CORRESPONDENCE

E-06-003

- Letter from the Environmental Protection Information Center
- Supplementary Materials
  Compiled & Submitted by the Environmental Protection Center

April 19, 2006

Audrey McCombs
California Coastal Commission
45 Fremont, Suite 200
San Francisco, CA 94105-2219

RE: Coast Seafoods Company Coastal Development Permit #E-06-003

VIA Email & Federal Express

Dear Ms. McCombs,

On behalf of the Environmental Protection Information Center (EPIC), we are writing to express our concerns regarding the Coastal Development Permit application #E-06-003 submitted by Coast Seafoods Company. We understand that the CDP application was received by your office on February 1, 2006 and deemed 'complete' on April 6, 2006, and will be considered by the Commissioners during the May hearing.

These comments are to formally register our concerns as they relate to the mariculture activities of Coast Seafoods in Humboldt Bay, California. We have also included documents for the public record. For the purposes of these comments we will use the following abbreviations set forth in the parenthesis following the agency or name: Coast Seafoods Company (Coast); California Coastal Commission (CCC); United States Army Corps of Engineers (USACE); California Department of Fish and Game (CDFG); US Fish and Wildlife Service (USFWS); National Marine Fisheries Service (NMFS); Endangered Species Act (ESA).

EPIC's Humboldt Bay Initiative

Humboldt Bay is the second largest coastal estuary in California and, one of the most pristine and biologically important estuaries on the West Coast. Humboldt Bay hosts an incredible array of species, including 141 invertebrate, 110 fish, 251 bird, and 30 mammal.

The Bay is a critical link for migrating and wintering birds in the chain of coastal wetlands from the Arctic Circle to South America, and it annually supports millions of waterbirds, shorebirds,

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raptors, and songbirds. Humboldt Bay's unique estuarine environment hosts an array of species that are linked by a complex and specialized food web.

In addition, the Bay's vast ecological wealth is the foundation for much of the area's economic activity and industry. Its banks and waters support recreation, sport and commercial fishing, tourism, mariculture, and other industries. The Bay is under increasing development pressure as the population of the Humboldt area continues to grow and economic demand shifts from resource consumption to natural amenity conservation.

This ecological treasure is at great risk of harm. Increasing development in and around the Bay threatens the ecological viability of the estuary. The Humboldt Bay Initiative of EPIC seeks to prevent further harm and ensure that all plans for the Bay include full protection of this magnificent estuary. It is our goal to advocate for and support sustainable industry and development.

We fully recognize that Coast has made substantial changes, at the bequest of regulatory agencies and the public, to their mariculture practices over the years. These changes have helped to reduce the adverse environmental impacts of this industry. Over time Coast has abandoned such ecologically detrimental practices as oyster prey depredation, and bottom culture. In addition, Coast has reduced the acreage of their operational footprint, and is actively involved protecting the water quality of Humboldt Bay.

General Comments

We are concerned that this permit process and 10-year permit application is not receiving the level of environmental review that is necessary and legally required in this instance. The project, as proposed, will adversely affect the Humboldt Bay environment, and the project plan does not contain adequate measures to mitigate those impacts as required by CEQA and other state and Federal laws. These impacts, as outlined below, are in addition to the legacy effects from more than 50 years of oyster culture in the Bay. In examining the project's potential for impact, these cumulative impacts may not be ignored or discounted. Additionally, the operational changes made by Coast do not offset or negate the potential for continued impact. Due to the significance of the known and potential impacts and the ecological value of Humboldt Bay, an Environmental Impact Report (EIR) is necessary for this project.

To date, the Biological Opinion prepared by NMFS and the Initial Study prepared by Jones & Stokes, have both concluded that the project with mitigation measures will result in no significant impact on key biological species. Based on our review, this conclusion is not supported by the scientific information available. Furthermore, the Biological Opinion includes multiple findings of no significant impact, citing a lack of data or availability of scientific information. Where there does exist a risk of significant impact, a finding of no significant impact should not grounded in ignorance. Where such substantial uncertainty exists, a reasonable manager cannot provide the level of assurance required by law and regulation that a project, such as the one under consideration here, will not result in significant impacts.

The project proponents have consistently argued that if scientific evidence does not explicitly prescribe or support an action or the possible results of mariculture related activity, then no

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alteration to their operations is justified, even if recommended by a trustee agency (Jones & Stokes, 2005). As a responsible company, community-based industry, and bay steward Coast should recognize the value in erring on the side of caution. The paucity of scientific studies drawn from identical situations does not, by itself, sufficiently justify a finding of no significant impact. On the contrary, it would be more appropriate to employ the precautionary principle and conclude a potential for significant impact in order to protect the respective resource. Moreover, such operational changes are not necessarily contrary to economic feasibility or viability.

While we agree with the position held by Coast and resource agencies (CDFG, NMFS), that the conversion of historic bottom culture to off-bottom culture results in a reduction of impact to biological resources, the reduction does not offset of the potential impacts of long-line culture. Now that Coast has followed the recommendations of CDFG, FWS, and NMFS in making the conversion, the impacts of long-lines have to be assessed independently and cumulatively. Again, abandonment of one culture method does not eliminate or offset the impacts of another method.

The project, as proposed, lacks a number of critical components that need to be addressed and analyzed. Several of the mitigation measures included in the proposal have questionable value and efficacy in reducing impacts and Coast has not provided sufficient information to justify the value of these methods. We also believe that the development of additional mitigation measures is necessary prior to permit approval. Information regarding any future mariculture projects, changes to operational footprint size or location, or changes to operational methods has not been provided by Coast. While we realize this may include many possibilities, this type of information is needed to adequately analyze the impacts of this project.

Based on the project description as well as the scientific evidence available, this project will have significant adverse impact on the biological resources of Humboldt Bay. EPIC is concerned that the project may adversely affect the public trust values of the Bay if the project is permitted to proceed as is. The extent and severity of these impacts necessitate a thorough and comprehensive analysis of Coast's past, current, proposed, and future operations. This level of analysis, which is long overdue, will help to develop sustainable mariculture practices and provide Coast with regulatory certainty.

While the comments below address specific areas of concern it is important to note, the potential for continued ecosystem-level impacts. Sustained mariculture in Arcata Bay has the potential to adversely affect the linkages between species and trophic levels of both the inshore waters and the open ocean. In order to protect Humboldt Bay's estuarine environment, short sighted review of such projects has to be replaced by comprehensive analysis and ecosystem-level management.

Biological Resources

Eelgrass (*Zostera marina*)

" Despite the obvious value of eelgrass, over 900,000 hectacres of seagrass loss has been documented throughout the world over the last decade" (NMFS 2003).

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Of significant concern to us is the project's impact on the eelgrass habitat of Arcata Bay. Eelgrass is widely recognized as an extremely valuable habitat in the estuarine and marine environment (Fonseca et. al. 1998). Found to be one of the most productive habitat types and ecosystems worldwide (Merkel 1991), providing critical habitat for many invertebrates and marine species (Hoffman 1986, Phillips 1984), nutrient regeneration (Klug 1980), sediment stabilization (Fonseca 1996), and primary productivity (Zieman and Wetzel 1980). For nearly twenty years there have been extensive efforts made by Federal and state resources agencies to protect what little seagrass habitat remains. The eelgrass habitat of Humboldt Bay is considered one of the largest remaining stands and "one of the least impacted major estuaries in California" (NMFS 2003). Regulatory agencies have an explicit responsibility to protect the vital the eelgrass of Humboldt Bay. Although some may argue that the level of impact to eelgrass from mariculture is unclear, there is substantial evidence that significant impacts exists and continues.

Coast proposes to maintain the approximately 250+ acres currently occupied by long-line culture, rack and bag, and other operational structures. In addition, Coast proposes to convert approximately 45 acres from bottom culture to long-long lines. All long-lines are and will be planted at 2.5 foot spacing. Contrary to the arguments put forth by Coast, the WRAC study did reveal significant impacts to eelgrass coverage and density. In the Rumrill and Puolton report (2003), "a strong trend of decreasing eelgrass spatial cover and density with decreasing distance between oyster long-lines" was observed (NMFS 2000). For the 2.5 foot long-line spacing currently employed and proposed for the 45 acre conversion, "Rumrill and Puolton (2003) observed an average spatial cover of 4.5 percent and an average density of 10.3 shoots/m^2 compared to an eelgrass control site which reached up to 70 percent spatial cover and 62 shoots/m^2. Results from this study also indicate that the presence of dense oyster lines (1.5, 2.5 and 5-ft line spacing) generally results in reduced eelgrass blade length and biomass" (NMFS 2003).

Other studies have also documented impacts to eelgrass. For example, Everett et. al. (1995), conducted a study in the South Slough Estuary, Oregon and found significant negative impacts to both eelgrass density and cover as a result of rack and stake culture. The results indicated that following 18 months of rack culture the area below the rack was devoid of eelgrass while the surrounding areas remained vegetated. Similar results were observed following 10 months of stake culture. Other studies (Griffin 1997) have also found decreased eelgrass density and cover resulting from mariculture activities.

Coast's position on the impacts of oyster mariculture has consistently been that the lack of 'conclusive' science equates to 'no significant impacts', which ignores the scientific evidence available as well as the continued potential for impacts (Cziesla 2006). Coast has also argued that scientific studies "indicate that, even if some amount of eelgrass is displaced by Coast long-lines, the habitat value of that eelgrass is at least replaced by the habitat value of Coast's long-lines, resulting in not net loss of habitat or loss of managed species. Furthermore… much of the oyster aquaculture subject to the current permit application is occurring or proposed to occur in areas that are currently void of eelgrass…. As such, the overall effect of Coast's proposal, based on these studies, is an increase in habitat for managed species." (Cziesla 2006)

We take issue with this position and conclusion for a number of reasons. First, by claiming that because the current operational footprint occurs in areas currently "unvegetated" the potential for

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eelgrass displacement neglects the fact that much of Coast's present operations occur in areas that were historically eelgrass beds. Second, the artificial presence of long-lines is not a biological replacement for eelgrass habitat. While long-line studies may have concluded that their presence supports marine species, the biological presence and function of eelgrass can not be replaced by nor compared to that of long-lines. In the Initial Study drafted by Coast's consulting firm, Jones & Stokes, the results of the Dealteris et. al. study (2004) are used to substantiate the position that long-lines provide habitat value equal to that of eelgrass. However, this position is not substantiated by the results of one study that analyzed only species diversity. Species diversity is not necessarily an indication of biological function or habitat value.

The aerial photographs of Humboldt Bay taken in 1997 and 2000 clearly illustrate the impact oyster culture has had on eelgrass spatial coverage and density. Nearly concentric circles are still visible from abandoned bottom culture sites. This visible impact warrants further analysis of mariculture and eelgrass recovery rates of those areas previously cultivated. This is an important component in understanding the extent, severity, and longevity of the impact.

At issue is the obvious correlation of eelgrass habitat and culture areas. As illustrated by Figure 1 of the Initial Study by Jones & Stokes, all mariculture sites are located within the boundaries of eelgrass habitat as established by CDFG (Jones & Stokes 2006). We concur with the Essential Fish Habitat Conservation Recommendation #3 from the Biological Opinion written by NMFS, which recommends that "Coast should evaluate the feasibility of culturing oysters at depths typically unsuitable for eelgrass growth (i.e., -1.5 ft to + 1.5 ft MLLW) in Humboldt Bay" (NMFS 2005).

Pacific Herring

Pacific herring are a essential component of the diverse and complex marine and estuarine ecosystem of the Pacific Northwest and the world. Yet, like many other species the herring has a history of "world wide overexploitation" and is in need of "prudent management measures" (PHMC 1982). Humboldt Bay provides both spawning and rearing habitat to Pacific herring, particularly in eelgrass beds.

John Mello (CDFG) stated in a Memorandum to the Coastal Commission, dated February 22, 2006, that the importance of eelgrass habitat to spawning pacific herring is critical and has been undervalued by the Biological Opinion and Coast. Furthermore, North (Arcata) Bay and more specifically East Arcata Bay supported the highest percentage of Total Spawn Escapement for all of Humboldt Bay from 1974 through 2005(Mello 2006). Additionally, the total tons of Humboldt Bay Pacific herring landings from 1974 through 2005 have declined dramatically. As Mello points out the El Niño years have contributed to the decline, but other factors are also likely influences. Therefore, the Humboldt Bay spawning habitats must be managed in such a way as to protect and enhance these areas of North Bay, especially the area know as East Bay.

The spawning studies conducted by CDFG have resulted in a clear understanding of the location and habitat preference of Pacific herring. Throughout Arcata Bay, the results illustrate a high correlation between eelgrass habitat and spawning. As the data indicates the East Bay area supports the highest spawning coverage (m^2) and escapement (tons) in all of Arcata Bay (Mello 2005).

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Coast proposes that the Mariculture Monitoring Committee (MMC) will decide, by majority vote, where the long-lines (converted from ground culture) are to be located. The CDFG study also noted the variability of spawning events, and the 60-ton commercial catch quota set for the Bay, as influences on herring populations. These conditions however, do not eliminate the potential for impact nor the necessity in considering the cumulative effects of continued mariculture in East Bay. In light of the eelgrass and spawning value of East Bay, we do not believe any additional mariculture should be permitted and the placement of long-line culture should be determined by CDFG and NMFS.

Coast whose operations occur in both eelgrass and spawning areas, proposes as avoidance and impact minimization, to monitor within the culture area during the spawning season. According to this proposal, if there is evidence of spawning activity Coast will contact CDFG and cease all harvesting activities for a period of two weeks. While we consider this policy to be a step in the right direction, we are concerned that it will not provide adequate protection. A spawning event may last several hours or several days and hatching time is dependent upon water temperature (Rabin 1976). It is also unclear and lacking analysis as to how larval and juvenile development will be impacted by resumed activity following this two-week period. According to Rabin (1976), juveniles do not leave their nursery grounds until late summer or fall, at which point they leave for offshore waters. For this policy to be considered a sufficient protection of the herring spawning event the project proponent should be required to provide a detailed analysis of how this two-week cessation of activity constitutes a true protective measure. Furthermore, greater confidence would be placed in this policy if it was supported and substantiated by the trustee agencies of CDFG and NMFS. Moreover, such monitoring should be carried out by CDFG to ensure the full extent of protection.

Salmonids

The project has the potential to significantly affect the sensitive and imperiled salmonid. Species listed as Threatened under the Federal ESA which may be affected by the project include SONCC coho salmon, NC steelhead, CC Chinook Salmon, and their critical habitat as defined in section 3(5)(A). These three species utilize Humboldt Bay for migration, feeding, nurseries, and rearing. In light of the poor current condition and continuing decline of these species, as well as the mounting threats to their survival, it is more critical than ever to protect their habitat. The primary constituent elements (PCEs) that comprise the ecologically significant units for the listed species, are considered of “high conservation value because it [Humboldt Bay] provides migratory connectivity for juveniles and adults between high value freshwater spawning and rearing habitat and the ocean” (NMFS 2005).

While the extent of use and type of use may vary among these species, it is clear that eelgrass habitat is vital for various life stages. Moreover, it is clear that eelgrass is critical to key prey species. While salmonids are known to be opportunistic feeders and have a variety of prey species, studies have shown that certain species continue to constitute the majority of their diets. A four year study conducted in the nearshore waters of Humboldt Bay and Trinidad found rockfish, herring, osmerids, euphausiids, and anchovies comprised between 90.4 and 95.1 percent of salmonids’ diet (Petrovich, 1970).

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NMFS concluded in the Biological Opinion "that the project will result in a change in cover which will diminish the value of rearing habitat in the action area. Thus, the project will adversely affect designated critical habitat for SONCC coho salmon, NC steelhead, and CC Chinook salmon" (NMFS, 2005). Concerns regarding the adverse impacts to salmonids from oyster culture have been documented by scientific literature, trustee agencies, and noted by the public. In a letter to USACE dated January 21, 1998, James Bybee of NMFS stated:

> " Federally listed threatened southern Oregon/northern California coastal (SONCC) coho salmon and proposed as threatened northern California (NC) steelhead trout are know to be present within the proposed oyster harvest area. The juvenile life phase of these salmonids is susceptible to impacts from oyster culture operations. Juvenile salmonids rear in eelgrass areas and feed on animals that live on eelgrass blades. Loss of available habitat to juvenile salmonids within the affected area has not been well documented, but decreases in the eelgrass habitat would presumably impact the juvenile life stage of these fish" (NMFS 1998).

Humboldt Bay Fisheries & Federally Managed Species

There is increasing concern over the impacts of oyster culture on fish species managed under the Coastal Pelagics, Pacific Groundfish, and Pacific Salmon FMPs, and their prey species. In response to this concern, Coast argues that aquaculture 'gear' has been found to provide habitat. Specifically, the study cited found that the 'gear' "provides habitat for many species throughout the year in contrast to the seasonal nature of eelgrass and that species abundance and richness was higher during all times of the year; while species diversity was also higher but not significantly so in aquaculture gear as compared to eelgrass"(Jones & Stokes 2006).

Even if this study proves to be valid, it does not justify the leap of logic necessary to conclude, from a biological standpoint, that aquaculture in Humboldt Bay is habitat enriching when compared to the natural conditions present in eelgrass. The habitat enrichment argument does not include a thorough biological analysis of the specific conditions of such enrichment. Furthermore, it does not take into consideration the possibility that the artificial presence of aquaculture mimics or provides the equal value of eelgrass habitat in terms of which species benefit, how they benefit, and how the habitat is utilized. It should be considered, before such conclusions are made, that the artificial enrichment may actually be causing disruptive changes in the Bay's biological system.

Below is an excerpt from comments submitted to USACE from NMFS regarding Public Notice #26912N, dated November 24, 2004. The excerpt summarizes additional impact concerns for fisheries.

> "Reductions in density and/or coverage of eelgrass habitat from mariculture activities could result in concomitant losses in associated ecological functions. Of particular concern to NOAA Fisheries are potential reductions in the quantity and quality of habitat available for fish species managed under the Coastal Pelagics, Pacific Groundfish, and Pacific Salmon FMPs and their prey items. Based upon the Barnhardt et. al. (1992) report, the following Federally managed species have been documented to occur in Humboldt Bay: leopard shark (*Triakis semifasciata*), soupfin shark (*Galeorhinus zyopterus*), spiny dogfish (*Squalus acanthius*), big

skate (*Raja binoculata*), lingcod (*Ophidon elongatus*), cabezon (*Scorpaenichthys marmoratus*), kelp greenling (*Hexagrammos decagrammaus*), black rockfish (*Sebastes melanops*), blue rockfish (*Sebastes mystinus*), bocaccio (*Sebastes auriculatus*), copper rockfish (*Sebastes caurinus*), grass rockfish (*Sebastes rastrelliger*), vermillion rockfish (*Sebastes miniatus*), yellow rockfish (*Sebastes flavidus*), butter sole (*Isopsetta isolepis*), Dover sole (*Microstomus pacificus*), English sole (*Paraphrys vetulus*), Pacific sanddab (*Citharichthys sordidus*), sand sole (*Psettichthys melanostrictus*), starry *flounder (Platichthys stellatus*), northern anchovy (*Engraulis mordax*), coho salmon (*Oncorhynchus kisutch*), and chinook salmon (*Oncorhynchus tshawytscha*). Of these, English sole, copper fish, rockfish larvae/juveniles are considered resident users of eelgrass beds and black rockfish, kelp greenling, lingcod, cabezon, butter sole, Dover sole, starry flounder, northern anchovy, chinook salmon, coho salmon, and spiny dogfish are considered 'transient' users, as described in Phillips (1984) description of eelgrass meadows in the Pacific Northwest."

NMFS's letter also points out that studies like that conducted by Love et. al., have documented the severe decline of coastal fish assemblages. Sensitive nursery habitats like eelgrass beds should be a priority for protection, conservation, and restoration if we are to protect these species. "Loss or alteration of these nursery habitats, which are already limited in abundance, could have long-lasting detrimental consequences to the survival of rockfishes and the replenishment of their populations" (Love et. al. 2002).

Shorebirds

Humboldt Bay supports more than 250 avian species and remains key to those migratory species on the Pacific flyway. For this reason, we are concerned about any adverse impacts to shorebirds resulting from continued oyster mariculture in Arcata Bay. The potential for impact is yet another area that has not been adequately examined. Our concern is based on the evidence provided throughout this document that addresses the many ways in which the habitat of Arcata Bay is impacted as a result of mariculture. Overall, the scientific evidence available indicates that oyster culture and related activities alter the habitat structure of the bay and it's biological functions. With changes to the bay's vegetative cover and density, sedimentation, hydrology, and nutrient cycling, there is the potential to adversely impact shorebirds.

A study conducted in Tomales Bay, California found a "net decrease in the total shorebird use in areas developed for aquaculture" (Kelly et. al. 1997). In addition, the study also found changes to the diversity of avian species foraging in the tidal flats under oyster culture. While additional studies have also examined impacts to shorebirds as well as the habitat use throughout Humboldt Bay, a complete review of the information is needed before concluding that impacts will not occur or are insignificant in Arcata Bay.

Epiphytic & Benthic Communities

The importance of eelgrass habitat is supported further by the fact that the seagrass is an attachment point for many epiphytes, like caprellid amphipods or harapacticoid copepods.

According to Simenstad (1994), harapacticoid copepods are key prey items for both Pacific herring and juvenile salmon. Therefore, the reduction of eelgrass has the potential to reduce the number of prey items available, which in turn might reduce the population and viability of these predatory species (NMFS 2004).

Another lesser studied and undervalued topic is the impact to benthic communities that may result from mariculture. Coast suggests that despite the deposition of sediment and bio-deposition resulting from mariculture structures, the natural fluctuations of tides combined with storm and wind events will mediate impacts to benthic communities. Yet this conclusion is contrary to the findings of the study conducted by Tang and Fang (2002). According to Tang and Fang, oysters are capable of producing as much as 120g of dry weight feces within a year. While a portion of the feces is consumed, converted, and carried away the authors argue that the majority of deposition will remain beneath the culture structures. This deposition changes the benthos textural composition, and this change impacts the assemblages of benthic species. When Tang and Fang compared the invertebrate biomass of culture sites to historic vegetation, dramatic declines were evident.

Further consideration of the potential impacts to these communities resulting from mariculture should be examined. Epiphytes and the array of invertebrates that are part of the Bay environment, are important prey sources for a multitude of estuarine species, salmonids and shorebirds included.

Siltation & Hydrology

There is the potential for aquaculture related 'gear' to affect bay hydrology, sediment deposition, and siltation. The lack of data specific to the siltation, and hydrology effects of Coast's operations does not justify the dismissal of these issues nor the potential impacts. Siltation has been documented by observers, although such observations may not constitute a definitive causal relationship they do show the necessity to examine these issues. For example, Eric Larson of CDFG documents personal observations of sediment accumulation under Coast's rack and bag structures. The CDFG also made a formal recommendation that Coast "move the "rack and bag" operation to areas outside of eelgrass habitat" (Larson 2003).

Operational Concerns

Mariculture in Eelgrass Habitat

Due to the known and potential adverse impacts of oyster culture to eelgrass and eelgrass dependent species, no mariculture should be permitted in eelgrass beds. Specifically, mariculture should be located outside of the conditions most suitable for eelgrass (–1.5 ft to + 1.5 ft MMLW). This measure affords the highest level of eelgrass protection.

Long-line spacing

If the planting of long-lines is permitted within eelgrass habitat, a minimum of 10-ft spacing should be required. As discussed in previous sections there is substantial evidence from WRAC and other studies that eelgrass coverage and density decline because of decreased line spacing, particularly for 1.5ft –2.5 ft spacing. If this permit application were to be approved as is, all of Coast's long-lines will be planted at 2.5 ft spacing. We believe such spacing constitutes significant localized and ecosystem-level impacts.

Placement of 45.49-acre conversion

Coast proposes that the sites for this conversion will be determined by a majority vote of the Mariculture Monitoring Committee (MMC). We believe this to be an inappropriate means of selecting site location. As previously recommended by CDFG in a letter dated December 1, 2003 to USACE, the conversion should be determined by a "consensus of the resources agencies (CDFG, NOAA Fisheries, USFWS) and Coast." CDFG also notes that the MMC "is strictly an advisory group to the Humboldt Bay Harbor District". It is our opinion that the resources agencies are better qualified, and equipped to determine the appropriate location for mariculture practices based on sound science and dedication to safeguarding public resources.

Monitoring of Pacific herring spawning

We believe the proposed monitoring method is inadequate. Additional information about the herring event is required. We also believe that CDFG should be responsible for monitoring the spawning event as well as determining when and how culture activities will be resumed .

Permit Length

The 10-year permit, as proposed by this application, should be limited to a 3-year permit with the ability to renew each year for the period of two years. We believe that the permit length of 5-years in total will provide Coast with the appropriate operational framework, while ensuring the biological resources of Humboldt Bay are protected. The proposed permit length of 10-years will stall scientific evaluations and studies of impacted resources and an ecosystem-wide assessment of mariculture in Humboldt Bay.

Based on the known and anticipated environmental impacts a permit length of 5-years will facilitate an adaptive management strategy for mariculture. To date there are too many unknowns regarding the significance of impacts to shorebirds, bay hydrology, epiphytic and bethic communities, sedimentation, and bio-deposition to grant a 10-year permit. A shorter permit length will enable future proposals and permits to be developed and granted based on the most current information available.

Proposed Mitigation Measures

1. 50 Acre transfer

   While we applaud the measure and do not dispute the habitat value of the proposed 50-acre parcel to be transferred, we are concerned as to how the habitat type constitutes

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mitigation. To date the most significant concerns regarding mariculture in Arcata Bay relate specifically to eelgrass habitat and it's dependent species. As described in Jones & Stokes Technical Memorandum, dated March 7, 2006, the proposed parcel contains very little eelgrass habitat compared to other parcels owned by Coast. A more thorough explanation of how this transfer will mitigate impacts is also needed.

2. Lease Holdings

   Coast proposes to maintain it's leases with the Harbor District, City of Eureka, and Karamu Corporation on approximately 3,645 acres of tidelands. Coast will satisfy payment requirements and will renew these three leases until the year 2015. In this time no mariculture activity will occur. The maintenance of the leases is "intended to offset any perceived environmental impacts of Coast's operations on the 300-acre operational footprint" (Jones & Stokes 2006).

   Without clarification as to how this action will specifically offset environmental impacts, it is difficult to determine the nature and quality of this measure. No action on these leased acres does not, necessarily constitute mitigation. Moreover, the value of the mitigation is unclear without information regarding Coast's intentions following the expiration of this permit.

3. 45.49 Acre Conversion

   This conversion is an operational improvement not a mitigation measure. While we recognize the value of this conversion, the reduction in impact from one method to another does not offset nor eliminate the impact that will result from the long-lines.

4. Marine Mammals

   Coast cites that " no take or harassment (as defined by the Marine Mammal Protection Act) of any marine mammal will be allowed" (Jones & Stokes 2006). What is unclear are the circumstances and methods by which this action will be taken. If, for example, Harbor Seals (*Phoca vitulina*) are found to be hauled out on a bed that is scheduled to be harvested, will Coast cease activities until such time that the marine mammals have left the area? Further clarification of this measure is needed to assess its effectiveness.

Recommendations

We have outlined below improvements to the proposed mitigation methods and operational conditions. These recommendations will strengthen protections for Humboldt Bay's environment. Also identified below, are a number of areas, both biological and operational, that require further analysis and consideration regarding this project as well as mariculture throughout Humboldt Bay.

Proposed mitigation measures

1. 50 acre transfer of Coast owned tidelands
    - Coast will provide specific information as to how and why the proposed transfer will mitigate impacts within the 300-acre operational footprint is required.
    - Development, by Coast, of a transfer plan that outlines, specifically, the timeframe of the transfer (e.g. 1 or 2 years) and the criteria by which the recipient will be selected.

2. Lease holdings
    - These lease holdings may only be considered as mitigation if the information (i.e. future use) provided by Coast indicates clearly, how such action constitutes mitigation and if the trustee agencies, of CDFG and NMFS substantiate the measure as mitigation.

3. 45.46-acre conversion
    - Will not be considered mitigation, but will be noted as a significant and positive change to Coast's operation.

4. Marine Mammals
    - Coast will provide a detailed explanation of this measure to ensure adequate protection of marine mammals within the project zone.

Operational conditions

1. Mariculture in eelgrass habitat

    - No long-lines or other culture structures will be planted in the zone of –1.5 ft to + 1.5 ft MMLW.

2. Long-line spacing

    - The 45.46 acres (the converted acreage) of long-lines will be planted at a minimum spacing of 10 ft, if sites are located in eelgrass habitat. This measure will help to mitigate impacts to the eelgrass environment. In addition, this spacing will serve as an examination of the ecological, operational, and financial viability of such spacing.

3. Placement of 45.46 acre conversion

    - Long-lines will not be located in the area known as the East Bay Management area.
    - Placement will not occur in areas where eelgrass or eelgrass rhizomes are present.
    - Culture location will be determined by the consensus of CDFG, NMFS, and Coast.

4. Monitoring of Pacific herring spawning

    - All monitoring will be conducted by CDFG.

- CDFG will determine the period of time that cessation of mariculture activity is necessary to protect larvae and juveniles.
- Coast will provide 'in-kind' services to CDFG.

5. Permit Length

    - A 3-year permit with the option to renew each year for a period of two years.
    - Option to renew is conditional. Renewal will be granted if Coast has complied with all mitigation measures, if no unforeseen impacts have occurred, and if Coast has continued to work with the agencies of CDFG and NMFS on the identification and study of impacts to the biological resources of Humboldt Bay.

Additional studies

1. Below is a list of resource areas that we believe to be impacted or potentially impacted by continued mariculture activities in Humboldt Bay. A concerted effort must be made, on the part of regulatory agencies, Coast, and the community, to examine these areas to determine the ways in which aquaculture affects them and how they might be protected.

    (a) Eelgrass growth and regeneration following oyster culture
    (b) Habitat use of salmonids
    (c) Success of Pacific herring spawning and rearing in Arcata Bay
    (d) Shorebirds interactions with culture dominated habitat
    (e) Bio-deposition resulting from oysters
    (f) Changes to bay hydrology and sediment delivery patterns
    (g) Importance of epiphytes to Bay environment and predatory species
    (h) Effects of sedimentation and bio-deposition on bethic communities and eelgrass

2. We also wanted to include a list of operational considerations to be explored. There is evidence that suggests that alterations to culture practices may result in increased sustainability and economic viability. The development and examination of a range of alternatives should be part of this process. Below we have listed a few culture practices that have been shown to both economically and environmentally advantageous.

    (a) Oyster culture at depths above or below that, which is most suitable to eelgrass.
    (b) Increased line spacing (10ft)
    (c) An eelgrass restoration program

Summary

In conclusion, we reiterate our evaluation that the project as proposed will impact, and has the potential to significantly impact, the estuarine environment of Humboldt Bay. As described in our comments we are particularly concerned about the continued impacts to eelgrass habitat and the species that depend on it for spawning, rearing, foraging, and cover. In addition, we do not believe this project proposal is reflective of the scientific information available nor does it include sufficient mitigation to effectively avoid, offset, or reduce impacts.

The Environmental Protection Information Center –Humboldt Bay Program
P.O. Box 147 • Eureka, CA 95502 • 707.476.8340

Due to the biological and operational concerns of this project, we have recommended a number of alterations necessary to protect environmental resources and promote sustainable mariculture. We believe a renewable three year permit is most appropriate considering the additional studies needed. This permit length will also ensure that new information regarding impacts will be incorporated as an adaptive management strategy for mariculture in Humboldt Bay.

We hope our comments presented above will assist the Commission in making a determination regarding the permit application. EPIC will provide additional comments as necessary, throughout this process.

Thank you for your time and attention to these important issues.

Sincerely,

Danielle E. Creedon
Humboldt Bay Advocate

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Supplementary Materials

Compiled & Submitted by the Environmental Information Protection Center
April 19, 2006

Supplementary Material Index

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4. California Department of Fish and Game: Letter to USACE dated January 29, 1998
5. National Fish and Wildlife Service: Letter to USACE dated February 6, 1998
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Images

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SOUTHERN CALIFORNIA EELGRASS MITIGATION POLICY

(Adopted July 31, 1991)

Eelgrass (Zostera marina) vegetated areas are recognized as important ecological communities in shallow bays and estuaries because of their multiple biological and physical values. Eelgrass habitat functions as an important structural environment for resident bay and estuarine species, offering both predation refuge and a food source. Eelgrass functions as a nursery area for many commercially and recreational important finfish and shellfish species, including those that are resident within bays and estuaries, as well as oceanic species that enter estuaries to breed or spawn. Eelgrass also provides a unique habitat that supports a high diversity of non-commercially important species whose ecological roles are less well understood.

Eelgrass is a major food source in nearshore marine systems, contributing to the system at multiple trophic levels. Eelgrass provides the greatest amount of primary production of any nearshore marine ecosystem, forming the base of detrital-based food webs and as well as providing a food source for organisms that feed directly on eelgrass leaves, such as migrating waterfowl. Eelgrass is also a source of secondary production, supporting epiphytic plants, animals, and microbial organisms that in turn are grazed upon by other invertebrates, larval and juvenile fish, and birds.

In addition to habitat and resource attributes, eelgrass serves beneficial physical roles in bays and estuaries. Eelgrass beds dampen wave and current action, trap suspended particulates, and reduce erosion by stabilizing the sediment. They also improve water clarity, cycle nutrients, and generate oxygen during daylight hours.

In order to standardize and maintain a consistent policy regarding mitigating adverse impacts to eelgrass resources, the following policy has been developed by the Federal and State resource agencies (National Marine Fisheries Service, U.S. Fish and Wildlife Service, and the California Department of Fish and Game). While the intent of this Policy is to provide a basis for consistent recommendations for projects that may impact existing eelgrass resources, there may be circumstances (e.g., climatic events) where flexibility in the application of this Policy is warranted. As a consequence, deviations from the stated Policy may be allowed on a case-by-case basis. This policy should be cited as the Southern California Eelgrass Mitigation Policy (revision 10).

For clarity, the following definitions apply. "Project" refers to work performed on-site to accomplish the applicant's purpose. "Mitigation" refers to work performed to compensate for any adverse impacts caused by the "project". "Resource agencies" refers to National Marine Fisheries Service (NMFS), U.S. Fish and Wildlife Service (USFWS), and the California Department of Fish and Game (CDFG).

