8 December 2010

Mr. David Cottingham, Chief
Marine Mammal and Sea Turtle Conservation Division
Office of Protected Resources
National Marine Fisheries Service
1315 East-West Highway
Silver Spring MD 20910-3226

Dear Mr. Cottingham:

The Marine Mammal Commission, in consultation with its Committee of Scientific Advisors on Marine Mammals, has reviewed the petition from the California Gray Whale Coalition to designate the Eastern North Pacific population of gray whales (*Eschrichtius robustus*) as "depleted" under the Marine Mammal Protection Act (75 Fed. Reg. 68756). The Commission provides the following recommendations and rationale.

RECOMMENDATIONS

The Marine Mammal Commission recommends that the National Marine Fisheries Service—

- defer any status review until the scientific evidence provides a stronger basis for concluding that the population may be below its maximum net productivity level;
- focus its research and management efforts related to the eastern North Pacific gray whale population on continued monitoring and expanded study of the whales' natural history and factors that may affect conservation of the population, including the whales' responses to changes in their environment;
- establish and fund a program to continue monitoring gray whale abundance and reproduction, and to initiate efforts to understand how climate change in the Arctic affects gray whale feeding, nutritional status, and carrying capacity; and
- take advantage of opportunities (e.g., at meetings of the Alaska Scientific Review Group, Marine Mammal Society biennial meetings) to convene groups of gray whale researchers from Mexico, Canada, the Service, state research and management agencies, non-governmental organizations, academic institutions, and Native American groups to discuss ways of coordinating research aimed at the issues that are most relevant to conservation of the eastern North Pacific gray whale population.

RATIONALE

The California Gray Whale Coalition presents considerable information on the eastern North Pacific gray whale population, including the substantial loss of whales in the 1999-2000 die-off, high variability in annual calf production, predation by killer whales, poor condition of some whales, and effects of climate change on their habitat. The information presented indicates that the population warrants close monitoring and attention by the

National Marine Fisheries Service, the Marine Mammal Commission, and other agencies and organizations with research, management, or oversight responsibilities.

That being said, the Marine Mammal Protection Act and implementing regulations specify that a population stock is to be designated as depleted only when its abundance is less than its optimum sustainable population. The optimum sustainable population is defined as a range, the lower limit of which is the population's maximum net productivity level. Thus, the question to be addressed here is whether the petition presents sufficient information to conclude that the eastern North Pacific gray whale population may be less than its maximum net productivity level and, therefore, warrants a status review.

Maximum Net Productivity of the Eastern North Pacific Gray Whale Population

Scientists have used two main approaches to evaluate whether this population is above or below its maximum net productivity level. The first, used by the California Gray Whale Coalition, assumes, in accordance with established policy, that the maximum net productivity level is equivalent to 60 percent of the environmental carrying capacity for this population. The Coalition then cites a carrying capacity estimate provided by Alter et al. (2007) and argues that the current population is below 60 percent of that estimate. The difficulty with this argument is that the approach used by Alter et al. (2007) estimates what is, in effect, an average of long-term abundance and not necessarily abundance immediately prior to the start of commercial whaling on this population in the 1840s. In addition, this approach is relatively new and unproven and, because it produced results (76,000 to 118,000) that far exceed the expectations of many marine mammal biologists, it is considered quite controversial. Indeed, Alter et al. (2007) themselves pointed out that—

> [g]enetically determined past population sizes for Atlantic humpback, minke, and fin whales are surprisingly high..., prompting the need for further exploration of results from other species and expanded genetic data sets.

Those authors also acknowledged some sources of uncertainty regarding their approach.

> Using genetic data to assay past populations depends on the balance between genetic drift reducing variation at individual loci and mutation increasing it. The relationship between genetic diversity and population size also varies with population subdivision, natural selection, changes in population size over time, and departures from perfectly random mating.

This genetic approach to estimating pre-whaling population size may prove to be informative and the Commission encourages further studies of this type. However, at present, the Commission does not consider this approach to be sufficiently tested and reliable to be used as a basis for management.

