the Chirikov Basin declined severely and there is now less food available for Gray whales and other species to feed on.

" Some scientists believed that the Gray whale population grew too large and overgrazed the amphipod communities, while other scientists point to climate change effects on the oceanography of the Bering Sea that resulted as the cause of a less productive system or perhaps some combination of factors.

With the loss of this important feeding area, scientists reported in 2003 that aggregations of feeding Gray whales were further north in the southern Chukchi Sea and whales are now travelling to new areas and spending more time looking for their primary food sources. Recent sightings of " skinny " Gray whales at Laguna San Ignacio suggest that food limitation is a factor in the health and status of individual whales and of the population. Stress resulting from having to find new food resources and to work harder to get them could make the whales more vulnerable to parasites and disease.

Disruption of the Gray whales' food chain can also have implications for Gray whale calf production and their survival. Counts of newborn calves in Laguna San Ignacio in 2007 were the lowest ever recorded, as were counts of female Gray whales with calves passing Punta Pedras Blancas in California Norte during the northward spring migration. ***Low Gray whale calf counts are especially troublesome because they could indicate a reduction in the reproductive capacity of the population.*** *(our emphasis). Gray whale females can give birth to a calf every two years -12-13 months for gestation, followed by the birth of a calf and then 6-9 months nursing before the calves can feed on their own.*

Scientist Mary Lou Jones used photographic identification data to estimate the calving interval for female Gray whales that were seen during a 5-year period in Laguna San Ignacio.Her estimate based on re-sightings of these female whales was 2.11 years during the period 1977 to 1982. Biologist Sergio Gonzales of the UABCS whale research team developed a new estimate for calving interval of 2.48 years for the period 1996-2000 suggesting that fewer females are reproducing every other year and that the reproductive rate of the Gray whale population is slowing down. These lower calf counts could indicate that some Gray whale females are unable to obtain sufficient energy resources to conceive, or if pregnant to bring calves successfully to term, or their calves do not survive after birth."

Urban et al. 2009[25] report: on the significance of the cow calf collapse in breeding lagoons:-

> *The fluctuations of the numbers of cow-calf in the lagoons is similar to changes in the estimates of northbound gray whale calves based on shore-based surveys conducted from the Piedras Blancas Light Station in California (Perryman et al. 2010) which indicates that the changes in the abundance in the lagoons are a reflect of what happened in the population.*

Further evidence of the importance of the population trend data gathered in the two Baja Lagunas in terms of the status of the Gray Whale population is documented in Swartz et al. (2009)[26]

> *Overall trends in the numbers of whales seen in Laguna San Ignacio do track the estimated one third decline in the ENP population following the 1998-2000 die-off (Le Boeuf et al.2000, Rugh et al. 2005), and this suggests that counts of gray whales in Laguna San Ignacio may serve as a reliable index of the status of the overall population.*

The same paper indicates:-

> *Low gray whale calf counts could be indicators that some gray whale females are having to range further to obtain sufficient energy resources to conceive, or if pregnant to bring calves successfully to term.*

LAGUNA OJO DE LIEBRE

Petitioners table counts from 2006-2010 carried out by **the Reserva de la Biosfera El Vizcaino / Comision Nacional de Areas Naturales Protegidas / SEMARNAT / México.**

LAGUNA OJO DE LIEBRE GRAY WHALE COUNTS

FECHA	B./CRÍA	B. SOLAS	TOTAL
30-ene-06	277	258	812
07-feb-06	858	215	1931
13-feb-06	645	334	1624
27-feb-06	667	243	1577
06-mar-06	412	146	970
13-mar-06	341	56	738
20-mar-06	220	51	491
27-mar-06	197	28	422
03-abr-06	74	2	150

FECHA	B./CRÍA	B. SOLAS	TOTAL
15-ene-07	35	38	108
22-ene-07	42	31	115
29-ene-07	120	85	325
06-feb-07	263	109	635
20-feb-07	231	112	574
05-mar-07	359	206	924
12-mar-07	265	112	642
26-mar-07	75	11	161

[25] Jorge Urban, Alejandro Gomez-Gallardo, Lorenzo Rojas-Bracho, Steven Swartz, Historical Changes in Gray Whales Abundance In San Ignacio and Ojo de Liebre Breeding Lagoons, Mexico. SC/62/BRG36
[26] Steven Swartz, Jorge Urban, Alejandro Gomez-Gallardo, Sergio Gonzalez, Benjamin Troyo V, Mauricio Najera. Preliminary Comparison of Winter Counts of Gray Whales in Laguna San Ignacio, B.C.S. Mexico from 1978 to 2008.

02-abr-07	95	19	209
09-abr-07	20	3	43

FECHA	B./CRÍA	B. SOLAS	TOTAL
14-ene-08	18	27	63
22-ene-08	64	41	169
28-ene-08	118	70	306
05-feb-08	209	88	506
11-feb-08	187	107	481
18-feb-08	283	155	721
26-feb-08	344	161	849
03-mar-08	472	148	1192
10-mar-08	318	156	792
24-mar-08	155	88	398
04-abr-08	112	14	238
11-abr-08	97	6	200
15-abr-08	46	3	95

FECHA	B./CRÍA	B. SOLAS	TOTAL
19-ene-09	72	68	212
28-ene-09	194	155	543
03-feb-09	309	153	771
11-feb-09	245	211	701
16-feb-09	335	274	944
23-feb-09	322	285	929
02-mar-09	214	89	517
17-mar-09	149	19	317
24-mar-09	60	2	122
30-mar-09	42	6	90
06-abr-09	57	4	118

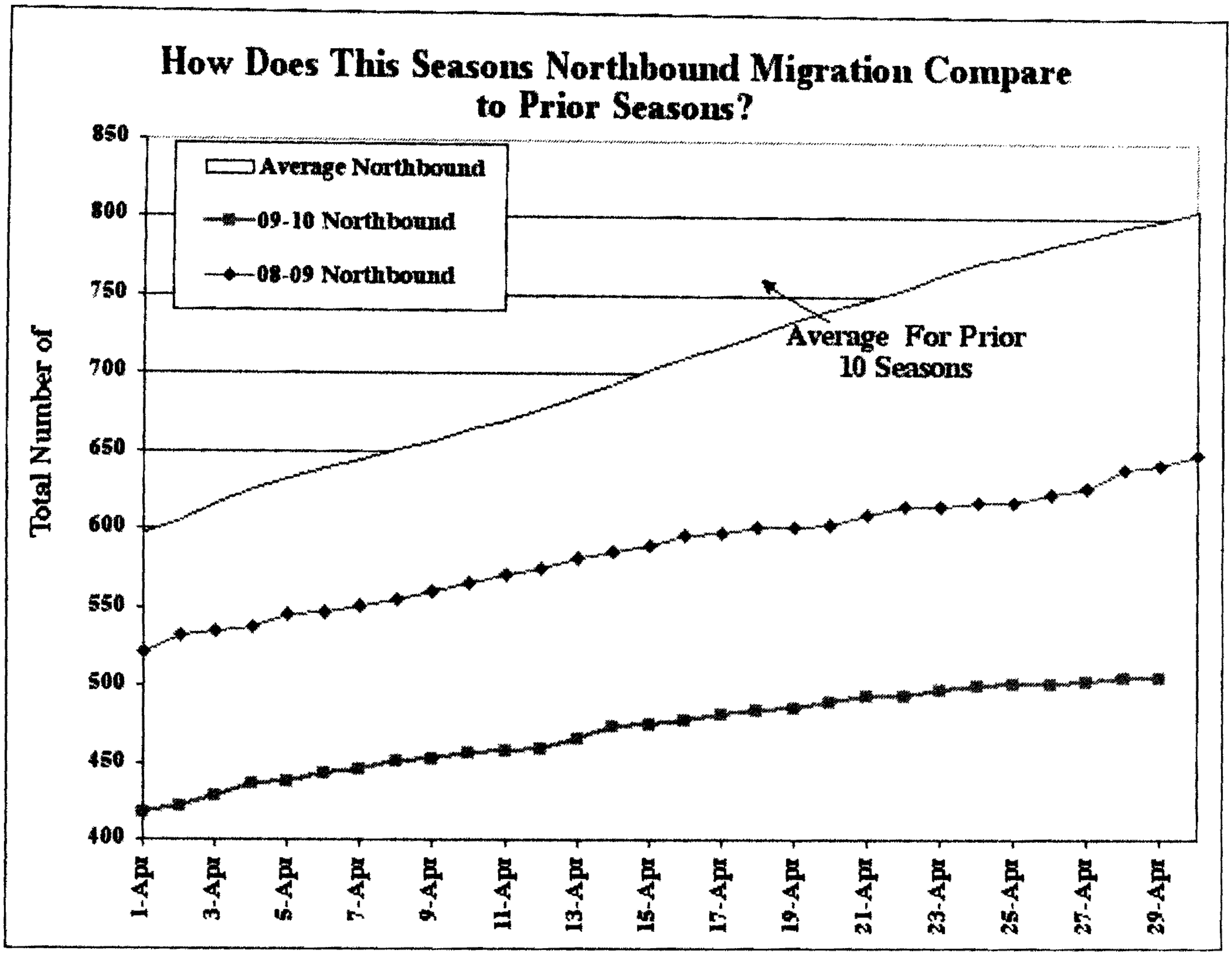
FECHA	B./CRÍA	B. SOLAS	TOTAL
19-ene-10	40	33	113
28-ene-10	53	91	197
02-feb-10	112	74	298
15-feb-10	183	207	573
24-feb-10	181	160	522
01-mar-09	136	117	389
08-mar-10	118	65	301
16-mar-10	67	48	182
22-mar-10	36	27	99
29-mar-10	35	4	74
07-abr-10	23	3	49
12-abr-10	4	2	10

Information from Biol. Arturo Zaragoza – Gray Whale Program Manager from the Reserva de la Biosfera El Vizcaino / Comision Nacional de Areas Naturales Protegidas / SEMARNAT / México.

