Marin Audubon Society

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Memorandum

From: Marin Audubon Society
To: Department of Interior, Secretary Ken Salazar
Date: September 3, 2010

Re: Response to Lytz/DBOC Letter (July 6, 2010) and Summary of Science Relative to Environmental Impacts of Mariculture in Drakes Estero

As stated in the cover letter, the purpose of this memorandum is to correct the inaccuracies and incomplete accounting of the environmental impacts by Lytz in his July 6, 2010 letter. Before beginning, it is important to note that there are a number of instances where that letter is also incomplete and inaccurate in attempting to summarize the historical and current legal and policy framework, which we believe provides ample justification for choosing to restore a designated wilderness area rather than authorizing commercialization of wilderness. Others will submit a detailed letter correcting Lytz's summary of legal and policy issues. Because of our strong interest in natural resource protection, we will focus on the science issues.

Regarding the report (NRC, 2009) on environmental impacts of the oyster operation, the National Research Council cautioned that "the report should not be interpreted as recommendations in support of or in opposition to an extension of the lease." That being said, there is useful data and science in the report, and there is even more scientific evidence available now. New peer-reviewed data and publications significantly affect NRC (2009) conclusions. There is additional strong scientific evidence for adverse impacts and risk from mariculture in Drakes Estero, and there is scientific evidence which contradicts claimed benefits. Some of the new findings are:

- Researchers have concluded that cultivation of non-native oysters prevents the recovery of the native Olympia oyster in west coast estuaries where oyster mariculture is practiced (Trimble et al, 2009).

- NRC (2009, p. 8) stated that research on the risk of spread of the invasive tunicate, *Didemnum vexillum*, is urgently needed, not just in Drakes Estero, but worldwide. Some of that research is now complete. It is now shown in peer reviewed literature that the invasive tunicate can gain the ability to move from human introduced hard structures (such as buoys and mariculture gear) to nearby eel grass beds causing damage to eel grass (Carmen and Grunden, 2010).

- Becker et al. (2010) report results of statistical analysis recommended by NRC and have shown a strong correlation between high oyster production and lower use of the estero by adult and pup harbor seals.

- A peer-reviewed article summarizes west coast research on mariculture effects. (Dumbauld, et al., 2009) In open coastal bays with low stocking density like Drakes Estero, the article states that filtering and material process impacts from mariculture exist at the cultivated bed level and are generally insignificant at the estuary level. These open coastal bay systems are dominated by marine influences and are generally not subject to eutrophication. This report negates claims of beneficial material processes.

In addition to these new findings, it is important to comment on some claims made by Mr. Lytz that we believe are contradicted by the NRC report and other scientific literature. In other cases, Mr. Lytz "cherry picked" sentences from NRC (2009) without mentioning the lack of evidence and limitations of those claims. Some of these key points are:

- There is no documentation for the claim that an earlier population of Olympia oysters were present in numbers and biomass as high as the cultivated oysters in Drakes Estero.

- The cultivated oysters are not ecologically equivalent to native Oysters. They differ in growth rates, diet, habitat and reproductive characteristics.

- The off-bottom hanging culture method is not environmentally friendly in Drakes Estero: eel grass does not grow in the shade and operational disturbance at the racks, and the racks and hanging oysters are a main substrate for the invasive tunicate

- The conjecture that a doubling of eel grass occurred due to oyster production between 1991 and 2007 is not supported by the data – the data shows a correlation between eelgrass going up while oyster production goes down – the opposite of Mr. Lytz's conjecture. Research indicates that native clams growing naturally in and around eel grass beds are sufficient to provide nutrient recycling for the growth of eel grass.

We urge you to consider the claims by Mr. Lytz point by point:

Claim: There is a lack of strong scientific evidence that shellfish farming has major adverse ecological effects on Drakes Estero. (NRC, 2009, p. 6, quoted in Lytz letter, p. 6)

Actually, there is strong evidence of major effects and risks. Subsequent to the writing of the NRC (2009) report, recent scientific articles add to the body of scientific evidence of major effects and risks:

Trimble, A.C., J.L. Ruesink, and B.R. Dumbauld. 2009. *Factors Preventing the Recovery of a Historically Overexploited Shellfish Species, Ostrea lurida,* Journal of Shellfish Research 28(1):97-106. This article reports on research showing that cultivation of non-native oysters in west coast bays prevents the recovery of the native oyster. Native oysters settle preferentially on cultivated oysters and die. "Our results suggest that intertidal Pacific oysters are a recruitment sink" (Trimble et al, 2009). The native oyster is a species of special concern and there are small populations remaining in Drakes Estero. Since some aspects of Drakes Estero match conditions in the bays where research was done, this study suggests that oyster farming over the past 75 years in Drakes Estero may have prevented the recovery of the native oyster to whatever level existed historically.

