

**IN THE MATTER OF****PROPOSED REGULATIONS GOVERNING  
THE TAKING OF THE COOK INLET, ALASKA,  
STOCK OF BELUGA WHALES BY ALASKA NATIVES****Docket No. 000922272-0272-01****DECLARATION OF DANIEL GOODMAN, PH.D.**

1 I am Daniel Goodman, Ph.D. I have been serving as an advisor to the Marine Mammal  
2 Commission on matters related to Cook Inlet beluga whales and this rulemaking for nearly four  
3 years. I submitted testimony and served as the Commission's expert witness at the previous  
4 hearing in this matter. My qualifications and experience as an expert in environmental statistics  
5 and risk analysis modeling for endangered animal populations are discussed in my earlier  
6 testimony and will not be repeated here.  
7

8 The primary purpose of this hearing is to establish a regime for governing the harvest of  
9 Cook Inlet beluga whales by Alaska Native subsistence hunters for 2005 and subsequent years.  
10 In accordance with stipulations agreed to by the parties to this rulemaking, this long-term harvest  
11 regime is to be a science-based regime that will –  
12

13 (a) provide reasonable certainty that the population will recover, within an acceptable  
14 period of time, to the point where it is no longer considered to be depleted;  
15

16 (b) take into account the uncertainty concerning our knowledge of the population  
17 dynamics and vital rates of the Cook Inlet beluga whale population;  
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1 (c) allow for periodic adjustment of the allowable strike levels based upon the results of  
2 population abundance surveys and other relevant information, recognizing that the strike  
3 level and allocation regime agreed to for the period between 2001-2004 will not be  
4 reduced below that minimum (1.5 whales per year) without substantial information  
5 demonstrating that subsistence takings must be reduced below that level to allow  
6 recovery of the Cook Inlet beluga whale population from its depleted status; and

7  
8 (d) be readily understood by diverse constituencies.

9  
10 The National Marine Fisheries Service (NMFS) filed its proposal for the long-term  
11 harvest management regime (the "Subsistence Harvest Management Plan for Cook Inlet Beluga  
12 Whales") on 30 April 2004. The Service's proposed Plan fails to satisfy stipulations (a), (b), or  
13 (c). The Plan does not meet its own quantitative standard for providing reasonable certainty of  
14 population recovery; it does not respond correctly to the uncertainty or the available evidence  
15 about the population dynamics; and it fails to provide for reducing the harvest rate below the  
16 interim minimum as soon as substantial information demonstrates that the harvest rate should be  
17 so reduced to ensure recovery in accordance with the standard. Provided herein is my analysis of  
18 the Service's proposed regime and my assessment of the extent to which it satisfies the criteria  
19 set forth in the stipulations.

20  
21 A key aspect of implementing the stipulations is defining what constitutes "reasonable  
22 certainty" of population recovery, and what constitutes an "acceptable period of time" in which  
23 to achieve that recovery. It is critical that these criteria be quantified so as to provide a  
24 measurable and consistent standard for judging progress in achieving the recovery goal of the  
25 Marine Mammal Protection Act and for establishing harvest limits consistent with that goal. The  
26 Plan proposed by NMFS states that standard as "not increasing time to recovery (when compared  
27 with zero harvest) by more than 25 percent, with 95 percent certainty." For brevity, I will refer to  
28 this as the 25-95 criterion.

