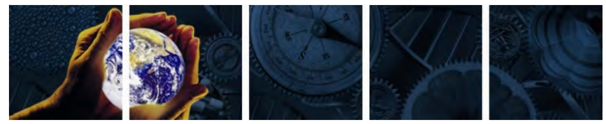

Comments on Drakes Bay Oyster Company Special Use Permit Environmental Impact Statement

Point Reyes National Seashore

Prepared for:
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1 Introduction

ENVIRON International Corporation (ENVIRON) has reviewed the Draft Environmental Impact Statement (DEIS) Drakes Bay Oyster Company Special Use Permit (ID: 43390), and appreciates this opportunity to report our technical comments to the National Park Service (NPS) in print form. ENVIRON regularly participates in NEPA processes such as this, and respects the effort put forth by the NPS in order to develop this draft document. The purpose of these comments is to assist the NPS in developing a more scientifically accurate and complete final document that is consistent with NEPA and NPS policy.

In general, the structure of the DEIS is unusual in that there is no alternative that represents the proposed action. Neither is there an alternative that represents a continuation of current conditions. In the current structure of the DEIS, the public is left to glean unknown conditions without the Drakes Bay Oyster Company (DBOC) as the no action scenario. Consequently, the impacts resulting from conditions under alternatives that depart from this unknown status (Alternative A) are even more difficult to understand. No explanation is provided for this deviation from standard NEPA protocol, and ENVIRON questions the efficacy of this approach.

Setting aside the DEIS structure, comments have been developed in several topic areas. ENVIRON found consistent omissions and mistakes that err in a way that exaggerates potential negative impacts and understates potential positive impacts benefits. NEPA protocol requires the author to apply a net impact analysis – an assessment of both positive and negative impacts. Without this net approach, results could point toward a ‘least negative’ alternative which might in fact be worse for the environment than another option that had more negatives, but more positives that potentially balance out or mitigate for the negative impacts.

Our findings with respect to select comment topics are summarized briefly below in Table 1. In the final column, a statement of the overall impact conclusion reported in the DEIS for Alternative D is shown for each receptor. The assessment is followed by a recommended overall impact conclusion based on our review of the subject material (presented in bold). Alternative D is chosen since it anticipates the largest SUP area and highest levels of oyster production. Therefore, our recommendations apply also to Alternatives B and C, which may be assumed to be even more benign.

Table 1. Summary of DEIS Comment Topics Discussed.

Subject	**Comment Themes**	DEIS Impact Conclusion	**ENVIRON Recommendation**
Eelgrass	• Incomplete measurement techniques • Inappropriate references used to support impact claim • Unsupported claim of sediment resuspension • Misattribution of natural impacts to DBOC • Failure to consider the net result regarding invasive species • Misinterpretation of references regarding epiphytic algae	LT moderate adverse	**LT neutral or beneficial**

Subject	Comment Themes	DEIS Impact Conclusion	ENVIRON Recommendation
	• References not relevant to the action • Omission of mariculture/eelgrass positive interactions		
Benthic Fauna	• Misleading description of bivalve competition • Misunderstanding of invasive dispersal impact • Misrepresentation of sessile organisms • Omission of oyster rack benefits to the benthic community • Inappropriate impact description regarding non-catch mortality	LT moderate adverse	**LT neutral or beneficial**
Bird Interactions	• Conclusion completely unsupported by scientific record • No credit given for use of donated shells for snowy plover and least tern restoration	LT moderate adverse	**LT beneficial**
Habitat Restoration	• No credit given for beneficial use of shells in habitat restoration projects	LT moderate adverse (wildlife habitat)	**LT beneficial**
Water Quality	• Failure to mention shellfish contribution to water clarity • Omission of cattle related nutrient mitigation feature of mariculture • No mention of biosequestration of nitrogen and phosphorus • No mention of denitrification benefit • Failure to discuss marine debris mitigation by current owners and DBOC staff patrol program • Incorrect analysis of impacts that do not change with alternative (wastewater; impervious surfaces) • Exaggeration of runoff impact found safe by CDH • Exaggeration of impacts from CCA leaching and pesticides	ST minor adverse and LT minor adverse	**ST and LT moderate beneficial**
Wetlands	• Completely ignores NWP 48 analysis that there are minor impacts to wetlands from shellfish operations • Unsupported claims that wetlands are impacted	ST minor adverse and LT moderate adverse	**ST minor and LT neutral**
Coastal Flooding	• Floodplain analysis is inappropriate because DBOC is not in a flood zone	LT moderate adverse impacts	**LT neutral or unknown**

Subject	**Comment Themes**	DEIS Impact Conclusion	**ENVIRON Recommendation**
Noise	• Noise Measurements Consistently Underestimate Background Noise • Noise Measurements Consistently Overestimate DBOC Noise	ST moderate and LT major adverse	**ST and LT neutral or negligible**
Recreation	• Underestimated Value of Visitors to DBOC	LT moderate adverse	**LT neutral or beneficial**
Culture	• Cultural Value of Last Shellfish Processor in CA under emphasized		
Socioeconomics	• Dismissive approach to job and housing loss • No mention of Ecosystem Service value	LT beneficial	**Agreement**
Environmental Justice	• Differential impact will hit Hispanic workers		

ST = short term impact; LT long term impact

Author Biographies

Bud Abbott, PhD – Fisheries and Ecology

A Senior Principal Environmental Biologist at ENVIRON, Dr. Abbott has more than 30 years of experience performing assessments of fisheries and aquatic resources for government agencies and the private sector. He specializes in fisheries ecology, marine bioacoustics, underwater explosive impacts, and natural resource modeling. He has managed large teams of scientists and field technicians designing monitoring programs, collecting and entering field data, performing modeling based on field data, and analyzing model outputs and databases. He is an authority on Sacramento-San Joaquin River Delta and San Francisco Bay fisheries issues and is an expert in threatened and endangered species of fish, dam removal permits, underwater explosive and pile driving impacts on fish, and aquatic pest control. He has worked in the Sultanate of Oman, Egypt, Burma, Chile, and Kiribati on various fisheries, aquaculture, and development projects.

Prior to joining ENVIRON, Dr. Abbott worked for many international institutions, including Asian Development Bank, World Bank, USAID, and the U.S. Peace Corps. He is a registered Professional Engineer in the states of New Jersey, Connecticut, and New York; a Licensed Environmental Professional in the state of Connecticut; a Certified Ground Water Professional; and has obtained New Jersey Department of Environmental Protection Certification in Subsurface Evaluation. He holds both a PhD in Fisheries and a MS in Fisheries from the University of Washington, and a BS in Biology from California Western University.

Rabia Ahmed, M.S. – Environmental Justice

Ms. Rabia Ahmed has over nine years of experience in policy and regulatory economics, natural resource economics, and community/development economics. She has a Master's degree in economics from Portland State University. Ms. Ahmed has extensive experience in conducting socioeconomic and environmental justice impact analyses for National Environmental Policy Act (NEPA), State Environmental Policy Act (SEPA), and California Environmental Quality Act (CEQA) projects, studying water laws and water markets in the Western states, water demand analysis, valuation of ground and surface water, economic impact analysis of critical habitat designations under the Endangered Species Act (ESA), survey design, and participatory research methods, using tools such as focus group discussions and open-ended questionnaires. She has successfully managed a number of projects involving multi-disciplinary teams.

Ms. Ahmed has conducted a number of socioeconomic and environmental justice analyses required under NEPA and CEQA relating to power and energy projects, recreation, proposed residential and commercial developments, industrial projects, and land management plans. In addition, she has worked directly with communities in many countries to understand and evaluate impacts of development projects on these groups. Ms. Ahmed has also been involved in studies on the economic impacts, costs, and benefits of critical habitat designation under the ESA, focusing on impacts of such designations on commercial, governmental, and private activities. Her quantitative background includes statistical analysis, including linear regression, using SAS and Gauss. She is also experienced in facilitating community meetings and conducting focus groups.

Gretchen Greene, PhD - Socioeconomics

Dr. Gretchen Greene is a Senior Manager and Economist with more than 15 years of diverse economics experience in community and natural resource economics. She is a senior practitioner in ENVIRON's Ecology Sediment Group. She has expertise in natural resource damage assessment (NRDA), ecosystem service valuation, net environmental benefit analysis (NEBA), remediation cost analysis, and natural resource management. She also brings experience in regulatory analysis and National Environmental Policy Act (NEPA) processes (Environmental Assessments and Environmental Impact Statements) (EAs and EISs); endangered species economics; water demand and water resources planning; conservation planning and sustainable economic development; cost-benefit analysis; population projections and forecasting; decision analysis with uncertainty; survey design and data analysis; and agricultural trade and markets. She has worked with numerous federal, state, and municipal agencies throughout the U.S., tribal authorities in the U.S. and Canada, as well as private industrial clients and law firms. She has worked as a teacher, trainer, and facilitator in the U.S. and internationally. Gretchen received a PhD. and MS degree from the Food and Resource Economics Department at the University of Florida. She has an undergraduate degree from Wellesley College in Religion Studies.

Dr. Felix C. Kristanovich, PE, CFM – Flooding

A manager in the Seattle office, Dr. Felix Kristanovich is a senior water resources engineer with experience in the Pacific Northwest and California. Felix is a lead hydraulic engineer, and has worked on numerous streamflow restoration projects, including Skagit River Delta, Nisqually Wildlife Refuge, Chinook River/Estuary, Black River, and Goldsborough Creek in Washington, and numerous wetland mitigation sites and rivers in California. He has performed flood insurance studies for FEMA via LOMR, CLOMR, and LOMA processes, and prepared dam design documents in compliance with the Department of Ecology Dam Safety. As a hydrologist and hydraulic engineer, Felix specializes in development and application of hydraulic models HEC-RAS, HEC-HMS, and HEC-6, hydrologic models HSPF, MGSFlood, and WWHM, and hydraulic/water quality models SWMM, CORMIX, RMA2 and QUAL2K models. Felix also regularly uses HEC-RAS, HY-8, and other hydraulic models for design of culverts and bridges for fish passage.

As a water quality engineer, Felix organized and implemented water quality monitoring programs (including water quality monitoring at Meadowbrook Pond facility, and several post-construction water quality monitoring projects), coordinated numerous field investigations for hydrologic reports, environmental impact studies, and also provided water quality modeling of pollutants from various developments. As a costal design engineer, Felix designed shoreline protection against wind-waves, ship-waves and river currents on the Columbia and Willamette rivers, and along shorelines at different Puget Sound harbors. As a stormwater engineer, Felix was the lead engineer in development and application of HSPF models for the Port of Seattle Third Runway Master Drainage Plan, and for the City of Kent storm-drain master plan. Felix also used MGSFlood, WWHM, and KCRTS models to recommend and size stormwater facilities and BMPs.

Felix is professionally registered as a Civil Engineer in California, Oregon and Washington. He is actively involved in the AWRA, where he helped organized 2005 and 2009 AWRA conferences in Seattle. He organized numerous dinner meetings, and served as an acting Secretary, Treasurer, and the President of the AWRA Washington State Section. Felix is the member of the Seattle Section of the ASCE and of Northwest Regional Floodplain Manager Association (NORFMA). Felix has a PhD in Civil Engineering from Louisiana State University, a MS in Civil Engineering from CALTECH, and a BS in Civil Engineering from the University of Zagreb. Felix is a registered professional engineer (civil) in Washington, Oregon, and California.

Scott Luchessa, M.S. - Wetlands

Scott Luchessa is a senior wetland scientist and certified ecologist with more than 24 years' experience in aquatic, wetland, and terrestrial ecology. He currently leads ENVIRON's wetlands and stormwater management services in the Pacific Northwest. He has a comprehensive knowledge of local, state, and federal government permitting processes pertaining to wetlands and water resources. Scott has successfully provided permitting assistance and regulatory compliance services to a wide range of public and private sector clients, including many port authorities; other state, federal, and local government agencies; large corporations; and non-profit organizations. Among some of the clients Scott has successfully served are the Ports of Seattle and Portland; the U.S. Navy; National Park Service; Weyerhaeuser, Taylor Shellfish, and Dow; Trust for Public Land and The Nature Conservancy. Scott is an expert in wetland restoration and mitigation and has designed compensatory wetland mitigation plans and specifications as part of National Resource Development Assessment (NRDA) settlement claims and Section 404 of the Clean Water Act (CWA) permitting processes. He has led and overseen multi-disciplinary investigations required to demonstrate compliance with the CWA, Endangered Species Act (ESA), National Environmental Policy Act (NEPA) and other federal, state, and local government laws and regulations. Scott received an MS in environmental studies from the University of Montana and BS in biology from San Diego State University.

Erica McCormick , M.Sc., RPA /Cultural Resource Specialist

Erica D. McCormick, M.Sc., RPA, has extensive experience in GIS technologies, cadastral mapping, and tribal consultation. Her expertise is reflected in a Graduate Certificate in GIS and in her membership in the Register of Professional Archaeologists (RPA). As a GIS Analyst and Consulting Scientist, she routinely processes and georeferences Indian Lands and General Land Office (GLO) cadastral data, the products analogous to the Canada Lands Digital Cadastral Data which will be critical to the success of this project. Similarly, she has specialized knowledge of Donation Land Claims (DLCs)-the American equivalent of the Land Claim Settlement Lands, utilized in Canada-and is competent interpreting historical administrative and cultural features on early maps as well as the historical field notes commonly included by the original cadastral surveyors. She regularly directs large-scale cultural resources research projects, incorporating ethnographic and geospatial data from numerous archival, online, and first-person sources.

Ms. McCormick's tribal coordination has included government-to-government relations as a representative of the BLM as well as for the Confederated Tribes of Warm Springs, where she served as Tribal Archaeologist. Consultation has included oral histories, research of traditional plant and animal resources, protection and identification of traditional plants, surveying for and mapping Tribal trails demarcated by early surveyors by tree blazes, and the creation of GIS Deliverables for Tribes. She has access to a range of data sources, which have been significant to her research of aboriginal land use patterns and ethnographic lifeways. Erica has a Graduate GIS Certificate from Portland State University, an MSc in Paleopathology from University of Durham (UK), and a BA in Anthropology from the University of Oregon. Erica is also a registered RPA

Marlene Meaders, M.S. – Fisheries and Ecology

Ms. Meaders is a fisheries biologist with over 11 years of experience. She specializes in environmental risk assessment, habitat analysis, population dynamics, invertebrate ecology, and fish health. Ms. Meaders has a diverse background in identifying habitat conditions for an array of biota, including marine mammals, anadromous and resident fish, and marine invertebrates. In addition, she has created numerous reports and models to aid in the consultation process for fisheries management, aquaculture operations, and environmental permitting. Ms. Meaders is well-versed at baseline studies that require thorough evaluation of background literature related to Environmental Impact Statements (EIS), Environmental Risk Assessment (ERA), Habitat Conservation Plans (HCP) and Biological Assessments/Evaluations (BA/BE). Ms. Meaders holds a master's of science in fisheries biology, focusing on invertebrate biology, from Humboldt State University, and a bachelor's of science in Biological Oceanography from the University of Washington.

Greg Reub, M.S. – Fisheries and Ecology

Mr. Reub has over 27 years' experience related to impact assessment, mitigation, and restoration of natural resources. His expertise is currently focused on integration of science-based strategies to expedite resolution of complex natural resource issues. He has been involved in numerous large and small environmental assessments that encompass aquatic, estuarine, marine, riparian, and terrestrial environments as project manager, lead and contributing scientist, technical negotiator, and expert witness. Mr. Reub has extensive experience related to Natural Resource Damage Assessments (NRDA), habitat restoration, landscape-level conservation planning, Endangered Species Act (ESA) compliance and environmental assessment and permitting. His projects have focused on determining physical and/or chemical impacts to habitats and then developing innovative restoration/conservation measures for cost effective resolution. Mr. Reub is known for developing and working with interdisciplinary teams to solve interrelated issues ranging from physical and biological relations such as instream flows, fish passage, water and sediment quality, geomorphic changes and vegetation interactions to the social, cultural and political realities associated with natural resources. Mr. Reub has worked in diverse geographic locations including most of the contiguous United States, Alaska, Canada, Colombia, Bolivia, Brazil, Panama, Ecuador, Chile, the Philippines, and Guam. Greg has a MA in Ecology and Systematic Biology and BS in Wildlife and Fisheries Science from South Dakota State University.

Richard Steffel, PhD - Noise

A Principal Consultant at ENVIRON, Mr. Steffel has over 28 years of experience evaluating impacts and mitigation related to mobile and area sources of air pollution, including 15 years conducting transportation and general conformity assessments under state and federal air quality rules. Many of these were transportation projects and/or transit or transit-oriented development or redevelopment projects that included project-level air quality conformity determinations. Mr. Steffel also has over 18 years of experience conducting and managing a wide variety of environmental noise compliance, impact, and mitigation assessments. He has conducted and overseen numerous evaluations of roadway, transit, and development projects which have included consideration of compliance with state and local noise rules along with both federal and state noise impact and mitigation criteria established by the Federal Transit Administration (FTA), the Federal Highway Administration (FHWA), the US Department of Housing and Urban Development (HUD), and various state transportation agencies including the Washington State Department of Transportation (WSDOT). Mr. Steffel has also conducted numerous air and noise studies for new and modified marine port and intermodal facilities. Mr. Steffel has managed and conducted hundreds of air quality and environmental noise studies at the behest of state, county, and municipal agencies and private interests that have included reviews required by the State Environmental Policy Act (SEPA) and/or the National Environmental Policy Act (NEPA). Richard has a MS in Environmental Studies from the University of Montana (Air Quality/ Energy Conservation) and a BA in Anthropology from Georgia State University.

2 Comments

Below are summary statements regarding the comments that ENVIRON addressed from the DEIS. Comments are addressed in several topic areas, including:

A. eelgrass,
B. benthic fauna,
C. bird interactions,
D. habitat restoration
E. water quality
F. wetlands
G. coastal flooding
H. noise

I. recreation

J. cultural value

K. socioeconomics

L. environmental justice

There is an extended discussion of comments for eelgrass, water quality and benthic invertebrates presented in Appendix A. These topics were determined to need special attention because the negative impacts stressed in the DEIS centered around these topics.

A Eelgrass

A1. Propeller Scarring – on page 265 of the DEIS, the authors attempt to compare aerial photography of “propeller scars” in eelgrass beds between 2007 (NAS 2009) and 2010 (NPS data). Although they provide a value for the estimate of area impact in 2007 (50 acres) they do not provide a corresponding area impact value for 2010, even though the data is based on higher resolution photography, which should provide a more accurate estimate of this impact. Further, there is no indication in the DEIS of how long these impacts potentially persist.

It is our contention that the DEIS did not provide a comparative value in 2010 because it is substantially lower than the 2007 estimation, which was “loosely quantified.” In fact, calculating the area based on the distance reported for the 2010 data (8.5 miles), and providing a range of possible widths, the area of impact is a minimum of 91% lower than calculated in 2007. Additionally, the maximum area of impact calculated (4.1 acres) represents 0.2% of the total Drakes Estero waterbody and 0.6% of eelgrass habitat available in the estuary.

Finally, and most importantly, the impact is in two forms: temporary and longer term. The majority of the impact from boat use is temporary and minor. This involves grazing the tops of eelgrass leaves; similar to mowing a lawn, which stimulates growth. Regrowth of eelgrass from this type of impact would take approximately 2-4 weeks to recover the original biomass (J. Ruesink, pers. comm., 2011). Further to the point, shoot density remains unchanged, and no long term damage occurs in terms of density. The longer term impact is from the removal of the meristem, which may occur occasionally. Regrowth from this type of impact would typically occur at a rate of 1cm/2 weeks (J. Ruesink, pers. comm., 2011).

Although the majority of impact is temporary, the scars observed from aerial photography represent an accumulation of longer term impact. In other words, the 8.5 mile estimate is not over a single day, but over a much longer period of use (likely over a period of a year or more). (Note that this is based on the fact that the average width of impact would be 3 ft, which would require approximately a year to regrow based on the 1cm/2wk growth rate.) In general, boating in the Estero typically occurs in water deep enough to avoid interactions with eelgrass that would pull up the entire plant. Where these few occurrences occur, plants would be able to regrow within a year if not continuously disrupted.

In summary, this impact should be considered short-term and minor based on the intensity of impact, persistence, and how little of the waterbody is affected.

A2. Boat Use and Transit Plan – on page xxxvi of the DEIS, the authors state that a transit plan must be created by DBOC and submitted to NPS for approval. Additionally, there is language in the DEIS on page xxxvii that would limit boat use by DBOC to two motorboats and two barges, approximately 12 trips per day, 8 hours a day combined. These restrictions are not substantiated and would cause undue burden on DBOC operations.

A vessel transit plan, including GPS boat tracking reports, has already been completed and submitted to NPS. The NPS has disregarded what was submitted in the scoping process and has created an arbitrary lease area in the DEIS (Figures ES-7, ES-9, ES-11). The proposed restriction would make it impossible to access certain oyster beds. A vessel transit plan should definitely be a part of the EIS. However, allowing NPS in the future to “approve” or “not approve” a vessel transit plan gives them the authority to strangle DBOC without a public process. No data or evidence showing harm caused by the existing boat routes has been provided. DBOC would agree to modify its vessel transit plan through use of an adaptive management approach. Adaptive management recommendations would be made by an adaptive management team composed of individuals representing NOAA, CDFG, NPS, CDPH and DBOC. The Marine Mammal Commission (MMC) has recommended this adaptive management team, which should be responsible for all offshore management change decisions.

The boat use restriction would make it almost impossible for DBOC to conduct its business. DBOC actually has had 3 boats for much of the past 5 years, and is on the water for most of the day in order to complete operations. To limit boat use to a combine 8 hours per day would be devastating to operations. There is no justification for this restriction, and it appears that it is in place to functionally debilitate operations if they are allowed to proceed through the SUP.

A3. Uprooting Eelgrass – on page 265 of the DEIS, the authors claim that eelgrass biomass and abundance is compromised because of boat activity and damage from propellers. However, as discussed above, although this may occur to a minor extent, the majority of interactions with eelgrass do not remove the entire plant, and regrowth occurs within 2-4 weeks. Additionally, the references used to discuss this potential impact do not have any similarity with conditions in the estuary.

The disturbance to seagrass discussed in Preen et al. (1995) was related to two major storms and a cyclone, all in succession. These disturbances are, at minimum, several orders of magnitude greater than the disturbance created by boat traffic associated with tending culture operations in the Drakes Estero. Further, the turbidity that remained in the system following these major storm events was related to 1000 km^2 of eelgrass being uprooted. In the second citation provided in the DEIS to support the conjecture of impact, Fonseca and Bell (1998), the only mention of how storms can influence beds was from the quote “We did not determine whether acute wind events periodically act to organize seagrass bed formation through extensive reductions in seagrass coverage, although some systems (e.g. Tampa Bay) can experience marked changes in cover after large storm events.” Notably, there is no discussion in the paper regarding scarred beds.

In summary, there is no evidence that eelgrass habitat is being moderately impacted relative to boating activities, and the implication that boating can create turbidity that will further affect eelgrass growth is based on events that are infinitely more intense. Based on the information presented, this impact appears to be negligible in Drakes Estero and has no bearing on the overall quality of eelgrass habitat.

A4. Boat Wake Erosion – on page 266 of the DEIS, the authors discuss how propeller wash can erode eelgrass in navigation channels. The authors are using the cited references inappropriately to try to attribute propeller wash in Drakes Estero. The propeller wash noted by Thom et al. (2003) was based on pleasure crafts (yacht) and ferryboats, which displace much larger volumes of water than the 20-ft long skiffs used in DBOC operations. Koch (2002) was based on more recreational type boating, but they ultimately concluded that negative effects to seagrass were minimal, and even further reduced when boats moved at high speeds during a high tide. Further, Koch (2002) commented that the strongest impact was from resuspension of a small amount of sediment, and that it was "redeposited within minutes." There is no evidence that propeller wash is occurring in Drakes Estero, and trying to compare navigation channels with the habitat in Drakes Estero, or reporting the results incorrectly, is simply poor science.

A5. Sediment Resuspension – on pages 265 and 266 of the DEIS, the authors claim that sediments are destabilized in Drakes Estero due to the removal of eelgrass from DBOC operations. There is no evidence, and no supporting data, to these claims. First, the work by Anima (1991) was done when Johnson Oyster Company was working in Drakes Estero, and the only mention of disturbing the bottom was associated with the boat dock in Schooner Bay. Second, the reference to boat-generated waves in Koch (2001) was from Stewart et al. (1997), a study completed in the Upper Mississippi River in a major navigation channel. Third, as discussed above, Koch (2002) noted minimal impact generated from a 21-ft V-hulled boat to seagrass habitat.

A6. Introduction of Invasive Species – on page 263 and 266 of the DEIS, the authors attribute the introduction and expansion of *Didemnum* to DBOC operations and mariculture structure. Further, the authors claim that *Didemnum* has the ability to colonize eelgrass. The authors fail to recognize, (1) *Didemnum* was not introduced by mariculture operations, (2) there are many colonial tunicate species in Drakes Estero, (3) because it has the ability to colonize eelgrass, taking out the mariculture structure would only make eelgrass a more attractive substrate for attachment, and (4) current minimization measures that manage for invasive species. In general, colonial tunicates are more problematic for the oyster industry (Jamison 2007) than the local biota in Drakes Estero, and it is in the best interest of DBOC to control the organism. It should also be noted that, even though the NPS claims that they have been monitoring this species, they do not provide any data that it has expanded in abundance in Drakes Estero since initiation of monitoring. In summary, DBOC is not responsible for the introduction of this species, which could just as likely have been introduced by recreational activity, and it provides a service to the NPS through control measures taken during harvest and maintenance activities associated with the farm. If the NPS is serious about managing for invasives, then it should be working with DBOC rather than implicating it in a problem that they did not originate and for which they are improving.

A7. Epiphytic Algae – on page 263, Chapter 4 of the DEIS, the authors suggest that removing the DBOC would reduce potential harm to eelgrass by removing mariculture structures that stimulate the growth of epiphytic algae. In fact, mariculture is more likely to reduce algae production through consumption of nutrients. Further, the authors use inappropriate scientific references to support the mistaken claim.

For example, when Hauxwell et al. (2001) and Dumbauld et al. (2009), cited by the DEIS authors, were discussing vegetation that grows on mariculture structures, they were not talking about epiphytes, they were talking about epiphytic *macro*algae. There is a big difference. Epiphytic macroalgae (e.g., *Ulva*, *Fucus*, *Enteromorpha*) are algal species that colonize on structures and can outcompete eelgrass by shading it out, especially newly recruiting shoots (Hauxwell et al. 2001). Epiphytes (e.g., diatoms) that colonize eelgrass blades are a result of natural processes, but can be overproduced due to nutrient loading in a system (Hauxwell et al. 2001, Nielsen et al. 2004). Shellfish aquaculture can actually control the growth of epiphytes by reducing water column nutrients.

A8. Eelgrass under Oyster Racks – on page 266 of the DEIS, the authors state that bags and racks used for shellfish cultivation have been shown to reduce coverage and density of eelgrass due to shading. To support their claims, they use a number of references from

California and the Pacific Northwest that were interpreted incorrectly. Interactions between shellfish cultivation and eelgrass are not as simplistic as presence/absence. Although there may be space competition in a small portion of the estuary associated with the racks and bags (1%), the water filtration and sediment enrichment benefits that shellfish provide positively benefit more than 92% of the Estero and associated benthic communities. (Note: this value is based on the figure presented in NAS (2009) that DBOC has impacted 8% of eelgrass resources, although 7% was based on boating impacts to eelgrass, which more recent data does not support, as discussed above).