Petitioners note the LOL figures represent a 68% drop in total numbers since 2006 and a 74% drop in cow calf numbers since 2006.

Data collected by the American Cetacean Society during its annual northbound count of Gray Whales[27] revealed the lowest cow/calf count in 27 years in 2010.

[27] American Cetacean Society Gray Whale Census and Behavior Project May 12



Similarly, Dr Wayne Perryman, a NMFS scientist, reported the second lowest calf count by May 10, 2010 in the 17 year time series of northbound Gray Whale calf counts.[28]

The best available scientific evidence demonstrates that US Gray Whale calf counts have declined by more than 60 per cent since peak numbers of 1,528[29] recorded in 2004. Combined with catastrophic collapses in Baja lagoons, evidence supporting a depleted status for Gray Whales is overwhelming. The number of calves (breeding rate) in the Gray Whale population is a reflection of the health of the population and habitat.

Calf count data collected during northbound Surveys of Gray Whales off the California coast for 2007, 2008, 2009 and 2010 have declined by 74, 62, 81, and 81 per cent respectively compared to peak calf count data from 2004.[30]

> *A joint research and education project of UCSB's coal oil point reserve, Goleta and the American Cetacean Society and the Channel Islands and Cascadia Research Collective, the Marine Physical Laboratory, and the Scripps Institution of Oceanography, University of San Diego, La Jolla cites:-*
>
> *" In 2007 we observed a troubling, estimated drop-off of 46.8% in calves from the previous year, 2006. A similar percentage was reported from other primary, survey stations along the migration route. The confirmation has alerted scientists who are investigating climate*

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[28] Dr Wayne Perryman, Journey North, May 10, 2010

[29] Wayne L. Perryman, Stephen B. Reilly, Richard A. Rowlett, **SC/62/BRG1, April, 2010 Results of Surveys of Northbound Gray Whale Calves 2001-2009 and Examination of the Full Sixteen Year Series of Estimates from the Piedras Blancas Light Station (unpublished)**

[30] Ibid

changes and access to prey in the primary feeding regions off Alaska. Observed stress on the population points up the importance of consistent monitoring and close collaboration between survey sites. [31]"

In Canada, scientists from the University of Bath reported a dramatic fall in the number of gray whale sightings in British Columbia in 2010.

> *In 2004, scientists spotted almost 100 whales on the southern central coast. This number fell dramatically to a low of just three in 2009. Dr Willliam Megill, a lecturer in the Oceans Technologies Laboratory at the University of Bath, says his colleagues in Mexico, where the whales breed, are continuing to see large numbers of thin and hungry whales. Three years ago Dr Megill warned that gray whales arriving malnourished in their breeding grounds off the Mexican coast may have represented an early indication of environmental changes in the Pacific. In 2009, Dr Megill and his team found that the tiny crustaceans they feed on, known as'mysids' had disappeared from Clayoquot Sound, forcing the whales to feed offshore. (Physorg.com June 9th, 2010)*

Some scientists claim that many Gray Whale calves are now born in the open sea along the migration route, rather than in the Baja Lagunas. Shelden et al., (2004)[32] details the possible changes:-

> *" A one week shift in the timing of the southbound migration since 1980 placed the mean passage date for pregnant females near Carmel at 8 or 9 January, coinciding with earlier estimates of mean calving date (10-13 January). Assuming the median parturition date has not changed, this would mean that nearly half of the calving now occurs north of Carmel. "*

Calves born along the migration route face significant threats as detailed by Dr. Wayne Perryman, [33] SWFSC, La Jolla.

> *" If a calf is born along the migration route, it will be required to migrate instead of just hanging around. This would cause it to burn more energy. Calves are born skinny with little or no insulative blubber layer so they will burn up some energy just keeping warm. The water in the lagoons is not only warm, but the salinity is very high. Calves can float easily to the surface in the lagoon's high-density water, while calves born in the lower salinity waters along the California coast may have to swim to the surface, and the higher waves can make them more vulnerable to drowning. Probably themost important disadvantage of being born along the migration route is that killer whales can find the calves. There are normally no killer whales in the lagoons so it is a safer place if you are a calf. "*

A report on Climate Change Impacts[34](2010) concurs:-

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[31] http://www.acschannelislands.org/2008ProjectDescrp.pdf

[32] Shelden Kim E .W., David J. Rugh, Alisa Schulman-Janiger, 2004 Gray Whales Born North of Mexico:Indicator of Recovery or consequence of regime shift ? Ecological Appllications. 14:1789-1805 (doi:10.1890/03-5349)

[33] Dr Wayne Perryman, interview Journey North.

Warming sea temperature likely will result in a shift north of breeding areas. Gray whales (Eschrichtius robustus) for example, appear to be giving birth as far north as Monterey Bay expanding north from lagoons of Baja, Mexico. Giving birth outside the sheltered Baja calving lagoons presents greater risk of storm stress to newborn calves as well as increased risk of predation by killer whales and large sharks.

MIGRATION ROUTE DISRUPTION AND IMPACTS.

Proposed wave energy projects along the west coast have the potential to expose newborn calves born outside of the Baja lagoons to an even higher level of predation. Nelson et al. (2008)[35] report:-

Migration marine mammals may experience disruption in their pattern of migration that may lead to disrupted breeding cycles, habitat exclusion, increased energetic costs and different predator threats (Reynolds and Rommel 1999,2007). Most gray whales and humpback whales migrate between feeding grounds in Alaska and breeding grounds in Mexico and large wave parks may cause the migrating whale to choose a different route in order to circumvent the obstacle. This occurrence may create issues by delaying the arrival to the breeding or feeding grounds. Additionally, diverting around wave parks may cause mammals to move into deeper water, exposing them to greater threats from predators they may otherwise avoid in shallow waters, such as great white sharks and killer whales. To complicate this issue, delays may force whales to search for other food sources or prevent them from using their primary habitat (habitat exclusion), producing an additional energy cost. In the spring, mother whales escort their babies from breeding grounds northward, and both mother and offspring may be even ore susceptible to all these risks.

Gray Whale: Potential for Interaction: High

Gray whales are on of the most commonly sighted whales off California with approximately 18,000 individuals migrating or resident in nearshore waters. The entire northeastern Pacific population of gray whales may migrate through or reside within habitat slated for WEC/wave parks in California. The potential for interaction is high due to this extreme habitat overlap. Potential interactions include entanglement, and subsurface collision, increased vulnerability to predation, changes to prey availability, and foraging behavior (of resident whales).

In a report on Wave Energy's Potential Impact on Marine Birds and Mammals, Thompson et al (2009) [36]concludes:-

Numerous large-scale wave parks along the California coast could block the migratory pathway of the entire population of eastern gray whales (Eschrichtius robustus) ; this appears to be one of the most significant concerns. (our emphasis)

---

[34] Report of Joint Working Group of the Gulf of the Farallones and Cordell Bank National Marine Sanctuary Advisory Councils Climate Change Impacts 2010.

[35] P A Nelson, D. Behrens, J. Castle, G. Crawford, R Gaddamm, S.C. Hackett, J. Largier, DP Lohse, K.L. Mills, P.T. Raimondi, M. Robbart, W.J. Sydeman, S.A. Thompson, S. Woo. Developing Wave Energy in Coastal California: Potential Socio-economic and Environmental Effects. California Energy Commission, PIER Energy-Related Environmental Research Program and California Ocean Protection Council CEC-500-2008-083.

[36] S.A. Thompson, J. Castle, K. Mills, W. Sydeman, Farrallon Institute for Advanced Ecosystem Research 6.0 Wave Energy Conversion Technology Development in Coastal California: Potential Impacts on Marine Birds and Mammals.

<u>Predation by Transient orcas</u>.

