

September 22, 2008

To: Dr. Susan Roberts, Director, Dr. Pete Peterson, Chair, and members, Ocean Studies Board Drake's Estero panel, National Research Council, National Academy of Sciences

From: Dr. Corey Goodman, resident Marshall, CA; member, National Academy of Sciences

RE: **II. NPS Becker presentation to your NRC panel on September 4, 2008 and Becker's paper in press in Marine Mammal Science misrepresents impact of DBOC on seals at subsite OB**

## **Summary of Conclusions**

**1. The NPS Becker et al. paper in press in Marine Mammal Science (MMS) uses the wrong number for one major variable – oyster production in 2007.**

Tom Moore, California Department of Fish & Game, corrected Dr. Becker at the NRC panel meeting by pointing out that he had used 760,000 lbs. for 2007 when the real number was 466,503 lbs. Becker's number was 63% too high.

**2. The NPS Becker et al. paper reports a misleading analysis when it compares 2002-2004 vs. 2005-2007 to conclude that seals at subsite OB have significantly declined in recent years.**

NPS fails to point out that the mean number of seals at subsite OB in 2005, 2006, and 2007 was within the mean for the years 1997-2007. The mean number of seals at OB in 2004 was high compared to the 11-year mean.

**3. The NPS Becker et al. paper reports a misleading analysis when it compares seals at OB vs. oyster production for 2005-2007 to conclude that the seals at subsite OB have decreased in correlation with the increase in oysters.**

NPS fails to point out that populations across northern California declined from 2005 to 2007 (mean seals at OB declined by 17% and at Drakes Estero by 11%; maximum pups at combined PORE populations declined by 19%).

**4. The NPS Becker et al. paper conducted its analysis using a false assumption to compare oyster production in one year with seals in the previous year.**

DBOC oysters only spend their last 3-4 months at subsite OB and not 18 months as suggested by Becker. Becker made a false assumption that oyster production in one year should be compared with seal disturbances the previous year, when he should have compared them in the same year.

**5. The NPS Becker et al. paper fails to properly compare the mean number of seals at subsite OB vs. oyster production for the years 1997 to 2007.**

Had they done so, they would have seen that there is no meaningful correlation coefficient. The NPS has access to data going back to the 1970's and should have compared seals to oysters for the entire 25-year period.

**5. The NPS Becker et al. paper fails to properly compare the changes at subsite OB with the changes in the Drakes Estero population and the changes in the combined Pt. Reyes National Seashore (PORE) populations.**

The Drakes Estero population and the combined PORE populations correlate just the same with oyster production as does subsite OB. The correlation from 2000-2007 is insignificant. The correlations from 2004-2007 for OB, Drakes Estero, and combined PORE populations vs. oyster production are similar, indicating a different cause of the seal decline in northern California populations. Moreover, the mean number of seals at subsite OB correlates more highly with these populations than it does with oyster production.

**6. The NPS Becker et al. paper includes oyster-related disturbance data for 2006 and 2007 that neither met the authors' quality control criteria for data entry nor the NPS data management protocols for data entry.**

At the NRC panel meeting on September 4, 2008, Becker stated that he went through the data "*disturbance event by disturbance event*", and eliminated ambiguous data. Thus, the only oyster-related disturbance record for 2006 that he included should not have been used (since in the database it is labeled "*possibly oyster related*" and describes a boat DBOC does not own), and two of three oyster-related disturbances for 2007 also should not have been included (including the controversial April 26 Trip Report which, amongst many other issues, was entered into the database nine months late, a protocol violation).

**7. The NPS Becker et al. paper includes seal disturbance data, and calculates percent of disturbances due to the oyster operation (a misleading calculation given the small sample size), without considering the number of disturbances per survey, which goes down in 2007 compared to 2006.**

Since there were twice as many disturbance surveys conducted during the pupping season in 2007 vs. 2006, the number of disturbances at subsite OB per survey went down in 2007. These numbers do not correlate with oyster production but do make a false positive correlate with seals at OB, showing how analysis of a small selected dataset can lead to false conclusions.

**8. The NPS has already begun using the Becker et al. paper to state to the community and the press that their peer-reviewed analysis shows cause and effect in claiming that the increased oyster production from 2005 to 2007 led to a decline of seals at subsite OB. However, the NPS has no basis for concluding cause and effect.**

The analysis of the Drakes Estero population and surrounding combined PORE populations shows that their numbers correlate with oyster production to the same extent as does subsite OB. Some other ocean condition or food availability along the northern California coast likely led to modest changes in seal populations from 2005 to 2007 in Drakes Estero and along the coast. There is no reason, based on NPS data, to conclude that oyster production in Drakes Estero led to these changes in seal populations along the coast.

## Introduction

In his morning lead talk to your NRC Ocean Studies Board panel on September 4, 2008, NPS Dr. Benjamin (Ben) Becker made a presentation entitled “*Models for harbor seal counts in Drakes Estero*”. In this presentation, Becker focused on the data, statistical analysis, and conclusions from the peer-reviewed NPS paper by Becker, Press, & Allen in press in the Marine Mammal Science journal entitled:

*“Modeling the effects of el nino, density dependence, and disturbance on harbor seal counts in Drakes Estero, California: 1997-2007”*

After Becker’s presentation, NRC panel member Dr. Francis O’Beirn, Marine Institute (Galway, Ireland) and Becker had the following exchange in Q&A:

O’Beirn: *“Just very briefly: ...I agree that in Drakes Estero, absolute counts are lowering. But the actual proportional counts at a number of the other sites seem to be either greater than or at least equal to those in Drakes Estero as well and I’m wondering how you might explain that.*

Becker: *You’re saying the proportional counts might have decreased?*

O’Beirn: *Well, absolutely, yeah. At Double Point, Tomales Bay...*

Becker: *So at Double Point, I believe there was an elephant seal that came in and was trying to mate with all the harbor seals in 2003...*

O’Beirn: *That’s not my point. My point is that during the period that you’re apportioning it to aquaculture, which is the latter years, 2005, 2006, and 07, a similar decrease has been observed.*

Becker: *Oh, yeah. I did not mean to imply that there is any relationship to the total population size in the estero declining in relation to mariculture... there is no implication at this point as to the number declining in 2003 to 2007 related to mariculture. The paper was talking about subsites in the upper estero related to mariculture – this [graph] is the whole estero. Does that clear it up?”*

O’Beirn’s instincts were correct: the data do not support Becker’s conclusions. As shown in my report, the combined Pt. Reyes National Seashore (PORE) harbor seal populations decreased from 2005 to 2007 just as did subsite OB within Drakes Estero. Moreover, the Drakes Estero population and the surrounding combined PORE populations correlate with increased oyster production in Drakes Estero just as well as does subsite OB from 2005 to 2007. This analysis suggests that this correlation is of no meaning, and that the major conclusion of Becker’s paper is invalid.

