

**Briefing Statement - National Park Service Response to  
Goodman's January 18, 2009 Letter to NRC  
May 1, 2009**

This briefing statement addresses allegations and criticisms put forth in a January 18, 2009 letter from Dr. Goodman to the National Research Council (NRC). There are additional documents in support of this rebuttal. Dr. Goodman has made several accusations that fall into three categories: falsified data, manipulated and withheld information, and not following NPS protocols. His accusations are based on a number of assumptions, little data and faulty analyses. Here, we refute the accusations with sound data and scientific analyses.

**Allegations of falsified data**

The allegation of falsified data on April 29, 2007 is based on several incorrect assumptions. Dr. Goodman assumes that the seals do not use the site when sandbars are submerged and that seals are not disturbed by sources > 300 ft away. This is no supporting evidence for these allegations.

- Seals regularly hover over and rest on sandbars in Drakes Estero and elsewhere before the sandbars are exposed by falling tides. Also, disturbances of seals documented by NPS were recorded during the *breeding* season when females and pups are commonly on the sandbars. Dr. Goodman used incomplete tidal data for his analyses and analyzed tidal effects during January when seals are less common at the site.
- Dr. Goodman implies that seals could not be disturbed at distances greater than 300 ft. The National Marine Fisheries Service recommends generally a distance of 300 ft for not disturbing marine mammals; however, the published literature is replete with information on harbor seals disturbed at greater distances.

**Allegations of manipulated and withheld data**

The record of Dr. Becker's communications to the NRC and the editor of the Journal of Marine Mammal Science (MMS) demonstrates clearly that NPS did not manipulate data or mislead either the NRC (in his presentation to the NAS panel in September 2008 and in the final published paper in MMS which he shared with them) or the editor of MMS (in correspondence back and forth in final preparation of the paper). In the process of revising the paper, Dr. Becker found additional disturbances in the database that were missed during the first version of the paper but those omissions were rectified and fully explained to both the NRC and the MMS editor.

**Allegations of NPS failing to follow protocols and QA/QC**

Dr. Goodman challenged the validity of the survey on April 29, 2007 because he states that it did not meet the protocol criteria of the pinniped monitoring program based on tide height and the experience of the volunteers. The MMS paper clearly states that *count* data were filtered for date, observer experience, tide and weather. However, *disturbance* data are not subject to these criteria. Disturbances can be recorded at any tide, weather, or observer experience level. First year observers, all of who must attend trainings, have the ability to observe, for example, a motorboat flushing harbor seals off a sandbar. Furthermore, it is irrelevant whether a disturbance occurs in poor weather conditions or at a high or low tide. Nevertheless, the volunteers in question had at least one previous year of experience which Dr. Goodman did not recognize from the pinniped database, and their count data met the protocol for tide level.

We note that in previous letters from Dr. Goodman that he criticized the NPS statistical modeling techniques. His critiques were closely examined by editors and peer reviewers at MMS and were flatly rejected. He now primarily focuses on data handling and alleges NPS falsified data that were independently collected by several different volunteers and NPS staff. We find Dr. Goodman's statements misguided as evidenced by the conclusions of both the editors of MMS and the DOI Inspector General that there was no evidence of scientific misconduct. Separately, the NRC refused to consider his allegations of scientific misconduct.

**National Park Service Response to  
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This document addresses the allegations and criticisms put forth in a January 18, 2009 letter from Dr. Goodman to the National Research Council (NRC). We are not addressing all of the allegations in the letter because many of them were presented in earlier letters of Dr. Goodman that we previously rebutted. Because Dr. Goodman's letter addresses many themes and frequently revisits them in a non-linear fashion, we have reorganized what we believe are the salient points and address them in turn below. Several of the short responses below are supported by additional referenced documents that are attached in appendices.

**1. Allegation that NPS falsified data on harbor seal disturbance events.**

Dr. Goodman states on page 2 and on numerous other pages in his letter to the NRC that

*“Simply said, NPS presented you with false science. It is physically impossible for the disturbance events to have taken place as described...”*

The allegation of falsified data on April 29, 2007 is based on several incorrect assumptions. Dr. Goodman assumes that the seals do not use the site when the sandbars are submerged, that seals are not disturbed by sources > 300 ft away, that DBOC generally does not operate on Sundays, and that several volunteers and NPS staff separately fabricated disturbance data on several days of field observations. There is no supporting evidence for these allegations and we refute them with actual data.

- Assumption that seals do not use submerged sandbars (Goodman Letter, pages 7-12) Seals (especially mothers with pups) regularly hover over and rest on sandbars in Drakes Estero before they are exposed by falling tides, and this is a common behavior of harbor seals elsewhere. NPS has time stamped images of seals on the sandbars at similar falling tides during the 2008 *breeding* season in Drakes Estero. Furthermore, the disturbances documented by NPS were recorded during the breeding season when females and pups are commonly on these sandbars. Seals use these sandbars less frequently during January, the time of the “experiment” that Goodman cited in his letter. See **Appendix A** regarding tidal comparisons.
- Assumption that seals are not disturbed beyond the 300 foot Protective Zone (Goodman Letter, page 6) Dr. Goodman states that DBOC agreed to a 300 foot protective zone, and therefore, implies that seals could not be disturbed at distances greater than 300 ft. The National Marine Fisheries Service recommends a distance of 300 ft (100m) for not disturbing marine mammals; however, there is ample information in the published literature that documents harbor seals being disturbed at greater distances. Johnson and Gutierrez (2007) document power boats disturbing harbor seals in Washington at an average distance of 625 ft

(190.5 m) and as far as 1217 ft (371 m). Suryan and Harvey (1999) in another study in Washington document that 25% of disturbances to harbor seals occurred at a distance of 656-984 ft (200-300 m). Aircraft at high altitude also disturb harbor seals depending upon the amount of noise generated by the aircraft. It is not unreasonable that harbor seals in Drakes Estero were disturbed by boat noise generated at distances greater than 300 ft.

- Assumption that DBOC does not operate on Sundays (Goodman Letter, page 5) The April 29, 2007 disturbances occurred on a Sunday, however, Dr. Goodman states that DBOC does not normally operate on Sundays. We do not know at what frequency that DBOC boats operate on weekends; however, the DOI OIG investigation reports from an interview with the Chief Ranger of Point Reyes National Seashore that “Smith said that it was not uncommon for DBOC employees to take boats out into the estero after hours to fish.” (see page 26 of the DOI-OIG report July 2008). The NPS harbor seal monitoring database also reports DBOC activity in Drakes Estero on Sunday, May 11, 2007. In addition, NPS has time stamped images of a DBOC boat present on Drakes Estero on March 23, 2008, also a Sunday.
- Assumption of improbability of disturbances (Goodman Letter, pages 6-7) Dr. Goodman discounts the two April 29 disturbance events partly because they occurred so close together (50 minutes) that the boat would not have had enough time to return to the dock, pick up more bags, and then travel back to sandbar UEN. In fact, the volunteers never stated in their field notes that the boat returned to the dock and then came back between the disturbance events. There is no basis for Dr. Goodman to have assumed this, and subsequently discounting the events as logistically impossible is unclear. Possibly, the boat staged its operations from a barge moored within Drakes Estero, which is a common practice.
- Assumption that there are no other DBOC disturbance records (Goodman Letter, page 5) Dr. Goodman incorrectly states that as of April 29, 2007 there were no data documenting disturbances to harbor seals by DBOC. In fact, the database contains unambiguous records from April 26, 2007 documenting disturbances at multiple sites. An additional disturbance occurred the previous year on May 6, 2006.
- Assumption that the count occurred on April 29 at 3:15 PM (Goodman Letter, page 7) Dr. Goodman used a different time at which the volunteers conducted their full count of Drakes Estero from what is in the pinniped database. The database and datasheet clearly document that the data were collected at 2:15 PM. However, apparently based on a note on the photocopied datasheet Dr. Goodman assumes that the data were collected at 3:15 PM in his letter.