Predation by transient orcas is a major concern. The PBR does not reflect mortalities caused by transients. Nor mortality rate reflected in any population assessments and assumptions or Stock Assessment Reports.

Underling the Coalition's concern, a recent project " *Evaluating killer whale predation on eastern North Pacific gray whales* " by NOAA SWFSC states:-

> " *Newly derived abundance estimates of eastern North Pacific gray whales (Eschrichtius robustus) show a decline between the 1980's and current levels (Laake et al 2009). Although gray whale population demographics appear to be linked to the physical environment at their Arctic feeding grounds (Perryman et al 2002), there is increasing evidence that predation may be a significant mortality factor. For example, recent research near Unimak Pass, Alaska, has suggested that predation by mammal-eating "transient" killer whales (Orcinus orca) may be responsible for up to 35% of the average annual calf production of eastern North Pacific gray whales. (Barrett-Lennard et al 2005) but substantial uncertainty remains about predation in other regions. If the transient killer whale population continues to increase in the eastern North Pacific (Ford et al 2007) the potential for impact on gray whales will also increase.* '
> http://swfsc.noaa.gov/textblock.aspx?Division=PRD&ParentMenuId=211&id=16064

Petitioners commissioned a model of Gray Whale population projecting the results an average annual predation of calf production of 35%. The results indicate the potential for orca predation to drive the Gray whale population to extinction.

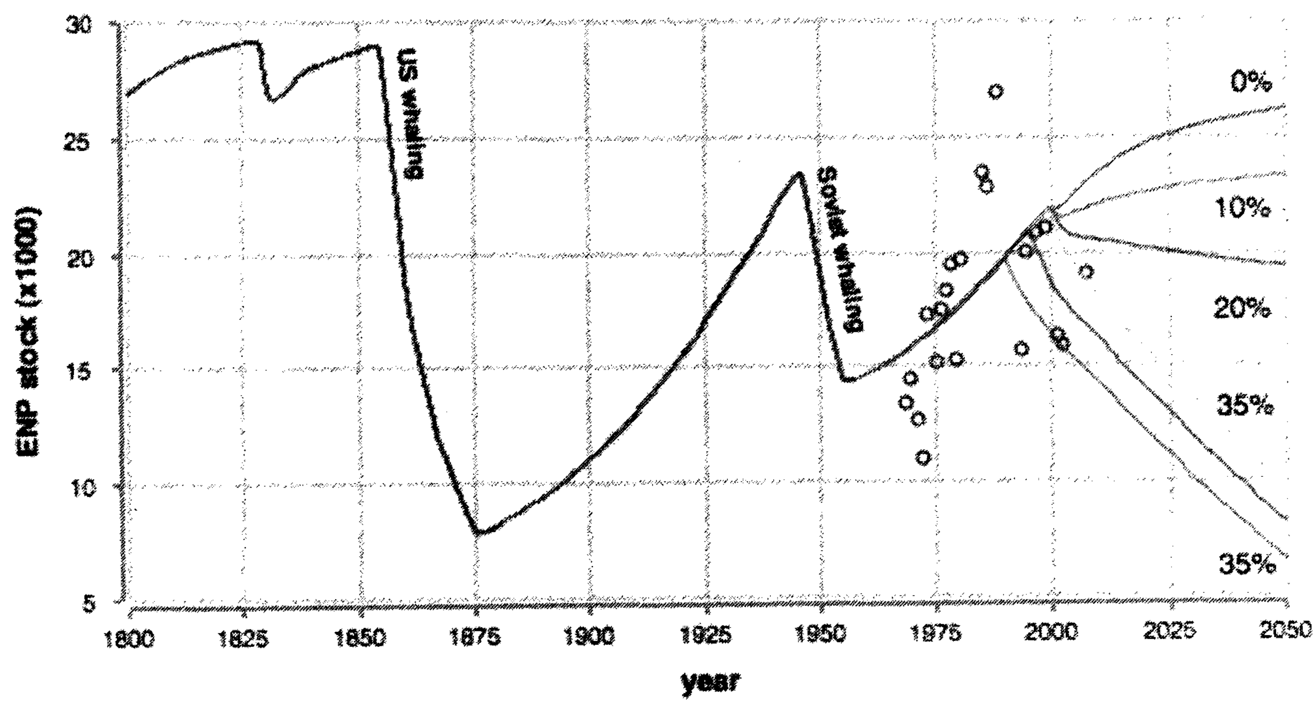

Fig. Model run with 35% specifically compared to 0, 10 and 20% (starting in 2000) - but with 3 different runs of 35% with (1) predation starting in 2000, (2) starting in 1995 and (3) starting in 1990.

Again each curve is the average of 1000 model runs.
Model by Ecological Modelling, Brisbane, Australia.

Matkin et al [37] estimate 120 transients feed on gray whale calves and yearlings for 40 days from early May to mid June.

> *" We assume that calves and yearling or juvenile whales are taken in a ratio of 60% calves and 40% yearling/juveniles although this ratio is based on a relatively small number of observations. We estimate killer whale average caloric requirements at 50 kg/day. Calves arriving in False Pass are thought to average about 2500kg and yearlings/juveniles 9000 kg. A portion carcass is bone and organs that are not likely consumed, and scavengers such as Pacific sleeper sharks also remove parts of the carcass. If 60% of the carcass is actually consumed, by the whales then* ***approximately 100 calves and 20 juveniles are killed each year in this region during the gray whale migration. (our emphasis)***

> *" Since calf recruitment varies from 1% to 8% of the population of approximately 20,000 gray whales, killer whales in this region alone may remove 6-50% of the calf production.*

> *" Killer whales are known to prey on gray whale calves (only) during migration in Monterey Bay, California and on also the Bering/Chukchi Sea feeding grounds. The overall impact of predation could be significant on years of poor calf production. "*

Lance Barrett-Lennard et al., [38] :

> *" the successful predation events that we witnessed in the Unimak area all involved gray whale calves or juveniles, in keeping with reports of killer whale predation on a number of large cetacean species. In the coastal waters of the Chukotka Peninsula, Russia, 66% of all observed predation events by killer whales involved gray whales (n=92) and 85% of kills were of whales less than two years old (Melnikov & Zagrebin 2005) "*

Petitioners note that the B.C. (British Columbia) Sightings Network supports the high predation of gray whales.

> *" Vancouver Aquarium marine mammal scientist Dr. Lance Barrett-Lennard has been studying Killer whale predation on gray whales in False Pass, Alaska, through which the majority of grey (sic) whales pass on their way to the Bering Sea. Transient killer whales in False Pass are estimated to kill up to 150 grey whales each year."*

Nancy Black has carried out some research on orca predation in Monterey Bay and she has indicated that in some years, transient orca predation on gray whales is as high as 30% of calves.[39]

> *Around Monterey Bay, California, killer whales congregate every year in the late spring when female gray whales with their young calves are migrating north close to the shore. Nancy Black and Richard Ternullo have studied these killer whales for 15 yr (Black 2001, 2003, Ternullo & Black 2002). During this period they have observed 84 predation events by the killer whales, of which 25 (30%) involved the killing of gray whale calves.* [40]

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[37] . Predation by Killer Whales in Cook Inlet and Western Alaska: An Integrated Approach 2008- 2009 Project R0303-01 Final Report Principal Investigator:
Craig O. Matkin, M.Sc. North Gulf Oceanic Society, 3430 Main St, Suite B1, Homer, Alaska 99603.

[38] Lance G. Barrett-Lennard[1,2*], Craig O. Matkin[3], Eva L. Saulitis[3], David Ellifrit[4], John W.Durban[5] Gray Whale Predation and Underwater Prey Caching by Transient Killer Whales at Unimak Island,Alaska

[39] Pers.comm.

[40] Have North Pacific killer whales switched prey species in response to depletion of the great whalepopulations? Sally A. Mizroch*, Dale W. Rice MARINE ECOLOGY PROGRESS SERIES Mar Ecol Prog SerVol. 310: 235–246, 2006 Published April 3

CHUKOTKA KILLER WHALE PREDATION.

Petitioners note that data from the Russian Federation which details the extent of transient orca predation is not available. However, it is clear from research presented to the IWC that the extent of predation is high.

> *Numerous sightings of killer whale predation on gray whales, and also the discovery of stranded carcasses of gray whales killed by killer whales, suggest that gray whales are today the chief source of food for killer whales in the coastal waters of the Chukotka Peninsula.*[41]

> Obtaining data on the extent of killer whale predation on Gray Whales in Chukotka is imperative. Given research (Matkin 2008-09) which suggests transient orcas may be pursuing Gray Whales into the Bering Sea as the sea ice disappears, thus increasing predation levels, and given the extraordinarily high predation levels now documented, establishing the ramifications on the Gray Whale population and including the extent in all methodologies, population assessments, PBR and other quotas is essential.