Carman, M.R., and D.W.Grunden. 2010. *First occurrence of the invasive tunicate Didemnum vexillum in eelgrass habitat.* Aquatic Invasions 5(1). For years, the tunicate colonized only on hard substrates such as buoys, piers and mariculture gear in Lake Tashmoo, a bay on Martha's Vineyard. Eventually, the tunicate gained the ability to spread from hard substrates to nearby eelgrass. This major adverse impact is now documented in scientific literature.

Becker, B.H., D.T. Press, and S.G. Allen. 2010. *Spatial use of Drakes Estero, California, by harbor seals correlated to anthropogenic disturbance and natural variation during 1982-2009.* Point Reyes National Seashore, Point Reyes Station, CA 94956 Based on NRC recommendations, Becker et al. conducted statistical analysis of the monitoring data and included data on oyster production, regional seal population, environmental conditions, and visitor disturbance observations. This peer-reviewed study shows that high oyster production is strongly correlated with lower pupping at the sites closest to mariculture bags and operations.

Claim: DBOC employs an environmentally friendly off-bottom hanging culture method. (Lytz letter, p. 6)

That claim is false as applied to Drakes Estero since the hanging rack culture has significant unfriendly environmental impacts. The racks are in eel grass beds, and eel grass does not grow in the shade and operational disturbance at the racks. DBOC motorboats slice paths through the eel grass to reach the racks. NRC (2009) cites NPS estimates that about 58 acres (8%) of eelgrass habitat in the Estero are impacted. (p.68).

The racks and hanging oysters are a main substrate for an invasive non-native species, the tunicate, *Didemnum vexillum*. The cultured oysters together with wooden culture racks and ropes increase the availability of hard surface for colonization by tunicates in Drakes Estero, which has few natural hard substrates such as rocky bottom. (NRC, 2009, pgs. 5 and 52). "It is now a very evident epibiont covering a substantial fraction (up to about half, judging from the committee's observations made during its September 2008 visit) of subtidal surface space on shell surfaces of living Pacific oysters and on associated oyster-

rearing gear in Drakes Estero"(NRC, 2009, p 52). *Didemnum vexillum* grows over and displaces native organisms, and is now a threat to eel grass in New England (Carmen and Grunden, 2010). It may become a threat to eelgrass in Drakes Estero Invertebrate "hitchhikers" like *Didemnum vexillum* contribute to the fact that it is not possible to restore native oyster populations on the west coast where non-native oysters are cultured. (Trimble et al., 2009). *Didemnum vexillum* is a fouling organism which may smother young, newly settled native oysters, killing them outright, or restrict food access to stunt growth. (Trimble et al., 2009).

Although Mr. Lytz refers to the hanging culture method as "environmentally friendly", he does not make that claim for the predominant DBOC culture method, bags on flats.

Based on NRC (2009) and subsequent articles, bag culture also is environmentally unfriendly in Drakes Estero.

Invasive feral shellfish - At DBOC, cultivated oysters and clams are raised and finished in bag culture. There is risk of release because bags may break, fall open, or be lost. (NRC, 2009, p52) There is a risk that these non-native shellfish will spawn either in the bags or after spilling from bags and represent a threat of invasion in Drakes Estero. The Manila Clam has invaded other estuaries in California where it is introduced. Pacific Oyster has become invasive in other countries. NRC (2009) indicates that environmental conditions in Drakes Estero might mitigate against the successful establishment of the Pacific oysters in Drakes Estero (p. 51), but there is a risk as evidenced by the discovery of feral Pacific oysters in San Francisco Bay.

Seal pups - DBOC expanded bag coverage on flats adjacent to seal pupping areas (see aerial photos on the Marine Mammal Commission web site). Becker et al. 2010, discuss the possibility that bag culture on flats may be a factor in the statistical association between high oyster production and low seal production in the estero.

Shorebirds - A reference cited by NRC (2009) provides evidence for shorebirds of significant overall avoidance of mariculture areas. (Kelly et al, 1996) In the article, the authors describe research on how oyster mariculture in nearby Tomales Bay affected use of tidal flats by wintering shorebirds. "These results from such a similar system, involving the same species of shorebirds that use Drakes Estero and the same plastic mesh culture bags, albeit not only placed on the ground but also on elevated racks, are probably directly transferable to Drakes Estero." (NRC, 2009, p. 59-60) Kelly et al. (1996) found that avoidance of mariculture plots by dunlins and western sandpipers substantially outweighed the selection of mariculture areas by willets—in terms of both absolute numbers and proportional abundances scaled to baywide wintering population sizes.