29

1           The 25-95 criterion proposed by the Service is an appropriate one that, if implemented,  
2 would provide a suitably high level of assurance that the primary goal of this rulemaking and of  
3 the Marine Mammal Protection Act – realizing the timely recovery of the depleted Cook Inlet  
4 beluga whale population – will ultimately be achieved, to the extent that regulated harvest plays a  
5 role in affecting the potential for recovery of this population. Time is of the essence in  
6 population recovery, because harmful genetic effects accrue at low population sizes, the  
7 population may experience social disruption that impedes recovery at low population sizes, the  
8 population will be vulnerable to random environmental disturbances that raise the probability of  
9 extinction at low population sizes, and while the population is at low population sizes it may not  
10 be functioning fully in its usual role in the ecosystem, contrary to the declared policy of the  
11 Marine Mammal Protection Act, and with possible adverse consequences for the prospects for  
12 recovery. Time is also of the essence in managing a population for harvest, because the recovery  
13 threshold is designed to more or less coincide with the maximum sustained yield stock size, so  
14 the sooner the population recovers, the sooner it can be harvested sustainably at or near its long  
15 term production potential. Accepting a 25 percent delay in time to recovery, consistent with the  
16 25-95 criterion, allows some harvest to proceed while recovery is underway, if in fact recovery is  
17 underway. Allowing harvest to proceed if recovery is not underway will not satisfy the 25-95  
18 criterion, will not promote recovery, and would be contrary to the stated policies and goals of the  
19 Marine Mammal Protection Act.

20  
21           The core failure of the proposed Plan is that it ignores the existing information about the  
22 population dynamics of the Cook Inlet beluga population, and instead proceeds on the basis of  
23 optimistic assumptions about the dynamics that are, in fact, inconsistent with the available data.

24  
25           During the course of the investigations of the Technical Team, convened as per the  
26 stipulations agreed to by the parties in 2001, it emerged that the available data on this population  
27 indicate with a substantial degree of probability that the population's current capacity for growth  
28 is considerably lower than would be expected by comparison with normal, healthy toothed whale  
29 or dolphin populations. There was agreement about this broad fact, but not about its  
30 interpretation or implications.

1  
2 Since no consensus document was produced by the Technical Team, I will provide the  
3 results of my calculations, as they contributed to the effort of the Technical Team. These  
4 calculations were first communicated to the Parties in a presentation at the Long Term Harvest  
5 Regime Working Group meeting in Seattle, in September 2003. Full mathematical  
6 documentation was emailed to the members of the Technical Team in January 2004. This  
7 analysis formed the basis for some of the comments by the Marine Mammal Commission in the  
8 letter, dated February 13, 2004, from Mr. David Cottingham to Dr. James Balsiger, NMFS  
9 Regional Administrator, and was referred to specifically in that letter. Dr. Balsiger's reply to the  
10 Marine Mammal Commission, in his letter of June 25, 2004, acknowledged specifically that my  
11 analysis was correct. Nevertheless, this analysis is not mentioned in the Plan, and its  
12 implications are not addressed in the Plan.  
13

14 For ease of communication, I here report my estimate of the population's capacity for  
15 growth in units of the population's annual percent growth in the absence of harvest or of  
16 crowding effects.<sup>1</sup>  
17

18 In my calculation, based on the available estimates of the population size, reported  
19 harvest, and numbers struck and lost for the years 1994 through 2003, the central estimate  
20 (corresponding roughly to what is usually called the "best" estimate) of the growth capacity is a  
21 little less than half a percent per year. This is considerably below the expected range of 2% to  
22 6% for a normal, healthy toothed whale or dolphin population.  
23

24 My calculation took account of the uncertainty in the estimate, allowing a quantification  
25 of the degree of certainty that the growth capacity is in specified ranges. The analysis showed

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<sup>1</sup> The plan defines this as the "maximum theoretical net productivity rate." The Plan also refers to this quantity as  $R_{\max}$ , but there is some ambiguity in that notation since there are other scientific definitions of  $R_{\max}$  in use in the literature. Because the population is depleted, it is now thought to be well below the density at which it would experience significant crowding effects, and because the reported harvests in the period starting with 1999 have been very low, the population's actual growth rate in this period has been rather close to its capacity for growth. Still, for consistency with the models used by the Technical Team, and for consistency with elements of the Plan, I will continue my discussion in terms of capacity for growth, rather than actual growth rate.