1. **Mitigation Need.** Eelgrass transplants shall be considered only after the normal provisions and policies regarding avoidance and minimization, as addressed in the Section 404 Mitigation Memorandum of Agreement between the Corps of Engineers and Environmental Protection Agency, have been pursued to the fullest extent possible prior to the development of any mitigation program. Mitigation will be required for the loss of

provided giving the bounding x,y coordinates of the eelgrass areas. In addition to a spatial layer or table, a hard-copy map should be included within the survey report. The projection and datum should be clearly defined in the metadata and/or an associated text file.

All mapping efforts must be completed during the active growth phase for the vegetation (typically March through October) and shall be valid for a period of 60 days with the exception of surveys completed in August - October. Surveys completed after unusual climatic events (i.e., high rainfall) may have modified requirements and surveyors should contact NMFS, CDFG, and USFWS to determine if any modifications to the standard survey procedures will be required. A survey completed in August - October shall be valid until the resumption of active growth (i.e., in most instances, March 1). After project construction, a post-project survey shall be completed within 30 days. The actual area of impact shall be determined from this survey.

4. **Mitigation Site.** The location of eelgrass transplant mitigation shall be in areas similar to those where the initial impact occurs. Factors such as, distance from project, depth, sediment type, distance from ocean connection, water quality, and currents are among those that should be considered in evaluating potential sites.

5. **Mitigation Size.** In the case of transplant mitigation activities that occur concurrent to the project that results in damage to the existing eelgrass resource, a ratio of 1.2 to 1 shall apply. That is, for each square meter adversely impacted, 1.2 square meters of new suitable habitat, vegetated with eelgrass, must be created. The rationale for this ratio is based on, 1) the time (i.e., generally three years) necessary for a mitigation site to reach full fishery utilization and 2) the need to offset any productivity losses during this recovery period within five years. An exception to the 1.2 to 1 requirement shall be allowed when the impact is temporary and the total area of impact is less than 100 square meters. Mitigation on a one-for-one basis shall be acceptable for projects that meet these requirements (see section 11 for projects impacting less than 10 square meters).

Transplant mitigation completed three years in advance of the impact (i.e., mitigation banks) will not incur the additional 20 percent requirement and, therefore, can be constructed on a one-for-one basis. However, all other annual monitoring requirements (see sections 8-9) remain the same irrespective of when the transplant is completed.

Project applicants should consider increasing the size of the required mitigation area by 20-30 percent to provide greater assurance that the success criteria, as specified in Section 10, will be met. In addition, alternative contingent mitigation must be specified, and included in any required permits, to address situation where performance standards (see section 10) are not likely to be met.

For potential eelgrass habitat, a ratio of 1 to 1 of equivalent habitat shall be created.

Degradation of existing eelgrass vegetated habitat that results in a reduction of density greater than 25 percent shall be mitigated on a one-for-one basis. For example, a 25 percent reduction in density of a 100 square meter (100 turions/meter) eelgrass bed to 75

The monitoring of an adjacent or other acceptable control area (subject to the approval of the resource agencies) to account for any natural changes or fluctuations in bed width or density must be included as an element of the overall program.

A monitoring schedule that indicates when each of the required monitoring events will be completed shall be provided to the resource agencies prior to or concurrent with the initiation of the mitigation.

Monitoring reports shall be provided to the resource agencies within 30 days after the completion of each required monitoring period and shall include the summary sheet included at the end of this policy.

10. **Mitigation Success.** Criteria for determination of transplant success shall be based upon a comparison of vegetation coverage (area) and density (turions per square meter) between the **project impact area** and **mitigation site(s)**. Extent of vegetated cover is defined as that area where eelgrass is present and where gaps in coverage are less than one meter between individual turion clusters. Density of shoots is defined by the number of turions per area present in representative samples within the original impact area, control or transplant bed. Specific criteria are as follows:

a. the mitigation site shall achieve a minimum of 70 percent area of eelgrass and 30 percent density as compared to the original project impact area after the first year.

b. the mitigation site shall achieve a minimum of 85 percent area of eelgrass and 70 percent density as compared to the original project impact area after the second year.

c. the mitigation site shall achieve a sustained 100 percent area of eelgrass bed and at least 85 percent density as compared to the original project impact area for the third, fourth and fifth years.

Should the required eelgrass transplant fail to meet any of the established criteria, then a Supplementary Transplant Area (STA) shall be constructed, if necessary, and planted. The size of this STA shall be determined by the following formula:

$$STA = MTA \times (|A_t + D_t| - |A_c + D_c|)$$

MTA = mitigation transplant area.
A_t = transplant deficiency or excess in area of coverage criterion (%).
D_t = transplant deficiency in density criterion (%).
A_c = natural decline in area of control (%).
D_c = natural decline in density of control (%).

The STA formula shall be applied to actions that result in the degradation of habitat (i.e., either loss of areal extent or reduction in density).

Southern California Eelgrass Mitigation Policy
Monitoring and Compliance Reporting Summary

PERMIT DATA:

Permit (Type, Number)	Issuance Date	Expiration Date	Agency Contact
ACOE:			
CDP:			
Other:			

EELGRASS IMPACT AND MITIGATION REQUIREMENTS SUMMARY:

Permitted Eelgrass Impact Estimate	(m^2)	
Actual Eelgrass Impact,	(m^2)	(post-const. survey date)
Eelgrass Mitigation Requirement	(m^2)	(mitigation plan ref.)
Impact Site Location		(location)
Impact Site Center Coordinates		(define projection and datum)
Mitigation Site Location		(location)
Mitigation Site Center Coordinates		(define projection and datum)

PERMITTEE CONTACT INFORMATION:

Project Name	(same as permit ref.)
Permittee Information	(permittee name)
	(mailing address)
	(city, state, zip)
	(permittee contact)
	(phone, fax., e-mail)
Mitigation Consultant	(consultant contact)
	(phone, fax., e-mail)

PROJECT ACTIVITY DATA:

Activity	Start Date	End Date	Reference Info.
Eelgrass Impact			
Installation of Eelgrass Mitigation			
Initiation of Mitigation Monitoring			

MITIGATION STATUS DATA:

Mitigation Milestone	Scheduled Survey	Survey Date	Area (m^2)	Density (turions/m^2)	Reference Info.
Requirement					
0-month					
6-month					
12-month					
24-month					
36-month					
48-month					
60-month					

EFFECTS OF AQUACULTURE ON HABITAT USE BY WINTERING SHOREBIRDS IN TOMALES BAY, CALIFORNIA

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We measured abundances of wintering shorebird species simultaneously on four control plots and two aquaculture plots from November 1989 to February 1994 on tidal flats in Tomales Bay, California. Twelve abundance estimates for each plot were obtained each year. We used analysis of covariance to model the results, controlling for the presence of roosting gulls that may have displaced foraging shorebirds. The analysis included effects related to intraseasonal timing, annual variation, and the presence of aquaculture. The two most abundant shorebird species in Tomales Bay, western sandpiper, *Calidris mauri*, and dunlin, *Calidris alpina*, significantly avoided aquaculture areas. Willets, *Catoptrophorus semipalmatus*, however, were attracted to aquaculture plots. Four other species showed no preferences for control or aquaculture plots. Evidence of underlying (pre-existing) habitat conditions did not explain these results. We found no differences in species richness or Shannon diversity index between control and aquaculture areas. Our results suggest a net decrease in total shorebird use in areas developed for aquaculture.

INTRODUCTION

Shorebirds generally concentrate where feeding efficiency is greatest (Goss-Custard 1970, Connors et al. 1981; reviews by Evans and Dugan 1984, Meire and Kuyken 1984, Puttick 1984) and invertebrate prey density (Goss-Custard et al. 1977, Bryant 1979, Wilson 1990, Colwell and Landrum 1993) or availability (Recher 1966, Myers et al. 1980, Goss-Custard 1984) is highest. Sediment characteristics can influence shorebird distribution and density by affecting prey density or availability (Page et al. 1979, Quammen 1982, Yates et al. 1993). Foraging distributions and densities of shorebirds are also influenced by other macrohabitat (Burger 1984a) and microhabitat characteristics (Recher 1966, Baker and Baker 1973, Gerstenberg 1979, Burger 1984b). In some species, social behavior determines the extent to which habitat characteristics or food availability influence numbers of shorebirds using a particular area (Myers 1984).

Pacific oyster, *Crassostrea gigas*, culture alters spatial habitat structure by introducing shellfish, racks, stakes, culture bags, marker poles, and other equipment onto open tidal flats. Research conducted to date on ecosystem effects of oyster

culture has been limited to studies of effects on sediment (Ottmann and Sornin 1985, Deslous-Paoli et al. 1992) and benthic infauna (Triani[1] 1994); effects of oyster culture on bird populations have not been addressed. Therefore, from 1989 to 1994 we investigated the use of intertidal mud flats by wintering shorebirds in relation to Pacific oyster growing operations at Walker Creek Delta, Tomales Bay, California. Study objectives were to (i) test for selection or avoidance of aquaculture areas by wintering shorebirds, (ii) test for differences in shorebird diversity between open tidal flats and aquaculture areas, (iii) examine temporal and spatial variation of shorebird abundance on open tidal flats and aquaculture areas, and (iv) compare intraseasonal shifts in use of tidal flats and aquaculture areas with overall abundance changes in Tomales Bay.

STUDY AREA AND METHODS

We conducted the study on test plots at Walker Creek Delta near the north end of Tomales Bay, California (Fig. 1). Tidal flats on the delta were composed of consolidated fine sands, silts, and clays (Daetwyler 1966) and were divided by three creek channels. We marked six study plots around the perimeter of the delta, each plot occupying 225 meters of shoreline and covering approximately 2 ha of tidal flat between 0.0 and 0.3 m above mean lower low water (MLLW) (Fig. 1). Two control plots (Plots 1 and 2) were on the south perimeter of the delta. Two others (Plots 3 and 4) were designated as treatment plots on currently used aquaculture lease areas (Fig. 1). We established Plots 5 and 6 on undeveloped aquaculture areas to provide temporal experimental control as they were developed for aquaculture; however aquaculture development did not occur as expected. Instead, local oyster growers developed an area that included approximately 15% of Plot 6 by the end of the 1992-93 sampling period (Fig. 1). This aquaculture operation was abandoned subsequently and the aquaculture equipment was removed prior to the 1993-94 sampling period. Control and aquaculture test areas were separated by at least 100 m; within control and aquaculture areas, plots were separated by 50 m.

Oyster growers used 0.61 x 0.91-m black plastic mesh bags placed on the bottom and 0.30 to 0.61 m above the bottom on 1.22 x 2.44-m steel re-bar frames supported by PVC pipe legs. The ends of rows of oyster bags were often marked with 1 to 2.5-m-high PVC stakes.

We conducted three counts per month on each plot, from November through February 1989-90 to 1993-94. Count days were clustered in groups of three, usually consecutive days during spring tides. Three observers, each observing two plots used telescopes to conduct simultaneous counts of all shorebirds on the six study plots. Observers rotated among pairs of plots on successive days. Each count period consisted of three 20-min counts initiated at 30-min intervals as the edge of the falling tide receded through the study plots; shorebirds generally foraged near the edge of the falling tide (Recher 1966, Evans and Dugan 1984). We recorded the peak number

[1] Triani, M. 1994. Influence of oyster culture methods on benthic infauna of Humboldt Bay, California. Draft M.S. Thesis, Humboldt State University, Arcata, California, USA.

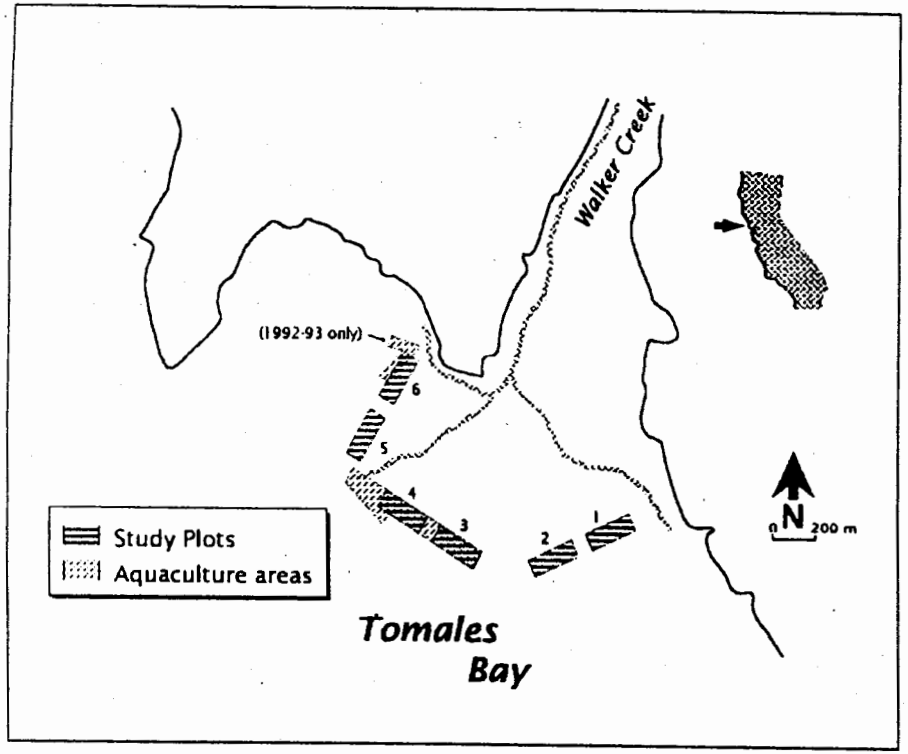

Figure 1. Shorebird study plots and aquaculture lease areas of Walker Creek Delta, Tomales Bay, California. Gray lines show the stream channels.

of birds of each species seen in each plot during each 20-min count interval. Abundances from the three count intervals were averaged to provide an index of shorebird use. We did not estimate absolute density because of increasing exposure of suitable foraging habitat as the water level receded.

To account for possible population effects on annual and intraseasonal differences in habitat use, we compared results with Tomales Bay-wide counts (Kelly[2] 1990-94). We conducted three Tomales Bay-wide counts in early winter (November-December) and three in late winter (15 January - 28 February) each year. We generally scheduled Tomales Bay-wide counts within 3-7 days of plot counts. Kelly[3] (1990) described the census methods.

[2] Kelly, J.P. 1990-94. Annual report of the Tomales Bay shorebird census. ACR Project Reports 89-4-1, 89-4-2, 89-4-3, 89-4-4, and 89-4-5, Audubon Canyon Ranch, Stinson Beach, California, USA.

[3] Kelly, J.P. 1990. 1989-90 winter and spring shorebird abundances on Tomales Bay, California, and notes on the movements of shorebirds within Tomales Bay. ACR Project Report 89-4-1, Audubon Canyon Ranch, Stinson Beach, California, USA.

Statistical Analysis

We used a mixed-model analysis of covariance (ANCOVA), controlling for displacement of shorebirds by roosting gulls, to model patterns of abundance. Prior to the analysis, the plot counts were log-transformed to normalize the data. Aquaculture treatment (presence or absence) and intraseasonal timing (early vs. late winter) were considered to be fixed effects; plots (nested within control and aquaculture areas) and years were considered to be random effects. We used this same analysis method to examine species diversity within plot counts, based on the Shannon index (Magurran 1988). We tested for associations between the abundance of gulls and shorebirds on the study plots using correlation analysis.

We investigated the possibility that habitat use gradients occur on the delta by using ANCOVA to test for differences (fixed effects) between (i) control plots on the northwest (Plots 5 and 6) and southeast (Plots 1 and 2) sides of the delta and (ii) control plots on the inner (Plots 1 and 6) and outer (Plots 2 and 5) portions of the delta (Fig. 1). We examined the possible influence of the partial use of Plot 6 for aquaculture on shorebird abundance by using ANCOVA to test for differences (fixed effects) between (i) Plot 6 in 1992-93 and the other 4 years of study, and (ii) Plot 6 and the other control plots in 1992-93. Further, ANCOVA models generated for each species were repeated after removing the 1992-93 Plot 6 data and examined for differences in the significance levels of individual effects.

A maximum likelihood approach was used to estimate parameters of the ANCOVA models (BMDP Program 3V; Dixon 1992). The significance of each source of variation was tested with a likelihood ratio chi-square comparing the original model with a submodel in which the associated parameter was set to zero.

RESULTS

While completing 360 shorebird plot counts, we observed dense concentrations of gulls roosting on Walker Creek Delta. The maximum number of gulls observed within a plot was 7,400; the median was 65. Of all gulls observed on study plots, 76.6% were California gulls, *Larus californicus*; 18.2% were western, *Larus occidentalis*, or glaucous-winged gulls, *Larus glaucescens*; 5.4% were ring-billed gulls, *Larus delawarensis*; and 0.8% were mew gulls, *Larus canus*. The number of gulls occupying study plots was inversely related to the number of marbled godwits, *Limosa fedoa* ($r = -0.15$, $P < 0.01$); western sandpipers, *Calidris mauri* ($r = -0.20$, $P < 0.001$); least sandpipers, *Calidris minutilla* ($r = -0.21$, $P < 0.001$); dunlins, *Calidris alpina* ($r = -0.26$, $P < 0.001$); willets, *Catoptrophorus semipalmatus* ($r = -0.12$, $P < 0.05$); and all shorebirds combined ($r = -0.25$, $P < 0.001$). Correlations of gull abundance with black-bellied plover, *Pluvialis squatarola* ($r = -0.08$), and sanderling, *Calidris alba* ($r = -0.04$) were negative, but not significant ($P > 0.05$).

It is not likely that these relationships resulted from differences in habitat use because gulls and shorebirds used the same areas and we obtained similar results in separate within-plot analyses. The negative signs of correlation coefficients between gulls and all seven species of shorebirds analyzed in this paper suggest that roosting

gulls displaced shorebirds in areas of otherwise suitable shorebird habitat. Therefore, we used ANCOVA to control for the effects of roosting gulls on the use of control and aquaculture plots by shorebirds.

Oyster workers were present on aquaculture areas during 62% of our counts, suggesting that human activity might have influenced bird distributions. However, the distribution of gulls on the delta was not related to the presence of oyster workers (likelihood ratio = 0.58, P >0.45) or developed aquaculture areas (likelihood ratio = 0.001, P >0.97). We observed no movements of shorebirds into or out of plots in response to human activity and the distributions of shorebirds were not significantly related to the presence of oyster workers on aquaculture plots (ANCOVA; P = 0.11, 0.59, 0.89, 0.10, 0.49, 0.68, 0.17 for black-bellied plover, willet, marbled godwit, sanderling, western sandpiper, least sandpiper, and dunlin). The most abundant shorebird species we observed was dunlin, followed by least sandpiper and western sandpiper (Table 1). Sanderlings and larger shorebirds such as marbled godwits and willets were less abundant. Greater yellowlegs, *Tringa melanoleuca*; ruddy turnstones, *Arenaria interpres*; black turnstones, *Arenaria melanocephala*; short-billed dowitchers, *Limnodromus griseus*; and long-billed dowitchers, *Limnodromus scolopaceus*, each occurred on less than 10% of plot counts.

Data for seven species were adequate for parametric tests of the hypothesis that abundance on aquaculture and control areas did not differ (Table 2). Use of control and aquaculture areas by black-bellied plovers, marbled godwits, sanderlings, and least sandpipers was not significantly different than expected by chance, given the underlying variation among the nested plots (P >0.05) (Tables 1 and 2). However, western sandpipers and dunlins were significantly less abundant (P <0.05) and willets significantly more abundant (P <0.001) on aquaculture plots than on control plots.

A significant difference in the use of all study plots by willets between early and late winter (Table 2: Seasons) resulted primarily from mid-season influxes onto aquaculture plots (Table 1; F = 29.92, df = 1, 118, P < 0.001). Smaller early-to-late winter increases of willets occurred on control plots (Table 1; F = 9.46, df = 1, 238, P = 0.002). We found no general baywide intraseasonal increase (pooled across years) in willet numbers on Tomales Bay (F = 1.75, df = 1, 27, P = 0.20) and no significant baywide intraseasonal differences were found within individual years (F values for all years not significant: P > 0.05; Kelly[2] 1990-94).

A significant early-to-late winter difference in the use of study plots by marbled godwits (Table 2) also resulted from mid-season increases on aquaculture plots (Table 1; F = 8.23, df = 1,118, P = 0.005); early-to-late winter differences on control plots were not significant (Table 1; F = 0.58, df = 1, 238, P = 0.45). We found no general baywide intraseasonal increase (pooled across years) in number of marbled godwits (F = 0.56, df = 1,27, P = 0.46); within years, marbled godwits increased only in 1990-91 (F = 35.04, P < 0.01, df = 1,3; Kelly[2] 1990-94).

Interactions between areas, seasons, and years accounted for some of the variability of shorebird abundance. Differences in abundance of black-bellied plovers, willets, and least sandpipers between control and aquaculture areas were partly dependent on winter timing (Table 2: Areas x Seasons). Differences in

Table 1. Means and 95% confidence intervals of means (L_1 - L_2) of shorebird abundance on study plots from 1989-90 to 1993-94 at Walker Creek Delta, Tomales Bay, California n = 116 and 124 on early winter (EW) and late winter (LW) control plots and 58 and 62 on EW and LW aquaculture plots. Confidence intervals are asymmetric because values are transformed back into linear scale from log-transformed data.

		Control		Aquaculture	
Species	Season	Mean	L_1 - L_2	Mean	L_1 - L_2
Black-bellied Plover	EW	0.91	0.65 - 1.22	1.36	0.81 - 2.08
	LW	0.99	0.71 - 1.32	0.43	0.23 - 0.68
Greater Yellowlegs	EW	0.00	0.00 - 0.00	0.02	-0.01 - 0.06
	LW	0.00	0.00 - 0.00	0.00	0.00 - 0.00
Willet	EW	0.42	0.20 - 0.58	1.45	0.87 - 2.20
	LW	0.84	0.63 - 1.08	5.03	4.01 - 6.27
Marbled Godwit	EW	2.44	1.53 - 3.66	1.27	0.57 - 2.28
	LW	3.01	2.10 - 4.19	4.15	2.39 - 6.81
Ruddy Turnstone	EW	0.02	0.00 - 0.03	0.12	0.05 - 0.20
	LW	0.00	0.00 - 0.02	0.02	0.00 - 0.04
Black Turnstone	EW	0.08	0.03 - 0.13	0.31	0.13 - 0.53
	LW	0.00	0.00 - 0.00	0.02	-0.01- 0.05
Sanderling	EW	1.82	1.14 - 2.72	2.48	1.27 - 4.34
	LW	0.81	0.51 - 1.17	2.09	1.14 - 3.45
Western Sandpiper	EW	23.63	16.28 - 34.10	2.99	1.60 - 5.15
	LW	9.83	6.14 - 15.41	1.80	0.90 - 3.13
Least Sandpiper	EW	36.61	24.98 - 53.44	9.20	4.95 - 16.48
	LW	9.61	6.01 - 15.07	10.86	6.25 - 18.39
Dunlin	EW	111.72	69.88 -178.26	9.12	4.63 - 17.20
	LW	23.24	13.91 - 38.40	5.97	3.09 - 10.88
Long-billed Dowitcher	EW	0.00	0.00 - 0.00	0.00	0.00 - 0.00
	LW	0.05	-0.02 - 0.12	0.00	0.00 - 0.00
Short-billed Dowitcher	EW	0.11	0.03 - 0.20	0.09	0.01 - 0.17
	LW	0.00	0.00 - 0.01	0.01	0.01 - 0.02
Dowitcher (Grouped)	EW	0.12	0.05 - 0.20	0.37	0.13 - 0.65
	LW	0.02	-0.01- 0.05	0.12	0.02 - 0.23
Gull species (Covariate)	EW	64.22	43.49 - 94.62	160.99	112.23 - 230.75
	LW	154.27	113.37 - 209.80	74.91	49.89 - 112.24

Table 2. Components of variation of log-transformed winter shorebird abundance at Walker Creek Delta, Tomales Bay, California. Analysis of covariance was used to control for the displacement of shorebirds by gulls. $*P < 0.05$, $**P < 0.01$, $***P < 0.001$.

Source of Variation	Black-bellied Plover	Willet	Marbled Godwit	Sanderling	Western Sandpiper	Least Sandpiper	Dunlin
AREAS							
(control vs. aquaculture)							
Parameter Estimate	0.014	-0.189	0.016	-0.080	0.344	0.126	0.395
Standard Error	0.032	0.036	0.060	0.121	0.154	0.181	0.125
Likelihood Ratio χ^2 (df = 1)	0.183	10.952***	0.069	0.427	3.914*	0.479	6.159*
PLOTS							
(nested within AREAS)							
Parameter Estimate	0.002	0.004	0.009	0.038	0.076	0.099	0.025
Standard Error	0.002	0.003	0.009	0.028	0.056	0.071	0.025
Likelihood Ratio χ^2 (df = 1)	2.654	7.661**	4.586*	35.753***	27.331***	32.703***	4.108*
YEARS							
Parameter Estimate	0.041	0.002	0.143	0.065	0.035	0.000	0.285
Standard Error	0.028	0.009	0.102	0.074	0.073	0.000	0.240
Likelihood Ratio χ^2 (df = 1)	11.703***	0.081	6.442*	1.169	0.288	0.000	3.286
SEASONS							
(early vs. late winter)							
Parameter Estimate	0.041	-0.132	-0.124	0.052	0.118	0.114	0.185
Standard Error	0.024	0.038	0.050	0.035	0.070	0.050	0.090
Likelihood Ratio χ^2 (df = 1)	2.575	7.030**	4.082*	1.826	2.281	3.745	3.119

Table 2. Continued.

Source of Variation	Black-bellied Plover	Willet	Marbled Godwit	Sanderling	Western Sandpiper	Least Sandpiper	Dunlin
AREAS X SEASONS							
Parameter Estimate	-0.062	0.062	0.059	0.044	0.035	0.125	0.103
Standard Error	-0.024	0.022	0.036	0.027	0.054	0.046	0.048
Likelihood Ratio χ^2 (df = 1)	5.319*	5.465*	2.141	2.706	0.404	6.045*	3.520
AREAS X YEARS							
Parameter Estimate	0.000	0.001	0.006	0.068	0.066	0.121	0.088
Standard Error	0.000	0.005	0.015	0.051	0.067	0.070	0.073
Likelihood Ratio χ^2 (df = 1)	0.000	0.063	0.177	9.307**	1.819	7.168**	3.192
SEASONS X YEARS							
Parameter Estimate	0.000	0.010	0.012	0.006	0.020	0.005	0.059
Standard Error	0.000	0.010	0.017	0.007	0.035	0.014	0.049
Likelihood Ratio χ^2 (df = 1)	0.000	2.185	0.648	1.210	0.318	0.195	2.083
AREAS X SEASONS X YEARS							
Parameter Estimate	0.006	0.004	0.008	0.000	0.023	0.000	0.000
Standard Error	0.004	0.006	0.016	0.000	0.035	0.000	0.000
Likelihood Ratio χ^2 (df = 1)	4.496*	1.108	0.495	0.000	0.883	0.000	0.000
GULLS: Covariate							
Parameter Estimate	-0.018	-0.057	-0.073	0.016	-0.087	-0.156	-0.112
Standard Error	0.023	0.023	0.041	0.038	0.060	0.065	0.066
Likelihood Ratio χ^2 (df = 1)	0.599	5.796*	2.996	0.164	1.998	5.599*	2.601

abundance of black-bellied plovers and marbled godwits between control and aquaculture areas were partly dependent on differences among years (Table 2: Areas x Years). Winter timing influenced the abundance of black-bellied plovers on control and aquaculture areas differently among years (Table 2: Areas x Seasons x Years).

Comparisons of shorebird abundance among control plots showed no underlying habitat gradients and additional analyses using subsets of controls were consistent with our initial results. Habitat use did not differ between the inner (Plots 1 and 6) and outer (Plots 2 and 5) portions of the control area for all species analyzed (P ranged from 0.45 to 0.88), except for sanderlings, which were significantly more abundant on outer control plots than on inner control plots (likelihood ratio = 4.11, $P = 0.043$). Habitat use by black-bellied plover, willet, marbled godwit, sanderling, and dunlin did not differ between the northwest and southeast sides of the delta (P ranged from 0.06 to 0.88). Western sandpipers and least sandpipers used the northwest side of the delta significantly more than the southeast side (likelihood ratios = 6.78 and 8.53; $P < 0.01$). An additional ANCOVA using only control plots on the southeast side of the delta, where western sandpiper abundance was lower, was consistent with the initial results based on all four control plots, showing significant avoidance of the aquaculture area (likelihood ratio = 8.04, $P < 0.01$). Analysis of covariance using only control plots on the northwest side, and in a separate analysis, only control plots on the southeast side of the delta confirmed the absence of significant aquaculture effects on least sandpiper abundance (likelihood ratios = 2.94 and 0.23, $P > 0.05$). Although dunlin abundance did not differ significantly between control areas on the two sides of the delta (likelihood ratio = 3.52, $P = 0.06$), mean values were higher on the southeast side. Analysis of covariance based only on control plots on the northwest side of the delta confirmed our initial results showing significant avoidance of the aquaculture area by dunlins (likelihood ratio = 4.02, $P = 0.045$).

The presence of aquaculture equipment on up to 15% of Plot 6 in 1992-93 did not influence the overall results. Shorebird abundance on Plot 6 did not differ ($P > 0.05$) between 1992-93 and the other 4 years of study and, except for willets, did not differ ($P > 0.05$) from other control plots in 1992-93. Willets were significantly more abundant on Plot 6 in 1992-93 than on the other control plots (likelihood ratio = 4.19, $P = 0.041$) as a result of the regular occurrence of one individual in the vicinity of the oyster racks (J. Kelly, pers. obs.). Analysis of covariance models generated for each species after removing the 1992-93 Plot 6 data produced the same significant effects as the original analyses. However, the strength of significant aquaculture effects increased; probabilities that the observed aquaculture effects on abundance of western sandpipers, dunlins, and willets were random were further reduced (likelihood ratios = 5.62, 8.13, 15.10; P= 0.022, 0.004, 0.0001; cf Table 2).

Species richness did not differ between control and aquaculture plots (likelihood ratio = 0.007, $P = 0.93$). We also found no significant difference in proportional species diversity, based on the Shannon index, between control and aquaculture plots (likelihood ratio = 0.616, $P = 0.43$).

DISCUSSION

Wintering western sandpipers and dunlins avoided aquaculture areas, whereas willets favored these areas. These differences were not the result of underlying spatial variation detectable among plots nested within areas. However, we must consider the alternative hypothesis that observed differences between control and aquaculture areas resulted from underlying (pre-aquaculture) habitat conditions along a larger habitat gradient. Although our study did not have a complete set of temporal treatments to control for larger spatial effects, aquaculture development on up to 15% of Plot 6 in 1992-93 influenced the strength of the results. Shorebird use of Plot 6 in 1992-93 was not significantly different from other control plots or years, but the higher significance levels that resulted from the removal of 1992-93 Plot 6 data were consistent with our other results, suggesting that aquaculture effects were independent of underlying spatial gradients. We emphasize, however, the need for further corroboration using more complete temporal controls.

Differences in shorebird densities have been related to differences in foraging substrate types (Page et al. 1979; Myers et al. 1980; Quammen 1982, 1984; Hinklin and Smith 1984; Yates et al. 1993). Existing evidence suggests that pre-aquaculture substrates were similar among plots. Before the development of the aquaculture area, surface sediments at Walker Creek Delta were composed of fine sands, silts, and clays; "clayey silts" (> 50% silt; median grain size = 0.004 - 0.063 mm) dominated the entire study area, with transitional occurrences of poorly sorted "sand-silt-clay" (< 50% of each class; median grain size = 0.063 - 0.250 mm) on the southwest edge of the delta, primarily below MLLW (Daetwyler 1966). Therefore, pre-aquaculture substrates could have had an increasing proportion of fine sands on the outer edge of the delta, but primarily below the lower edge (MLLW) of the study plots. Further evidence that possible pre-aquaculture sediment gradients did not affect our results was found in the absence of underlying habitat use gradients between control plots on the inner and outer delta. Substrates did not appear to differ among study plots, although we did not measure sediment characteristics during our study. Some accumulations of very fine unconsolidated material characteristic of oyster pseudofeces (Day et al. 1987) were occasionally observed in the aquaculture plots (J. Kelly, pers. obs.).

Shorebird density and distribution often varies with the density of prey (Goss-Custard et al. 1977, Connors et al. 1981, Hinklin and Smith 1984, Evans and Dugan 1984, Wilson 1990, Colwell and Landrum 1993). However, pre-aquaculture substrate conditions in the vicinity of our study (Daetwyler 1966) may not have been associated with measurable differences in prey species composition, diversity, or density. Johnson (1971) reported that it is rarely possible in Tomales Bay to demonstrate a high correlation between the abundance or distribution of invertebrate species and a specific property of the sediment, such as particle size. Juskevice[4] (1969) found positive correlations in Tomales Bay between the abundance,

[4]Juskevice, J.A. 1969. Interspecific correlation and association in benthic marine communities. Ph.D. Dissertation, University of Chicago, Chicago, Illinois, USA.

of a few invertebrate species and particle size, but only within a narrow range of particle sizes. Therefore, existing evidence suggests that significant pre-aquaculture habitat differences between control and treatment plots may not have been detectable. Nevertheless, without more extensive temporal treatment of control areas, our results only suggest that aquaculture effects on shorebirds were independent of underlying spatial habitat differences.

Hypotheses that could explain factors or processes responsible for the observed differences in shorebird abundance between aquaculture and control areas were not tested in this study. Such hypotheses include reduced or increased foraging opportunities related to (i) aquaculture-induced changes in the abundance or availability of preferred prey (Triani[1] 1994); (ii) alteration of foraging substrates related to aquaculture-induced accumulation of pseudofeces or other sediments (Day et al. 1987, Deslous-Paoli et al. 1992); (iii) alteration of foraging substrates associated with foot traffic by oyster growers, maintenance of stakes and bags, or other aquaculture related activities; (iv) selection or avoidance of oyster bags or racks as foraging substrates; (v) differences in opportunities for group foraging or territoriality resulting from the interruption of open foraging areas by oyster bags and racks; or (vi) differences in risk of predation by raptors.