For reference, Rumrill and Poulton (2004) found that spacing oyster longlines more than 5 feet apart resulted in no significant reduction in eelgrass density relative to reference areas: the eelgrass spatial coverage among long lines spaced at 5 or 10 ft intervals was within the range of variability found in reference plots. Longlines spaced closer than 5 feet were found to reduce the spatial coverage of eelgrass. Thus, appropriate spacing was found to reduce the space competition found between mariculture gear and eelgrass, and allowed for the coexistence of mariculture operations and suitable eelgrass habitat. The distance of the most densely clustered oyster racks in Drakes Estero are separated by 16 to 20 feet (K. Lunny, pers. comm., 2011). In addition, many authors have reported that bottom culture can increase eelgrass growth rates, even if the plants are less dense (Peterson and Heck 2001, Newell 2006, Tallis et al. 2009). At most, effects from the presence of aquaculture gear in Drakes Estero can be considered neutral if you consider the amount of space that is impacted due to space competition (1%) compared to the amount of benefits it provides through water filtration, sediment enrichment, and predator refugia (92%).

A9. Erosion under Oyster Racks – on page 267 of the DEIS, the authors claim that oyster racks promote erosion and/or sedimentation. There is little value in this statement. First of all, it is unclear if the authors feel that sedimentation or erosion is problematic in relation to the oyster farm. Second, both of these processes are typical of tidally-driven systems. According to numerous researchers, tidal action is the dominant driver in sediment distribution in Drake Estero (Anima 1991, Elliott-Fisk et al. 2005). Anima (1991) reports that there is an overall sedimentation trend in Drakes Estero. The rate of sedimentation has varied over the history of the estuary. From 8,000 to 3,000 yrs BP the sedimentation rate was 37.5 cm/100 yrs; from 1,200 to 1,700 yrs BP the rate was 3.8-6.4 cm/100 yrs; and finally a calculated short-term deposition rate of 9-60 cm/100 yrs. In general, Anima (1991) reports that sedimentation has increased in the last 150 yrs, which he attributed to increased land use as a result of population growth. Actions that he attributed to the sedimentation rate included trail and road use, road building, increase in paved areas that increase the amount of surface runoff, and cattle grazing. However, overall, the rate of filling was similar to other West Coast lagoons.

Anima (1991) also described how the estuary can be dominated by sedimentation processes in some years and erosional processes in others. Drakes Estero is an open-coast system, which have direct influence on the distribution of sediment inside the estuary. When the entrance is to the extreme west (as in 1953 and 1974), oceanic wave and tidal approach is nearly aligned with the main arm of the tidal channel and carries sediment suspension further into the lagoon. When the mouth is in a west side configuration, incoming waves and tides attack the adjacent cliffs, and result in increased erosion.

Finally, filter feeders play an important role in the deposition of fine grained sediment. Suspended matter removed by oysters is deposited as feces and pseudofeces (biodeposition). The rate of biodeposition has been reported to be seven times faster than the deposition of solids by gravity or settling from suspension (Haven and Morales-Alamo 1966 as cited in Anima 1991). The authors also observed that the biodeposition rate of other common invertebrates equals or exceeds that of oysters. Further, according to Harbin 2004 as cited in Elliot-Fisk et al. 2005), the amount of organic matter resulting from pseudofeces produced by suspended oysters is far less than the amount of organic matter resulting from eelgrass decomposition, considering how expansive and dense the beds are within the estuary, making any significant organic inputs from the oysters undetectable (Harbin 2004 as cited in Elliott-Fisk et al. 2005). The Elliot-Fisk et al. (2005) report went on to conclude that "We found the oyster racks to have no pronounced impacts on the eelgrass beds, which existed both under and away from the racks as an incredibly rich habitat type." Overall, DBOC oyster racks account for 0.6% (7 acres out of 1,152 acres) of the total intertidal habitat within the Estero. Therefore, the increased sedimentation rate associated with the racks is an insignificant portion of the overall sedimentation in the estuary contributed by tidal action, eelgrass habitat and other invertebrates. More importantly, the presence of oyster racks is not inhibiting eelgrass growth in Drakes Estero.

A10. Expansion of Eelgrass Habitat – on page 262 of the DEIS, the authors note that eelgrass habitat in Drakes Estero has expanded from 1991 to 2007, but that this expansion cannot be attributed to the shellfish operations (they do not attempt to explain what other cause could be related to this expansion). Shellfish have been shown by multiple researchers to provide benefits to eelgrass habitat (Reusch and Williams 1998, Peterson and Heck 2001, Newell 2006). Additionally, areas that see expansion of culture (as long as it is within carrying capacity of the system) have also seen an increase in seagrass habitat (Ward et al. 2003). Even if the benefits that shellfish provide are not recognized, it is obvious that, under the environmental baseline, DBOC operations are not having a negative impact on eelgrass, as eelgrass coverage has doubled in the last 16 years (Figure A-1).

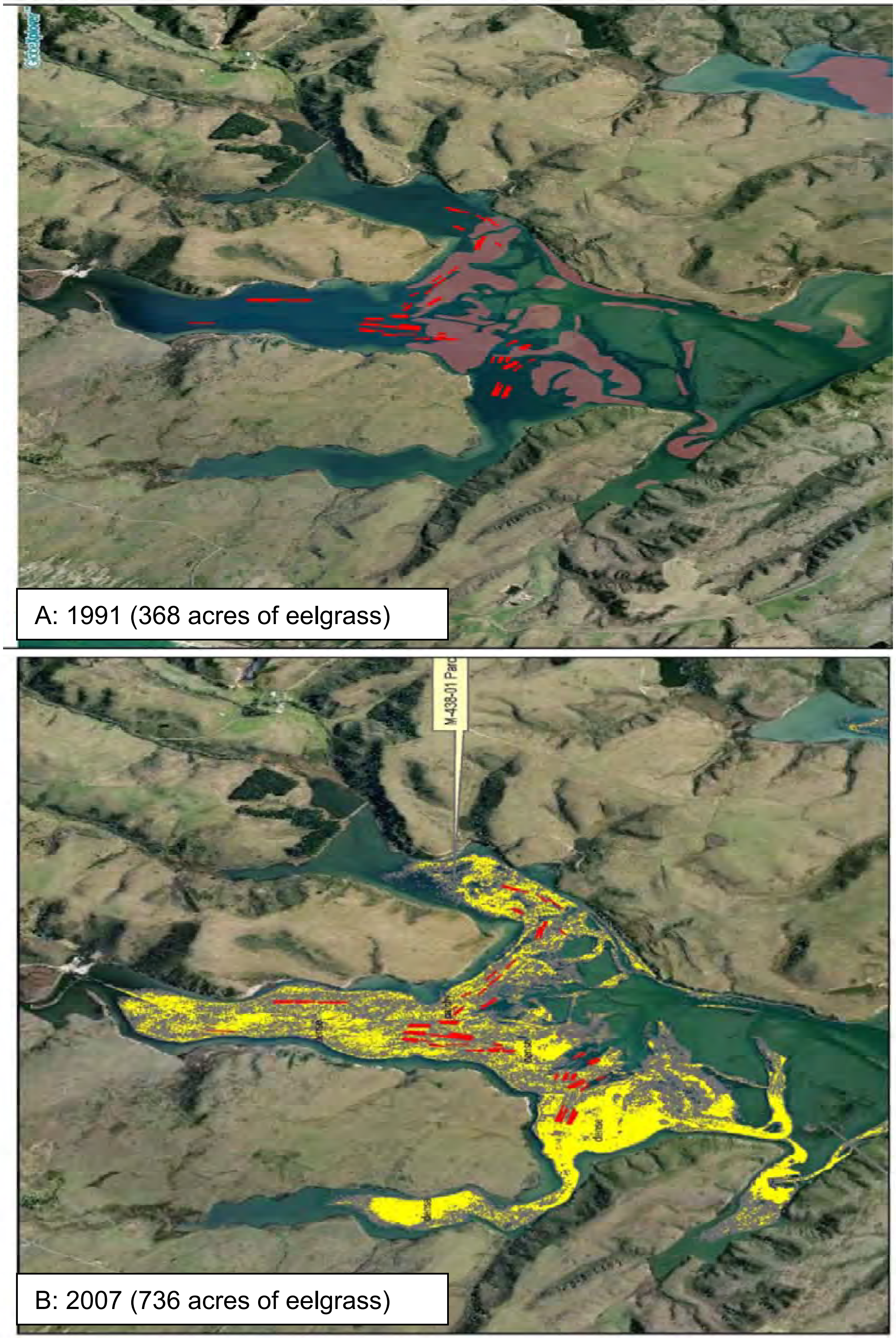

Figure A-1. Eelgrass habitat in Drakes Estero from 1991 (A) to 2007 (B). Aerial photography shows a doubling of eelgrass habitat in sixteen years. Red = the location of oyster racks (7 acres).

A11. Failure to Note Potential Eelgrass-Mariculture Relationship – Scientists at San Francisco State University are studying the synergistic relationship between the native oyster and eelgrass. The native oyster filters the water and allows better light penetration that benefits the eelgrass. The large patch of eelgrass shown in Figure A-2 is directly adjacent to one of the Marin Rod and Gun Club (MRGC) oyster reefs (see section D for additional information on the MRGC project.

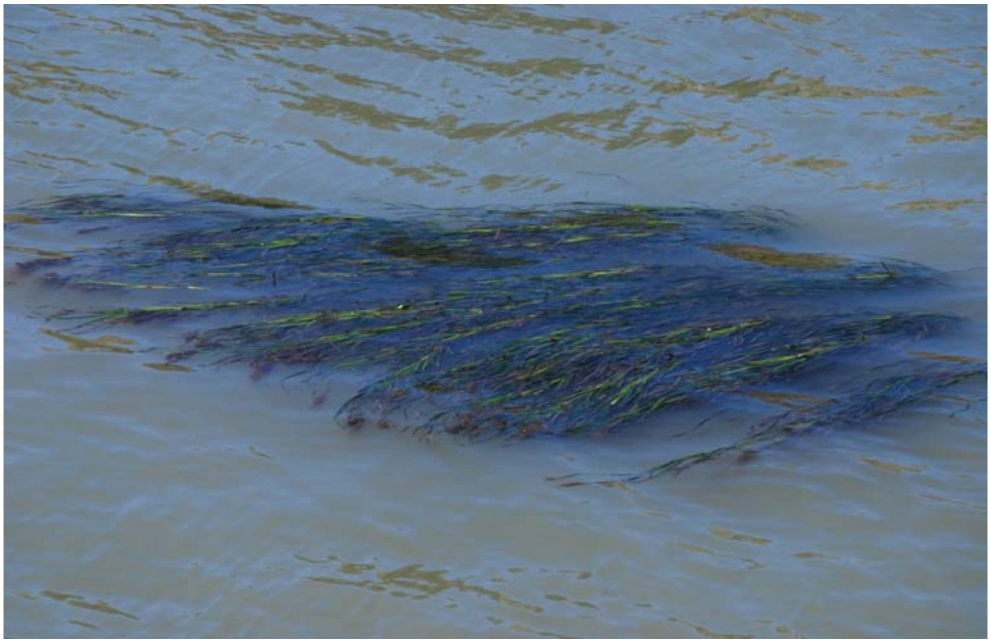

Figure A-2. Patch of eelgrass adjacent to the Marin Rod and Gun Club oyster reefs.

B Benthic Fauna,

B1. Bivalve Competition–on page 274 and 278 of the DEIS, the authors claim that mariculture in Drakes Estero will result in the escape of non-native bivalves from cultivation, which would become established in Drakes Estero and outcompete native benthic species. This contention does not make sense biologically or in terms of potential carrying capacity in the estuary.

Elliott-Fisk et al. (2005) reported that the water temperature in Drakes Estero is too low for Pacific oysters to successfully reproduce (per Fred Conte, University of California, Davis), which leads to these species being incubated on shore for several weeks before they are placed on the wooden racks for grow-out. In contrast, the Manila clam has been shown to successfully naturalize in a system in which it was introduced. However, when populations of feral clams dominate a system conditions are typically eutrophic (Pranovi et al. 2006, Humphreys et al. 2007). In other words, Manila clams thrive in poor water quality conditions. This is not the case in Drakes Estero. Although there is nutrient loading from freshwater sources, it is not in a quantity that is causing eutrophication (Anima 1991).

The second claim that non-native oysters will outcompete native benthic species is also misinformed. Although it is true that aquaculture adds bivalves to a system that will directly compete for space and resources with native bivalves, there is no indication that Drakes Estero is at or near carrying capacity. In a study by Elliott-Fisk et al. (2005), the authors reported that, “the relative abundance of ostracods and bivalves approximately doubles between the racks and 50 meters away.” If the system were at carrying capacity, then there would be signs of nutrient limitation and even a stimulation of algal growth rates (Prins et al.

2006). If there is consistent tidal flushing, an increase in benthic invertebrates and bivalves in association with oyster racks, and additional inputs from upland habitat, Drakes Estero is unlikely to be close to carrying capacity. Although there is no data that can be presented to fully support this claim, it cannot be stated that oysters are outcompeting native benthic species.

B2. Introduction of Shellfish Diseases – on page 274 of the DEIS, the authors claim that mariculture in Drakes Estero has the potential to introduce bivalve diseases into the estuary. As noted above, regulations are in place to control the possibility of disease or species introduction from the transport of oyster seed. The 1998 FONSI for the NPS EA for construction and replacement of facilities at Johnson's Oyster Company (JOC) stated, "to mitigate any impacts related to this issue ["hitch-hiking" alien species], both JOC, and the CDFG have agreed to establish a policy of zero tolerance, develop a risk assessment, and protocols for importing Mexican oysters into Drakes Estero." As detailed above, the current measures that minimize the risks of invasive species introductions are principally associated with the use of larval seed from West Coast hatcheries that are prescreened for pathogens and invasive species, and authorized for interstate export only after review by state agencies. The seed is certified free of disease and pests by a USDA/APHIS certified veterinarian. All shellfish seed imported into California must be certified disease free by a USDA/APHIS certified veterinarian and are regulated by the CDFG by an importation permit. All of the seed comes from hatcheries in Washington, Oregon, and Hawaii. Growers no longer import wild seed from out of the country. These hatcheries submit seed inspection reports on a regular basis to the CDFG. CDFG only allows importation of seed from established hatcheries with a minimum two-year history of documented absence of disease. In view of these precautions, and shellfish growers ongoing interest in keeping their growing waters free of hazardous exotic species, current shellfish farming practices at Drakes Estero pose little risk of causing new introductions of invasive or exotic species. The continuation of claims that diseases are introduced by practices employed at the Drakes Estero are simply not supported by existing data, nor do they recognize the best management practices and regulatory regimes in place for many, many years that address and significantly minimize this risk.

B3. Invasive Tunicate, *Didemnum* – on page 274 of the DEIS, the authors discuss the invasive tunicate, *Didemnum* sp., which is found in Drakes Estero and has the potential to smother habitats and inhibit normal biological functions of benthic fauna. In addition, on page 275, the claim was made that maintenance activities can fragment *Didemnum* and thus increase their dispersal. The concept that *Didemnum* is "smothering" habitat is misleading. The reference associated with this information, Mercer et al. (2009), indicated that *Didemnum vexillum* was able to colonize cobble-pebble substrates and form mats on the seafloor. As a result, there were "subtle shifts" in the benthic community, and the authors state in the conclusions that "the abundance of epifaunal organisms was not significantly affected by presence of the ascidian mats."

The second comment that DBOC operations will fragment and spread *Didemnum* is also misleading. It is true that colonial tunicates will fragment, but it is also true that because *Didemnum* is primarily isolated to mariculture structure in Drakes Estero, DBOC is able to effectively control this species through harvest and maintenance activities. While *Didemnum* has been observed among the oyster racks in the Estero, what is not recognized is that this species has been established in many locations along the entire West coast from southern California to British Columbia. It was first recognized in San Francisco Bay in 1993 (http://woodshole.er.usgs.gov/project-ages/stellwagen /didemnum/htm/page10. html) and culture operations were not the source of its introduction. It is clearly a structure-associated species, but as such creates a nuisance for principally the grower, not the Estero environment, as other hard substrate is extremely limited in the Estero. If NPS is serious about trying to control colonial tunicates, then they should be working with DBOC to remove the species from the system rather than implicating them in causing a problem that they did not originate.

B4. Fouling Organisms – on page 274 of the DEIS, the authors indicate that shellfish mariculture can support a variety of fouling organisms. Aquaculture gear is well known for providing artificial reef habitat for a variety of organisms. However, the use of the term "fouling" (a.k.a., sessile organisms) is a misnomer in terms of the local biota in Drakes Estero. The reference used in the DEIS (Light et al. 2005) is related to freshwater organisms (*Cordylophora caspia* (the "sponge", really a hydroid), *Urnatella gracilis* (the goblet worm), and *Balanus improvisus* (the barnacle)) associated with ship fouling. None of these organisms have any relation to Drakes Estero. Although organisms do colonize mariculture gear in Drakes Estero, the only "fouling" and nonnative organisms reported are the colonial tunicates (*Didemnum lahilei*), bryozoans (*Schizoporella unicornis* and *Watersipora subtorquata*), and sponge (*Halichondria bowerbanki*) (Elliott-Fisk et al. 2005). Common organisms that were likely native, but because they were only identified to genus their status was left as unknown, included *Balanus* (barnacle), *Botrylloides* (chain tunicates), *Botryllus* (colonial tunicates), *Obelia* (hydroid), and *Spirorbis* (polychaete worms).

Organisms that colonize aquaculture gear are typically sessile organisms that require hard substrates for attachment (Dealteris et al. 2004; Pinnix et al. 2005); however, the result is typically a diverse biota of organisms that provide additional food resources for fish and larger invertebrates.

B5. Benthic Fauna Abundance – on page 275 and 277 of the DEIS, the authors cite references that indicate that certain benthic species are lower beneath oyster racks relative to other natural habitats. In one sense they are correct. *Certain* organisms are lower in abundance (i.e., those that prefer mudflat habitat over hard structures). However, the overall benthic biota typically increases from mudflat assemblages to more reef-like assemblages with the introduction of mariculture structure. This occurrence was recognized in Elliott-Fisk et al. (2005; of which Harbin was an author), which stated, "the relative abundance of ostracods and bivalves approximately doubles between the racks and 50 meters away." Additionally, many researchers have reported that oyster beds or aquaculture gear are equal (or superior) to adjacent eelgrass habitat in terms of the diversity and abundance of benthic fauna and fish (Meyer and Townsend 2000, DeAlteris et al. 2004, Pinnix et al. 2005, Powers et al. 2007).

Although these changes are a product of mariculture structure, it is false to state that the benthic biota is lower. Additionally, the influence of mariculture structure to the benthic biota in Drakes Estero does not extend significantly beyond the structures themselves. Aquaculture in the Estero represents a total of 12% (142 acres out of 1,152 acres) of potential intertidal habitat for benthic fauna. (Note: there were many figures presented in the DEIS for intertidal habitat, this figure was reported on page 166 from Anima (1991)). Therefore, this effect can be considered at worst minimal, even though it provides a benefit to food resources for fish and larger invertebrates

B6. Non-Catch Mortality – on page 275 of the DEIS, the authors quote a term from Kaiser (2001) called "non-catch mortality". Non-catch mortality is a term used in fisheries biology for mortality caused by fish that are not collected, but affected by the fishing process. This makes sense since the Kaiser (2001) reference is in relation to fish aquaculture. It has no meaning in shellfish aquaculture. The fact that benthic organisms that have colonized the bags, which in other locations of the DEIS are called "fouling organisms," are a product of aquaculture structure. Because these organisms would not be present in the densities observed without the presence of the oyster bags, taking them out of the system during harvest does not impact the population. In addition, some of these organisms are returned to the environment before bags are processed, thereby reducing this potential effect even further.

B7. Displacement of Benthic Fauna in Schooner Bay – on page 275 of the DEIS, the authors indicate that there is direct destruction of native benthic fauna by boat propellers and dredging. Although motor boats would not be present in Drakes Estero if DBOC is not operating, there is no indication that disturbance of sediment would cease at the boat dock in Schooner Bay. On page 353 of the DEIS, the authors indicate recreation by kayakers would continue, and even increase, following removal of DBOC facilities. In addition, on page 276 of the DEIS, the authors indicate that recreational clamming would continue in the Estero, which would also result in disturbance of the benthic fauna. According to Logan (2005), recreational clamming was shown to have a significant impact on the abundance of macrofauna in a mudflat in Maine. Therefore, there would still be a disruption of sediment from recreational activities.

In terms of dredging, DBOC has never dredged. They have asked for a one-time permission to dredge at the dock as a part of the EIS (Lunny, pers. comm., 2010). The insinuation that dredging is a part of typical operations is a gross misrepresentation of information. Because no option would change these recreational activities, and because dredging would occur as a one-time event, this statement should be taken out of the EIS.

B8. Purple-hinged Rock Scallops – on page 279 of the DEIS, the authors claim that purple-hinged rock scallop is only likely to occur in Drakes Estero in larval form. This statement is false. They can be found at all low tides in many parts of Drakes Bay in adult form. It is difficult to not step on them in some places. In addition, purple-hinged rock scallops and the Olympia oyster (native oyster) were historically harvested by JOC for commercial sale. This misrepresentation was brought to the attention of the Inspector General of the National Parks Service. In fact, Drakes Bay Oyster Company has tried to obtain authorization to cultivate both the native Olympia oyster and the purple hinge rock scallop, but the NPS has inappropriately resisted authorization to cultivate these species even though they grow naturally in Drakes Bay*.* These are native species that are important ecologically and commercially. They are found all along the Pacific Coast and recently they have become a candidate for commercial cultivation.

The native Olympia oyster is considered a keystone species because they create hard vertical structure off the bottom that becomes the essential microhabitat for many species of invertebrates and fish. Because they are so important ecologically, there has been a major effort to restore them to San Francisco Bay. They are also commercially sold as a specialty oyster product at oyster bars. The Hog Island Oyster Company in Tamales Bay is aggressively moving ahead with plans for cultivation and marketing of the Olympia oyster (see www.fiesta.bren.ucsb.edu/~oyster/Native%20Oyster%20Aquaculture/). The University of California at Santa Barbara is considering supporting a research program for the aquaculture of the Olympia oyster to support restoration (Hudson et al. No Date)

The same holds true for the purple-hinge rock scallop. Although they are slow growing, they would provide a product diversification option for the farm. The purple-hinge rock scallop has recently become a serious aquaculture candidate as scientists have worked out methods to induce spawning and provide nutrition during the early life history of this species while they are free swimming *(*Leighton and Phleger 2009).

The commercial culture of the Olympia oyster and purple-hinged rock scallop by DBOC would allow the farm to re-establish native species in Drakes Estero (a NPS goal), fulfill a market need, and diversify their product line. This is particularly important now that there is a crisis in the oyster seed production industry. Growers are dependent on hatchery in Washington, Oregon and Hawaii, and in 2011 hatcheries were forced to provide only a fraction of the orders since they were not able to keep the larvae alive. The causes are under investigation.

B9. Mud Snail, *Batillaria attramentaria* – on page 279 of the DEIS, the authors state that the nonnative mud snail, *Batillaria attramentaria*, was introduced by JOC and that it is detrimental to the native snail. The introduction of *B. attramentaria* was from the import of Pacific oysters from Japan in 1932 (Byers 1999). Byers (1999) goes on to report that Drakes Estero contained predominantly Cerithidea with a few populations of Batillaria in Schooner's Bay. In fact, the author indicates that "The population of *Batillaria* in Drakes, however, remains very restricted – likely a major reason for its apparent absence from previous surveys." As noted above, the introduction of seed from outside Drakes Estero is highly regulated, and the importation of oysters from Japan no longer occurs. Given the limited distribution of this species, it does not pose a problem to the biota of Drakes Estero.

B10. Invasive Species Management – on page 280 of the DEIS, the authors claim that the presence of the DBOC in Drakes Estero hinders the NPS efforts to management invasive species and influence the amount of time that a natural benthic faunal community can be re-established. This statement is both misleading and falsely emphasized. The NPS does not provide any indication in the DEIS of what they actually do for invasive species management. DBOC does nothing to prevent them from exercising their right to provide such management. In fact, it would be beneficial for both parties if NPS were willing to work with DBOC to further control invasive tunicates. DBOC is currently managing invasives associated with their farm and structures, as discussed above, which is more efficient than any program that NPS could provide for the Estero, including:

1. They are able to remove organisms that colonize structure from the Estero during harvesting and processing of shellfish.

2. DBOC has long abandoned past practices of importing shellstock from overseas, the primary vector for past invasive species introductions from shellfish aquaculture.

3. Boats and gear used in DBOC operations are not moved outside of the Estero, thus preventing spread through hull fouling or gear introduction. Incidentally, there is more potential to introduce organisms through recreational boaters or clam harvest due to unwashed gear that was used in other waterbodies.

4. The DBOC project description includes a sediment basin and filter system to further reduce the release of invasive tunicate fragments in shellfish wash water discharge.

In terms of natural benthic faunal community re-establishment in areas of DBOC aquaculture, the farm affects 12% (142 acres out of 1,152 acres) of potential intertidal flat habitat, much of which native species are thriving due to the benefits provided by aquaculture structure and filter-feeding organisms. Additionally, as discussed in above, there is a recorded increase in native benthic fauna associated with mariculture structure (Meyer and Townsend 2000, DeAlteris et al. 2004, Pinnix et al. 2005, Powers et al. 2007). The presence of DBOC in Drakes Estero is at most a minimal impact on benthic fauna, and more likely provides a benefit to foraging resources for fish and larger invertebrates. As previously stated, if NPS is serious about trying to control invasive species, then they should be working with DBOC to remove the species from the system rather than implicating them in causing a problem that they did not originate.

B11. Tidal Cycling and Eelgrass – on page 278 of the DEIS, the authors claim that nutrient cycling in West Coast estuaries has more to do with the tides and upwelling, and that the eelgrass population in Drakes Estero controls the cycling of organic materials to the sediments. Although we do not disagree that Drakes Estero has a short residence time for water in most of the estuary, and that eelgrass is a major contributor to the cycling of organic materials, it should be recognized that the shellfish present in the Estero provide a benefit to the environment, even if in more localized areas.

The combined filtering activity of the millions of filter-feeding shellfish being grown in the Estero clears as much as 350,000 m^3 each day, removing particles as small as 2 microns (R. Rhealt, pers. comm., 2010). This represents 4% of the volume of water in Drakes Estero (est. total volume of 7,680,000 m^3 by NOAA 2011), which is small, but not an insignificant amount.

Finally, Dumbauld et al. (2009) is consistently misused throughout the DEIS. Dumbauld et al. (2009) never claim that West Coast estuaries are controlled by the tides and upwelling. They state that, “water column and sediment nutrient concentrations are generally relatively high and greatly influenced by the proximity to deeper nearshore ocean waters where upwelling controls production during summer months” [emphasis added], in other words, when freshwater inputs are at their lowest. To make the jump that shellfish filtration has no beneficial influence on water quality (or only localized benefit) is a false statement.