The second approach used with the eastern North Pacific gray whale population is best exemplified by the work of Punt and Wade (2010). This work uses corrected estimates of the population's abundance over the past several decades (Laake et al. 2009) with a

Bayesian framework to model the population's growth and then uses the results to estimate the maximum net productivity and current abundance relative to it. Their results indicate that the population's maximum net productivity occurs at a population size of about 17,000 and that the current population is equal to 129 percent of its maximum net productivity level and 85 percent of its carrying capacity. These results are based on the most recent and best available abundance estimates and were generated using modeling methods that have been widely accepted in the field of ecology. The results are less sensitive to assumptions and therefore more robust.

However, although the Commission gives more weight to the results generated by the Punt and Wade (2010) modeling approach, the question to be addressed is more complicated. Both the California Gray Whale Coalition and Alter et al. (2007) suggest that climate change has caused a reduction in the carrying capacity of the eastern North Pacific gray whale population, and the analysis by Punt and Wade (2010) was not structured to address that concern. Their modeling approach estimates population size and status during the period covered by the model (1930-2009). The model does not attempt to estimate possible changes in carrying capacity during this period and, to the extent that carrying capacity did change, there is additional, unmodeled variation that will be reflected in the posterior distributions. If the carrying capacity for gray whales has been diminished over time because of changing environmental conditions (i.e., from climate change), a fundamental question remains as to what level a stock should then be required to recover, that is, should it be to the pristine level when human exploitation began, to the reduced level resulting from climate change, or to some other level.

This dilemma is a fundamental issue when management is based upon maximum net productivity level and environmental carrying capacity as standards for assessing population status. At any point in time, marine mammal populations can respond only to their surrounding conditions, regardless of how altered those conditions may be. With regard to gray whales, scientists have hypothesized that the climate-driven reduction in sea ice might (1) increase their carrying capacity by opening new foraging areas and/or (2) decrease their carrying capacity if the new open-water ecosystems are less productive. To date, some of the evidence collected supports the former hypothesis (e.g., Perryman et al. 2002) whereas other evidence supports the later (e.g., Moore et al. 2003). However, Moore (2008) describes the behavioral flexibility, or resilience, demonstrated by eastern North Pacific gray whales in their capacity to forage on diverse types of prey over broad areas of their range. It is, therefore, too soon to form conclusions about the long-term effects of climate change on this population. The 1999-2000 die-off, as well as observations of skinny whales and the low calf production in some recent years all are consistent with a population approaching its carrying capacity.

With all this in mind, the Marine Mammal Commission does not believe that a status review is warranted at this time or would be a good use of limited resources. The resources available to the National Marine Fisheries Service for gray whale studies would be better directed toward careful monitoring and investigation of the factors that may affect their conservation. Continued monitoring of this population during its feeding and reproductive

seasons, and during its migration should yield better insights into population status and the manner in which climate-related changes in the environment are affecting their environmental carrying capacity and maximum net productivity level. With those information needs in mind, the Marine Mammal Commission recommends that the National Marine Fisheries Service defer any status review until the scientific evidence provides a stronger basis for concluding that the population may be below its maximum net productivity level. Instead, the Commission recommends that the Service focus its research and management efforts related to the eastern North Pacific gray whale population toward continued monitoring and expanded study of the whales natural history and factors that may affect conservation of the population, including the whales' responses to changes in their environment.

Other Considerations

The California Gray Whale Coalition identified five causes of decline for this population. Their fourth and fifth causes pertained to changes in prey and habitat resulting from climate change and causing starvation; those causes are discussed in the preceding paragraphs. The three other causes identified by the Coalition are as follows.

Potential Biological Removal Level: In its petition, the Coalition claims that the National Marine Fisheries Service has used an outdated abundance estimate and an inappropriately high recovery factor to calculate the potential biological removal level for the eastern North Pacific stock of gray whales and that this has resulted in over-harvesting of the population. The Coalition cites the 2002 stock assessment report, which included a minimum population estimate of 24,477, but fails to mention the 2005, 2007, or 2008 versions of the stock assessment report published by the Service, each of which used a minimum population estimate of 17,752. The draft 2010 report proposes to increase the minimum population estimate to 18,017 based on new data and analyses, including the technical memorandum by Laake et al. (2009) that was cited by the Coalition as the basis for the minimum population size of 16,033 that it advocates using. The Commission believes that the Service acted reasonably in using the most recent (2006/2007) population estimate and its associated coefficient of variation to estimate the minimum population size. This approach is more defensible than the Coalition's suggestion that the Service select a lower population estimate that is nearly ten years old. In any event, the Service has not for several years been using the 2002 minimum population estimate of 24,477 to calculate the potential biological removal level for this population as the Coalition claims in the petition.