*“Based upon the tide chart with appropriate lag correction, it would have been difficult if not impossible for them to count seals on UEN and OB until 15:15. If*

*the tide was too high and they couldn't count the seals on UEN or OB until 15:15, then how could they record a disturbance at 12:50?"*

The field data sheet from the survey on April 29, 2007 reads, "poor tide – counted when could – had to leave at 3:15." Dr. Goodman mistakenly concluded that the volunteers could not count the harbor seals until 3:15 PM, which incorrectly supported his claims that earlier disturbances could not have occurred.

## **2. Allegation that 2003 disturbance data were covertly manipulated among versions of the MMS paper:**

Dr. Goodman states on page 16 in his letter to the NRC that:

*"The 2003 disturbance data changed from Becker I to Becker II with no comment about why these data were missed in Becker I or how they were found for Becker II."*

During preparation for the first Marine Mammal Science (MMS) journal submission, Becker inadvertently overlooked the 2003 disturbances. The datum (one disturbance) was in the dataset that D. Press, the NPS data manager, provided to Becker preparing the first MMS manuscript. While preparing for the NRC presentation on September 4, 2008, Becker realized his error of omission, and *therefore, included an asterisk by the 2003 data with "possible disturbance" on the NRC presentation (see Appendix B)*. Additionally, in Becker's Sept. 22, 2008 letter to the MMS editor, he clearly included this one disturbance in an analysis on page 8 (that particular analysis was not used in the final paper).

Then, after the NRC meeting, when revising the MMS paper in late September, 2008, and after the first letter was sent to MMS, D. Press found an additional disturbance event in the comments section of the data sheet for that the 2003 survey day. In sum, there were two actual disturbances in 2003. Becker incorporated both into the final paper which he shared with NRC as soon as it was accepted by the editor of MMS. The MMS editor himself read through and made minor editorial corrections on the near final copy of the paper with the corrected two disturbances in it. Thus, communications to both the NRC (in the presentation and in the final paper) and the MMS editor (in correspondence back and forth) clearly demonstrate that the NPS was openly exchanging information.

## **3. Allegation that NPS withheld information from the MMS editor.**

Dr. Goodman states on page 19 that

*"In his (Becker's) statement in the results section of his paper on lines 319-329, he told us one important fact that he did not tell the Editor in his cover letter when he wrote:*

*"For example, there was still a significant positive correlation ... of disturbance rate with oyster harvest even when removing the 2006 disturbance, four of the*

*2007 disturbances (including two disturbances on one day in 2007 that the mariculture company challenged), and four of the 1996 disturbances (nine total) from the analysis””*

Goodman’s allegation is incorrect. We sent the editor this sample paragraph before final re-acceptance of the paper. The editor approved, and it was included in the final paper. See attached email to the MMS editor in **Appendix C** of this correspondence.

Furthermore, we addressed each one of Dr. Goodman’s September 2008 criticisms directly with the MMS Editor, who in addition to reviewing them himself, passed them on to the Associate Editor of MMS and the two original peer reviewers. Thus, the notion that we cherry-picked data or misled the reviewers in any way is incorrect. In fact, we pointed the reviewers and editor to the DOI Inspector General report. The MMS editor also corresponded directly with the NRC and The California Department of Fish and Game. We also offered to the MMS Editors our raw data and NPS pinniped database, so they could conclude for themselves whether the datasets were credible, that our handling of the data was appropriate, and whether Dr. Goodman’s allegations had any merit.

Dr. Goodman also alleges that by our performing the correlations without some of the disturbances in order to show their robustness of the correlations, we are acknowledging that these disturbances are false. This is incorrect. After discussion with the MMS editor, we chose to include this statement (quoted above) to show that even if some disturbance data are questioned, the positive correlation still exists when those data are not considered. Dr. Goodman had previously disputed only the NPS Trip Report of April 26, 2007 conducted by S. Allen. To demonstrate the robustness of the analyses to small sample size, we removed several disturbances, including the April 26 survey.

#### **4. Inclusion of the 1996-1999, and 2008 disturbance data in the second paper.**

Dr. Goodman states on page 2 that:

*“In Becker II (the second revised version of the Becker et al. paper), Becker cherry-picked the data by arbitrarily going back to 1996 (instead of just 2000) to claim six oyster related disturbances in 1996 (and none in 1997-1999). Four of those six disturbances were fabricated.”*

We incorporated more years at the suggestion of Dr. Goodman’s comments to the NRC and MMS in September of 2008. There is no cherry-picking as we included all appropriate data. The 1996-1999 data were not in the database upon preparation of the first version of the MMS paper, but we were able to compile and access it for the revised second submission. Similarly, we had not looked closely at the 2008 disturbance data prior to the first submission, but revisited it for the revision.

On page 2 of his report, Dr. Goodman asserts that we falsified disturbance records in 1996 to improve our statistical results and create a more dramatic graph.

The NPS pinniped database indicates **four** disturbances in 1996. Due to Dr. Goodman's query, we have realized that we accidentally included two *potential* disturbances from 1996 in our calculations since they had a "disturbance = "Yes" entered in the database. In fact, there were 4 oyster related disturbances and 2 oyster related *possible* disturbances. We regret this error but it nonetheless does not alter the statistics or conclusions in any way. We will inform the Editor of MMS of our error and seek his guidance on whether a correction is warranted.

Nevertheless, the removal of two disturbances in 1996 does not change any conclusions or patterns described in the paper (see **Appendix D**). 1996 is still the year with highest rate of disturbance, and the significance and correlation of the oyster harvest-disturbance rate remain exactly the same since we used ranks tests for the analysis. See **Appendix D** for original and new plots. Thus, Dr. Goodman's allegation that we purposely increased the number of disturbances in 1996 to "help" our statistics or create a more dramatic graph is inconsistent with the facts and the analyses.

We assume Dr. Goodman only counts two disturbances in 1996 (rather than four) because he characterizes two of the motorboat related disturbances as non-oyster related while we consider these to be oyster related. As is well known, only oyster company motor boats are allowed in the Estero without special permission and this closure has been in effect since the early 1990s. Goodman's statement that "*many fishing and recreational motorboats enter the estero*" on page 17 of his letter is not supported by park records including law enforcement case reports, harbor seal monitoring field notes and park staff observations.

Finally, cherry-picking is alleged because we did not analyze other disturbance sources in the estero (other than to note the relative frequency of human related disturbance is higher in the lower estero because some of lower estero haul-out sites are attached to the mainland). On November 12, we provided the NRC with a justification for solely analyzing the mariculture related disturbances and we explained in the MMS paper. See **Appendix E**.

##### **5. Allegation that NPS did not follow stated QA/QC protocols:**

Dr. Goodman states on page 12 that:

*"April 29, 2007: Disturbance Survey Violated NPS Protocols."*

Dr. Goodman challenged the validity of the survey based on tide height and the experience of the volunteers on April 29, 2007.

- The MMS paper clearly states that *count* data were filtered for date, observer experience, tide and weather. However, the disturbance data were not subject to these criteria. Disturbances can be recorded at any tide, weather, or observer experience level.