On numerous occasions, we observed least sandpipers foraging on top of oyster bags as well as on sediments below elevated oyster bags; in contrast, western sandpipers and dunlins generally foraged under or between rows of oyster bags. The primary foraging method used by least sandpipers is pecking at the substrate surface (Baker and Baker 1973), which probably involves visual cues. An emphasis on visual searching and surface feeding may allow least sandpipers to exploit the surfaces of oyster bags and racks and may account for the absence of significant differences in their abundance between control and aquaculture areas. In contrast, dunlins (Baker and Baker 1973) and western sandpipers (Recher 1966, Ashmole 1970) forage more often by probing into substrates and may therefore be less suited for feeding on or around oyster bags and racks. These behavioral differences could account for the reduced abundance of western sandpipers and dunlins we observed in the aquaculture area.

Our results suggest that willets preferred areas with aquaculture activity as feeding areas in winter. We often saw willets foraging on or between aquaculture structures, suggesting enhanced foraging opportunities for willets in these areas. Willets are known to use a wide variety of foraging habitats and prey species and may show seasonal changes in diet (Recher 1966, Stenzel et al. 1976, Page et al. 1979, Kelly and Cogswell 1979). Our results also suggest that willets may exploit aquaculture areas to a greater extent as winter progresses, perhaps opportunistically as food availability or competition for food changes among habitat areas.

Western sandpipers or dunlins may be at greater risk of predation by raptors in aquaculture areas than on open tidal flats because of (i) reduced visibility and delayed detection of approaching predators in aquaculture areas, (ii) increased predation pressure related to the use of aquaculture equipment for perches by predators, or (iii) disruption of antipredator flocking behavior (Page and Whitacre 1975, Kus et al. 1984) related to the interruption of open foraging areas by oyster bags and racks. In spite of these possibilities, foraging least sandpipers remained on the ground beneath elevated oyster racks during attacks by a peregrine falcon, *Falco peregrinus*, (J. Kelly, pers. obs.), suggesting that aquaculture areas provide increased cover that may protect some species from predation.

Several authors have provided evidence that shorebird populations may be limited by foraging opportunities or habitat modification during winter (Baker and Baker 1973; Goss-Custard 1979, 1984; Evans and Pienkowski 1984; Senner and Howe 1984; Goss-Custard et al. 1995). Evans (1991) estimated that most mortality in dunlins (76%) occurs during the nonbreeding season. In our study, avoidance of aquaculture plots by western sandpipers and dunlins substantially outweighed the selection of aquaculture areas by willets (Table 1). If shorebirds are limited by wintering habitat, changes in habitat use may reflect population effects. When we scaled observed differences in shorebird use to population sizes on Tomales Bay (mean baywide winter abundances of 400, 6,033, and 1,851 for willet, dunlin, and western sandpiper; Kelly[2] 1990-94), average decreases in dunlin and western sandpiper on aquaculture plots were 1.52 and 1.18 times greater than the relative increase observed in willets. When scaled to estimated Pacific Flyway populations (70,000, 450,000-600,000, and 1,300,000 for willet, dunlin, and western sandpiper; Page and Gill 1994), the average decrease in dunlin was 2.70-3.51 times greater than the increase in willet, whereas the proportional decrease in western sandpiper, the most abundant shorebird species in the Pacific Flyway, was only 0.30 times the increase in willet. We emphasize that these comparisons are based on rough population estimates and should be interpreted cautiously.

Existing evidence suggests that (i) foraging shorebirds generally concentrate along the edge of the falling or rising tide (Recher 1966, Evans and Dugan 1984); (ii) oyster growers concentrate their operations on intertidal strata with particular tidal exposure regimes, generally below 0.3 m MLLW (pers. obs.); (iii) small losses in the extent or quality of available feeding habitat could result in proportionally greater decreases in wintering shorebird populations (Myers et al. 1979, Goss-Custard 1979, Senner and Howe 1984); and (iv) the two most abundant shorebird species on Tomales Bay (Kelly[2] 1990-94) and other coastal wetlands of the Pacific Flyway (Kjelmyr et al.[5] 1991) significantly avoided areas used for aquaculture on Tomales Bay (this study). Therefore, foraging opportunities for some species may be particularly limited when tide levels coincide with elevational strata preferred for growing oysters. Although willets may forage preferentially in these areas, and species diversity based on proportional abundances is not significantly affected, our results suggest a net decrease in overall shorebird use of open tidal flats developed for aquaculture.

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ROOSEVELT ELK ALONG THE PRAIRIE CREEK DRAINAGE: AN EVALUATION OF ESTIMATING ABUNDANCE AND HERD COMPOSITION

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Roosevelt elk, *Cervus elephus roosevelti*, abundance north of Orick, Humboldt County, California, was estimated using a mark-resight method for individuals that possessed unique scars, pelage, and antler configurations. Estimated population size was 115 (95% CI = 105-134). Calf:cow, yearling bull:cow, and bull:cow ratios were 0.45:1, 0.21:1, and 0.38:1. Monte Carlo simulations using the joint hypergeometric distribution suggest that improvements in the reliability of estimates can be obtained by increasing the number of resight episodes and observing a large proportion of the population. Estimating size of this unhunted population using the mark-resight approach appears to be reliable and cost-effective.

INTRODUCTION

Since at least the 1920s, Roosevelt elk, *Cervus elephus roosevelti*, have been more abundant in Humboldt County than in any other part of California (Harper et al. 1967, McCullough 1969, Mandel and Kitchen[1] 1979). In particular, an area north of Orick, including the riparian-meadow habitat along Prairie Creek, Gold Bluffs Beach, and Boyes Prairie, has frequently been mentioned as supporting abundant populations of Roosevelt elk (Barnes 1925 a, b; Prescott 1925; Dasmann[2] 1964; Harper et al. 1967; Franklin[3] 1968; Lieb[4] 1973; Mandel and Kitchen[1] 1979; Bowyer 1981). In spite of the seeming abundance of elk in this area, there has been no estimate of the population size that is based on objective, repeatable methods and that measures sampling variation. The reason, in part, has to do with the dense vegetation and the apparent difficulty of detecting individuals. The primary objective of my study was to develop a cost-effective protocol for reliably estimating abundance using a mark-resight approach (White 1996). I estimated population size and 95% confidence interval

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UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
Southwest Region
777 Sonoma Avenue, Room 325
Santa Rosa, California 95404

January 21, 1998 F/SW022:TYD

Lt. Colonel Richard G. Thompson
District Engineer
San Francisco District
U.S. Army Corps of Engineers
333 Market Street
San Francisco, California 94105-2197

Dear Colonel Thompson:

Thank you for the opportunity to review Public Notice 22720N (PN), dated November 24, 1997. The applicant, Coast Seafoods Company, has applied for a Department of the Army permit to place oyster seed and apparatus used for off-bottom and bottom oyster culture in Humboldt Bay, Humboldt County, California. Coast Seafood's harvest of oysters will be conducted with use of hydraulic dredging and hand-picking, from 500 acres of Humboldt Bay substrate and waters.

Federally listed threatened southern Oregon/northern California coastal (SONCC) coho salmon and proposed as threatened northern California (NC) steelhead trout are known to be present within the proposed oyster harvest area. The juvenile life phase of these salmonids is susceptible to impacts from oyster culture operations. Juvenile salmonids rear in eelgrass areas and feed on animals that live on eelgrass blades. Loss of available habitat to juvenile salmonids within the affected area has not been well documented, but decreases in the eelgrass habitat would presumably impact the juvenile life stage of these fish.

According to the project description, there have been cumulative losses of eelgrass due to oyster culture, although the loss over two decades have not been clearly determined. The Corps of Engineers (Corps) has determined that more information is needed to assess the significance of impacts of oyster harvesting on the environment.

Coast Seafoods has proposed to minimize impacts of their operations by following the actions set forth in the First Draft Management Plan, Coast Seafood, July 1997. The Management Plan proposes the following measures to minimize impacts to the environment: 1) Production of oysters would cease in eelgrass beds, 2) Coast Seafoods would also convert most of its oyster

culture operations to off-bottom culture the first year after the adoption of the management plan, which would occur after permits are obtained 3) Coast Seafoods will limit its "bottom culture" harvesting methods to hydraulic and/or hand picking methods, and 4) Coast seafoods proposes an advisory committee be formed to review the management plan on an annual basis.

Based on available information, the National Marine Fisheries Service (NMFS) provides the following comments:

1) Due to past and continuing effects of oyster culture on eelgrass, which serves as habitat for threatened SONCC coho salmon and NC steelhead trout, NMFS recommends that oyster culture not be permitted in eelgrass areas, or potential eelgrass habitat.

2) The NMFS recommends increased use of off-bottom culture to further reduce the adverse impacts to SONCC coho salmon and NC steelhead trout.

3) Current information suggests that hydraulic dredging appears to be the least damaging method of harvesting oysters. NMFS recommends that this method of harvest be used by Coast Seafoods in their operations.

Incidental take of threatened SONCC coho salmon, NC steelhead trout, and other adverse effects to these species may result from the proposed action. Our recommendation is that the Corps initiate section 7 consultation pursuant to the Endangered Species Act of 1973.

If you any questions concerning these comments please contact Mr. Thomas Daugherty at (707) 575-6069.

Sincerely,

James R. Bybee

James R. Bybee
Environmental Coordinator
Northern California

cc:
R. Brown - USFWS
D. Ammerman - USACE
D. McKee - CDFG

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FISH & WILDLIFE SERVICE
CCFWO, ARCATA, CA

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January 29, 1998

Lieutenant Colonel Richard G. Thompson
District Engineer
Attention: Regulatory Branch
Eureka Field Office
U. S. Army Corps of Engineers
P. O. Box 4863
Eureka, California 95502

Dear Lieutenant Colonel Thompson:

Department of Fish and Game (DFG) personnel have reviewed Public Notice (PN) No. 22720N regarding the application of Coast Seafood Company for a Department of the Army permit to grow and harvest oysters in Humboldt and Arcata Bays. More specifically, the applicant proposes to place oyster seed and apparatus used for off-bottom and bottom culture over 500 acres of northern Humboldt and Arcata Bays during any given crop cycle (three to four years). In addition, Coast Seafood Company proposes to harvest oysters by hydraulic dredging and hand-picking from approximately 500 acres of Bay waters and intertidal mudflats adjacent to the cities of Eureka and Arcata.

In an effort to minimize impacts on the resources of Humboldt and Arcata Bays due to oyster culture, Coast Seafood Company proposes to modify its former aquaculture operations which consist primarily of bottom culture. In their draft Management Plan (October 1997), Coast Seafood proposes to culture a "floating" or changeable, 500-acre plot within its 3384.5 acres of tidelands lease in Humboldt and Arcata Bays, convert 70 percent of its historical bottom culture to off-bottom culture within a three-year period in areas free of eelgrass, utilize 150 of the 500 acres for bottom culture in areas without eelgrass, discontinue use of a drag dredge to harvest bottom-cultured oysters and replace this method with hydraulic dredge and/or hand picking, utilize off-bottom long-line and rack-and-bag methods in their conversion from bottom to off-bottom culture, and abandon 56.25 acres of historical production sites.

The DFG is supportive of a phased-in conversion from bottom culture, a method often associated with adverse impacts, to off-bottom culture, a method with potentially less impacts, as well as the replacement of drag dredge with hydraulic dredge and hand picking as methods of harvest. However, the DFG has the following concerns about the potential effects of this proposal, as it is described in the Public Notice, on a variety of fish and wildlife resources in Humboldt Bay:

- In order to properly evaluate the proposed operation, it would be helpful to remove apparent discrepancies in the reported production acreage. Acreage quantities in the Management Plan do not agree necessarily with figures listed in the PN Summary, i.e.,

  PN indicates that the total acres of Pacific longlines added to production = 177 acres, **(we calculate 267.85 acres)**

  PN indicates that the net loss of cultured area (by the year 1999/2000) = 159.9 acres, **(we calculate 69.9 acres)**

  Coast reports 500 acres in total production, however, 150 acres remaining (bottom culture) added to 268 acres (new calculation for added longline) totals only **418** acres.

- Coast Seafood should clarify in its Management Plan that the areas designated on the proposed planting maps for cultivation are subject to change as a result of the "floating" 500 acres approach and that those maps would be updated annually.

- The importance of eelgrass beds to a variety of marine vertebrate and invertebrate species has been well documented. The cumulative loss of eelgrass in northern Humboldt and Arcata Bays is of particular concern to the DFG, and oyster cultivation has been reported to be a major contributor to these losses. There is substantial evidence that bottom culture severely impacts eelgrass beds, although longline off-bottom culture is not without its own potential negative impacts. For example, the use of longlines has been shown to cause sedimentation underneath culture sites which could have adverse impacts on adjacent eelgrass beds. Increased sedimentation also could affect benthic epifauna and infauna underneath and in the vicinity of longline sites. Additionally, the placement of longline apparatus in Bay waters can influence tidal flows and circulation.

- Disturbance to resident and migratory shorebirds as a result of the use of longlines in oyster culture is another concern of the DFG. Shorebirds in general are gregarious species requiring large open expanses for foraging, roosting, and preening. In the Humboldt Bay area, shorebirds generally forage in intertidal areas above the upper limit of eelgrass growth. Shorebirds are active during the day as well as at night. Placement of vertical structures in these habitats limits shorebird visibility and may provide obstacles during night time activities. Longlines will cover mud flats used exclusively by shorebirds at low tides and may cause direct loss of foraging habitat. In addition, areas surrounding longlines may be avoided by shorebirds as well. Consolidating cultivation sites, if feasible, could potentially reduce the impacts to shorebirds.

- Other potential impacts due to bottom and off-bottom culture that the DFG is concerned with are the potential disturbances to marine mammals, particularly during breeding and pupping season; displacement of recreational users such as sport fishermen, clammers, and waterfowl hunters; changes to the substrate; depredation of species around bottom culture operations; and effects on endangered, threatened, or other special status species that are found in the area. More information needs to be provided on the potential impacts to these resources as a result of the proposed oyster cultivation operation.

As a result of the aforementioned concerns, yet keeping in mind the DFG's legislative mandate to promote aquaculture in California while minimizing impacts to the marine environment, we recommend that the Army Corps of Engineers issue an individual permit to Coast Seafood Company for a limited period of no more than five years with the following two conditions: 1) Coast Seafood should be required to amend their Management Plan to include a multiyear monitoring plan, approved by the DFG, that will address all of the concerns of our agency and will fully identify any additional significant impacts to fish and wildlife resources as a result of the change in operations. A baseline study, done in the first year of the monitoring plan and designed in coordination with the DFG, could help identify minimal impact plots for longlines; and 2) potential mitigation measures such as alternative cultivation methods (e.g., rack, floating rack, and rack and bag), transplanting eelgrass, removal of debris, clean-up of abandoned sites etc., should be evaluated for the purpose of substantially reducing or eliminating impacts identified by the monitoring plan. Based on the results of the monitoring plan, it could then be determined by the regulating agencies whether refinement of Coast's Management Plan would be adequate to allow reissuance of the permit after 5 years, or whether a full Environmental Impact Statement would be needed at this time.

As always, DFG personnel are available to discuss our concerns and comments in greater detail. To arrange for discussion, please contact Ms. Becky Ota, Associate Marine Biologist, California Department of Fish and Game, Marine Resources Laboratory, 411 Burgess Drive, Menlo Park, California 94025, (650) 688-6361.

Sincerely,

DeWayne Johnston
Regional Manager
Marine Region

cc: Ms. Nadell Gayou
Projects Coordinator
Resources Agency
Sacramento, California

Mr. Richard L. Elliot
Regional Manager
Department of Fish and Game
Redding, California

Ms. Becky Ota
Department of Fish and Game
Menlo Park, California

Mr. A. Petrovich, Jr.
Deputy Director
Department of Fish and Game
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United States Department of the Interior

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February 6, 1998

Lieutenant Colonel Richard G. Thompson
District Engineer
Corps of Engineers, San Francisco District
Attention: David Ammerman, Regulatory Branch
Eureka Field Office
P.O. Box 4863
Eureka, California 95502-4863

Subject: Public Notice No. 22720N, Coast Seafoods Company, Bottom and Off-bottom Culture and Harvest of Oysters, Humboldt Bay, Humboldt County

Dear Lieutenant Colonel Thompson:

The Fish and Wildlife Service (Service) has reviewed Public Notice(PN) No. 22720N, which describes an application by Coast Seafoods Company for a Department of the Army permit to conduct oyster-culture activities in Humboldt Bay.

The Service previously submitted information to the Corps of Engineers (Corps) regarding the impacts of Coast Seafoods' culture activities on the fish and wildlife resources of Humboldt Bay in a letter dated June 16, 1997. That letter responded to a Corps pre-construction notification that proposed to authorize Coast Seafood's aquaculture operations under a Nationwide Permit No. 4, for actions conducted in waters of the United States related to Fish and Wildlife Harvesting, Enhancement, and Attraction Devices and Activities. Based upon comments received in response to that notification, we understand that the Corps determined the potential impacts of this proposed action do not meet the requirements for a Nationwide Permit and thereby warrant a full public interest review. In addition to the Service, a number of other agencies, organizations, and individuals, expressed concerns about the impacts of historic oyster culture operations on fish and wildlife resources in Humboldt Bay. In response, Coast Seafoods has developed an operations plan that proposes to address these concerns

by phasing project operations from predominantly bottom-culture techniques to mostly off-bottom techniques over a three-year period. We understand that Coast Seafoods is currently authorized to operate in areas of the Bay that do not support eelgrass, *Zostera marina*, on an interim basis under Nationwide Permit No. 4, and that authorization expired in January 1998.

The Service's comments regarding this PN have been prepared under the authority, and in accordance with the provisions, of the Fish and Wildlife Coordination Act (FWCA)(16 U.S.C. 661-667e, et seq.) and the Endangered Species Act (ESA)(16 U.S.C. 1531-1544 et seq.). Our comments and recommendations are presented within the framework of the Corps' preliminary environmental assessment format.

Project Description

Based upon the PN, Coast Seafoods' July 10, 1997 Management Plan, and their Tentative Planting Plan for the next three-years (97/98, 98/99 & 99/00), we understand that the Company proposes to alter the location and areal extent of tidelands on which they culture oysters. Although continuing the use of historic bottom-culture techniques, Coast Seafoods also plans to gradually reduce their reliance upon bottom-culture while increasing their use of off-bottom culture methods including Pacific long-lines and rack-and-bag techniques.

The Management Plan states that Pacific long-lines will consist of 200-foot-long ropes with oyster seed shells (cultch) threaded into the rope at one-foot intervals. The rope is suspended approximately one-foot off the bottom and is supported by PVC pipe spaced at 2.5-foot intervals along the rope. Groups of four long-lines running parallel to each other are spaced 10 feet apart from adjacent groups and each line in a group is 2.5 feet away from the next line. The rack-and-bag technique consists of mesh bags contain single seed oyster shell contained in mesh bags that are suspended approximately one-foot off the bottom in racks.

The length of rack rows or spacing between rows is not described in the Company's Plans or the PN. The percentage of off-bottom areas in long-lines versus rack-and-bag culture is not stated either. These details will be necessary in order to fully assess the proposed project.

We understand that Coast Seafoods has access, by ownership or lease, to approximately 3,945 acres of tidelands, located entirely in the North Bay of Humboldt Bay, for the purpose of oyster culture. Under the new planting plan they propose to culture on rotating plots that total no more than 500 acres in a given year. By the conclusion of

the third year they plan to have no more than 150 acres in bottom-culture, using off-bottom methods for the remaining 350 acres. At the end of this period Coast Seafoods states that they would evaluate whether they are able switch to a completely off-bottom culture operation based upon the success of this technique over the previous three years.

Coast Seafoods would continue to harvest bottom-culture oysters by hand-picking and hydraulic dredge. They would discontinue use of the drag dredge for harvesting. Off-bottom cultured oysters would be harvested by hand or by use of a barge and boom.

The PN, and Coast Seafoods' Plans indicate that by the completion of the three-year phase-in period the 150 acres of tidelands still in bottom-culture would be located in areas without eelgrass. Although not explicitly stated, we assume this means that until that time bottom-culture would continue to be conducted in areas where eelgrass does occur. We also understand that off-bottom culture will be conducted in areas that will have "minimal eelgrass impact". We take this to mean that off-bottom culture will occur in areas of lower density or patchy eelgrass distribution. The definition of minimal eelgrass impact needs to be explicitly defined before an evaluation of project impacts can occur.

Based upon the PN it is unclear what, if any, depredation control actions Coast Seafoods may implement in conjunction with future operations. The PN suggests that trawling for bat rays, *Myliobatis californica*, may have been permanently eliminated as a result of actions by the California Fish and Game Commission. But, we are led to believe that bat ray exclusion fencing around bottom-culture areas, with associated maze traps, and trapping for crabs, *Cancer antennarius*, and *C. productus* , or other species, may continue.

Comments Regarding the Preliminary Environmental Assessment

a. Impacts On The Aquatic Ecosystem
(1) Physical/Chemical Characteristics And Anticipated Changes

Substrate -

It is unclear to the Service whether there are areas, besides those under active cultivation, which continue to be affected by past oyster culture activities. Specifically, are there areas where shell was spread on the substrate to enhance oyster culture conditions, e.g. firm up substrate or eliminate eelgrass, which continue to have an impact on these areas? Any such areas should be identified and measures taken to mitigate for the impact of past actions, i.e. areas

of unnatural, extensive shell deposition should be remediated to pre-culture conditions. If such areas still exist, they should also be included in any analysis of impacts for ongoing culture activities.

In addition, as current culture areas are removed from use they should also be remediated to pre-culture substrate conditions to accelerate the re-establishment of flora and fauna associated with undisturbed intertidal substrates.

Erosion/Sedimentation Rate -

Based upon observations by Service staff at the site visit to Coast Seafoods' new off-bottom, long-line culture sites on December 11, 1997, it was apparent that increased sedimentation was occurring at the sites. It is believed that the change in current velocity through the sites caused by the off-bottom culture apparatus is enough to cause increased sedimentation. Such a change in sedimentation rate, and consequently substrate composition, may affect the populations of benthic and epibenthic organisms that use these sites and reduce the productivity and value of these areas for more mobile organisms that forage there.

Water Quality -

The PN and Coast Seafoods' Management Plans do not state whether chemically-treated wood products would be used for off-bottom culture structures. Any off-bottom culture structural components treated with preservatives that are toxic to marine life that could be released into the surrounding waters or sediments should not be used.

(2) Biological Characteristics And Anticipated Changes
Mud Flats (Special Aquatic Site) -

The PN recognizes the importance of mud flats as a source of food organisms for many of the fish and wildlife species that use Humboldt Bay. The Service, along with the California Department of Fish and Game (CDFG), and others, encouraged Coast Seafoods to change their culture methods from bottom to off-bottom techniques, and to move culture activities out of eelgrass meadows. However, the mud flats where culture activities would be focused under the proposed plan also have important fish and wildlife values. We are particularly concerned about impacts upon fish and wildlife that are dependant upon mud flats for specific needs; shorebirds and marine mammals are of greatest concern.

A study in Tomales Bay, California found that oyster culture structures in mud flat areas affected foraging use of these areas by

certain shorebird species (Kelly, et al. 1996). Such an impact in Humboldt Bay would be of particular concern due to the importance of the Bay as a stop along the Pacific Flyway for these species (Colwell 1994).

Mud flats in Arcata Bay are also used by harbor seals, *Phoca vitulina*, as haul out areas for resting and pupping. Specific locations of seal use in Humboldt Bay have been identified in the past (Barnhart, et al. 1992, per Monroe 1973) and should be reaffirmed, and avoided by culture activities.

We concur with the Corps' conclusion that "no precise quantification of impacts can be determined without further investigation." As such, it appears that surveys by the applicant are warranted to identify important mud flat areas for fish and wildlife use in order to avoid or minimize impacts to these areas from culture activities.

Vegetated Shallows (Special Aquatic Site)

In previous correspondence, the Service, and others, have discussed the importance of eelgrass to the ecology of Humboldt Bay and as a habitat feature for fish and wildlife. The PN includes additional information that addresses the importance of eelgrass meadows.

The PN states that "Coast Seafoods no longer firms up oyster beds or uses beds of oysters for culture." However, as noted previously, we are concerned about the lingering impacts of these activities upon the re-establishment of eelgrass. Studies likely will be necessary to determine how long after bottom culture is discontinued until the former functions, including native flora and fauna, are re-established. These studies may also need to research what, if any, remediation can be conducted on these tidelands to accelerate their return to fully functioning eelgrass habitats. Ceasing culturing activities alone may not result in the short-term re-establishment of eelgrass in these areas as is implied by the PN and Coast Seafoods' Management Plans.

Although Coast Seafoods has proposed to remove culturing activities from the areas of greatest eelgrass density, it appears that smaller patches of eelgrass will still be affected to a degree that has not yet been quantified. It is important to understand that these smaller patches of eelgrass are not without value to fish and wildlife. They still provide many, if not all, of the ecological functions that are ascribed to larger eelgrass meadows. Therefore, impacts to smaller areas of eelgrass must also be taken into consideration for mitigative purposes and should not be discounted.

For this reason, until we understand what impacts that long-line and rack and bag structures have upon intertidal areas, it would be appropriate to restrict these structures to previously disturbed areas rather than venturing into tidelands that have not previously been subject to culture impacts.

According to Coast Seafoods' proposal, up to 150 acres of bottom-culture would remain at the end of three-years, and might never be converted to off-bottom. It is the Service's position that all eelgrass impacted by the project should be mitigated and that avoidance is our preferred mitigation action.

Because culture activities are proposed to be rotated between various locations in the Bay, then the acreage impacted by the project at any given time may be greater than stated since recovery time of harvested plots is unknown. We recommend that the rotation of culture sites be limited until the recovery time for a cultured plot is determined.

We are also unclear why culture sites need to be rotated among sites and why or how particular sites are chosen for use. Neither the PN or Coast Seafoods' Plans explain why the rotation of plot locations is necessary or desirable. We recommend that the EA address this issue.

Wildlife Sanctuaries

We agree that Humboldt Bay National Wildlife Refuge (HBNWR) and Coast Seafoods have common interests, such as maintaining water quality and limiting the loss of tidelands to permanent development. However, there can also be conflicts as described in our letter of June, 1997 which included the following citation from the Service's 1988 EA update: "Increasing brant use of the bay is a primary refuge objective. Maintaining the integrity of the intertidal zone and the eelgrass community, and reduction of human disturbances is basic to the attainment of this objective" (Helvie, et al. 1988).

While bottom culture of oysters may result in a greater diversity of benthic invertebrates in culture sites(see Griffin 1997), stating that "oyster culture can complement and add to aquatic diversity of Humboldt Bay", exaggerates the benefits of culture activities to the ecology of the Bay, and focuses on but a single attribute of the intertidal zone. After all, the purpose of this activity is the monoculture of an exotic species. Further, any benefits realized immediately disappear when the oysters are harvested (Griffin 1997).

The importance of oysters as a food source for bat rays, crabs, or any other species that occur in Humboldt Bay, is debatable and currently not supported by any documented evidence (Gray et al. 1997). Because

of the well known importance of eelgrass to black brant, *Branta bernicla nigricans*, and many other species, the protection of eelgrass meadows are of paramount concern for the Service. Any benefits that cultured oysters might provide with respect to the diversity of the invertebrate community, or as forage of benthic feeding organisms, does not mitigate the loss of eelgrass.

We believe it is important to reiterate the Service's opinion that Humboldt Bay and the myriad species that rely upon the habitats it encompasses are an Aquatic Resource of National Importance. Clearly the eelgrass meadows of the Bay are one of its outstanding features.

Endangered Species

Project impacts to the brown pelican, *Pelecanus occidentalis californicus*, marbled murrelet, *Brachyramphus marmoratus*, and tidewater goby, *Eucyclogobius newberryi*, are described in the PN. After discussions between Service staff biologist Dan Licht and Corps Project Manager David Ammerman, Corps staff clarified they had decided that a "no effect" determination was appropriate for the tidewater goby and a "not likely to adversely affect" determination was concluded for the brown pelican and marbled murrelet. The Service concurs with these determinations.

Both the brown pelican and the marbled murrelet are known to use Humboldt Bay. The marbled murrelet is a diving bird that feeds primarily on small fish (especially in the summer) and invertebrates. Neither of these food sources is expected to be significantly impacted by project activities. The brown pelican dives from the air for fish, and less frequently, crustaceans. The food source for the brown pelican is not expected to be significantly impacted by the project.

However, both species may be disturbed by project activities. Of special concern is disturbance to juvenile murrelets. While we do not anticipate such disturbance to be adverse we do recommend that the Corps take measures to further minimize potential harassment and aid in the species conservation. As a conservation recommendation we advise the Corps to provide the applicants information on the marbled murrelet and brown pelican. We would be happy to provide this information if the Corps does not already have it.

This consultation addresses only the marbled murrelet, brown pelican, and tidewater goby. The Corps did not request consultation on other listed species for this project. No incidental take was requested for the proposed project, and none is authorized with this consultation. This concludes the informal consultation process. No further action pursuant to the ESA is necessary unless new information reveals that

the proposed action may affect listed species or critical habitat in a manner or to an extent not considered, the action is modified in a manner that causes an effect to the listed species or critical habitat not considered, or a new species or critical habitat is designated that may be affected by the proposed activity.

Habitat for Fish, Aquatic Organisms, and Other Wildlife

As noted previously, we have yet to be provided with any evidence to support claims of significant oyster depredation losses to any of the targeted species in Humboldt Bay, and only evidence to the contrary exists for bat rays (Gray, et al. 1997). Without documentation or field data to support these claims, or information that describes the effect of depredation activities upon the populations of target and non-target species, we strongly object to depredation actions which result in the capture and sacrifice of bat rays, rock crabs, or other organisms.

Summary of Cumulative Impacts

In addition to the impacts associated with other oyster culture operations in Humboldt Bay, cumulative impacts should also be considered from other projects that have impacts to or result in the loss of vegetated shallows and mudflats, such as channel deepening and maintenance or other harbor development activities. The loss and mitigation of mud flat and vegetated shallows is a matter of great interest and ongoing concern for the resource agencies and many other parties that have an interest in the Bay.

Oyster culture impacts may not be permanent in the sense that habitats remain subject to tidal influence and culture activities may move to different locations. However, the impacts of culture activities by Coast Seafoods have certainly resulted in a relatively constant area of disturbance over a long period of time which is specific and quantifiable.

We are concerned that lingering impacts of past oyster culture actions have cumulative effects upon important bay habitats and species. Thus we reiterate our recommendation for the need to determine the time required for abandoned or recently harvested sites to revert to their former, non-cultured state. Impacts to special aquatic sites will be far greater than assumed if re-establishment of native flora and fauna is delayed for an extended period of time.

Evaluation of Alternatives

Upon review of the PN and Coast Seafoods' proposed planting and management plans, we suggest consideration of the following alternatives in the environmental analysis:

Siting:

Clustering of Sites - Should sites be clustered or dispersed? Which minimizes impacts to tidelands? Clustered sites may reduce maintenance and harvest disturbance of wildlife.

Rotation of Sites - Annual relocation of culture sites, no matter the method, may greatly increase the impact of culture activities depending on the time required for cultured sites to revert to pre-culture conditions. Should new culture be limited to sites previously used for culture and currently disturbed or can culture activities be moved into new undisturbed sites with no change in tideland impacts?

Vegetated shallows versus mud flat - Both are important tideland habitats. We recommend minimizing impacts on both with emphasis on avoiding eelgrass. Unavoidable impacts should be compensated.

Method -

Off-bottom versus bottom culture - The available information indicates that off-bottom culture can have far less impacts on the intertidal environment than bottom culture. While we concur with the phased change in culture methods from bottom to off-bottom techniques we recommend that the ultimate goal should be complete elimination of bottom culture in Humboldt Bay.

Different methods of off-bottom culture - Why is long-line apparently preferred over other methods? Raft culture would on the face appear to have the least impact of off-bottom methods. Why has this method not been considered since it is apparently used successfully in other locations?

Fish and Wildlife Service Conclusions and Recommendations

It is clear from the available information that the bottom culture of oysters has had a significant, long-term, detrimental impact upon the fish and wildlife resources of Humboldt Bay. Furthermore, that information indicates that mitigation of those impacts can partially be achieved by: (1) switching from bottom to off-bottom culture methods, (2) removing all culture activities from tidelands that

support eelgrass meadows, and (3) ceasing all related depredation activities focused on bat rays and crabs.

Unfortunately, all of the information necessary to provide complete and detailed recommendations regarding the impacts that may result from Coast Seafoods' proposed operations are not available. At this time we are uncertain what alternatives may best mitigate project impacts, and what compensation may be appropriate for those impacts that cannot otherwise be mitigated.

We recognize that Coast Seafoods' proposed Management Plan responds to comments and recommendations by the Service, and others, for changes in their operations from bottom culture to off-bottom culture methods. These recommendations resulted from concerns regarding the impact of bottom culture of oyster upon eelgrass meadows and associated depredation activities focused upon bat rays and rock crabs but which impacted numerous incidental species as well.

We also appreciate Coast Seafoods' stated commitment to change their operations over the next three years to largely off-bottom culture techniques. We believe that the conversion to off-bottom methods coupled with changes in culture locations are the primary means of avoiding and minimizing project impacts to fish and wildlife resources in Humboldt Bay. However, significant details of that conversion remain to be determined.

Therefore, the Service will not object to the issuance of a permit to Coast Seafoods for the culture of oysters in Humboldt Bay provided that the following special conditions are included in the permit:

(1) Permit is issued for a period of three years to coincide with the implementation and decision timeline identified in Coast Seafoods' Management Plan.

(2) During the period of the permit, Coast Seafoods, in consultation with the resource agencies, should conduct studies to evaluate the impacts of off-bottom culture structures on shorebird and marine mammal use, mud flat invertebrate populations, eelgrass, and localized sedimentation. These studies should also address whether clustering of sites will reduce project impacts.

(3) Until evaluations are completed, both bottom and off-bottom culture should be conducted in areas that have been previously disturbed by culture activities.

(4) Coast Seafoods, in consultation with the resource agencies, should conduct studies to evaluate the time period necessary for

abandoned sites to recover after culture activities have ceased based upon invertebrate populations, eelgrass regrowth, and substrate conditions. These studies should also consider what remediation actions, if any, are appropriate to hasten recovery of abandoned sites.

(5) Coast Seafoods should cease use of any depredation structures under the jurisdiction of the Corps used for the capture and sacrifice of bat rays or any other species.

(6) Based upon the results of the proposed studies, Coast Seafoods, in consultation with the resource agencies, should determine what, if any, compensatory mitigation is appropriate for all impacts that are not ameliorated by other forms of mitigation, i.e. avoidance, minimization, etc.