If one expands the years from the artificial analysis of 2002-2004 vs. 2005-2007, and examines the data from 2000 to 2007, then the correlation becomes insignificant, again suggesting that it is spurious. Thus, Becker's conclusion from his statistical analysis was misleading. There is no NPS data to justify the conclusion that the oyster operation impacted the seals in Drakes Estero.

The analysis for the Becker et al. paper was initiated in August 2007, shortly after the meeting at which Senator Feinstein directed an independent review of NPS May 2007 testimony and reports (which led to your NRC panel) be initiated and insisted that NPS provide me access to their harbor seal database to compare to their May 2007 claims.

The Becker et al. paper was completed and submitted to the Journal in February 2008. Several weeks prior to that submission, the NPS database was amended to include one of the key disturbance events (from the controversial Apr 26 Trip Report), in violation of the NPS database management protocols and contrary to standards described to the NRC panel by Becker. Moreover, based upon the NPS reply to my FOIA request, there does not appear to be a proper edit log entry for this addition that occurred nine months late, and no justification was given as to how it improves the integrity of the database as required by NPS protocols.

Peer review was finished and publication was approved in May 2008. It appears to have been submitted to your NRC panel on or about June 3, 2008.

Even though the study involved the Lunnys' oyster farm, and came to the conclusion that their operations were harming the harbor seals, the Lunnys were not informed that the study was underway and never provided with a copy of the results or conclusions.

Even though I was asked to make a presentation before your panel, I was similarly not informed of the study or that the agenda was changed to offer the Becker study the prominence of being the lead presentation. Nor was the Becker et al. paper readily available on your web site. Moreover, from Becker, I learned that it was designed to be secret until presented – it was intended to be a surprise. When Becker and I got together after your panel meeting on Sept 4, 2008, and given the revelation that I had prior knowledge of the paper and had already formulated criticisms of its data inclusion and analysis, Becker asked me, "how did you get it?", revealing that NPS did not expect the study to be seen by anyone else prior to your panel meeting.

After Becker's presentation, I pointed out some of its inaccuracies and questioned some of the disturbance data included in it. Tom Moore from California Department of Fish & Game informed NPS that one of the central numbers used in their analysis -- the number of pounds of oyster production for 2007 -- was too high by 63%. When the change from 2007 vs. 2006 was compared, the number used by NPS was too high by 267%.

Several weeks after your panel meeting, I have now had the opportunity to

review the Becker paper from a perspective different from the Journal's reviewers. More questions are raised about the paper's veracity including its data inclusion, statistical analysis, and conclusions. Whereas I presume that the reviewers did not have access to the primary data, I have the NPS harbor seal database, and thus I have examined the primary data, and in particular analyzed the data not presented, and the comparisons not made in the paper.

In the Becker, Press, and Allen paper and during his presentation, Becker claimed that during 2005 to 2007 (compared to 2002 to 2004), the harbor seals at subsite OB (one of eight harbor seal subsites in Drakes Estero and one of three shared with the oyster operation) decreased in correlation with an increase in oyster production by Drakes Bay Oyster Company (DBOC). Becker concluded, based on the analysis in his paper, that disturbances from the oyster operation, particularly in 2007, led to a decrease in seals at subsite OB.

In the abstract of his paper, Becker wrote:

*“Comparison of counts at OB during 2002 – 2004 (prior to increasing oyster harvest, but after ENSO effects had tapered off) with 2005 – 2007 indicates an 57% decline in use by adults and 54% decline by pups at subsite OB.”*

In a companion letter, I describe how the NPS misrepresented their own NPS harbor seal data when in May of 2007 they gave public testimony and issued the Drakes Estero Report with the claim that DBOC had caused an “80% decline” in harbor seals at one subsite compared to “two years ago”, and that this was of “national significance”. As described in my companion letter, and in more detail in the hand-out I provided to the NRC panel on September 4, 2008, the numbers and dates in the claims made by the NPS in May of 2007 are completely consistent with sandbar A which is in the wilderness area and outside the oyster lease. The seals at sandbar A did in fact have a dramatic 80% decline from 2005 to 2007. However, the disturbances at sandbar A were from Park visitors and predators and not from DBOC. There are no oyster operations at sandbar A.

The NPS is now using the Becker et al. paper in press to bolster their claim that DBOC harmed the harbor seals in Drakes Estero in 2007. Moreover, they are using the Becker paper to now say that they were referring to subsite OB and not sandbar A in May of 2007 (something they did not say for 16 months). NPS claims they meant to say three years ago when they said “two years ago”, that they meant to say a 56% decline when they said an “80% decline”, and that they meant to say that there were around 80 seals at this subsite on Saturday May 5<sup>th</sup> when they said “around 35” seals in their testimony. Observers recorded a maximum of 33 seals at sandbar A on May 5, 2007 and a maximum of 82 seals at subsite OB.

In his September 9, 2008 document distributed to the local press, Superintendent Don Neubacher brought the marine mammal community into his NPS scientific misrepresentations. Explaining the derivation of the 80% decline statement from

May 2007, Neubacher involved the Society for Marine Mammalogy and its journal Marine Mammal Science. He quoted from the abstract of Becker's paper when he wrote that the mean counts at subsite OB from 2002-2004 compared to 2005-2007, during the increase in oyster production, had declined by ~ 55%.