Brant - Brant is a California species of special concern which may be displaced by disturbance of mariculture operations. (Davis and Deuel, 2008, p. 82) "Because Brant do not dive, they can usually access Eel-grass only at low tides. Still, they tend to feed in the

deepest possible areas permitted by tides and close to large tidal channels and other areas where Eel-grass biomass and protein content are higher." (Davis and Deuel, 2008, p. 82) "Drakes Estero represents an important site for overwintering and seasonally migrating shorebirds and waterfowl, with special significance as a feeding and staging site for migrating Black Brant geese. Boat travel by the mariculturists is likely to disturb and flush seaducks, shorebirds, and other waterbirds." (NRC, 2009, p. 69) Noise is also a factor. DBOC operates motor boats in the Estero and uses percussive, pneumatic equipment to shuck oysters, and there is loud radio music at the facility. A local naturalist, Rich Stallcup noted, the eelgrass meadows in the Estero are dense and lush. "At Drake's Estero, if it weren't for the motor boats (run by the mariculture interest) and blaring 'music', the waters would be teeming with grebes, loons and waterfowl particularly Brant Geese." (Stallcup, pers.comm.)

Furthermore, the presence of lines of oyster bags on the intertidal flats, and the tending of those bags, is likely to diminish the feeding and grit gathering opportunities for Brant in Drakes Estero. "Brant often feed in areas close to gritting sites which are intertidal mudflats, sandbars, or spits, where the birds ingest grit necessary for food digestion." (Davis and Deuel, 2008, p. 82)

"Historically, Tomales Bay, Drake's Estero, and Bodega Harbor supported large wintering populations [of Brant], but since the 1950s numbers there have declined substantially." (Shuford et al., 1989). NRC (2009) misinterpreted Point Reyes Christmas Count (CBC) data to conclude there is a rising abundance of wintering Brant in the Estero. The CBC data does not show an increase in the wintering population in Drakes Estero.

Native invertebrates - Bags on flats interfere with nutrient, oxygen, and waste flow to and from the myriad native organisms that live naturally in the flats, under the bags. Such effects are probably limited to bed-level effects (Dumbauld et al., 2009). Many acres of oyster bags are placed in the Estero, so even bed-level effects may be important. The cultivated oyster and clam beds are extensive and may cause a significant impact for that tidal flat habitat in the Estero.

Claim: The potential that oyster culture in Drakes Estero is replacing the important filtering capacity and biogeochemical processing that was lost in the mid-19th century and subsequent decades with the over harvest and functional elimination of the native Olympia oyster (NRC 2009 p. 68) … DBOC oysters are helping to restore an historic baseline ecosystem. (Lytz letter, p. 6).

NRC (2009) acknowledges **there is no scientific evidence for these claims** in Drakes Estero. Numeric equivalency is unknown: "Insufficient information is available to know how many oysters and how much biomass existed under historical baseline conditions" (NRC, 2009, p 3). Functional equivalency is unlikely: "There is a dearth of research on the extent to which the cultured Pacific oyster restores the ecological contribution of the native Olympia oyster in Drakes Estero." (NRC, 2009, p 79). "The substrate habitat provided by oysters, elevated wooden racks, and plastic mesh bags on the bottom does

not replicate the exact nature of structural habitat once offered by beds of native oysters on the bottom." (NRC, 2009, p 79).

Native Olympia oysters differ in growth rates, habitat, diet, and reproductive characteristics from the cultivated non-native oyster. Just as important is the fact that cultivated oysters and mariculture racks, plastics, and bags are foreign, novel structures that do not replace the habitat for native organisms provided by a native oyster reef. Hanging oysters do not mimic natural, native oyster habitat. (Beck et al., 2009), nor do oysters in bags. And, any native organism that settles and attaches on a cultivated oyster is harvested.

Furthermore, Trimble et al. (2009) state: "Unfortunately, we show evidence that the commercial species introduced to replace [the native oyster] *O. lurida*, in addition to hitchhiking species, may in fact be contributing to the inability of the native oyster to return to its former abundance in west coast bays." DBOC cultivated oysters **do not help** to restore an historic baseline ecosystem.

Claim: Ancient oyster middens are still present in the estero. (Lytz letter, p 2).

