

John R. Hulls

Dr. Susan Roberts, Director, Ocean Studies Board Drake's Estero Panel, National Research Council, National Academy of Sciences

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Dear Susan,

It was a pleasure meeting you at the NAS Panel meeting in Mill Valley. I spoke during the public-comments portion of the hearing and referred to an analysis I had done of the seal population in Drake's Estero, using the National Park Service database. Please send it to the panel along with the spreadsheet and graphic. I do not claim that this is an exhaustive analysis of Estero seal populations, but simply a snapshot of the same time interval over the three year period that Drake's Bay Oyster Company has operated in the Estero. However, it underscores the difficulties that I have with the science behind NPS Report, "Drake's Estero, A Sheltered Wilderness Estuary" that Senator Feinstein directed your panel to investigate. I have similar difficulties with subsequent Becker *et al* paper.

I undertook the analysis primarily to understand the validity of the National Park Service claims of seal-pup loss in 2007. My analysis is a snapshot of Drakes Estero for two days in early May 2007 at the height of the pupping season. The period in May was selected because it was immediately prior to the May 8, 2007 NPS presentation to the Marin County Board of Supervisors. At the meeting, NPS claimed they had recent data showing major losses of seal pups caused by expanding oyster operations. I compared 2007 vs. the average of all 3 years in which Drake's Bay Oyster Company has been operating, 2005-2007. As the attached spreadsheet shows, large day-to-day variation in the subsites prevails. For instance, from May 5-6 2006, the adult seal population at site UEN declined from 160 to 13. Similar large variations are shown in the analysis.

NPS data shows overall 2007 variation from the average 2005-2007 seal-population was nine seals, or 1.7% of total Estero population, even though, as noted in Becker, closing the channels protecting sandbar A in 2007 caused a major site shift. As the graphic shows, the seals moved to adjacent, more protected areas when sandbar A became accessible from shore. Note that the UEN haulout site apparently selected by most of the displaced seals (it shows the greatest increase) is on the southern edge, closest to sandbar A. It is a mile from where the boats were rafted together on the NAS field trip near the site where NPS claims the oyster-related disturbances occurred. Note from Fig.1 in Becker *et al* that the channel haulout area in OB is far less desirable than the southern edge of UEN for access to the main channel and feeding grounds.

The NPS database shows that major shifts in site utilization in the upper estero can be caused by disturbances at the lower estero sites. Examining the database figures, the lower sites, which have no mariculture-related disturbances, have a far higher level of disturbance, mostly from Park visitors than the sites OB, UEN and UEF. How, without modeling the effect from disturbance-related movements in the lower estero, can Becker *et al* claim that their model predicts site utilization. "*The predicted and actual counts for the best model at OB were quite close...predicted counts at UEF using the scaled best fit...strongly suggest that similar processes (ENSO and oyster harvest) are driving counts at OB and UEF.*" Becker *et al* pp13-14).

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Becker makes no attempt to indicate daily and annual variations in site utilization within Drakes Estero, which—shown in the attached spreadsheet of my analysis—are substantial. Likewise, there is no attempt to establish normal site utilization within the entire Estero correlated with changes caused by oyster operations, or more importantly, as oyster operations are a tiny fraction of disturbances, with total disturbances. The database would seem to indicate that doing so could not produce any statistically significant results, as substantiated by comments made in Pendleton's presentation to the panel that the Drake's Estero seal population should be considered a single population.

This is further confirmed by studying the relationship of seal populations within the immediate area to see if oyster harvesting is a driver of site utilization. Some factor is obviously causing a consistent decline in seal population over all sites for the last three years, yet it cannot be attributed to oyster harvesting. Dr. Goodman and I examined the correlation (Pearson's correlation coefficient) for various populations: from 2000-2007, correlation with oyster harvesting vs. mean number of seals at OB, all of Drakes Estero and maximum number of seals for all sites in Point Reyes National Seashore is -0.11, -0.21 and -0.23 respectively. Dr. Goodman is sending the panel a detailed analysis of these correlations.

Becker *et al* doesn't make the case that oyster harvesting is a driver, especially when looking at the small sample size of oyster-harvesting disturbances and the shifts in population caused by the hydrological changes at Sandbar A, shown in the attached spreadsheet, and the analysis of the 2000-2007 data. If the generalized linear models (GLM) as discussed in Becker *et al* p8 uses the 2004-2007 OB population data (vs. the 2000-2007 data) as a major driver, it will overstate the decline in seal population vs. oyster-harvesting disturbances. It is not possible to determine whether this was done without having the actual model and input data available, but Table 1 shows that a 2000-2005 OB average population was used, which would produce a similar result.