Dr. Goodman appears to have misunderstood NPS procedures for reviewing harbor seal data prior to analysis. All data that we receive from volunteers are entered into the database and prior to analyzing and reporting the data, we review the *count* data to see if any of the surveys were of potentially poor quality and should be discarded from our analysis. Records are never discarded from the database itself, which remain important NPS records.

Each survey is evaluated and assigned a “HighQualityCount?” value of “yes” or “no”. A survey may be of poor quality and assigned a value of “no” for the following reasons:

- poor visibility
- not all subsites were surveyed
- poor observer quality of *all* survey participants
- other comments noted on the datasheet, especially in regard to weather conditions

In addition, for the purposes of the Becker et al. paper, we limited the count data used to surveys collected on days with a 2.0 ft tide or less. For our analyses, we extracted the maximum count per survey, and we checked to ensure that the count occurred at a reasonable time in relation to the low tide time.

A key point that Dr. Goodman misrepresents is that although we review each disturbance record in the database for accuracy against the paper data sheet, we do not enforce the additional, above QA/QC procedures on the disturbance data. This is clearly outlined in methods section of the MMS paper. We have confidence that our first year observers, all of who must attend trainings, have the ability to observe, for example, a motorboat flushing harbor seals off a sandbar. Furthermore, it is irrelevant whether or not that disturbance occurs in poor weather conditions or at a high or low tide.

- Dr. Goodman asserted that the volunteers (Mr. and Mrs. Leite) who surveyed on April 29, 2007 did not have more than one year of survey experience and that their first survey was on March 24, 2007 (page 15). This is in fact the date of their first survey in *Drakes Estero*. The Leites, however, began volunteering with our program in April of 2006, spending most of their time at Bolinas Lagoon and Duxbury Reef. In addition, March 24 was not their first survey of the 2007 monitoring season. The databases that store these surveys were delivered to Dr. Goodman in his FOIA requests dated August 2007 and January 2008. In short, the Leites did meet our criteria of having at least one year of prior experience in our program before including their data for analysis.

## **6. Statement that the MMS paper title is incorrect.**

Dr. Goodman states on page 25 that:

*“Becker cherry-picked the 1996 data, but never changed their title or abstract, which still begins with 1997.”*

The paper clearly models data only from 1997-2007, as the title describes. As is clearly explained in the paper, we include disturbance (but not *count*) data from 1996 and 2008. This data is not modeled but only used to report disturbance patterns. Count data were not complete enough to pass QA/QC protocols for 1996, and we did not model 2008 data since it was after reaffirmed guidelines that DBOC avoid seal areas during the breeding season. In fact, eliminating disturbance data that we had available (e.g., 1996 and 2008) would actually be cherry picking. It is difficult to see how including all available data is cherry picking.

## **7. Application of Spearman ranks test to test for correlation between disturbance rate and oyster harvest:**

Dr. Goodman states on page 19 that:

*“Becker told us that “This correlation is highly robust to sample size.” As framed by Becker, this may be technically correct given that he cherry-picked both the data he included and the data that he excluded, but it is highly misleading. It is not because the data are so strong, but rather because this kind of correlation (in this case using 1-tailed Spearman ranks test) is a weak test, and can be driven by a single anecdotal observation.”*

Contrary to Dr. Goodman’s assertion, the S-plus statistical software user’s manual indicates that:

*“Because both Kendall’s and Spearman’s methods are based on ranks, they are not so sensitive to outliers and non normality as the standard Pearson estimate.”* (Insightful 2003).

Furthermore, in the MMS paper, our demonstration of the removal of several disturbances with continuing significance proves that the test is not succumbing to the effects of a “single anecdotal observation”. Other correlation tests show similar results. Specifically, Pearson correlations (although not appropriate) and Kendall’s Tau (which is an appropriate test).

Dr. Goodman also indicates that we must have gone back to the 1996 data only to get a stronger correlation (Page 22). However, if only considering the disturbance rate from 2000 – 2008, the P value is similar ( $P < 0.03$ ), and the Spearman correlation is actually higher ( $r_s = 0.69$ ) than the full time series. Thus, there is no basis for the allegation that we cherry picked data (omission or commission) to improve our statistical results.

## **8. Conclusion**

We note that in previous iterations of his statements, Dr. Goodman criticized our statistical modeling techniques, which are all standard professional practice. His critiques

were closely examined by editors and peer reviewers at MMS and flatly rejected. He now primarily focuses on data handling and alleges we falsified data that were independently collected by several different volunteers and NPS staff. We find Dr. Goodman's statements misguided as evidenced by the conclusions of both the editors of Marine Mammal Science and the DOI Inspector General that there was no evidence of scientific misconduct (see **Appendix F**). Separately, the National Research Council refused to consider his allegations of scientific misconduct. Lastly, during the preparation of the MMS paper and NRC presentations, the database we were working with was available to several different groups, including Dr. Goodman and the NRC. We also offered it to the editor of Marine Mammal Science. Thus, there is no basis for the allegation that we are manipulating data; the raw data are available for these groups to see and arrive at their own conclusions about our analyses and interpretation. Nevertheless, we treat with utmost seriousness Dr. Goodman's persistent allegations of scientific misconduct.

We stand by our procedures and methodology, which are scientifically sound. While we welcome critiques of our scientific studies, the pattern of Dr. Goodman's attacks is concerning insofar as it suggests that his primary goal is not to improve the scientific methodology used by the Park, but rather to cast doubt on the credibility of particular individuals. We value the hard work of the park volunteers, and are saddened to see their veracity questioned in so untoward a manner. We will continue to defend the integrity of our scientific studies and programs.

## **References**

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# **APPENDIX A**

**Appendix A**  
**NPS Review of Tidal Patterns and Harbor Seal Behavior in Drakes Estero**

On January 18, 2009, Dr. Goodman submitted a document to the National Research Council entitled “New Information Shows that the National Park Service Committed Scientific Misconduct in the Documents it Presented to Your Panel”.

Dr. Goodman devotes much of this document to discrediting harbor seal data collected in Drakes Estero on April 29, 2007. On this date, volunteers noted two disturbances by Drakes Bay Oyster Company (DBOC) when workers in a motorboat dropped oyster bags on a sandbar. Dr. Goodman challenged the validity of the April 29 survey based in part on the tide chart for that day and subsequent analysis of tidal patterns in Drakes Estero. Dr. Goodman concluded that no such disturbances could have occurred on April 29, 2007 because the tide was too high.

The April 29 survey began at 9:30 AM and concluded at 3:15 PM, as noted on the datasheet for that day. The harbor seal monitoring program standardizes its tides to San Francisco (Golden Gate Bridge), and the low tide for April 29 was 1.46 ft at 4:25 PM. The first DBOC disturbance occurred at 12:50 PM from DBOC’s motorboat. The observers noted that at sandbar UEN, “mom and pup flushed when boat accelerated toward Bull Point from N. end of OB channel after throwing out bags.” The second DBOC disturbance, again at sandbar UEN, occurred at 1:40 PM when the “boat returned, threw more bags, left again.” The observers conducted the first and only full count of the harbor seals in Drakes Estero at 2:15 PM, documenting a total of 751 harbor seals. The events of the April 29 survey are summarized in Table 1.

Table 1. Summary of significant events on April 29, 2007. Low tide is standardized to San Francisco (Golden Gate Bridge).

<b>Time</b>	<b>Time before low tide</b>	<b>Survey Event</b>
9:30 AM	6 h 55 m	Start of observations.
12:50 PM	3 h 35 m	First DBOC disturbance at sandbar UEN.
1:40 PM	2 h 45 m	Second DBOC disturbance at sandbar UEN.
2:15 PM	2 h 10 m	Complete harbor seal count.
3:15 PM	1 h 10 m	End of observations.