C Bird Interactions

C1. Foraging Birds – With regard to impacts to foraging birds, the scientific record does not support a conclusion that shellfish farming negatively impacts bird use as posited in the DEIS. In fact, there is strong evidence that shellfish, whether cultured or wild, forms an important source of food for a wide variety of marine shorebirds, marine seabirds, and raptors (Dankers and Zuidema 1995, Norris et al. 1998, Hilgerloh et al. 2001, Lewis et al. 2007).

Studies have shown either positive impacts—increasing avian species richness and abundance due to increased forage opportunities, or benign impacts—eliciting no significant difference in use from natural beds. Through their foraging habits, migrating marine shorebirds can significantly alter the community structure of wild bivalve populations in soft-bottom intertidal areas (Lewis et al. 2007). At shellfish aquaculture sites, some species of marine shorebirds feed directly on the shellfish products themselves (e.g., Dankers and Zuidema 1995), while others feed on the macrofauna and flora that colonize shellfish aquaculture gear (e.g., Hilgerloh et al. 2001). Taylor Shellfish in Washington State has documented many bird species foraging on their shellfish beds, including dunlins, killdeer, godwits, sand pipers, eagles, great blue herons, and gulls. Figure C-1 presents a few of the species mentioned using shellfish beds for foraging.

Figure C-1. Marine shorebirds, sand pipers (top left), dunlins (top right), and godwits (bottom), foraging on Taylor Shellfish oyster and clam beds.

Furthermore, shellfish aquaculture sites influence the abundance of marine shorebirds. For example, Connolly and Colwell (2005) reported that seven of 13 marine shorebirds and three of four wading birds were more abundant on oyster longline plots compared to reference sites. Although marine shorebirds feed at shellfish aquaculture sites, the aquaculture sites themselves do not necessarily attract larger numbers of birds than non-cultured areas (Hilgerloh et al. 2001). For instance, Zydelis et al. (2006) found that natural environmental attributes were the primary determinants of densities of wintering surf scoters and white-winged scoters in Baynes Sound, B.C. Moreover, the authors found that shellfish aquaculture variables did not necessarily predict bird densities for both scoter species. According to Zydelis et al. (2006), these findings suggest that winter scoter populations and the shellfish aquaculture industry may be mutually sustainable. In other words, there was no evidence of a negative impact on winter scoter populations at the current level of shellfish farming practiced in Baynes Sound, B.C. Indeed, Connolly and Colwell (2005) found that shellfish aquaculture in Humboldt Bay, California did not negatively affect the foraging behavior of most marine shorebirds studied.

C2. Use of Oyster Shell by ESA-list Species – The DEIS failed to recognize some significant use of oyster shell that DBOC donates for the habitat restoration of ESA-listed bird species. DBOC donates oyster shell to the San Francisco Bay Observatory and the Pt. Reyes Bird Observatory to improve hatching and fledging success of the Western snowy plover (federally threatened species). These efforts have been highly successful. In an article printed in the *Chinook Observer* by Long (2005), oyster shell was shown to be ideal for plover nests. USFWS reported nearly a doubling in successful chick hatching from 2001 to 2002 with the addition of oyster shell in a restoration area on Leadbetter Point, Washington (Long 2005). WDFW and USFWS have reported consistently successful nesting populations as a result of oyster shells to the restoration site in 2006 and 2007 (Pearson et al. 2007, 2008). Figure C-2 provides photographs sent by Caitlin Robinson at the San Francisco Bay Bird Observatory of snowy plover use of oyster shell for nesting success and predator refugia.

Figure C-2. Photographs of snowy plover (federally threatened species) using oyster shell for nesting success (above) and predator refugia (below).

The second program for which DBOC donates shell is the least tern (federally endangered species) habitat enhancement through the California Department of Fish and Game. This program has also been highly successful.

It is interesting that the NPS fails to recognize that the wilderness area and Limantour spit (about a ½ mile from the end of the shellfish lease) were locations of snowy plover nesting until 2000. The likely reason for the loss of snowy plovers has been attributed to human disturbance from seashore visitors to the park (Lunny, pers. comm., 2011). It is also interesting that the 1998 EA written by NPS declared that no special status species would be affected from the same project interactions from which it is all of a sudden claiming negative impacts. In summary, DBOC is doing a great deal of habitat restoration that is positively affecting the success of ESA-listed bird species. If DBOC operation no longer existed, these programs would require trucking in shell from out-of-state sources to continue because there is no other shellfish company with the capacity to donate oyster cultch. In that case, some of these programs may fail due to the prohibitive cost of trucking in shell.

D Habitat Restoration

D1. Failure to Discuss Benefits of Habitat Restoration – The National Park Service has omitted the importance of the oyster shells provided by DBOC to restoration projects in San Francisco Bay for habitat restoration. Without DBOC's contribution of shells for restoration projects the shells would have had to be imported from Washington State, and it is uncertain whether the restoration project would have gone forward.

The Marin Rod and Gun Club (MRGC) has supported a native oyster restoration project since 2005. The restoration project uses oysters cultch donated by DBOC (~100 cubic yards of oyster shells) to build reef mounds that approximate the ecological functionality of a coral head or a constructed reef ball (a.k.a., an artificial reef) in San Francisco Bay (Figure D-1). The artificial reefs, created with the bagged oyster shells (Figure D-2 and D-3), were constructed near the Port of Redwood City, in the South Bay, near Berkeley Marina in the Central East Bay and at the MRGC in the North Bay. The reef mounds were then seeded with native oysters (Olympia oysters) that use the shell for attachment. The reefs are anticipated to support nearly 250,000-500,000 oysters.

There is evidence that the reef-like habitat created by shellfish aquaculture gear or oyster beds can be equivalent to the biodiversity observed in eelgrass beds (Dumbauld et al. 2000, Meyer and Townsend 2000, Pinnix et al. 2005, Powers et al. 2007, Dumbauld et al. 2009). The reefs provide a substrate for the colonization of numerous organisms, creating an invertebrate community that increases prey resources. For example, the spawn of Pacific herring, a common forage fish for salmon, seals, marine mammals, and marine sea birds, has been observed on the reef mounds (Figure D-4). Salmon use of MRGC artificial reefs is being tracked by radio-tagged hatchery smolts to understand the extent of utilization. Anecdotally, fishermen claim that they catch more fish near the reefs. Volunteers have also observed seals and marine sea bird use of the reefs for foraging.

The value of these donated oyster shells is both in terms of the shells that provide the necessary structure for attachment and the comparable cost and greenhouse gas effect of transporting these shells from out of state. If DBOC is not allowed to continue operations, the cost of obtaining this shell from a different source may prohibit the continuation of this highly successful project.

Figure D-1. A low tide view of one of the reefs constructed from oyster shells donated by Drakes Bay Oyster Company.

Figure D-2. Volunteers bagging oyster shells donated by Drakes Bay Oyster Company. These are middle school students that had a great time and learned a lot about oyster biology.

Figure D-3. A truck load of bagged oyster shells donated by Drakes Bay Oyster Company that were used in the construction of artificial reefs at the Marin Rod and Gun Club and near the Berkeley Marina.

Figure D-4. Herring eggs laid on oyster shells donated by Drakes Bay Oyster Company.

E Water Quality

F1. Bivalve Contribution to Water Clarity – on page 337 of the DEIS, the authors claim that the bivalves in Drakes Estero do not contribute significantly to water clarity because the estuary is not a highly turbid system and has low residence time in most of the Estero. There are three basic points that contradict this statement: (1) the shellfish in Drakes Estero are in the best possible position to control the pathogen levels and nutrient loading from cattle ranching and other terrestrial input sources (e.g., the 2.4 million visitors to the national park every year), (2) if the benefits from shellfish are considered local and minor, then by the same token the impacts should be considered local and minor, and (3) tidal flushing is not the same for the entire estuary, and protected pockets at the upper arms of the Estero stand to benefit the most from the presence of DBOC shellfish.

F2. Water Quality Monitoring – on page 339 of the DEIS, the authors claim that removal of shellfish mariculture will not modify the water quality appreciably. However, even though it is admitted on page 342 of the DEIS, in this section the authors are failing to recognize that shellfish are currently providing mitigation for nutrient loading in the system from cattle ranching upstream. As indicated above, pathogen and nutrient loading has been documented by CDPH in association with cattle ranching in the upper portion of the basin. Further, the shellfish in the Estero are positioned to control these influences to water quality through filtration, biosequestration, and denitrification. If the shellfish are removed, then how does NPS intend to counteract this issue?

Tidal flushing of the upper arms of Drakes Estero is not as significant as the main part of the estuary. Although there are native species of bivalves in the system, they are not as efficient at treating nutrient loading as the species and densities provided by DBOC. Further, eelgrass habitat has doubled in the last 16 years in Drakes Estero, which has been attributed to the presence of DBOC shellfish (Bartley et al. 2009, NAS 2009)--a finding that the DEIS does not recognize, and does not provide any other reason for its occurrence. In summary, the evidence supports that DBOC operations improve and mitigate water quality impacts to the Drakes Estero, not impact it as contended in the DEIS.

F3. Omission of Biosequestration Benefit – shellfish cultivated at the Estero help to mitigate for excessive nutrient contributions through harvest. No mention is found of the Nitrogen (N) and Phosphorous (P) removal benefit associated with the action alternatives.

The rate of nitrogen removal from harvest is dependent on species-specific filtration rates, which may be modified as well by local water quality conditions that affect physiological parameters of the shellfish (e.g., water temperature, zooplankton abundance, etc.). Thus, estimates for total nitrogen in oysters, including shell, range from around 0.2 to 0.5 g N/oyster, with variation depending on species, condition, size, and geographical location. The harvest of approximately 4.3M oysters and 1M clams annually from the DBOC results in the direct removal of approximately 2,500 kg N and 750kg P from these sensitive waters (R. Rhealt, pers. comm., 2010). Excessive contributions of inorganic nitrogen (ammonia and nitrate) is recognized as the primary cause of degraded water quality, hypoxia, habitat loss and biodiversity in our nation's coastal ecosystems (NOAA 2009). Shellfish cultivated at the Estero help to mitigate for these excessive nutrient contributions through harvest.

F4. Omission of Denitrification Benefit – mariculture causes denitrification, which makes nitrogen available to be fixed by different microbes in the terrestrial rhizosphere. This environmental benefit would be gained in the action alternatives, but no mention is made of the benefit in the DEIS.

Anthropogenically enhanced sources of N and P, such as agricultural run-off and septic-tank discharge, can result in enhanced phytoplankton production and blooms of both toxic and nontoxic microalgae (Newell et al. 2005). Bivalve filter-feeding serves an important role in improving water quality conditions through benthic-pelagic coupling, which is the consumption of nutrients and creation of biodeposits (feces and pseudofeces). N and P that are not digested and incorporated into tissue are processed through the bivalves and excreted as soluble ammonia and biodeposits of mucous-bound feces and psuedofeces. When these biodeposits become incorporated into aerobic surficial sediments, microbially-mediated processes facilitate nitrification-denitrification coupling to permanently remove sediment-associated nitrogen as nitrogen gas (N_2) (Newell 2004). According to Newell et al. (2005), “the species of bivalves that can exert the greatest influence on benthic-pelagic coupling are those, such as oysters and mussels, which maintain high clearance rates and reject relatively large amounts of POM as pseudofeces.” Newell et al. (2002) calculated that under aerobic conditions in a laboratory, oysters resulted in denitrification of ~20% of the added N. Therefore, oysters are very effective in achieving the long-term goal of improving water quality in Drakes Estero.

F5. Mariculture Debris – on page 339 of the DEIS, the authors indicate that mariculture debris has been found on mudflats and shorelines of Drakes Estero. Mariculture debris mentioned in the DEIS is an issue that DBOC inherited from the previous owners (Johnson Oyster Company (JOC)), for which they have made dramatic strides to clean-up. JOC began using plastics in the early 1960s in its rack and stake culture. Both culture methods used the black plastic spacers, and the stake culture also used plastic coffee can lids. The spacers and coffee can lids were lost during storm events. Due to the extensive loss of plastic into the environment, CDFG required JOC to stop stake culture in Drakes Estero. By the mid-1990s all stake culture had ceased and had been replaced by bag culture.

In 2005, DBOC took over the shellfish farm in Drakes Estero. Fully aware of the legacy plastic debris problems, DBOC made several changes in farm practices to further reduce the chances of losing culture gear into the environment, including:

1. Immediately implementing a policy that no wires would be cut when harvesting strings from the racks until above the high tide line (above the stringing shed). DBOC removes the oysters from the wires without cutting the wire. Using this technique, the black plastic spacers are not subject to loss into the environment.

2. Beginning in 2006, DBOC began to replace the Japanese Hanging Cultch wire string culture method with “French tubes”. These French tubes reduce consumables (i.e., the wire strings which can only be used for one growing season), and do not require the black spacers. It should be noted that DBOC, EAC, or NPCA have never found a fugitive French tube anywhere in Drakes Estero. Over the past five years, approximately 100,000 strings have been replaced with the French tube method, and this technique now represents the majority of the rack culture. DBOC will, however, continue to cultivate a portion of its oysters with the traditional wire string and spacer method. The description of this historic culture method during DBOC’s interpretive on-farm tours is of great interest to the visiting public.

3. DBOC checks the oyster racks regularly to remove any loose materials so they are not lost into the environment.

4. DBOC anchors all oyster bags in areas where there is potential for tidal energy to displace bags.

5. DBOC initiated a program whereby all floating culture is anchored in a least two places and all floating bags are attached to at least two anchored lines (a DBOC "redundancy program").

Additionally, DBOC made a commitment to pay staff to clean-up the beaches to address JOC's legacy debris problem. DBOC's staff patrols the beaches of Drakes Estero on a regular basis to pick up any marine debris. It is notable that most of the trash retrieved is unrelated to mariculture (i.e., it is a product of recreational activity in the park). DBOC also pays for refuse disposal fees. The majority of the plastic mariculture debris that is currently being picked up and disposed of by DBOC includes the plastic coffee can lids that have not been used in Drakes Estero for almost 20 years. It is evident that these efforts are paying off because DBOC is finding less and less of this legacy mariculture debris each year.

F6. Wastewater – on page 340 of the DEIS, the authors try to indicate that potential risk from wastewater entering Drakes Estero is only associated with DBOC operations. However, as indicated on page 344 of the DEIS, the authors state that, "the risk of discharges from a lack of capacity appears unlikely." Further, by their own admission (page 340), NPS will not remove any of these structures if DBOC operations do not exist in the area. Given the fact that: (1) there have been no releases of wastewater into the Estero, (2) there was only one violation of water quality criteria as a result of a failed septic system in the last 77 years of shellfish operations (a new system was constructed in 1998 to resolve this problem), and (3) none of the alternatives discussed will eliminate this risk, this impact is negligible and cannot be attributed solely to DBOC operations**.**

F7. Impervious Surfaces – on page 340 of the DEIS, the authors try to indicate that there is potential risk of run-off from impervious surfaces associated with DBOC operations. However, by their own admission, NPS will not remove any of these structures, or abandon any of the road network that contributes to impervious surfaces in the basin, if DBOC operations do not exist in the area, which means that this impact, considered minimal anyway, is the same for all alternatives. Further, the mitigating role of the cultured oyster biomass to any runoff from impervious surfaces will be effectively eliminated with the removal of DBOC operations.

F8. CCA Leaching – on page 343 of the DEIS, the authors attempt to indicate that maintenance and repairs to racks and the dock would introduce chromate copper arsenate (CCA)-treated wood to Drakes Estero. This comment is completely false and lacking any understanding of current procedures related to DBOC operations. By their own admission (page 343 of the DEIS), NPS understands that wood treated in the past is no longer leaching CCA into the environment. Any new wood used to repair existing racks in need of maintenance would be subject to approval by NOAA Fisheries (WWPI 2011). DBOC is currently trying to find new construction materials that would be more benign in terms of environmental effects for use in their oyster racks. They have looked into biodegradable materials, plastics that wouldn't leach into the water, and are open to new ideas that improve their stewardship of the environment (Lunny, pers. comm., 2011).

It should also be noted that on page xxxvi of the DEIS, the NPS states that "Ongoing maintenance of racks, assuming 5 percent replacement or repair annually, may include repairs or replacement." However, according to the operator, racks require major repairs approximately every 10 years. If all racks were currently in good repair, roughly 10% of the racks would require maintenance each year. Currently, roughly 50% of the racks are in need of immediate repairs. Given that the life of the investment is roughly 10 years, and the proposed SUP is 10 years, the proper business decision would be to make the repairs to all of the racks as soon as possible. It is critical that NPS not limit the percentage of the racks repaired in any given year.

F9. Pesticides and Herbicides – on page 343 of the DEIS, the authors claim that offshore activities would potentially release DDE (no other compound was found above the detection limit) into Drakes Estero. This contention is both misleading and the reference is used inappropriately. Although DDE can be found in Drakes Estero in small quantities, it was noted by Anima (1991) that the levels of traceable DDE in the sediment are "below the limits set by the National Academy of Sciences and the U.S. Environmental Protection Agency for organisms." The limits set include 1,000 μg/kg ΣDDT (the sum of ODD, DDE, and DOT) wet weight for the protection of fish-eating wildlife (NAS 1973) and 150 μg/kg ΣDDT wet weight in fish (EPA 1980). The maximum of amount of DDE sampled from Drakes Estero represents approximately 1% of the USEPA limit established for this compound. Even if DDE is disturbed, which is unlikely given that it was sampled from "deeper tidal channels in which the research vessel could transit" (Anima 1991), it does not represent a risk to aquatic organisms in the Estero.

F10. Runoff Water – on page 344 of the DEIS, the authors indicate that water from spray-wash at the conveyor station and outdoor setting tanks is returned to the Estero, which results in a minor adverse effect. Within the same section, the authors concede that the replacement of the existing conveyor washing station with a new system, as proposed by DBOC, would filter the water before it re-enters Drakes Estero. This system would decrease the sediment load and local turbidity entering the Estero. Further, the discharge from the spray-wash was tested by California Department of Health Services and found to be non-hazardous (Baltan 2006, DEIS p. 200).

In addition to direct testing of water discharge from DBOC operations, California Department of Health Services looked at potential sources of contamination in Drakes Estero. As reported on DEIS p. 198, "Baltan (2006) and Zubkousky (2010) list five source types of bacterial pollution potentially affecting the water quality of Drakes Estero. These sources include cattle operations, septic systems, industrial waste, wildlife, and watercraft. The primary source of pollution is from cattle waste originating from the six cattle ranches within the watershed." It is notable that the shellfish industry was not listed as a contributing factor to water quality concerns in Drake Estero. In summary, these impacts, which were reported to be minor based on existing conditions, would be further reduced with proposed improvements by DBOC.

Finally, it should be noted that on DEIS p. xxxi, the NPS states that, "Alternative D considers expansion of operations and development replacement of new existing infrastructure as requested by DBOC as part of the EIS process." In fact, the replacement is not an expansion of operations; it is the replacement of the conveyor station agreed upon in the 1998 NEPA EA and FONSI (NPS 1998, PRNS 1998). This should be considered as part of Alternative B, which assumes that operations will not change from current conditions.

F Wetlands

F1. Nationwide Permit (NWP) 48 – The NPS identifies (page 249 of the DEIS) that the USACE has a Nationwide Permit for shellfish aquaculture, but fails to provide a sufficient explanation of the Nationwide Permit program. By definition, Nationwide Permits, such as NWP 48, are for permitting activities that have gone through a thorough programmatic evaluation of potential impacts on the Waters of the United States, including wetlands, and have been determined to have a minimal impact. As stated on the San Francisco District's website and in the Special Public Notice reauthorizing Nationwide Permits published in the Federal Register, "The purpose of the Nationwide Permit Program is to streamline the evaluation and approval process throughout the nation for certain types of activities that have only *minimal* impacts to the aquatic environment [emphasis added]." The suggestion that ongoing aquaculture has "minor" or "moderate" long-term impacts is in direct opposition of this thorough NWP 48 review. At best, it is misleading and is not supported in the DEIS.

F2. Adverse Impacts – On pages 253, 255, and 257 of the DEIS, it is suggested that Alternatives B, C, and D would continue to have long-term adverse impacts on 138 acres of intertidal wetlands. This statement is misleading for several reasons. First, 138 acres seems like a relatively large number when no context is provided. Second, it implies that shellfish aquaculture is detrimental to eelgrass beds, estuarine intertidal unconsolidated shore-mud, and estuarine intertidal unconsolidated shore-cobble-gravel-sand without providing any evidence of any impacts. Lastly, though it is acknowledged that bottom bags are not allowed in eelgrass beds, subsequent statement suggests that floating culture, including bags and seed trays have an adverse impact, which has not been demonstrated.

It is important that more context is provided to accurately convey the relative diversity and complexity of "wetlands", particularly those that are actively in cultivation, compared to the overall distribution and availability of these habitats within Drakes Estero and the Estero de Limantour. As noted on page 166 of the DEIS, "The total area of Drakes Estero, excluding Estero de Limantour, below the high tide line (an area that includes both subtidal and intertidal areas) is approximately 1,958 acres (NPS 2011n)." So, even if the entire 138 acres is considered, that represents only seven percent (7%) of the total subtidal and intertidal wetlands below the high tide line. At 22 acres, the total bottom bag culture area that has been in production the last two years is 1% of the "wetlands" below the high tide line. However that too would be misleading, as there are many different types of "wetlands." This is clear from the DEIS on pages 166 and 167, which states:

> *At low tide, much of the Drakes Estero bottom is exposed as intertidal wetlands, most of which contain no vegetation (i.e., the sandy shorelines, sandbars, and mudflats) (Anima 1991xiv). The intertidal sand and mudflat wetland types are the most common wetlands within the study area. Intertidal vegetated marshes (E2EM1 systems) can be found within the upper, shallow-water reaches of each of the bays interlaced by shallow tidal creeks (E2SB systems). Palustrine systems occur landward of the tidal zone dominated by freshwater marshes (PEM) with pockets of scrub-shrub (PSS) in low-lying guts and valleys along streams and/or groundwater seeps.*

Figures 3-1 and 3-2 on pages 168 and 169 of the DEIS show the distribution of wetlands within Drakes Estero and in relation to DBOC's onshore facilities.

The implication that bottom bag culture is adversely affecting non-vegetated mudflats and tideflats is not supported by the information provided. In fact, documentation provided by ENVIRON under the categories of eelgrass, wildlife habitat and benthic fauna, water quality, and nutrient cycling, clearly show that shellfish aquaculture can provide a benefit to wetland habitat. For example, benthic invertebrate abundance and diversity in these cultivated tideflats has been shown to increase in relation to mariculture structures (Elliot-Fisk et al. 2005), which provides additional foraging opportunity for fish and birds.

A more transparent and meaningful evaluation would be to provide a quantitative matrix to show the acreage and relative percentage of sand and tideflats, or estuarine, intertidal, unconsolidated shore, and sand/mud wetlands (using the Cowardin classification system) and each of the other "wetland" types in the Estero that would be under cultivation under each of the action alternatives. It is uncertain why such an analysis was not provided when the NPS clearly has such GIS data available.

Furthermore, potential wetland changes or impacts should have been compared to the baseline condition, which for all intents and purposes should be with some level of shellfish cultivation. The conclusion for Alternatives B, C, and D of short-term minor adverse and long-term moderate adverse impacts on wetlands is an artifact of the intensity definitions used, misleading, and does not appear to be supported by the best available science.

F3. Identification of a Wetland – On pages 165 of the DEIS, the definition of a wetland is presented as such:

> *Areas that are inundated or saturated by surface or groundwater at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. (33 CFR 328.3[b]; 40 CFR 230.3[t]).* AND
>
> *Lands transitional between terrestrial and aquatic systems where the water table is usually at or near the surface or the land is covered by shallow water. For purposes of this classification, wetlands must have one or more of the following three attributes: (1) at least periodically, the land supports predominantly hydrophytes; (2) the substrate is predominantly undrained hydric soil; and (3) the substrate is nonsoil and is saturated with water or covered by shallow water at some time during the growing season of each year (Cowardin et al. 1979).*

It should be noted that, based on these definitions of a wetland, the lands have to be *transitional* between terrestrial and aquatic systems. The lands where DBOC has mariculture structures are below the high water mark, which is considered completely aquatic. According to Tom Moore, an associate marine biologist at California Department of Fish and Game, DBOC is not farming in a wetland. His response when asked by Kevin Lunny was, "No, Drakes Estero is subtidal…below the mean high tide." Therefore, any reference to wetland impacts in Drakes Estero in the DEIS should be deleted, as this is not a valid definition of a wetland. Additionally, because DBOC aquaculture is not within a wetland, it meets the *NPS Management Policies 2006* of "no net loss" of wetlands.

G Coastal Flooding

G1. FEMA Does not Recognize Drakes Bay as a Flood Zone – The DEIS section "Impact on coastal flood zones" in Chapter 4: Environmental Consequences, is entirely based on implementing policies associated with protection of structures and facilities in a flood zone. However the flood zone was not mapped in that area by FEMA or any other federal agency even on the most recent FEMA maps (Flood Insurance Rate Maps (FIRM) 06041C0210D and 06041C0205D, FEMA 2009). FEMA usually designates even potential flooding in a coastal zone as Zone V, or similar zone (VE). The National Flood Insurance Program (NFIP) usually implements and adopts FEMA procedures. The NPS states that the FEMA map was not "available". FEMA does not map certain area, until it confirms through different sources and through detail hydrologic and hydraulic analyses the extent of the aerial flooding. That has not been confirmed for the Schooner Bay area of the Drakes Bay area.

The Executive Order 11988 on Floodplain Management allows any federal agency to make determination of the location of the floodplain based on the best available information.

However, the entire mapping and all of the consecutive conclusions in the DEIS were entirely based on only one storm of March 20, 2011 (pages 194-196 of the DEIS), with an unknown frequency, and conclusions were extrapolated from measurements taken at Bolinas Bay, a site 17 miles away. It was assumed by NPS that this storm, which was approximately a 100-year storm for Bolinas Bay, is similar to a 100-year storm for Drakes Estero.

The NPS is based on an unreliable methodology with a high potential for error. There are two problems with the extrapolation that NPS used in their evaluation: (1) the evaluation was based on only one storm recorded 18 miles away; and (b) there is significant change in bathymetry and shoreline between Bolinas Bay and the Drakes Bay area. Therefore, local conditions in between the two bays can significantly influence tidal and storm surge signatures. To be completely certain in this evaluation, the 100-year storm recorded at Bolinas Bay should have had at least 18-mile radius, covering both bays during the recorded event. Also, and again, 18 miles is significantly long distance, where it is possible for bathymetry and shoreline to substantially change. What if that was a 200-year storm? Would the consecutive floodplain mapping still be applicable? Impacts from different management actions entirely based on this mapping would simply be invalid.

A better methodology, with less potential for error, would be for NPS to collect tidal measurements simultaneously at Bolinas Bay, at Drakes Bay, and at another location midway (i.e., 9 miles from each site). Tidal signatures should be recorded throughout winter season in order to record changes in water level at these locations during several significant storms, which would preferably include a 100-year storm, 20-year storm, and an average annual storm. In that way, a correct relationship could be developed for different ranges of water levels during different storm events at these locations.