The Service is available to discuss our concerns and recommendations with the Corps and the applicant if there are any questions regarding these comments. Please contact staff biologist Randy Brown at the letterhead address or phone number.

Sincerely,

Bruce G. Halstead
Project Leader

cc: ARD, FWS, Klamath/Central Pacific Coast, Portland, OR
FWS, Humboldt Bay NWR, Loleta, CA
CDFG, Dir., Sacramento
CDFG, Region 1, Reg. Mgr., Redding
CDFG, Eureka
CDFG, Menlo Park
EPA, Region IX, San Francisco
CRWQCB, North Coast Region, Santa Rosa
California Coastal Commission, San Francisco
NMFS, Santa Rosa
Coast Seafoods, Eureka
Northcoast Environmental Center, Arcata
Mr. Melvin McKinney, Eureka
Humboldt Bay Harbor, Recreation, and Conservation Dist., Eureka
City of Arcata, Arcata
City of Eureka, Eureka

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Date: 7/5/99
Melvin Mckinney
P.O. Box 78
Cutten, CA 95534

Lead Agency:
Humboldt Bay Harbor,
Recreation, and Conservation District.

P.O. Box 1030
Eureka, CA 95502-1030

Re: Draft Mitigated Negative Declaration.
Coast Seafoods Mariculture Application Notice 6/17/99

Dear Sirs:

After receiving the Mitigated Negative Declaration I will refer to it as M.N.D. I still find that major areas of Arcata Bay are threatened. Exsamples Bird Island, Mad River, East Bay and Sand Island Eel grass areas. This document purports to nullify Coasts admitted violation of Fish & Game Eel grass laws. Coast has agreed at meetings and in written statements to all Agencies that they would start removal of ground culture, but I feel Coast has lost sight of their aquaculture purposes because Coast was not supposed to put long line on previous removed ground culture sites and as a result they are continuing to develop cummulative impacts until such times these sites can be environmentaly reviewed for impacts and Mitigation. I don't find this to be an undertaking by the M.N.D. Specific sites should be the norm to include all of Coasts Mariculture operations.

Coast uses the word (feasible) to describe their activity in removing Mariculture from Eel grass. I really don't see the Fish & Wildlife Service, Cal Fish & Game, Army Core of Engineers and the National Marine Fishery Service applying: (Avoidance of Eel grass where feasable) to their comments concerning Eel grass.

Where in this M.N.D. document does the H.B.H.R.C. district list their policy on Eel grass other than the public trust disclosure.

Another method of growing Oysters was not considered in the text of this M.N.D. Coast can grow and harvest oysters in Rafts anchored on the edges of channels in the north Arcata Bay.

Coast must be educated to the fact that Eel grass is fully protected and their private interests are not going to be put ahead of the public trust.

Oyster rafts were not considered as a replacement of Mariculture methods if long lines and Rack and Bag activities prove to be unaceptable. We already know ground culture is unaceptable unless and maybe in areas above the Eel grass elevations. Mariculture in Tomalas Bay is full of Raft lease sites in that bay. Why not the alternative here in Arcata Bay. The use of Rafts for Mariculture does not render Oyster Mariculture impossible.

I do not see any research studies specifically stated to be done on the use of the hydraulic dredging and its relationship to Eel grass and Benthic communities.

Benthic studies are also left out of the agenda for evaluation studies. I recommend a theses by Michael S. Trianni entitled The Influence of Commercial Oyster culture Activitives on Benthic Infauna of Arcata Bay Dec. 1966, be considered as an addition to this M.N.D. along with Waddell J.E. 1964, Humboldt State Collage, Arcata, CA.

The activity of Oyster dredging on ground culture is not listed for a study of the impact on Salmon spawning Migration while they travel thoughout the East Bay to go to creeks like Ryan slough, Freashwater and all creeks north of the Ryan Slough bridge. This Salmon Migration begins in the month of October and continues through December for Silver Salmon and King Salmon with the mounth of December and January for steelhead Migrations to their home streams.

The Oyster harvesting by hydraulic dredge near the fish passage water ways must be measured for IMPACT when the salmon migration is in the bay. This dredge operates by running ;2; fifty horse power motors turning adjustable propellars forceing water on to the bottom of the bay and blowing oyster and Eel grass and Biota and Bycatch into their conveyor system aboard a barge. This activity can work at high tides.
I am requesting to have Herring studies added to the M.N.D. along with the Eel grass studies. If COAST was to remove their ground culture from the Eel grass at Bird Island, Mad River, Sand Island and East Bay areas, I am sure it would have a favorable affect on Herring populations in the North Bay as well as Salmon smolts.

I view with suspecion the fact that the W.R.A.C. group are doing the studies for Mitigation and policy and not have the local colleges totally envolved. This project looks more like the Aquaculture Industry is policeing itself by its position on full mitigation for studies. These aguaculture studies under the direction of the Dept of Agriculture and not the Calf. Dept of Fish & Game and the Marine Resource Dept. is really not accepted by some local citizens and the acedemic community and will be monitored very heavly by enviromental organizations as well.

The scientists doing the work from Oregon and Washington must be made aware of the C.E.Q.A. and Fish & Game laws of the state of California. As well as the ACOE and U.S.F.W.S. and the N.M.F.S. laws as they are applied to Mariculture in this state.

I note that some studies in the draft MND. are of questionable and detailed methoods of operation and too many current studies are left out. Examples are shrimp and starfish infestations and proof that Bat Ray's really prey on Oysters.

I have always maintained that Oysters must be grown in a protective way with out any impacts with in our wild environment. The public trust says it must remain the same as a wild environment.

Coasts MND says the Eel grass in Arcata Bay has been constant for the past forty years and they cite the Ecoscan study. I do not find this necessarly so. Eel grass may be constant but to what extent are the impacts on their ground culture and Eel grass sites.

I trust that these questions shall be answered as a result of the W.R.A.C. studies and that many more studies should be done and will be added to the M.N.D. If the studies as promised are not sufficient we should expand the M.N.D. or replace it with a full E.I.R.

I cannot agree that the WRAC studies are the only base for mitigation and that other land swaps and monetary compensations should also be levied. As I understand your MND accepts only limited studies by WRAC as total mitigation. This is just not acceptable to our Public Trust Lands.

Sedimentation is not a goal of the WRAC and is lightly addressed. How can we overlook the amount of sedimentation from Ryan slough waterways and the Elk river waterways as it applies to the amount of dredging and destruction of buried Eel grass and smothered oyster culture and continued filling of lands in the bay. There are ongoing studies about this issue and I sugest the Harbor and Coast Seafood get envolved in this destruction of our bay.

In the M.N.D. the Attachment No. 1 paragraph #8 is not spelled out in total detail.

I request the lease of Coast Seafood be made a part of the M.N.D for full disclosure and be added to the documentation for the M.N.D. and printed for public disclosure of Coasts tide land leases. This includes all monetary funds paid to the Harbor district for their leases and each acre leased and cents per gallon as it is applied from Coasts total income from Humboldt Bay.

I request the Tide Lands commettee do an audit and negociate a return of moneys that allows a realistic share of funds collected for the Harbor District for their Aquaculture leases. It is now time to make the aquacultur business pay for itself and include an added income to the district.

It is time the taxpayers of this district are afforded a more realistic management of the mariculture tide lands instead of just practically giving away the resource and maintaining a monopoly with one company.

The trusties of the public trust may not be aware of the discrimination against small business by not allowing any competition to affect the use of the bay aquatic resourses.

Coast states they only culture 500 acres during one given crop cycle, if this is so then the district has the duty to allow other local and out side interests to enter in what will be considered marketable leases. No company should be leased more tide lands then they can culture and must culture on all leased acres or show environmental cause.

The M.N.D. shows there are approximally 2884 acres tied up by Coast that they do not grow culture on. This is too big of a buffer to allow a monopoly to continue to exist in this HBHRC at the expense of lost value of other qualified mariculture businesses.

The M.N.D. states that a five year lease and permit for mariculture will be the permits for the future. I fully concur on this as it fits well with the other permiting agencies.

The public trust states in the M.N.D. that a use encompassed within the tide lands trust-is the preservation of these lands in their natural state, so that they may serve as ecological units for scientific study, as open space, and as environments which provide food and habitat for birds and marine life, and which favorably affect the scenery and climate of the area.

I find no referance to these areas in Arcata Bay being mentioned in the M.N.D. Where are the designations of areas for public use for clamming, crab trapping,hunting, boating and wind surfing publicly noticed. There are no ecological units set aside for study and documented for public use and notice.

These issues are a prime threshold of environmental significance. I request that these issues of Bird Island and Sand Island be made a part of the M.N.D. for full consideration and be added to the documentation for the M.N.D.

I request that separate units of Arcata Bay be set aside for the public use and for environmental study. These areas shall consist of Bird Island AND Sand Island.These units consist of Environmental International concern and should be set aside for balance as a Aquatic Resource of National importance.

Lets not compromise the short term ecomonic benifits for any company at the expense of our National Resource. Arcata Bay is the only Natural Aquatic Nursery left in the state of Califorina that has the cleanest water available for a natural environment.

Thank you for providing me with the opportunity to present my comments for better protection of the ecology of Arcata Bay within the Draft Mitigat Negative Declaration of Coast Seafoods Mariculture Application.

Sincerely,

Melvin Mckinney

Melvin McKinney

Sports Fisherman and member of:

cc: North Coast Environmental Center
cc: Redwood Region Audubon Society
cc: Natural Resource Defense Council
cc: Center for Marine Conservation
cc: California Trout

cc: US Army Core of Engineers, Eure
cc: Senator Mike Thompson
cc: Assemblywoman Virgina Strom Mar
cc: State Senator Wesley Chesbro

cc: North Group Redwood Chapter Sierria Club
cc: Calif Coastel Commission
cc: National Marine Fisheries Service
cc: Calif Dept of Fish & Game, Eureka.
cc: US Fish & Wildlife Service, Arcata.
cc: North Coast Regionel Water Quality Control Board, Santa Rosa.

State of California · The Resources Agency

GRAY DAVIS, Governor

DEPARTMENT OF FISH AND GAME

http://www.dfg.ca.gov

Marine Region
20 Lower Ragsdale Drive, Suite 100
Monterey, California 93940
(831) 649-2870

July 7, 1999

Mr. David Hull
Chief Executive Officer
Humboldt Bay Harbor
Recreation and Conservation District
P.O. Box 1030
Eureka, California 95502-1030

Dear Mr. Hull:

Department of Fish and Game (Department) personnel have reviewed the Humboldt Bay Harbor Recreation and Conservation District's (Harbor District) Draft Mitigated Negative Declaration (DMND) entitled Coast Seafoods Mariculture Application (State Clearing House # 99062069). The Department understands that the Harbor District is considering an application from Coast Seafoods Company (Coast Seafoods) for conducting mariculture operations on tidelands in the northern portion of Humboldt Bay (i.e., Arcata Bay), Humboldt County.

It is our understanding that Coast Seafoods has been operating in Humboldt Bay for approximately 40 years. It currently owns 560.9 acres of bottom land and leases another 3,384.5 acres (3,945.5 acres total), all in Arcata Bay (Bay), for mariculture operations. Coast Seafoods proposes to culture, on a rotating basis, a total of 500 acres of oysters within the 3,945.5 acres. Historically, Coast Seafoods has used bottom-culture as their primary method of oyster culture. This method entails depositing seed oysters (i.e., oyster cultch) onto the bottom of the Bay in areas where crushed oyster shell has been placed to improve culture conditions, and subsequently harvesting the oysters by drag-dredge and hydraulic dredge. Bottom-culture is considered by many to be the most environmentally damaging of those methods available. Through their Management Plan, Coast Seafoods has agreed to convert 70 percent of their mariculture operations from bottom-culture to off-bottom culture (i.e., long-lines) over a period of three years (1998 to 2000); has ceased the use of the drag-dredge method for harvesting bottom-cultured oysters; and has committed to conducting bottom-culture in areas without eelgrass (*Zostera marina*). Once the conversion is complete, a maximum of 150 acres will be planted using bottom-culture, 56.25 acres of historic bottom-culture sites will be removed from production due to impacts to eelgrass, and the remaining acreage will be placed in long-line production. Long-line culture will ... "consist of 200-foot lines with oyster seed shells set along each line approximately one foot apart. Each line is suspended approximately one foot above the bay bottom and is supported by notched PVC tubes, spaced every 2.5 feet along the line. Individual lines are spaced 2.5 feet apart in groups of four. Each group of four lines is separated from the adjacent groups by an open interval of 10 feet."

The Harbor District, identified as the lead agency under the California Environmental Quality Act (CEQA), is required to complete a review of the potential environmental impacts that the proposed mariculture project may have on the resources of greater Humboldt Bay (including Arcata Bay). In addition, the Harbor District is "... mandated by its legislation of creation, and the Humboldt Bay Master Plan, to consider activities which produce economic returns from the tidelands placed under their trust while also considering its obligations under the public trust doctrine to protect the natural resource and ecological values present in Humboldt Bay which could be harmed by the proposed activity."

The Harbor District's rationale for choosing a Mitigated Negative Declaration is based on the assertion that existing information on Humboldt Bay's natural ecological systems and processes, and the proposed activity, is not sufficient for them to meet their CEQA obligation for identifying potential impacts, or effective mitigation measures. Additionally, the Harbor District has indicated that the time frame for preparing an Environmental Impact Report (EIR) would potentially cause the applicant to cease operations, which would then result in Coast Seafoods going out of business. As described in the DMND, the Harbor District's proposed action consists of the following components: a one-year permit with annual renewals for a total of five years, conditions of approval which require studies and interim reports from the applicant, and a subsequent long-term preparation of an environmental review based on the information obtained from the interim studies. The Harbor District proposes that at the end of the five-year permit process and period of study, they will require a new application from Coast Seafoods, and that a new environmental review process would be conducted incorporating environmental impacts and additional mitigation measures.

The DMND clearly indicates that the proposed mariculture project would have potentially significant environmental impacts on eelgrass, salmonids (*Oncorhynchus spp.*), Pacific herring (*Clupea pallasi*), a variety of shorebirds and migratory waterfowl, harbor seals (*Phoca vitulina*), bay rays (*Myliobatis californica*), rock crabs (*Cancer antennarius*), red crabs (*C. productus*), and benthic communities. Other potential impacts related to the applicant's operations consist of the effects of long-line culture on biological and physical processes (e.g., water movements and sedimentation), as well as shell deposition and other materials placed in Humboldt Bay. It is clear that mitigation measures proposed in the DMND consist primarily of studies. A portion of these studies, initiated by the University of California's Cooperative Extension Program, would be funded by the Western Regional Aquaculture Center (WRAC), with research being done by academic and agency researchers from Washington and Oregon. The stated focus of the WRAC studies is to ... "investigate the effects of oyster mariculture on estuarine ecosystems, specifically including effects on eelgrass, salmonids, and benthic invertebrates." Studies on the potential impacts of long-line mariculture operations on shorebirds would potentially be funded by Humboldt State University and Coast Seafoods.

The Department's review of the DMND, as well as other information available to our agency, strongly indicates to us that Coast Seafood's oyster mariculture operation currently causes short-term, significant adverse impacts, as well as potential long-term and cumulative effects, to the fish and wildlife resources of Humboldt Bay. It is our considered opinion that the DMND does not adequately portray these impacts, provide appropriate mitigation to offset losses to fish and wildlife and their habitats, nor comply with CEQA requirements to produce a full-disclosure document that proposes measures to reduce significant adverse impacts to a level that is less than significant. The Department recommends that the

DMND be revised to fully comply with CEQA. We believe that the Harbor District should produce a complete and comprehensive Environmental Impact Report (EIR) in which all impacts to fish and wildlife from existing mariculture operations are described, appropriate mitigative measures to avoid or minimize these impacts are provided, all external and internal studies proposed to identify and quantify long-term and cumulative effects from continued and new operations are described and discussed, and in which the District commits to a full supplemental EIR at the conclusion of these studies. An EIR would more appropriately and adequately address data gaps and provide focus and direction for necessary studies. The Department would not object to the issuance of interim permits (e.g., annual) to Coast Seafoods to continue production with conditions that require implementation of appropriate mitigation measures which eliminate or offset fish and wildlife impacts as they are identified in the EIR and scientific reports from ongoing studies, particularly those impacts that occur as a result of current operations. We see little difference between this recommended approach with regard to continued mariculture operation and what Coast Seafoods was permitted during the period in which the DMND was prepared.

The Department has the following specific concerns, comments, and recommendations regarding the DMND

- CEQA does not require a minimum level of information before the responsible entity is required to identify the environmental setting, the potential impacts, and to specify mitigation measures. The CEQA process also does not require data collection as a necessary precursor to the writing of an EIR; it simply requires the applicant to identify what is known, or not known. There is little question that the applicant would be in a better position to evaluate their project in an EIR after the WRAC studies are completed; however, that improvement is not required before the applicant and the District meet their obligation under CEQA. The possible significance of negative impacts from a project should be evaluated based on the best available scientific information. The Department does not consider it to be reasonable to allow currently identifiable negative impacts to continue, while studies are conducted that may or may not offer refinements to mitigation measures. An example of impacts that are currently identifiable now include potentially significant long-term losses of eelgrass.

- The document states that ... "since Coast Seafoods has been conducting mariculture operations for four decades, impacts resulting from mariculture operations are by now not new impacts and thus requiring an EIR will not result in avoiding most of the impacts." CEQA requires that all significant impacts be addressed before a project is approved. The fact that Coast Seafoods has been operating for four decades does not remove them from this obligation. Additional impacts do not need to be identified before appropriate action should be taken to achieve the District's public trust goal. However, the Department believes that additional impacts will occur in the short-term through the conversion to Pacific long-line as proposed. The District's statement seems to be in contradiction to earlier comments that the District and applicant cannot identify impacts. We believe that if they have been happening for four decades, they should be relatively apparent. The CEQA standard for evaluating environmental impact is not based on a determination as to whether the impact will be long-term. The Department believes that there is potential for significant negative impacts associated with the proposed placement of long-line structures that are both short- and long-term.

Mr. David Hull
July 7, 1999
Page Four

- Although we understand the District's position in meeting its legal obligation while continuing to permit Coast Seafoods' operations in Arcata Bay, we disagree that "the necessary study tasks described herein as mitigation measures for the Mitigated Negative Declaration" (page 2) are the only mitigation options available. No measures for avoidance, minimization, or onsite/offsite mitigation are discussed in the DMND. Due to the significant cumulative losses of eelgrass associated with Coast Seafoods' existing operation, and the likely continuation of these losses, the District and Coast Seafoods may wish to consider the feasibility of a mitigation bank or other similar large-scale effort to address this proposal.

- As we mentioned previously, under CEQA, studies are not of themselves appropriate mitigation for project-induced impacts. The District's approach sidesteps its obligation under CEQA to protect natural resources by relying on study tasks as mitigation and a short-term permitting process, with annual evaluations of monitoring reports, to identify necessary permit modifications that will protect the environment. This approach is particularly problematic since it also provides for the necessity to conduct other "as-yet-unidentified ecological studies needed to fully characterize impacts." This approach also undermines CEQA's intent to identify and obligate the applicant to implement mitigation for significant negative environmental impacts before the project is approved. Obvious mitigation would then commence much more rapidly and be refined as the WRAC studies suggest. On page 3 of the DMND, the District describes their approach as an early programmatic environmental review followed by more detailed reviews. However, the DMND does not, in our view, comply with the type of programmatic document necessary to meet CEQA requirements.

- Although the Department has trustee and regulatory authority over natural resources in Humboldt Bay, our staff has not been contacted regarding specifics of the scientific studies or been requested for all available relevant information within Department files. Additionally, we believe that our concerns, although fully known to the District, have been minimized relative to the discussion of "level of significance" in the DMND.

- There are several parts of the project description (page 3) that warrant clarification. First, the DMND indicates that Coast Seafoods will convert its operation from bottom- to off-bottom culture; this equates to approximately 500 acres. Previous measurements (Trianni 1996) show that oyster operations in Arcata Bay encompass approximately 417 acres. Based on these contrasting figures, we seek clarification as to whether oyster operations will eventually entail expansion, as well as conversion. Second, Coast Seafoods has identified the goal of conducting bottom-culture in areas without eelgrass; however, subsequent comments (page 13) have indicated that the applicant believes it impossible to avoid these areas entirely. This should be addressed. Last, Arcata Bay comprises approximately 9,000 acres (Waddell 1964) and, of that acreage, Coast Seafoods controls about 44 percent. In the past, Coast Seafoods maintains it has limited its operation to approximately 500 acres. What is not mentioned in the environmental document is that these 500 acres are not static. Culturing sites have been moved from location to location, thereby affecting far more than 500 acres of Arcata Bay. It is unclear in the DMND as to whether this practice will continue.

- While the document states that the applicant has removed as much of its activities from eelgrass areas as it deems feasible, it also indicates that conversion to Pacific long-line will continue to

occur in areas with eelgrass. Coast Seafoods and the District have overlooked the primary reason the Department previously recommended long-lines in favor of ground culture. Coast Seafoods has demonstrated that it can grow oysters on long-lines in high elevation areas of the Bay which have little or no eelgrass. However, due to potential wildlife concerns, it was decided that Coast Seafoods would plant long-lines only on previously cultured areas. Unfortunately, many of the sites chosen for future conversion have significant amounts of eelgrass. We believe that there is sufficient information through the Ecoscan study, field observations by Department personnel, and scientific work done by others (e.g., Triani, Everett et al., etc.) that long-lines have significant impacts upon eelgrass habitat. Little mention was made of this information in the DMND, but great emphasis was placed on the "lack of information"; we would welcome further research on eelgrass impacts from all of Coast Seafoods operations, current or contemplated. The Department strongly disagrees with the findings that placement of long-line structure will not create significant long-term impacts to public trust uses in Arcata Bay. It is apparent that major changes in culture methods are being proposed without the advantage of a CEQA environmental review. The District would not be meeting its public trust responsibility if they allow conversions, as described in the DMND, in the absence of the full disclosure and public participation provided through the CEQA process. Additionally, it is clear that significant cumulative impacts (observed, implied, and documented) have occurred in Arcata Bay as a result of Coast Seafoods activities. To allow continuation of the reduction of additional eelgrass without any discussion of actual onsite or offsite mitigation measures, we believe is shortsighted.

- In the absence of a full disclosure document which identifies and evaluates potential negative impacts using best available scientific information in compliance with CEQA, it will be difficult for the District to determine if there is a conflict with the Regional Water Quality Control Board's Basin Plan (page 8). It will also be difficult for the Water Board to determine what mitigation would be appropriate. This comment is equally applicable to the California Coastal Act (Plan) and Commission (page 9).

- Regarding the effects of long-line structures (page 10), the District provides conflicting views on the significance of these impacts. The Department is concerned that the placement of Pacific long-line structures in areas with eelgrass will adversely affect this resource. Furthermore, it appears that current plans are to place those structures within existing beds. The anticipated negative effects may be long lasting and are proposed to occur in the absence of CEQA review by following the current approach in the DMND. Implementation of long-term mitigation measures developed during the studies to offset mariculture impacts will not allow consideration of options that may have maintained eelgrass in its current configuration. Use of a Mitigated Negative Declaration does not achieve a reasonable balance between the District's broad goals identified on page 1 of the DMND.

- The document states under Section IV (C), Eelgrass, that the State (i.e., the Department) withdrew authorization (letter from E.H. Knaggs, CDFG, dated 4 June 1997) to remove eelgrass as a result of bottom-culture practices. The Department has never authorized the removal of eelgrass (Robson Collins, Pers. Commun.). The letter referred to provided only clarification for Coast Seafoods' benefit that any disruption of eelgrass was not authorized. The Department, along with other agencies cited (i.e., National Marine Fisheries Service and U.S. Fish and Wildlife Service), has directed the applicant to avoid disrupting eelgrass

- With regard to shell deposits, we disagree that "past actions are not subject to review in this assessment ...." CEQA requires full disclosure of a project and its action We believe this issue to be relevant to the discussion of impacts to eelgrass (Everett et. al 1995, Griffin 1997, Taylor 1954)) and changes in benthic infauna (Triani 1996, Simenstand and Fresh 1995). Without any documentation or discussion, the District has concluded that removal of deposited shell materials from former bottom-culture sites is infeasible. Had better communication between all interested parties been initiated and continued, our recommendations regarding shell removal would be clearly defined. We disagree with the conclusion that removal of shell materials is infeasible at this time as there is no description in the DMND of what shell removal would entail and why it is infeasible. By eliminating shell removal as an alternative, the District is improperly narrowing the scope of mitigation options before it has determined the scale of any significant negative environmental impacts.

  The District also indicates that it "does not anticipate the need to place additional shell on the bottom" (page 11). This statement does not provide a reasonable basis for conducting an environmental assessment. It does not hold Coast Seafoods to any condition with regard to placement of shell material, yet it is the basis for asserting that there will be no adverse effects on water quality or biological conditions of the Bay.

- The District discusses elevation changes and habitat conditions in the DMND (page 12). It is apparent to us that the placement of structural elements on 350 acres in Arcata Bay would likely have significant, long-term ecological impacts on eelgrass and benthic communities (Everett et. al 1995, Griffin 1997, and Simenstad and Fresh 1995). Again, we disagree with the District's conclusion that only short-term significant impacts are likely to occur. This negates responsibility of any past actions by Coast on the resources of Arcata Bay. As we indicated earlier, adverse impacts should be evaluated on the best scientific information available, and appropriate mitigation offered to offset those impacts.

- Benthic community studies (e.g., invertebrates) are not included in the WRAC studies (pages 12, 22, 25, 27, and 28), yet the District indicates that they will be conducted. It is not clear in the DMND how this discrepancy will be addressed. Considerable information on impacts to benthic organisms was generated by Triani (1996).

- The DMND implies that a decade is insufficient time for a mariculture operation to have an effect on eelgrass. The Department is unaware of any reasonable foundation in the referenced reports for making that assertion.

- Throughout the section that addresses effects on sensitive species, habitats, or ecological processes (C, pages 13-22), the District's analysis of potential impacts mirror that used in the earlier section on eelgrass The DMND asserts that no short-term significant environmental impacts are occurring to the resources of Arcata Bay from existing mariculture operations. However, the basis for evaluating short-term impacts is not provided and, as a result, these appear to be unfounded assertions. If the basis for making an assertion is available, it should be sufficient for use in developing an EIR Without an appropriate basis, the approach used in the DMND places the resources of Arcata Bay at risk of degradation from project activities, without mitigation, for a minimum of five years Furthermore, it is not clear that the WRAC studies will

demonstrably improve the District's ability to assess impacts. While the Department encourages those studies because of their potential to improve our understanding of the environmental impacts associated with mariculture, it does not appear likely that they will provide all of the definitive answers that the District seems to anticipate

- We are unclear as to why the scientific studies proposed are four years, with the exception of shorebirds (one year). Given the significant value of Humboldt Bay for shorebirds, we are at a loss as to why shorebird studies appear to be less important relative to other "studies" discussed within the document.

  The same potential adverse effects of oyster mariculture listed for shorebirds (page 18) should also include brant (*Branta bernicla*). Coast Seafood operations over the past 40 years have led to the elimination and reduced density of eelgrass resources in Arcata Bay. Brant rely almost exclusively on eelgrass for food. Harris (1991) indicates that there is some information for the period 1943 to 1947 that brant use of Arcata Bay may have been more widespread than at present Furthermore, the loss of eelgrass due to a number of factors, including oyster culture and disturbance due to boating (in part as a result of "normal" Coast operations), may have led to the indirect elimination of that segment of the brant population during the winter migration

- The DMND discusses Coast Seafoods' potential for degrading the environment, including their effect on sensitive species and habitats (page 22). It is clear from the discussion that the continuation of Coast's activities will likely contribute to the ongoing significant losses of eelgrass resources within Arcata Bay. We agree that impacts associated with shorebirds, for example, are less obvious; nevertheless, we believe these species and others have the potential for incurring significant impacts.

- "The District finds that the short-term nature of the current proposal is not associated with a contribution to a significant cumulative effect, since the effects of the approval are no greater than (in fact, are less than) the effects of mariculture activities conducted in the bay for more than 40 years." We believe that this statement demonstrates a major concern the Department has expressed many times, i.e., that significant cumulative losses of eelgrass have occurred within Arcata Bay as a result of Coast Seafoods oyster-culturing operations. Any additional losses only add to the significance of total losses of this highly valuable resource.

- Coast Seafoods is required, as part of their U.S. Army Corps of Engineers permit, to conduct studies on the effects of bat ray fences. It is our understanding that this study will not be in conjunction with Humboldt State faculty, but will be conducted entirely by the project sponsor. We question the advisability of this approach. In addition, we have seen no study design which includes comparable control sites, etc. Based on what is mentioned in the document, the data collected will only indicate what birds are using the site. We are at a loss as to the value of these data without an adequate control site with which to compare critical information. A full EIR will provide an ideal platform to consider the potential impacts of these fences. Studies,observations, monitoring, etc. proposed by the District and Coast Seafoods (pages 31-35) should only be conducted by qualified personnel.

- The Harbor District has committed to establishing a "monitoring committee" for District responsibilities affecting public trust concerns and natural resources discussed in the DMND (page 35). We are concerned that there is no discussion as to the criteria for tenure as a member of the "monitoring committee". Moreover, it is unclear as to what authority members have to render a decision regarding modification of any of Coast's activities. The Department believes that this committee should be more clearly described and strong consideration given to a scientifically qualified, diverse, and balanced membership.

  It is proposed that Coast Seafoods shall cooperate, to the maximum extent feasible, with the Harbor District's monitoring committee to limit potential conflicts with other resources and tidelands values. We would assume this to imply that if study results indicate a significant impact on one or more resources of Arcata Bay, Coast Seafoods would be required to avoid (via modification of operations), or reduce those impacts to a less than significant level, perhaps through mitigation. Statements such as "Coast Seafoods shall cooperate, to the maximum extent feasible" do not provide any level of assurance that this will always be the case. In the Department's view, one or more supplemental EIR would be the most appropriate way of committing the Harbor District and Coast Seafoods to addressing impacts uncovered by the proposed studies and implementing mitigation measures considered by the monitoring committee, the Department, and others.

In conclusion, we reiterate our evaluation that the DMND strongly indicates to the Department that Coast Seafoods' oyster mariculture operations currently cause short-term, significant adverse impacts, as well as potential long-term and cumulative effects, to the fish and wildlife resources of Humboldt Bay, and that the DMND does not adequately portray these impacts, provide appropriate mitigation to offset losses to fish and wildlife and their habitats, nor comply with CEQA requirements to produce a full-disclosure document that proposes measures to reduce significant adverse impacts to a level that is less than significant. The DMND is, in our view, inadequate and inappropriate, and we recommend that the document be revised to fully comply with CEQA. We believe that the Harbor District should produce an Environmental Impact Report (EIR) in which all impacts to fish and wildlife from existing mariculture operations are described, appropriate mitigative measures to avoid or minimize these impacts are provided, all external and internal studies proposed to identify and quantify long-term and cumulative effects from continued and new operations are described and discussed, and in which the District commits to a supplemental EIR at the conclusion of these studies. The Department would not object to the issuance of interim permits (e.g., annual) to Coast Seafoods to continue oyster culturing operations, with conditions, however, that require implementation of appropriate mitigation measures that eliminate or offset fish and wildlife impacts as they are identified in the EIR and scientific reports from ongoing studies (e.g., WRAC), particularly those that occur as a result of current operations. Additionally, we strongly recommend that Coast Seafoods not be permitted to go forward with long-line conversion without consultation with the Department regarding location and other issues of importance.

Mr. David Hull
July 7, 1999
Page Nine

Thank you for the opportunity to review the DMND. As always, Department personnel are available to discuss our concerns, comments, and recommendations in greater detail. To arrange for discussion, please contact Ms. Becky Ota, Associate Marine Biologist, California Department of Fish and Game, Marine Resources Laboratory, 411 Burgess Drive, Menlo Park, California 94025, or by telephone at (650) 688-6361.

Sincerely,

DeWayne Johnston
Regional Manager
Marine Region

Attachment

cc: Ms. Nadell Gayou
Projects Coordinator
Resources Agency
Sacramento, California

Mr. Donald Koch
North Coast Region
Department of Fish and Game
Redding, California

Ms. Becky Ota
Department of Fish and Game
Menlo Park, California

Mr. Jim Bybee
National Marine Fisheries Service
Santa Rosa, California

Mr. Jim McKevitt
U.S. Fish and Wildlife Service
Sacramento, California

Mr. Bob Merrill
California Coastal Commission
San Francisco, California

Mr. Tuck Vath
North Coast Regional Water
Quality Control Board
Santa Rosa, California

the Northcoast Environmental Center

July 8, 1999

David Hull,CEO, and
Board of Commissioners
Humboldt Bay Harbor, Recreation and Conservation District
POB 1030
Eureka, CA 95502

VIA FAX: 443-0800

RE: Coast Seafoods Company Draft Negative Declaration

Gentlepersons:

These are the comments of the Northcoast Environmental Center regarding the issues of environmental concern associated with the continuing operation of Coast Seafoods Company in Humboldt Bay, and the "Draft Mitigated Negative Declaration" (the Draft) for their activities in Humboldt Bay and dated June 2, 1999 .

We believe that any permit issued to Coast Seafoods Company (Coast) must comply with the California Environmental Quality Act (CEQA). We have raised this issue repeatedly for several years. One barrier to this CEQA compliance, in our view, has to do with a financial conflict of interest between the Humboldt Bay Harbor, Recreation and Conservation District (the District) and Coast. The District receives revenues from Coast for leased tidelands and an undisclosed production fee per gallon of oysters. Lease details and paid "gallonage" are apparently concealed as a proprietary concern.

Their have been changes in the operations of Coast with regards to its environmental impacts. These changes have come very slowly and only rarely voluntarily. Shell dumping has ended. Wholesale killing of bat rays and associated bycatch species is a thing of the past, and slowly Coast is proposing to get it's operations off of the bottom with "a goal of getting out of the eelgrass."

It should be mentioned that these changes in Coast's operations have came as a result of the persistent efforts of commissioner Jimmy Smith, Melvin "Cappy" McKinney, Redwood Region Audubon Society and the Northcoast Environmental Center. Slowly, to, several of the agencies with responsibilities over Humboldt Bay have

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begun to speak up for the public trust attributes of the bay.

Still in all, however, a full and complete CEQA review should be required that analyzes the past and prospective effects of the various operations of Coast on Humboldt Bay and that completely addresses mitigations for those impacts.