DBOC attempted to better understand how the tides may have looked on April 29, 2007 by asking John Hulls of the Point Reyes Light newspaper to conduct an experiment. Mr. Hulls selected tides on January 1 and 2, 2009 and measured the high tide at sandbar OB to determine that there was an approximate 1.3 hr lag compared to the Point Reyes NOAA buoy tide chart. More importantly, Mr. Hulls measured the tidal heights at which the very highest points on UEN and OB first rose above the water, which were at +3.0 ft and +2.0 ft, respectively. Based on Mr. Hulls’ observations in January 2009, Dr. Goodman went back to April 29, 2007 and concluded that the sandbars in Drakes Estero must have been underwater at the time of the disturbance events on that date and, therefore, no seals could have been present to be disturbed.

Dr. Goodman and Mr. Hulls missed several important points in their attempts to 1) model the tides at subsites OB and UEN in Drakes Estero and 2) subsequently predict harbor seal use of these subsites at certain tide levels. We find Mr. Hulls' experiment without merit and find it unreasonable for Dr. Goodman to discredit the April 29, 2007 survey based on an incomplete investigation of tidal and seal haul-out relationships.

Mr. Hulls and Dr. Goodman failed to recognize common harbor seal behavior which invalidates their conclusions that there were no harbor seals present to disturb on April 29, 2007. Researchers of harbor seals at Point Reyes and elsewhere have noted the presence of seals hovering nearby and over the haul out sites before sandbars are exposed by low tide and after sandbars are submerged by rising tides. This is particularly important for females with pups where they can nurse their pups in shallow waters. Flushing harbor seals from a submerged sandbar is entirely possible, and can be especially detrimental during the pupping season.

In regards to the tide experiment, we believe that a sample size of two dates is too small to develop these types of tidal predictions. Second, coastal winds and barometric pressure, which may affect tidal water level, were not taken into account. There can be a marked difference between the observed water level and predicted tidal water level due to winds and barometric pressure along coastal California (Largier et al. 1993). Lastly, it is incorrect to assume that the sandbar heights and configurations did not change between 2007 and 2009. The sandbars naturally shift on a seasonal and annual basis, and larger scale shifts may dominate for several years. In summary, tidal modeling and developing tidal predictions is a sophisticated science that must incorporate a variety of atmospheric, hydrographic and oceanographic driving forces. The NPS relies on our colleagues at NOAA, USGS, and university experts for this type of guidance.

The NPS has conducted its own review of the April 29, 2007 survey and associated tides because of the questions raised by Dr. Goodman. However, the NPS review of the survey took a different approach than Dr. Goodman and Mr. Hulls. We identified six dates during the peak breeding season in 2008 that closely match the tide chart for the April 29 survey. Table 2 shows that the dates selected (April 17-19, 2008 and May 2-4, 2008) more closely match April 29, 2007 than the tides selected by Mr. Hulls for study on January 1 and 2, 2009. Harbor seal use of Drakes Estero, particularly in the middle estero where the April 29 disturbances occurred, is reduced in January, and we felt that it was more appropriate to select dates during the harbor seal breeding season for comparison. Harbor seals haul out more often and for longer time periods during the breeding and molt seasons from March 1 to July 31.

For the six dates selected by NPS for review (Table 2), the NPS examined date and time stamped photographs taken of Drakes Estero by remote camera. The remote camera was on-site at Drakes Estero for the majority of the 2008 breeding season, capturing images every minute from 7:00 AM to 7:00 PM. The camera view encompassed the "lateral" channel with sandbar OB in the foreground.

Examination of the photo series for the selected dates shows that for a low tide similar to that on April 29, 2007, the OB sandbar becomes exposed at the low tide between approximately 3.5 and 2.5 hours prior to the low tide for San Francisco (Table 3).

Table 2. NOAA low tide data for April 29, 2007 and a series of dates selected for study by NPS and DBOC. Tides are standardized to San Francisco (Golden Gate Bridge).

<b>Date</b>	<b>Low Tide Time</b>	<b>Low Tide Height</b>	<b>Type</b>
April 29, 2007	4:25 PM	1.46 ft	Original Survey
April 17, 2008	4:22 PM	0.89 ft	This Study
April 18, 2008	4:56 PM	1.28 ft	This Study
April 19, 2008	5:29 PM	1.68 ft	This Study
May 2, 2008	3:30 PM	1.01 ft	This Study
May 3, 2008	4:13 PM	1.37 ft	This Study
May 4, 2008	4:56 PM	1.74 ft	This Study
January 1, 2009	8:16 AM	2.82 ft	DBOC Study
January 2, 2009	9:17 AM	2.51 ft	DBOC Study

Table 3. Time that harbor seals are first observed at sandbar OB and time that OB is just exposed by the falling low tide on six dates chosen for review by NPS. The time before the low tide is included in parentheses. Tides are standardized to San Francisco (Golden Gate Bridge).

<b>Date</b>	<b>Time of First Harbor Seals</b>	<b>Time Sandbar First Exposed</b>	<b>Low Tide Time</b>	<b>Low Tide Height</b>
April 17, 2008	12:23 PM (3h 59m)	1:17 PM (3h 5m)	4:22 PM	0.89 ft
April 18, 2008	2:01 PM (2h 55m)	2:15 PM (2h 41m)	4:56 PM	1.28 ft
April 19, 2008	1:43 PM (3h 46m)	2:25 PM (3h 4m)	5:29 PM	1.68 ft
May 2, 2008	11:52 AM (3h 38m)	11:58 AM (3h 32m)	3:30 PM	1.01 ft
May 3, 2008	12:54 PM (3h 19m)	13:05 PM (3h 8m)	4:13 PM	1.37 ft
May 4, 2008	2:18 PM (2h 38m)	2:40 PM (2h 16m)	4:56 PM	1.74 ft

In summary, the NPS concludes that subsite UEN may have been slightly underwater at the time this subsite was first disturbed at 12:50 PM on April 29, 2007, which occurred about 3.5 hours before the low tide (Table 1). However, if we accept the findings of Dr. Goodman and Mr. Hulls, who conclude that the UEN sits 1 ft higher than OB, then based on the NPS photographs, subsite UEN would have been well exposed by the time of the first disturbance.

In regards to harbor seal use of the sandbars, on each of the six dates selected by the NPS, harbor seals are clearly seen in the photographs using the OB sandbar *before* the sandbar is actually exposed by the low tide (Table 3). On April 17, 2008, for example, seals were present on the sandbar 40 minutes before it was first exposed by the low tide. By the time the OB sandbar was just exposed, up to a dozen harbor seals could already be seen resting on the sandbar. If Mr. Hulls had conducted his tidal experiment in Drakes Estero at the correct time of year, he too would likely have observed this pattern of harbor seal behavior and drawn different conclusions about the validity of the April 29, 2007 disturbances.

Although our review indicates that the UEN sandbar may have been underwater at 12:50 PM on April 29, 2007, the disturbance record for that day remains reliable based on our review of tidal data and seal behavior at that site. By the time the second DBOC disturbance occurred on April 29, 2007 at 1:40 PM and the complete harbor seal count occurred at 2:15 PM, the sandbars were, without question, well exposed. Although Dr. Goodman insists that “swimming harbor seals cannot be flushed off of a sandbar that is underwater”, we have photographic documentation to the contrary.