H Noise

H1. Background Sound Levels Misrepresented and Understate Existing Conditions – The NPS DEIS used the median daily sound level (i.e., the median L_{50} from 30 days of measurements) to represent the existing condition. The L_{50}, while a sometimes somewhat meaningful metric indicating the sound level exceeded ½ the time of a measurement period, is not particularly meaningful in this context for establishing an existing level against which to compare facility noise because ½ the time the measured sound levels were higher than reported. A more useful and representative metric would be the 30-day equivalent sound level (L_{eq}, or sound energy average) because the L_{eq} considers sound energy and duration of all noise events. It is therefore more useful for comparison purposes. The 30-day L_{eq} measured by Volpe was about 6 dBA higher than the 30-day L_{50} (Volpe 2011, Table 2, page ES-23), so comparing the existing L_{eq} to facility-related noise would change the conclusions of the analysis. In addition, the DEIS included discussion of only the summertime L_{50} while the available data included information for winter, and the measured wintertime 30-day L_{eq} and L_{50} were both about 2 dBA higher than the respective summer levels. Available data also include daytime-only L_{eq}s, which would better represent the period of DBOC operations that could be used for comparison with calculated facility-related noise to provide a more representative context. The data presented in the DEIS are incomplete and misrepresentative of the existing soundscape, and appear to have been selectively chosen to indicate lower existing sound levels that then artificially inflate the potential impact of DBOC operations noise. This flawed approach should be rectified to present a more complete and genuine discussion of existing noise sources and levels.

H2. Used Data from a Single Sound Level Measurement in the Vicinity to Estimate Existing Ambient Levels Throughout The Large Study Area (Volpe 2011) – The DEIS noise impact assessment was based on the assumption that a single sound level measurement (SLM location #4, see Figure H-1) provided an adequate representation of existing ambient levels throughout the large study area. Measured ambient sound levels at this location do not account for traffic noise on Sir Francis Drake Blvd., and so may understate ambient levels near this road, i.e., in the northern end of study area. A comprehensive noise impact assessment would include additional specific data regarding both sound levels and sources throughout the area for which impacts are being assessed.

Figure H-1. Drakes Estero Area Showing DBOC Facility Location and Volpe SLM Location #4

H3. DEIS Omitted Adequate Description of Existing Sound Sources as Documented In Volpe SLMs – The Volpe report provided a breakdown of observed noise sources, noted percentage-of-time contributions from aircraft, and indicated aircraft noise was audible more than 10 percent of the time (i.e., 13% summer; 18% winter; Table 3, page ES-24, Volpe 2011), which was the percent time contribution used as indication of "major" noise impacts from DBOC sources. But the DEIS ignored this fact and included no discussion of aircraft noise or the fact that it would remain a substantial contributor to the future soundscape, with or without DBOC. Because aircraft noise is already a substantial contributor to the existing soundscape in the study area and is unlikely to decrease in the future, even entirely removing DBOC-related noise from the area might have much less of an effect in restoring the natural soundscape than suggested in the DEIS noise analysis. The implications of aircraft noise versus DBOC noise for the future "restored" soundscape must be fully analyzed and explained if the conclusions of the noise impact assessment of the alternative future actions are to be believable.

H4. The DEIS Noise Analysis Substantially Exaggerates Noise from all DBOC-Related Sources, Invalidating Conclusions Based on This Analysis – The DEIS noise analysis relied on estimates from a library of sound level data to represent DBOC sources of concern. But there is a very small population of equipment involved that could have been easily and specifically quantified to provide more accurate results. As documented below, the sound source estimates used in the DEIS grossly overstated noise levels from DBOC equipment, thereby discrediting the conclusions derived from this flawed analysis.

On November 22, 2011 ENVIRON staff visited the DBOC facility and took direct sound level measurements of the noise sources identified in the DEIS and one that was not. ENVIRON used a B&K 2250 Type 1 sound level meter to both measure the sound levels and to record audio samples of the sources of interest during the measurements. These data were subsequently downloaded to a computer for aural and numeric analysis. The results of these measurements are summarized in Table H-1. Photos of the noise sources and graphic summaries of the measurement data are presented in the Noise Attachment (Attachment B).

Table H-1. DBOC Source Noise Sound Levels Reported in DEIS and Actual (dBA)

Equipment	NPS Reported Sound Level [a]	Measured Source Noise Levels			Overstated Factor [b]
		Duration	Fast L_{max}	L_{eq}	
Motorboat #1	71	15 seconds	63.4	60.1	12
Motorboat #2	71	30 seconds	61.7	58.2	19
Frontend Loader [c]	79	4, 30-seconds	67 - 68	64 - 65	25
Pneumatic Drills [d]	85	≈ 1 minute	77.5 / 79.7	70.4 [e]	29
Oyster Tumbler	79	2 minutes	59.4	49.8	825
Air Compressor [f]	Not considered	72 seconds	N/A [g]	58.0	

[a] Levels reported in the DEIS and used in the noise impact assessment. No metrics or time intervals for the source noise levels were reported. But because these levels were used to estimate exposure over time and because it would not make sense to use the L_{max} for this purpose (because the fast L_{max} is a 1/8-second sound level), ENVIRON interprets these levels as source noise L_{eq}s.

[b] The "overstated factor" is the number of sound sources emitting an L_{eq} as measured that it would take to generate the sound level used to represent this source in the DEIS noise analysis. For example, it would take 12 boats like DBOC boat #1 all operating in the same location and emitting a passby L_{eq} of 60.1 dBA to generate the 71 dBA L_{eq} that was used in the noise assessment reported in the DEIS.

[c] The small frontend loader, which is used to move empty shells into piles, was reported in the DEIS as a "forklift." The levels reported here are for four passby event SLMs.

[d] Due to space constraints, only one of the two pneumatic drills used at the facility was measured, twice. The other drill is identical and used in the same fashion, so the sound levels would be the same.

[e] The measured L_{eq} for a single pneumatic drill was 67.4; assuming two drills were working at the same location simultaneously results in an L_{eq} 3 dBA higher, as reported here.

[f] The air compressor that provides air to power the pneumatic drills was not considered in the DEIS. The compressor is housed inside a building, so except for openings within the building, noise from this source is already partially controlled and could be even more effectively quieted with a more complete enclosure.

[g] The compressor runs only occasionally, and when it does, produces a constant sound level. The L_{max} metric is therefore not pertinent to this source.

Source: Sound level measurements by ENVIRON International Corporation, 2011

As shown in Table H-1, <u>all</u> of the estimated equipment noise levels used in the noise impact assessment presented in the DEIS substantially exaggerated noise from DBOC operations. <u>Every single one of the estimated source noise levels was too high by factors ranging from 12 to 825</u>. This fact invalidates the noise impact assessment presented in the DEIS and requires a completely new and accurate analysis.

H5. Inadequate DBOC Noise Impact Assessment – The noise impact assessment presented in the DEIS does not constitute use of "best science available to determine impacts" as required by Director's Order #47 (No. 7 Defining Impacts on Park Soundscapes) ("Soundscape Preservation and Noise Management," Director's Order #47, Washington, DC: National Park Service, December 2000; cited in Volpe, 2011 to define soundscape).

The noise analysis did not consider the duration of noise exposure from the intermittently operated sources related to DBOC operation, but simply assumed that roughly estimated hours of operation of various activities equated to hours of exposure at all possible locations. So there was no consideration of variability of noise from DBOC sources and especially mobile sources (i.e., small motor boats and the frontend loader). This overly simplistic approach may have grossly overstated DBOC-related noise impacts, and given the severity of the resulting conclusions, this simple approach cannot be justified. In addition, the combination of this simplistic methodology with the vastly exaggerated equipment noise levels used in the analysis (see comment H4) provides a completely unfair and inadequate assessment of potential noise impacts from the facility. An adequate analysis will require use of a noise model to simulate DBOC sound source activities at specific locations over the course of a day to develop noise isopleths that can be compared with new estimates of existing sound levels. NPS should provide a comprehensive and accurate noise impact assessment using a noise model that employs standard accepted calculational practices.

H6. No Consideration of Possible Noise Control Measures that could be Employed to Significantly Reduce DBOC-Related Noise if Needed – Possible noise control measures were not even mentioned in the DEIS, must less evaluated for potential effectiveness. This lack of an adequate evaluation of potential means to control any actually problematic noise sources again grossly overstates DBOC noise levels that could be achieved with effective controls. If a complete and accurate analysis indicates noise reductions are in fact needed to avoid impacts, some DBOC sources could be very simply and effectively controlled to reduce the potential for impact.

The NPS approach that did not consider possible control measures to reduce or eliminate identified noise impacts is not consistent with Director's Order #47 (No. 6 Establishing Soundscape Preservation Objectives) (a) which says, "the soundscape management goal [in the event of authorized noise sources] would be to reduce the noise to the level consistent with the best technology available – to mitigate the noise impact, but not adversely affect the authorized activity." The DEIS noise assessment ignored this directive and concluded that the only possible means of controlling noise was the total elimination of the DBOC noise sources. This is an inappropriate approach.

Excluding any consideration of means for reducing DBOC noise is also inconsistent with Director's Order #47 (No. 8 Constructive Engagement) which says that in addressing noise that has been found to be "inappropriate" that "Superintendents must work constructively and cooperatively with those responsible for inappropriate sources of noise in parks…" Such a cooperative effort to identify and, if needed, to reduce facility-related noise, has never been seriously attempted as mandated by this order. Cooperative discussion with DBOC should be included as part of the revamped noise impact assessment.

I Recreation

I1. The DEIS Distorts the Recreational Benefit of the Oyster Farm Itself by Evaluating Visitors to DBOC as a Share of the Total Number of Visitors to the Seashore – The DEIS determines that alternatives B, C, and D, those alternatives where DBOC would remain in operation, would have a "long-term moderate adverse impact on visitor experience and recreation". There is no discussion of the loss of unique recreation and education opportunities that would occur if DBOC were forced to close. DBOC is open from 8:30 am to 4:30 pm every day and receives approximately 50,000 visitors each year. DBOC is the only oyster farm in California permitted to allow visitation and regularly provides tours to school groups at no cost. Visitors are able to go on interpretive tours of the last oyster cannery in California, purchase oysters for consumption, and picnic onsite. Furthermore, undergraduate and graduate students from local universities come to DBOC for coursework and research purposes. The DEIS states that the continued operation of the oyster farm would disrupt the wilderness experience of the Seashore but does not reflect on the visitors to the Seashore that appreciate viewing a working aquaculture farm. Many visitors see the oyster farm as a vital part of their visit to the Seashore as demonstrated in the letter provided by the operators of the local kayak companies.

I2. DBOC Recreation Experience Discredit – On pages 212-214, Chapter 3, Visitor Experience is described. The discussion includes an analysis of why DBOC does not meet the definition of a visitor service. The section also includes an explanation of several different types of visitor experiences at the Seashore but minimizes the visitor experience of the DBOC. This is accomplished by disregarding the importance of the tradition of visiting the DBOC, the importance of acquiring fresh oysters which is an experience not otherwise available in the vicinity, and by suggesting that the experiences of the 50,000 annuals visitors is not statistically significant.

J Culture

J1. Affected Environment Shortcoming – On page x of the Executive Summary, the following statement is made: "Dismissed topics include vegetation, lightscapes, air quality, climate change and greenhouse gas emissions (carbon footprint), geological resources, paleontological resources, cultural resources, and environmental justice." Pursuant to 40 CFR 1502.15, the "Affected Environment" section of an EA or EIS should provide background information on the prehistory and history of the area and describe known historic and cultural resources that may be affected by the project. This should entail the inclusion of a Cultural Resources section describing the prehistoric context, the ethnographic setting, an historical background, known cultural resources present in or near the project area vicinity, Indian Trust Assets, and Native American consultation. The historical background review should include the wide-ranging local, regional, and national effects that the DBOC has had.

Chapter 3 of the DEIS provides sections describing the affected environment but fails to include a section on Cultural Resources. On page 155, the DEIS states "The 'Affected Environment' chapter describes the Drakes Estero environment; relevant physical and biological processes within Drakes Estero; and the existing conditions for those elements of the natural, cultural, and social environment that could be affected by the implementation of the actions considered in this DEIS. The impact topics addressed in this DEIS include wetlands, eelgrass, wildlife and wildlife habitat, special-status species, coastal flood zones, water quality, soundscapes, wilderness, visitor experience and recreation, socioeconomic resources, and NPS operations. Impacts for these impact topics are analyzed in 'Chapter 4: Environmental Consequences.'" Cultural resources were identified by NPS staff and dismissed from further analysis “because either (a) the resources do not exist in the project area or would not be impacted by the project or (b) impacts would have less than minor impacts” (page x, Executive Summary). Pursuant to 40 CFR 1502.15, cultural resources must be thoroughly addressed during the NEPA process.

J2. Culture Incorrectly Summarized – On page xvi of the Executive Summary, in Table ES-2. *Issues and Impact Topics Considered but Dismissed from Further Analysis: Cultural Resources,* cultural resources are incorrectly summarized. They are first correctly identified citing the NHPA but falsely categorized citing the NPS. The DEIS states that the NPS considers cultural resources to be archaeological resources, cultural landscapes, museum objects, and ethnographic resources. In fact, the 2006 NPS Management Policies, Policy 5, Cultural Resource Management, states that “These resources are categorized as archeological resources, cultural landscapes, ethnographic resources, **historic and prehistoric structures**, and museum collections” (NPS 2006) (emphasis added). Because the buildings constituting the DBOC are of an age older than 50 years, they are considered historic structures and qualify as cultural resources.

J3. Assessment of Cultural Landscape Incorrectly Applied – On page xvi of the Executive Summary, in Table ES-2. *Issues and Impact Topics Considered but Dismissed from Further Analysis: Cultural Resources,* cultural resources are incorrectly summarized. They are first correctly identified citing the NHPA but falsely categorized citing the NPS. The DEIS states that the NPS considers cultural resources to be archaeological resources, cultural landscapes, museum objects, and ethnographic resources. In fact, the 2006 Management Policies, Policy 5, Cultural Resource Management, states that “These resources are categorized as archeological resources, cultural landscapes, ethnographic resources, **historic and prehistoric structures**, and museum collections” (NPS 2006) (emphasis added). Because the buildings constituting the DBOC are of an age older than 50 years, they are considered historic structures and qualify as cultural resources.

J4. Assessment of Historic Structures – On page xvii of the Executive Summary, Table ES-2: *Issues and Impact Topics Considered but Dismissed from Further Analysis: Historic Structures*, the assessment of the historic structures was inadequately applied, similar to cultural landscapes above. The DBOC meets the definition of an historic structure but was not considered eligible for listing in the NRHP based on its lack of integrity, citing that the requirement of integrity is not met based on aspects such as workmanship, materials, and design, noting that the structures are in disrepair and therefore affect the feeling aspect of integrity.

According to the NPS itself: “Integrity is a property's historic identity evidenced by the survival of physical characteristics from the property's historic or pre-historic period. The seven qualities of integrity are location, setting, feeling, association, design, workmanship and materials. When evaluating these qualities, care should be taken to consider change itself. For example, when a second-generation woodland overtakes an open pasture in a battlefield landscape, or a woodland edge encloses a scenic vista. For situations such as these, the reversibility and/or compatibility of those features should be considered, both individually, and in the context of the overall landscape. Together, evaluations of significance and integrity, when combined with historic research, documentation of existing conditions, and analysis findings, influence later treatment and interpretation decisions” (NPS 1994). Therefore, had integrity been more accurately assessed, the DBOC could have been considered an eligible historic structure.

J5. Relevant State Laws and Policies – The DEIS should consider including a section defining CEQA. Under the guidelines of CEQA, the significant impacts and environmental consequences of project implementation must be evaluated if any of the following could occur:

- A substantial adverse change in the significance of a historical resource that is either listed
    - or eligible for listing on the National Register of Historic Places, the California Register of
    - Historic Resources, or a local register of historic resources;
- A substantial adverse change in the significance of a unique archaeological resource;
- Disturbance or destruction of a unique paleontological resource or site or unique geologic feature; or
- Disturbance of any human remains, including those interred outside or formal cemeteries.

J6. The DBOC qualifies as a historic site regardless of whether it was found to be ineligible for listing in the NRHP. Furthermore, NPS Management Policies state that the Park Service's cultural resource management program is responsible for the stewardship "cultural resources. These resources are categorized as archeological resources, cultural landscapes, ethnographic resources, historic and prehistoric structures, and museum collections" (NPS 2006).

J7. Visitor Experience Misrepresented – On page 144, Chapter 2: Alternatives, the topic Visitor Experience and Recreation minimizes the portion of the population that values the DBOC traditions. Furthermore, the DEIS authors state that the experience is available "in the immediate area." In fact, the DBOC experience is unique and constitutes the only oyster farm in the Seashore as well as the last operating oyster company in the state of California.

J8. Determination of Eligibility – In the DOE, the DBOC was determined ineligible for listing based on lack of integrity. While clearly meeting National Register Criterion A, the DBOC was dismissed based on three aspects of integrity: workmanship, materials, and design. These were stated to deleteriously affect the aspect of feeling, thereby outweighing the aspects of integrity that it does possess: location, setting, and association. This is an inaccurate assessment of the application of "integrity" when assessing a property's significance.

The Advisory Council on Historic Preservation notes: "Integrity is the ability of a property to convey its significance. To be listed in the National Register of Historic Places, a property must not only be shown to be significant under the National Register criteria, but it also must have integrity. The evaluation of integrity is sometimes a subjective judgment, but it must always be grounded in an understanding of a property's physical features and how they relate to its significance.

K Socioeconomics

K1. Description of Socioeconomic Impact is Inconsistent, Incomplete, and Appears Biased in Favor of Park Operations over DBOC On pages 392 and 393 of the DEIS, the impacts of Alternative A are determined to be minor despite the fact that

- 31 full-time jobs and 1 part-time job are anticipated to disappear,
- many of the newly unemployed will simultaneously lose their homes,
- some likely will have to move out of the county to find alternative low-income housing, and
- it is not clear whether they will not be able to find similar work elsewhere

These oversights do not provide an accurate assessment of the socioeconomic impacts. No mention is made of the fact that these workers have been living in the homes for decades doing this work.

The estimated $1 million in DBOC payroll is also dismissed as merely representing 2-3 percent of all agricultural employment in the San Francisco San Mateo Redwood City Metropolitan area, which is a large area to consider. Perhaps the NPS mistakenly meant Marin County, which is still large, but which has an agricultural labor force estimated at between 600 and 1,000 (MCCDA 2011). These estimates were developed by Marin County in a document identifying a strategy for achieving agricultural labor housing, which is apparently in short supply. In this light it seems that the significance of the lost housing is even more important. The Inverness CDP has a population of less than 2000 people, and the agricultural labor force in the area may well be dominated by the DBOC. To accurately tally socioeconomic effects of the no action alternative, the NPS must place the number of jobs to be lost in an appropriate context—namely, the loss to the specific socioeconomic group, and the impact on housing as well as incomes.

In contrast, the NPS employment of 165 employees in the area is described in the most positive terms: representing a payroll of $10 million and including the 'value added' portion of this payroll as generating an additional $13 million. No similar 'value added' portion is reported associated with the DBOC payroll of $1 million. Also, the NPS labor is credited with supporting a 'value of $100 million' to park visitors. But although the DEIS acknowledges that 2-3 percent of the visitors also visit DBOC, this contribution to visitation is described as merely 'detectible.'

K2. Value to Consumers Overlooked If the two economic activities (shellfish production and park operations) are to be compared evenly, the 'value' to consumers of shellfish must also be counted. The value to NPS visitors describes the consumer surplus that accrues to visitors (estimated at $100 million). The consumer surplus is the value of an economic good or service that is over and above what the buyer paid for it. In this case, the value of the PRNS is described, but the value to shellfish consumers is not. Shellfish consumers pay lower prices for DBOC oysters than others that might be imported from Asia, and hence, the consumer surplus is higher. The NPS should either exclude mention of the 'value' of recreational visitation, or include the 'value' of the seafood production.

Neither is there any mention made of the fact that if such a large portion of the oyster market exits production (DBOC produces between 16 and 34% of the statewide oyster market, DEIS at 392), there will be excess demand which can be expected to raise prices. Consumers will have to pay more, and therefore benefit less from oyster purchases. The analysis of Alternative D does point to this, by mentioning that continued DBOC operations would be beneficial to oyster production in the state. Because of the magnitude of contribution to the supply of local, nutritious, natural food, it would in fact be helpful to include the economic impacts anticipated in the seafood market.

K3. Natural Food Status Overlooked In addition to failing to mention the economic losses to consumers, the loss of DBOC production under Alternative A is not recognized for its unique attributes as a natural food that promotes health and is produced for a local population. This is not only a consumer preference that can be seen in markets for natural and healthy foods, but also represents national benefits of improved public health. Further, consumers tend to be Asian and Hispanic (N. Lunny, pers. communication, November 2011), and so, understating the loss of this production disproportionately undervalues losses to specific ethnic groups.

K4. Economic Value of Ecosystem Services Not Considered In evaluating the socioeconomic benefits of Alternative D, or losses of Alternative A, the NPS might have noted the economic value of nutrient sequestration and water filtration. For example, a recent publication from Burke (2009) uses the replacement value method to estimate the value of nitrogen removal resulting from oyster aquaculture. DBOC oyster harvest for 2010 totaled 5,400,000 oysters, estimated to sequester and remove between 972 and 2,808 tons of nitrogen. Using the value estimates from Burke, this suggests that the value of removing nitrogen from the Drakes Estero water is between $2,916 and $84,240 per year.

L Environmental Justice

L1. Environmental Justice Approach Deficient – Adverse social and economic effects have the potential to occur if the action has disproportionately high adverse effects on industries in which low-income or minority workers are clustered, thereby potentially causing job losses or wage cuts that disproportionately affect these groups. To identify whether potential adverse effects will occur within minority populations as a result of the No Action or Action Alternatives, first it is necessary to determine whether DBOC employs a high percentage of minority and low-income workers, and then to determine whether any impacts are anticipated as a result of the No Action or Action Alternatives.

All the 22 workers at DBOC, who would lose their jobs if DBOC operations were to cease, are of Hispanic or Latino ethnicity, and most also fall into the category of low-income. According to Census 2010 data, there are 79 people of Hispanic or Latino ethnicity in Inverness CDP, making up 6.1 percent of the CDP population of 1,304 residents (U.S. Census Bureau 2010). The 22 DBOC workers essentially make up more than a quarter (28 percent) of the Hispanic or Latino population in Inverness CDP. Further, many of these workers and their families reside in on-site housing provided by DBOC as part of their incomes. This type of low-income housing is rare in Marin County. It is likely that these workers, along with their families, comprise a large proportion of the Hispanic and Latino population in the CDP. While the percentage of Hispanic and Latino population in the CDP is lower than that in Marin County (almost 16 percent), the potential that almost all of this minority group would be affected implies an environmental justice concern. In case of No Action, these adverse effects could be, among others, loss of livelihood, loss of housing, potential relocation to other states (such as Oregon and Washington) in order to utilize their specialized skills, potential for lower wages in future employment due to switching to a new profession, and loss of a family profession

In addition, DBOC roughly hires half women and half men as workers at the farm. Inverness CDP is a largely agricultural area, where most farms and ranches typically hire men. Traditionally, DBOC has hired the wives of many of these farm and ranch workers, thus providing means for additional income for these families. The neighboring farms and ranches also have a competitive advantage when hiring workers because of the potential for DBOC hiring the wives. The impact on the closure of DBOC on these neighboring farms and ranches need to be analyzed in the DEIS.

L2. No Attention to Ethnicity – on page 215, Chapter 3 of the DEIS, the authors present race data as a percent of population in Marin County and the State of California. However, the analysis does not identify or present Hispanic population in these areas. Ethnicity data is available from the U.S. Census Bureau, and Hispanics are also considered a minority. Further, this data is key for the environmental justice analysis given that the potential minority group affected by the No Action or Alternatives is Hispanics. Approximately 95 percent of the 30 workers at DBOC are Hispanic, and most also fall into the category of low-income. In Inverness CDP, Hispanics make up over six percent of the population, this ethnic group is almost 16 percent of the population in Marin County, and makes up about 38 percent of the population of the State of California.

Section 3-3, EO 12898 specifically states that:

> *[E]ach Federal agency, whenever practicable and appropriate, shall collect, maintain and analyze information on the* ***race, national origin, income level, and other readily accessible and appropriate information*** *for areas surrounding facilities or sites expected to have a substantial environmental, human health,* ***or economic effect on the surrounding populations,*** *when such facilities or sites become the subject of a substantial Federal environmental administrative or judicial action. Such information shall be made available to the public, unless prohibited by law.*

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Appendix A

Additional Information for Eelgrass and Benthic Invertebrate Discussion

EELGRASS

1. **PROPELLER SCARRING** – on page 265 of the DEIS, the authors attempt to compare aerial photography of "propeller scars" in eelgrass beds between 2007 (NAS 2009) and 2010 (NPS data). Although they provide the value for the estimate in 2007 (50 acres) they do not provide a corresponding value for 2010, even though the data is based on higher resolution photography, which should provide a more accurate estimate of this impact. Further, there is no indication in the DEIS of how long these impacts potentially persist.

   It is our contention that the DEIS did not provide a comparative value because it is substantially lower than the 2007 estimation, which was "loosely quantified." In fact, calculating the area based on the distance reported for the 2010 data (8.5 miles), and providing a range of possible widths,, the area of impact is a minimum of 91% lower than calculated in 2007 (see Additional Information below). Additionally, the maximum area of impact calculated (4.1 acres) represents 0.2% of the total Drakes Estero waterbody and 0.6% of eelgrass habitat available in the estuary.

   Finally, and most importantly, the impact is in two forms: temporary and longer term. The majority of the impact from boat use is temporary and minor. This involves grazing the tops of eelgrass leaves; similar to mowing a lawn, which stimulates growth. Regrowth of eelgrass from this type of impact would take approximately 2-4 weeks to recover the original biomass (J. Ruesink, pers. comm., 2011). Further to the point, shoot density remains unchanged, and no long term damage occurs in terms of density. The longer term impact is from the removal of the meristem, which may occur occasionally, and regrowth typically occurs at a rate of 1cm/2 weeks (J. Ruesink, pers. comm., 2011). Scars observed from aerial photography represent an accumulation of impact. Therefore, the 8.5 mile estimate is not over a single day, but over a much longer period of use (likely over a period of a year or more). Boating in the Estero typically occurs in water deep enough to avoid interactions with eelgrass that would pull up the entire plant. Where these few occurrences occur, plants would be able to regrow within a year if not continuously disrupted.

   In summary, this impact should be considered short-term and minor based on the intensity of impact, persistence, and how much of the waterbody is affected.

   Additional Information
   Based on the mileage calculated from the 2010 aerial photography for the boat routes through eelgrass (8.5 miles or 45,031 linear feet), a number of possibilities can be calculated for total acreage of impacts from DBOC boats (Table 1). We estimated the width of the propeller scar according to the NPS statement on page 266 of the DEIS, "the width of propeller scars in Drakes Estero is highly variable and can range from one to several feet wide." What each of these calculations shows is that the 2010 aerial photography, based on higher resolution images, estimates a much lower impact than previously calculated, even for scars up to "several feet wide".

Table 1. Acreage calculation of potential propeller scarring in Drakes Estero.