Here I will examine the NPS database and compare subsite OB with the Drakes Estero population and with the combined Point Reyes National Seashore harbor seal population, and show that all of them declined from 2004 to 2007, even though most of these populations did not coexist with oyster operations. The statistical correlation with Drakes Estero oyster production applies equally well to subsite OB, the Drakes Estero population (in which 5 of the 8 subsites are far from the oyster operation), and the combined Pt. Reyes National Seashore populations (most of which lack oyster operations), suggesting that something other than DBOC (perhaps ocean conditions or food availability) caused the modest harbor seal decline along the northern California coast from 2004 to 2007.

The data suggest that there is no reason to conclude that DBOC was the cause of the decline at subsite OB. Moreover, the decline at subsite OB occurred between 2004 and 2005; from 2005 to 2007, subsite OB varied in a similar pattern to the Drakes Estero population and combined Pt. Reyes National Seashore populations. The data suggest that there is no reason to conclude that DBOC caused serious disturbances of harbor seals at subsite OB in 2007, and that these disturbances caused a decline in seals at that subsite.

This analysis is in part in response to NRC panel member Dr. Francis O'Beirn, Marine Institute (Galway, Ireland) who in the Q&A session after Becker's talk, asked Becker whether from 2005-2007, the surrounding harbor seal populations (e.g., Double Point, Tomales Bay, etc.) also decreased? The answer is yes. O'Beirn's instincts were correct. Thus, Becker's major conclusion was invalid. There is no NPS data to justify the conclusion that the oyster operation negatively impacted the seals in Drakes Estero. In addition, the analysis below will show that Becker presented misleading analysis of harbor seal disturbances by DBOC and used controversial and inappropriate data to falsely show a dramatic increase in disturbances caused by DBOC at OB in 2007.

**Understanding the fallacies of the Becker et al. paper requires analysis of the NPS database. This analysis reveals that Becker misrepresented the NPS data to derive a false connection between the oyster production and seals at OB.**

## **Subsite OB Claims in Becker, Press, & Allen in press**

On May 8, 2007, the Marin County Board of Supervisors held an important hearing concerning DBOC and Drakes Estero. Supervisor Steve Kinsey, who organized the hearing, wanted his fellow supervisors to unanimously endorse a letter to Senator Feinstein asking for her help in resolving the issue.

NPS Superintendent Don Neubacher appeared at the hearing and testified:

*“... it’s amazing how many pups we have probably lost this year. We have a serious problem right now... I mean it’s that complex, because now you’re talking about the Marine Mammal Commission -- wrote us a letter this morning, they’re going to take it up. This is a national issue. They’re going to take it up on a national level.”*

In her May 8 2007 testimony, Allen also said that NPS had alerted the Marine Mammal Commission and had received a letter of support from them. The DOI Inspector General wrote on page 2 of his report on July 21, 2008:

*“Further, he [Neubacher] exaggerated the Marine Mammal Commission’s role in responding to DBOC’s impact on the harbor seal population in Drakes Estero when he spoke before the Marin County Board of Supervisors (MCBS).”*

In his September 9, 2008 document distributed to the local press, Neubacher once again brought the marine mammal community into his NPS scientific misrepresentations. In his September 9, 2008 document explaining the derivation of the 80% decline statement from May 2007, Neubacher involved the Society for Marine Mammalogy and its journal, Marine Mammal Science, when he wrote:

*“In a more recent and detailed analysis that will be published shortly in a peer reviewed scientific journal, a comparison of mean counts at subsite OB during 2002-2004 (prior to increasing oyster harvest activities) with 2005-2007 (during increasing oyster harvest activities) indicates a 57% decline in use by adults and a 54% decline by pups at the subsite.”*

This appears to be a selective misuse of numbers. Between 2005 and 2007, the harbor seal counts along the entire northern California coast were down, according to the NPS database. Bolinas Lagoon was down 9%, Double Point was down 26%, Drakes Estero was down 18%, Duxbury Reef was down 30%, Tomales Bay was down 40%, and Tomales Point was up 56%. The total for these six populations was down 16%. Clearly, the oyster operations in Drakes Estero had not driven down all of these other populations. Something else must have been going on. Was it responsible for NPS to blame the decline at OB on the oyster operation? On what basis did the NPS assign cause and effect at subsite OB?

Was the decline at OB significant given the variance at this and other subsites? Was the decline at OB significant compared to the Drakes Estero population? Was the decline at OB significant compared to the general decline along the northern California coast? The answer to all of these questions is no.

The mean number of seals at OB (Apr 15 to May 15 as measured by Becker et al.) went from 75 in 2005 to 88 in 2006 to 62 in 2007 (during the three years of ownership of the oyster farm by DBOC), a decrease of 17% from 2005 to 2007. The mean seals at Drakes Estero declined by 11% over this period and at other

surrounding combined Pt. Reyes National Seashore (PORE) populations, maximum pups declined by 19% and maximum adults by 2% over this period. Was this of “national significance”? Is this worthy of a letter to the Marine Mammal Commission in May of 2007, or a paper in Marine Mammal Science submitted in 2008?

The big drop at subsite OB occurred between 2004 and 2005, and not from 2005 to 2007 as the number of oysters increased. But that apparent drop occurred because 2004 had an unusually high number of seals at OB. If NPS finds this drop from 2004 to 2005 alarming, why didn’t they point it out in 2005, or 2006? Why make this claim in 2007 and further claim that it occurred in 2007?

Becker et al. artificially compare 2002-2004 vs. 2005-2007 when they conclude there was a 57% decline in adults and 54% decline in pups at subsite OB in the abstract of their paper. In their abstract, they write:

*“Comparison of counts at OB during 2002 – 2004 (prior to increasing oyster harvest, but after ENSO effects had tapered off) with 2005 – 2007 indicates an 57% decline in use by adults and 54% decline by pups at subsite OB.”*

They used the unusually high number of seals at OB in 2004, and the drop from 2004 to 2005, to create a boundary comparison of 2002-2004 vs. 2005-2007 to suggest that the oyster operation, and in particular the increased number of oysters produced, was having a negative impact on the harbor seals at subsite OB. Do they have data to support this? Below are the seal numbers from the NPS database and oyster production numbers from CA Dept. of Fish & Game.