To illustrate the findings of our inquiry, Figures 1-3 depict sandbar exposure and harbor seal presence at sandbar OB on a falling tide. Although we do not have similar images taken of sandbar UEN, we believe that these photographs provide supporting evidence that the April 29, 2007 survey was accurate for both disturbance and count data.



Figure 1. Harbor seals present on sandbar OB prior to exposure of the sandbar to the falling tide. Photograph taken at 12:47 PM on April 17, 2008, 3 hours and 35 minutes prior to a low tide of 0.89 ft at San Francisco. The first disturbance on April 29, 2007 also occurred 3 hours and 35 minutes before the low tide of 1.46 ft.



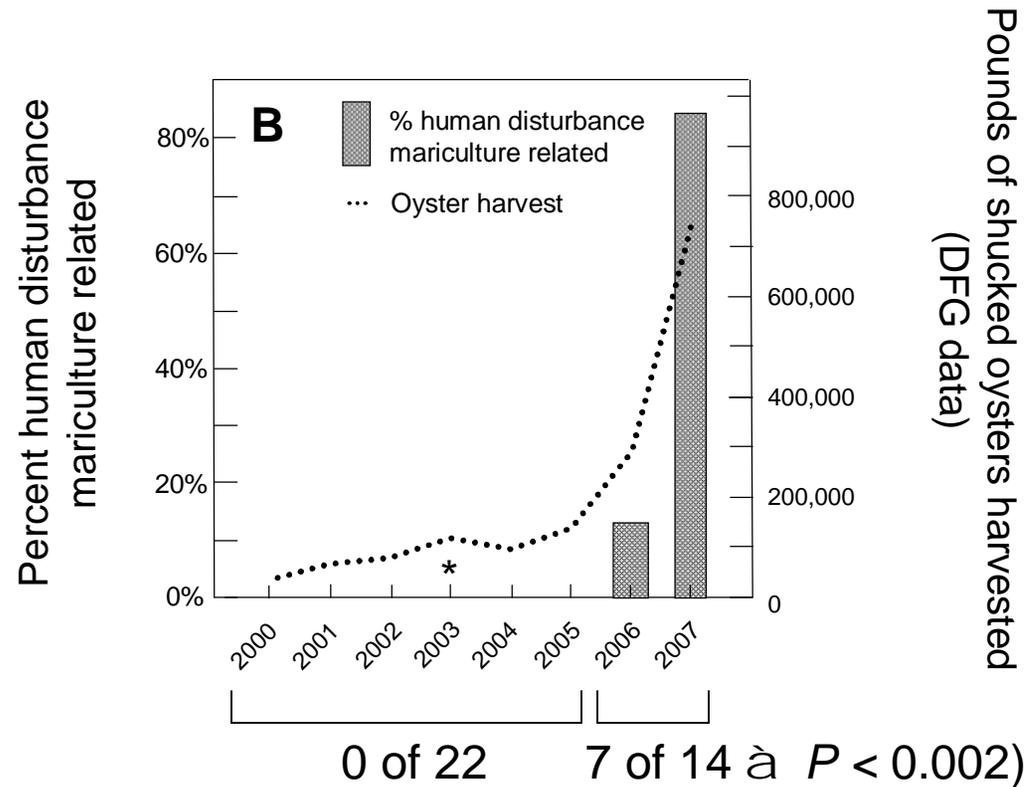
Figure 2. Harbor seals present on sandbar OB on the falling tide. Note paired heads of seals which are likely females with pups. Photograph taken at 2:44 PM on April 19, 2008, 2 hours and 45 minutes prior to a low tide of 1.68 ft at San Francisco. The second disturbance on April 29, 2007 also occurred 2 hours and 45 minutes before the low tide of 1.46 ft.



Figure 3. Harbor seals present on sandbar OB on the falling tide. Photograph taken at 1:20 PM on May 2, 2008, 2 hours and 10 minutes prior to a low tide of 1.01 ft at San Francisco. The full count on April 29, 2007 also occurred 2 hours and 10 minutes before the low tide of 1.46 ft.

# **APPENDIX B**

# Increase in percentage of human-related disturbance in upper estero (OB, UEN, UEF) due to mariculture: 2000 - 2007



- High statistical power ( $1-\beta > 0.91$  at  $\alpha = 0.05$ )
- No mariculture related disturbances in middle-lower estero
- Human disturbance is less frequent in upper estero (~1-2/subsite/yr) than the middle-lower estero (~5 subsite/yr)

\* Possibly one disturbance in 2003

# **APPENDIX C**

Dear Dr. Boness,

Below is an outline of the substantive changes to ms #2668 discussed with either you or proposed by us and accepted by the reviewers. Please note that I used the previous MMS copy edited version as a starting point, hence the formatting style. Because of this, footnotes appear at the end of the document as endnotes. I have listed the most substantive changes in **bold**.

**Introduction:**

No substantive changes

**Methods:**

1. **We now use the updated oyster harvest value for 2007.**
2. **Lines 174-185: We now include disturbance data for 1996 – 2008. Previous paper only had 2000-2007. Count data modeled for 1997-2007 (as before) but we discuss 1996 and 2008 data in the discussion.**
3. **Lines 207 – 212: Description of new tests used to analyze disturbance data as proposed in previous MMS correspondence.**
4. Lines 219-240: Clarified data handling.
5. Lines 257-265: Clarified density dependence data used in models.
6. **Lines 266-275: Description of how we look at density dependence on a daily basis but also investigate effect on an annual mean basis. Description of how we model oyster harvest in the same year, but also investigate 1-year lag.**
7. Lines 303-307: Description of regression tree methods.

**Results:**

1. Lines 312-318: Shortened first paragraph
2. **Lines 319-329: Results of *oyster harvest vs. disturbance* correlation and rank tests. These are all now based on disturbance *rate* rather than *frequency*. We illustrate here that omitting up to nine of the disturbances (including the one in 2006 and 2/3 of those 2007) still would result in a significant increase in disturbance with increase in oyster harvest. Also see Figure 2B. We also note that this includes on lines 325-326: “including two disturbances on one day in 2007 that the mariculture company challenged”. Please let us know if this is OK or if you have a different idea for this statement. Alternatively, we could leave the parenthetical statement out and just leave the part that illustrates dropping many of the disturbance events still results in a significant relationship.**
3. Lines 333-351: New GLM results using updated 2007 oyster harvest value and no time lag for oyster harvest. All model rankings are similar to previous paper.
4. Lines 355-364: GLM analyses also redone to test 1-year vs no year lag effects of oyster harvest, and using density dependence as a daily or annual value. All results were robust to these different approaches with Oyster always being

important in the best models. We focus on same year oyster harvest values, though.

5. Lines 366-373: UEN best model (although weak fit) includes oyster harvest.
6. Lines 374-381: We now report a regression tree that corroborates GLM models. Tree shows lower counts with higher oyster harvest. This replaces prior 2002-2004 to 2005-2007 2-sample tests (t-test, Wilcoxon) comparisons in previous version.

#### **Discussion:**

1. Shortened first paragraph.
2. Lines 463-476: Discussion of potential reasons why lower performance of predictive model (OB model predicting UEF) when oyster harvest is high.
3. Lines 527-532: Discussion of middle-lower estero counts related to density dependent effects at upper subsites.
4. Lines 546-553: Presentation of unmodeled 1996 count data at OB and how it is low during the highest oyster harvest and the highest disturbance rate during the study period.
5. **Lines 554-577: Discussion of how small increase in 2008 subsite OB count data is consistent with restricted mariculture activity near the subsite due to a new (for 2008) California Coastal Commission guideline, and how disturbances subsequently dropped to only 1 in that year. We also suggest that this operational shift may weaken the simple use of “oyster harvest” as a proxy for modeling counts in the upper estero beyond 2007. Nonetheless, the modeling for 1997-2007 is unaffected.**

#### **References:**

1. Added Allen *et al.* 1989 (ENSO effects on seals) and Bejder *et al.* 2006 (Disturbance causing local redistribution of Dolphins).