1 about a 75% certainty that the growth capacity is lower than the expected range of 2% to 6%.  
2 This result was not due simply to an absence of data, for the data were sufficient for the analysis  
3 to show about a 90% certainty that the growth capacity is in the range from negative 3% to  
4 positive 5%. The analysis showed about a 46% probability that the growth capacity is negative.

5  
6 These results indicate with a reasonably high probability (on the order of 75%) either (1)  
7 that there is something amiss with the data, in which case there is insufficient information to  
8 justify continued harvest, or (2) that the data are valid and the population is experiencing some  
9 sort of stress that is depressing its growth capacity. If we accept the validity of the data, and  
10 nothing is done to identify and successfully address whatever is depressing the population's  
11 growth capacity, these estimates lead to a calculation, based on the currently available data, that  
12 the proposed continuation of a harvest rate of 1.5 per year will fail, by a wide margin, to satisfy  
13 the 25-95 criterion. In other words, the data already in hand are sufficient to show that the  
14 harvest rate proposed in the Plan for the period 2005-2009 is too high to meet the stated recovery  
15 goal. Indeed, there is a substantial probability that the population will actually decline during the  
16 period 2005-2009 even in the absence of any subsistence harvest. If the harvest rates proposed  
17 in the Plan are implemented, the probability of a decline becomes even higher.

18  
19 It must be emphasized that this analysis of the data through 2003 casts a much different  
20 light on the status of the population than did the scientific review at the time of the hearings on  
21 this matter in 2000. In 2000, the scientists involved assumed that high rates of harvest in the  
22 period through 1998 were the only important cause of the decline of the Cook Inlet beluga  
23 population, and the modeling presented at the hearing used the assumption that, if the permitted  
24 harvest were curtailed, the population would begin to recover, expressing a normal growth  
25 potential in the range of 2% to 6%. The data available at that time did not contradict this  
26 assumption, and had little statistical power to do so. At that time, too few years had elapsed  
27 since the low harvest regime was instituted (the moratorium began in 1999), and the earliest  
28 years of the data series (1994-1996) had comparatively low resolution in the population  
29 estimates. The data available now tell a different story. Notwithstanding a near zero legal  
30 harvest for the five-year period from 1999 through 2003, the continuing series of population

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1 estimates through this period is essentially flat, and shows no indication of the expected recovery.  
2 My analysis estimating the population's growth potential responds to this evidence and quantifies  
3 it statistically.  
4

5 This evidence raises the stakes for management of the Cook Inlet beluga population.  
6 Rather than treating future harvest as the only important factor that will be affecting this  
7 population, the realistic position is to consider harvest as a contributing factor that could make a  
8 bad situation worse, even to the point of precluding recovery. Not only should management take  
9 account of the evidence of depressed population growth in regulating future harvests, it should  
10 direct additional research and monitoring efforts at determining why the population is not  
11 recovering as expected, as a matter of priority.  
12

13 The proposed Plan does not respond to this evidence. The annual strike limit for the  
14 interim period 2005-2009 demonstrably fails to meet the 25-95 criterion using the existing data.  
15 The control rules proposed for 2010 and beyond use harvest rates (listed in Table 1 of the Plan,  
16 and revised in a new table e-mailed to the Parties by Dr. Hobbs on July 14, 2004) calculated on  
17 the assumption that the growth capacity is in the range 2% to 6%, contrary to the existing  
18 evidence, and these control rules also fail to meet the 25-95 criterion given present evidence.  
19 The back-stop provisions in the control rule, presumably intended to eventually detect and  
20 respond to failures of assumptions, are too insensitive to the data stream to respond rapidly  
21 enough, and when they do respond, the response is too small, since the allowable harvest rates in  
22 the Table are calculated assuming a future population growth potential in the range of 2% to 6%,<sup>2</sup>  
23 even when the monitoring has detected a significant decline, which of course is contradictory.  
24

25 This unwarranted assumption of a growth potential in the range of 2% to 6%, despite  
26 substantial contrary evidence, explains the otherwise puzzling feature of the revised Table, that  
27 there is *no difference* between the harvest rates for the column corresponding to "No Trend" and

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<sup>2</sup> See "Technical Notes for NMFS Harvest Plan April 26, 2004" in the section "Table of five year strike limits...", item 1 of "Each of the test simulations...", last sentence of this item: "An  $R_{max}$  for the period after the initial year was drawn at random from a uniform distribution between 0.02 and 0.06."