Major changes in primary prey and habitat as a result of climate change

The purpose of the MMPA is to protect marine mammals " to the greatest extent feasible", consistent with sound resource management to " *maintain the health and stability of the marine ecosystem*". 16 U.S.C. § 1361 (6).

Section 3 (9) of the MMPA (16 U.S.C. 1362 (9) defines " *optimum sustainable population (OSP) .. with respect to any population stock, (as) , keeping in mind the carrying capacity (K) of the habitat and the health of the ecosystem of which they form a constituent element.* "

> *"Gray whales are marine bulldozers that feed on the sea floor,consuming tube worms,mollusks and small crustaceans. Gray whales are important "ecosystem engineers" because as they feed on the bottom of the ocean,they suck in and expel sediment and water,redistributing large amounts of material. This mode of feeding makes significant quantities of food available for many other kinds of ocean life, including seabirds.The whales are themselves food for predators such as orcas,and for scavengers such as the nearly extinct California condor that once fed regularly on washed up marine mammal carcasses.*[42] "

The Canadian Government lists Grey * (Canadian spelling) as a species of Special Concern.

> *The ecological significance of Grey whales has been described as a keystone species of benthic ecosystems in the Arctic. As the major benthic predator in shallow arctic seas, they maintain the structure and diversity of benthic invertebrate assemblages (Nerini 1984; Oliver and Slattery 1985). Nerini (1984) estimated that in the early 1980s, grey whales turned over an area of 3 565 km2 in the Arctic or 9% of the available amphipod community each season. This figure has increased substantially since. Bottom-feeding grey whales rearrange soft sediments and thus mobilize chemical nutrients bound in benthic substrates (Feder et al. 1994; Oliver and Slattery 1985). By feeding on benthic biomass but defecating and urinating in the water column, grey whales also return nutrients to the water column (Reeves and Mitchell 1988). Due to their coarse*

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[41] Killer Whale predation in coastal waters of the Chukotka Peninsula. Melnikov, Zagrebin, SC/53/SM19

[42] http://stanford.edu/group/Palumbi/PNAS/LenfestRS.pdf August 2007

baleen, grey whales only filter relatively large (> 6 mm) invertebrates from the sediments and smaller invertebrates are expelled near the surface where they serve as food for marine birds and fishes (Obst and Hunt 1990; Grebmeier and Harrison 1992).

In a paper by Perryman et al.,(2009)[43] presented to the IWC meeting in Morocco, Gray Whale habitat limitations and the impacts of major changes in the Arctic are detailed:-

Most of the eastern North Pacific gray whale population depend on the highly productive shallow water benthic communities of the Arctic to accumulate the stored energy necessary to support them through the migration to and from the warm water breeding and calving grounds where prey are scarce. It appears now that one biological impact of the trend towards warmer temperatures and less ice (Parkinson et al. 1999) in the Arctic is a shift away from an ecosystem based on tight pelagic and benthic coupling to one including more pelagic fish and other previously sub-Arctic forms (Grebmeier et al. 2006a, 2006b). It is likely that this shift is already impacting populations that feed primarily on benthic prey, and it has been suggested that the shift in feeding grounds from the Northern Bering Sea into the Chukchi Sea is in response to these changes. (Moore et al. 2003). This shift in feeding ground is hypothesized to be the driving force underlying the observed relationship between seasonal sea ice and calf production of this population and possibly an overall reduction in carrying capacity for gray whales. Certainly this population is responding to the biological processes resultant from the warming.

Petitioners submit evidence which demonstrates the habitat and health of the ecosystem on which ENP Gray Whales depend is neither healthy nor able to ensure maximum productivity of the population of the species.

Massive changes in the Bering and Chukchi Seas and the entire Arctic region have not been acknowledged or described in any Gray Whale SAR. Climate change is having a drastic impact on the Arctic environment as demonstrated by satellite images and a wealth of research.

At the Alaska Marine Science Conference in January, 2010, Dr Sue Moore presented evidence of major changes in Gray Whale habitat and behavior :-

'Observations indicate that recent extreme sea ice retreats are influencing the phenology of polar bears, walruses and gray whales in the Pacific Arctic. For 2007-09, September sea ice extent was 35% below normal. Observations indicate that recent extreme sea ice retreats are influencing the phenology of occurring on the Pacific side of the Arctic. Autumn 2009 had an unprecedented low freeze-up rate, suggesting that the Arctic is switching to a new and more ice-free climate state

Gray and bowhead whales now routinely feed in proximity to one another near Barrow from late summer through autumn, a phenomenon not seen in the 1980s. Collectively, these observations suggest that marine mammals are responding to the climate-related change and thereby act as ecosystem sentinels. A summertime nearly ice-free Arctic is now predicted by mid-century. While it is anticipated that ice-obligate marine mammals, such as polar bear, walrus and ice seals, will retreat to limited sea ice refugia or adapt to coastal haulouts, the fate of ice-associated and seasonally migrant cetaceans is less predictable. As an in-flow system, the Pacific Arctic will experience dynamic changes in trophic structure via advection and production of novel prey. In addition to ecosystem alteration, all marine mammals will have to contend with increased anthropogenic activity. In the face of rapid change, predictive scenarios for marine mammals can provide a framework for scientific investigation and responsible resource management.

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[43] Wayne L. Perryman, Stephen B. Reilly, Richard A. Rowlett, Results of Surveys of Northbound Gray Whale Calves 2001-2009 and Examination of the Full Sixteen Year Series of Estimates from the Piedras Blancas Light Station. SC/62/BRG1

Grebmeier et al (2006) [44] state:-

> *... data suggest that the prey base for benthic-feeding gray whales, walrus, and sea ducks is declining in the northern Bering Sea.*

Moore et al.(2003)[45], states:

> *' in the 1980's, the Chirikov Basin was considered a prime Gray whale feeding area, but there has been no recent comprehensive assessment of whale or prey distribution and abundance. In 2002, a 5 day survey for Gray whales revealed restricted distribution in the basin and a 3-to 17-fold decline in sighting rates.'*
>
> And *' Over the last decade, the sediment structure in the northern Bering Sea has changed and sediments in the Chirikov Basin have become coarser, suggesting a changing hydrographic regime. Since the dominant ampeliscid amphipod in the FG 1 group is a tube builder that agglutinates fine sediment into its tubes, coarser sediments could lead to a reduction in amphipod numbers. In addition, a 30% decline in sediment oxygen uptake in the productive areas to the southwest of St. Lawrence Island was observed during the 1990s (Grebmeier and Cooper 1995). This decline in sediment oxygen uptake is another indication of a reduction of carbon to the benthos."*

The 2006 Ocean Science meeting in Hawaii documented major changes in the Arctic.

> *Beginning in the mid-1990s, the geographic displacement of marine mammal population distributions has coincided with a reduction of benthic prey populations, an increase in pelagic fisheries as well as increased air and ocean temperatures and reduced sea ice concentrations. Given current climate trends we expect the changes now appearing on the shallow shelf of the northern Bering Sea to extend northwards and impact a much broader portion of the Pacific-influenced sector of the Arctic Ocean.*

Major changes in Arctic summer and winter sea ice are shown at:- http://www.arctic.noaa.gov/reportcard/seaice.html[46] . Clearly, massive changes are taking place in the Arctic and sub-Arctic marine environments.

Dr Steven Swartz (2007)[47], states:-

> *"historical feeding areas in the Bering and Chukchi Seas have been disrupted by ongoing ocean regime shifts associated with Arctic climate change, and gray whales are foraging in alternative areas on alternative prey species."*
>
> *" The 2000/2001 census estimate indicated that the population had declined to approximately*

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[44] Jacqueline Grebmeier, James e. Overland, Sue E. Moore, Ed.V. Farley, Eddy C. Carmack, A Major Ecosystem Shift in the Northern Bering Sea. Science Vol. 311 10 March, 2010

[45]

Sue E. Moore, Jacqueline M. Grebmeier, and Jeremy R. Davies Can. J. Zool. 81(4): 734–742 (2003) | doi:10.1139/z03-043 | © 2003 NRC Canada

Gray whale distribution relative to forage habitat in the northern Bering Sea: current conditions and retrospective summary

[46] Arctic Report Card, 2009 NOAA

[47] Steven L. Swartz,Changes in the Eastern North Pacific Gray Whale population Status: Monitoring a " Sentential"Population , May 2007. (unpublished).

18,000 individuals, or a 30% decrease in population size since 1997.