I have the mean data for Drakes Estero going back to 2000, and only maximum adult and pup data (and not mean seal data) for the combined Pt. Reyes National Seashore populations (PORE) going back to 2000. The NPS, Dr. Allen, and the Pt. Reyes Bird Observatory (PRBO) have data going back to the 1970’s. The NRC and MMS should request harbor seal data from NPS/Allen/PRBO and oyster production data from California Dept. of Fish & Game for the past 25 years to do a better and independent statistical analysis of harbor seals vs. oyster production.

Year	Mean seals at OB (Apr 15 - May 15)	Oysters (pounds)	Mean seals at Drakes Estero	Max adult seals at PORE (PRNS)
1997	64	476,791		
1998	15	292,188		
1999	19	125,749		
2000	21	34,094	692	2576
2001	36	65,676	829	2617
2002	149	78,064	905	3272
2003	113	118,643	1080	3082
2004	183	96,754	905	3622
2005	75	138,958	836	2838
2006	88	291,538	863	2660
2007	62	466,503	748	2771

If indeed Allen and Neubacher in May of 2007 were in fact describing OB and not sandbar A in May 2007 when they claimed an 80% decline that was of “national significance”, then do the data support such a claim? Why focus on subsite OB? Was there a problem at OB in 2007?

Clearly, the major percentage drop in seals at OB was from 2004 to 2005, and not from 2005 to 2007 or from 2006 to 2007. But was this drop alarming? The data from 1997 to 2007 show that 2004 was a particularly high year. The mean number of seals for the period 1997-2004 was 75. The 2005-2007 mean numbers of 75, 88, and 62 also have a mean of 75. Thus, the mean for 1997 to 2007 is 75 at OB. There is nothing unusual about the number of seals at OB in 2005, 2006, or 2007. 2004 was the highest year over the 11-year period. 2005, 2006, and 2007 were normal years given the mean data over the 11-year period. If one examines the database, and moreover examines the survey forms for individual days, one discovers that there is enormous hour-to-hour and day-to-day variation at individual subsites.

I have analyzed the NPS data shown above from 1997 to 2007 to look for any correlation between the mean number of seals at subsite OB and the number of pounds of shucked oysters from Drakes Estero. Consider of course that such a correlation would not prove causation, and moreover, that it makes a major assumption that pounds of oysters are directly related to disturbances to the seals in the form of number of boat trips to subsite OB, number of worker hours at subsite OB, or number of oyster-related disturbances at subsite OB (for example, the number of boat trips are not linearly related to the pounds of oysters according to DBOC records). Nevertheless, let's take a look at this correlation, since it forms the basis of the Becker et al. paper in press. If seals went down at subsite OB as oysters went up, then we would expect to see a negative correlation of -1.0, or at least something above -0.5 and closer to -0.8 or -0.9.

To derive their correlation, Becker et al. did something that is highly unusual: they did not compare head-to-head numbers of seals vs. oysters for a given year, but rather they compared oysters produced in one year vs. seals at subsite OB in the year before. On page 11 of their manuscript, they explain why they did this one year offset when they wrote:

*“... oyster aquaculture activity measured as the weight of oysters harvested ( $\times 10^5$  lbs) the following year. The last factor was chosen a priori with a 1year time lag since time from oyster spat outplanting to harvest is about 18 months and any effects due to harvest levels should begin to be felt sometime during the 18 months prior to harvest<sup>8</sup>. The oyster harvest factor is assumed related to boat traffic, human activity, and oyster bag placement that may displace or disturb seals.”* [reference #8 is: Personal Communication, Tom Moore, Biologist, California Department of Fish and Game, Bodega Bay, California.]

However, they never checked with Kevin Lunny, owner of Drakes Bay Oyster Company, to determine if this was a reasonable assumption. It is not. NPS never told Lunny that they were working on a scientific paper concerning his oyster operation even though the terms of the lease require them to do so. Lunny was neither informed of their analysis, nor asked for his input. I recently asked Lunny, and he told me that the oysters only go out in the oyster bags at subsite OB or UEN in the last 3-4 months before they are harvested. They spend most of their life growing in Schooner Bay or other permitted locations in the estero. Thus, the number of pounds of oysters harvested from Drakes Estero should be compared to the same year when examining the impact on seals at OB.

The Pearson's correlation coefficient was examined comparing the mean number of seals (Apr 15 – May 15) at subsite OB vs. the oyster production (measured in pounds) for the years 1997-2007 in two ways: (i) same year analysis using numbers for the same year for seals vs. oysters, and (ii) one year offset as done by Becker et al. using the previous year number of seals vs. the oyster production.

<b>Years</b>	<b>analysis</b>	<b>correlation coefficient</b>
<b>1997-2007</b>	<b>same year</b>	<b>- 0.18</b>
<b>1997-2007</b>	<b>one year offset</b>	<b>+ 0.17</b>
<b>2000-2007</b>	<b>same year</b>	<b>- 0.11</b>
<b>2000-2007</b>	<b>one year offset</b>	<b>+ 0.19</b>
<b>2004-2007</b>	<b>same year</b>	<b>- 0.67</b>
<b>2004-2007</b>	<b>one year offset</b>	<b>- 0.61</b>
<b>2005-2007</b>	<b>same year</b>	<b>- 0.53</b>
<b>2005-2007</b>	<b>one year offset</b>	<b>- 0.78</b>

Three conclusions arise from this analysis.

First, when one examines the 11-year data from 1997 -2007, one sees that there is no meaningful relationship between seals at OB and oyster production in Drakes Estero. The correlation coefficient is – 0.18 when the data are examined for the same year, and reverse and show a positive but insignificant correlation of + 0.17 when the data are examined using the Becker et al. assumption with the one year offset. The same lack of significance is true for 2000-2007.