Option	2010 Calculations			2007 Calculation	% Difference in Area
	Length (ft)	Width (ft)	Area (acre)	Area (acre)	
1	45,031	0.5	0.5	50	-99%
2	45,031	1.0	1.0	50	-98%
3	45,031	1.5	1.6	50	-97%
4	45,031	3.0	3.1	50	-94%
5	45,031	4.0	4.1	50	-92%

In addition to the small area of impact, there is no discussion in the DEIS of how long these effects persist. The only discussion regarding prop scarring is related to aerial photography; there was no ground-truthing completed in relation to the analysis. According to the operator (K. Lunny, pers. comm., 2011), no evidence of damage is evident the day after boats travel through the estuary. For the most part, the extent of damage would be taking off the ends of the leaves, but not removing the entire meristem. Regrowth for eelgrass that is only damaged on the surface requires branching of the plant to replace the lost biomass. According to J. Ruesink (pers. comm., 2011), regrowth from loss of the top portion of the plant (i.e., the meristem is still in place) takes approximately 2-4 weeks. There would be no long term damage in terms of density.

The calculation of damage from aerial photography represents an accumulation of shoot removal over a longer period. J. Ruesink (pers. comm., 2011) stated that regrowth of eelgrass that has been removed at the meristem typically occurs at a rate of 1cm/2 weeks. Therefore, if the width of the scar is 3 ft (91.4 cm), then it would take approximately 0.9 years to replace the lost biomass. If a consistent path is desired to reduce potential damage to eelgrass beds, then a comparison should be made between the 8.5 miles of accumulated damage over a year, and potentially denuding a consistent pathway.

Original DEIS Citation

Chapter	Page	Quote
3	172	The effects of propeller scars can easily be observed as linear, dark signatures through seagrass beds on high-resolution aerial photography (Zieman 1976). In their review of shellfish mariculture impacts on eelgrass in Drakes Estero, the NAS (2009) cites an estimated 50 acres of eelgrass habitat that was impacted by propeller damage based on review of 2007 aerial photography, but qualifies the estimate by saying that it was “loosely quantified” due to the resolution of the imagery used. In an effort to provide a more detailed and current assessment of propeller damage to eelgrass, recent (2010) high-resolution aerial photography of Drakes Estero was evaluated using GIS technology. This evaluation showed that 8.5 miles (45,031 linear feet) of propeller scars through eelgrass are readily seen on the aerial images. Due to the large variability among the widths of scars, this analysis method was not suited for calculating a comparable quantity for comparison with the 50-acre quantity reported by NAS (2009).

2. **Boat Use and Transit Plan** – on page xxxvi of the DEIS, the authors state that a transit plan must be created by DBOC and submitted to NPS for approval. Additionally, there is language in the DEIS that attempts to limit boat use by DBOC. These restrictions are not substantiated and would cause undue burden on DBOC operations.

A vessel transit plan, including GPS boat tracking reports, has already been completed and submitted to NPS. The NPS has disregarded what was submitted in the scoping process and has created an arbitrary lease area in the DEIS (Figures ES-7, ES-9, ES-11). The proposed restriction would make it impossible to access certain oyster beds. A vessel transit plan should definitely be a part of the EIS. However, allowing NPS in the future to "approve" or "not approve" a vessel transit plan gives them the authority to strangle DBOC without a public process. No data or evidence showing harm caused by the existing boat routes has been provided. DBOC would agree to modify its vessel transit plan through use of an adaptive management approach. Adaptive management recommendations would be made by an adaptive management team composed of individuals representing NOAA, CDFG, NPS, CDPH and DBOC. The Marine Mammal Commission (MMC) has recommended this adaptive management team, which should be responsible for all offshore management change decisions.

The boat use restriction would make it almost impossible for DBOC to conduct its business. DBOC actually has had 3 boats for much of the past 5 years, and is on the water for most of the day in order to complete operations. To limit boat use to a combine 8 hours per day would be devastating to operations. There is no justification for this restriction, and it appears that it is in place to functionally debilitate operations if they are allowed to proceed through the SUP.

Original DEIS Citation

Chapter	Page	Quote
Executive Summary	xxxvi	A vessel transit plan for DBOC boat use within Drakes Estero would be developed and submitted to NPS for approval.
Executive Summary	xxxvii	Two motorboats and two nonmotorized barges would be operated in Drakes Estero, approximately 12 trips per day, 8 hours a day, combined.

3. **Uprooting Eelgrass** – on page 265 of the DEIS, the authors claim that eelgrass biomass and abundance is compromised because of boat activity and damage from propellers. However, as discussed above, although this may occur to a minor extent, the majority of interactions with eelgrass do not remove the entire plant, and regrowth occurs within 2-4 weeks. Additionally, the references used appear to be taken out of context and are not comparable to potential impacts from shellfish aquaculture being evaluated.

The disturbance to seagrass discussed in Preen et al. (1995) was related to two major storms and a cyclone, all in succession. These disturbances are, at minimum, several orders of magnitude greater than the disturbance created by boat traffic associated with tending culture operations in the Drakes Estero. Further, the turbidity that remained in the system following these major storm events was related to 1000 km^2 of eelgrass being uprooted. In the second citation provided in the DEIS to support the conjecture of impact, Fonseca and Bell (1998), the only mention of how storms can influence beds was from the quote "We did not determine whether acute wind events periodically act to organize seagrass bed formation through extensive reductions in seagrass coverage, although some systems (e.g. Tampa Bay) can experience marked changes in cover after large storm events." Notably, there is no discussion in the paper regarding scarred beds.

In summary, there is no evidence that eelgrass habitat is being moderately impacted relative to boating activities, and the implication that boating can create turbidity that will further affect eelgrass growth is based on events that are infinitely more intense. Based on the information presented, this impact appears to be negligible in Drakes Estero and has no bearing on the overall quality of eelgrass habitat.

Original DEIS Citation

Chapter	Page	Quote
4	265	DBOC activities, particularly boat traffic, adversely impact eelgrass biomass and abundance because plants are uprooted or otherwise physically damaged by boat propellers (NAS 2009).
4	265	Once a propeller scar is created, wave action or fast-moving currents can lead to erosion within the scar, resulting in scouring and deepening of the disturbed area. Heavily scarred beds may also be prone to further damage or destruction by severe storms (Fonseca and Bell 1998). In addition, reduction in water clarity through resuspension of sediments destabilized by seagrass removal can lead to more extensive declines in cover (Preen, Lee Long, and Coles 1995).

4. **BOAT WAKE EROSION** – on page 266 of the DEIS, the authors discuss how propeller wash can erode eelgrass in navigation channels. The authors are using the cited references inappropriately to try to attribute propeller wash in Drakes Estero. The propeller wash noted by Thom et al. (2003) was based on pleasure crafts (yacht) and ferryboats, which displace larger volumes of water than the 20-ft long skiffs used in DBOC operations. Koch (2002) was based on more recreational type boating, but they ultimately concluded that negative effects to seagrass were minimal, and even further reduced when boats moved at high speeds during a high tide. Further, Koch (2002) commented that the strongest impact was from resuspension of a small amount of sediment, but that it was "redeposited within minutes." There is no evidence that propeller wash is occurring in Drakes Estero, and trying to compare navigation channels with the habitat in Drakes Estero, or reporting the results incorrectly, is simply poor science.

Additional Information

When propeller wash is discussed in relation to navigation channels, it is in relation to large vessels, such as ferries, pleasure crafts (yacht) and barges that are associated with commercial ports. The reference that was made in Thom et al. (2003) was from information presented by Thom et al. (1996), which researched vessels longer than 250 feet and traveling at speeds of 12 mph. A direct relationship cannot be drawn to the small boats that DBOC uses in its operations in Drakes Estero. Their boats are 16 to 20 feet long and travel at speeds up to 25 mph, although more often at 5 mph when towing barges. As such, there is no evidence that propeller wash is occurring in Drakes Bay, and certainly not from the small boats used by DBOC.

The work on the east coast by Koch (2002) could be more directly related to conditions in Drakes Estero because it was based on 21-ft V-hulled boats moving at 7.4 and 14.1 mph. However, the authors of the DEIS used his work to say that propeller wash was "known to erode eelgrass." In fact, Koch (2002) concluded that, "the possible negative impacts (increased sediment resuspension, release of sediment nutrients, and reduced light levels) were much smaller than expected, being minimal when compared to natural fluctuations in this habitat (conditions to which the plants have acclimated)."

Original DEIS Citation

Chapter	Page	Quote
4	266	Further, "propeller wash" (i.e., water turbulence behind propellers in boat wakes) and boat-generated waves are known to erode eelgrass along the edges of navigation channels, a phenomenon that has been documented both on the west coast (Thom et al. 2003) and on the east coast (Peterson, Summerson, and Fegley 1987; Koch 2002).

5. **SEDIMENT RESUSPENSION** – on pages 265 and 266 of the DEIS, the authors claim that sediments are destabilized in Drakes Estero due to the removal of eelgrass from DBOC operations. There is no evidence, and no supporting data, to these claims. First, the work by Anima (1991) was done when Johnson Oyster Company was working in Drakes Estero, and the only mention of disturbing the bottom was associated with the boat dock in Schooner Bay. Second, the reference to boat-generated waves in Koch (2001) was from Stewart et al. (1997), a study completed in the Upper Mississippi River in a major navigation channel. Third, as discussed above, Koch (2002) noted minimal impact generated from a 21-ft V-hulled boat to seagrass habitat.

Additional Information

There is no evidence that DBOC boating operations destabilize eelgrass. The comment that boats disturb the bottom substrate by Anima (1991) was related to operations by Johnson Oyster Company, who owned the oyster farm prior to DBOC, and it was related to the boat dock in Schooner Bay. The actual quote from Anima (1991) is "In Schooner Bay the channel is somewhat artificial in that it has been scoured out by the constant boat traffic from the oyster operation. The work by Anima (1991) focused on discharge of pesticides in the water from upland sources and the general geology of the site. Not only is the work associated with a totally different company, but it has no bearing on eelgrass habitat at all.

The only reference to boat-generated waves in Koch (2001) was from Stewart et al. (1997). The Stewart et al. (1997) study was analyzing boat-generated waves in a navigation channel of the Upper Mississippi River. Nothing about that study can be compared to conditions in Drakes Estero. The Mississippi River is a freshwater system with constricted shores (compared to an estuary), is a navigation channel with intense aquatic traffic, and contains vessels that are orders of magnitude greater than the skiffs used by DBOC.

There is no evidence that DBOC boating operations increase turbidity. Koch (2002) found minimal negative impacts to seagrass habitat associated with 21-ft V-hulled boats traveling at speeds of 7.4 and 14.1 mph. In fact, the researcher found that boat generated waves contained less energy than storm or wind-generated waves. Fonseca (1996 *as cited by* Koch 2002) states that, “seagrasses effectively reduce currents and waves promoting sediment deposition.” Any resuspension of sediment caused by boat-generated waves resettled within a matter of minutes and would not, as the authors of the DEIS claim, “result in temporary reductions in photosynthesis.”

Original DEIS Citation

Chapter	Page	Quote
4	265	[R]eduction in water clarity through resuspension of sediments destabilized by seagrass removal can lead to more extensive declines in cover (Preen, Lee Long, and Coles 1995).
4	266	DBOC operations adversely impact eelgrass cover and density because boats disturb the bottom substrate (Anima 1991iv), thereby adversely affecting the rooting medium for eelgrass. Eelgrass regrowth into propeller scar areas can be relatively rapid (weeks), or it can take as long as 2 to 5 years, depending on the severity of the impact on the substrate or the root systems (Waddell 1964, as cited in Simenstad and Fresh 1995; Zieman 1976)…Finally, boat traffic can cause a reduction in photosynthesis, and therefore biomass, due to the following: (1) boat traffic causes temporary increases in water column turbidity due to resuspension of sediments, (2) increased turbidity reduces the depth to which sunlight can penetrate the water column, (3) sunlight is a requirement for photosynthesis, and (4) plants must photosynthesize to add biomass; therefore, (5) boat-induced turbidity results in temporary reductions in photosynthesis and can stall or reverse biomass accumulation (Koch 2001, 2002).

6. **Introduction of Invasive Species** – on page 263 and 266 of the DEIS, the authors attribute the introduction and expansion of *Didemnum* to DBOC operations and mariculture structure. Further, the authors claim that *Didemnum* has the ability to colonize eelgrass. The authors fail to recognize, (1) *Didemnum* was not introduced by mariculture operations, (2) there are many colonial tunicate species in Drakes Estero, (3) because it has the ability to colonize eelgrass, taking out the mariculture structure would only make eelgrass a more attractive substrate for attachment, and (4) current minimization measures that manage for invasive species. In general, colonial tunicates are more problematic for the oyster industry (Jamison 2007) than the local biota in Drakes Estero, and it is in the best interest of DBOC to control the organism. It should also be noted that, even though the NPS claims that they have been monitoring this species, they do not provide any data that it has expanded in abundance in Drakes Estero since initiation of monitoring. In summary, DBOC is not responsible for the introduction of this species, which could just as likely have been introduced by recreational activity, and it provides a service to the NPS through control measures taken during harvest and maintenance activities associated with the farm. If the NPS is serious about managing for invasives, then it should be working with DBOC rather than implicating it in a problem that they did not originate and for which they are improving.

Additional Information

Didemnum was first observed on the West Coast in San Francisco Bay in 1993 (Bullard et al. 2007). It is unknown how the species was introduced, but aquaculture is not implicated in its introduction. That said, shellfish aquaculture has served as a vector for past species introductions, and this has been acknowledged by the industry for many years. Unfortunately, the DEIS fails to acknowledge regulated industry practices that greatly limit the potential for new introductions that have been in place for many years.

The current measures that minimize the risks of invasive species introductions are principally associated with the use of larval seed from West Coast hatcheries that are prescreened for pathogens and invasive species, and authorized for interstate export only after review by state agencies. All shellfish seed imported into California must be certified disease free and are regulated by the CDFG by an importation permit. All of the seed comes from hatcheries in Washington and Oregon; growers no longer import wild seed from Japan or Europe. The seed is routinely inspected via histological and PCR inspection for disease and pest species and then certified free of disease and pests by a USDA/APHIS certified veterinarian. CDFG carefully monitors hatchery and seed production facilities in Washington and Oregon. It requires these facilities to submit seed inspection reports on a regular basis, and routinely conducts seed inspections and histopathological analysis on imported seed. CDFG only allows importation of seed from established hatcheries with a minimum two-year history of documented absence of disease. The certification process includes inspection of larvae and seed for disease, parasites and invasive/exotic species. It also includes regular communication with Washington and Oregon State biologists and regulators to maintain open communication about relevant issues. In view of these precautions, and shellfish grower's ongoing interest in keeping their waters free of hazardous exotic species, current shellfish farming practices, pose little risk of causing new introductions of invasive or exotic species.

Past practices of importing shellstock from overseas, the primary vector for past species introductions from shellfish aquaculture, are prohibited. Further, boats and gear used in DBOC operations are not moved outside of the Estero, thus preventing spread through hull fouling or gear introduction. In this manner, kayakers and other recreationalists are more likely to introduce "hitch-hiking" species than DBOC. While *Didemnum* has been observed among the oyster racks in the Estero, colonizing hard substrate, what is not recognized is that this species has been established in many locations along the entire West Coast from southern California to British Columbia (Fofonoff et al. 2005, Ruiz et al. 2005). Dr. Andy Cohen (Jamison 2007), director of the Biological Invasions Program at the San Francisco Estuary Institute, told the Point Reyes Light, "*Didemnum* can only grow on hard surfaces. Since the bottom of Drakes Estero is soft sand and mud, he said, the organism is more likely to affect Lunny's oysters than any other marine life in the estuary."

The NPS uses the evidence of *Didemnum* establishment on the racks as evidence that the Estero propogates this species for further distribution outside the Estero. However, while the racks may serve as a source for tunicate settlement, DBOC manages the problem through harvest and maintenance activities. DBOC is doing more for the control of this organism than any eradication program the NPS could devise. If NPS is serious about trying to control colonial tunicates, then they should be working with DBOC to remove the species from the system rather than implicating them in causing a problem that they did not originate.

Finally, tunicates have been known to colonize eelgrass, which typically occurs in the absence of other more suitable structures for colonization (Shumway, pers. comm., 2011). Researchers from University of Connecticut who have studied colonial tunicates extensively (Sandra Shumway, Stephan Bullard, and Robert Whitlatch) have indicated that in the absence of mariculture structure, the colonial tunicates in Drakes Estero are more likely to colonize eelgrass (Shumway, pers. comm., 2011). Therefore, taking out the mariculture structures would do more to distribute the invasive tunicate in Drakes Estero than leaving it in place.

Original DEIS Citation

Chapter	Page	Quote
4	266	As noted in NAS (2009), commercial shellfish operations have caused the expansion of nonnative invasive species such as the invasive tunicate *Didemnum* into various habitats in Drakes Estero. Although hard structures such as oyster racks and bags represent a point of introduction and/or expansion for this species (Bullard, Lambert, et al. 2007), recent research has shown that this species has the capacity to colonize soft substrates such as eelgrass blades (Carman et al. 2009; Carman and Grunden 2010; NAS 2010). Invasive tunicates have been recently observed colonizing eelgrass blades in Drakes Estero (Grosholz 2011b).
4	263	When eelgrass blades become covered with species such as invasive tunicates or epiphytic algae, this reduces the surface area of the leaves that are exposed to sunlight for photosynthesis. Therefore, because alternative A would reduce the potential for such leaf-blade colonization, the result would be long-term beneficial impacts on eelgrass due to the associated increases in primary productivity.

7. **Epiphytic Algae** – on page 263, Chapter 4 of the DEIS, the authors suggest that removing the DBOC would reduce potential harm to eelgrass by removing mariculture structures that stimulate the growth of epiphytic algae. In fact, mariculture is more likely to reduce algae production through consumption of nutrients. Further, the authors use inappropriate scientific references to support the mistaken claim.

For example, when Hauxwell et al. (2001) and Dumbauld et al. (2009), cited by the DEIS authors, were discussing vegetation that grows on mariculture structures, they were not talking about epiphytes, they were talking about epiphytic *macro*algae. There is a big difference. Epiphytic macroalgae (e.g., *Ulva*, *Fucus*, *Enteromorpha*) are algal species that colonize on structures and can outcompete eelgrass by shading it out, especially newly recruiting shoots (Hauxwell et al. 2001). Epiphytes (e.g., diatoms) that colonize eelgrass blades are a result of natural processes, but can be overproduced due to nutrient loading in a system (Hauxwell et al. 2001, Nielsen et al. 2004). Shellfish aquaculture can actually control the growth of epiphytes by reducing water column nutrients.

Additional Information

Macroalgae does not colonize eelgrass blades in the way that epiphytes grow on blades, but can outcompete eelgrass for nutrients (Nielsen et al. 2004). Growth of macroalgae is dependent on nitrogen loading in an estuary (Figure 1, Hauxwell et al. 2001). According to Press (2005), as stated on page 161 of the DEIS, *macro*algae is “not a major source of primary production in Drakes Estero, but may function as important habitat for benthic invertebrates and may also contribute to nutrient cycles in the sediments”.

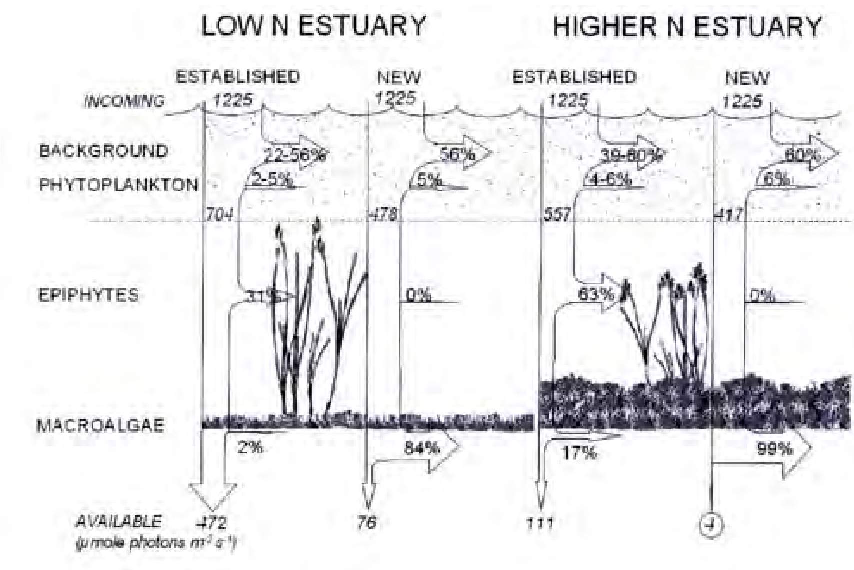


Figure 1. An illustration of mean summer light intensity effects to newly recruiting eelgrass based on the interception of light due to background attenuation and standing stocks of phytoplankton, epiphytes, and macroalgae in two estuaries of Waquoit Bay subject to different nitrogen loading rates (Hauxwell et al. 2001).

In contrast, epiphytes (primarily diatoms) can form thick layers on eelgrass blades. This is a natural processes, and important in the food chain because this layer of epiphytes is grazed by aquatic invertebrates (van Montfrans et al. 1984, Nelson and Waaland 1997). Epiphytic growth can impact photosynthetic processes (Hauxwell et al. 2001, Nielsen et al. 2004), but overproduction of epiphytes is a result of nutrient water column pollution (Williams and Ruckelshaus 1993, Hauxwell et al. 2001, Nielsen et al. 2004). Shellfish aquaculture can provide mitigation of these conditions due to water filtration and control of nutrients that promote the growth of epiphytes. Therefore, the contention that the presence of epiphytes in Drakes Estero would improve with the removal of DBOC is completely inaccurate. If anything, epiphytic growth would increase without the farm.

Original DEIS Citation

Chapter	Page	Quote
4	263	Removal of DBOC activities would also reduce the potential for offshore mariculture structures such as racks and bags to stimulate the growth of algae, which can become established on nearby eelgrass blades (termed “epiphytic” algae) (Hauxwell et al. 2001; Dumbauld, Ruesink, and Rumrill 2009; NAS 2010).

8. **EELGRASS UNDER OYSTER RACKS** – on page 266 of the DEIS, the authors state that bags and racks used for shellfish cultivation have been shown to reduce coverage and density of eelgrass due to shading. To support their claims, they use a number of references from California and the Pacific Northwest that were interpreted incorrectly. Interactions between shellfish cultivation and eelgrass are not as simplistic as presence/absence. Although there may be space competition in a small portion of the estuary associated with the racks and bags (1%), the water filtration and sediment enrichment benefits that shellfish provide positively benefit more than

92% of the Estero and associated benthic communities. (Note: this value is based on the figure presented in NAS (2009) that DBOC has impacted 8% of eelgrass resources, although 7% was based on boating impacts from eelgrass, which more recent data does not support, as discussed above).

For reference, Rumrill and Poulton (2004) found that spacing oyster longlines more than 5 feet apart resulted in no significant reduction in eelgrass density relative to reference areas: the eelgrass spatial coverage among long lines spaced at 5 to 10-ft intervals was within the range of variability found in reference plots. Longlines spaced closer than 5 feet were found to reduce the spatial coverage of eelgrass. Thus, appropriate spacing was found to reduce the space competition found between mariculture gear and eelgrass, and allowed for the coexistence of mariculture operations and suitable eelgrass habitat. The distance of the most densely clustered oyster racks in Drakes Estero are separated by 16 to 20 feet (K. Lunny, pers. comm., 2011). In addition, many authors have reported that bottom culture can increase eelgrass growth rates, even if the plants are less dense (Peterson and Heck 2001, Newell 2006, Tallis et al. 2009). At most, effects from the presence of aquaculture gear in Drakes Estero can be considered neutral if you consider the amount of space that is impacted due to space competition (1%) compared to the amount of benefits it provides through water filtration, sediment enrichment, and predator refugia (92%).

Additional Information

Data from Drakes Estero show reductions, or absence, of eelgrass below oyster rack structures, and this is not disputed. What is not recognized in the DEIS is to what degree the eelgrass in the Estero is benefitted outside of these structures by the filtration and sediment enrichment provided by the shellfish biomass the rack structures support. The filtering activity of the shellfish farmed by DBOC clears excess turbidity from the waters, which improves water clarity and deepens the photosynthetically active radiation zone benefitting eelgrass and macroalgae. The combined filtering activity of the millions of filter-feeding shellfish being grown in the Estero clears as much as 350,000 m^3 each day, removing particles as small as 2 microns (R. Rhealt, pers. comm., 2010). Based on the positioning of the mariculture racks and bags (Figure 2), these benefits are concentrated in more protected areas of the Estero that may not be completely flushed from tidal exchange. This was also acknowledged by Anima (1991) who stated that the greatest abundance of oyster racks is located in areas of the Estero where “tidal flushing is limited.” Additionally, in terms of the most localized benefits, shellfish culture is positioned in proximity to nutrient loading from cattle land in the upper watershed, which means that the farm provides mitigation for excess nutrients added to the Estero.

Estuaries with excessive nitrogen inputs and inadequate populations of filter-feeding bivalves often exhibit losses of eelgrass caused by inadequate light penetration from phytoplankton blooms, and dissolved and suspended solids. Filter feeders (e.g., oysters) mitigate for this eutrophication by consuming water-column phytoplankton and particulate organic matter that can interfere with light penetration required for eelgrass photosynthesis (Best et al. 2001, Koch and Beer 1996). Evidence that bivalves in the Estero are providing a benefit to eelgrass can be seen in the doubling of eelgrass habitat from 1991 to 2007 (Bartley et al. 2009, NAS 2009).

The nutrient cycling aspects of shellfish populations may be a significant element in maintenance and growth of eelgrass communities in estuarine ecosystems. Eelgrass growth is likely accelerated in areas where the plants are co-mingled with bottom-growing shellfish (Newell 2006). Mussels (*Modiolus americanus*) enhanced seagrass (*Thallasia testudinum*) productivity in a Florida study (Peterson and Heck 2001) by increasing porewater nutrient concentrations, which correlated with increased nitrogen and phosphorus content in seagrass blades and faster growth. A similar study in southern California examined interactions between eelgrass (*Zostera marina*) and an introduced mussel (*Musculista senhousia*) (Reusch and Williams 1998). Mussels were placed in eelgrass beds and near eelgrass transplants at several densities. At high densities, mussels inhibited rhizome extension of eelgrass, but across a range of densities, eelgrass blade growth rates increased. This finding of enhanced growth was consistent with those of Tallis et al. (2009) in their evaluation of bottom cultured oysters in Willapa Bay, and their documentation that disturbance/displacement of eelgrass varies by oyster culture method.

These and other studies document that while some degree of displacement of eelgrass can occur from cultured shellfish, in the broader embayment where the culture occurs, benefits to eelgrass can be significant if densities of culture operations do not completely outcompete eelgrass for space or exceed the carrying capacity of the local waters. Suspended shellfish systems, in particular, limit space competition and, provided they are not in a density that would exceed the exchange rate for flushing or lead to over enrichment of sediments, they can be maintained sustainably and provide ecological benefits.
To this end, the NAS (2009, p.4) notes, “Mariculture activities had an impact on about 8% of the eelgrass habitat in Drakes Estero in 2007: 1% of eelgrass acreage was displaced by oyster racks and 7% was partially scarred by boat transit through the eelgrass beds. Research elsewhere demonstrates that damaged eelgrass blades have rapid regeneration capacity and that eelgrass productivity can be locally enhanced by the cultured oysters through a reduction in turbidity and fertilization via nutrient regeneration.” Thus, in terms of a ‘permanent’ adverse impact, the assessment observes a maximum of 1% at 2007 coverage levels.