" During 1999/2000, the population suffered an unusual and significant mortality event across all age and sex classes and throughout its entire geographic range. "

' Our preliminary hypotheses as to the contributing cause(s) of these changes in the ENP gray whales are focused on the relationship between population abundance and carrying capacity of the eastern north Pacific ecosystem. These include recognition of the impacts of climate change on a wide range of living marine resources, especially Gray whale prey species and exposure to new disease vectors associating with switching to alternative prey species. (Moore et al. 2001)

" It appears that while climate change has lead to an overall warming of the region and reductions in ice cover and benthic prey, possibly the root cause of the shift in prey selection for gray whales, the majo. reflection of habitat shift, may be an increased sensitivity to short term climate events compounded by a longer-term decline in prey base the north Pacific marine ecosystem can provide. "

Dr Swartz adds : ... *' gray whales are key "indicators" or " sentinel" species that can inform on the Health and status of the north Pacific ecosystem. "*

Further evidence of very significant decline of sea ice is portrayed in two graphs published by the Polar Science Center

http://psc.apl.washington.edu/ArcticSeaiceVolume/images/BPIOMASIceVolumeAnomalyCurrent.png

http://psc.apl.washington.edu/ArcticSeaiceVolume/images/IceVolAnomaly19792010.MarNov2.png

Petitioners note that ice algae are " *a very important part of the marine food web, contributing on average 70% to the total Arctic marine primary production.* "[48]

Professor Ray Highsmith, (at the time of his comment an academic at the University of Alaska) an expert on amphipods suggests that :-

" We believe that events such as El Nino or global warming of seawater would have a negative impact on the amphipods which live in tubes in the sand and depend upon a high rate of settlement of diatoms from the water column to the seafloor. There is some evidence that warming involves a change in nutrient supply and a shift from diatoms to much smaller phytoplankton – coccolithophores. The coccolithophores have a much lower sinking rates and are probably too small for the amphipods to harvest. "

In another important study [49]In the case of marine mammals and seabirds, climate effects appear to be mediated through the food web, although in some cases the links may be direct (Springer, 1998).

Schumacher J.D et al., (2003) indicate that:-

Prediction through mechanistic understanding is the goal of many applied sciences (e.g., Schumacher and Kendall, 1995). Using our increasing knowledge of processes important to the functioning of the Bering Sea ecosystem, we speculate below what might happen if the majority

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[48] *Gosselin M. Levasseur et al New measurements of phytoplankton and ice algai production in the Arctic Ocean. Deep-Sea Res. 11, 44 1623-1644.*

[49] **Climate Change in the Southeastern Bering Sea and Some Consequences for Biota** by J. D. Schumacher [1], N. A. Bond [2], R. D. Brodeur [3], P. A. Livingston [4], J. M. Napp[4] and P. J. Stabeno[5] (2003)

of years within the next decade resemble environmental conditions observed during spring and summer of 1997. We note that as atmospheric CO_2 and temperature over the arctic have increased, decreases in primary (1965–1990) and secondary production (1965–1993) have been inferred from time series of carbon isotope ratios in whale baleens (Schell, 1998) and summertime zooplankton biomass over the southeastern shelf (Sugimoto and Tadokoro, 1997). From a mechanistic view, the reduction of onshelf transport during 1997 stands out as a fundamental process regulating production on the shelf. This transport is important for supplying inorganic nutrients, heat and salt (thereby affecting stratification) to the shelf. Assuming that the next decade has decreased on shelf flux of nutrients, weaker stratification, reduced influence of sea ice, and warmer water temperatures, we envision the following changes. Annual primary production will decline and the spring phytoplankton bloom (in the absence of ice) will also be of lower magnitude but longer duration. This will favor planktonic rather than benthic production."

SUMMARY.

Current peer reviewed, published scientific research supports an original pre-exploitation estimate of between 60,000-70,000 . Therefore, by definition, the population is below 60% of K. Any stock that falls below its optimum sustainable population must be classified as " **depleted**", 16 U.S.C. § 1362 (1) (A) and NMFS must prepare and implement a conservation plan to restore the stock to its optimum population. 16 U.S.C. 1383 (b).

In essence, the overall health of marine mammals ultimately reflects the health of the ecosystems upon which they depend. (Burek et al. 2008). Changes in individual body condition can demonstrate shifts in the prey base and food web structure .. (S. Moore 2008)

Increasing numbers of emaciated whales have been sighted the entire length of the migration route. Whales dying from starvation are becoming more commonplace. Diminished reproduction is evident in four consecutive seasons of very low cow/calf production. Indications that Gray Whales are migrating further north in search of food provide further evidence of shifts in the prey base. Climate change is impacting the food web structure contributing to increasing vulnerability of the species. No research has provided evidence of the availability of adequate substitute prey. All indicators point to a rapidly declining population with inhibited reproduction and increasing vulnerability to death by starvation.

The evidence of an ongoing decline since 1985 is detailed in the data by Laake et al (2009) and in the models included in this petition.

Transient orca predation as estimated by Dr Lance Barrett Lennard and Craig Matkin accounts for 150 whales a year a Unimak Pass. Dr Barrett Lennard has estimated an overall annual 35% mortality rate of calves and juveniles, without taking into account data from the Russian Federation which would indicate a higher predation rate.

Petitioners note the Gray Whale is a migratory stock and that information on transient orca predation, entanglements, incidental mortalities, human-caused mortalities, and other factors which may be causing a decline or impeding the recovery in Mexico and the Russian Federation are not taken into account in NMFS management scenarios and population hypotheses.

The Draft SAR 2010 notes under Habitat Concerns:

Ocean acidification is another future development that could affect gray whales by affecting their prey. Increased acidity in the ocean will reduce the abundance of shell-formiing organisms (Fabry et al.2008, Hall-Spencer et al 2008), many of which are important in the gray whales' diet. (Nerini 1984, Moore and Huntington 2008).

What are the impacts of ocean acidification (OA) on the Gray Whales diet ? What studies are being undertaken to specifically identify problems associated with OA and how is this affecting the energy needs and reproduction abilities of the whales ? These are important questions highly relevant to the future survival of the species.

The Draft SAR 2010 states:-

> *Based on currently available data, the estimated annual level of human-caused mortality and serious injury (126.5), which includes mortalities from commercial fisheries (3.3), Russian harvest (121) unlawful hunt (1) ad ship strikes (1.2) does not exceed the PBR (360). Therefore the Eastern North Pacific stock of gray whales is not classified as a strategic stock. *(amounting to 253 animals).*

Petitioners say this statement sums up the failure of NMFS to provide proper management of the Gray Whale based on the best available scientific data as required under s. 117 of the MMPA. Currently available data which should include the loss of 150 calves and juveniles annually as they migrate through False Pass, Alaska, plus the loss of 18 whales (SC62/BRG35), plus the allocated annual quota for the Russian Federation of 141.

The sum total including the IWC allocated quota plus annual transient orca predation (admittedly understated as the figure is only relevant to False Pass), plus the loss of 18 whales now comes to 421 animals. That is 61 animals over and above the PBR. An entirely unacceptable situation.

Petitioners contend the only responsible action by NMFS is to take immediate steps to upgrade the status of Gray Whales to depleted under the MMPA.

Petitioners re-iterate that the average abundance estimate according to Laake et al.(2009) from 1967-2006 is 17,819. This number is well below the population estimate when Gray whales were delisted in 1994 (20,103)- Laake et al.(2009) and well below 60% of K, where K is 60,000 to 70,000.

Petitioners says the Recovery Factor is inappropriate for a depleted species and the over-harvesting resulting from invalid data used in the PBR cannot be ignored in assessing the status of the population.

The California Gray Whale Coalition represents economic and environmental concerns in Mexico, the US and Canada.

At the 2009 meeting of the Scientific Committee of the International Whaling Commission, the following comment was made in relation to ENP Gray Whales.

> *The Committee also noted that due to population increases and some environmental changes during the last decade (e.g., retreating sea-ice and a regime shift in the Bering Sea), eastern gray whales have begun foraging much more extensively in the Chukchi Sea. This is a region of increased interest for the development of offshore petroleum resources, and the Committee urges the Commission to request National Governments to ensure that appropriate resource agencies pay additional attention to the changing role and habitat use of gray whales in the Arctic.*
> (Annex H. Report of the Aboriginal Subsistence Whaling Sub-Committee., June 2009)

The California Gray Whale Coalition strongly supports the Commission's request of National Governments to ensure the appropriate resources agencies pay additional attention to the changing role and habitat use of gray whales.

Upgrading the Gray Whales to depleted status under the MMPA is the appropriate response to the IWC Scientific Committee request and the evidence provided in this petition.