This is in addition to two other errors in Becker *et al* as noted previously at the NAS hearing. Table 1 fails to correct for the fact that there were twice as many observations in 2007 as 2006, and the oyster harvest was overstated by nearly a factor of 2. Becker claimed at the NAS panel hearing that making the corrections would actually increase the strength of the correlation in his model. Again, it is this statement cannot be evaluated without seeing the model itself and the data inputs. But p14 para. 2 shows that the comparison is OB from 2005-2007 vs 2002-2004. Looking at the entire database, the selected subset includes the highest count at OB of the entire 1997-2007 period. (187 in 2004 vs. an average of 75) Thus, there are errors in both the oyster harvest, and the data subset used to demonstrate population decline at OB

The apparent large decline in seals at OB results from selecting a small subset of the data that includes the peak value in the overall data distribution. Further, the claim on p14 that other subsites show a different pattern is incorrect for the overall database: the 2005-2007 data shows that the population decline at OB, Drakes Estero and the entire Point Reyes populations were 17%, 18% and 16% respectively. In fact, on p18, Becker states that the GLM models were fit to the data. One asks again: what dataset was used. Curve-fitting based on using outliers in the overall database is clearly not valid, and the entire dataset from 1997-2007 should have been used, as implied in the article title.

In fact, Becker states on p18, in reference to Fig 4, “*however, the GLM models were fit to the actual data (what data?) so it would be inappropriate to predict if OB would have continued to increase or asymptote after 2004 in the absence of an increase in oyster harvesting.*” Figure 4 compares the 2002-2004 and 2005-2007 average seal populations at OB. But site utilization by seals on OB was substantially higher in 2002-2004, then declined to levels in 2005-2007 which are slightly higher than the 1997-2001 levels. According to the Becker *et al* analysis, one would posit that the increase in seals from the 1997-2001 levels to the 2002-2004 levels was caused by a change in the level of oyster harvest. As there are no mariculture related disturbances shown during the 1997-2004 period, this is clearly not the case. I hypothesize that some other effect, possibly hydrological changes, caused the change in utilization. Clearly, it is not the oyster harvest levels.

On page 19, the paper states in its summary that “*The results of these analyses illustrates the benefits of long-term studies for understanding multiple anthropogenic and environmental factors that can affect pinniped populations and productivity.... The study also demonstrates how chronic disturbance activities, in this case from mariculture operations, can lead to long term displacement of seals at haulout sites...*” While I can claim no expertise in modeling pinniped populations, this would appear to be a monstrous overstatement. Even disregarding the outright errors in oyster harvesting and failing to correct for number of samples, (factors of 2 are not trivial) the Becker *et al* analysis is not valid for other time periods and locations within Drakes Estero, let alone extrapolating to seal populations and mariculture in general.

This paper will be read by the general public and regulatory agencies, who have neither the time nor the resources to critique the analysis, but will rely on the conclusions as stated in the previous paragraph. This goes to Senator Feinstein’s questions as to appropriate use of science by the Park Service, though the original request was to examine the science available at the time that the “*Drake’s Estero, A Sheltered Wilderness Estuary*” report was issued. I hope that the panel will fully analyze the Becker *et al* paper, as well as the Drakes Estero report and the underlying science in a manner that is clear not only to the scientific community but to the regulatory bodies and, most importantly, to the general public who paid for it.

Respectfully,

John R. Hulls

Atch. Drake’s Estero spreadsheet, graphic

cc. NPS

Dr. Boness, Editor, Marine Mammal Science  
Kevin Lunny, Drakes Bay Oyster Company

**Seal Site Utilization at Drake's Estero in Early May 2007 vs. Average Early May 2005-2007**

Year	Date	Adult/Pup	A	A1	DBS	DEM	L	OB	UEF	UEN	Subtotals	Total	Percent Av.
2005	6-May	A	220	96	0	0	184	17	33	40	590	796	91.41
		P	101	15	0	40	0	13	21	16	206		
2005	7-May	A	214	1	21	102	174	80	46	4	642	827	
		P	60	1	8	26	51	25	12	2	185		
2006	5-May	A	49	120	15	0	197	35	14	160	590	877	
		P	39	78	9	41	0	33	5	82	287		
2006	6-May	A	130	106	33	82	264	156	0	13	784	1002	115.06
		P	66	52	17	0	17	60	0	6	218		
2007	5-May	A	12	169	0	2	194	61	30	168	636	840	
		P	8	73	0	1	48	21	9	44	204		
2007	6-May	A	0	157	71	125	87	74	0	218	732	883	
		P	0	53	4	8	8	25	0	53	151		
Total: All Years			899.00	921.00	178.00	427.00	1224.00	600.00	170.00	806.00	5225.00	5225	
Average: All Years			149.83	153.50	29.67	71.17	204.00	100.00	28.33	134.33	870.83		
Total:2007			20.00	452.00	75.00	136.00	337.00	181.00	39.00	483.00	1723.00		
Average:2007			10.00	226.00	37.50	68.00	168.50	90.50	19.50	241.50	861.50		
Numerical difference between 2007 av overall average site population			-139.83	72.50	7.83	-3.17	-35.50	-9.50	-8.83	107.17	-9.33		
Difference as percent of average total			-16.06	8.33	0.90	-0.36	-4.08	-1.09	-1.01	12.31	-1.07		

-9.33Total difference between av. #seals and 2007 population

-1.07Percent difference av. # seals and 2007 population

**Seal Site Utilization at Drake's Estero**  
**2005-2007 average seal counts compared to 2007 average seal counts**

*Note: Yellow bars are 2005-2007 average, green bars are 2007 average*