It should be recognized that the SUP permit would authorize only the continuation of operations within the historic footprint of the farm’s activities, and not any expansion. Thus, the spatial impact of operations would remain the same. The question must be asked, if 99% of the eelgrass in the Estero is not occluded by oyster racks, and 92% of the eelgrass is benefitted by the filtration and fertilization functions of the oysters, is there a net impact, or benefit?

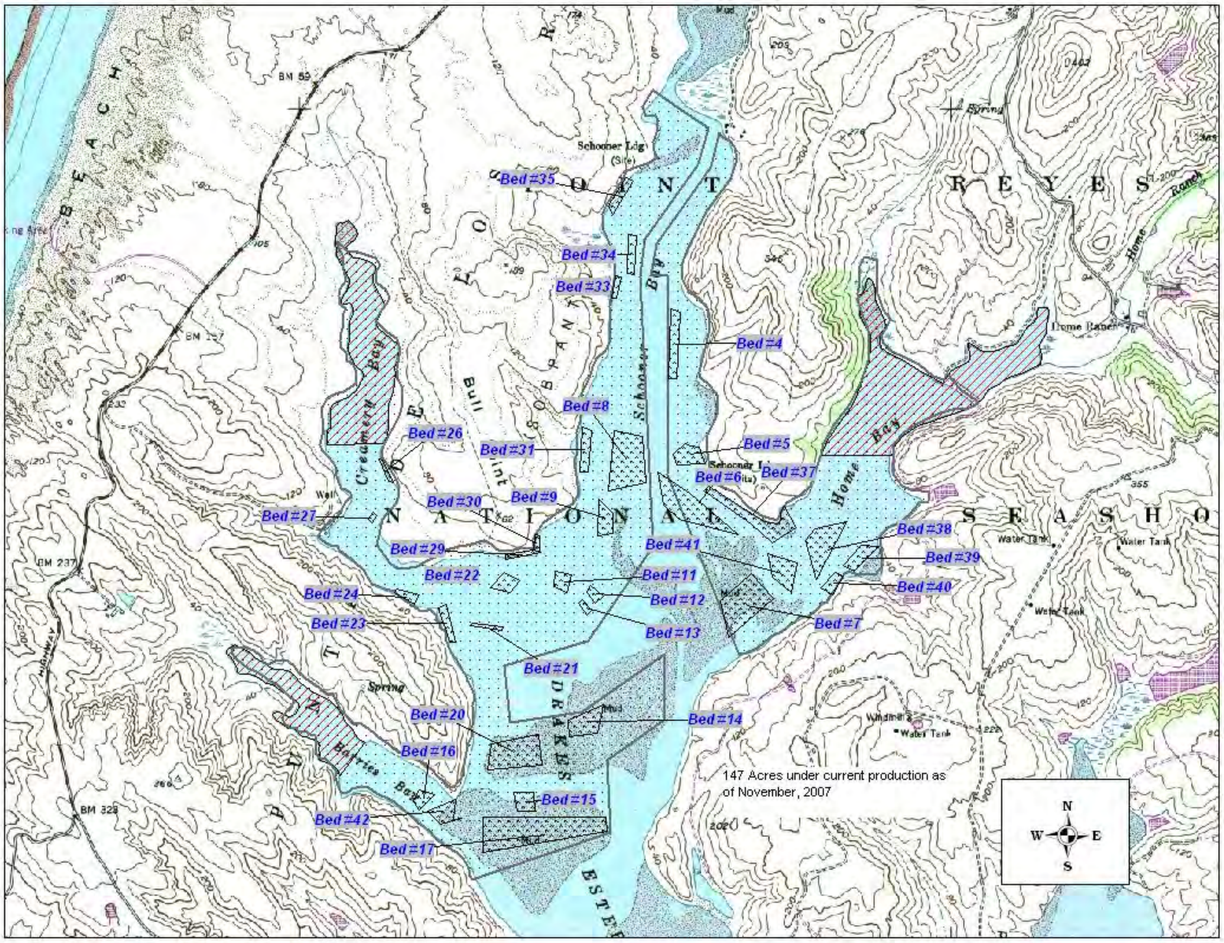


Figure 2. Location of culture beds owned by DBOC in Drakes Estero (total of 142 acres).

Original DEIS Citation

Chapter	Page	Quote
4	266	Based on research conducted in Drakes Estero, bags and racks used for shellfish cultivation have been shown to reduce coverage and density of eelgrass due to shading or preemption of space (e.g., Wechsler 2004v; NAS 2009). Similar results have been found underneath structures used for oyster cultivation in other California estuaries, e.g., Humboldt Bay (Rumrill and Poulton 2004), and throughout the west coast (Pregnall 1993; Simenstad and Fresh 1995; Ruesink et al. 2005; Everett, Ruiz, and Carlton 1995; Tallis et al. 2009). Reduced coverage and density of eelgrass under or adjacent to racks and bags have an associated reduction in primary productivity of eelgrass, because there is less leaf area available to photosynthesize (Everett, Ruiz, and Carlton 1995; Rumrill and Poulton 2004; Tallis et al. 2009; NAS 2010). In addition, lower eelgrass abundance results in a reduction of habitat for wildlife species that use eelgrass for nursery grounds, refuge, and food (Simenstad and Fresh 1995; Dumbauld, Ruesink, and Rumrill 2009; NAS 2009).

9. **EROSION UNDER OYSTER RACKS** – on page 267 of the DEIS, the authors claim that oyster racks promote erosion and/or sedimentation. There is little value in this statement. First of all, it is unclear if the authors feel that sedimentation or erosion is problematic in relation to the oyster farm. Second, both of these processes are typical of tidally-driven systems. According to numerous researchers, tidal action is the dominant driver in sediment distribution in Drake Estero (Anima 1991, Elliott-Fisk et al. 2005). Anima (1991) reports that there is an overall sedimentation trend in Drakes Estero. The rate of sedimentation has varied over the history of the estuary. From 8,000 to 3,000 yrs BP the sedimentation rate was 37.5 cm/100 yrs; from 1,200 to 1,700 yrs BP the rate was 3.8-6.4 cm/100 yrs; and finally a calculated short-term deposition rate of 9-60 cm/100 yrs. In general, Anima (1991) reports that sedimentation has increased in the last 150 yrs, which he attributed to increased land use as a result of population growth. Actions that he attributed to the sedimentation rate included trail and road use, road building, increase in paved areas that increase the amount of surface runoff, and cattle grazing. However, overall, the rate of filling was similar to other West Coast lagoons.

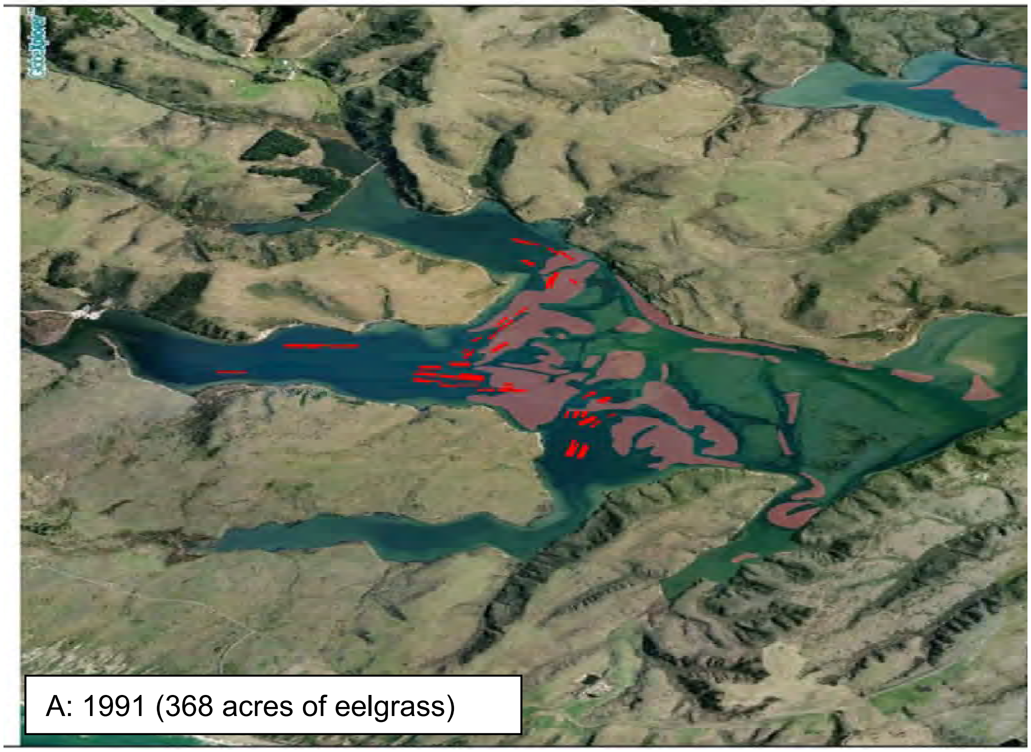
   Anima (1991) also described how the estuary can be dominated by sedimentation processes in some years and erosional processes in others. Drakes Estero is an open-coast system, which have direct influence on the distribution of sediment inside the estuary. When the entrance is to the extreme west (as in 1953 and 1974), oceanic wave and tidal approach is nearly aligned with the main arm of the tidal channel and carries sediment suspension further into the lagoon. When the mouth is in a west side configuration, incoming waves and tides attack the adjacent cliffs, and result in increased erosion.

   Finally, filter feeders play an important role in the deposition of fine grained sediment. Suspended matter removed by oysters is deposited as feces and pseudofeces (biodeposition). The rate of biodeposition has been reported to be seven times faster than the deposition of solids by gravity or settling from suspension (Haven and Morales-Alamo 1966 *as cited in* Anima 1991). The authors also observed that the biodeposition rate of other common invertebrates equals or exceeds that of oysters. Further, according to Harbin 2004 as cited in Elliot-Fisk et al. 2005), the amount of organic matter resulting from pseudofeces produced by suspended oysters is far less than the amount of organic matter resulting from eelgrass decomposition, considering how expansive and dense the beds are within the estuary, making any significant organic inputs from the oysters undetectable (Harbin 2004 *as cited in* Elliott-Fisk et al. 2005). The Elliot-Fisk et al. (2005) report went on to conclude that "We found the oyster racks to have no pronounced impacts on the eelgrass beds, which existed both under and away from the racks as an incredibly rich habitat type." Overall, DBOC oyster racks account for 0.6% (7 acres out of 1,152 acres) of the total intertidal habitat within the Estero. Therefore, the increased sedimentation rate associated with the racks is an insignificant portion of the overall sedimentation in the estuary contributed by tidal action, eelgrass habitat and other invertebrates. More importantly, the presence of oyster racks is not inhibiting eelgrass growth in Drakes Estero.

Original DEIS Citation

Chapter	Page	Quote
4	267	Oyster racks have been shown to cause changes in sediment/substrate quality due to erosion and/or sedimentation processes that are increased by the presence of the structures (NAS 2010). Erosion in particular has been noted in association with oyster racks in Drakes Estero (Harbin-Ireland 2004vi) and in Coos Bay, Oregon (Everett, Ruiz, and Carlton 1995). Erosion reduces substrate quality and availability for colonization by eelgrass, thus contributing to the reduction in eelgrass abundance and cover beneath the racks.

10. **EXPANSION OF EELGRASS HABITAT –** on page 262 of the DEIS, the authors note that eelgrass habitat in Drakes Estero has expanded from 1991 to 2007, but that this expansion cannot be attributed to the shellfish operations (they do not attempt to explain what other cause could be related to this expansion). Shellfish have been shown by multiple researchers to provide benefits to eelgrass habitat (Reusch and Williams 1998, Peterson and Heck 2001, Newell 2006, Tallis et al. 2009). Additionally, areas that see expansion of culture (as long as it is within carrying capacity of the system) have also seen an increase in seagrass habitat (Ward et al. 2003). Even if the benefits that shellfish provide are not recognized, it is obvious that, under the environmental baseline, DBOC operations are not having a negative impact on eelgrass, as eelgrass coverage has doubled in the last 16 years (Figure 3).


A: 1991 (368 acres of eelgrass)

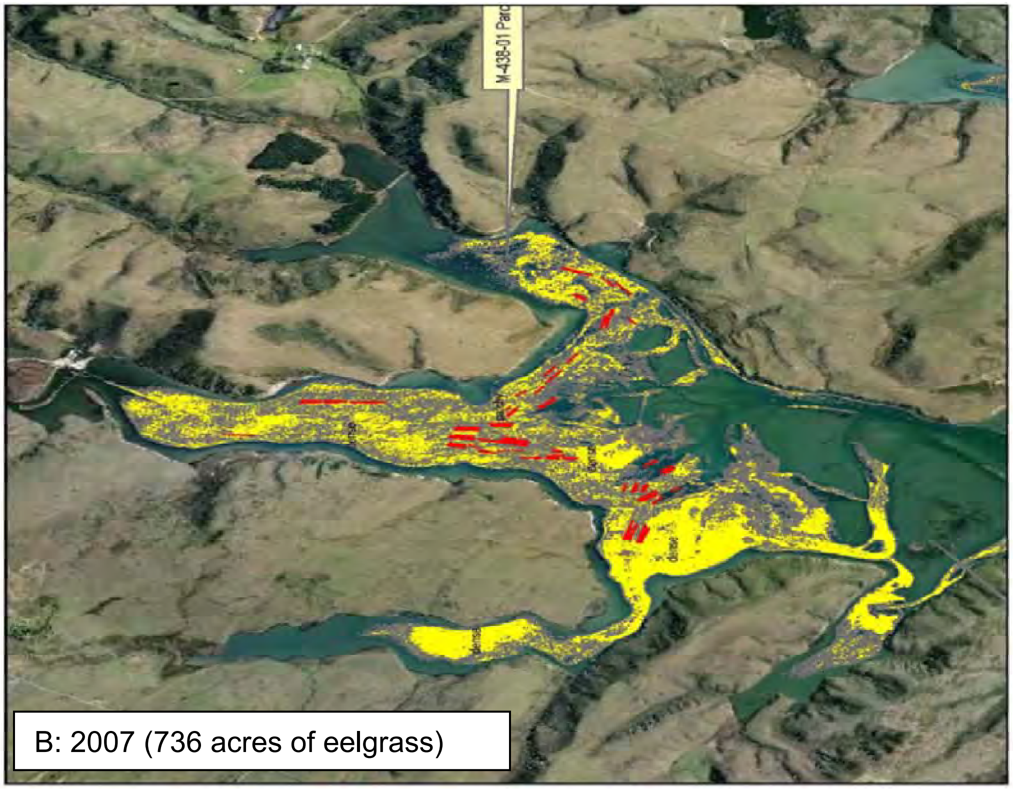


Figure 3. Eelgrass habitat in Drakes Estero from 1991 (A) to 2007 (B). Aerial photography shows a doubling of eelgrass habitat in sixteen years. Red = the location of oyster racks (7 acres).

Additional Information

In a marine habitat mapping study recently completed at Bahía San Quintín, Baja California del Sur, Mexico. Bahía San Quintín is one of the foremost seagrass areas in western North America. Estimates of total extent of eelgrass range from 2,069 ha to 2,390 ha. Satellite (SPOT, and Landsat 5 and 7) imagery was used to track long term changes in eelgrass distribution in a portion of the bay with recently expanded oyster operations (Ward et al. 2003). The authors noted that oyster rack farming was not associated with any detectable loss in eelgrass spatial extent, despite the increase in number of oyster racks from 57 to 484 over the study period. On the contrary, there was an apparent gain in eelgrass coverage in oyster culture areas, and a small loss outside these areas, with the data showing no significant impact on eelgrass distribution from oyster racks.

The results of the Mexico rack and bag study are borne out by Wechsler's work in Drakes Estero (2004). While Wechsler acknowledges that eelgrass growth is restricted directly beneath oyster racks, his ultimate conclusion is, "A qualitative look at the distribution of eelgrass beds in Schooner Bay indicated that its productivity was not affected substantially by oyster mariculture" (Wechsler 2004). Indeed, Wechsler himself notes the positive effect shellfish culture can have on eelgrass growth: Peterson and Heck (1999) similarly suggest that biodeposits from bivalves high in nitrogen and phosphorus can enhance growth of aquatic macrophytes, specifically eelgrass and kelp. This appears to be born out from records reviewed by the NAS on eelgrass coverage in the Estero, which document that coverage of eelgrass in the Estero has doubled from 1991 to 2007 (NAS 2009). While eelgrass coverage has also increased in some other West coast estuaries over this time period, the results clearly would not support that the oyster operations are adversely affecting the eelgrass resource in the Estero.

Original DEIS Citation

Chapter	Page	Quote
4	262	NAS (2009) discussed an increase in eelgrass between 1991 and 2007. The conclusion from the NAS report was that eelgrass was expanding despite the ongoing commercial shellfish operations but notes this trend was not only observed in Drakes Estero. The NAS report did not evaluate the potential reasons that could be attributed to the expansion.

BENTHIC FAUNA

1. **Bivalve Competition** – on page 274 and 278 of the DEIS, the authors claim that mariculture in Drakes Estero will result in the escape of non-native bivalves from cultivation, which would become established in Drakes Estero and outcompete native benthic species. This contention does not make sense biologically or in terms of potential carrying capacity in the estuary.

Elliott-Fisk et al. (2005) reported that the water temperature in Drakes Estero is too low for Pacific oysters to successfully reproduce (per Fred Conte, University of California, Davis), which leads to these species being incubated on shore for several weeks before they are placed on the wooden racks for grow-out. In contrast, the Manila clam has been shown to successfully naturalize in a system in which it was introduced. However, when populations of feral clams dominate a system conditions are typically eutrophic (Pranovi et al. 2006, Humphreys et al. 2007). In other words, Manila clams thrive in poor water quality conditions. This is not the case in Drakes Estero. Although there is nutrient loading from freshwater sources, it is not in a quantity that is causing eutrophication (Anima 1991).

The second claim that non-native oysters will outcompete native benthic species is also misinformed. Although it is true that aquaculture adds bivalves to a system that will directly compete for space and resources with native bivalves, there is no indication that Drakes Estero is at or near carrying capacity. In a study by Elliott-Fisk et al. (2005), the authors reported that, "the relative abundance of ostracods and bivalves approximately doubles between the racks and 50 meters away." If the system were at carrying capacity, then there would be signs of nutrient limitation and even a stimulation of algal growth rates (Prins et al. 2006). If there is consistent tidal flushing, an increase in benthic invertebrates and bivalves in association with oyster racks, and additional inputs from upland habitat, Drakes Estero is unlikely to be close to carrying capacity. Although there is no data that can be presented to fully support this claim, it cannot be stated that oysters are outcompeting native benthic species.

Original DEIS Citation

Chapter	Page	Quote
4	274	[T]he termination of DBOC activities in Drakes Estero would remove actions associated with shellfish mariculture…[which] would remove the potential for

		commercially grown nonnative bivalves to escape cultivation, become established in Drakes Estero, and outcompete native benthic species (NAS 2010).
4	278	The Pacific oyster, which is the primary species cultured by DBOC, is not native to the Northern California region (Trimble, Ruesink, and Dumbauld 2009). Similarly, the Manila clam, a recent introduction into DBOC's shellfish cultivation stock and a species that could be produced on a much wider scale under this alternative than under existing conditions, is a nonnative species. Such introductions have the potential to develop naturally breeding populations in Drakes Estero (NAS 2004, 2009). The introduction of commercially grown nonnative bivalve species carries a certain level of risk that the nonnative species would compete with native bivalves for food or habitat, leading to a decrease in local biodiversity of native bivalve species (Ruesink et al. 2005; Trimble, Ruesink, and Dumbauld 2009; Dumbauld, Ruesink, and Rumrill 2009; NAS 2010). The phenomenon of native species displacement has already been observed for the Manila clam (Pranovi et al. 2006), the native Olympia oyster (Trimble, Ruesink, and Dumbauld 2009) and other species introductions on the west coast (Ruesink et al. 2005).

2. **INTRODUCTION OF SHELLFISH DISEASES** – on page 274 of the DEIS, the authors claim that mariculture in Drakes Estero introduces bivalve diseases into the estuary. As noted in above, regulations are in place to control the possibility of disease or species introduction from the transport of oyster seed. The 1998 FONSI for the NPS EA for construction and replacement of facilities at Johnson's Oyster Company (JOC) stated, "to mitigate any impacts related to this issue ["hitch-hiking" alien species], both JOC, and the CDFG have agreed to establish a policy of zero tolerance, develop a risk assessment, and protocols for importing Mexican oysters into Drakes Estero." As detailed above, the current measures that minimize the risks of invasive species introductions are principally associated with the use of larval seed from West Coast hatcheries that are prescreened for pathogens and invasive species, and authorized for interstate export only after review by state agencies. The seed is certified free of disease and pests by a USDA/APHIS certified veterinarian. All shellfish seed imported into California must be certified disease free by a USDA/APHIS certified veterinarian and are regulated by the CDFG by an importation permit. All of the seed comes from hatcheries in Washington and Oregon. Growers no longer import wild seed from out of the country. These hatcheries submit seed inspection reports on a regular basis to the CDFG. CDFG only allows importation of seed from established hatcheries with a minimum two-year history of documented absence of disease. In view of these precautions, and shellfish growers ongoing interest in keeping their growing waters free of hazardous exotic species, current shellfish farming practices at Drakes Estero pose little risk of causing new introductions of invasive or exotic species. The continuation of claims that diseases are introduced by practices employed at the Drakes Estero are simply not supported by existing data, nor do they recognize the best management practices and regulatory regimes in place for many, many years that address and significantly minimize this risk.

Original DEIS Citation

Chapter	Page	Quote
4	274	Removal of shellfish mariculture (including 7 acres of racks and up to 88 acres of bottom bags) from Drakes Estero would also reduce the potential for introduction of bivalve diseases, which can be borne by cultured shellfish (Friedman 1996; Burreson and Ford 2004).

3. **INVASIVE TUNICATE, DIDEMNUM** – on page 274 of the DEIS, the authors discuss the invasive tunicate, *Didemnum*, which is found in Drakes Estero and has the potential to smother habitats and inhibit normal biological functions of benthic fauna. In addition, on page 275, the claim was made that maintenance activities can fragment *Didemnum* and thus increase their dispersal. The concept that *Didemnum* is "smothering" habitat is misleading. The reference associated with this information, Mercer et al. (2009), indicated that *Didemnum vexillum* was able to colonize cobble-pebble substrates and form mats on the seafloor. As a result, there were "subtle shifts" in the benthic community, and the authors state in the conclusions that "the abundance of epifaunal organisms was not significantly affected by presence of the ascidian mats." Because the mariculture structures offer the best attachment points for colonial tunicates in Drakes Estero, the removal of these structures would not eradicate this species (Shumway, pers. comm., 2011).

   The second comment that DBOC operations will fragment and spread *Didemnum* is also misleading. It is true that colonial tunicates will fragment, but it is also true that because *Didemnum* is primarily isolated to mariculture structure in Drakes Estero, DBOC is able to effectively control this species through harvest and maintenance activities. While *Didemnum* has been observed among the oyster racks in the Estero, what is not recognized is that this species has been established in many locations along the entire West coast from southern California to British Columbia. It was first recognized in San Francisco Bay in 1993 (http://woodshole.er.usgs.gov/project-ages/stellwagen /didemnum/htm/page10. html) and culture operations were not the source of its introduction. It is clearly a structure-associated species, but as such creates a nuisance for principally the grower, not the Estero environment, as other hard substrate is extremely limited in the Estero. If NPS is serious about trying to control colonial tunicates, then they should be working with DBOC to remove the species from the system rather than implicating them in causing a problem that they did not originate.

Original DEIS Citation

Chapter	Page	Quote
4	274	After years of shellfish production in Drakes Estero, the invasive tunicate *Didemnum* has become established in Drakes Estero. The removal of offshore commercial shellfish infrastructure would minimize the potential for new colonization of invasive tunicates, which the NAS report associated with DBOC's mariculture structures (NAS 2009) (see discussion under alternative B). Invasive colonial tunicates have the potential to smother habitats and inhibit normal biological functions of benthic fauna (Osman and Whitlatch 2007; Mercer, Whitlatch, and Osman 2009).
4	275	[T]he ability of invasive tunicates (such as *Didemnum*) to regenerate after being fragmented increases their dispersal capabilities (Bullard, Sedlack, et al. 2007), which can be worsened by activities associated with the maintenance of oyster bags and racks (NAS 2009). Therefore, the termination of commercial shellfish activities would reduce the risk of further dispersing the tunicate.
4	279	In California (Foss et al. 2007; Heiman 2006), as elsewhere (Dijkstra, Sherman, and Harris 2007; Dijkstra, Harris, and Westerman 2007), invasive tunicates have been shown to reduce local biodiversity by displacing natural habitats and reducing the availability of resources used by multiple species. Because shellfish mariculture is the

		most likely mode of introduction for invasive tunicates on the west coast (Herborg, O'Hara, and Therriault 2009), these invaders, which have already been identified on native substrates within Drakes Estero, are likely to remain a problematic species in estuaries where shellfish mariculture is practiced.

4. **FOULING ORGANISMS** – on page 274 of the DEIS, the authors indicate that shellfish mariculture can support a variety of fouling organisms. Aquaculture gear is well known for providing artificial reef habitat for a variety of organisms. However, the use of the term "fouling" (a.k.a., sessile organisms) is a misnomer in terms of the local biota in Drakes Estero. The reference used in the DEIS (Light et al. 2005) is related to freshwater organisms (*Cordylophora caspia* (the "sponge", really a hydroid), *Urnatella gracilis* (the goblet worm), and *Balanus improvisus* (the barnacle)) associated with ship fouling. None of these organisms have any relation to Drakes Estero. Although organisms do colonize mariculture gear in Drakes Estero, the only "fouling" and nonnative organisms reported are the colonial tunicates (*Didemnum lahilei*), bryozoans (*Schizoporella unicornis* and *Watersipora subtorquata*), and sponge (*Halichondria bowerbanki*) (Elliott-Fisk et al. 2005). Common organisms that were likely native, but because they were only identified to genus their status was left as unknown, included *Balanus* (barnacle), *Botrylloides* (chain tunicates), *Botryllus* (colonial tunicates), *Obelia* (hydroid), and *Spirorbis* (polychaete worms).

   Organisms that colonize aquaculture gear are typically sessile organisms that require hard substrates for attachment (Dealteris et al. 2004; Pinnix et al. 2005); however, the result is typically a diverse biota of organisms that provide additional food resources for fish and larger invertebrates.

   Original DEIS Citation

Chapter	Page	Quote
4	274	In addition, shellfish mariculture structures can support a variety of other fouling nonnative and native organisms (which attach to underwater structures during their adult phase, inhibiting the normal function of the structure). Examples of other fouling organisms include barnacles, sponges, and goblet worms (Light, Grosholz, and Moyle 2005).