Second, the way to get a more significant negative correlation coefficient is to compare the years 2004 to 2007 (- 0.67), or 2005 to 2007 (- 0.53), and that correlation gets better (i.e., more negative to – 0.78 for 2005-2007) when one does the Becker et al. one year offset. Perhaps this is why Becker et al. used the one year offset.

Third, basing the conclusions of a paper solely on comparing the years 2002-2004 vs. 2005-2007 is faulty since (i) the 11-year data do not support the conclusion, and (ii) the seal populations across northern California were down by the same percentage during the years 2005-2007. The authors tell us that data prior to 2002

are influenced by an ENSO event (El Nino Southern Oscillation) as a way of justifying their focus on the 2004/2005 boundary, but do not consider other non-ENSO events influencing ocean conditions and food supply, for example, that might have influenced the entire northern California coast between 2005 to 2007.

We can do a further analysis and ask whether the correlation between the seals at subsite OB from 2000 to 2007 and from 2004 to 2007 is any different from the correlation with the Drakes Estero population or with the combined Pt. Reyes National Seashore populations along the northern California coast.

The Pearson's correlation coefficients are as follows (PORE = PRNS populations):

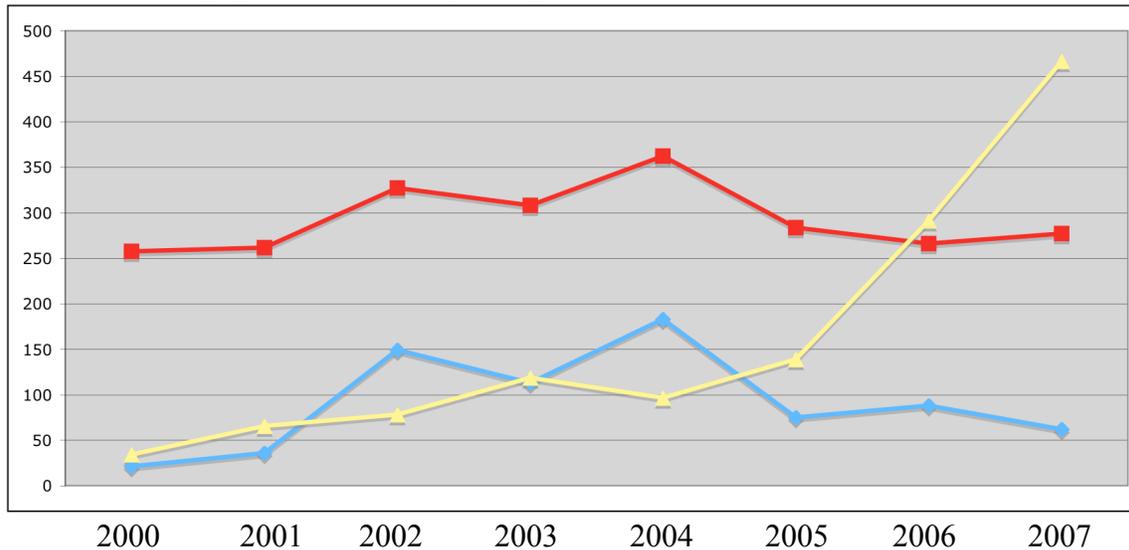
<b>Years</b>	<b>analysis</b>	<b>correlation coefficient</b>
2000-2007	mean OB vs. oysters	- 0.11
2000-2007	mean Drakes Estero vs. oysters	- 0.21
2000-2007	max PORE vs. oysters	- 0.23
2004-2007	mean OB vs. oysters	- 0.67
2004-2007	mean Drakes Estero vs. oysters	- 0.85
2004-2007	max PORE vs. oysters	- 0.64

We can conclude from this analysis that the mean number of seals in the Drakes Estero population and the maximum number of adults in the combined PORE populations correlate just as highly with the oyster production from 2000-2007 and from 2004-2007 as does the mean number of seals at subsite OB. Thus, the major conclusion from Becker et al., namely that as the oyster production goes up in Drakes Estero the number of seals at subsite OB goes down, is invalid.

Finally, I analyzed whether the mean number of seals at subsite OB correlated more strongly with the Drakes Estero and combined PORE populations or with the oyster production. The answer is with the overall seal populations.

<b>Years</b>	<b>analysis</b>	<b>correlation coefficient</b>
2000-2007	mean OB vs. oysters	- 0.11
2000-2007	mean OB vs. mean Drakes Estero	+ 0.64
2000-2007	mean OB vs. max adults PORE	+ 0.65

### Comparison of seals at subsite OB and surrounding combined PORE populations vs. oyster production from 2000 to 2007



red = maximum adults in combined Pt. Reyes National Seashore (PORE) sites (X 10)

blue = mean number of seals at subsite OB (Apr 15 – May 15)

yellow = oyster production in pounds (X 1000)

The graph above confirms what is shown in the tables in this section. The pattern of variation at subsite OB from 2000 to 2007 correlates with the pattern of seals in the surrounding combined PORE populations. There is no reason to conclude that the oyster production led to the changes at subsite OB from 2004 to 2007.

In summary, Becker et al. appear to make a limited analysis of mean seals at OB vs. oyster production (offset by one year) taking 2002-2004 and comparing it to 2005-2007 to derive their faulty conclusion that oyster operation disturbances were leading to a decrease in harbor seals at subsite OB from 2004 to 2007. The selective use of data from certain years led to a false conclusion. When we analyze a broader range of years, and also look for patterns in the Drakes Estero population and overall PORE populations, as suggested by NRC panel member Dr. Francis O'Beirn, this conclusion falls apart. Subsite OB correlates with oyster production no more than the entire Drakes Estero population or the combined Pt. Reyes National Seashore (PORE) populations. Clearly something else drove the modest decline from 2005 to 2007 across the northern California populations. NRC panel member Dr. Francis O'Bierns' instinct was right when he questioned Dr. Becker about this.