#### **Tables:**

1. We have removed table 1, as figure 2B now illustrates these patterns and tests. We indicate in the results that human disturbance rates are higher in middle-lower estero.
2. Table 1 (Table 2 in previous version): updated with all new models, rankings are essentially the same.
3. Table 2 (Table 3 in previous version): updated with new best model coefficients.

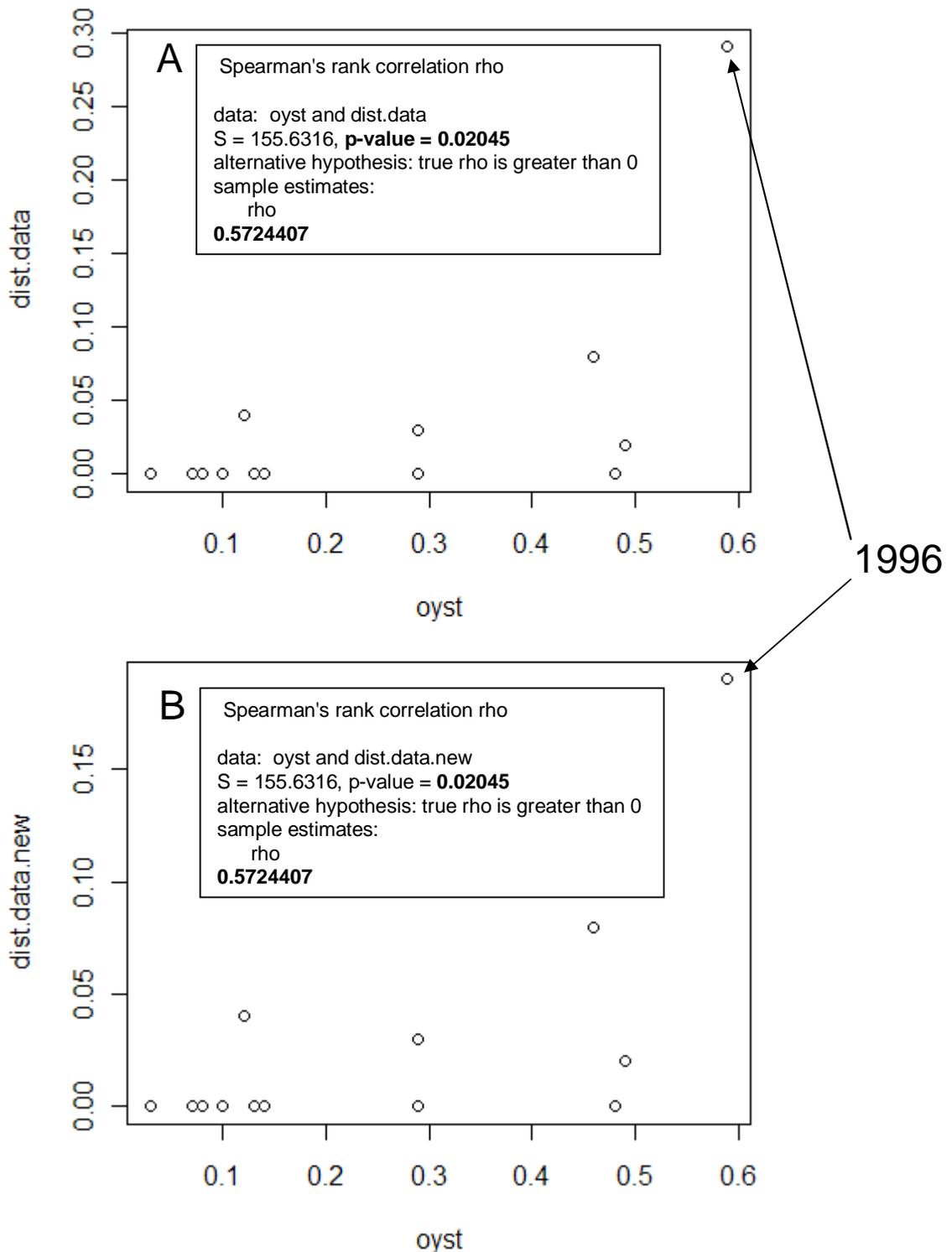
#### **Figures:**

1. Figure 2A: Now has corrected 2007 oyster harvest value.
2. Figure 2B: New, as proposed to reviewers in previous MMS correspondence. Replaces previous figure 2A.
3. Figure 3A: Similar to previous figure 3A, but is a scatter plot rather than a bar chart.
4. Figure 4: Regression tree replaces bar chart showing recent declines at OB. The new model is described in the text.

5. Figure 5: Drakes Estero Panel has been redone. There was a scaling problem (software bug) in the previous version when drawing multiple panels at the same scale that showed~15-20% fewer seals than reality at only drakes estero. We also added black bars to the Drakes Estero panel to indicate count pattern for the middle-lower estero used for density-dependence calculations.

# **APPENDIX D**

Appendix D. (A) Original plot used in MMS paper with 6 disturbances in 1996 and (B) corrected plot with 4 disturbances in 1996. Note that 1996 is still by far the highest point, which is why the statistics have *no difference* between datasets. Note that the y-axis scale changes between plots. In the first version (MMS paper), we accidentally counted two *potential* disturbances as *actual* disturbances. “Oyst” is annual lbs. oysters harvested x 10<sup>-6</sup>. See text for details.



# **APPENDIX E**

11/12/2008

To: National Research Council, Panel of Mariculture in Drakes Estero.

From: Ben Becker, David Press, Sarah Allen; Point Reyes National Seashore.

**Re: Rationale for *not* modeling disturbances and counts in the entire Drakes Estero.**

Becker, Press and Allen (MMS, in press) only modeled and considered disturbances in the upper estero (near oyster harvest activities) for the following reasons.

1. Subsites A, A1, OB, and UEN are the primary pupping sites for the Estero (see Figure 1). Thus, with one (and perhaps 2, OB and UEN) important pupping subsite potentially impacted by oyster harvest activities, this merited further investigation. Processes at subsite A were clearly related to attachment to the mainland. A1 was increasing (perhaps due to displacement from other sites such as A or others).
2. Plots of all 8 subsites in Drakes Estero from 1997 – 2007 indicate that the only subsites which experienced a significant decline since 2004 were subsites OB, UEF, and A (Figs 1-3). Subsite A was clearly reduced after attachment to the mainland in or around 2004 which resulted in several coyote predation events. Subsites OB and UEF had no other apparent changes other than proximity to increased oyster activities/harvest. DEM had a decline in 2006-2007, but had high inter-annual variation during the entire time series. Variation at DEM was likely because of changes in size and proximity to mainland due to wave action and tides at the mouth of the estero. Subsite L increased over time (especially in adult use), potentially related to increased visitor education on avoiding seal disturbance at the Limantour Beach access.
3. There was a clear and significant (proportions test or Fisher's exact test) increase in mariculture related disturbances in the upper estero (OB, UEF, UEN). During March-May of 2000-2004, anthropogenic, non-airplane disturbances were limited to one kayak, one clammer, and one oyster related. Then from March-May, 2005-2007, all anthropogenic, non-airplane disturbances, were related to mariculture with one in 2006 and six in 2007. This increase in mariculture related disturbances coincided with a decrease in adult and pups seals counts at subsite OB (and UEF), which warranted further investigation.
4. It is essential to model density-dependence. However, if considering all subsites, then it would not be possible to use the lower-middle estero as a control for density-dependence since all counts could not be assumed independent of the other seven sites (seals do of course move around and a loss at one site would likely result in an increase at another site). Furthermore, other regional colony data prior to 2000 had not been fully compiled before preparation of the manuscript. Nonetheless, local density-dependence (lower-middle estero) is more desirable since it more likely to reflect local processes in the estero because it (1) eliminates other confounding factors such as disturbance effects at other colonies, and (2) is closer, more similar habitat.