7

1 the column corresponding to "Declining Trend," and there is very little difference between these  
2 and the harvest rates for the column corresponding to "Increasing Trend." This failure to adjust  
3 the harvest rate in response to a population decline, compared to no trend, even when it is  
4 detected, flies in the face of common sense, and, in fact, is technically unjustified. It arises  
5 because of the same technical flaw that undermines the performance of other aspects of the Plan,  
6 namely an assumption that the future growth potential of the population must be in the range of  
7 2% to 6%.

8  
9 In fact the back-stop provisions in the Plan are insufficient to ensure that the population  
10 will be allowed to recover at all. Consider the scenario, which is not implausible given the  
11 current evidence about the growth capacity, wherein the population can just sustain a continued  
12 harvest of 1.5 per year, without growing or declining.<sup>3</sup> Under the control rule proposed in the  
13 Plan, a harvest averaging 1.5 per year would be permitted indefinitely in this scenario, since the  
14 control rule would get stuck in the cells for rows 3 and 4 (population average 300-349 or 350-  
15 399) and column 2 (zero trend) in Table 1, with the harvest alternating between 7 in 5 years and 8  
16 in 5 years. This harvest regime would thus prevent the population from ever recovering.

17  
18 More generally, the back-stop provisions proposed in the Plan rely on three possible lines  
19 of future data:

- 20 1. Violation of a floor of 260 animals in the census estimate.
- 21 2. Statistical detection of a declining population trend.
- 22 3. Detection of an "unusual" number of mortalities.

23 None of these will suffice to ensure attainment of the 25-95 criterion, if, as now seems  
24 reasonably likely, the population's growth capacity is below 2%. Nor are these even sufficient to  
25 protect against possible biological impairment at low population sizes.

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26  
<sup>3</sup> Note that a harvest of 1.5 per year from a population of 357 animals, which is the most recent population estimate, corresponds to a harvest mortality of 0.42% annually, which is very close to my central estimate of the growth capacity at 0.48% annually, so the two might cancel.

1           The proposed floor of 260 for the census estimate is designed to offer 95% confidence  
2 that this clause will be triggered before the actual population declines below 200 animals (total),  
3 of which 60 are assumed to be adult females. This number is far lower (by an order of  
4 magnitude) than the current scientific opinion on how large a population must be to prevent  
5 eventual genetic deterioration (Allendorf and Ryman, 2002; Franklin and Frankham, 1998;  
6 Lynch and Lande, 1998; Ralls, DeMaster and Estes, 1996). Note that these recent papers stating  
7 that the current scientific consensus is for an effective population size of at least 500 include  
8 papers authored by some of the same authors (Ralls and Lande) whose much earlier papers are  
9 cited in the Plan. The argument that a brief stay at comparatively small population sizes is  
10 relatively harmless, would apply only if we had assurance that the population would recover  
11 quickly from the small population size, which is not possible with the present data, and would be  
12 even less plausible in the event that the population actually declined below its present size to the  
13 proposed floor. Note that the Cook Inlet beluga population has already endured almost a decade  
14 at a population size below 500. The citation provided by NMFS to argue that environmental  
15 perturbations do not present an undue risk to a non-recovering population of 200 individuals,  
16 does not in fact make that argument. That study is based on a model life table that assumes a  
17 growth capacity above 2%, and it explores rather low levels of environmental variation. In any  
18 case, this study found that, when harvest rates “approached the intrinsic rate of increase,” even  
19 the variation owing to chance differences between individuals had an appreciable influence on  
20 the populations. One of the concerns with the Cook Inlet beluga harvest management Plan is that  
21 the harvest rates might approach the intrinsic rate of increase. The key actual conclusion of the  
22 cited paper is that “quantitative information on the magnitude and frequency at which  
23 environmental stochasticity is causing survival rates (and/or reproductive rates) to decrease” is  
24 critical to the probability of extinction for small populations. No estimates of this critical  
25 quantity have been put forward for the Cook Inlet beluga population.