Instead, the District has chosen to engage Coast in an adaptive management plan that will be based on a number of ongoing studies and that require ongoing reporting from Coast regarding wildlife and recreation. We have serious concerns with the proposed studies and the compliance of Coast with regard to the proposed monitoring schedule.

As a condition of its depredation permit for rock crabs and bat rays Coast was to have reported number of target species and bycatch species annually to the California Department of Fish and Game. We were unable to locate those reports. Coast did provide numbers of target species for each year of its "depredation permit," but no tally of non-target animals was reported, although it was widely known that the non-target impact of the otter trawl could be large.

So we believe that the District must identify who will monitor compliance with the numerous mitigation measures outlined in the Draft (personal communication, Dr. Albert Beck, May, 1999) and also who will be responsible for verifying compliance. We have provided a sample "Mitigation Monitoring Report" as an attachment to this letter that is used to clarify compliance with promised mitigations and to serve as a public record of compliance. We request that the District review the compliance record for Coast annually and that the District make provisions for revoking its mariculture permit if Coast has not performed according to its agreed upon schedule or plan.

The Draft also proposes that the long-term effects of Coast's operations in Humboldt Bay will be mitigated by the gathering of information through studies performed under the auspices of the University of California Extension and the Western Regional Aquaculture Center (WRAC). If it was pointed out in the Draft, it should be underscored, that Coast's permit approval is based on a promise of the U.S. Department of Agriculture (USDA) (presumably through WRAC officials) to provide $400,000 in subsidies to get the outlined studies on track.

Given that the Congress prepares a budget for federal agencies annually it is curious that the USDA can make such a 4-year commitment. As a member of the federally chartered California Coast Province Advisory Committee that oversees implementation of the Northwest Forest Plan, I have seen that although the Clinton

administration has made certain promises regarding what the Forest Service would do to implement monitoring or surveys for rare species, that the Congress has found it to be within its purview to not fund these promises! Is the WRAC not subject to the Congressional purse strings?

It also must be said that the USDA, the WRAC and the various university units associated with mariculture are its infrastructure and its cheerleading squad. Mariculture or aquaculture was promoted heavily by universities and politicians as being environmentally benign. And, as such, the WRAC has an interest in the outcome of the studies.

The District , however, is asking the public to have faith in it, Coast and the WRAC, in a rather faithless time I might add. A mitigation for the trust problem is to require the WRAC to add public and environmental group members as oversight to the "external steering committee" outlined on page 8 of the Draft's attachment #3.

Humboldt Bay is one of the least disturbed coastal estuaries on the West Coast in terms of the introduction of exotic and invasive non-indigenous marine organisms. What is the role of Coast's activities in affecting the introduction of exotic species in Humboldt Bay--will trapping and destroying the native rock crab species give an advantage to the invasive green crab species? I don't see where the studies outlined will answer these questions.

Humboldt Bay is also considered to contain one of the largest eelgrass meadow sites on the West Coast. Eelgrass is documented as a keystone species in estuarine ecosystems, a habitat that provides food and shelter for numerous marine invertebrates that, in turn, provide food for many young fish of commercial and ecological significance (Barnhart, et al. 1992; and many others).

Fish species that use eelgrass for spawning and feeding include the English sole, smelt and herring (Barnhart, 1992). Sole are commercially important in the Pacific Coast fisheries economy and have been subject to to recent sharp reductions in take (PFMC, 1997).

Salmonid species also are known to use eelgrass meadows, including coho salmon, chinook salmon, steelhead and sea-run cutthroat trout (Griffin, 1997). Several of these fish species are either listed under the Endangered Species Act as threatened or have candidate status for prospective listing. The Army Corps of Engineers will have to deal more directly with this issue in issuing Coast a permit than you do,because of its mandated responsibilities under the Endangered Species Act (ESA).

Also, an error or at least lack of clarity, with regard to the ESA, exists in the Draft on pages 13 and 14 of Attachment 1 where it states that "at the present time the federal government is still considering various lines of evidence regarding whether one or more of the salmonid species which swim through Humboldt should be protected under the Endangered Species Act." The implication is that the ESA listing of salmonids is under consideration, but in fact coho salmon have been ESA listed for two years!

In addition to unquantified impacts to threatened fisheries, the destruction of the eelgrass meadows also affects a variety of birds, including loons, grebes, ducks, brant and shorebirds (Kelly, et al., 1997; Levalley, 1996; and others). The Draft states that "At one time a substantial wintering population of brant occurred on Humboldt Bay, but the species no longer winters here." When did the brant decide that Humboldt Bay was no longer a useful wintering area, before or after Coast operations began?

Also, the Draft states, in a way that minimizes the importance of the Arcata Bay meadows, that most of the eelgrass is in the South Bay. But interestingly, later in the document it is noted that 80% of the spawning herring use the Arcata Bay eelgrass for their spawning purposes. It is also noted that the herring have been in decline.

Although Coast is proposing to lessen its impacts to the eelgrass meadows, California Department of Fish and Game law, policy and regulation prohibits ANY destruction of eelgrass without adequate mitigation plantings.

We reiterate that in our view the Draft fails to adequately address the issue of the potential for aquaculture to bring more invasive species into Humboldt Bay. In August, 1997 a total of 77 marine biologists and marine science professionals signed a letter to Governor Pete Wilson calling for tougher controls on aquaculture in California. They said,"Aquaculture activities in general are inadequately regulated to prevent the introduction of harmful non-indigenous organisms into the California environment.

We also request that a public hearing be held on this issue. Such a hearing would give more opportunity for both the public and agencies to comment on the probable cumulative effects of oyster culture on the bottom of Humboldt Bay.

Thank you for your thoughtful consideration of our comments.

The Northcoast Environmental Center (NEC) was established in 1971 to illuminate the relationships between humankind and the biosphere in the North Coast and Klamath-Siskiyou Regions. The NEC has approximately 3,500 members and ten member groups, that including the Redwood Region Audubon Society, the north group of the Redwood Chapter of the Sierra Club and others with an interest in protection and

restoration of the natural productivity of living systems.

Sincerely,

Tim McKay, executive director

TM/me
cc:
Senator Wes Chesbro
Assemblywoman Virginia Strom Martin
California Coastal Commission
National Marine Fisheries Service
California Department of Fish and Game, Eureka, Redding and Sacramento
U.S. Fish and Wildlife Service, Arcata
Humboldt Bay Wildlife Refuge
David Krueger, Esq.
Mark Massara, Esq.
Redwood Region Audubon Society
North Group Redwood Chapter Sierra Club
Natural Resources Defense Council
Center for Marine Conservation
North Coast Regional Water Quality Control Board
the State Lands Commission

United States Department of the Interior

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July 20, 1999

Mr. David Hull
Chief Executive Officer
Humboldt Bay Harbor, Recreation, and Conservation District
601 Startare Drive
P.O. Box 1030
Eureka, California 95502-1030

Subject: Coast Seafoods Mariculture Application, Draft Mitigated Negative Declaration, Humboldt Bay, Humboldt County, California

Dear Mr. Hull:

The Fish and Wildlife Service (Service) has reviewed the Harbor District's Draft Mitigated Negative Declaration (DMND) for mariculture operations in Humboldt Bay by Coast Seafoods Company. We understand this document was prepared, pursuant to the California Environmental Quality Act (CEQA), for a pending permit application with the Harbor District.

The proposed action may impact trust resources for which the Service has primary responsibility. We have participated in the proposed federal permitting of Coast Seafoods' oyster culture activities on Humboldt Bay through the program administered by the Army Corps of Engineers (Corps) under Section 404 of the Clean Water Act (33 U.S.C. 1344) and Section 10 of the Rivers and Harbors Act (33 U.S.C. 403). The Service's comments in that proceeding have been prepared under the authority, and in accordance with the provisions, of the Fish and Wildlife Coordination Act (16 U.S.C. 661-667e, et seq.)

The Service also administers and maintains the Humboldt Bay National Wildlife Refuge which was established to protect important habitats for waterfowl, shorebirds, and other estuarine-dependant species. In light of the Service's interests, we have prepared comments and recommendations that may be useful in the District's consideration of this matter.

The Service has previously prepared comments and recommendations regarding Coast Seafoods' oyster culture activities in correspondence to the Corps of Engineers dated June 16, 1997, and February 6, October 29, and December 18, 1998. All correspondence with the exception of the June 1997 letter was also forwarded to the Harbor District.

We have enclosed a copy of our June 1997 letter, in addition to the following comments on the Harbor District's DMND, for your information.

General Comments

The Service's stated mission is to conserve, protect and enhance fish, wildlife and their habitats for the continuing benefit of the American people. In particular, primary responsibilities include migratory birds, endangered species, and anadromous fisheries, all of which are potentially impacted by the culture of oysters in Humboldt Bay.

Over the past two years the Service has attended a number of meetings with representatives of Coast Seafoods, the Corps, California Department of Fish and Game, and other parties interested in the oyster culture issue. The Service is supportive of Coast Seafoods' stated intent to work with the resource agencies and other interested parties to avoid and minimize the impacts of their oyster culture activities on other important fish and wildlife resources in Humboldt Bay.

Upon review of the DMND, the Service has identified a number of issues that raise questions, or urge comment, based upon our past involvement and understanding of the course which the permitting of Coast Seafoods operations seems to be taking. We address these issues in no particular order:

Mitigation -

The definition of mitigation by CEQA regulations essentially includes the avoidance, minimization, or compensation of impacts to the environment from a proposed action. We address these definitions in greater detail later in these comments. The DMND identifies a number of studies to be conducted either by Coast Seafoods or through funding by the Western Regional Aquaculture Committee (WRAC) of the Department of Agriculture that are proposed to address the potential impacts of oyster culture on estuarine fish and wildlife resources. While these studies may well lead to future mitigation measures, they do not meet the accepted definition of mitigation and should not be presented or considered in that vein. Similarly, cooperation by Coast Seafoods in the gathering of information necessary for the Harbor District to define the impacts of oyster culture in Humboldt Bay may be important, but should not be considered mitigation for culture impacts to fish and wildlife resources.

However, measures such as the modified placement of culture sites and prohibitions on the placement of oyster shell may be mitigation if they truly do serve to avoid or minimize the impacts of oyster culture in the Bay. Further clarification of these measures, as noted later in these comments, is needed to determine how these proposed actions may lead to mitigation of culture impacts.

WRAC Studies -

The WRAC studies are proposed to be conducted under the leadership of an impressive group of scientists and may well lead to the collection of valuable information that will benefit both the industry and the protection of natural resources. However, we must point out that the focus of the WRAC studies does not cover the scope of issues identified by the Service in our correspondence to the Corps dated February 6, 1998. Further, neither the Service or any other resource agencies involved with the oyster culture issues on Humboldt Bay were provided the opportunity to review or comment on the WRAC studies during their development.

Based upon our review of the revised WRAC proposal dated February 16, 1999 and included as Attachment 3 in the DMND, it appears that the proposed WRAC studies may be adequate to address

some of the concerns that we have expressed in prior correspondence. But we do not believe that completion of these studies is a requisite for identifying appropriate mitigation measures for Coast Seafoods' operations in Humboldt Bay. The Harbor District should also consider that no matter how well intentioned or conducted, the results of the WRAC studies will likely not lead to clear, unequivocal, or popular solutions to the issues under consideration, and a 5-year delay will not make the decisions any easier.

Short -Term and Ongoing Impacts -

The DMND proposes to delay final decisions on mitigation measures for oyster culture in Humboldt Bay based upon conclusions that :

> (1) "...the extent of information about Humboldt Bay, its natural ecological systems and processes, and the proposed activity does not meet the requirements ...for accurately identifying potential impacts, or for specifying effective mitigation measures." (page 1)
>
> (2)" ...Coast Seafoods has been operating in Humboldt Bay for approximately four decades. Impacts which may result from the mariculture operations are, by now, not new impacts...." (page 2)
>
> (3) "...the proposed short-term operation of Coast Seafoods will not create significant long-term impacts to the biological resources and aquatic ecosystems of Humboldt Bay." (page 23)

The Service disagrees with each of these conclusions. We recommend that the Harbor District use the considerable information that is available to institute reasonable mitigation measures that begin to move towards the avoidance and minimization of suspected short and long-term impacts of oyster culture in Humboldt Bay. There is sufficient information to conclude that a number of important resources, including eelgrass, *Zostera marina*, Pacific herring, *Clupea harengus pallasi*, coho salmon, *Oncorhynchus kisutch*, and black brant, *Branta bernicla nigricans*, could be significantly impacted in the short-term by oyster culture activities. We also do not believe that the available evidence can support a conclusion that the continuing impacts of oyster culture in the Bay by Coast Seafoods can be dismissed simply because they have been occurring for 40 years. As additional information is collected, the Harbor District can use adaptive management to institute additional changes as warranted, but sufficient information exists to make important decisions about Coast Seafoods' operations now, not later.

Proposed District Action -

Based upon currently available information, the Service can concur with the Harbor District's proposed intent to issue one-year permits with annual renewals, not to exceed a total renewal period of five (5) years, provided that in addition to necessary studies, reasonable mitigative measures are proposed and instituted. The basis for these measures should focus upon avoiding and reducing oyster culture impacts to eelgrass meadows, which is the basis of concern for most, but not all, impacts of oyster culture associated with fish and wildlife species in Humboldt Bay.

Specific Comments

Page 3 - paragraph 4 - "...this period approximately corresponds to the maximum duration of the Section 404/10 permit from the U.S. Army Corps of Engineers."

FWS comment: It is our understanding that the Corps has yet to issue a permit to Coast Seafoods for their activities in Humboldt Bay, and is still operating under an interim permit of unknown duration or conditions.

Page 4 - paragraph 2 - "South Bay is almost entirely included in Humboldt Bay National Wildlife Refuge"

FWS comment: Actually, very little of South Bay tidelands are within the ownership of Humboldt Bay National Wildlife Refuge (Refuge). There is some confusion about the "approved boundaries" of the Refuge, which have been identified for planning purposes and possible future acquisition, that do encompass much of south bay. Current Refuge ownership includes about 275acres of existing south bay tidelands located in the Table Bluff, Hookton Slough, White Slough and Salmon Creek management units.

Page 4 - paragraph 2 - "By limiting culturing activity to 500 acres, this limits Coast Seafoods' activities to 12.6 percent of the land area it owns or leases, and includes only about three percent of the total area of the bay."

FWS comment: Any relevant discussion of the impacts of Coast Seafoods' operations on fish and wildlife resources in the Bay needs to go beyond consideration of the current and proposed future total area of tidelands cultivation. Available information suggests that past culture activities may still be affecting Bay habitats and the cumulative effect of these past sites should be investigated. Citing figures such as "three percent of the total area of the bay" are irrelevant to fish and wildlife impacts since it ignores the type and value of habitats affected and the cumulative impacts of past activities. Any action that impacts 500+ acres of tidelands in Humboldt Bay, especially within important eelgrass meadows is significant.

Page 10 - paragraph 8 - "...the applicant has demonstrated to the District that removing existing shell deposits from areas which are no longer to be used for mariculture purposes is cost-prohibitive for Coast Seafoods and is therefore infeasible according to the California Environmental Quality Act."

FWS comment: The Service has tentatively identified the removal of oyster shell from past deposition and culture sites as a potential mitigation measure for oyster culture activities in the Bay. It also appears that the extensive deposition of shell may greatly contribute to lingering impacts of past culture and the cumulative effects of future culture. The DMND dismisses this important issue, at least as perceived by the resource agencies, without adequately disclosing the basis for the decision. We believe this issue may be far more important than the DMND gives it credit for. We are disappointed that Coast Seafoods and the Harbor District have chosen to limit their consideration of this matter without the benefit of a cooperative discussion with the resource agencies.

Page 11 - paragraph 2 - "Coast Seafoods has informed the District that it 'does not anticipate the need to place additional shell on the bottom.'" "...the District will adopt a mitigation measure prohibiting such deposition of shell as a part of the bottom culturing practices absent a modification to Coast Seafoods' approved project."

FWS comment: It is our understanding that by definition, bottom-culture of oysters results in the deposition of shell due to the spreading of cultch, which we understand is larger oyster shell with the smaller seed oyster attached to it. It is also our understanding that the harvesting process does not retrieve all cultch that has been placed on the ground -culture sites. Therefore, shell deposition in the Bay is an inherent aspect of this culture method.

Also , how can prohibition of a practice that we understand has not occurred for a number of years, and which Coast Seafoods' has determined to be unneeded, be considered mitigation?
Page 13 - paragraph 4 - "...this assessment concludes that avoiding all areas of eelgrass growth within Arcata Bay cannot be required of the applicant based on existing information regarding feasibility."

FWS comment: What information was evaluated or alternatives analysis was conducted for the DMND to arrive at this conclusion? How does the Harbor District reconcile this conclusion with State Fish and Game Code (Title 14, Sections 30:10) which prohibits the cutting or disturbance of eelgrass ?

Page 15 - paragraph 1 - DMND: "The applicant has presented an analysis to the Harbor District that indicates: (i) that the cost of removing the shell is prohibitive, given the applicant's economic status; and (ii) that it is highly unlikely that the removal could be conducted without creating unacceptable environmental impacts on Humboldt Bay. The District has accepted this assessment, has concluded that removing the shell is infeasible, and will not require that crushed shell be removed from abandoned bottom-culture sites as part of the proposed project."

FWS comment: Why are the results of this analysis not presented in the DMND, since the purpose of this document is to disclose the environmental impacts of the proposed action? We are disappointed that the District and Coast Seafood have not chosen to share the results of this analysis with the resource agencies so that we might able to suggest some feasible alternatives to the shell removal proposal developed by Coast Seafoods. Also, the statement that shell removal would result in "unacceptable environmental impacts" leads us to believe that our recommendation has been misunderstood. Further discussion of this matter is warranted.

Page 15 - paragraph 3 - DMND: "An evaluation of the occurrence of eelgrass in Humboldt Bay based on current available information indicates that the South Bay is more important than Arcata Bay and Entrance Bay."

FWS comment: Although south bay may contain more eelgrass in terms of density and areal coverage, assignment of "importance" of that eelgrass to the ecology of the Bay or to a particular species may not necessarily follow. We view eelgrass in Arcata Bay to be just as valuable as that in South Bay. For example, information indicates that herring spawning occurs mostly in Arcata Bay. Also, the current status of black brant use in Arcata Bay may not be a reflection of this area's importance to this species prior to the disturbance that has resulted as a function of oyster culture. We also know from studies in the bay that relatively small patches of eelgrass still see considerable use by fishes.

Page 15 - paragraph 3 - DMND: "Based on these historical data (i.e., Keller 1963, Waddell 1964; also see Dykhouse 1976) there appears to be some currently unidentified biological effect in operation that makes South Bay more favorable for eelgrass than is Arcata Bay, even absent the effects of mariculture (which had been operating in Arcata Bay on a sustained basis for less than a decade when Keller and Waddell did their thesis work)."

FWS comment: A review of the literature finds that the reduction of eelgrass as a result of various types of disturbance, including oyster culture, can occur rather rapidly, but recovery may not occur on the same scale (see for example Fonseca, et al. 1998; Wilson and Atkinson, 1995; Everett, et al. 1995; and Beckman and Barilotti, 1976) Nevertheless, we are not aware of any information that leads us to discount or devalue the ecological importance of eelgrass in Arcata Bay even though density and acreage may be less overall.

Page 15 - paragraph 5 - DMND: 'The southern Oregon/northern California stock of coho (a.k.a. silver salmon, *O. kisutch*) has been listed as "threatened." The northern California stock of steelhead (*O. mykiss)* is currently listed as "proposed threatened."'
FWS comment: Listed salmonid species that frequent Humboldt Bay are currently designated as follows:

Scientific Name	Evolutionarily Significant Unit	Common Name	Category	Critical Habitat
O. kisutch	southern Oregon/ northern California	coho salmon	threatened	yes
O. mykiss	northern California	steelhead	candidate	no
O. tshawytscha	southern Oregon/ coastal California	chinook salmon	proposed threatened	no

Page 16 - paragraph 6 - DMND: "...the USFWS conducted preliminary consultations with the ACOE regarding the murrelet, wherein the opinion was reached that Coast Seafoods' proposed activities were 'not likely to adversely affect' the Marbled Murrelet."

FWS comment: The Service conducted "informal consultation" with the Army Corps of Engineers (Corps) regarding marbled murrelet, *Brachyrhamphus marmoratus*, (see Service correspondence dated February 6, 1998) in response to the Public Notice issued in preparation for an individual permit to Coast Seafoods pursuant to Section 404 of the Clean Water Act and Section 10 of the Rivers and Harbors Act. The Corps determined that the proposed action "may effect" marbled murrelet, but that it was "not likely to adversely effect" the species. The Service concurred in that determination by the Corps.

The Corps also reached determinations of "may effect, not likely to adversely effect" for California brown pelican, *Pelecanus occidentalis californicus*, and "no effect" for tidewater goby, *Eucyclogobius newberryi*, with which the Service also concurred.

Page 17 - paragraph 2 - DMND: "The tidewater goby...is a small fish that lives in burrows in the bottoms of estuarine streams along the northern California coast"

FWS comment: Tidewater goby range from San Diego County in southern California through Del Norte County in northern California. The goby is considered a true estuarine species and is most often found in the brackish waters of coastal lagoons and in the mouths of creeks and rivers where they interface with salt water, although it is not uncommon for them to be found in completely freshwater. Examples of past locations documented for tidewater goby in Humboldt Bay include Jacoby Creek and Freshwater Slough. Goby are small, free-living, bottom-dwelling fishes that attain lengths seldom longer than 2-inches. Goby construct burrows in soft mud or sand bottom sediments for the purpose of spawning and egg protection.

Page 19 - paragraph 4 - DMND: "It is unclear whether reductions in eelgrass density associated with mariculture limit the utility of Humboldt Bay to migrating brant..."

FWS comment: Studies on Willapa Bay appear to have linked reductions in eelgrass meadows, as a result of ground culture of oysters, to reductions in numbers of brant using the Bay (Wilson and Atkinson, 1995). Willapa Bay along with Humboldt Bay constitute the two most important brant feeding stopovers between summer and winter habitats in Alaska and Mexico, respectively. The identification

of this possible linkage between brants and oyster culture activities, as well as the importance of eelgrass for other species in the Bay, is sufficient to raise our concerns about the potential impacts of culture activities.

Page 19 - paragraph 5 - DMND: "Circumstances are clouded because the relative importance of eelgrass in Arcata Bay is not clearly differentiated from the more extensive occurrence of eelgrass in South Bay. A clear discussion that compared the importance of eelgrass in the two sections of Humboldt Bay, based on long-term scientific study, would be useful..."

FWS comment: It is not clear whether this statement speaks only to the issue of eelgrass use by black brant in Arcata Bay or the importance of eelgrass for all species. The importance of eelgrass to brant, as well as other species in the Bay, is clear and unequivocal. Ecologically, we do not value eelgrass in Arcata Bay any less than that in South Bay. Preservation and restoration of eelgrass meadows in Humboldt Bay is a high priority for the Service that has important implications for the many species that rely upon the Bay, a number of which also have considerable commercial and recreational value.

Page 24 - paragraph 3 - DMND: "The District finds that the short-term nature of the current proposal is not associated with a contribution to a significant cumulative effect, since the effects of the approval are no greater than (in fact, are less than) the effects of mariculture activities conducted in the bay for more than 40 years."

FWS comment: It is unclear how the Harbor District arrived at this conclusion. Given the District's position that insufficient information exists to define the impact of oyster culture in the Bay, we do not understand how impacts can be defined as less in the future versus the past, or that cumulative effects are not significant because they have occurred for over 40 years. The increasing number of human impacts on the Bay may in fact lead to cumulative impacts that will only increase with time. And as previously noted, any activity that effects 500+ acres of fish and wildlife habitat in Humboldt Bay should be considered significant.

Page 24 - paragraph 4 - DMND: "For the current proposal, the study projects identified in this section and in Attachments 3 and 4 constitute mitigation measures that (the District confidently expects) will assist the District and the several responsible and trustee agencies for the project to identify long-term mitigation measures for mariculture in Humboldt Bay."

FWS comment: Based upon the definition of mitigation in the CEQA guidelines (15370), studies do not constitute mitigation. Mitigation is defined as

(a) Avoiding the impact altogether by not taking an action or parts of an action.
(b) Minimizing impacts by limiting the degree or magnitude of the action and its implementation.
(c) Rectifying the impact by repairing, rehabilitating , or restoring the impacted environment.
(d) Reducing or eliminating the impact over time by preservation and maintenance operations during the life of the action.
(e) Compensating for the impact by replacing or providing substitute resources or environments.

While we agree that additional information regarding the effects of oyster culture on Bay ecology are necessary and warranted, they do not constitute mitigation as defined by regulation, or as accepted by the resource agencies. Also, in the event that study results of the WRAC research do not address concerns and issues in Humboldt Bay culturing activities, how does the District intend to proceed to identify long-term mitigation measures?

Page 24 - paragraph 5 - DMND: "The District specifically invites comments from Responsible Agencies and Trustee Agencies on modifications of the following measures which these agencies feel are appropriate in order that they may carry out their own legal responsibilities."

FWS comment: In our letter to the Corps of Engineers in response to their Public Notice for Coast Seafoods' culture operations in the Bay dated February 6, 1998, the Service provided extensive comments regarding our concerns about the impacts of oyster culture on the ecology of the Bay, and our recommendations for additional information, studies, and mitigation measures based upon the best available information. That letter was also submitted to the Harbor District. We recommend that you revisit that correspondence and contact our staff if you have additional questions.

Page 31 - paragraph 6 - DMND: "When operating in areas containing eelgrass, Coast Seafoods shall not remove eelgrass as part of its mariculture operations (as is already required by the Fish and Game Commission)."

FWS comment: It is our understanding that considerable amounts of eelgrass can be uprooted and dislocated when oysters are harvested with the hydraulic dredge. It is also our understanding that for this very reason use of a hydraulic dredge is prohibited in other regions in areas containing eelgrass (Simenstad and Fresh, 1995). This proposed mitigation measure implies that Coast Seafoods will only harvest ground culture in the future by hand, which we understand is the common practice in other locations along the coast such as Tillamook Bay in Oregon. Please explain the intent of this proposed mitigation measure since it appears to be the only true mitigation proposed in the DMND.

Page 35 - paragraph 1 - DMND: "Coast Seafoods shall not deposit crushed oyster shell on the bottom of Humboldt Bay as part of the 150 acres of bottom culture that Coast Seafoods expects to maintain in the future."

FWS comment: It is our understanding that Coast Seafoods' bottom culture operations still result in the deposition of oyster shell in Humboldt Bay since not all cultch shell placed on ground culture sites can be subsequently harvested by the hydraulic dredge. Therefore, a net addition of shell to the substrate as a result of culture operations will continue. Please explain how this proposed mitigation measure will be achieved in light of these operations, or if some shell deposition is allowed, what threshold of non-harvested cultch will be acceptable under the DMND.

Conclusion

The Service remains committed to working with the Harbor District, Coast Seafoods, and other interested parties to protect and restore fish and wildlife habitats in Humboldt Bay. We also appreciate the actions and commitments that Coast Seafoods has instituted in response to the concerns of the resource agencies and others regarding the impacts of their activities in the Bay. The Service is optimistic that proposed studies funded by the WRAC and Coast Seafoods will lead to valuable information that benefits the oyster culture industry as well as the protection of fish and wildlife resources.

However, we believe that sufficient information does currently exist to institute significant mitigation measures prior to the outcome of those proposed studies. The importance of eelgrass meadows to resident and migratory fish and wildlife resources along the entire Pacific Coast, in addition to Humboldt Bay is unequivocal. The protection and restoration of eelgrass habitats in Humboldt Bay should be a priority for all parties interested in the ecological integrity of this nationally, if not internationally, significant ecosystem. We recognize that cooperation among all parties is key to achieving this goal, but

delays in working towards that goal will not serve to benefit any party and are not warranted or necessary based upon our current knowledge.

If the Harbor District has any questions regarding these comments and recommendations please contact staff biologist Randy Brown at the letterhead address and telephone number.

Sincerely,

Bruce G. Halstead
Project Leader

Enclosure

cc: w/o enclosure
FWS, PARD, ES, Portland, OR
FWS, GARD, K/CPC, CNO, Sacramento, CA
Humboldt Bay NWR, Loleta
CDFG, Dir., Sacramento
CDFG, Reg. Mgr., Region 1, Redding
CDFG, Marine Region, Menlo Park
CRWQCB, North Coast Region, Santa Rosa
California Coastal Commission, San Francisco
NMFS. Santa Rosa
Coast Seafoods, Eureka
Northcoast Environmental Center, Arcata
Mr. Melvin McKinney, Eureka
City of Arcata, Arcata
City of Eureka, Eureka
USACE, Eureka

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Fonseca, M.S., W.J. Kenworthy, and G.W. Thayer. 1998. Guidelines for the conservation and restoration of seagrasses in the United States and adjacent waters. NOAA Coastal Ocean Program Decision Analysis Series No. 12. NOAA Coastal Ocean Office, Silver Spring, MD. 222 pp.

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Wilson, U.W. and J.B. Atkinson. 1995. Black brant winter and spring-staging use at two Washington coastal areas in relation to eelgrass abundance. The Condor. 97:91-98

STATE OF CALIFORNIA—THE RESOURCES AGENCY GRAY DAVIS, GOVERNOR

CALIFORNIA COASTAL COMMISSION
FREMONT, SUITE 2000
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September 21, 2001

Greg Dale
Coast Seafoods
25 Waterfront Drive
Eureka, CA 95501

L. Robert Studdert
P.O. Box 6
12781 Sir Francis Drake Blvd.
Inverness, CA 94937

Re: Status Letter for Coast Seafoods Company Coastal Development Permit Application E-01-024

Dear Mr. Dale and Mr. Studdert:

The Coastal Commission staff has reviewed your above-referenced coastal development permit ("CDP") application and pursuant to CDP filing requirements contained in 14 CCR § 13053.5(a), has determined that it is incomplete and cannot be filed until the information specified below has been submitted. This information is needed for the Coastal Commission to adequately analyze the proposed project under the policies of Chapter 3 of the Coastal Act. Our review includes information included in the Mitigated Negative Declaration ("MND") prepared and certified by the Humboldt Bay Harbor, Recreation and Conservation District in 1999.

1. **APN Numbers.** Please submit the APN numbers for all lands owned and leased by Coast Seafoods (assessor's parcel maps were submitted in the CDP application, but full APN numbers were not given).

2. **CDP Application Fee.** The application did not include a permit application fee although you indicated on page 15 of the application that you intend to apply for an administrative permit. This project does not qualify for an administrative permit. The fee for this type of project is determined based on project cost (see page 16 of the CDP application). Please submit the applicable application fee.

3. **Interested Party and Property Owner Notification.** Eleven envelopes for interested parties were submitted in the application package. Please submit additional stamped, addressed envelopes for all of the 19 property owners listed in Appendix C of the CDP application. Please also submit stamped, addressed envelopes for all potentially interested parties, including but not limited to the Regional Water Quality Control Board, California Department of Fish and Game, Army Corps of Engineers, U.S. Fish and Wildlife Service, the

U.S. National Marine Fisheries Service and other members of the Mariculture Monitoring Committee.

4. **Harbor District Permit.** The CDP application includes a letter from the Humboldt Bay Harbor, Recreation, and Conservation District dated December 11, 2001 indicating a one-year extension to December 2, 2001 of Permit No. 1998-3 to conduct aquaculture activities, including "shellfish culture, Manila clams, Pacific oysters, Kumamoto oysters, mussels, scallops, and other commercially viable shellfish." The scope of the Harbor District's permit is not consistent with the scope of the project description submitted for this CDP application, or with Coast Seafoods' Aquaculture Registration with the California Department of Fish and Game ("CDFG"), which lists "Pacific oysters, Littleneck clams, Manila clams, and Kumamoto oysters" as the species to be cultured by Coast Seafoods. Please explain these inconsistencies in project scope and description, and if necessary, submit additional project description information. In addition, please indicate the procedures and timeframe for renewing or extending the current Harbor District permit beyond December 2, 2001.

5. **Project Description.** The project description described in the application is unclear. The CDP application discusses primarily oyster culture, but Commission staff understands that Coast Seafoods has performed other development activities, such as those discussed in the above paragraph, that are subject to the permit requirements of the Coastal Act. Please submit a detailed project description for all mariculture operations and all development performed by Coast Seafoods in Humboldt Bay, including a detailed map of the project area and bathymetry, with coordinates based on differential GPS with a + or – 15-foot level of accuracy. The project description should include but is not limited to the installation of a bat ray fence (including date of installation, length, height, materials used, and method of installation), placement of structures or materials, harvesting operations, anti-depredation activities, and any use of chemicals in the marine environment. Please submit a more detailed, comprehensive project description that specifically addresses the following information:

   (a) a description of all current and proposed oyster culture methods, including a clarification of whether bottom culture is still being employed, or whether complete conversion to off-bottom culture has been achieved, and whether the project description contemplates for all future mariculture operations the use of off-bottom culture methods;

   (b) the number of years it takes each type of seed to reach harvest size;

   (c) all existing and proposed materials to be placed in the project area and their locations (e.g., depredation devices, culture materials such as bags and racks, etc.);

   (d) a description of the harvesting methods that are proposed to be used and in what proportion (i.e. amount of proposed hydraulic harvesting versus hand-picking). The project description's discussion of harvesting methods is very brief and unclear as to whether drag harvesting is still be used, and does not provide a sufficiently detailed description of the other proposed harvesting methods, hydraulic harvesting and hand-picking;

(e) the number of acres Coast Seafoods proposes to culture or develop in any way during any one planting cycle or year;

(f) the length of time an area that has been harvested is left out of production;

(g) a more detailed planting plan that shows which beds are intended for what type of culture or development in what year. Please provide GPS coordinates for the outline of all existing and proposed future culture beds, as well as the type of culture occurring in each culture bed. The 3-page planting plan submitted with the CDP application lacks sufficient detail regarding precise locations of beds, timeframes for future planting and harvest, and length of time a bed will be left out of production;

(h) a description of type, amount, and location of all existing culture-related materials, including but not limited to the already installed bat ray fences, long-line structures, racks, and oyster shell deposits;

(i) does Coast Seafoods still place shell deposits on the seafloor in Humboldt Bay as a part of its oyster culture operations? If not, please indicate when this activity ceased, identify locations of shell deposits, and clarify whether Coast Seafoods is proposing this activity as a part of its project description for current and future activities. In addition, please clarify whether off-bottom culture or harvesting generates shell deposits or other similar debris. What are Coast Seafoods' plans for removing shell deposits and other project-related debris?