The other key variable indentified by the Coalition as contributing to an inappropriately high potential biological removal level is the Service's selection of a recovery factor of 1.0. The Coalition advocates the use of a recovery factor of 0.1 in light of the "major population crash" experienced by the population. The selection of a recovery factor is left somewhat to the discretion of the Service but is governed by general guidance adopted by the agency (National Marine Fisheries Service 2005). Under that guidance, default recovery factors of 0.1, 0.5, and 1.0 have been adopted, respectively, for (1) endangered species, (2) threatened species and stocks of unknown status, and (3) stocks known to be

within their optimum sustainable population range. The 2010 draft stock assessment report for the eastern North Pacific population of gray whales uses a recovery factor of 1.0 because, presumably, the Service believes that the population is above its maximum net productivity level, but also because the population has been increasing for the past several decades and appears to have recovered. If this population's recent decrease in calf production continues, the Service reasonably could use a lower recovery factor. However, this is a matter best addressed in the context of the periodic reviews of stock assessment reports required under section 117 of the Marine Mammal Protection Act, rather than in the context of responding to a petition for a depletion designation.

The potential biological removal approach was established to address human-related removals from a population. Clearly, the estimate of the potential biological removal level depends on the minimum population estimate, productivity rate, and recovery factor used in its calculation. The Service's 2010 draft assessment sets the level at 360 whales. The petitioners suggest a level of 37, the discrepancy resulting almost exclusively from the use of a recovery factor of 0.1 instead of 1.0. The selection of a recovery factor of 0.1 seems overly conservative and, in the Commission's view, it is more appropriate to assess the impacts of takes from this population using the Service's value, or at least something close to that value.

It is also important to note that the calculation of a potential biological removal level does not, in and of itself, have any effect on the population. The effects stem directly from the actual taking. The primary source of human-caused mortality of gray whales from this population is subsistence hunting, which averages about 120 removals per year. Other sources of mortality identified in the stock assessment report include taking incidental to commercial fisheries and by vessel strikes. However, the annual number of deaths and serious injuries attributed to these sources appears to be relatively small. In fact, the total number of removals from this population in a given year is probably less than half of the potential biological removal level calculated by the Service. As such, even if the Service calculated the potential removal level using a more conservative recovery factor of 0.5, it appears that the current mortality and serious injury rate would not cause the population to decline below its optimum sustainable population level, or prevent it from achieving that level if it currently is below its maximum net productivity level, as the Coalition contends.

Cow/calf numbers: In its petition, the Coalition also asserts that recent patterns in calf production are a clear indication that the population warrants designation as depleted. However, as explained above, the productivity of a marine mammal population is not a criterion used for determining when such designation is warranted; that determination is based solely on population abundance relative to its maximum net productivity level.

Reproduction and calf/juvenile survival often are the two most sensitive and variable vital rates for marine mammals and may vary with a number of factors, the most important of which likely is the availability of adequate foraging habitat. When reviewing calf production and survival, it is important to look at relatively long-term patterns, as variation in these parameters over short periods (i.e., a few years) can be misleading. With regard to the eastern North Pacific gray whale population, calf production has dropped sharply in the

past few years, but this decline is consistent with the high variability in calf production over the past several decades (Perryman et al. 2010). That being said, the recent downturn in calf counts raises legitimate concerns and the Commission believes that calf production should be monitored closely.

In addition, the apparent drop in calf production may reflect, at least in part, a shift in the distribution and habitat use of gray whales. In particular, they may be using areas other than Laguna San Ignacio or Laguna Ojo de Liebre (Scammon's Lagoon) as calving and nursing grounds. More research is needed to investigate that possibility.

Predation: With regard to predation, the Coalition focuses, and reasonably so, on the population consequences of predation by killer whales. The Coalition cites a number of observations of predation off the California coast and in or near Aleutian passes between the North Pacific Ocean and the Bering Sea. Absent evidence of human interference, predation is generally considered to be a natural process. Undoubtedly, killer whales take a considerable number of calves and juveniles. The Coalition cites observations by several knowledgeable cetacean biologists who have studied that predation.