### Disturbances and Quality Control in Becker et al. in press

The data used in the Becker et al. paper for disturbances at subsites OB, UEF, and UEN are inconsistent with their stated QA/QC procedures, and in certain instances inconsistent with NPS data management protocols.

On pages 9 and 10 of Becker et al.'s manuscript for their paper in press, they

described their QA/QC procedures for disturbance data when they wrote:

*“Data on disturbance events at each subsite were compiled and classified based on whether they were caused by oyster vessels or other activities related to mariculture (“mariculture related” and “nonmariculture related” disturbances). We only analyzed events that resulted in head alerts or flushing toward or into water. To be conservative, if two or more activities (e.g., oyster boat and a kayak) appeared to cause a seal disturbance, the event was categorized as “nonoyster” related.”*

*“Prior to population analyses, survey data from Drakes Estero collected from 1997 – 2007 were filtered to remove: (1) data from observers with less than one year of survey experience, (2) observations at tide levels above +2 ft (+0.61 m) (MLW) when fewer seals would be present because some subsites might be submerged (Allen Miller 1988, Grigg et al. 2004), and (3) observation dates where weather reduced visibility.”*

In Dr. Ben Becker’s presentation to the NRC Ocean Studies Board panel on September 4, 2008, he described the same QA/QC procedures for disturbance data when he said:

*“The disturbance events that Corey submitted and threw up there were, I’d really like to review those with him and with the database manager. It might be more appropriate to have an analyst look at those independently, but there’s definitely some disagreement it sounds like. I can definitely say this: the database manager and I went through the disturbance event by disturbance event making sure it was valid and if there was a kayak and an oyster disturbance event at the same time, we threw it out.”*

However, three out of four of the mariculture-related disturbance dates listed for 2006 and 2007 on Table 1 do not meet what should have been Becker’s criteria for data entry. Becker et al. should have rejected these disturbance dates by the standards imposed by the authors on themselves, and by the NPS database management QA/QC criteria.

Moreover, all three of the mariculture-related disturbance dates listed for 2007 occurred between April 26 and May 8, during the period after Superintendent Neubacher told Marin Supervisor Kinsey on April 5 that he had overwhelming data on harm by DBOC to the harbor seals (which he did not) and after Dr. Allen told Joe Cardaro of NOAA on April 24 that NPS had “no direct observations” of DBOC disturbing the harbor seals (which is consistent with the NPS harbor seal database).

First, the one and only 2006 mariculture-related human disturbance shown on Table 1 does not meet either the author’s stated criteria or the NPS QA/QC criteria. This disturbance occurred on May 6, 2006. It is not described in the

“source” column of the database as being caused by an oyster boat, but rather is described as a “motor boat” and in the “source specific” column as “1 blue-yellow motorboat”. Kevin Lunny and DBOC do not own a blue-yellow motorboat. The DOI IG report of July 21, 2008 confirms that Lunny does not own a blue-yellow motorboat. I recently asked Lunny if he has ever had a blue-yellow motorboat, and he answered no. The May 6, 2006 listing in the database has the following statement in the “comments” column to the far right: “blue yellow, possibly oyster related zipped through the channel and headed in the direction of Johnson’s”.

Does a “possibly oyster related” observation of a boat that Lunny does not own constitute an appropriate mariculture-related disturbance to put in the paper and thus create the “14%” mariculture-related disturbances in 2006 in Table 1 and Figure 2B? This May 6, 2006 disturbance is the only mariculture-related event for listed for 2006, and the only one prior to Neubacher’s April 5, 2007 statement to Supervisor Kinsey in which he claimed to have overwhelming evidence (which he did not). According to what Becker told the NRC panel, he went through this database “disturbance event by disturbance event” with the database manager (Dave Press). Does this record meet the standard to be included in his publication and analysis? Does this constitute a record of an oyster farm-related disturbance?

Second, one of the three mariculture-related human disturbances in 2007 (Apr 26) shown on Table 1 (Apr 26, Apr 29, and May 8) does not meet those criteria, and another (see #3 below) is also questionable. The disturbances from Dr. Allen’s Apr 26 Trip Report (see pages 75 to 92 from the hand-out I gave the NRC panel) are controversial and should not have been included. DBOC records show that the boat observed was not in the water that day; the engine was being repaired. DBOC records show that the oyster works observed had already clocked out on shore and gone home. The proper harbor seal disturbance form was apparently not filled out. The Apr 26 2007 data was not entered into the NPS harbor seal database as of Aug 13 2007 when the QA/QC database was given to me. Lunny filed a complaint about the Apr 26 Trip Report with the California Coastal Commission, and copied his complaint to the NPS, in September 2007. NPS never replied. This Apr 26 Trip Report data was finally, after a complaint was filed, entered into the NPS database that was given to me on January 16, 2008. The NPS protocols say that data should be entered into the database within one week, not 9 months later. The NPS protocols say that any change to the database should be thoroughly described in the edit log, but the edit log provided to me by NPS on August 25, 2008 in response to my FOIA request includes around 75 entries from 2000 to 2007, but it neither includes an entry for the change made in entering the Apr 26 2007 data nor an explanation of why this entry improved the integrity of the database.

Third, the May 8, 2007 disturbance is also controversial, as described in my December 18, 2007 report to the NRC Ocean Studies Board which I copied to NPS Bomar, Jarvis, Neubacher, and Allen. The NPS never responded. On page 34 of that report, I wrote:

*“The next and only other recording in the NPS database of the*

*oyster farm causing seal flushing is on May 8<sup>th</sup>, the very day of the Marin County Board of Supervisors hearing (the coincidence factor is troubling). The NPS database records 113 seals getting flushed into the water by an oyster boat on that morning. But the May 8<sup>th</sup> observation has some other peculiarities in addition to the date. The time is odd. The event starts at 8:45 am, about 2 hours before low tide, when observations are normally made around low tide. But the real oddity is the simultaneous timing.*