(j) a description of all shellfish processing activities including any discharges to bay waters or waste disposal at the processing plant;

(k) a description of all currently-employed and proposed anti-depredation activities, including the aforementioned bat ray fence; and

(l) does Coast Seafoods currently use or propose to use carbaryl or any other form of pesticide? If yes, please describe the type of pesticide, quantity and frequency of use.

6. **Other Agency Approvals.** Please identify all other agency approvals required for the proposed project, such as the U.S. Army Corps of Engineers and the Regional Water Quality Control Board. Please submit either (a) evidence of agency approval or (b) at minimum, evidence that Coastal Seafoods has applied for all applicable permits.

7. **Culture Methods.** Please submit an assessment of all potential environmental impacts associated with each type of culture method (i.e. rack, rack-and-bag, and long-line, and bottom culture), including (1) an explanation of the similarities and differences in impacts of bottom and off-bottom culture; (2) an identification of the least environmentally damaging off-bottom culture method; (3) an explanation of why rotation of culture areas or beds is necessary or desirable; and (4) an assessment of the individual and cumulative impacts of each method and culture bed rotation.

8. **Harvesting Methods.** The MND states that Coast Seafoods will replace its historic drag-dredge harvest method with hydraulic harvester and/or hand picking methods. Please confirm if this is still the case. Has Coast Seafoods ceased all use of a drag-dredge? In addition, Attachment 4 of the MND states that the practice of harvesting bottom culture oyster beds by drag or hydraulic dredges causes resuspension of fine sediments, disturbance to benthic communities and damage to eelgrass. Please submit an assessment that identifies and evaluates the potential environmental and water quality impacts from use of a hydraulic harvester. Please identify any measures proposed by Coast Seafoods to avoid, reduce or eliminate identified impacts.

9. **Eelgrass.** Please submit the following information regarding eelgrass in the proposed project area: (1) a detailed map of the areas of eelgrass that are within 100 feet of the existing and proposed oyster-culturing operations (in greater detail than is shown in Figure 2 of the 1992 *Ecoscan* report), including bathymetry, with coordinates based on differential GPS with a + or – 15-foot level of accuracy, and a description of the mapping methods used; (2) an analysis of the historical extent of eelgrass in the area (based on aerial photographs, if feasible); (3) an assessment of all impacts to eelgrass and associated biota resulting from the proposed project and currently-employed and proposed culture methods; (4) an analysis of alternative locations that could be used to lessen or avoid impacts to eelgrass; and (5) proposed measures to mitigate impacts of the project on the eelgrass resource, including eelgrass restoration, and a clarification of whether any culture activities are currently located in or near eelgrass.

10. **Fish.** Please assess project impacts (including direct, indirect, and cumulative) to the following species or uses: (1) salmonids; (2) herring spawning areas; (3) use of eelgrass meadows by larval fish species; and (4) bat rays due to the placement of anti-depredation fences. Please identify any measures proposed by Coast Seafoods to avoid, reduce or eliminate identified impacts.

11. **Birds.** Please assess project impacts on bird use of mudflats and eelgrass, and how project activities affect their food availability. Please also identify impacts on birds from the various culture methods used, debris, and overall operations. Please include an assessment of potential impacts to listed species and species of concern (e.g., brown pelican and marbled murrelet, especially juvenile murrelets). Please identify any measures proposed by Coast Seafoods to avoid, reduce or eliminate identified impacts.

12. **Benthic Habitat.** Please assess project impacts, including shading, on the productivity of the benthic communities in Humboldt Bay. If there is continuing bottom culture, the assessment of impacts should include benthic invertebrate sampling in Humboldt Bay in order to compare species diversity, density, and biomass in oyster bottom culture areas and unimpacted locations with similar habitat and to assess the use of these habitats over time by various fishes and invertebrate predators. Please identify any measures proposed by Coast Seafoods to avoid, reduce or eliminate the identified impacts.

13. **Marine Mammals.** Please assess project-related impacts to marine mammals. Please identify any measures proposed by Coast Seafoods to avoid, reduce or eliminate identified

impacts. Please include the monthly marine mammal reports conducted by Coast Seafoods and include methods used, number and species of mammal, location and dates.

14. **Water Quality.** Please assess the proposed project's potential impacts on water quality. Please identify any measures proposed by Coast Seafoods to avoid, reduce or eliminate identified impacts.

15. **Culture-Related Materials.** Please assess project impacts from the placement of culture-related materials (e.g., long-line structures, other off-bottom structures, and bat ray fences) in the project area on shorebirds, bat rays, and water quality. Please clarify whether chemically-treated wood products were used to construct the bat ray fence. Please identify any measures proposed by Coast Seafoods to avoid, reduce or eliminate identified impacts.

16. **Sedimentation.** Please assess the proposed project's potential impacts overall, and in particular due to placement of the bat ray fences and other culture materials and structures, on the following: tidal currents, sedimentation rates, substrate composition, benthic habitat and benthic and epibenthic organisms, eelgrass, shorebirds, fish, and marine mammals. Please identify any measures proposed by Coast Seafoods to avoid, reduce or eliminate identified impacts.

17. **Cumulative Impacts.** Neither the MND nor the CDP application contain an adequate assessment of the cumulative impacts of Coast Seafoods' operations. Please submit a comprehensive assessment of the cumulative impacts of Coast Seafoods' operations to the biological resources and aquatic ecosystems of Humboldt Bay, and proposed mitigation measures.

If you have any questions, please call me at 415/904-5249, or Alison Dettmer, Manager, Energy & Ocean Resources Unit, at 415/904-5205.

Sincerely,

Marina Cazorla

Marina Cazorla
Environmental Specialist
Energy & Ocean Resources Unit

cc: David Ammerman, ACOE
Becky Ota, CDFG
Vicki Frey, CDFG
Tom Moore, CDFG
Jim Nelson, CDFG
Nan Reck, NMFS
Randy Brown, USFWS
David Hull, Harbor District

epic

October 16, 2001

Emily Dean
NCRWQCB
5550 Skylane Boulevard, Suite A
Santa Rosa, CA 95403

Re: Water Quality Certification for Coast Seafoods' Aquaculture Operations in Humboldt Bay, California

Dear Ms. Dean,

On behalf of the Environmental Protection Information Center (EPIC), we are writing to express our concern regarding Coast Seafoods' aquaculture operations in Humboldt Bay and offer our preliminary comments on their application for water quality certification under Section 401 of the Clean Water Act, 33 U.S.C.A. § 1341. Coast Seafoods employs bottom culture methods to harvest oysters in Humboldt Bay, a practice that causes great harm to the water quality and beneficial uses of this important estuarine habitat. Coast Seafoods Inc., a Seattle-based company, has never obtained the mandatory permits that are required by the federal Clean Water Act and other state and federal laws, knowingly operating out of compliance with these laws for many years. We believe these operations are creating a condition of pollution or nuisance in violation of the Porter-Cologne Water Quality Control Act and the federal Clean Water Act, and request that the NCRWQCB take appropriate action to halt all bottom culture activities in Humboldt Bay by Coast Seafoods.

Bottom culture operations by Coast Seafoods has significant adverse environmental effects, including direct and indirect impacts on eelgrass and associated marine communities. Eelgrass provides essential marine habitat for a diverse community of aquatic species, and is an important beneficial use in Humboldt Bay (*see* Table 2-1,pg.2-5.00 Basin Plan). Bottom culture harvesting involves hydraulic dredging, which causes direct mortality to eelgrass, as well as disturbance to the substrate and suspension of silt, mud particles and other sediment. As sediment particles become suspended, pollutants that have settled are also washed into the water column, causing serious adverse impacts to marine habitat and aquatic organisms. According to the Draft Nearshore Fishery Management Plan of the California Department of Fish and Game (CDFG), dredging causes multiple adverse environmental impacts by disturbing sediments and putting toxic pollutants back into the waters of Humboldt Bay:

Environmental Protection Information Center
P.O. Box 818 • Arcata, CA 95518 • 707-822-1343
P.O. Box 397 • Garberville, CA 95542 • 707-923-2931 • www.wildcalifornia.org

"The U.S. Environmental Protection Agency (EPA) estimates that approximately 10 percent of the sediment underlying our nation's surface water is sufficiently contaminated with toxic pollutants to pose potential risks to fish and to humans and wildlife who eat fish (or oysters?). This represents about 1.2 billion cubic yards of contaminated sediment out of the approximately 12 billion cubic yards of total surface sediment where many bottom dwelling organisms live, and where the primary exchange between the sediment and overlying surface water occurs. Approximately 300 million cubic yards of sediment are dredged annually from harbors and shipping channels nationwide to maintain commerce (and cultivate oysters), and about 3 to 12 million cubic yards of those are sufficiently contaminated to require special handling and disposal (EPA 1997). The dredging of sediments in Humboldt Bay, San Francisco Bay, Santa Monica Bay, Seal Beach, Los Angeles, Newport Bay, and San Diego Bay has the potential to redistribute high levels of contaminants in the environment. Many pollutants in the sediments have the potential to accumulate in increasing concentrations up the food chain, and therefore affect more than just the organisms directly exposed to the contaminant. Adverse effects to organisms in or near sediment can occur even when contaminant levels in the overlying water are low. Marine organisms may accumulate pollutants through direct ingestion of sediment, transport of pollutants across body membranes, uptake of dissolved contaminants present in the interstitial (pore) water, ingestion of benthic organisms, or ingestion of first-order carnivores. Contaminated sediments can affect the food chain base by eliminating food sources, and in some cases altering natural competition, which can affect the population dynamics of higher trophic levels. The US Army Corps of Engineers (Corps) is authorized to permit disposal of dredge material into the nearshore waters after determining that the dumping will not unreasonably degrade or endanger human health, welfare, amenities, marine environments, ecological systems, or economic potentialities." [http//www.dfg.ca.gov/mrd/nfmp/ (2001)] (emphasis added).

Any disturbance of bottom sediments increases the health risks to people who consume seafood harvested from Humboldt Bay. In addition, disturbance of bottom sediments causes adverse impacts to the marine habitat, reproduction and early development and migration of aquatic organisms, including federally listed anadromous salmonids. We believe these impacts constitute "harm" and "harassment" as defined by Congress and federal courts, and that Coast Seafoods is violating the federal Endangered Species Act with their operations in Humboldt Bay. 16 U.S.C. § 1538.

Disturbance of bottom sediments also causes significant adverse impacts to benthic communities. The benthic communities have been adversely impacted by oyster culture activities (Waddell 1964). Coast Seafoods continues to subject large areas in Humboldt Bay to bottom culture operations, with at least 150 acres still being harvested with such methods. Bottom culture is suspected to alter the structure and composition of benthic communities across the full range of habitat types, from eelgrass to mudflats. Monitoring meetings mandated by Coast Seafood's Mitigated Negative Declaration (1999) that have taken place this year indicate that agencies such as CDFG still lack definitive information on the amount of bottom culture that exists, and what habitat types are directly effected by ground disturbing activities. However, based upon Coast Seafood's Mitigated Negative Declaration (1999), the company still uses bottom culture methods on at least 150 acres, and we have reason to believe this acreage is substantially greater. We

In addition to these issues, we are also concerned that Coast Seafoods and the Humboldt Bay Harbor District have failed to comply with the requirements of the California Environmental Quality Act (CEQA). PRC §§ 21000, et seq. Coast Seafoods is currently operating under the guise of a Mitigated Negative Declaration; we believe the intensity and severity of the impacts from these operations require that an Environmental Impact Statement be prepared and circulated, and that a mitigated negative declaration was improperly used in this process. Aside from this issue, Coast Seafoods has not implemented or complied with the mitigations set forth in said Mitigated Negative Declaration, and continues to operate without ever instituting the measures that the Harbor District determined necessary to prevent impacts from becoming significant. We believe this gives the NCRWQCB reason to deny water quality certification pursuant to the California Code of Regulations, which states, in relevant part:

> "[a]n application for water quality certification may be denied when compliance with water quality standards and other appropriate requirements is not yet necessarily determined, but the application suffers from some procedural inadequacy (e.g., failure to provide a complete fee <u>or to meet CEQA requirements</u>). In this case denial shall be without prejudice. § 3837(b)(2).

EPIC will provide additional comments on this issue in future correspondence, as well as comments that arise after our review of any material that Coast Seafoods submits in seeking water quality certification. We also request to be added to all mailing lists and correspondence related to the NCRWQCB's water quality certification of Coast Seafoods' operations in Humboldt Bay.

Thank you for your time and attention to this important issue and the related problems facing Humboldt Bay.

Sincerely,

Christine Ambrose, Coastal Advocate

/s/Cynthia Elkins, Program Director

cc: CDFG, Marine Region
CDFG, Region 1
U.S. Environmental Protection Agency
U.S. Fish and Wildlife Service
CA State Environmental Environmental Health
CA California Coastal Commission
U.S. Army Corps of Engineers

request a definitive answer on how much bottom culture is currently taking place, and when it will cease.

According to the applicable Water Quality Control Plan (Basin Plan), beneficial uses in Humboldt Bay include marine habitat, estuarine habitat, spawning, reproduction, and/or early development, migration of aquatic organisms, commercial and sport fishing, wildlife habitat, rare, threatened, or endangered species, shellfish harvesting, and aquaculture. While shellfish harvesting and aquaculture are considered beneficial uses, the NCRWQCB can not allow activities from one beneficial use to degrade multiple other beneficial uses. According to the NCRWQCB, where multiple beneficial uses of water exist, the most stringent water quality objectives for protection of all beneficial uses are selected as the protective water quality criteria. For this reason, dredging for aquaculture should not be allowed to degrade all other beneficial uses. We believe that bottom culture should cease immediately because it is a controllable water quality factor that could easily be eliminated in Humboldt Bay.

Coast Seafoods has been operating within Humboldt Bay for many years without obtaining the necessary permits from the California Coastal Commission, U.S. Army Corps of Engineers or the North Coast Regional Water Quality Control Board. The sole permit that Coast Seafoods has secured is a temporary permit from the Humboldt Bay Harbor District. Only recently did Coast Seafoods begin the process to obtain a permit from the California Coastal Commission, and this permit has not yet been granted. Years overdue, Coast Seafoods requested an application for water quality certification from the NCRWQCB on October 4, 2001, and is apparently preparing to finally seek water quality certification from your agency and obtain its required permit from the U.S. Army Corps of Engineers.

Pursuant to the authority granted to you under Section 401(d) of the Clean Water Act [U.S.C.A. § 1342(d)] [1], we request the NCRWQCB include, at a minimum, the following conditions on the federal permit in question:

1. The immediate cessation of all bottom culture operations, due to the degradation it is causing to other beneficial uses and the fact that this is a controllable water quality factor that could be avoided with other alternatives.

2. All remaining harvest in bottom culture areas conducted by hand and the hydraulic dredge(s) in Humboldt Bay removed.

Absent these provisions, EPIC believes that compliance with water quality standards and other relevant requirements cannot be achieved, and that certification under Section 401 of the Clean Water Act cannot be lawfully granted by your agency. *Id.* and CCR § 3837(b), 26 USC § 169, 40 C.F.R. §§ 20 and 21, and § 13160, Water Code. If the process for certification is delayed for any reason, we believe it will become necessary for your agency to issue a cease and desist order to immediately halt these damaging activities.

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[1] See also *PUD No. 1 of Jefferson County v. Washington Dep't of Ecology*, 511 U.S. 700, 114 S.Ct. 1900, 1905, 128 L.Ed.2d 716 (1994).

A Changing Scene For Oyster Culture In Humboldt Bay, California

KENNETH K. CHEW, Professor and Associate Dean, College of Ocean and Fishery Sciences, University of Washington, Seattle, Washington

Humboldt Bay located in northern California is one of the major oyster growing areas for the state with over one million pounds of oyster meat produced annually. Although oysters are cultivated further south in Tomales Bay, Drakes Bay, Morro Bay, and others, this bay bordered by the town of Eureka, has always been one of the major oyster producers for California.

I recently had the opportunity to revisit Humboldt Bay oystering operations and was able to compare it with what it was in the 1960's when Dr. Albert K. Sparks, (my former colleague), and I were involved with a research project in the area. At that time, we were there to study the Pacific oyster's (*Crassostrea gigas*) growth, disease, and mortalities along the coast of California, Oregon, and Washington. The operations manager of Coast Oyster Company (later named Coast Seafood Company), was the late Francis Douglas. During our time there he ferried us to check on oysters that were growing profusely in numerous beds throughout the northern part of Humboldt Bay. I can still remember Douglas sharing how important this bay was ecologically and economically to many people involved in growing and harvesting Pacific oysters. Most of problems for the industry at the time came from natural predators, also associated with bottom cultivation. Those were the days when essentially all oyster cultivation was on bottom beds with seed caught naturally during the summer and brought in from the state of Washington, British Columbia, or imported from Japan.

One of the major problems he had to deal with were natural predators like the California bat sting ray (*Myliobatis californica*), and the red rock crab

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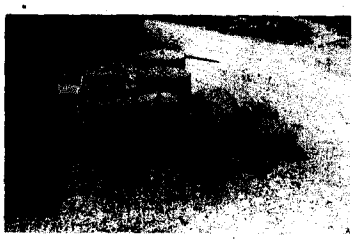

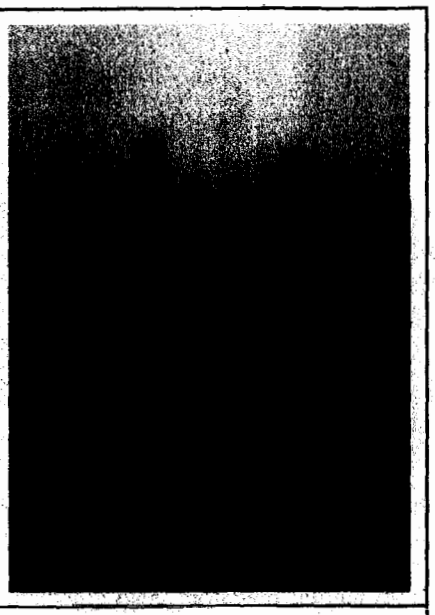

Greg Dale, Operations Manager and Kham Phong Xayavong, Farm Manger of Humold Bay operations inspecting off-bottom long line culture of Pacific oysters ready for harvest.

(*Cancer productus*). These particular predators can cause significant mortalities to oysters grown using bottom culture techniques. To battle the bat sting ray, redwood poles were put up around the oyster beds and spaced evenly like fencing and when the tides receded the sting rays could then be herded into encircled fenced areas similar to a fyke net for capture and removal. In the years that the red rock crabs were prevalent (1950's-70's), and since these creatures have a gregarious appetite for Pacific oysters and could seriously damage harvest yields, Coast Seafoods used a technique employing trap lines with crab pots attached to capture and dispose of them.

Another predator that can cause heavy mortalities of small seed and/or young Pacific oysters is the Japanese oyster drill (*Ocenebra japonica*). It was introduced when Pacific oyster seed from Japan was used in great quantities on the west coast, especially during the late 40's to late 70's. The import of seed at the time was needed because of the decline in stocks of the native Olympia oyster (*Ostrea conchaphila*). During those years, the major recipients of the Pacific oyster were operations in Washington and the heaviest infestation of the oy centered in the southern Pu area of Washington. After the of the oyster drill in the area of Bay, operators began to look and consequently moved th areas for young oysters mortalities.

In June 2001, I re-visited Bay to see what changes had t since the 60's. Boating Humboldt Bay with Operation Greg Dale, and the farm mana Phong Xayavong, I could see been some major changes in o practices. Almost all their p now consists of off-bottom, culture. As a matter of fa mentioned that they have 43 beds and only three are now bottom culture (about 30 acres remaining 340 acres have been to off-bottom long line culture mentioned that at one time th 1,000 acres used for bottom cul but this has now changed becaus operations and regulatory requi He expects in the very near fu all oyster production in the area

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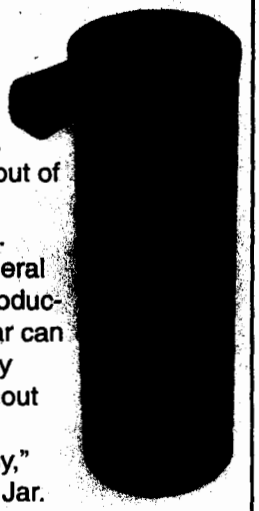

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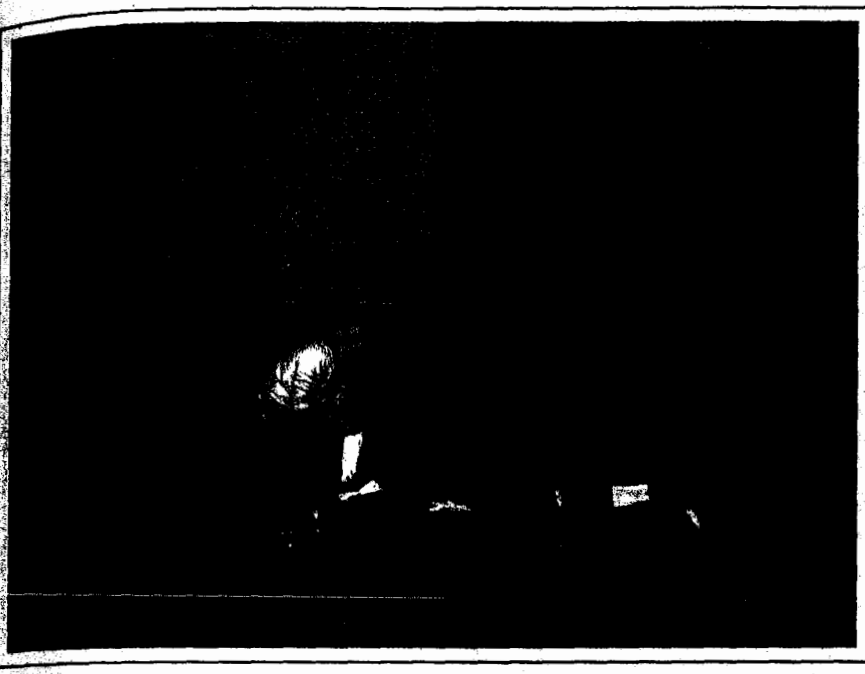

Ken Chew sampling Pacific oysters from experimental trays with Francis Douglas, Manager of the then Coast Oyster Co. in Humboldt Bay in May 1963. Note bottom culture of oysters in the background.

off-bottom long line cultivation for many reasons.

I questioned Dale further about the change in culture activity for the area. He indicated the changes were prompted by the re-authorization of the 1996 Magnuson-Stevens Act which deals with the management of near- and off-shore fisheries which supports efforts to save essential fish habitat for several different types of indigenous fish, especially salmon. Eel grass habitat is thought to be very important to many species of aquatic life, therefore, the ruling was created to move oyster cultivation off the bottom of ocean beds. At the beginning of this move, large-scale off-bottom culture was virtually untried in Humboldt Bay, making this wholesale change difficult at first. Although some earlier experimental work elsewhere had provided some positive proof-of-concept to off-bottom culture, it was the economic and ecological unknown variables involved with extra labor, equipment, materials, research etc. that added uncertainty to the process.

As a result of these modifications/ changes and to exchange needed information, Coast Seafoods interacts with the Western Regional Aquaculture Center (WRAC). They also support research of these culture practices and help to identify the mitigating effects ecologically and the dynamics tied in

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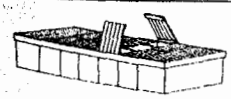

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ng line cultivation. These lastic mesh containing ly 6-8,000 Pacific oyster to old Pacific oyster shells. used for their operations sted at the Coast Seafood Quilcene Hatchery in tate.

ocess of collecting seed the new seed clings to (clutch) in plastic mesh in large setting tanks. The seed is then taken directly and shipped by trucks to y. The bags of seed are on ed out to the nursery beds sturbed until they are y 2+ mm. Generally, the allowed to grow on the until their shells start to the mesh bags. Once the y, the bags are brought in based plant where students polypropylene lines to be d placed in the long line e the oysters are attached to ystem, it takes about two n to reach market size, as e three plus years it would take oysters grown using bottom culture beds.

In the early years with ocean bed or bottom culture, predation by bat sting rays, red rock crabs, and Japanese oyster drills was expected and factored into the culture cycle for company production projections. Now, with long line off-bottom, the problem of predation is reduced, allowing for more accurate prediction of crop survival.

Dale also emphasized that communication is very important, and welcomes anyone interested to visit their operation. He presently interacts with several groups including local, state, and federal agencies, as well as community environmental groups in order to demonstrate that Coast Seafood Company's operations strive to be economically sound, and to show their awareness and efforts to insure the integrity of the local ecosystem. He strives to develop confidence between one and another to work together for the future of all activities that might take place in Humboldt Bay. There are still hurdles, of course, such as some permits that still need to be approved to improve the company operations, but this will come in time, as it relates to education and open interaction/communication and decisions that will be of benefit to all.

The final question I asked Dale was "in looking ahead, what do you see as the future of the oyster industry in Humboldt Bay." He indicated there are four companies operating in Humboldt Bay. They are his own company, Coast Seafoods, and three others: North Bay Shellfish, Aqua Rodeo Farms, and Emerald Coast Seafoods. Another operation in the northern part of Humboldt Bay near the mouth of the Mad River Slough is Ted and Linda Kuiper's operation where they grow seed for a variety of bivalve species for sales to growers on the Pacific Coast and elsewhere.

Finally, I left Humboldt Bay with a good feeling. Discussions I have had with Fred Conte from the University of California - Davis and my on-site visit with Dale indicates changes have been made that will insure the future of the shellfish culture and industry in Humboldt Bay.

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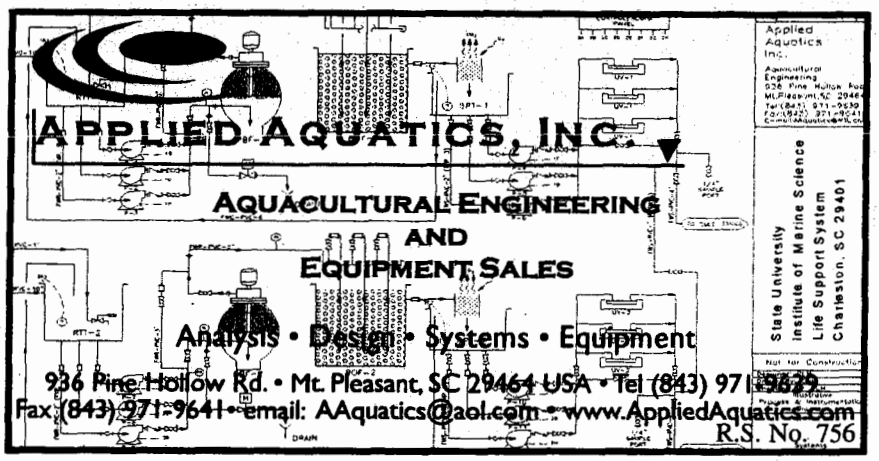

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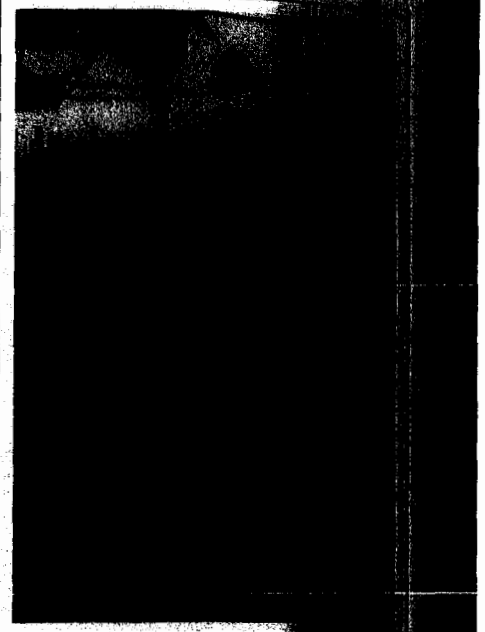


Coast Seafood Co. worke[illegible] ing the polypropylene ro[illegible] mother shell containing [illegible] Pacific oyster seed for cr[illegible] string onto the plastic pip[illegible] earlier on the grow-out oyst[illegible]

with environmental issues in H[illegible] Bay. Studies through the WRA[illegible] examining comparisons betwee[illegible] and off bottom culture of Paci[illegible] on eel grass and unvegetated [illegible] communities is headed by [illegible] Rumrill, research scientist from [illegible] This study will also monitor the [illegible] off-bottom culture on the infa[illegible] epifaunal invertebrates and fish[illegible] area. Rumrill is conducting the [illegible] in Humboldt Bay, as well as in C[illegible] in South Slough, Oregon.

Further discussions with [illegible] indicated that he believes off-b[illegible] long line culture is here to s[illegible] Humboldt Bay. He notes tha[illegible] surprisingly, long line cultur[illegible] provided many benefits, to incl[illegible] better shaped oyster, a higher survi[illegible] due in part to less predation, grow[illegible] the oysters seems to be accelerated ([illegible] years harvest on long-line vs. thre[illegible] or more with bottom culture), which in turn provides more product to market, and lessons negative impact on the environment.

Another benefit associated with long line culture is that less seed is needed for crop introduction. In the past, with bottom culture as many as 40,000 bags of seed were used compared to 10,000

saltwort (*Batis maritima*) and annual pickleweed (*Salcornia bigelovii*) integrate with cordgrass in the lower zone and perennial pickleweed (*Salcornia virginica*) and other middle zone plant species occur at higher than normal elevations in these and other southern California marshes.

In addition to the plant communities, other defining characteristics often associated with California's tidal wetlands include mudflats, tidal creeks, intertidal channels and sloughs, salt flats, and shallow pannes. Fresh water inflows are also often found in many of the state's coastal wetland areas, adding to the diversity of habitat types and associated species use.

Many of California's coastal wetlands are estuarine salt marshes. These salt marshes, associated mudflats, and eelgrass beds develop along the shores of protected estuarine bays and river mouths, as well as in more marine-dominated bays and lagoons. Overall, the state's tidal and estuarine wetland ecosystems provide some form of food, shelter, or other benefits to nearly a thousand species of fish, amphibians, reptiles, birds, mammals, and a multitude of invertebrates. During peak annual migration periods, hundreds of thousands of birds migrating along the Pacific Flyway descend upon the state's estuarine wetlands in search of refuge and food.

California's tidal wetlands also provide habitat for an array of endangered species, including the salt marsh harvest mouse, California clapper rail, certain runs of salmon, and wetlands plants such as a species of salt marsh birds peak. Wetlands produce an abundant yield of vegetation, which in turn provides the basis for a complex food chain nourishing a rich assortment of living organisms. The diversity and abundance of organisms in coastal wetlands is remarkable, given the often extreme and variable conditions that can occur. Bacteria, protozoa, algae, vascular plants, invertebrates, amphibians, fish, birds, and mammals can all be found within the state's coastal wetland ecosystems, and together comprise the biotic community of the wetland. Many of these organisms are dependent on the wetland for their existence, either spending their entire lives in the wetland, or spending a critical portion of their life cycle in the wetland.

Region	Estimated Original Acreage	Estimated Remaining Acreage	Estimated Percent Reduction
Northern Coast	unknown	31,300	unknown
Central Coast	unknown	3,800	unknown
San Francisco Bay	200,000	93,000 (tidal and mudflat)	54%
Southern Coast	53,000	13,100	75%
Statewide	5,000,000	450,000	91%

Historic Losses of California Coastal Wetlands

Source: Procedural Guidance for the Review of Wetland Projects in California's Coastal Zone, California Coastal Commision.

Status of Biological Knowledge

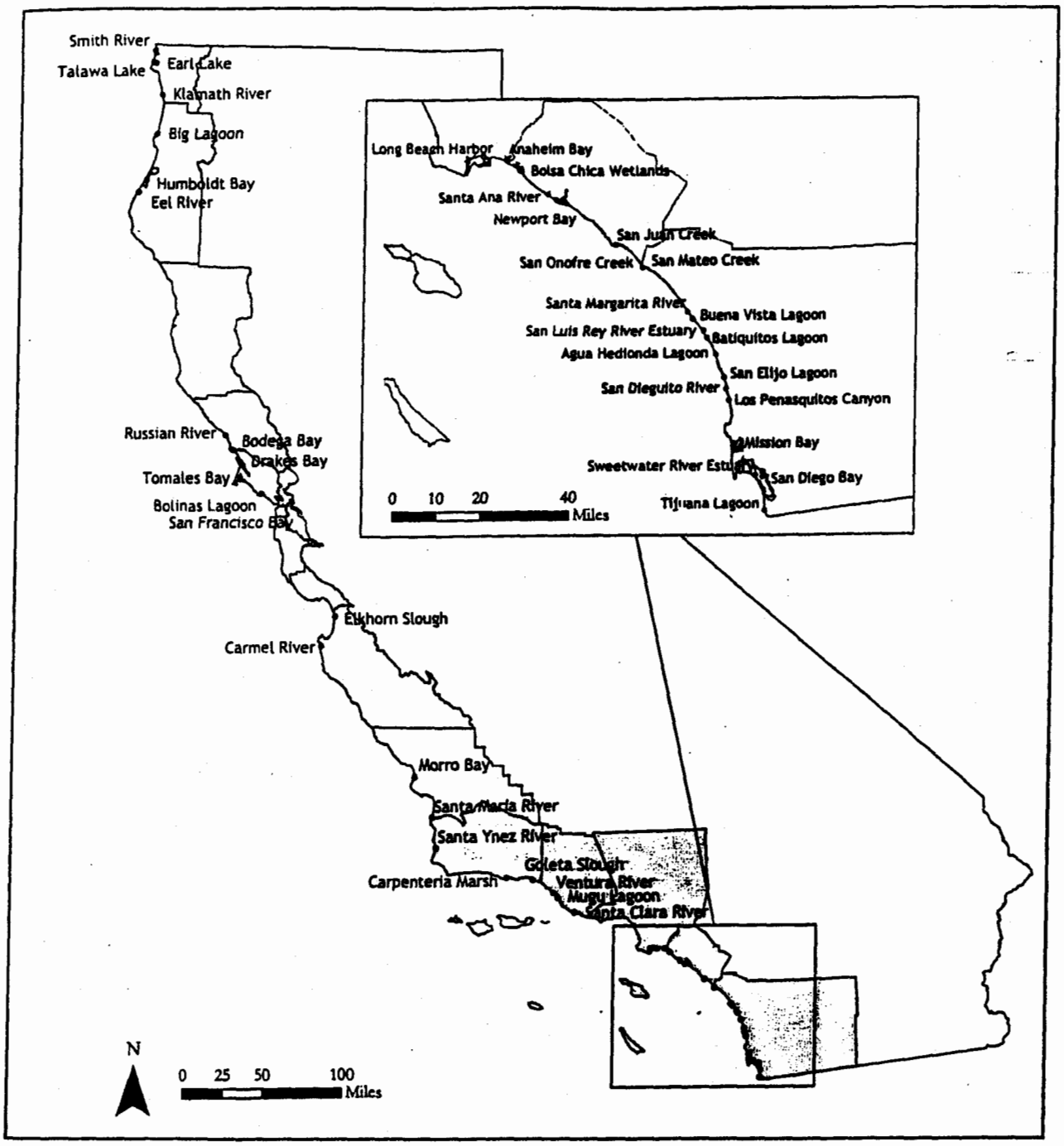
Literature on wetland science addresses a broad range of topic and setting, and much has also been written specific to California's estuarine and coastal wetlands. Programs such as the San Francisco Bay National Estuary Project, San Francisco Bay Baylands Ecosystem Habitat Goals Project, and organizations such as the Pacific Estuarine Research Laboratory, state and private universities, and numerous state and federal resource agencies have contributed extensively to the knowledge base of California's coastal wetland ecosystems. This is not to say that questions do not remain about the functions and science of the state's coastal wetlands.