APPENDIX 1

YEAR	RANGE	SOURCE
1874	30,000-40,000	Scammon
67/68	11,136	Buckland et al Marine Mammal Science Vol.9. No.3 1993
68/69	11,503	Buckland et al Marine Mammal Science Vol.9. No.3 1993
69/70	11,882	Buckland et al Marine Mammal Science Vol.9. No.3 1993
70/71	12,273	Buckland et al Marine Mammal Science Vol.9. No.3 1993
72/73	13,095	Buckland et al Marine Mammal Science Vol.9. No.3 1993
73/74	13,527	Buckland et al Marine Mammal Science Vol.9. No.3 1993
74/75	13,972	Buckland et al Marine Mammal Science Vol.9. No.3 1993
75/76	14,433	Buckland et al Marine Mammal Science Vol.9. No.3 1993
76/77	14,908	Buckland et al Marine Mammal Science Vol.9. No.3 1993
77/78	15,400	Buckland et al Marine Mammal Science Vol.9. No.3 1993
78/79	15,907	Buckland et al Marine Mammal Science Vol.9. No.3 1993
79/80	16,431	Buckland et al Marine Mammal Science Vol.9. No.3 1993
80/81	16,972	Buckland et al Marine Mammal Science Vol.9. No.3 1993
81/82	17,532	Buckland et al Marine Mammal Science Vol.9. No.3 1993
82/83	18,109	Buckland et al Marine Mammal Science Vol.9. No.3 1993
83/84	18,706	Buckland et al Marine Mammal Science Vol.9. No.3 1993
84/85	19,323	Buckland et al Marine Mammal Science Vol.9. No.3 1993
86/86	19,959	Buckland et al Marine Mammal Science Vol.9. No.3 1993
86/87	20,617	Buckland et al Marine Mammal Science Vol.9. No.3 1993
87/88	21,296	Buckland et al Marine Mammal Science Vol.9. No.3 1993
92/93	17,674	RIWC 1995
93/94	23,109 (20,800-25,700)	Laake et al.,1994 –Status Review of ENP Stock of Gray Whales -August, 1999 NMFS (Rugh, Muto, Moore,DeMaster)
95/96	22,263(18,700-	Hobbs et al-Status Review of ENP Stock of Gray Whales
	22,571 Min. Est – 21,597	NMFS Gray Whale Stock Assessment 8/8/1997

97/98	26,300(21,900-32,400)	IWC
	26,635 (21,878-32,427)	Hobbs & Rugh 1999
	29,758 min est.-24,477	Rugh eg al., (NMFS Gray Whale Stock Assess. 2/6/2005
	29,758 (24,241-36,531)	Rugh et al., Eastern North Pacific Gray Whales J. Cetacean Res. Manage. 7(1):1-12,2005
	25,130 to 30,140	Federal Register Notice April 6,1998 Vol.63, No.65 based on a revised Bayesian analysis of Gray whale population.
00/01	26,635 24,477 min.	NMFS GrayWhale Stock Assessment 2000
	18,761	NMML Gray Whale Census (Rugh et al.,)
	19,448	Rugh et al., NMFS Gray Whale Stock Assessment 2/6/05
	19,448 (16,096-23,498)	Rugh et al., Eastern North Pacific Gray Whales J. Cetacean Res. Manage. 7(1):1-12,2005
	18,246	Rugh et al., 2004 (Marine Mammal Research: Conservation Beyond Crisis – John Elliott Reynolds Timothy J. Ragen.
01/02	17,500	NOAA 2002 Press Release 5/10/02 and NMML Quarterly Research Report (Rugh)
	16,848	Rugh et al., 2004 (Marine Mammal Research: Conservation Beyond Crisis – John Elliott Reynolds Timothy J. Ragen.
	18,178(15,010-22,015	Rugh et al., Eastern North Pacific Gray Whales J. Cetacean Res. Manage. 7(1):1-12,2005
	17,414	NMFS (American Cetacean Society Gray Whale Census Project 2007-2007)
04/05	18,813 Min. 17,752	NMFS Gray Whale Stock Assessment 2/6/05 based on mean of 2000/2001 and 2001/2002 abundance estimates.
05/06	19,000-23,000	NOAA 2006 –R114 Press Release – NOAA reports significant increase in 2006 calf numbers.

06/07	18,813 Min.17,752	NMFS Gray Whale Stock Asssessment 3/31/07 based on mean of 2000/2001 and 2001/2002 abundance estimates.
	20,110 (16,936 to 23,878)	Rugh et al. NMFS Report of 2006/07 Census (Field Report) of ENP Stock of Gray Whales AFSC Processed Report 2008-03
07/08	18,178	Federal Register Notice Vol. 73, No. 82 April 28, 2008 NOAA Incidental Takes of Marine Mammals during Specified Activities: Shallow Hazard and Site Clearance Surveys in Chukchi Seas. Angliss and Outlaw (2007) reported " the population has increased to a level that equals or exceeds pre-exploitation numbers".

APPENDIX 2

Laake et al. (2009) page 36, Table 9.

Table 9. Current and previous gray whale abundance estimates and coefficient of variation (cv=standard error/estimate) constructed from southbound migration surveys conducted from 1967-1968 to 2006-2007. Ratio of current to previous estimates shows proportional change which is largely explained by f_s ratio which is $E(S)/\bar{s}$ from Table 7 divided by f_s, the pod size correction from previous surveys.

	Current		Previous				
Year	$\hat{N}_y$	$cv(\hat{N}_y)$	$\hat{N}_y$	$cv(\hat{N}_y)$	Ratio	f_s	f_s ratio
1967-1968	13426	0.094	13776	0.078	0.975		
1968-1969	14548	0.080	12869	0.055	1.130		
1969-1970	14553	0.083	13431	0.056	1.084		
1970-1971	12771	0.081	11416	0.052	1.119		
1971-1972	11079	0.093	10406	0.059	1.065		
1972-1973	17365	0.080	16098	0.052	1.079		
1973-1974	17375	0.082	15960	0.055	1.089		
1974-1975	15290	0.084	13812	0.057	1.107		
1975-1976	17564	0.086	15481	0.060	1.135		
1976-1977	18377	0.080	16317	0.050	1.126		
1977-1978	19538	0.088	17996	0.069	1.086		
1978-1979	15384	0.080	13971	0.054	1.101		
1979-1980	19763	0.083	17447	0.056	1.133		
1984-1985	23499	0.089	22862	0.060	1.028		
1985-1986	22921	0.082	21444	0.052	1.069		
1987-1988	26916	0.058	22250	0.050	1.210	1.131[1]	1.050
1992-1993	15762	0.068	18844	0.063	0.836	1.430[2]	0.737
1993-1994	20103	0.055	24638	0.060	0.816	1.420[2]	0.760
1995-1996	20944	0.061	24065	0.058	0.870	1.399[3]	0.806
1997-1998	21135	0.068	29758	0.105	0.710	1.516[4]	0.685
2000-2001	16369	0.061	19448	0.097	0.842	1.486[4]	0.750
2001-2002	16033	0.069	18178	0.098	0.882	1.485[4]	0.717
2006-2007	19126	0.071	20110	0.088	0.951	1.361[5]	0.811

[1] Buckland et al.(1993), [2] Laake et al.(1994), [3] Hobbs et al. (2004), [4] Rugh et al. (2005),

[5] Rugh et al. (2008a)

CITATIONS.

Alter, S. E.; Rynes, E; and Palumbi S. R. 2007. DNA evidence for historic population size and past ecosystem impacts of gray whales. Proceedings of the National Academy of Sciences 104(38) 15162-15167

American Cetacean Society Gray Whale Census 2010.

Arctic Report Card, NOAA 2009.

Barrett-Lennard L G., Matkin C.O., Saulitis E L., Ellifrit D., Durban J W., Gray Whale Predation and Underwater Prey Caching by Transient Killer Whales at Unimak Island, Alaska.

CAFF CBMP Report No. 16 April, 2009

C. Scott Baker and Phillip J. Clapham 2004, Modelling the past and future of whales and whaling. Trends in Ecology & Evolution, Vol. 19, Issue 7.365-371

Dillingham P.W., Fletcher D. 2008. Estimating the ability of birds to sustain additional human-caused mortalities using a simple decision rule ad allometric relationships. Biological Conservation Volume 141, Issue 7. Pages 1783-1792

Punt A, Allison C, Fay G, 2004. An examination of assessment models for the eastern North Pacific gray whale based on inertial dynamics. J. Cetacean Res. Manage, 6 (2):121-132.

Federal Register notice, April 6, 1998 Vol. 63, No. 65

Federal Register notice, August 4, 2010 Vol.75 No. 149 Draft 2010 Marine mammal Stock Assessment Reports

Federal Register August 13 2010. Vol. 75 No.156 NOAA RIN 0648-XV09 Takes of Marine Mammals Incidental to Specified Activities; Taking Marine Mammals incidental to open water marine seismic survey in the Beautfort and Chukchi Seas, Alaska.

Gosselin M. Levassseur et al., 1997 New Measurements of phytoplankton and ice algai production in the Arctic Ocean. Deep-Sea Res. 11,44 1623-1644.

Hunt G.L. Jr., 2006 . Evidence for Bottom-Up Control of Upper-Trophic-Level Marine Populations. Is it Scale-Dependent. Whales, Whaling and Ocean Ecosystems. University of California Press.