*The observers report an oyster boat (or boats?) simultaneously causing seals to flush on three different islands: UEN, OB, and UEF. UEN and UEF are over one mile from each other. Was it one boat at all three locations? This seems physically impossible. Or was it three different boats? But Lunny doesn't have three different boats. There are no other records of disturbances for another 2 hours, and then from 10:40 am until 11:25 am, right around low tide (the normal time for observations), there are 6 additional records of disturbances (mostly by an aircraft)."*

In summary, the May 8, 2007 disturbance record claims that at 8:45 am – coincidentally the morning of the Marin County Board of Supervisors hearing -- that a single oyster boat caused simultaneous flushing of seals from three different islands (UEF, OB, and UEN) that are over one mile apart at precisely the same minute. This would appear to be physically impossible. The NPS has never clarified this data entry, even though I questioned its veracity in my December 18, 2007 report to the NRC and NPS. Should it have been included in the Becker et al. paper as one of three disturbances in 2007 that are mariculture-related? Do these data rise to the QA/QC standards claimed by Becker in his paper and presentation to the NRC panel?

The NPS Becker et al. paper includes seal disturbance data, and calculates percent of disturbances due to the oyster operation (a misleading calculation given the small sample size), without considering the number of disturbances per survey. Since there were twice as many survey in 2007 vs. 2006 (48 vs. 24 during the pupping season), the number of disturbances per survey actually went down in 2007 (see previous powerpoint slides submitted to NRC and Marine Mammal Science journal editor). Human disturbances at subsites UEF, OB, and UEN per survey were 0.13 in 2005, 0.29 in 2006, and 0.15 in 2007. These numbers do not correlate with oyster production (Pearson's correlation coefficient of + 0.08) but do correlate (in what I hope the reader agrees is a rather meaningless way) with mean number of seals at subsite OB (+ 0.80).

Neither Becker et al. nor Lunny would want us to think that as human disturbances at subsites OB, UEF, and UEN go up, that the number of seals at subsite OB goes up. Yet that is just the kind of false correlation you can make when you selectively pick and choose numbers from just a few years and a small number of samples.

**In conclusion, the NRC scientists and MMC reviewers should carefully look at the NPS database and harbor seal survey forms, and do their own statistics, before accepting the conclusions in the Becker et al. paper. That paper's conclusions are flawed and are not supported by a broader analysis of the NPS harbor seal database for Drakes Estero and surrounding PORE populations.**

**The NPS needs to explain to the NRC panel and the Editor of Marine Mammal Science, why NPS did not include the concomitant changes in the Drakes Estero population and surrounding combined PORE populations. This is precisely what NRC panel member Dr. Francis O'Beirn requested in his questions at the end of Dr. Becker's presentation on September 4, 2008. How did the NPS determine cause and effect in their analysis?**

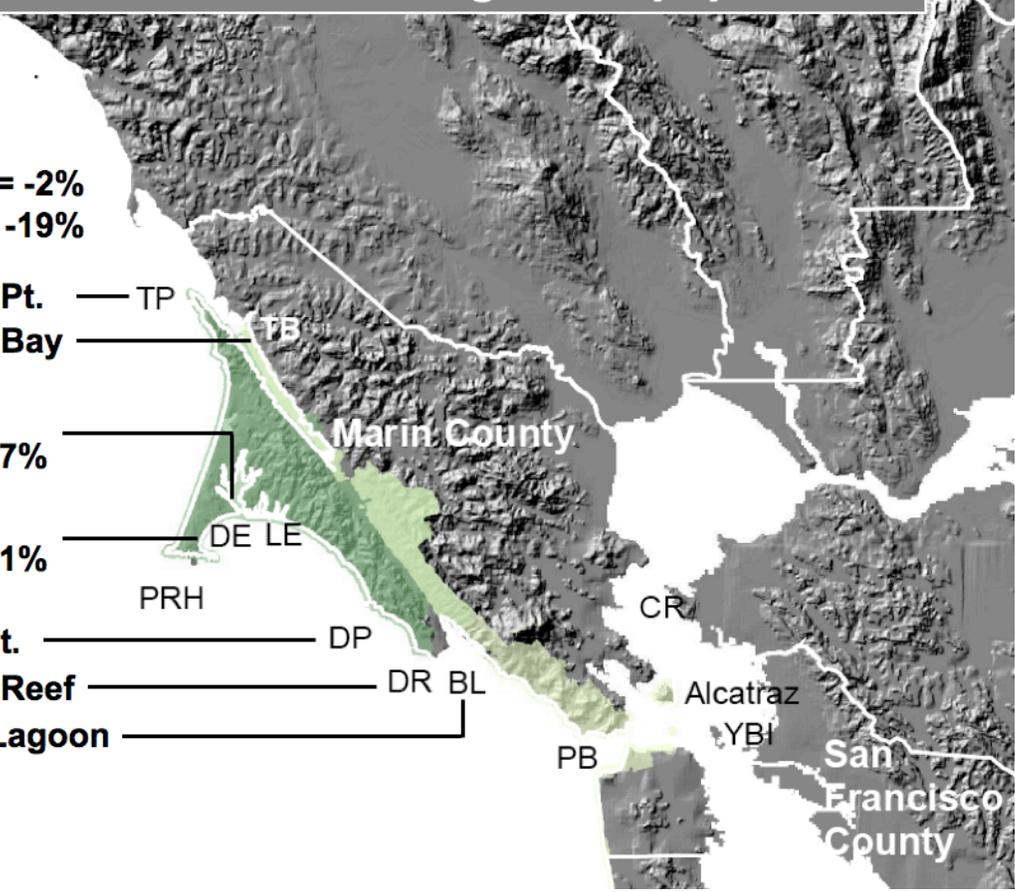
**The NPS has harbor seal data going back to 1991 (see graph on next page from May 2007 NPS Report). Dr. Allen has access to data going back to the 1970's. A proper statistical analysis should be done to compare seals with oyster production over this period. As Dr. Allen concludes in the May 2007 Report: "The 2006 pup count was 6% lower than 2005, but still within the normal range of variation for the past 10 years." The same conclusion could be drawn for the 2007 adult and pup counts. With the exception of sandbar A, the other subsites, and overall Drakes Estero population, were within the normal range of variation in 2007 when compared to the past 11 years.**

cc: NPS Deputy Chief Scientist Dr. Dennis  
NPS Regional Director Jarvis  
NPS Superintendent Neubacher  
NPS Staff Scientist Dr. Allen  
NPS Staff Scientist Dr. Becker  
Editor Marine Mammal Science Dr. Boness  
DBOC Lunny