26  
27           Generally within the conservation biology literature, a population of 200 individuals is  
28 considered to be dangerously small. Many populations listed under the Endangered Species Act  
29 are quite a bit larger than 200. Note that the widely used IUCN criteria for categorizing  
30 threatened species classify a population with a size estimate fewer than 250 mature individuals as

1 “Endangered... considered to be facing a very high risk of extinction in the wild,” as  
2 distinguished from populations with a size estimate fewer than 1000 mature individuals, which  
3 are considered to face “a high risk of extinction” (IUCN, 2001).  
4

5 In addition, the statistical detection of a declining trend, as proposed in the Plan, is too  
6 insensitive, because it demands a 95% confidence that the trend is declining. Because of this  
7 misplaced burden of proof, the probable performance of this clause of the control rule is that it  
8 will be triggered at about the same time as the census floor clause, which renders this back-stop  
9 measure largely meaningless. In any case, under the revised Table, triggering the declining trend  
10 determination doesn't actually change the harvest rate from the default (no trend) harvest rate in  
11 the Plan, so the effect of this clause is moot.  
12

13 The “unusual” mortalities clause likewise offers insufficient protection because its  
14 baseline is the average of the observed non-harvest mortalities in the period 1999-2003, during  
15 which time the population was failing to recover as expected. As such, this might have already  
16 been a time of unusual mortalities, so waiting for observed mortalities to exceed this by a margin  
17 of about half the width of the observed distribution is to wait for mortalities that are *very* unusual  
18 indeed. No analysis is presented or referred to in the Plan to document what fraction of non-  
19 harvest mortalities are detected, or to relate the non-harvest mortality detection to inferences  
20 about population growth or decline.  
21

22 The harvest management plan proposed by NMFS includes interim harvest limits for the  
23 next five-year period (2005-2009), alternating between two strikes and one strike per year. This  
24 averages out to 1.6 whales per year, which is higher than the interim harvest level agreed to for  
25 2001-2004. As the NMFS proposal indicates, the proposed interim harvest limits for 2005-2009  
26 were agreed to by the Service and various groups of Native hunters at a 7 December 2003  
27 meeting in Anchorage. What the Service fails to note is that the Marine Mammal Commission,  
28 the only other party that was invited to or attended that meeting, objected to that proposal. The  
29 Commission noted that, while a harvest level of 1.5 whales per year was an acceptable starting  
30 point, it was inappropriate to establish this as a default value for the next five years. Rather, an

1 appropriate harvest regime should include triggers for increasing or decreasing the authorized  
2 strike limits based on the trends detected by the Service's monitoring program and other relevant  
3 data. In its 13 February 2004 letter commenting on a draft version of the Service's proposal, the  
4 Commission expressed its support for a shorter interim harvest regime using default limits  
5 (through 2007), but stated that any further extension was unwarranted. I agree with that position  
6 of the Marine Mammal Commission.

7  
8 In discussing the proposed harvest regime for the forthcoming five-year period, NMFS  
9 claims that "[t]he setting of interim harvest levels is necessary because existing data do not  
10 provide sufficient resolution on the population trends within this stock to support the  
11 management strategy that will be used in subsequent five year intervals." However, it has not  
12 provided any information or analyses to substantiate that claim or to explain why sufficient  
13 resolution might not be available in a shorter period of time. Additionally, the Service provides  
14 no information to support the implicit expectation that in subsequent five-year intervals (i.e.,  
15 after 2009) the data will "provide sufficient resolution" to support the proposed long-term  
16 regime.