Laake J., Punt A., Hobbs R., Ferguson M., Rugh D., Breiwick 2009. NOAA Technical Memorandum NMFS- AFSC-203. Re-Analysis of Gray Whale Southbound Migration Surveys 1967-2009

Matkin C, 2009 Predation by Killer Whales in Cook Inlet in Western Alaska: An Integrated Approach 2008-2009 North Gulf Ocean Society Project R0303-01

Melnikov, Zagrebin. 2001 Killer Whale Predation in coastal waters of the Chukotka Peninsula. SC/53/SM19

Mizroch S.A., Rice Dale W. 2006 Have North Pacific killer whales switched prey species in response to depletion of the gray whale populations ? Mar Eco Prog SerVol.310: 235-246

Moore S.E. 2008 Marine Mammals as Ecosystem Sentinels. Journal of Mammology, 89(3):534-540.

Moore S., Grebmeier J., Davies J.R. 2003 Gray Whale distribution relative to forage habitat in the northern Bering Sea:current conditions and retrospective summary. Can.J. Zool. 81(4): 734-742 (2003)

P A Nelson, D. Behrens, J. Castle, G. Crawford, R Gaddamm, S.C. Hackett, J. Largier, DP Lohse, K.L. Mills, P.T. Raimondi, M. Robbart, W.J. Sydeman, S.A. Thompson, S. Woo. Developing Wave Energy in Coastal California: Potential Socio-economic and Environmental Effects. California Energy Commission, PIER Energy-Related Environmental Research Program and California Ocean Protection Council CEC-500-2008-083.

NOAA Technical MemorandumNMFS-AFSC-150 2005. Eastern North Pacific Gray Whale Unusual Mortality Event, 1999-2000.

Ocean Studies Board, National Research Council of the National Academies of Science. Assessment of Sea-Turtle Status and Trends: Integrating Demography and Abundance, National Academies Press, 2010.

Ocean Studies Board, National Academies of Science, Marine Mammal Populations and Ocean Noise, National Academies Press 2005

Perryman W., Reilly S., Rowlett R., 2010 Results of surveys of Northerbound Gray Whale Calves 2001-2009 and Examination of the Full Sixteen Year Series of Estimates from Piedras Blancas Light Station. SC/62/BRG1

Wade P.R. and W. Perryman, An Assessment of the eastern gray whale population in 2002. SC/54/BRG7

Report of Joint Working Group of the Gulf of the Farallones and Cordell Bank National Marine Sanctuary Advisory Councils Climate Change Impacts 2010.

Rugh D., Moto M., Hobbs R., Shelden K., D'Vincent C., Larsen I M.,Reif S., Maher S.,Nilson S., Field Report of the 2006/07 census of the Eastern Pacific stock of gray whales. SC/59/BRG

Rugh D., Breiwick J., Banks A., Baraff L.,Shelden K., Weir J. 2001. Field Report of the 2000/2001 census of the Eastern North Pacific stock of gray whales. SC/53/BRG3.

Schumacher J D., Bond N A., Brodeur R.D., Livingston P.A., Napp J.M., Stabeo P J.,2003 Climate Change in the Southeastern Bering Sea and Some Consequences for Biota.

Shelden K., Rugh D., Schulman-Janiger 2004 . Gray Whales Born North of Mexico: Indicator of Recovery or consequence of regime shift? Ecological applications. 14:1789-1805(doi:10,1890/03-5349)

Swartz, S.l., Urban r, j., Gomez-gallardo, a., Martinez, s., Nanduca,h., Lopez u, a., del monte, a.l., najera, m. and perez p, h. Preliminary comparison of winter counts of gray whale in Laguna San Ignacio, B.C.S., Mexico from 1978 to 2008. 11pp. SC/60/BRG30

Swartz Steven L. 2007 Changes in the Eastern North Pacific Gray Whale population status: Monitoring a " Sentential " Population. (unpublished)

Urban J. Gomez-Gallardo A., Rojas-Bracho L. Swartz S., 2010 Historical Changes in Gray whale abundance in San Ignacio Laguna and Ojo de Liebre. SC/62/BRG.

Wade P.,2002. Bayesian stock assessment of the eastern Pacific gray whale using abundance and harvest data from 1967-1996. J. Cetacean Res.Manage.4(1) 85-98

CITATIONS.

Alter, S. E.; Rynes, E; and Palumbi S. R. 2007. DNA evidence for historic population size and past ecosystem impacts of gray whales. Proceedings of the National Academy of Sciences 104(38) 15162-15167

American Cetacean Society Gray Whale Census 2010.

Arctic Report Card, NOAA 2009.

Barrett-Lennard L G., Matkin C.O., Saulitis E L., Ellifrit D., Durban J W., Gray Whale Predation and Underwater Prey Caching by Transient Killer Whales at Unimak Island, Alaska.

CAFF CBMP Report No. 16 April, 2009

C. Scott Baker and Phillip J. Clapham 2004, Modelling the past and future of whales and whaling. Trends in Ecology & Evolution, Vol. 19, Issue 7.365-371

Dillingham P.W., Fletcher D. 2008. Estimating the ability of birds to sustain additional human-caused mortalities using a simple decision rule ad allometric relationships. Biological Conservation Volume 141, Issue 7. Pages 1783-1792

Punt A, Allison C, Fay G, 2004. An examination of assessment models for the eastern North Pacific gray whale based on inertial dynamics. J. Cetacean Res. Manage, 6 (2):121-132.

Federal Register notice, April 6, 1998 Vol. 63, No. 65

Federal Register notice, August 4, 2010 Vol.75 No. 149 Draft 2010 Marine mammal Stock Assessment Reports

Federal Register August 13 2010. Vol. 75 No.156 NOAA RIN 0648-XV09 Takes of Marine Mammals Incidental to Specified Activities; Taking Marine Mammals incidental to open water marine seismic survey in the Beautfort and Chukchi Seas, Alaska.

Gosselin M. Levassseur et al., 1997 New Measurements of phytoplankton and ice algai production in the Arctic Ocean. Deep-Sea Res. 11,44 1623-1644.

Hunt G.L. Jr., 2006 . Evidence for Bottom-Up Control of Upper-Trophic-Level Marine Populations. Is it Scale-Dependent. Whales, Whaling and Ocean Ecosystems. University of California Press.

Laake J., Punt A., Hobbs R., Ferguson M., Rugh D., Breiwick 2009. NOAA Technical Memorandum NMFS- AFSC-203. Re-Analysis of Gray Whale Southbound Migration Surveys 1967-2009

Matkin C, 2009 Predation by Killer Whales in Cook Inlet in Western Alaska: An Integrated Approach 2008-2009 North Gulf Ocean Society Project R0303-01

Melnikov, Zagrebin. 2001 Killer Whale Predation in coastal waters of the Chukotka Peninsula. SC/53/SM19

Mizroch S.A., Rice Dale W. 2006 Have North Pacific killer whales switched prey species in response to depletion of the gray whale populations ? Mar Eco Prog SerVol.310: 235-246

Moore S.E. 2008 Marine Mammals as Ecosystem Sentinels. Journal of Mammology, 89(3):534-540.

Moore S., Grebmeier J., Davies J.R. 2003 Gray Whale distribution relative to forage habitat in the northern Bering Sea:current conditions and retrospective summary. Can.J. Zool. 81(4): 734-742 (2003)

P A Nelson, D. Behrens, J. Castle, G. Crawford, R Gaddamm, S.C. Hackett, J. Largier, DP Lohse, K.L. Mills, P.T. Raimondi, M. Robbart, W.J. Sydeman, S.A. Thompson, S. Woo. Developing Wave Energy in Coastal California: Potential Socio-economic and Environmental Effects. California Energy Commission, PIER Energy-Related Environmental Research Program and California Ocean Protection Council CEC-500-2008-083.

NOAA Technical MemorandumNMFS-AFSC-150 2005. Eastern North Pacific Gray Whale Unusual Mortality Event, 1999-2000.

Ocean Studies Board, National Research Council of the National Academies of Science, Assessment of Sea-Turtle Status and Trends: Integrating Demography and Abundance, National Academies Press, 2010.

Ocean Studies Board, National Academies of Science, Marine Mammal Populations and Ocean Noise, National Academies Press 2005

Perryman W., Reilly S., Rowlett R., 2010 Results of surveys of Northerbound Gray Whale Calves 2001-2009 and Examination of the Full Sixteen Year Series of Estimates from Piedras Blancas Light Station. SC/62/BRG1

Wade P.R. and W. Perryman, An Assessment of the eastern gray whale population in 2002. SC/54/BRG7

Report of Joint Working Group of the Gulf of the Farallones and Cordell Bank National Marine Sanctuary Advisory Councils Climate Change Impacts 2010.

Rugh D., Moto M., Hobbs R., Shelden K., D'Vincent C., Larsen I M.,Reif S., Maher S.,Nilson S., Field Report of the 2006/07 census of the Eastern Pacific stock of gray whales. SC/59/BRG

Rugh D., Breiwick J., Banks A., Baraff L.,Shelden K., Weir J. 2001. Field Report of the 2000/2001 census of the Eastern North Pacific stock of gray whales. SC/53/BRG3.