**2005-2007 change at Drakes Estero subsite OB vs. Drakes Estero and surrounding PORE populations**

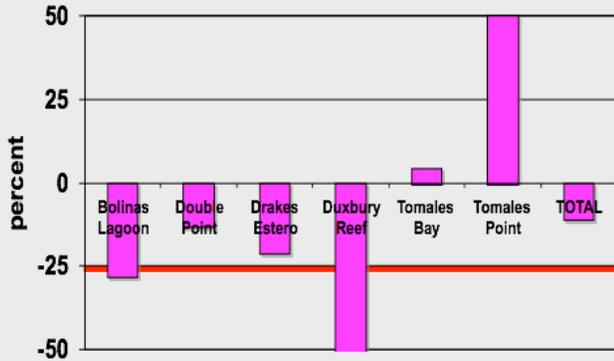
PORE max adults = -2%  
 PORE max pups = -19%

- Tomales Pt.** — TP
- Tomales Bay** — TB
- DE subsite OB**  
mean seals = - 17%
- Drakes Estero**  
mean seals = - 11%
- Double Pt.** — DP
- Duxbury Reef** — DR
- Bolinas Lagoon** — BL

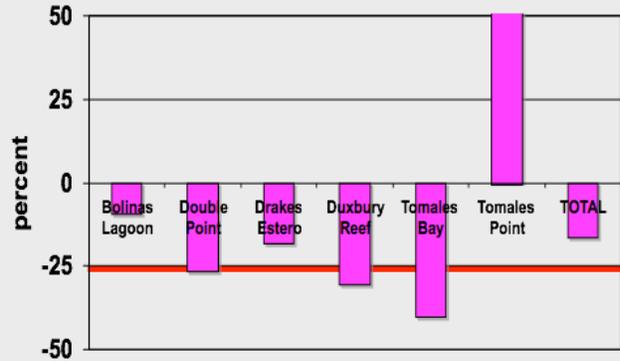


## Seals & pups in Estero in 2007 compared to other sites

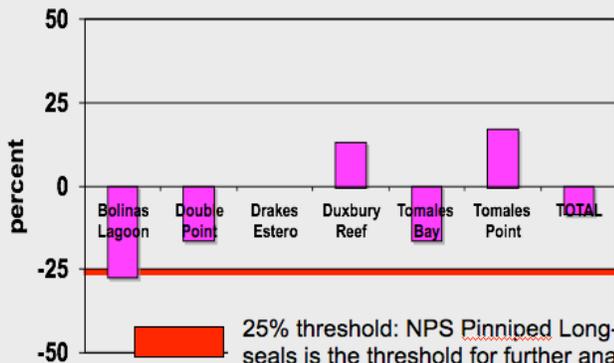
**Maximum Pups 2007 vs. 2006**



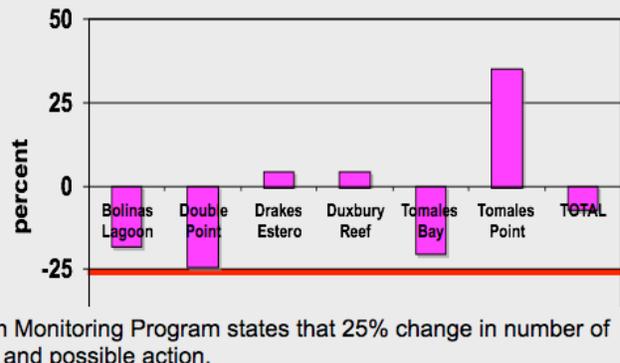
**Maximum Pups 2007 vs. 2005**



**Maximum Adults 2007 vs. 2006**



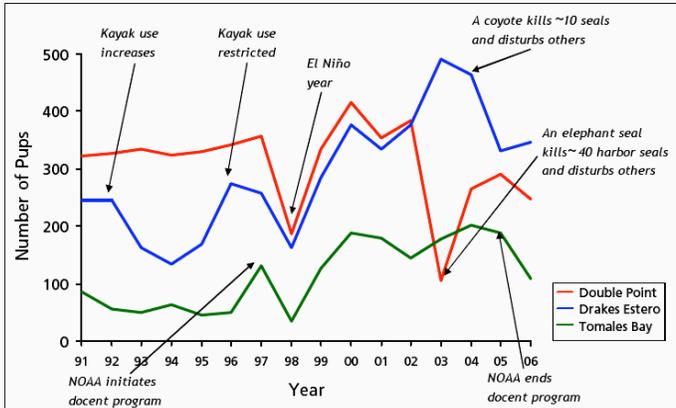
**Maximum Adults 2007 vs. 2005**



**25% threshold:** NPS Pinniped Long-Term Monitoring Program states that 25% change in number of seals is the threshold for further analysis and possible action.



# Harbor Seal Monitoring at Point Reyes National Seashore and Golden Gate National Recreation Area



The harbor seal pup population is sensitive to human disturbance, climate variability and interactions with other species. Different management approaches also affect the seal population.

**Preliminary Results:** Harbor seal colonies are stable, but vulnerable to human disturbance and climate change.

The harbor seal population at PORE has increased over the past 30 years. However over the past few years, the population has stabilized and may be at carrying capacity for haul-out space and/or food availability. The 2006 pup count was 6% lower than 2005, but still within the normal range of variation for the past 10 years. Humans on foot were the primary cause of 21% of all disturbances, non-motor boats were 13%, and motor boats were 11%. The park has adaptively managed seal colonies by restricting human activity in places where disturbances prevented seals from resting onshore. Boating, for example, is restricted from March through June in Drakes Estero to protect pupping seals.