Scientific study in the field of wetland science is ongoing. The role that the state's coastal wetland habitats play in the support of fish and wildlife resources is an area of extensive research, particularly in the effects of, and techniques for enhancement and restoration. Many of the coastal wetland restoration projects undertaken within the state include research and monitoring aspects within the project designs. Such analyses are vital to the overall knowledge base of wetland science and are critical to the improvement of subsequent wetland restoration activities.

Status of the Habitat

Human influence along California's coastline has a long history. The effect of this history is evidenced by the profound alteration of the natural environment, most pronounced of which are the modification of the shallow-water habitats within the state's bays and estuaries and the staggering loss of coastal wetlands. The total loss of California coastal wetlands is estimated at five million acres. This represents some 91 percent of the historic wetland acreage present before 1850. Although the entire coastline of the state has experienced losses of coastal wetland habitat, the largest losses are believed to have occurred in the San Francisco Bay estuary and along the southern coast of the state.

A variety of activities have contributed to the dramatic loss of California's wetlands. These include diking, filling, draining, and vegetation removal for agricultural uses; diking and filling for residential, commercial, and industrial development; placement of fill material for road and pad construction associated with oil and gas exploration and development; filling and other associated construction for roads, highways, and railways; dredging and filling for port and marina development; and channelization and filling for flood control purposes. Coastal wetland losses, including those historically occurring within bays and estuaries, throughout the state are primarily attributed to urban development. Although state and federal regula-



Principle Coastal Wetlands of California

tions, as well as social pressures have reduced activities that cause wetland losses, many are still occurring. Much of the current loss of wetlands is attributed to a lingering legacy of past development, such as continued use of wetland areas for agriculture, or expansion of existing urban and industrial complexes within wetland habitats. Secondary or indirect impacts also have contributed to the continued loss of coastal wetlands, including point and non-point source storm and wastewater discharges, and alteration of natural fresh and salt water inflows to the state's estuaries and wetland areas.

The Bolsa Chica wetlands in the Huntington Beach community is a site of recent controversy over wetland development and is an example of one of southern California's continuing struggles with the preservation of remnant coastal wetlands. The Bolsa Chica wetlands are the largest stretch of unprotected coastal marshland south of San Francisco, and provide 1,100 acres of wetland habitat, sup-

porting many species of plants, fish, and wildlife, including several endangered species of birds, such as the California least tern, light-footed clapper rail, Belding's Savannah sparrow, and peregrine falcon. Southern California once had over 53,000 acres of coastal wetland areas. This number is now down to approximately 13,000 acres. Such wetland losses have contributed to a decline in California's wintering bird population. Once estimated to be about 60 million, flyway populations now fluctuates between two and four million waterfowl, one and two million shorebirds. For the Pacific Flyway as a whole, there has been some improvement in recent years, partly because of the end of a multi-year drought in the northern breading areas, but also because of the efforts made at restoring California's coastal and inland wetlands.

In many ways, the degree and type of tidal wetland habitat losses within the San Francisco Bay estuary reflect what has occurred in the state. Early reclamation activities resulted in the draining and diking of tidal, freshwater, and brackish marshes in the San Francisco Delta, as well as around Suisun Bay and San Pablo Bay. Much of this reclaimed land was cultivated for agricultural purposes. Additionally, the construction of salt production facilities resulted in the conversion of thousands of acres of tidal marsh to permanent salt pond operations. At the end of World War II, urbanization of the San Francisco Bay Area resulted in the conversion of intertidal and subtidal habitats to urbanized uplands. As a result of these wetland conversion activities, it is estimated that 95 percent of the estuary's tidal marshes have been leveed or filled. Some of the converted wetland areas, such as salt ponds and diked lowlands, remain as wetland habitat, but of a different type, offering substantially altered functions than that which existed before conversion. At present, it is estimated that less than 38,000 acres of tidal wetlands remain in the San Francisco Bay estuary, with an additional mudflat habitat of approximately 65,000 acres, diked seasonal wetland habitat of approximately 58,000 acres, and salt ponds and salt crystallization facilities of approximately 36,500 acres of non-tidal wetland habitat.

Losses and alteration impacts of tidal wetland habitat associated with coastal inlets and riverine estuaries along the California coast have also been great. Many of the state's historical wetland areas of this type have been lost or reduced in size due to direct impacts such as channelization, dredging and continued breaching of outer sandbars for flood control, and marina and harbor construction. However, off-site activities including water diversion and sediment inputs associated with watershed alterations including logging and agricultural cultivation also have significantly impacted California's coastal tidal wetlands.

California's remaining coastal wetlands are highly valued as habitat for the multitude of species that depend on them, and as aesthetic, functional, environmentally necessary elements. In fact, tidal wetland protection and restoration activities have become front-page news in many areas of the state and funding sources, once unobtainable, are now becoming increasingly available. Even with such changes in the political, economical, and environmental settings, much work needs to be done to recapture and protect California's tidal wetland habitats. Additional research and continued monitoring of existing wetland restoration projects are needed to build and contribute to the database on how best to address and undertake these activities. Additionally, methods need to be developed to address problems which could lead to the further loss of coastal wetland areas due to the anticipated rising sea-level, and other factors such as invasive species. Further public education, community involvement, and political action are needed.

Eric J. Larson
California Department of Fish and Game

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California's Living Marine Resources:
A Status Report

The Resources Agency
The California Department of Fish and Game

California Governor Gray Davis

Resources Secretary Mary D. Nichols

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Bay and Estuary Ecosystems

The bays and estuaries dotting California's coastline are truly the jewels in the crown of the state's marine environment. These partially enclosed bodies of water are protected from the full force of ocean waves, winds, and storms. Bays are wide inlets or indentations of the ocean, whereas estuaries are inlets containing the terminus of a river or stream. Many of the organisms described in this report spend part of their life in bays or estuaries. However, this section of the report focuses primarily on the plant and animal species that utilize the state's estuarine areas as their principal habitat.

California estuaries vary widely in shape and size, and are often referred to as lagoons, harbors, inlets, esteros, and sounds. The defining feature of an estuary is the mixing of fresh water from upland and riverine sources with oceanic salt water. The estuary ecosystem forms a zone of transition from land to sea and from fresh to salt water. The sheltered waters of California's estuaries support unique assemblages of plant and animal communities, varying by environmental conditions and location. Estuarine habitat types include shallow open waters, fresh and saltwater marshes, sandy beaches, tidal mud and sand flats, rocky shorelines, oyster-shell beds, river deltas, eelgrass meadows, and kelp beds.

California's estuarine environment sustains remarkably high levels of productivity. Often referred to as the "ocean's nursery," these waters support early life-history stages of such important organisms as California halibut, Dungeness crab, Pacific herring, starry flounder, and numerous surfperch species. Representative organisms typifying California estuaries include rails and stilts, harbor seal, Dungeness crab, surfperches, leopard shark, starry flounder, and clams and oysters. These animals are linked to one another and to an assortment of specialized plants and microscopic organisms through a complex food web, unique to estuarine environments. Tens of thousands of birds, mammals, fish, and other wildlife depend on estuarine habitats as places to live, feed, and reproduce. Additionally, the state's estuaries provide ideal locations for migratory birds in the Pacific Flyway to rest and forage during their journey. Due to their critical importance, the U.S. Environmental Protection Agency's National Estuary Project has identified San Francisco Bay, Morro Bay, and Santa Monica Bay as nationally significant estuaries, thus affording federal funding for research, management, and restoration efforts. This designation of three of the state's estuaries in no way diminishes the ecological importance of the other bay and estuarine ecosystems that dot the California coastline.

Besides serving as critical habitat for wildlife, the wetlands that fringe many of the state's bays and estuaries also provide other important ecological and human benefits. Wetland plants and soils act as natural buffers between land and ocean, absorbing flood waters, dissipating storm surge, and filtering sediments, nutrients, and other pollutants. The state's bays and estuaries are also cultural centers of coastal communities, serving as the focal point for local commerce, recreation, and cultural activities. The protected waters of California's bays and estuaries support important public infrastructure uses, serving as harbors and ports vital for the state's shipping, maritime, and industrial related economy.

Because of the complexity and fragility of estuarine ecosystems, they are imperiled by their proximity to intensive human activity and development. Sewage, industrial waste, dredging, filling of marshes and tidal flats, and oil development and spills typify the long-term degradation of many of California estuaries. As a result, 40 animal and 10 plant species that occur in or depend on the state's estuarine ecosystems, currently are listed by the federal government as threatened, endangered, or protected status. Additionally, environmental harm from nonindigenous, or invasive, species has increased exponentially in recent years. San Francisco Bay is considered by experts to be "the most invaded estuary in the world." Notable examples of deleterious nonindigenous species are the Chinese mitten crab, the Asian clam, and the European green crab. Such invaders are capable of wreaking extensive ecological and economic harm. As California's population grows, these impacts can be expected to increase. So too does the importance of protecting the state's estuarine resources for all of their natural, economic, and aesthetic values.

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Bay and Estuarine Plants: Overview

From a biological perspective, no other complex is more important to bay and estuary ecosystems than their plant communities. Whether discussing tidal wetlands, shallow subtidal habitat, or marine algae, plant communities and the habitats they form are vital to the function and health of bays and estuaries. Two important plant components within the bay and estuary setting are the tidal wetland, and the subtidal eelgrass (*Zostera marina*) and *Gracilaria spp.* communities. While these two plant groupings are small fractions of the bay and estuarine plant assemblage and do not occur in all bays and estuaries of the state, they are significant contributors to the overall productivity and species diversity of these ecosystems. Other commonly occurring bay and estuarine plant communities, such as phytoplankton, algal mats, and sea lettuce are not addressed by this report, but are important food contributors and principal components of these ecosystem carbon budgets.

Bay and estuary ecosystems are the probably the most impacted and altered environments of the California coastline. Most of the state's bay and estuary ecosystems are intensively urbanized, serving as centers for industry, agriculture, and commerce. The impacts of such anthropogenic activities are acutely evident within the bay and estuarine plant communities. The loss of tidal and subtidal wetland habitats on a statewide level is substantial. Where once vast mosaics of tidal wetlands predominated, agriculture, housing, or other developments have been formed from lands diked from the bay or filled. Similarly, losses of subtidal plant communities are accelerating worldwide. In southern California, it has been estimated that as little as ten percent of the historical distribution of eelgrass remains. In the majority of cases, once bay and estuary plant communities are destroyed they are lost forever. Some restoration has occurred throughout the coastal region of California with significant efforts focused on southern California, particularly within Mission and San Diego bays and the reopening of Bataquitos Lagoon to tidal flow. However, in most cases, the goal remains one of preservation.

Bay and estuary plant communities provide critical habitats, which support a diverse array of fish and wildlife including species that are in danger of extinction. The diverse structure of bay and estuarine plants also helps to improve water quality, protect lands from flooding, provide energy to the marine and estuarine food web, and stabilize shorelines against erosion. Studies have found that subtidal plant communities are also principal contributors to primary productivity within bay and estuary ecosystems.

The economic value of bay and estuarine wetlands and subtidal habitats is considered to be among the highest of all natural resources. Such habitats support commercial harvests of fish and shellfish and provide millions of days of recreational fishing and waterfowl hunting each year. On a global level, such plant communities help stabilize available nitrogen, atmospheric sulfur, carbon dioxide, and methane. In the crowded urban environment, where many remnant populations of bay and estuary plant communities exist, such habitats contribute to open space and are a valuable aesthetic asset. A recent economic assessment of California's wetlands conducted by the California Coastal Commission established annual benefits valued at between $6.3 billion and $22.9 billion.

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Coastal Wetlands - Emergent Marshes

General Description

Wetlands are broadly defined as the transitional lands that occur between the terrestrial and aquatic systems where the water table is usually at or near the surface, or the land is covered by shallow water. There are five major systems of wetlands – marine, estuarine, riverine, lacustrine (lake), and palustrine (freshwater marsh). This paper discusses California's marine and estuarine wetland systems. However, it should be noted that all five systems occur in the state, all of which serve important roles as fish and wildlife habitat and in many ways are ecologically tied to one another.

One of the most widely used and comprehensive wetland classification system was developed for the U.S. Fish and Wildlife Service and is referred to as the Cowardin definition. This classification system defines wetlands as having 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. Although this system is commonly used to classify wetlands, regulatory agencies such as the U.S. Army Corps of Engineers, the U.S. Environmental Protection Agency, and other public agencies use varying definition when regulating the discharge of dredged or fill material or other alterations to wetland areas.

The term "tidal wetland" refers to areas that are covered with shallow intermittent tidal waters. Coastal tidal wetlands in the California include a number of natural communities that share the unique combination of aquatic, semi-aquatic, and terrestrial habitats that result from periodic flooding by tidal waters, rainfall, and runoff. These coastal wetlands, also referred to as salt marshes, provide a vital link between land and open sea, exporting nutrients and organic material to ocean waters. Wetlands also help to improve water quality, protect lands from flooding, provide energy to the estuarine and marine food webs, and help stabilize shorelines against erosion.

Tidal wetlands are dominated by a community of plants that are tolerant of wet, saline soils, and are generally found in low-lying coastal habitats which are periodically wet and usually saline to hypersaline. In fact, no other feature defines a salt marsh better than the plant communities that form there. The location of plant species within a salt marsh is defined by zone, with cordgrass (*Spartina foliosa*) forming the most seaward edge of the emergent marsh plant community. Of the thousands of plant species in North America, only cordgrass thrives in the lowest zone of a salt marsh. This lower marsh zone occurs from approximately mean sea level to the line of mean high tide.

The middle zone of a tidal marsh occurs from approximately the line of mean high tide to the mean higher high tide line and is characterized by the occurrence of pickleweed (*Salcornia sp.*). Pickleweed is less tolerant of tidal inundation than cordgrass, but is the most dominant plant of California tidal wetlands. Jaumea (*Jaumea carnosa*) also occurs, but to a lesser extent within the middle zone of California's coastal marshes.

The upper zone of a tidal marsh is defined by the line of mean higher high tide to extreme high tide. This upper zone of a salt marsh may only be inundated infrequently, in some locations as little as once or twice annually. Such innundation usually occurs during the spring tide cycle (highest annual tides) and during severe storm events. The upper zone of the tidal marsh is characterized by the dominance of salt grass (*Distichlis spicata*) which tolerates only occasional tidal inundation. This upper area of marshes contains the largest plant species diversity of the three zones. Species such as fat hen (*Atriplex patula*), sand spurrey (*Spergularia marina*), marsh rosemary (*Limonium californicum*), brass buttons (*Cotula cornopifolia*), can be found within the upper zone of salt marshes throughout California. In the southern portion of the state, species such as Australian salt bush (*Atriplex semibaccata*), sea-bite (*Suaeda californica* and *Suaeda fruticosa*), shoregrass (*Monanthochloe littoralis*), and salt marsh bird's beak (*Cordylanthus* sp.) can be found within the upper salt marsh zone.

The zonation of marshes in southern California is somewhat more complex than that described above. Southern California salt marshes lack expansive stands of cordgrass; instead they are dominated by succulents. Within the Mugu Lagoon, Anaheim Bay, Newport Bay, Mission Bay, San Diego Bay, and the Tijuna River estuary, zones of

Carpinteria Salt Marsh, Santa Barbara Co.
Credit: USEPA, 1995

epic

December 7, 2001

Allison Dettner
Nancy Cave
California Coastal Commission
45 Fremont Street, Suite 2000
San Francisco, CA 94105-2219

Re: Coast Seafoods Company Coastal Development Permit Application E-01-024

Dear Ms. Dettner and Ms. Cave:

It is our understanding that Coast Seafoods (Coast) submitted an application to the California Coastal Commission on August 23, 2001 for a coastal development permit. Marina Cazorla of your staff submitted a letter to Greg Dale and Robert Studdart of Coast on September 21, 2001, informing them that the application that was submitted on August 23, 2001 was incomplete, and that additional information would be required. No mention was made in this correspondence of Coast operating without a permit, and that Coast operations were considered an ongoing violation that needed to be addressed. The violation has apparently been considered a separate action, yet it certainly appears to be a relevant piece of information in relation to Coasts application for a coastal development permit, and worthy of reference.

We were informed on November 21, 2001 that rather than requiring a coastal development permit, the California Coastal Commission was planning on negotiating an interim settlement agreement with Coast, possibly in closed session. The interim settlement agreement essentially sanctions a coastal development permit without public review. The interim settlement agreement is subject the following,

"...the public has the right to fully participate in decisions affecting coastal planning, conservation, and development; that achievement of sound coastal conservation and development is dependent upon public understanding and support; and that the continuing planning and implementation of programs for coastal conservation and development should include the widest opportunity for public participation" (Public Resources Code, section 30006).

We question the validity of the interim settlement agreement, particularly if it is negotiated in closed session. We object to resolution of this issue in closed session, without fines and penalties, while continuing to allow the destruction of critically important eelgrass beds which are an environmentally sensitive marine habitat of biological significance, and other marine resources. According to the Humboldt Bay Area Plan of the Local Coastal Program (HPAP) Section 3.30 (1989), identification of environmentally sensitive habitats, eelgrass is an environmentally sensitive habitat in Humboldt Bay, of special biological and economic significance. By reviewing Coast's application and ongoing violation in closed session, the lack of permits will essentially become a bonus for Coast, who can now use their continued disrespect of the law as a way to avoid public scrutiny. Coast has willfully chosen to continue their practices in the most environmentally damaging way, with full knowledge that their activities are directly impacting other commercial fisheries, including but not limited to the rockfish fishery, the salmon fishery, the herring fishery, and the crab fishery. Coast aquaculture operations constitute unfair business practices. Coast has continued to operate without permits in Humboldt Bay within eelgrass

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beds, in spite of the fact that their operations do not need to take place within eelgrass beds. We believe this constitutes unfair business practices for other oyster growers and commercial fishermen in Humboldt Bay, who are required to obtain valid permits. We formally request copies of all proceedings and documents produced by the California Coastal Commission, as well as copies of all documents submitted by Coast regarding this proposed action.

Coast aquaculture production is taking place on public trust lands and marine resources of the state of California where, "all public natural resources are held in trust by the State for the benefit of the People". Yet Coast has been dictating how these public trust marine resources are sacrificed based upon the monetary needs of Coast. Coast operations have been causing a significant adverse impact on beneficial uses of public trust lands and marine resources, to the detriment of public trust marine resources. These important public trust marine resources will no longer be available for the benefit of current and future generations of Californians.

As one of the state guardians over the public trust, the Coastal Commission is supposed to ensure public trust resources are protected so that they can be enjoyed by current and future generations of Californians. Those public trust resources include the land area of the bay, and all marine resources present within Humboldt Bay other than those species described in the permit 1998-3 (Manila clams, Pacific oysters, Kumamoto oysters, mussels, and scallops). Acting as the Trustee of the public trust, the Coastal Commission must ensure that they have adequately addressed known impacts to public trust resources, and adequately protected the Public trust resources. We strongly object to Coast practices that allow the continued destruction of public trust resources on the submerged land surface and within the waters of Humboldt Bay. These public trust resources include alterations in topography and channel hydrology, substrate, invertebrate communities, ecologically significant eelgrass beds, listed salmonid juvenile rearing grounds, adult salmonid staging areas, herring spawning grounds, related biota, essential fish habitat, rockfish species, crabs, bat rays, and other related biota in Humboldt Bay.

The HBAP provides the following direction:

"Marine resources shall be maintained, enhanced, and, where feasible, restored. Special protection shall be given to areas and species of special biological or economic significance. Use of the marine environment shall be carried out in a manner that will sustain the biological productivity of coastal waters and that will maintain healthy populations of all species of marine organisms adequate for long-term commercial, recreational, scientific, and educational purposes." Chapter 3, pg.55 HBAP.

We believe that the direction from the HBAP is clear: marine resources shall be maintained or enhanced, and where feasible, restored. Coast is not maintaining marine resources; they are actively engaging in their destruction. Coast Mariculture operations in North Bay clearly are not being carried out in a manner that will maintain the biological productivity of coastal waters. Coast Mariculture operations clearly also do not maintain healthy populations of all species of marine organisms. The Coastal Commission should require Coast to cease operations involving cleaning of bottom culture beds and planting of longlines until an evaluation of all beds in North Bay is completed to determine where oyster culture is appropriate. The Coastal Commission should require that no more bottom culture or use of the hydraulic dredge as part of the interim settlement agreement.

The Environmental Protection Information Center (EPIC) has numerous issues and concerns that we believe should be addressed by Coast if the Coastal Commission is going to negotiate an interim settlement agreement for Coast operations in lieu of a valid coastal development permit. Because the Mitigated Negative Declaration (MND) that was completed for the Harbor District in 1999 does not adequately assess the impacts caused by Coasts operations or provide the necessary information, we have organized our comments according to our issues and concerns associated with each of the MND conditions of approvals. We have also included specific recommendations for additional scientific studies and mapping information needs, as well as recommendations for required operating conditions that Coast must observe in order for them to continuing operating in Humboldt Bay.

Our comments are organized according to our issues and concerns associated with each of the MND conditions of approvals. We have also included specific recommendations for additional scientific studies and mapping information needs, as well as recommendations for required operating conditions that Coast must observe in order for them to continuing operating in Humboldt Bay.

ISSUES AND CONCERNS ASSOCIATED WITH THE MITIGATED NEGATIVE DECLARATION (MND)

The current state of the Western Regional Aquaculture Center (WRAC) studies, and the other ongoing studies required by the MND in 1999, do not satisfy the MND requirements. Coast has also not met many of the conditions of approval outlined in the MND in their operations, such as avoidance of eelgrass. Both Coast and the Harbor District executed the MND in 1999 knowing full well what the requirements were that were outlined in the MND, and what was required to meet those obligations. The MND requirements must be met in order for Coast and the Harbor District to be in compliance with CEQA.

We believe that Coast and the Harbor District have deliberately delayed meeting the MND requirements, and completing the WRAC studies and future planned studies in order to substantiate their claim that there is insufficient information for the other permitting agencies to issue permits to Coast for their operations. Because of a lack of permits, Coast has continued to operate wherever they chose in Humboldt Bay, while continuing to destroy public trust resources. We do not believe that Coast or the Harbor District have made a good faith effort to obtain permits, to adequately assess the impacts caused by Coasts operations, or to address known impacts and chose less environmentally damaging alternatives. Coast has consistently chosen the most environmentally damaging alternative, with full knowledge that their activities are directly impacting other commercial fisheries, including but not limited to the rockfish fishery, the salmon fishery, the herring fishery, and the crab fishery. Coast aquaculture operations constitute unfair business practices because they have been given an unfair advantage over other resource users in Humboldt Bay. Coast has continued to operate without permits in Humboldt Bay, within eelgrass beds, with full knowledge that their operations are destroying an important and critical marine habitat that is essential for many other commercially important species.

The MND contains a list of environmental concerns and mitigation measures that were supposed to address the environmental impacts associated with Coast operations in Humboldt Bay. To date, most of these mitigation measures have not been completed. The following section outlines our issues and concerns associated with the conditions and approvals listed in the MND.

A1. "Effects of mariculture on sediment accumulation and related effects on biological resources, including invertebrates" (MND, pg.25)	..."Coast shall cooperate with academic research personnel associated with the Western Regional Aquaculture Center (WRAC) in conducting a four year study of the effects of mariculture on sedimentation and the associated biota in tidal flats, applicable to Humboldt Bay."

A1. Issues: According to comments raised by CDFG at the mariculture monitoring meeting on November 28, 2001, essentially no studies have been conducted on the effects of mariculture on sedimentation rates in Humboldt Bay, particularly on the potential impacts of longlines. Eelgrass (*Zostera marina*) distribution is strongly influenced by elevation within Humboldt Bay, and increased sedimentation rates due to longlines may be adversely impacting eelgrass beds and associated biota. Increased sedimentation from longlines could potentially be creating more favorable conditions for the aquatic invasive species, the green crab, due to increased elevations. Green crabs favor higher tidal elevations than the native crabs (Susan McBride personal communication 2001). Increased sedimentation may favor green crabs over native crabs in areas impacted by longline structures. In addition, there has been no discussion of the potential impacts associated with the longline harvester that Coast may potentially use in the future to harvest longlines within Humboldt Bay. The impacts are currently unknown as to how the new longline harvester may effect sediment distribution, and biological resources, including eelgrass, and other marine biota.

Invertebrate studies are limited in nature, and will not be able to determine whether mariculture has had a significant effect on invertebrates, particularly macroinvertebrates (Mariculture monitoring meeting 11/28/01). Invertebrates each

favor different tidal elevations, substrates, and other environmental parameters that will not be adequately addressed by the current WRAC studies. Please see additional comments provided under mitigation measure A4.

Hydraulic dredging has also continued, and the impacts associated with increased turbidity and resuspension of sediment have not been addressed. While hydraulic dredging may be limited to the five bottom culture beds, these beds still represent a significant amount of eelgrass habitat. In fact, 4 of the 5 beds are located in dense eelgrass stands (MR 7-1, MR 8-2, MR 2, EB 6-2) according to CDFG mapping of eelgrass distribution (Appendix A). Only one bed is located outside of dense stands of eelgrass (EB 1-1). No studies have been conducted on the effects of hydraulic dredging as a form of mechanical disturbance to eelgrass, the bay substrate, and the invertebrate communities. There have been no studies on the potential for increased levels of suspended sediments and elevated levels of turbidity in the water column, which could potentially redistribute sediments within the Bay. These impacts have combined adverse cumulative impacts on eelgrass within Humboldt Bay that have not been addressed.

The only sediment measurements that were taken were sediment elevations self monitored by Coast along a bat ray fence (location unknown) between August 11, 1999 and August 30, 2000. This does not constitute a scientifically credible study on the potential sedimentation effects of bat ray fences. As long as bat ray fences are in place in Humboldt Bay, Coast should be required to conduct a scientifically valid study on sedimentation effects of bat ray fences.

In conclusion, we know of no studies currently being conducted on sedimentation rates associated with longlines in Humboldt Bay. Sedimentation studies from other estuaries such as Coos Bay, Oregon are not directly applicable to Humboldt Bay. Different geology, bay hydrology, tidal flux, tidal elevations, and sedimentation patterns within Humboldt Bay create a unique set of estuarine conditions. Sedimentation studies should be required to take place in Humboldt Bay so that they are directly applicable to the effected area.

A1 Recommendations: Require Coast to remove the hydraulic dredge, and require Coast to harvest remaining bottom culture beds by hand, and clean off shell by hand. Place longlines proposed for MR 7-1, MR 8-2, MR 2, EB 6-2 at less environmentally damaging sites outside of dense stands of eelgrass. Require Coast to conduct a scientifically credible study on the impacts of longlining and bat ray fences on sedimentation rates in Humboldt Bay. Require Coast to analyze the potential impacts of new potential harvesting equipment and harvesting methods that may be employed in the future, and determine whether they are appropriate for use in Humboldt Bay. Require Coast to conduct a scientifically credible study on the potential impacts of sedimentation and altered elevations on the distribution of both native and exotic crabs within Humboldt Bay. Require Coast to conduct a scientifically credible study on the effects of mariculture on invertebrate communities (including macro) present in both shallow and deep substrates.

A2. Effects of mariculture on eelgrass and related biota, including salmonids and Black Brant.	..."Coast shall cooperate with academic research personnel associated with the WRAC in conducting a four year study of effects of mariculture on eelgrass and associated biota in tidal flats, applicable to Humboldt Bay."

A2 Issues: The only research that has been conducted to date to fulfill this mitigation measure has been mapping and sampling of eelgrass beds. We are amazed that given the amount of money and time that has recently been spent on eelgrass mapping, there is not a better mapping product available that shows the current distribution and abundance of eelgrass. The Ecoscan mapping completed in 1992 is still the most accurate mapping to date for eelgrass; even Coast agrees with this statement, and still uses the Ecoscan mapping. The 1997 imagery was flown on December 2, 1997 for the purpose of oilspill response; it was not flown for the purpose of mapping eelgrass. Because eelgrass biomass is substantially reduced by December, any mapping of eelgrass from December imagery severely underestimates the standing eelgrass biomass and distribution present. The September 13, 2000 imagery is also considered inferior; the glare caused by the angle of the sun and the 2" tidal elevation render the imagery practically useless from an eelgrass mapping perspective. There is an urgent need to conduct eelgrass mapping on imagery flown at the appropriate time of the year (see NMFS eelgrass mitigation policy No. 2 , adopted July 31, 1991 for Southern California), according to scientifically credible protocols. Specific criteria and standards are obviously needed for future mapping efforts.

The original sampling design for sampling of eelgrass was completely biased to show a "no effect" for eelgrass in aquaculture treatment plots. According to CDFG comments in mariculture monitoring meetings, the sampling design was clearly not representative of Coast operations within Humboldt Bay. Based upon this input from CDFG, the sampling design was modified to include control plots. However, all the control plots were sampled in late November, and took place at a different time than the rest of the sampling that was conducted within the areas of aquaculture, which took place in the summer. A scientifically credible sampling design requires that all sampling be conducted ***at the same time***. In addition, because eelgrass is most abundant in the summer, and begins to slough off and deteriorate by September, any sampling of eelgrass in November would severely underestimate the amount of eelgrass present, while the samples in the summer would be most likely to represent the maximum biomass. As a result, if all samples were pooled together, there is a likelihood that the aquaculture plots would not show a statistically significant difference from the control plots, and may even have been more abundant. However, that is certainly an invalid approach to sampling, and clearly biased towards showing a no effect relationship of the impacts of mariculture on eelgrass. Another issue of concern is that eelgrass sampling is biased towards bed peripheries, where sampling is considered to be logistically easier. Oddly enough, Coast appears to have no logistical problems with operating in the interior of many eelgrass beds. However, samples from the edge of eelgrass beds may produce different results than samples from the interior of the bed. As you may know, nutrient levels are higher closer to the channels, and eelgrass density and biomass may be significantly higher closer to channels. Eelgrass recovery from disturbance may also be quicker along channels than in the interior of eelgrass beds. The current study can only make definitive statements about eelgrass density and biomass adjacent to channels. The current study has serious flaws that need to be addressed if this study is to be considered scientifically credible and applicable to the rest of Humboldt Bay.

Eelgrass sampling currently being conducted by Susan McBride, Sea Grant Marine Advisor is also focused exclusively on eelgrass beds adjacent to channels. Therefore, the information currently being collected by Sea Grant can only make definitive statements about eelgrass densities and biomass adjacent to channels, and cannot reasonably be extrapolated to apply to the interior of eelgrass beds.

A number of salmonids present in Humboldt Bay are listed under the Endangered Species Act (ESA). No studies have been conducted on any of the life stages of salmonids in Humboldt Bay. Yet it is known that estuaries are very important for salmonids and other anadromous fishes; adults use them as staging areas for upstream spawning migrations and juveniles and smolts use them as rearing areas (Sedell et al. 1991).
Studies for salmonids that take place in other bays or estuaries will not be applicable unless those areas are located within the same Evolutionarily Significant Unit (ESU) pursuant to the Endangered Species Act (ESA) of the particular species of concern. ESUs are areas where a population is reproductively isolated from other conspecific population units, and represents an important component in the evolutionary legacy of the species (NMFS 1991). Because ESUs represent different evolutionary legacies, species response to environmental variables will be different between ESUs. Information from other ESUs cannot be considered applicable to Humboldt Bay. Sampling for salmonids in Humboldt Bay needs to take place during appropriate sampling periods for each species - when they are expected to occur.

Eelgrass beds serve as a spawning area and/or nursery grounds for dungeness crabs, rockfish, herring, and salmonids, and thus, these species all constitute "related biota" of eelgrass. However, virtually no studies have been conducted about the impacts of mariculture on juvenile crabs, herring, or rockfish. This is a major deficiency within the MND. The MND does not address impacts on "related biota".

Aquaculture beds are located within East Bay on critical spawning grounds for herring. Aquaculture operations that remove eelgrass eliminate available substrate for herring spawning. Hydraulic dredging and other mariculture activities in East Bay not only eliminate the eelgrass; it can also destroy herring eggs if activities occur at the wrong time. Mariculture operations that take place during the herring spawn cause significant impacts to the fishery. While Coast has agreed to refrain from harvesting during the herring spawn, CDFG and the Harbor District do not police Coast mariculture operations during the herring spawn. It is essentially up to Coast to determine whether or not they should refrain from harvesting in a particular area. We believe this constitutes unfair business practices, because the herring fishery is left

virtually to the whim of Coast's decision on whether or not they should harvest. We believe that Coast should be required to cultivate oysters outside of known spawning areas, such as the East Bay.

Only one study has been conducted on the effects of mariculture on black Brant, which found a significant adverse affect due to disturbance from mariculture activities and subsequent reduced eelgrass stocks (Schmidt 1999). At the mariculture monitoring meeting held on November 28, 2001, concerns were raised by monitoring committee members that impacts on black Brant had not been addressed. Even though the MND explicitly addresses black Brant, no additional requirements were placed on Coast to ensure that adequate studies were conducted on the impacts of mariculture activities on black Brant. Instead, direction was given to consult with Humboldt State University professors to determine if they knew anything about the potential impacts of mariculture on black Brant. Consulting with a professor does not constitute scientifically credible research that explicitly addresses the effects of mariculture on black Brant.