11/12/2008

5. Modeling all sites and linking to mariculture would be a form of data dredging (several reviewers indicated this). We chose instead to follow an *a priori* multiple competing hypotheses approach.
6. Modeling disturbances without *a priori* hypotheses can be misleading because disturbance events require both a disturbance source *and* the presence of seals to disturb. This is illustrated clearly at subsite A: as the island attached to the mainland and seals began to abandon the subsite after 2004, disturbances also decreased.

*Three figures follow*

Fig 1. Mean (SE) seal **pups** at subsites in Drakes Estero during April 15 – May 15 of each year from 1997 - 2007.

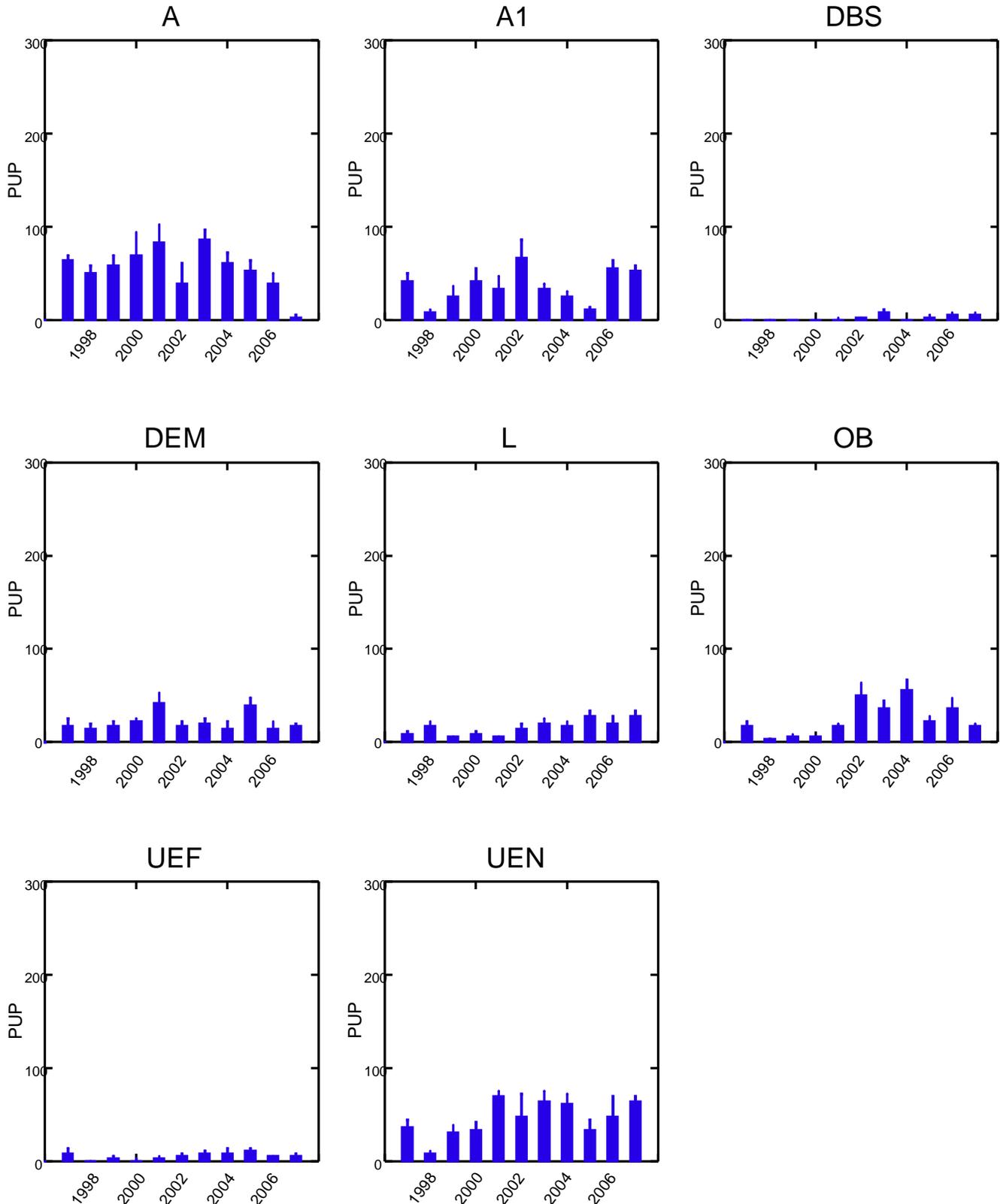


Fig. 2. Mean (SE) **adult** seals at subsites in Drakes Estero during April 15 – May 15 of each year from 1997 - 2007.