5. **BENTHIC FAUNA ABUNDANCE** – on page 275 and 277 of the DEIS, the authors cite references that indicate that certain benthic species are lower beneath oyster racks relative to other natural habitats. In one sense they are correct. *Certain* organisms are lower in abundance (i.e., those that prefer mudflat habitat over hard structures). However, the overall benthic biota typically increases from mudflat assemblages to more reef-like assemblages with the introduction of mariculture structure. This occurrence was recognized in Elliott-Fisk et al. (2005; of which Harbin was an author), which stated, "the relative abundance of ostracods and bivalves approximately doubles between the racks and 50 meters away." Additionally, many researchers have reported that oyster beds or aquaculture gear are equal (or superior) to adjacent eelgrass habitat in terms of the diversity and abundance of benthic fauna and fish (Meyer and Townsend 2000, DeAlteris et al. 2004, Pinnix et al. 2005, Powers et al. 2007).

   Although these changes are a product of mariculture structure, it is false to state that the benthic biota is lower. Additionally, the influence of mariculture structure to the benthic biota in Drakes Estero does not extend significantly beyond the structures themselves. Aquaculture in the

Estero represents a total of 12% (142 acres out of 1,152 acres) of potential intertidal flat habitat for benthic fauna. (Note: there were many figures presented in the DEIS for intertidal flat habitat, this figure was reported on page 166 from Anima (1991)). Therefore, this effect can be considered at worst minimal, even though it provides a benefit to food resources for fish and larger invertebrates.

Additional Information

The addition of structured habitat, artificial or otherwise, to homogenous marine habitats like sand and mud has long been recognized to increase the types and numbers of colonizing fish, invertebrates, and aquatic plants in a given area (Iversen and Bannerot 1984, Buckley and Hueckel 1985, Hueckel and Buckley 1987, Gregg 1995, Sargent et al. 2006). Such reef structures also provide refuge from predation and the enhancement of the availability of food for other marine organisms of no recreational interest—thereby enhancing local biodiversity (Hueckel and Stayton 1982, Hueckel and Buckley 1987). This "halo effect" underpins, in large measure, the initiative behind marine protected areas to enhance fishery resources throughout the World Ocean today. In brief, the structures create secure substrate, which in turn facilitates the settlement of epibiota (algae, barnacles, etc.) on the surface of the structure, and the consequent development of a more stable biological community that associate with that biota and the food and refuge it provides.

In terms of species abundance and diversity, DeAlteris et al. (2004) found that shellfish aquaculture gear supported more organisms, had higher species richness and higher species diversity than the non-vegetated seabed, and was similar (or superior) to eelgrass or submerged aquatic vegetation habitat. Likewise, Meyer and Townsend (2000) showed that man-made oyster reefs had a higher number of fish, mollusks, and crustaceans than adjacent natural reefs. O'Beirn et al. (2004) reported a wide variety and large numbers of marine organisms associated with the mesh bags of cultured oysters in Virginia. These included worms, mollusks, crustaceans, and fish. Powers et al. (2007) documented that the macroalgal growth on protective netting placed over hard clam (*Mercenaria mercenaria*) aquaculture sites supported elevated densities of mobile invertebrates and juvenile fishes similar to natural seagrass (*Z. marina* and *Halodule wrightii*) habitats. And finally, a three year study by USFWS (Pinnix et al. 2005) documented fish utilization between eelgrass, oyster culture, and mudflat habitats of North Humboldt Bay. Although results varied depending on the type of gear used, both shrimp and fyke net sampling resulted in fish abundance that was significantly higher in oyster culture habitat compared to the other two habitat types. When species diversity was normalized for abundance, it was noted that oyster culture and eelgrass beds supported a similar diversity. Overall, it is evident that fish are attracted to structure, and aquaculture operations can provide a surrogate for structure found in eelgrass beds.

Original DEIS Citation

Chapter	Page	Quote
4	275	Studies in Drakes Estero (Harbin-Ireland 2004vii; NAS 2009) and other systems (Castel et al. 1989; Nugues et al. 1996; Christensen et al. 2003; Lu and Grant 2008) have noted that the abundance of certain benthic species is lower beneath oyster racks relative to other natural habitats, such as nearby eelgrass beds (see discussion

		under alternative B).
4	277	Based on research conducted within Drakes Estero, the relative abundance of certain benthic invertebrates (i.e., the relative numbers of individuals within each species) was found to be lower directly underneath oyster racks than in nearby eelgrass habitat (Harbin-Ireland 2004viii; NAS 2009). Harbin-Ireland (2004ix) suggests that this decreased abundance is due to the fact that benthic habitat underneath oyster racks is more exposed to predators (such as fish) that prey on invertebrates living in the substrate. They further attributed the increased exposure to a lack of sufficient eelgrass cover, a phenomenon also observed by Everett, Ruiz, and Carlton (1995) underneath oyster racks in Coos Bay, Oregon.
4	277	However, some studies in west coast estuaries have shown that benthic invertebrate diversity can be higher near oyster beds than in adjacent unstructured habitat (NAS 2009). In one such study in Willapa Bay, Washington, benthic invertebrate densities were higher in on-bottom oyster beds than in adjacent mudflats, although both oyster and mudflat habitats showed lower diversity and density than eelgrass habitat (Hosack et al. 2006).

6. **NON-CATCH MORTALITY** – on page 275 of the DEIS, the authors quote a term from Kaiser (2001) called "non-catch mortality". Non-catch mortality is a term used in fisheries biology for mortality caused by fish that are not collected, but affected by the fishing process. This makes sense since the Kaiser (2001) reference is in relation to fish aquaculture. It has no meaning in shellfish aquaculture. The fact that benthic organisms that have colonized the bags, which in other locations of the DEIS are called "fouling organisms," are a product of aquaculture structure. Because these organisms would not be present in the densities observed without the presence of the oyster bags, taking them out of the system during harvest does not impact the population. In addition, some of these organisms are returned to the environment before bags are processed, thereby reducing this potential effect even further.

Original DEIS Citation

Chapter	Page	Quote
4	275	[W]hen the bags are harvested, any native benthic organisms that have colonized the bags are also harvested, brought onshore along with the cultured bivalves, and killed during processing—a case of accidental mortality referred to as "non-catch mortality" (Kaiser 2001) (see discussion under alternative B).

7. **DISPLACEMENT OF BENTHIC FAUNA IN SCHOONER BAY** – on page 275 of the DEIS, the authors indicate that there is direct destruction of native benthic fauna by boat propellers and dredging. Although motor boats would not be present in Drakes Estero if DBOC is not operating, there is no indication that disturbance of sediment would cease at the boat dock in Schooner Bay. On page 353 of the DEIS, the authors indicate recreation by kayakers (who would use the boat dock) would continue, and even increase, following removal of DBOC facilities. We presume that this would mean that the park would have the responsibility to dredge the habitat associated with the boat dock in order to maintain this service. In addition, on page 276 of the DEIS, the authors indicate that recreational clamming would continue in the Estero, which would also result in disturbance of the benthic fauna. According to Logan (2005), recreational clamming was shown to have a significant impact on the abundance of the amphipod

Corophium volutator. Because no option would change these recreational activities, this statement should be taken out of the EIS.

Original DEIS Citation

Chapter	Page	Quote
4	275	[T]he potential for substrate disturbance related to DBOC boat traffic in the main channel of Schooner Bay would no longer be present. Therefore, to the extent that such activities cause direct destruction of native benthic fauna by boat propellers or indirect displacement by disruption of benthic sediments. Further, the potential for disruption of benthic fauna and benthic habitat from dredging would no longer exist.
4	353	Use of Drakes Estero by kayakers would continue to take place and may even increase following the removal of DBOC facilities.
4	276	Alternative A, in combination with the MLPA would result in only recreational clamming allowed within the Estero.

8. **MUD SNAIL, *BATILLARIA ATTRAMENTARIA*** – on page 279 of the DEIS, the authors state that the nonnative mud snail, *Batillaria attramentaria*, was introduced by JOC and that it is detrimental to the native snail. The introduction of *Batillaria attramentaria* was from the import of Pacific oysters from Japan in 1932 (Byers 1999). Byers (1999) goes on to report that Drakes Estero contained predominantly *Cerithidea* with a few populations of *Batillaria* in Schooner's Bay. In fact, the author indicates that "The population of Batillaria in Drakes, however, remains very restricted – likely a major reason for its apparent absence from previous surveys." As noted above, the industry is now taking very careful steps before the introduction of seed from outside Drakes Estero, and the importation of oysters from Japan no longer occurs. Given the limited distribution of this species, it does not pose a problem to the biota of Drakes Estero.

Original DEIS Citation

Chapter	Page	Quote
4	279	In addition, Byers (1999) studied the invasion of a nonnative mud snail (*Batillaria attramentaria*), making specific reference to its introduction by JOC, the previous oyster operator in Drakes Estero. This organism was found to be detrimental to native snail populations (NAS 2009).

9. **INVASIVE SPECIES MANAGEMENT** – on page 280 of the DEIS, the authors claim that the presence of the DBOC in Drakes Estero hinders the NPS efforts to manage invasive species and influence the amount of time that a natural benthic faunal community can be re-established. This statement is both misleading and falsely emphasized. The NPS does not provide any indication in the DEIS of what they actually do for invasive species management. DBOC does nothing to prevent them from exercising their right to provide such management. In fact, it would be beneficial for both parties if NPS were willing to work with DBOC to further control invasive tunicates. DBOC is currently managing invasives associated with their farm and structures, as discussed above, which is more efficient than any program that NPS could provide for the Estero, including:

    1. They are able to remove organisms that colonize structure from the Estero during harvesting and processing of shellfish.

2. DBOC has long abandoned past practices of importing shellstock from overseas, the primary vector for past invasive species introductions from shellfish aquaculture.

3. Boats and gear used in DBOC operations are not moved outside of the Estero, thus preventing spread through hull fouling or gear introduction. Incidentally, there is more potential to introduce organisms through recreational boaters or clam harvest due to unwashed gear that was used in other waterbodies.

   In terms of natural benthic faunal community re-establishment in areas of DBOC aquaculture, the farm affects 12% (142 acres out of 1,152 acres) of potential intertidal flat habitat, much of which native species are thriving due to the benefits provided by aquaculture structure and filter-feeding organisms. Additionally, as discussed in above, there is a recorded increase in native benthic fauna associated with mariculture structure (Meyer and Townsend 2000, DeAlteris et al. 2004, Pinnix et al. 2005, Powers et al. 2007). The presence of DBOC in Drakes Estero is at most a minimal impact on benthic fauna, and more likely provides a benefit to foraging resources for fish and larger invertebrates. As previously stated, if NPS is serious about trying to control invasive species, then they should be working with DBOC to remove the species from the system rather than implicating them in causing a problem that they did not originate.

Original DEIS Citation

Chapter	Page	Quote
4	280	Prolonging the presence of these nonnative shellfish under alternative B could hinder NPS efforts at invasive species management in Drakes Estero and could lengthen the period of time before a natural benthic faunal community could be re-established, as compared to alternative A. This risk would result in adverse impacts extending beyond 2022 despite cessation of the shellfish operation.

WATER QUALITY

1. **TIDAL CYCLING AND EELGRASS** – on page 278 of the DEIS, the authors claim that nutrient cycling in West Coast estuaries has more to do with the tides and upwelling, and that the eelgrass population in Drakes Estero controls the cycling of organic materials to the sediments. Although we do not disagree that Drakes Estero has a short residence time for water in most of the estuary, and that eelgrass is a major contributor to the cycling of organic materials, it should be recognized that the shellfish present in the Estero provide a benefit to the environment, even if in more localized areas.

   The combined filtering activity of the millions of filter-feeding shellfish being grown in the Estero clears as much as 350,000 m^3 each day, removing particles as small as 2 microns (R. Rhealt, pers. comm., 2010). This represents 4% of the volume of water in Drakes Estero (total volume of 7,680,000 m^3 by NOAA 2011), which is small, but not an insignificant amount.

   Finally, Dumbauld et al. (2009) is consistently misused throughout the DEIS. Dumbauld et al. (2009) never claim that West Coast estuaries are *controlled* by the tides and upwelling. They state that, "water column and sediment nutrient concentrations are generally relatively high and greatly influenced by the proximity to deeper nearshore ocean waters where upwelling controls production *during summer months*" [emphasis added], in other words, when freshwater inputs are at their lowest. To make the jump that shellfish filtration has no beneficial influence on water quality (or only localized benefit) is a false statement.

Original DEIS Citation

Chapter	Page	Quote
4	278	[A]lthough introduced bivalves have been shown to have beneficial ecosystem impacts in certain settings through nutrient processing and organic enrichment of sediments (Newell 2004), the nutrient cycle in west coast estuaries (such as Drakes Estero) is controlled by the tides and the important ocean-derived nutrients from upwelling currents—a condition on which filter-feeding bivalves would have limited influence (Dumbauld, Ruesink, and Rumrill 2009). Also, since the dominant eelgrass population in Drakes Estero controls the cycling of organic material to the sediments (NAS 2009), any organic contributions from introduced bivalves would be negligible by comparison.

2. **BIVALVE CONTRIBUTION TO WATER CLARITY** – on page 337 of the DEIS, the authors claim that the bivalves in Drakes Estero do not contribute significantly to water clarity because the estuary is not a highly turbid system and has low residence time in most of the Estero. There are three basic points that contend this statement: (1) the shellfish in Drakes Estero are in the best possible position to control the pathogen levels and nutrient loading from cattle ranching and other terrestrial input sources (e.g., the 2.4 million visitors to the national park every year), (2) if the benefits from shellfish are considered local and minor, then by the same token the impacts should be considered local and minor, and (3) tidal flushing is not the same for the entire estuary, and protected pockets at the upper arms of the Estero stand to benefit the most from the presence of DBOC shellfish.

Original DEIS Citation

Chapter	Page	Quote
4	337	However, it should be noted that most of the studies showing the beneficial effects of bivalve cultivation (such as water clarity and sediment nutrient enrichment) were conducted in estuaries with relatively turbid waters full of particulates, with low to moderate tidal flushing. By contrast, Drakes Estero is not a highly turbid coastal embayment (NAS 2009), so bivalve contributions to water clarity would likely be relatively minor.
4	339	In the context of Drakes Estero, nutrient inputs are primarily a function of Drakes Estero's physiographic structure allowing tidal flushing from upwelling with short residence periods (NAS 2009; Dumbauld, Ruesink, and Rumrill 2009). Water quality monitoring conducted by the CDPH indicates that the inputs from upstream sources such as the cattle ranches affect the pathogen levels in the upper arms of the Estero resulting in the establishment of the "Water Quality Prohibited Areas" where shellfish harvest is prohibited (Zubkousky 2010).

3. **WATER QUALITY MONITORING** – on page 339 of the DEIS, the authors claim that removal of shellfish mariculture will not modify the water quality appreciably. However, even though it is admitted on page 342 of the DEIS, in this section the authors are failing to recognize that shellfish are currently providing mitigation for nutrient loading in the system from cattle ranching upstream. As indicated above, pathogen and nutrient loading has been documented by CDPH in association with cattle ranching in the upper portion of the basin. Further, the location of

shellfish in the Estero is positioned to control these influences to water quality through filtration, biosequestration, and denitrification. If the shellfish are removed, then how does NPS intend to counteract this issue?

Tidal flushing of the upper arms of Drakes Estero is not as significant as the main part of the estuary. Although there are native species of bivalves in the system, they are not as efficient at treating nutrient loading as the species and densities provided by DBOC. Further, eelgrass habitat has doubled in the last 16 years in Drakes Estero, which has been attributed to the presence of DBOC shellfish (Bartley et al. 2009, NAS 2009)--a finding that the DEIS does not recognize, and does not provide any other reason for its occurrence. In summary, the evidence supports that DBOC operations improve and mitigate water quality impacts to the Drakes Estero, not impact it as contended in the DEIS.

Original DEIS Citation

Chapter	Page	Quote
4	339	Water quality monitoring data collected from Drakes Estero reveal that the water quality standards are far below the thresholds required for contact recreational use (including swimming and boating). The removal of the shellfish mariculture facilities and operations would not be expected to modify the water quality appreciably, or to a level that would prohibit the continued use of Drakes Estero for recreation.
4	342	As filter feeders, shellfish provide beneficial water quality functions with their ability to remove suspended solids, nutrients, and phytoplankton from the water column. Pollutants that enter Drakes Estero from cattle operations and other non-point sources have the potential to be captured and processed by the cultivated shellfish. Under this alternative, cultivated shellfish would remain in Drakes Estero providing localized benefits to water quality by removing those pollutants entering the water.

4. **MARICULTURE DEBRIS** – on page 339 of the DEIS, the authors indicate that mariculture debris has been found on mudflats and shorelines of Drakes Estero. Mariculture debris mentioned in the DEIS is an issue that DBOC inherited from the previous owners (Johnson Oyster Company (JOC)), for which they have made dramatic strides to clean-up. JOC began using plastics in the early 1960s in its rack and stake culture. Both culture methods used the black plastic spacers, and the stake culture also used plastic coffee can lids. The spacers and coffee can lids were lost during storm events. Due to the extensive loss of plastic into the environment, CDFG required JOC to stop stake culture in Drakes Estero. By the mid-1990s all stake culture had ceased and had been replaced by bag culture.

In 2005, DBOC took over the shellfish farm in Drakes Estero. Fully aware of the legacy plastic debris problems, DBOC made several changes in farm practices to further reduce the chances of losing culture gear into the environment, including:

6. Immediately implementing a policy that no wires would be cut when harvesting strings from the racks until above the high tide line (above the stringing shed). DBOC removes the oysters from the wires without cutting the wire. Using this technique, the black plastic spacers are not subject to loss into the environment.

7. Beginning in 2006, DBOC began to replace the Japanese Hanging Cultch wire string culture method with "French tubes". These French tubes reduce consumables (i.e., the wire strings which can only be used for one growing season), and do not require

the black spacers. It should be noted that DBOC, EAC, or NPCA have never found a fugitive French tube anywhere in Drakes Estero. Over the past five years, approximately 100,000 strings have been replaced with the French tube method, and this technique now represents the majority of the rack culture. DBOC will, however, continue to cultivate a portion of its oysters with the traditional wire string and spacer method. The description of this historic culture method during DBOC's interpretive on-farm tours is of great interest to the visiting public.

8. DBOC checks the oyster racks regularly to remove any loose materials so they are not lost into the environment.

9. DBOC anchors all oyster bags in areas where tidal energy could displace bags.

10. DBOC initiated a program whereby all floating culture is anchored in a least two places and all floating bags are attached to at least two anchored lines (our "redundancy program").

Additionally, DBOC made a commitment to pay staff to clean-up the beaches to address JOC's legacy debris problem. DBOC's staff patrols the beaches of Drakes Estero on a regular basis to pick up any marine debris. It is notable that most of the trash retrieved is unrelated to mariculture (i.e., it is a product of recreational activity in the park). DBOC also pays for refuse disposal fees. The majority of the plastic mariculture debris that is currently being picked up and disposed of by DBOC is the plastic coffee can lids that have not been used in Drakes Estero for almost 20 years. It is evident that these efforts are paying off because DBOC is finding less and less of this legacy mariculture debris each year.

Original DEIS Citation

Chapter	Page	Quote
4	339	[E]quipment from the racks and bags have often become dislodged and found floating in Drakes Estero or washed up on mudflats and shorelines. The primary debris associated with commercial shellfish production that has been observed in and along the shores of Drakes Estero includes the plastic spacers used in hanging culture (to separate clumps of oysters) and Styrofoam floats (used for floating bags).

5. **WASTEWATER**– on page 340 of the DEIS, the authors try to indicate that potential risk from wastewater entering Drakes Estero is only associated with DBOC operations. However, as indicated on page 344 of the DEIS, the authors state that, "the risk of discharges from a lack of capacity appears unlikely." Further, by their own admission (page 340), NPS will not remove any of these structures if DBOC operations do not exist in the area. Given the fact that: (1) there have been no releases of wastewater into the Estero, (2) no violations of water quality criteria as a result of the on-site septic system in the last 77 years of shellfish operations, and (3) none of the alternatives discussed will eliminate this risk, this impact is negligible and cannot be attributed solely to DBOC operations.

Original DEIS Citation

Chapter	Page	Quote
4	340	DBOC operations include several wastewater tanks and pumps at the onshore facilities. Wastewater is pumped into two underground drain fields located upslope from the operations facility. While the wastewater system would remain, the level of

		use would be substantially reduced or eliminated, and the risk of wastewater entering Drakes Estero from a treatment facility failure or pumping leaks would cease.
4	340	The vault toilet near surface waters and wetlands would also remain. These facilities pose a slight risk of fecal coliform being introduced to Drakes Estero from pumping spills or undetected leaks. Such contaminants could temporarily affect water quality for aquatic species until flushed by tidal action or absorbed by biological processes. No spills have occurred in the past, and it is unlikely that the vault toilet would cause adverse impacts on water quality.
4	344	The capacity of the wastewater tanks, pumps, and drain fields appears to be sufficient to handle the effluent originating from the operations center. Thus, the risk of discharges from a lack of capacity appears unlikely. Impacts on water quality could occur from wastewater entering Drakes Estero if the treatment facility were to fail.

6. **IMPERVIOUS SURFACES** – on page 340 of the DEIS, the authors try to indicate that there is potential risk of run-off from impervious surfaces associated with DBOC operations. However, by their own admission, NPS will not remove any of these structures, or abandon any of the road network that contributes to impervious surfaces in the basin, if DBOC operations do not exist in the area, which means that this impact, considered minimal anyway, is the same for all alternatives. Further, the mitigating role of the cultured oyster biomass to any runoff from impervious surfaces will be effectively eliminated with the removal of DBOC operations.

Original DEIS Citation

Chapter	Page	Quote
4	340	NPS facilities would remain under this alternative. Non-point sources of pollutants reaching Drakes Estero would continue from the access road and canoe/kayak parking lot, although there would be less stormwater runoff compared to the runoff resulting from the action alternatives. These sources would be very small due to the limited use the parking lot receives, and would have a minor adverse effect on the Drakes Estero ecosystem as a whole.
4	344	Vehicular traffic to and from the operations facility associated with the commercial shellfish operations is predicated on employee travel, distribution/delivery trucks, and visitors to the DBOC interpretations center. Vehicular use would continue under current conditions, resulting in oils and other pollutants entering Drakes Estero through nonpoint-source stormwater runoff originating from vehicles.

7. **CCA LEACHING** – on page 343 of the DEIS, the authors attempt to indicate that maintenance and repairs to racks and the dock would introduce chromate copper arsenate (CCA)-treated wood to Drakes Estero. This comment is completely false and lacking any understanding of current procedures related to DBOC operations. By their own admission (page 343 of the DEIS), NPS understands that wood treated in the past is no longer leaching CCA into the environment. Any new wood used to repair existing racks in need of maintenance would be subject to approval by NOAA Fisheries (WWPI 2011). DBOC is currently trying to find new construction materials that would be more benign in terms of environmental effects for use in their oyster racks. They have looked into biodegradable materials, plastics that wouldn't leach into the water, and are open to new ideas that improve their stewardship of the environment (Lunny, pers. comm., 2011).

It should also be noted that on page xxxvi of the DEIS, the NPS states that "Ongoing maintenance of racks, assuming 5 percent replacement or repair annually, may include repairs or replacement." However, according to the operator, racks require major repairs approximately every 10 years. If all racks were currently in good repair, roughly 10% of the racks would require maintenance each year. Currently, roughly 50% of the racks are in need of immediate repairs. Given that the life of the investment is roughly 10 years, and the proposed SUP is 10 years, the proper business decision would be to make the repairs to all of the racks as soon as possible. It is critical that NPS not limit the percentage of the racks repaired in any given year.

Original DEIS Citation

Chapter	Page	Quote
4	343	The most commonly used chemical treatment for marine use is chromate copper arsenate (CCA). Most of the CCA remains affixed to the wood fibers; however, some may leach into the aquatic environment once exposed to rain or submersed in water (Brooks 1996; Weis and Weis 1996). As described by Sanger and Holland (2002), the vast majority of any leachates from the wood preservatives entering the water and sediment occur within the first 90 days of installation. The DBOC structures are far older than 90 days, and the active leaching of wood preservatives into Drakes Estero has ended, for the most part. Over the 10-year permit period under this alternative, however, maintenance and repairs to racks and the dock are expected. This action would introduce new treated lumber into the aquatic environment resulting in CCA leaching into the water column.

8. **PESTICIDES AND HERBICIDES** – on page 343 of the DEIS, the authors claim that offshore activities would potentially release DDE (no other compound was found above the detection limit) into Drakes Estero. This contention is both misleading and the reference is used inappropriately. Although DDE can be found in Drakes Estero in small quantities, it was noted by Anima (1991) that the levels of traceable DDE in the sediment are "below the limits set by the National Academy of Sciences and the U.S. Environmental Protection Agency for organisms." The limits set include 1,000 µg/kg ΣDDT (the sum of ODD, DDE, and DOT) wet weight for the protection of fish-eating wildlife (NAS 1973) and 150 µg/kg ΣDDT wet weight in fish (EPA 1980). The maximum of amount of DDE sampled from Drakes Estero represents approximately 1% of the USEPA limit established for this compound. Even if DDE is disturbed, which is unlikely given that it was sampled from "deeper tidal channels in which the research vessel could transit" (Anima 1991), it does not represent a risk to aquatic organisms in the Estero.

Original DEIS Citation

Chapter	Page	Quote
4	343	Sediment disturbances to the Drakes Estero bottom from all offshore activities have the potential to release pesticides and herbicides that may have accumulated in the sediment over time into the water column. An analysis of sediment cores sampled by Anima (1990) in Drakes Estero found the level of herbicides and pesticides to be "low or below the analytical cutoff points for the compounds tested, except for DDE (Dichlorodiphenyldichloroethylene), which in Schooner Bay, Estero de Limantour, Abbotts Lagoon, Barries Bay, and Creamery Bay did show concentrations between 0.1 to 2.1 µg/kg." The detection limit for DDE was 0.1 µg/kg.

9. RUNOFF WATER – on page 344 of the DEIS, the authors indicate that water from spray-wash at the conveyor station and outdoor setting tanks is returned to the Estero, which results in a minor adverse effect. Within the same section, the authors concede that the replacement of the existing conveyor washing station with a new system, as proposed by DBOC, would filter the water before it re-enters Drakes Estero. This system would decrease the sediment load and local turbidity entering the Estero. Further, the discharge from the spray-wash was tested by California Department of Health Services and found to be non-hazardous (Baltan 2006, DEIS p. 200).

In addition to direct testing of water discharge from DBOC operations, California Department of Health Services looked at potential sources of contamination in Drakes Estero. As reported on DEIS p. 198, "Baltan (2006) and Zubkousky (2010) list five source types of bacterial pollution potentially affecting the water quality of Drakes Estero. These sources include cattle operations, septic systems, industrial waste, wildlife, and watercraft. The primary source of pollution is from cattle waste originating from the six cattle ranches within the watershed." It is notable that the shellfish industry was not listed as a contributing factor to water quality concerns in Drake Estero. In summary, these impacts, which were reported to be minor based on existing conditions, would be further reduced with proposed improvements by DBOC.

Finally, it should be noted that on DEIS p. xxxi, the NPS states that, "Alternative D considers expansion of operations and development replacement of new existing infrastructure as requested by DBOC as part of the EIS process." In fact, the replacement is not an expansion of operations; it is the replacement of the conveyor station agreed upon in the 1998 NEPA EA and FONSI (NPS 1998, PRNS 1998). This should be considered as part of Alternative B, which assumes that operations will not change from current conditions.