This claim is not supported by scientific evidence or a reference citation. "Archaeological studies of middens in the vicinity of the estero suggest that oysters were not much utilized by the inhabitants at the time" (Dennis, 2009; see also Babalis, 2009; Rudo, 2009). NRC (2009, p. 20) states "The Olympia oyster, *Ostrea lurida*, was a former constituent of Drakes Estero of some unquantifiable abundance as evidenced by the mounds of its shells in the Coast Miwok midden near the on-land facilities of DBOC." (**NRC provides no citation**). The oyster shell mound near the on-land facilities of DBOC is not a reliable indicator of native oyster abundance because it is corrupted by modern deposits and disturbance. As Riley (1976) reported, the shellfish operator stopped dumping shellfish on the mound when the truck could no longer go up the hill.

Claim: Miwok Indians were the original "oyster-farm operators" with their harvesting of native shellfish thousands of years ago. (Lytz letter, p. 2)

We are aware of no historic, archeological or scientific documentation that Coastal Miwok tribes were "oyster farm operators" in Drakes Estero. The claim seems weak on several grounds:

- As just noted, local inhabitants at the Estero did not make much use of oysters. Clams were the predominant shellfish harvested.
- We are aware of no data indicating that Native Americans introduced non-native organisms and structures which harm the environment and their food sources in the Estero.
- DBOC oyster farm operators use plastic, mechanized transport, refrigeration, pneumatic hammers to open shellfish, and other technology not used by earlier inhabitants.

Claim: Cultivated, non-native oysters are also known as "ecosystem engineers" (Lytz letter, p. 6), i.e. they alter natural habitat, nutrient flows, invertebrate settlement patterns, and food webs.

Is this desirable? This claim is supported by science and is a cause for concern because this is human introduced impact. "Many characteristics of oysters lead to predictions that they would be successful, high-impact members of recipient ecosystems. This conclusion leaves open the discussion of whether such impacts are desirable in terms of restoration of coastal ecosystems, especially where restoration of native oysters is possible." (Ruesink et. al, 2005).

Claim: Cultivated non-native oysters bolster the ecosystem's resilience against abnormal events like phytoplankton blooms or sedimentation from storm water run-off" (NRC, 2009, p.22. 23 cited by Lytz letter, p. 6)

This headline grabbing claim in NRC (2009) about added resilience from the cultivated oysters is not supported by research in Drakes Estero or scientific research in similar coastal bays on the west coast. Dumbauld et al. (2009) indicate that West Coast estuaries have substantial oceanic influence. "Overall, oceanic conditions greatly influence both primary and secondary production within these systems." "We suggest that water clarity improvement will be more important in areas experiencing cultural eutrophication." – which is not a problem in Drakes Estero per NRC (2009, p. 27). For a more detailed discussion of this topic please refer to our April 8, 2010 letter to Secretary Salazar.

Claim: Possible beneficial effects of cultivated oysters on eelgrass in the area, given that eelgrass has approximately doubled in Drakes Estero from 1991 to 2007. (Lytz letter, p. 6)

The claim of a beneficial effect is not supported by data or science. During that time frame, oyster production fluctuated with an overall down trend in production. This time frame includes the period when Johnson Oyster Company reduced production. (See Figure 6. CDFG Drakes Estero Oyster Production Data in NRC, 2009, p. 18) In fact, if one does a linear regression of oyster production vs. year, the coefficient is a drop of about 33000 pounds per year with a correlation coefficient of -.65, a relatively strong negative relationship. Thus, while the eelgrass area was possibly doubling - going up, a regression line on oyster production was dropping. It appears from the data in Drakes Estero that **reducing oyster production is associated with increasing eel grass**, contrary to the claim of Mr. Lytz. [It should also be noted that the NRC comment about doubling of eelgrass area is anecdotal; NRC cites no scientific analysis and ground verification of the aerial data.]

While oyster production steadily dropped from a peak of 769000 pounds in 1995 to a low of 34000 pounds in 2000, native shellfish and other invertebrates in Drakes Estero continued their filtration and ecosystem services throughout that period. Local native clams and other filter-feeding organisms contribute to eelgrass productivity via nutrient regeneration. Carroll et al, (2008), showed that native clams in sediments benefit the

expansion of eelgrass beds in relatively clean estuaries by relieving nutrient limitation. In other words, the cultivated oysters are not necessary for eelgrass productivity and growth, and based on the negative correlation with oyster production data, it appears that oyster production in Drakes Estero may harm eel grass growth.

Summary

There are many environmental organizations who oppose the lease extension because of their interest in protecting the Estero's wilderness designation and defending the National Park Service's policies for protecting natural resources. We agree with those concerns, and agree that the policies provide grounds and mandate to deny the extension. Additionally, best available science shows that many of Lytz's and DBOC's conclusions are incorrect. Scientific evidence actually shows that there are major adverse impacts and risk of even greater adverse impacts from extending mariculture in Drakes Estero. The best available science supplements the policy reasoning for denying the use permit request, and we urge you to deny it.

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