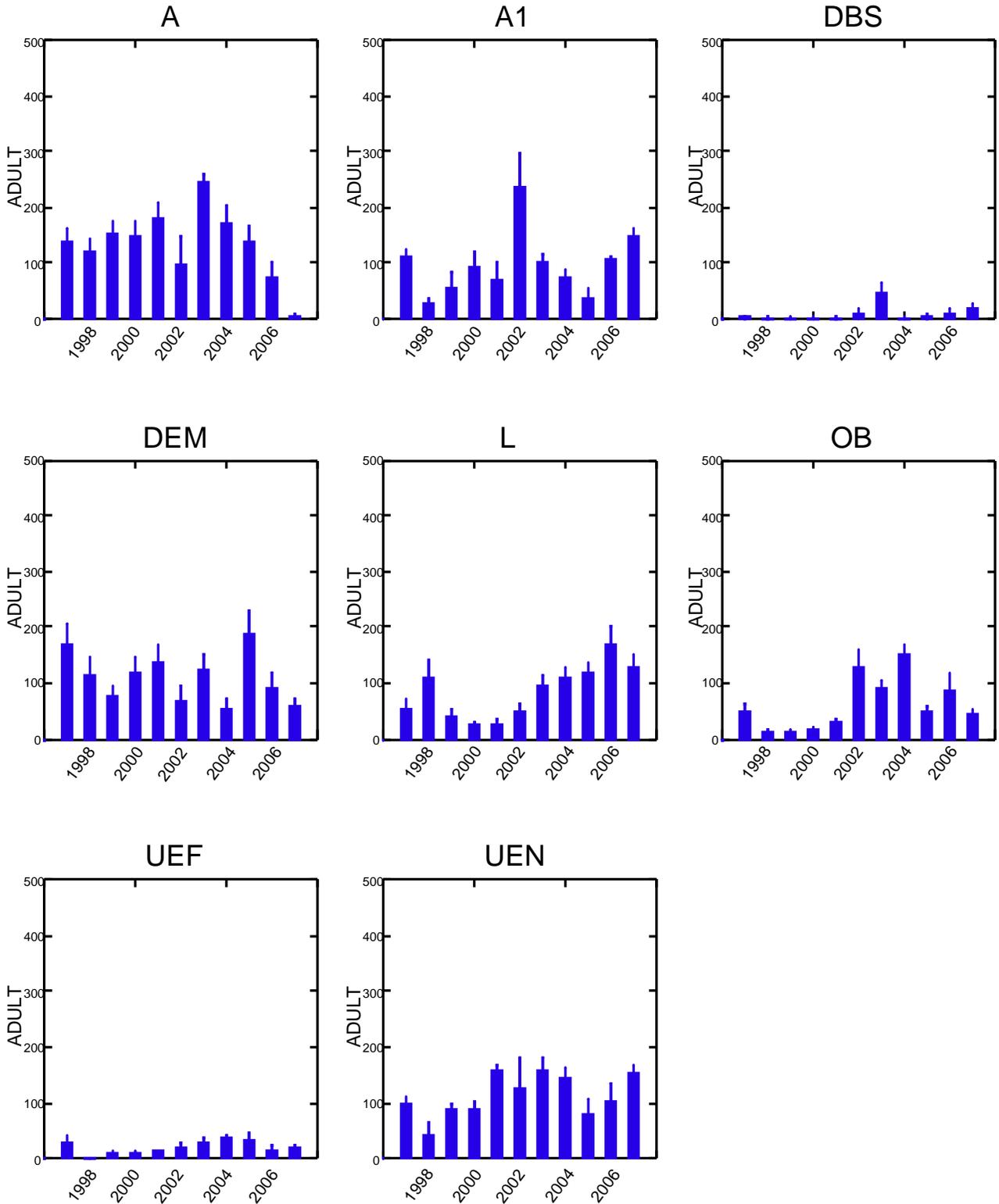
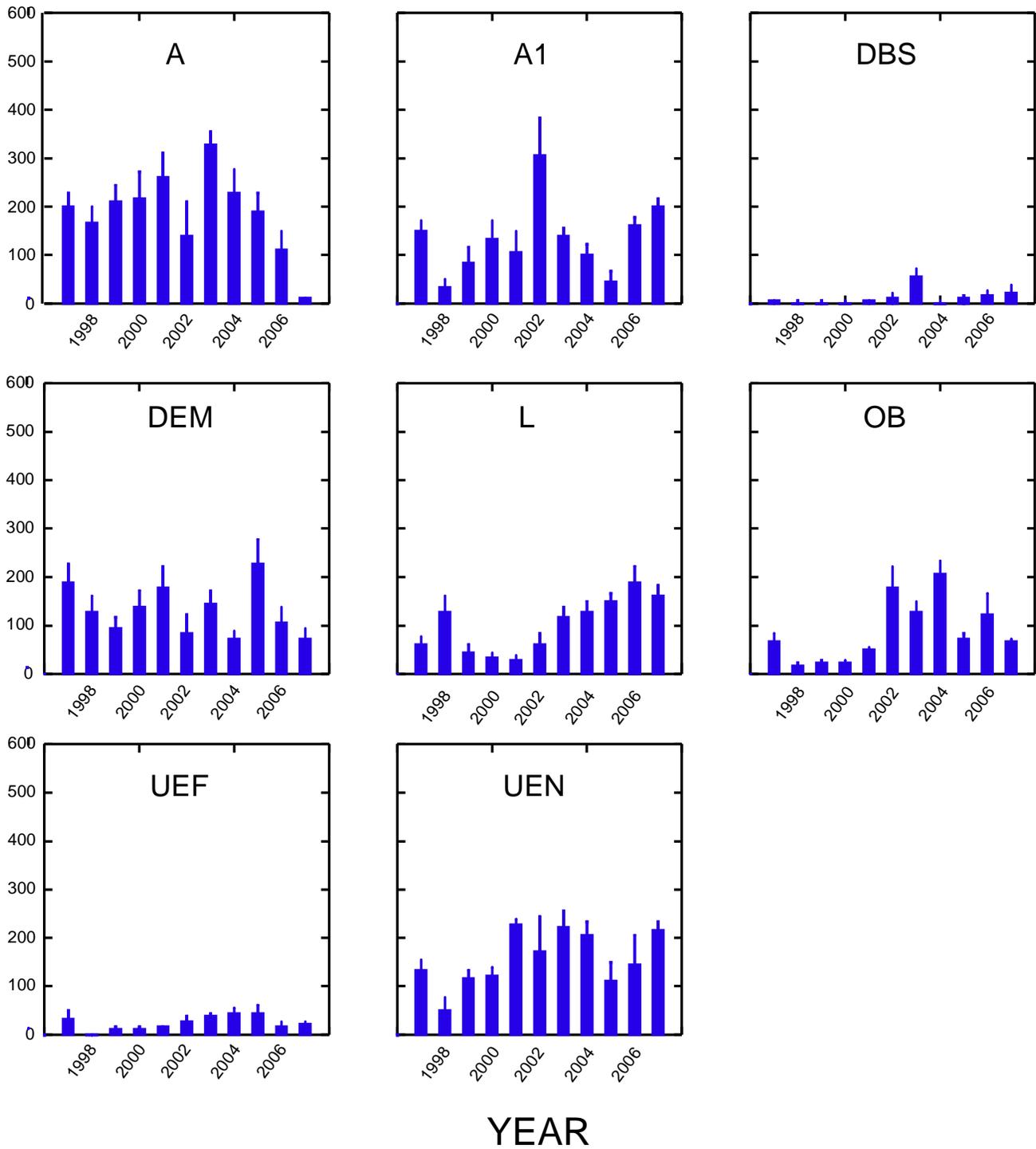


Fig 3. Mean (SE) **total** seals at subsites in Drakes Estero during April 15 – May 15 of each year from 1997 - 2007.



# **APPENDIX F**



"Daryl Boness"  
<mmsci@megalink.net>  
10/16/2008 08:56 AM

To <Ben\_Becker@nps.gov>  
cc "Marine Mammal Science"  
<marinemammalscience@gmail.com>  
bcc  
Subject Decision on "Modeling the effects of El Niño, density  
dependence, and disturbance on harbor seal counts..."

History:  This message has been replied to.

Dear Dr. Becker:

I have now received input from some of the original reviewers and Associate Editor on your replies to the concerns and questions raised by Dr. Corey Goodman (and others with similar points being made) concerning your in press paper entitled "Modeling the effects of El Niño, density dependence, and disturbance on harbor seal counts in Drakes Estero, California: 19972007." I have also spoken (or emailed) with Dr. Susan Roberts of the NRC and Dr. Tom Moore of the California Fish & Game. I am satisfied that there is no basis for considering pulling your paper from Marine Mammal Science for ethical grounds (scientific misconduct). The reviews I received based on your responses to Dr. Goodman's questions and your new analyses suggest there is no need to even revise your manuscript before publication should be allowed. I concur with the reviewers that the paper should be allowed to move forward with publication, but I also believe it would be best to include the updated information and improved analyses that you have proposed in your emails to me. In the revised paper, you should acknowledge the questioned data point and at least note that the conclusions would not change whether this point is included or not. Since you have information available on the 2008 harbor seal and oyster harvest levels I would also like to see you include in the discussion a statement about how this might affect your conclusions. It would be helpful if you identified in the revised paper where you have made the substantive changes as you indicate you will in your email replies.

I will process your revised paper as quickly as possible once I receive it. I appreciate your cooperation in this unusual situation regarding your paper that was accepted for publication in Marine Mammal Science.

Sincerely,

Daryl J. Boness  
Editor  
Marine Mammal Science