Original DEIS Citation

Chapter	Page	Quote
4	344	Water used to spray-wash harvested shellfish at the conveyor station is allowed to flow across the ground surface and reenters Drakes Estero. Drakes Estero water used for the indoor single-oyster cultch tanks is heated to a temperature of 23 to 25 degrees Celsius (73 to 77 degrees Fahrenheit) and enriched with nutrients (DBOC has not provided specifics as to which nutrients are added) to promote the growth of shellfish larvae. Water for the outdoor setting tanks is also heated and allowed to cool before re-entering Drakes Estero. Oysters in the setting tanks are fed by routing/circulating Drakes Estero water through the tanks on a continuous basis for several days. Because the original source of the water is Drakes Estero and the wastewater returning to Drakes Estero is relatively unchanged (with the exception of the small volume of nutrient-enriched water), these activities would be expected to have minor adverse effects on the water quality of Drakes Estero.
4	344	DBOC is proposing to remove the existing conveyor washing station and replace this facility with a new conveyor system that would capture the wastewater from the washing station and filter the water before the water is allowed to reenter Drakes Estero. This system would be expected to decrease the sediment loads entering Drakes Estero and local turbidity compared to the existing spraying system. This point source discharge is not expected to significantly impact water quality (Baltan 2006).

Appendix B

Noise Sources and Graphic Summaries

Noise Attachment

DBOC Source Noise Measurement Documentation and Summary Charts

This document provides supplementary information regarding the DBOC source sound level measurements conducted by ENVIRON International Corporation on November 22, 2011.

ENVIRON took these measurements using a B&K 2250 Type 1 sound level meter. The meter and the calibrator used during equipment setup were both factory certified as accurate within the previous 12 months.

The photographs on pages 2-5 depict the equipment that was considered in the measurements.

The charts on pages 6-11 summarize the measurement data.

Photo 1. Pneumatic Drill Use Stations

Photo 2. Pneumatic Drill Used to Break Apart Oyster Shell Clusters

Photo 3. Oyster Tumbler

Photo 4. Oyster Tumbler Motor (and primary noise source)

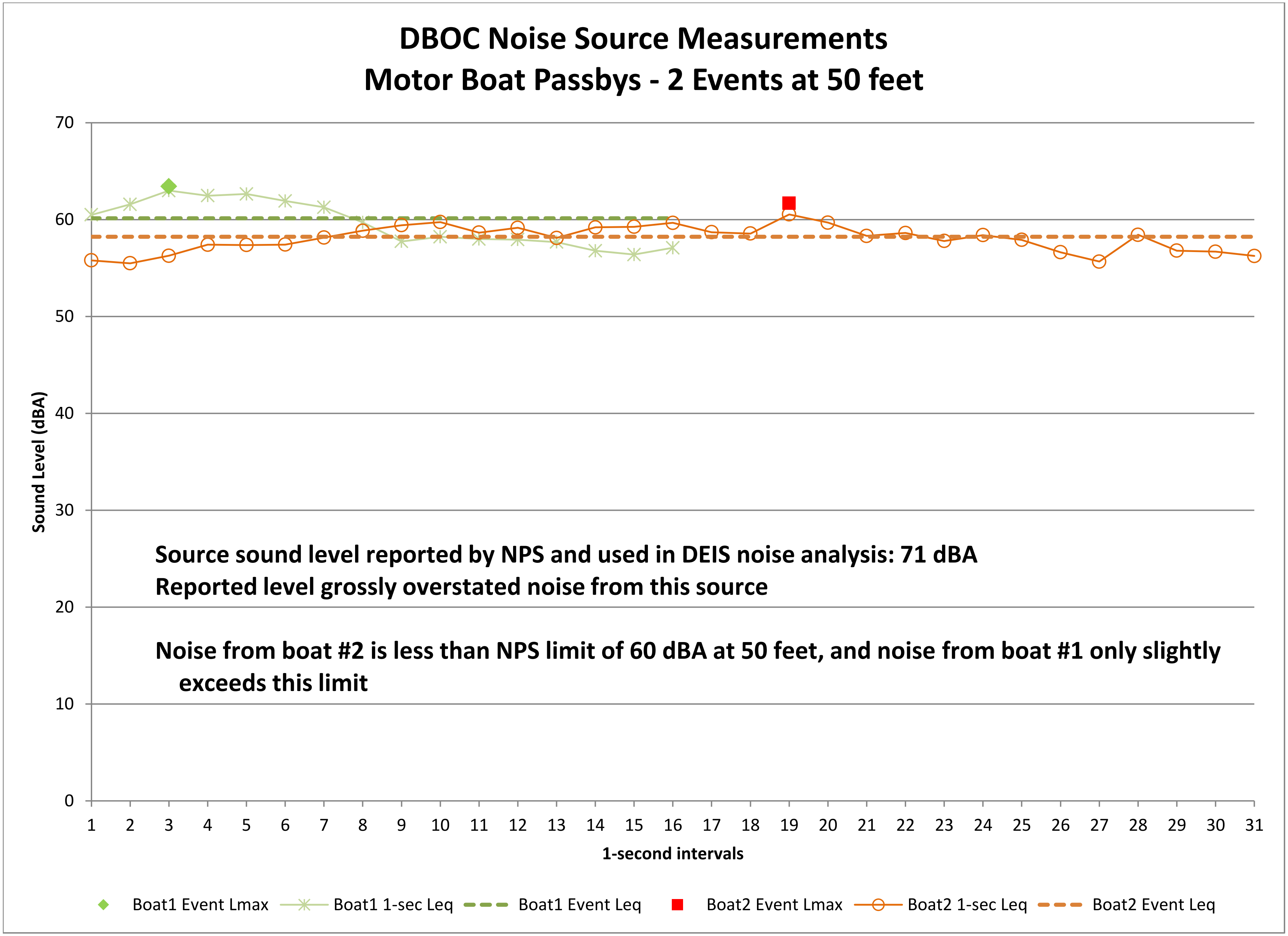
Photo 5. Boat Passby

Photo 6. Building (with openings) Housing Air Compressor

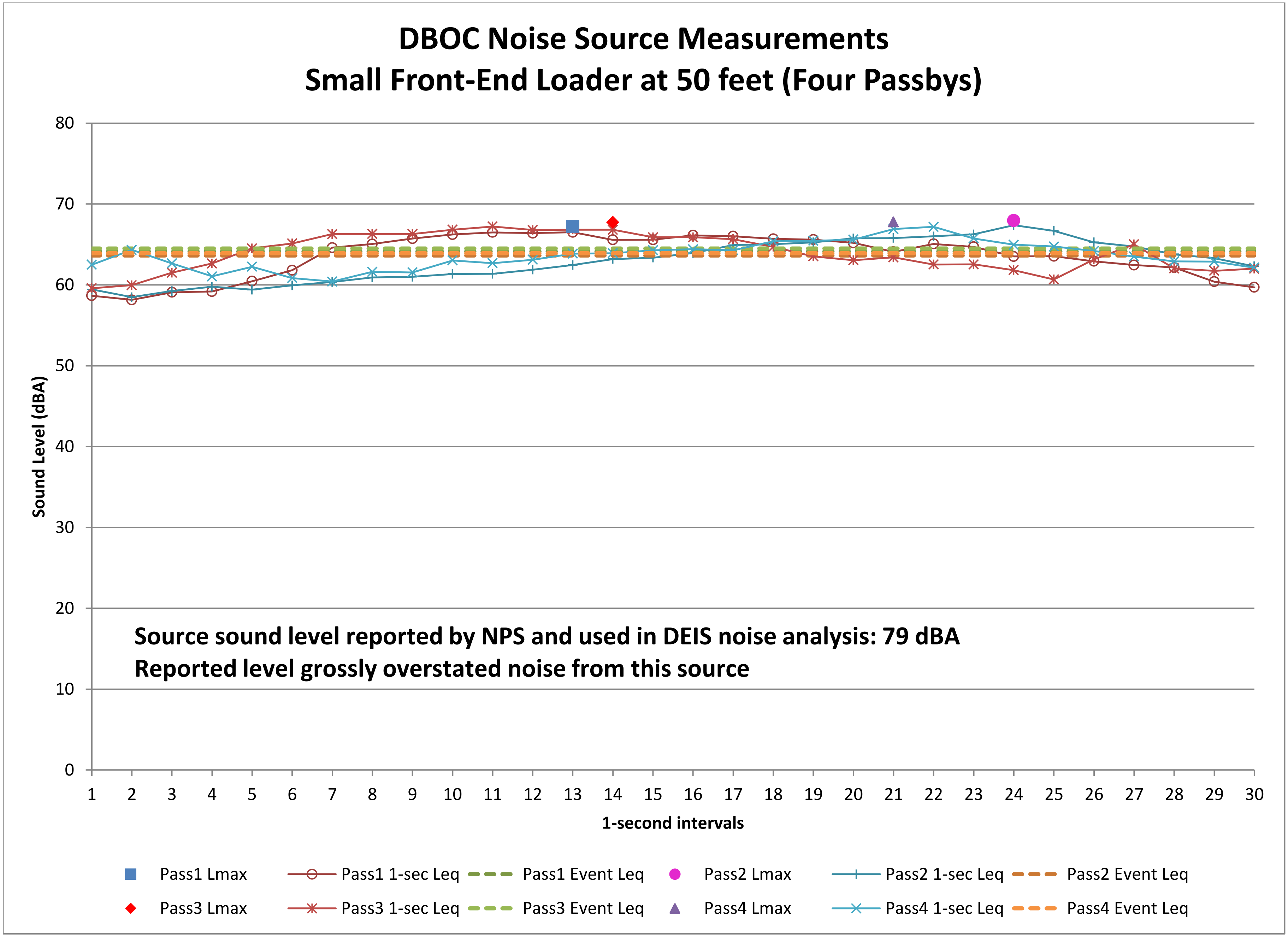
Photo 7. Frontend Loader Path

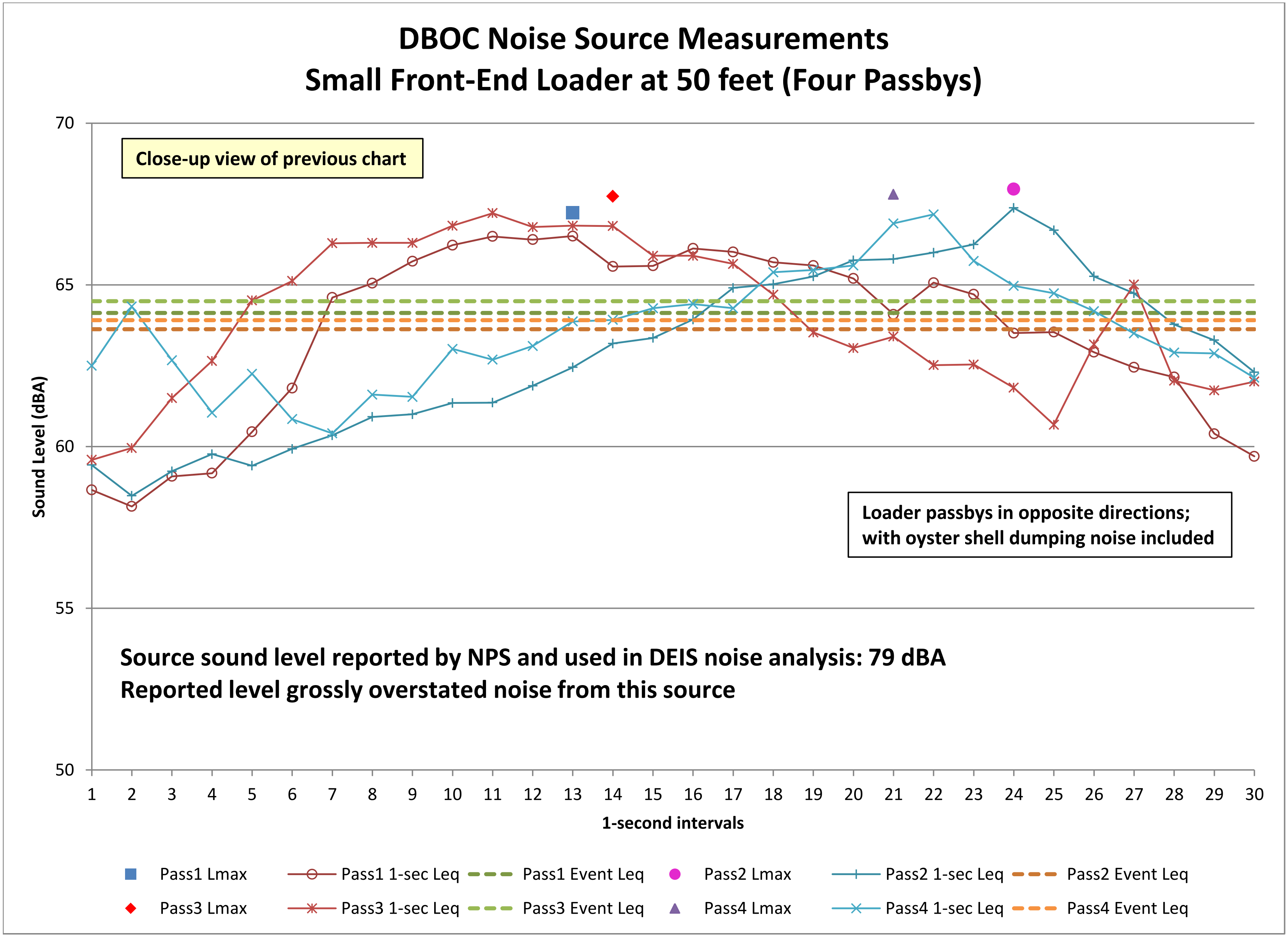
Photo 8. Frontend Loader Hauling Shells to Piles

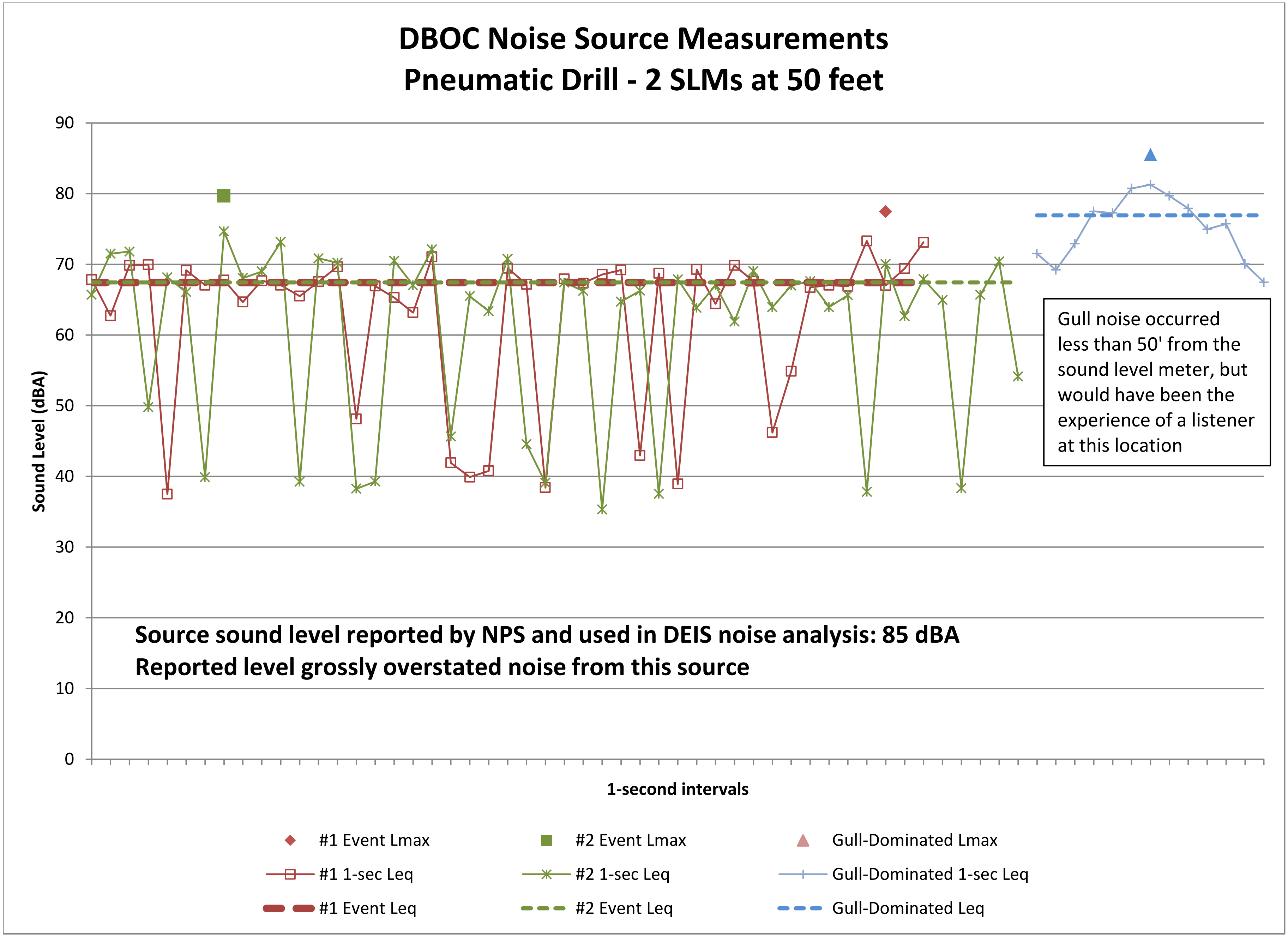
Sound level measurements taken by ENVIRON on 11/22/2011 using B&K 2250 Type I meter

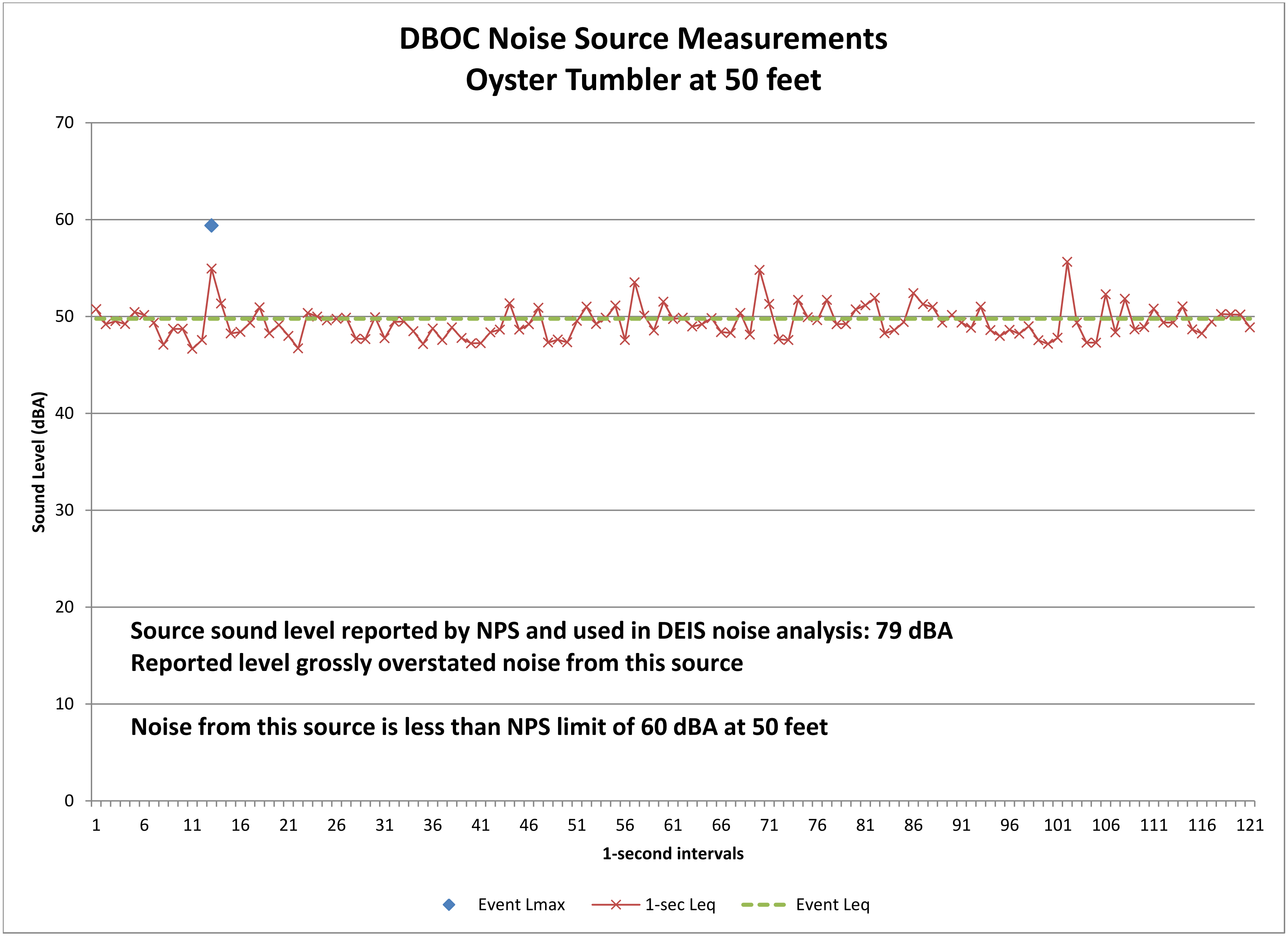


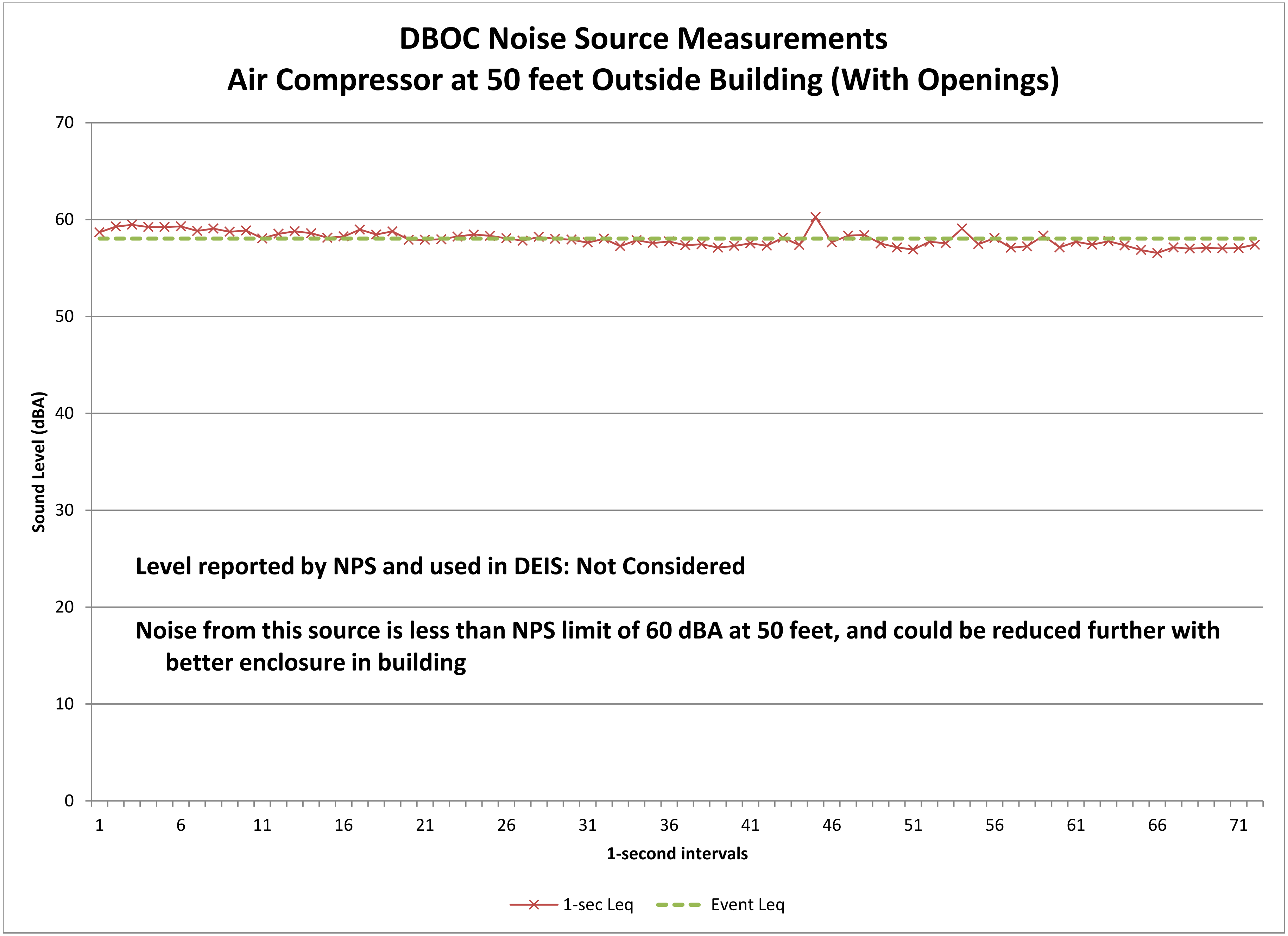
Sound level measurements taken by ENVIRON on 11/22/2011 using B&K 2250 Type I meter




DBOC Noise Source Measurements
Small Front-End Loader at 50 feet (Four Passbys)
Close-up view of previous chart
Loader passbys in opposite directions;
with oyster shell dumping noise included
Source sound level reported by NPS and used in DEIS noise analysis: 79 dBA
Reported level grossly overstated noise from this source
Sound Level (dBA)
70
65
60
55
50
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30
1-second intervals
Pass1 Lmax
Pass1 1-sec Leq
Pass1 Event Leq
Pass2 Lmax
Pass2 1-sec Leq
Pass2 Event Leq
Pass3 Lmax
Pass3 1-sec Leq
Pass3 Event Leq
Pass4 Lmax
Pass4 1-sec Leq
Pass4 Event Leq


DBOC Noise Source Measurements
Pneumatic Drill - 2 SLMs at 50 feet
Sound Level (dBA)
90
80
70
60
50
40
30
20
10
0
Gull noise occurred less than 50' from the sound level meter, but would have been the experience of a listener at this location
Source sound level reported by NPS and used in DEIS noise analysis: 85 dBA
Reported level grossly overstated noise from this source
1-second intervals
#1 Event Lmax
#2 Event Lmax
Gull-Dominated Lmax
#1 1-sec Leq
#2 1-sec Leq
Gull-Dominated 1-sec Leq
#1 Event Leq
#2 Event Leq
Gull-Dominated Leq


DBOC Noise Source Measurements
Oyster Tumbler at 50 feet
Sound Level (dBA)
70
60
50
40
30
20
10
0
1 6 11 16 21 26 31 36 41 46 51 56 61 66 71 76 81 86 91 96 101 106 111 116 121
1-second intervals
Source sound level reported by NPS and used in DEIS noise analysis: 79 dBA
Reported level grossly overstated noise from this source
Noise from this source is less than NPS limit of 60 dBA at 50 feet
Event Lmax
1-sec Leq
Event Leq


DBOC Noise Source Measurements
Air Compressor at 50 feet Outside Building (With Openings)
70
60
50
40
30
20
10
0
Sound Level (dBA)
1
6
11
16
21
26
31
36
41
46
51
56
61
66
71
1-second intervals
Level reported by NPS and used in DEIS: Not Considered
Noise from this source is less than NPS limit of 60 dBA at 50 feet, and could be reduced further with better enclosure in building
1-sec Leq
Event Leq