17  
18 The Marine Mammal Commission has advocated, and NMFS has agreed, that, to the  
19 extent possible, Native hunters should be called upon to target male whales. Because of the  
20 breeding strategies of species such as the beluga whale, an all male harvest likely would have  
21 much less of an impact on the reproductive potential of the population. The Service proposes to  
22 include measures for the preferential harvest of male whales in the co-management agreements,  
23 but has declined to adopt the recommendation that authorized strike levels be reduced if more  
24 than a certain number of female whales (e.g., 2) are struck during any five-year period. The  
25 selective harvest of males is a significant enough issue that it needs to be contained in the  
26 regulations themselves, rather than being deferred to the development of cooperative agreements  
27 between the Service and hunters. Furthermore, the heightened cost to the population of female  
28 kills should be offset by corresponding reductions in future strike limits.

29  
30 The Service indicates that it currently has funding available to conduct annual abundance

1 surveys of Cook Inlet beluga whales in 2005, but cannot guarantee that funding for future years  
2 will be forthcoming. As such, the Service has suggested that future surveys may be scheduled  
3 every other year, if it can be shown that this would meet the data requirements of the harvest  
4 management plan. Although I appreciate that the budgets of federal agencies are established  
5 annually, and there is never a guarantee that programs will be funded in future years, the  
6 suggestion that abundance surveys may be carried out only in alternate years is a major concern.  
7 The difficulty in collecting statistically significant data and in detecting population trends on a  
8 timely basis will only be exacerbated if surveys are conducted less frequently. Moreover, the  
9 dynamic nature of the proposed harvest management regime is premised on having access to  
10 timely data of comparable quality to that collected over the past several years. If fewer data  
11 points are being collected, and we are less able to detect population trends, corresponding  
12 changes in the harvest management regime will be needed to provide the necessary safeguards  
13 that the population is not adversely affected by the authorized level of taking. That is, the  
14 precautionary principle embodied in the MMPA would dictate that, in the face of greater  
15 uncertainty, a more conservative approach to setting harvest limits be adopted.

16  
17 The present ignorance about the basic biology of the Cook Inlet beluga population is so  
18 deep that there is not even an available analysis of whether the current failure of the population to  
19 recover is owing to an abnormally low reproductive rate or an abnormally high mortality rate or  
20 both. If the alarming status of this population is going to be taken seriously by the responsible  
21 agencies, these matters need to be looked into. This will require more research and monitoring,  
22 not less.

23  
24 In closing, I want to underscore the precarious status of the Cook Inlet beluga whale  
25 population, or any cetacean stock that numbers about 350 individuals and is not exhibiting a  
26 consistent growth potential. Although the National Marine Fisheries Service determined in June  
27 2000 that listing the stock as Endangered, under the Endangered Species Act, was not warranted,  
28 it did so based on the belief that the single factor having a significant adverse effect on the  
29 population was over-harvest by subsistence hunters, and that over-harvest was being  
30 satisfactorily addressed. After six years of little or no permitted subsistence hunting (three

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1 whales have been reported taken between 1999 and 2004), we have seen no detectable recovery  
2 of the stock, and my analysis shows this observation to be statistically informative. Thus, it  
3 appears that as yet unidentified factors are causing mortality or acting to depress population  
4 growth. As such, we should treat this stock with the care we would an endangered species  
5 whether it is currently listed or not.

\* \* \* \* \*

9 Pursuant to 28 U.S.C. § 1746, I swear under penalty of perjury that the foregoing is true  
10 and correct to the best of my knowledge and belief.

12 Executed on 15 July 2004, in Bozeman, Montana.

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16 Daniel Goodman, Ph.D.

19 Literature cited

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