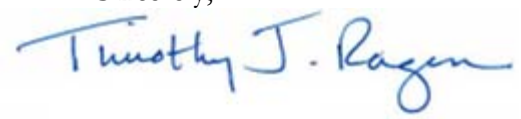
However, like the rate of reproduction, the amount of predation is not a criterion for designating a population as depleted. At any given point in time or space, the amount of predation is only relevant if, by itself or in combination with other factors, it causes the population to decline below its maximum net productivity level, which does not appear to be the case. The Coalition includes modeling results that indicate that adding high levels of mortality by predation would cause the population to decline and, in a general sense, that result seems reasonable. However, the petition does not include a full description of the model and it is therefore not possible to judge the reliability of its results. For example, the model should have included natural levels of mortality that would account for some or perhaps all of the predation-related mortality discussed in the Coalition's petition. By adding more mortality based on observations at different sites, it is possible that the model accounted for such mortality twice, thereby exaggerating its effect. Here, too, more study is required to evaluate the role of killer whale predation on the eastern North Pacific gray whale population. It is certainly conceivable that such predation has increased in recent years if the hypothesis by Springer et al. (2003) is even partially correct.

Although the Commission does not believe that the petition presents sufficient information to warrant a status review, it does present sufficient information to emphasize the importance of careful monitoring of this population. In view of the fact that this population migrates back and forth between the Arctic and the Mexican mainland coast, coordination of research seems essential to ensure that the limited resources available are used efficiently. With that in mind, the Marine Mammal Commission recommends that the National Marine Fisheries Service establish and fund a program to continue monitoring gray whale abundance and reproduction, and to initiate efforts to understand how climate change in the Arctic affects gray whale feeding, nutritional status, and carrying capacity. The Commission also recommends that the Service take advantage of existing opportunities (e.g., meetings of the Alaska Scientific Review Group, Marine Mammal Society biennial meetings)

to convene gray whale researchers from Mexico, the Service, state research and management agencies, private organizations, and Native American groups to ensure that their research efforts are coordinated and directed at the issues that are presently or are expected to become of most importance to the management and conservation of the eastern North Pacific gray whale population.

We hope these recommendations and comments are helpful. Please contact us if you have questions or wish to discuss them.

Sincerely,



Timothy J. Ragen, Ph.D.
Executive Director

Literature Cited

Alter, S.E., E. Rynes, and S.R. Palumbi. 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.

Laake, J., A. Punt, R. Hobbs, M. Ferguson, D. Rugh, and J. Breiwick. 2009. Re-analysis of gray whale southbound migration surveys, 1967-2006. U.S. Department of Commerce, NOAA Technical Memorandum NMFS-AFSC203, 55 p.

Moore, S. 2008. Marine mammals as ecosystem sentinels. Journal of Mammalogy. 89(3): 534-540.

Moore, S.E., J.M. Grebmeier, and J.R. Davies. 2003. Gray whale distribution relative to forage habitat in the northern Bering Sea: current conditions and retrospective summary. Canadian Journal of Zoology 81:734-742.

National Marine Fisheries Service. 2005. Revisions to Guidelines for Assessing Marine Mammal Stocks. 24 p. Available at: http://www.nmfs.noaa.gov/pr/pdfs/sars/gamms2005.pdf.

Perryman, W.L., M.A. Donahue, P.C. Perkins, and S.B. Reilly. 2002. Gray whale calf production 1994-2000: Are observed fluctuations related to changes in seasonal ice cover? Marine Mammal. Science 18(1):121-144.

Perryman, W.L., S.B. Reilly, and R.A. Rowlett. 2010. Results of surveys of northbound gray whale calves 2001-2009 and examination of the full sixteen years series of estimates from the Piedras Blancas Light Station. Paper SC/62/BRG1 presented to the IWC Scientific Committee, June 2010 (unpublished), 11 p.

Punt, A. E., and P. R. Wade. 2010. Population status of the eastern North Pacific stock of gray whales in 2009. U.S. Department of Commerce, NOAA Technical Memorandum NMFS-AFSC-207, 43 p.

Springer, A.M., J.A. Estes, G.B. van Vliet, T.M. Williams, D.F. Doak, E.M. Danner, K.A. Forney, and B. Pfister. 2003. Sequential megafaunal collapse in the North Pacific Ocean: An ongoing legacy of industrial whaling? Proceedings of the National Academy of Sciences 100(21):12223-12228.