Schumacher J D., Bond N A., Brodeur R.D., Livingston P.A., Napp J.M., Stabeo P J.,2003 Climate Change in the Southeastern Bering Sea and Some Consequences for Biota.

Shelden K., Rugh D., Schulman-Janiger 2004 . Gray Whales Born North of Mexico: Indicator of Recovery or consequence of regime shift? Ecological applications. 14:1789-1805(doi:10,1890/03-5349)

Swartz, S.l., Urban r, j., Gomez-gallardo, a., Martinez, s., Nanduca,h., Lopez u, a., del monte, a.l., najera, m. and perez p, h. Preliminary comparison of winter counts of gray whale in Laguna San Ignacio, B.C.S., Mexico from 1978 to 2008. 11pp. SC/60/BRG30

Swartz Steven L. 2007 Changes in the Eastern North Pacific Gray Whale population status: Monitoring a " Sentential " Population. (unpublished)

Urban J. Gomez-Gallardo A., Rojas-Bracho L. Swartz S., 2010 Historical Changes in Gray whale abundance in San Ignacio Laguna and Ojo de Liebre. SC/62/BRG.

Wade P.,2002. Bayesian stock assessment of the eastern Pacific gray whale using abundance and harvest data from 1967-1996. J. Cetacean Res.Manage.4(1) 85-98

APPENDIX 1

YEAR	RANGE	SOURCE
1874	30,000- 40,000	Scammon
67/68	11,136	Buckland et al Marine Mammal Science Vol.9. No.3 1993
68/69	11,503	Buckland et al Marine Mammal Science Vol.9. No.3 1993
69/70	11,882	Buckland et al Marine Mammal Science Vol.9. No.3 1993
70/71	12,273	Buckland et al Marine Mammal Science Vol.9. No.3 1993
72/73	13,095	Buckland et al Marine Mammal Science Vol.9. No.3 1993
73/74	13,527	Buckland et al Marine Mammal Science Vol.9. No.3 1993
74/75	13,972	Buckland et al Marine Mammal Science Vol.9. No.3 1993
75/76	14,433	Buckland et al Marine Mammal Science Vol.9. No.3 1993
76/77	14,908	Buckland et al Marine Mammal Science Vol.9. No.3 1993
77/78	15,400	Buckland et al Marine Mammal Science Vol.9. No.3 1993
78/79	15,907	Buckland et al Marine Mammal Science Vol.9. No.3 1993
79/80	16,431	Buckland et al Marine Mammal Science Vol.9. No.3 1993
80/81	16,972	Buckland et al Marine Mammal Science Vol.9. No.3 1993
81/82	17,532	Buckland et al Marine Mammal Science Vol.9. No.3 1993
82/83	18,109	Buckland et al Marine Mammal Science Vol.9. No.3 1993
83/84	18,706	Buckland et al Marine Mammal Science Vol.9. No.3 1993
84/85	19,323	Buckland et al Marine Mammal Science Vol.9. No.3 1993
86/86	19,959	Buckland et al Marine Mammal Science Vol.9. No.3 1993
86/87	20,617	Buckland et al Marine Mammal Science Vol.9. No.3 1993
87/88	21,296	Buckland et al Marine Mammal Science Vol.9. No.3 1993
92/93	17,674	RIWC 1995
93/94	23,109 (20,800- 25,700)	Laake et al.,1994 –Status Review of ENP Stock of Gray Whales -August, 1999 NMFS (Rugh, Muto, Moore,DeMaster)
95/96	22,263(18,700-	Hobbs et al-Status Review of ENP Stock of Gray Whales
	22,571 Min. Est – 21,597	NMFS Gray Whale Stock Assessment 8/8/1997

97/98	26,300(21,900- 32,400)	IWC
	26,635 (21,878- 32,427)	Hobbs & Rugh 1999
	29,758 min est.- 24,477	Rugh eg al., (NMFS Gray Whale Stock Assess. 2/6/2005
	29,758 (24,241- 36,531)	Rugh et al., Eastern North Pacific Gray Whales J. Cetacean Res. Manage. 7(1):1-12,2005
	25,130 to 30,140	Federal Register Notice April 6,1998 Vol.63, No.65 based on a revised Bayesian analysis of Gray whale population.
00/01	26,635 24,477 min.	NMFS GrayWhale Stock Assessment 2000
	18,761	NMML Gray Whale Census (Rugh et al.,)
	19,448	Rugh et al., NMFS Gray Whale Stock Assessment 2/6/05
	19,448 (16,096- 23,498)	Rugh et al., Eastern North Pacific Gray Whales J. Cetacean Res. Manage. 7(1):1-12,2005
	18,246	Rugh et al., 2004 (Marine Mammal Research: Conservation Beyond Crisis – John Elliott Reynolds Timothy J. Ragen.
01/02	17,500	NOAA 2002 Press Release 5/10/02 and NMML Quarterly Research Report (Rugh)
	16,848	Rugh et al., 2004 (Marine Mammal Research: Conservation Beyond Crisis – John Elliott Reynolds Timothy J. Ragen.
	18,178(15,010- 22,015	Rugh et al., Eastern North Pacific Gray Whales J. Cetacean Res. Manage. 7(1):1-12,2005
	17,414	NMFS (American Cetacean Society Gray Whale Census Project 2007-2007)
04/05	18,813 Min. 17,752	NMFS Gray Whale Stock Assessment 2/6/05 based on mean of 2000/2001 and 2001/2002 abundance estimates.
05/06	19,000- 23,000	NOAA 2006 –R114 Press Release – NOAA reports significant increase in 2006 calf numbers.

06/07	18,813 Min.17,752	NMFS Gray Whale Stock Asssessment 3/31/07 based on mean of 2000/2001 and 2001/2002 abundance estimates.
	20,110 (16,936 to 23,878)	Rugh et al. NMFS Report of 2006/07 Census (Field Report) of ENP Stock of Gray Whales AFSC Processed Report 2008-03
07/08	18,178	Federal Register Notice Vol. 73, No. 82 April 28, 2008 NOAA Incidental Takes of Marine Mammals during Specified Activities: Shallow Hazard and Site Clearance Surveys in Chukchi Seas. Angliss and Outlaw (2007) reported " the population has increased to a level that equals or exceeds pre-exploitation numbers".

APPENDIX 2

Laake et al. (2009) page 36, Table 9.

Table 9. Current and previous gray whale abundance estimates and coefficient of variation (cv=standard error/estimate) constructed from southbound migration surveys conducted from 1967-1968 to 2006-2007. Ratio of current to previous estimates shows proportional change which is largely explained by f_s ratio which is $E(S)/\bar{s}$ from Table 7 divided by f_s, the pod size correction from previous surveys.

	Current		Previous				
Year	$\hat{N}_y$	$cv(\hat{N}_y)$	$\hat{N}_y$	$cv(\hat{N}_y)$	Ratio	f_s	f_s ratio
1967-1968	13426	0.094	13776	0.078	0.975		
1968-1969	14548	0.080	12869	0.055	1.130		
1969-1970	14553	0.083	13431	0.056	1.084		
1970-1971	12771	0.081	11416	0.052	1.119		
1971-1972	11079	0.093	10406	0.059	1.065		
1972-1973	17365	0.080	16098	0.052	1.079		
1973-1974	17375	0.082	15960	0.055	1.089		
1974-1975	15290	0.084	13812	0.057	1.107		
1975-1976	17564	0.086	15481	0.060	1.135		
1976-1977	18377	0.080	16317	0.050	1.126		
1977-1978	19538	0.088	17996	0.069	1.086		
1978-1979	15384	0.080	13971	0.054	1.101		
1979-1980	19763	0.083	17447	0.056	1.133		
1984-1985	23499	0.089	22862	0.060	1.028		
1985-1986	22921	0.082	21444	0.052	1.069		
1987-1988	26916	0.058	22250	0.050	1.210	1.131[1]	1.050
1992-1993	15762	0.068	18844	0.063	0.836	1.430[2]	0.737
1993-1994	20103	0.055	24638	0.060	0.816	1.420[2]	0.760
1995-1996	20944	0.061	24065	0.058	0.870	1.399[3]	0.806
1997-1998	21135	0.068	29758	0.105	0.710	1.516[4]	0.685
2000-2001	16369	0.061	19448	0.097	0.842	1.486[4]	0.750
2001-2002	16033	0.069	18178	0.098	0.882	1.485[4]	0.717
2006-2007	19126	0.071	20110	0.088	0.951	1.361[5]	0.811

[1] Buckland et al.(1993), [2] Laake et al.(1994), [3] Hobbs et al. (2004), [4] Rugh et al. (2005) ,

[5] Rugh et al. (2008a)