A2 Recommendations: Coast should be required to follow the NMFS eelgrass mitigation policy, adopted July 31, 1991 for Southern California. Require Coast to conduct scientifically credible eelgrass mapping and sampling. Require Coast to conduct a scientifically credible study on the impacts of mariculture on all life stages of salmonids within Humboldt Bay. Studies on salmonids need to take place either within Humboldt Bay or within the ESU of each listed species. Require Coast to conduct a scientifically credible study on the impacts of mariculture on dungeness crabs, rockfish, and herring within Humboldt Bay. Require Coast to conduct a scientifically credible study on the impacts of mariculture on black Brant within Humboldt Bay. Require Coast to cultivate outside of known herring spawning grounds.

A3. Effects of mariculture on juvenile salmonids in Humboldt Bay	..."Coast shall cooperate with academic research personnel associated with the WRAC in conducting a four year study of effects of mariculture on juvenile salmonids in tidal flats, applicable to Humboldt Bay."

A3 Issues. Humboldt Bay provides a nursery for salmonids (Monroe 1973), including listed salmonid species. Eelgrass beds serve as the most important nursery habitat in Humboldt Bay. Yet the destruction of eelgrass beds that serve as an important nursery has been allowed to continue unabated, with virtually no research on the effects to listed species and other commercially important species that depend upon eelgrass beds for part of their life cycle. We believe that Coast's operations constitute a "take" of listed species under the ESA because eelgrass beds are considered to provide important marine habitat for salmonids. As stated above, we do not believe that studies on salmonids from other ESU's are applicable to Humboldt Bay, and that those studies need to take place within each species' ESU to be scientifically valid.

A3 Recommendations: Require Coast to conduct a scientifically credible study on juvenile salmonid use of eelgrass beds in Humboldt Bay, during appropriate times of the year for each species, using valid sampling procedures.

A4. Effects of mariculture on invertebrates, both infauna and epifauna.	..."Coast shall cooperate with academic research personnel associated with the WRAC in conducting a four year study of effects of mariculture on invertebrates in tidal flats, applicable to Humboldt Bay."

A4 Issues: In terms of invertebrate sampling, the decision was made to only collect core samples in five areas, rather than the box samples that were originally proposed. There has been no information provided as to whether there is a scientifically valid sampling design, or whether sufficient samples have been collected. The WRAC study will only be able to present preliminary findings regarding abundance of the top ten species found in the mud within the top 10". The sampling effort will not provide sufficient information for determining whether there are impacts to the other numerous species that burrow more deeply into the bay mud. The sampling does not meet the requirements of the MND, which requires that the effects of mariculture on invertebrates be evaluated.

A4 Recommendations:
Require Coast to conduct sampling on both infauna, epifauna (including macro) within the range of substrate conditions present in Humboldt Bay, in both shallow and deep substrates. Determine whether impacts on eelgrass are altering infauna and epifauna communities.

A5. Effects of mariculture on shorebird use of culturing areas.	..."Coast shall cooperate with academic research personnel associated with the WRAC in conducting a four year study of effects of mariculture on shorebird use of tidal flats, in Humboldt Bay."

A5 Issues: At the mariculture monitoring committee meeting on August 29, 2001, Dr. Mark Colwell from Humboldt State University presented results and preliminary conclusions regarding the impacts of longlining on shorebird use in north Humboldt Bay at the August mariculture monitoring Committee meeting A number of assumptions were stated; the controls were immediately adjacent to the longline plots, and the study did not differentiate between habitat types (.i.e., whether the site was disturbed or undisturbed, or whether eelgrass was present). Therefore, the study only examined impacts associated with longlining, and not with any other factors associated with mariculture activities, such as reduced prey base in different substrates that are the direct result of mariculture activities. The study did not address the potential impacts on shorebirds from bat ray fences.

Two species in particular may be significantly adversely impacted by the use of longlines; the black bellied plover and the long billed curlew. There are only approximately 300 long billed curlews left in Humboldt Bay, which makes the curlew a species of particular concern. These species are territorial in their nonbreeding habitat. As a result, any loss of habitat reduces their carrying capacity. Considering North Bay mudflats represent a total acreage of approximately 4,500 acres, and mariculture operations cover approximately 600 acres, the carrying capacity of North Bay for shorebirds has been reduced by approximately 13%. Mariculture has reduced the shorebird carrying capacity of north Humboldt Bay and there has been no determination of what threshold constitutes a significant adverse impact for shorebirds in North Bay.

While the MND required a four-year study on shorebirds, only one year was actually done. Based upon the findings presented by Dr. Mark Colwell, additional research is definitely warranted on shorebirds to determine what the threshold of disturbance and loss of habitat should be for shorebirds. Humboldt Bay has been designated part of the International Wetlands Western Hemisphere Shorebird Reserve Network. Additional consideration should be given to this important migratory link represented by Humboldt Bay.

A5 Recommendations:
Conduct a scientifically valid study on the impacts of bat ray fences on shorebirds. Lacking such a study, all bat ray fences should be removed by April of 2002 as was originally stated by Greg Dale in the August, 2001 mariculture monitoring meeting. Because impacts were noted for two shorebird species, further investigation is warranted. Conduct a scientifically valid study on the impacts of longlining on the black bellied plover and the long billed curlew. Require the removal of all remaining bat fences.

B1. Lack of clear understanding by the District and by other agencies precisely where Coast Seafoods operations occur in space and through time.	Coast shall cooperate with the District to develop and to update on a regular basis, GIS mapping for Coast operations and the occurrence of environmental resources potentially affected by those operations.

B1 Issues: The ambiguity in where aquaculture activities are occurring in space and time serves Coast well; as long as no one knows precisely where they are operating, it is difficult to assess the potential impacts. Considering Coast has been operating in Humboldt Bay since 1992, it is inexcusable that the Harbor District does not know more precisely how public trust resources are being impacted.

B1 Recommendations: Map annually, every spring and summer, during optimal density and biomass, according to NMFS eelgrass mitigation policy no.2 adopted July 31, 1991, while incorporating modifications appropriate for more northerly conditions.

B2. Lack of clear understanding by District and other agencies about areas previously modified for culturing, which could be restored to pre-culture conditions.	Coast shall cooperate with the District to identify all areas (if any) within Humboldt Bay which have been used for mariculture and/or which are not anticipated to be used for mariculture in the future.

B2 Issues: Coast owns 560.9 acres and has leased an additional 3,384.5 acres. Oyster culture has taken place over the years on an unknown percentage of this area. In the past, Coast preferentially chose sites with large concentrations of eelgrass because these areas contained the most desirable substrate for growing oysters (Melvin McKinney personal communication 2001). Many of these older sites have recovered substantially and now support healthy eelgrass stands. Many of other sites appear to have minimal recovery, and appear to be permanently degraded unless some additional restoration measures are taken to restore the bed to its prior condition. Coast has been reluctant to document where culturing activities are taking place because they want to use these same locations that previously supported dense stands of eelgrass for longline beds, in spite of the fact that other areas outside of eelgrass areas would also be suitable for mariculture. Because Coast has not documented where their activities have taken place, the amount of mariculture-related destruction to eelgrass beds in North Bay is unknown. The amount of time it takes for an area that previously supported eelgrass to recover is also unknown, because Coast has made it a practice not to document their activities. Yet it is clear that as long as culturing locations are "unknowns" Coast will be able to continue planting longlines on top of areas that were previously used for bottom culture. Unfortunately, this also prevents the agencies from determining which areas would be suitable for restoration to preculture conditions.

Coast currently operates on approximately 484 acres in Humboldt Bay, minus beds removed from production (Coast correspondence to Harbor District dated November 21, 2001). Less than 18% of their lease is supposedly in use at this time. As a result, Coast essentially precludes other oyster growers from potentially being able to cultivate in these areas, eliminating the potential for competition from other growers. Coast also precludes other beneficial uses such as marine habitat and the fisheries that eelgrass sustains from using this area. This lease continues to serve only the interests of aquaculture at the expense of other fisheries, giving Coast a monopoly over North Bay.

B2 Recommendations:
Coast should be required to cease all ground culture harvesting operations and longline planting until each culture bed, both ground culture and longline, have been reviewed by CDFG and other responsible agencies to determine the extent of eelgrass present. The Harbor District should limit the size of Coasts lease to only those areas currently under cultivation, so that other oyster growers and commercial fishermen can better utilize North Bay resources.

B3. Uncertainty about the extent of bycatch associated with authorized depredation.	Coast shall in perpetuity, report to the District no less frequently than once per month, that month's catch of the organisms that have been authorized for taking by depredation permits from the Fish and Game Commission.

B3 Issues:
Eelgrass constitutes a "fishery" according to the Marine Life Management act (Fish and Game Code Division 0.5, Chapter 1, section 94.1). Therefore, any eelgrass destroyed as part of Coast operations should also be considered as bycatch. We are definitely uncertain about the amount of eelgrass that is currently being destroyed on an ongoing basis by Coast.

Many other species utilize eelgrass beds as nursery grounds (listed salmonids, rockfish, dungeness crabs) and are likely significantly adversely effected by the hydraulic dredge. The impacts of longline harvesting with the current harvester and the future longline harvester are unknown, and need to be quantified. These impacts are not addressed by the WRAC studies.

B3 Recommendations:
Require Coast to submit information no less frequently than once a month on the amount of eelgrass that has been destroyed. Require Coast to assess the impacts of bycatch that currently results from hydraulic dredging, as well as from longlining operations.

B4. Effects of mariculture on herring spawning habitat within Humboldt Bay.	"Coast shall cooperate with the Harbor District and other appropriate research personnel in providing information on the effects of mariculture on herring."

B4 Issues:
When Coast harvests during the herring spawn, thousands of herring eggs are destroyed in the process. This is particularly an issue on the East Bay beds, and the Bird Island Beds, which completely overlap with herring spawning grounds. It is essential that Coast refrain from harvest during critical herring spawning times. In addition, it is critical that Coast refrain from destroying eelgrass in these same areas prior to the herring spawn because a reduction in eelgrass limits the amount of surface area available for attaching eggs. Although Coast has verbally agreed to refrain from oyster and shell harvesting during the herring spawn in bottom culture beds, this is not a condition of their permit. In addition, there is no direction as to whether Coast can harvest longline beds during the herring spawn. The same issues apply to the longline beds, and should be made a condition of their permit.

B4 Recommendations:
Require Coast to move mariculture operations out of prime herring spawning areas - East Bay and Bird Island. Require as part of Coast's permit additional conditions and permitting requirements that will ensure that the herring spawn is not adversely impacted by mariculture operations.

B5. Uncertainty about the degree to which Coast Seafoods' operations involve on-going removal of or impacts to eelgrass.	Coast shall avoid to the maximum feasible extent, locating operations within areas of Arcata Bay containing eelgrass. If it is not possible to locate mariculture operations outside of areas containing eelgrass, Coast shall not remove eelgrass as part of its mariculture operations (as required by CDFG).

B5 Issues:
It is our understanding that this mitigation measure is quite clear: avoid locating operations within areas containing eelgrass. If they cannot avoid the eelgrass, then Coast is not allowed to remove eelgrass as part of their mariculture operations. Appendix A contains a map of some of Coast operations in North Bay, superimposed over the CDFG eelgrass mapping for 1997. This map clearly demonstrates that Coast plans to locate longlines directly on top of eelgrass beds. Coast also plans to remove large areas of eelgrass in the process with the hydraulic dredge as part of the shell harvest and bed cleaning process. Clearly, Coast is in violation of the MND if they use the hydraulic dredge in beds MR 7-1, MR 8-1, MR 8-2, and EB 6-2, as well as in violation of the MND by proposing to plant these same beds in longline. Coast is also in violation of this mitigation measure if they plant longlines on MR11, MR 6-1, MR 10, EB 3-2, EB 5-1, EB 5-2, EB 7-1, EB 7-2, EB 8 (Appendix A). The approach used by Coast is similar to what was used in the rest of North Bay: remove all eelgrass as part of shell harvesting, and then plant the same area in longline, based upon the claim that there is no eelgrass growing at these locations. Unfortunately, the majority of these areas are prime eelgrass habitat that has been removed by Coast.

B5 Recommendations:
It is imperative that the Coastal Commission stop Coast as soon as possible from cleaning off the remaining beds, as well as stop Coast from planting longlines on beds that previously supported eelgrass. If Coast wishes to plant loglines in areas that currently support eelgrass or that supported eelgrass in the past, require mitigation at a 3:1 ratio. Coast should be required to cease all ground culture harvesting operations and longline planting until each culture bed, both ground culture and longline, have been reviewed by CDFG and other responsible agencies to determine the extent of eelgrass present,

and whether each bed is a suitable site for mariculture. Coast should be required to provide a history of each bed over time. Coast should be required to obtain permits from the Coastal Commission, NCRWQCB, and Army Corps of Engineers prior to any additional cleaning of beds, or planting of longlines. Mitigation at a 3:1 ratio (3 acres for every acre lost) should be required for past removal of eelgrass.

B6. Effects of presence of materials previously used, but no longer used, for culturing purposes on biological and recreational concerns.	Coast shall conduct a cleanup program to remove culturing debris remaining from past mariculture uses, as well as other discarded materials which also occur within the areas used for mariculture, from the areas Coast uses in Arcata Bay; the cleanup program in each area identified in the list shall be completed no later than the end of the summer in the year 2000.

B6 Issues:
We have heard complaints about the amount of plastic Coast inadvertently releases into the marine environment, whether it is pvc pipes used in longlining, seed cultch backs, old racks, etc. We have also "heard" that Coast dumps waste plastic at an unknown location on Woodley Island (anonymous personal communication, 2001). We find these complaints disturbing, and believe Coast should be held accountable for allowing excessive releases of waste culturing debris into the environment.

B6 Recommendations:
Investigate allegations and conduct a scientifically credible study to determine if excessive plastic and other debris has been released into the marine environment. If warranted, cite and fine Coast for polluting the marine environment.

B7. Lack of information about effects of fences currently authorized for bat ray depredation control on other organisms.	Coast shall conduct studies on the effects of the fences to be used to control depredation by bat rays, as Coast Seafoods has proposed to the Army Corps of Engineers. Coast shall provide copies of the study results to the District no less frequently than once per month when the fences are in place.

B7 Issues:
Coast has harvested excessive amounts of bycatch as part of their mariculture operations in the past, including thousands of bat rays and crabs each year. Coast apparently no longer kills bat rays and rock crabs as part of the normal operations. However, the bat ray fences are known to cause significant levels of mortality in the bat ray population, particularly if they are not entirely enclosed. The bat rays swim into the enclosure areas at high tide, and as the tide goes out, are caught behind the fence with no way to escape as the tide goes out. Dead bat rays collect on the inside of the fenced area. Large numbers of bat rays apparently still die as a result of the way the bat ray fences are situated. These impacts are not addressed by the WRAC studies.

B7 Recommendations:
Require all bat ray fences to be removed by a specific date, and cancellation of all depredation and fencing permits. Require Coast to conduct a scientifically credible study on the effects of bat ray exclusionary fences on the bat ray population within Humboldt Bay, including population estimates and a discussion about the current status of bat rays in North Bay.

B8. Lack of knowledge of harbor seal use of, and effects of mariculture on harbor seals and other marine mammals in Arcata Bay.	No less frequently than twice per week when Coast has personnel in the tidelands in Arcata Bay, Coast shall conduct a monitoring program for harbor seals occurring within the mariculture operating area in Arcata Bay.

B8 Issues:
North Bay is known to provide marine habitat for marine mammals, primarily the harbor seal (*Phoca vitulina*). According to past research, seals haul out onto mudflats exposed during ebb tides, primarily adjacent to small tidal channels in upper Arcata and South Bays (Barnhart et al. 1992). Mariculture is suspected to cause significant adverse impacts on harbor seals due to increased levels of human activity associated with mariculture around preferred harbor seal haulouts. Yet no scientifically credible study has been conducted on how mariculture activities are impacting harbor seal use of North Bay (Arcata Bay). Coast is not qualified to conduct a monitoring program for harbor seals.

B8 Recommendations:
Require that a scientifically credible study be conducted on the impact of Coast operations on harbor seals within Humboldt Bay. Require Coast to limit operations around favored haulout areas, particularly during the time when they give birth to their young (primarily April to June (Barnhart et al. 1992).

B9. Effects of mariculture on recreational activities and uses in Arcata Bay.	No less frequently than twice per week when Coast has personnel in the tidelands in Arcata Bay, Coast shall record the presence and activity of recreational users within or near the mariculture operations area in Arcata Bay.

B9 Issues:
Windsurfers have written letters of complaint regarding the bat ray fences. Coast has placed extensions on bat ray fences to make them more visible, however, bat ray fences continue to create a navigational hazard in North Bay.

B9 Recommendations:
Revoke all permits for bat ray fences in North Bay. If Coast is no longer conducting bottom culture they should no longer need the bat ray fences.

B10. Effects of oyster shell deposition on aquatic ecosystems in Bay.	Coast shall not deposit crushed oyster shell on the bottom of Humboldt Bay as part of the 150 acres of bottom culture that coast expects to maintain in the future.

B10 Issues:
Large areas of shell deposition are distributed throughout Humboldt Bay as a result of mariculture activities; in fact those areas are large enough to be visible on aerial photography of Humboldt Bay. These shell deposition areas cover a significant amount of former eelgrass habitat; preliminary estimates indicate approximately five acres of shell deposition may occur within North Bay (December 2, 1997 images). Shell deposition alters the substrate and the elevation, rendering most sites completely inhospitable for the re-establishment of eelgrass and naturally occurring benthic communities. Because shell is persistent, these deposition areas have had long lasting impacts.

B10 Recommendations:
Require Coast to remove the larger shell deposition areas as mitigation for destruction to eelgrass beds, and restore to original contours. Coast should be required to permanently end all bottom culture practices immediately.

B11. Uncertainty about Coast Seafoods' compliance with District's adaptive management approach.	Coast shall cooperate to the maximum extent feasible, with the Harbor District monitoring committee's recommendations to limit potential conflicts with other resources and values for tidelands under the District's jurisdiction.

B11 Issues:
In order for adaptive management to take place, it is necessary to establish baseline conditions for determining whether or not changes in practice result in positive or negative effects. Only then can adaptive management truly work. To date,

Coast and the Harbor District have not been able to demonstrate that they have established baseline conditions for Coast operations. While bottom culture obviously causes significant adverse environmental impacts, it is not possible to determine if longlining is actually less environmentally damaging than bottom culture based upon the information that has been collected and provided to the mariculture monitoring committee. The only fact that has been established is that it provides a higher economic yield for Coast. I have personally witnessed Coast agree to address specific issues in monitoring committee meetings such as the bat ray fences which were to be removed by April 2001 (August 29, 2001), only to hear at subsequent meetings that those agreements have been dropped (mariculture monitoring committee meeting November 28, 2001). CDFG recommended avoidance of eelgrass for any new bed planting as a member of the mariculture monitoring committee. We do not believe that Coast is cooperating with this committee recommendation. Removing all the eelgrass during cleaning operations, and then planting the same area in longlines does not constitute avoidance.

B11 Recommendations:
Because Coast has repeatedly shown a lack of willingness to cooperate with the mariculture committee recommendations, the Coastal Commission should imposing fines and penalties on Coast. Coast should be required to severely limit their operations until they can demonstrate that they can be responsible stewards of North Bay marine resources.

SUMMARY
The Harbor District has not been fulfilling their mission to protect the public trust resources of Humboldt Bay. We encourage the Coastal Commission to assume that role, and protect the public trust resources of Humboldt Bay for the citizens of California by forcing Coast to comply with the law.

Thank you for providing the opportunity to comment.

Sincerely,

Christine Ambrose
Coastal Advocate

cc: Army Corps of Engineers
cc: NMFS
cc: USFWS
cc: NCRWQCB
cc: CDFG, marine region & Region #1
cc: Coast Seafoods
cc: Watershed Preservation Network
cc: Sierra Club

Barnhart, R.A., M.J. Boyd, and J.E. Pequegnat, 1992. The ecology of Humboldt Bay: an estuarine profile. USFWS Biological Report #1.

Monroe, G.W. 1973. The natural resources of Humboldt Bay. Coastal Wetland Series #6, State of California Department of Fish and Game.

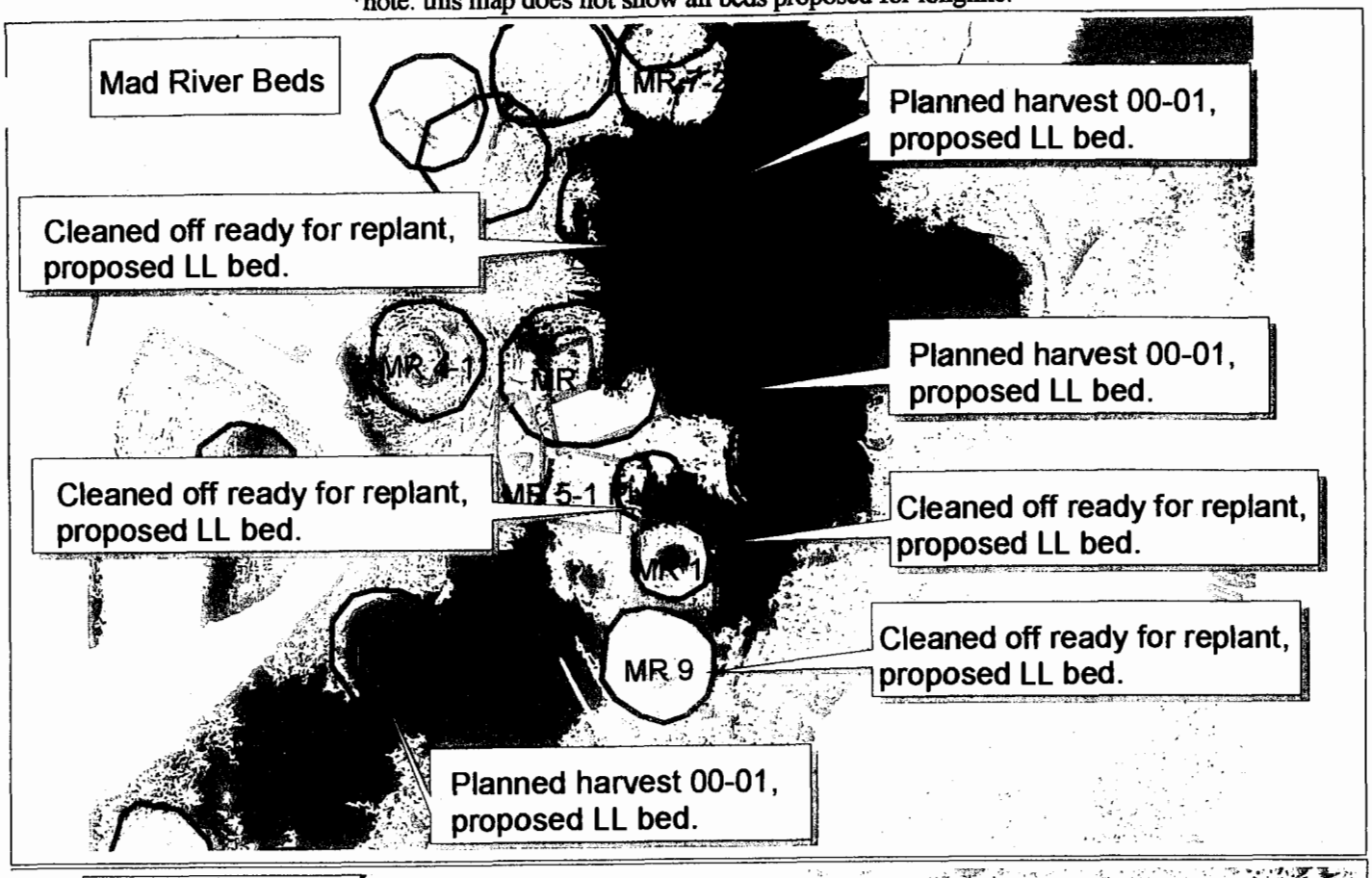
Schmidt, P.E. 1999. Populations counts, time budgets, and disturbance factors of black brant (*Branta Bernical nigricans*) at Humboldt Bay, California. Unpublished Masters Thesis, Humboldt State University.

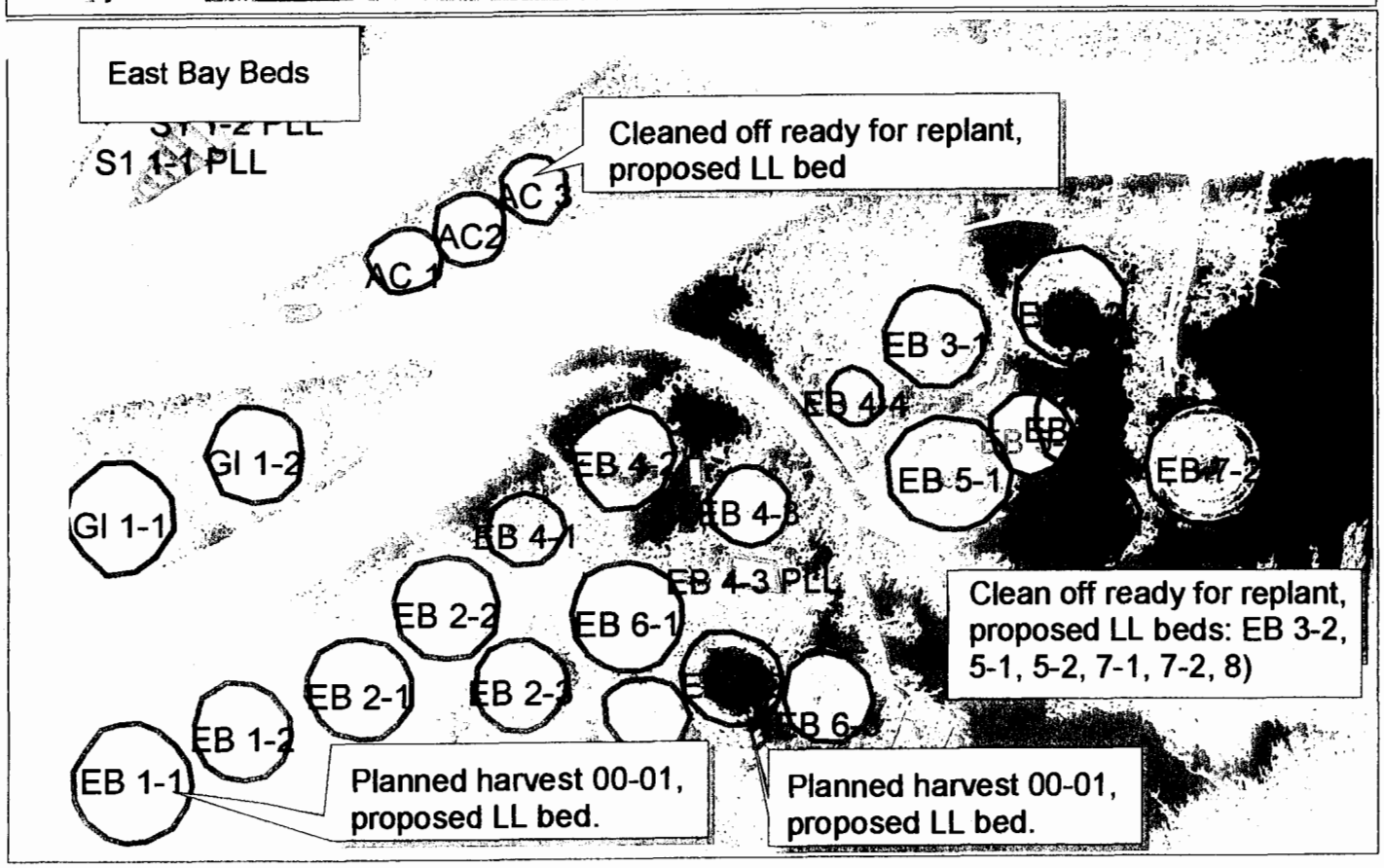
Sedell et al. 1991. Water transportation and storage of logs. Pgs 325-368. *In* W.H. Meehan, ed., Influences of forest and rangeland management on salmonid fishes and their habitats. American Fisheries Society Special Publication 19, Bethesda, MD.

Appendix A

Coast Seafoods Mariculture Operations:
Remaining Bottom Culture Beds, Proposed Longlines, and Eelgrass Distribution

*note: this map does not show all beds proposed for longline.





Eelgrass - CDFG, 2001, based on 1997 imagery.
Oyster beds - CDFG protocol: heads up digitizing, based on 1997 imagery.

Batray fences
Ground culture
Pacific longline
Eelgrass

EPIC, 2001.

epic

February 28, 2002

Marina Cazorla
California Coastal Commission
45 Fremont Street, Suite 2000
San Fransisco, CA 94105-2219

Re: Coast Seafoods Company Permit No. E-02-005

Dear Ms. Cazorla:

These comments are to formally register in writing an objection to the notice of an immaterial permit amendment for the development of a permanent clam seed nursery by Coast Seafood Company in North Humboldt Bay. Our objections are outlined below.

1. **Fragmentation of the project.** Coast Seafood Company mariculture operations involve a much larger suite of activities than just clam rafts, all in the same vicinity of North Humboldt Bay, with the exception of the oyster Floating Upwelling System (FLUPSY), which is located in Entrance Bay. All activities take place in environmentally sensitive areas of Humboldt Bay, including the clam rafts. "Environmentally sensitive area" means any area in which plant or animal life or their habitats are either rare or especially valuable because of their special nature or role in an ecosystem and which could be easily disturbed or degraded by human activities and developments (PRC 30107.5.).

Mariculture activities are all collectively taking place in North Humboldt Bay, with the exception of the FLUPSY. If this were a timber harvest plan, the timber operator would not apply for a separate permit to harvest Douglas-Fir trees and another permit to harvest redwood trees. All the trees that are proposed for harvest in a given area are considered under one timber harvest plan. Similarly, Coast Seafood Company mariculture activities have always been considered one project for purposes of California Environmental Quality Act (CEQA) review. The Humboldt Bay Harbor, Recreation, and Conservation District in their CEQA review of Coast Seafoods considered all of Coast Seafood activities as one "project", and issued permit 1998-3 for Manila clams, Pacific oysters, Kumamoto oysters, mussels, and scallops, and all activities associated with their cultivation. I question how one state regulatory agency (Humboldt Bay Harbor, Recreation, and Conservation District) can treat all of Coast Seafood Company activities as one project, while another state regulatory agency (California Coastal Commission) can fragment those same activities into multiple projects at their convenience. As the regulatory agency charged with carrying out the California Coastal Act as well as the functional equivalent of CEQA through the Local Coastal Plans (LCPs), it is highly inconsistent for your agency to be allowing Coast Seafood Company to fragment the project by species and/or activity. Indeed, California Coastal Commission staff have repeatedly requested that Coast Seafood Company submit a complete application that outlines all of the activities that are involved in Coast Seafood mariculture operations within North Humboldt Bay. California Coastal Commission staff have also expressed frustration over the difficulty in actually achieving this end. Yet

Environmental Protection Information Center
P.O. Box 818 • Arcata, CA 95518 • 707-822-1343
P.O. Box 397 • Garberville, CA 95542 • 707-923-2931 • www.wildcalifornia.org
Delivered in person at 12/06/01 Harbor District meeting

rather than requiring Coast Seafood to provide the information that was originally requested, it appears that the California Coastal Commission has given up in attempting to get the applicant to provide the requested information. We encourage the California Coastal Commission to require the applicant to provide the information that was originally requested.

2. The clam rafts degrade the visual quality of Humboldt Bay. The clam rafts are located at a highly visible location in North Humboldt Bay, where they can be seen from the Samoa Bridge. These clam rafts are ugly, particularly because they are made out of aluminum and are highly visible, appearing as floating "junk" to those who recreate on the bay, and to the casual observer driving by on the Samoa Bridge. The degradation of the visual quality by the clam rafts impacts my recreational experiences, and the recreational experiences of other bay users. This visual degradation of Humboldt Bay is in violation of the Coastal Act, which states the following, *"The scenic and visual qualities of coastal areas shall be considered and protected as a resource of public importance. Permitted development shall be sited and designed to protect views to and along the ocean and scenic coastal areas, to minimize the alteration of natural land forms, to be visually compatible with the character of surrounding areas, and, where feasible, to restore and enhance visual quality in visually degraded areas."* (PRC 30251).

3. The applicant has an ongoing violation for the proposed project. According to my records, Coast Seafood Company received a notice of violation from the California Coastal Commission for this very action that is now before you. There were previously only five clam rafts and a work platform that were all of wood construction, configured in two rows. Now there are ten permanent aluminum clam rafts and a work platform of metal construction, now totaling approximately 3,000 square feet, in one row. These clam rafts represent a 100% increase in the amount of surface area within North Humboldt Bay.

As you know, a 3,000 square foot house in the coastal zone would be subject to a great deal of scrutiny by the California Coastal Commission (currently the same size as the clam rafts). If that house was originally 1,500 square feet, and the size was doubled without any permits, the Coastal Commission would impose heavy fines upon the developer. In some cases, they have even ordered demolition. We believe that allowing Coast Seafood to double their operations constitutes unfair business practices, by exercising favoritism for Coast Seafood development in North Humboldt Bay by not imposing fines and penalties, and forcing them to comply with the law. We believe that rather than issuing a permit for their violations, the Coastal Commission should issue a cease and desist order with fines and penalties, while also requiring the immediate removal of the five additional clam rafts. We also believe that you should require that the five remaining rafts once again be constructed out of wood, according to PRC 30810. As one of the state guardians over the public trust, the California Coastal Commission is supposed to ensure public trust resources are protected so that they can be enjoyed by current and future generations of Californians. Allowing the permanent placement of these clam rafts with aluminum construction does not protect the public trust coastal resource values of North Humboldt Bay, and is in violation of the Coastal Act.

4. Lack of mitigation requirements. Coast Seafood Company has been allowed to essentially create a floating support service facility/pier in North Humboldt Bay. "The diking, filling, or dredging of open coastal waters, wetlands, estuaries, and lakes shall be permitted in accordance with other applicable provisions of this division, where there is no feasible less environmentally damaging alternative, and where feasible mitigation measures have been provided to minimize adverse environmental effects" (PRC 30233). Nature study, aquaculture, or similar resource-dependent activities are all subject to the provisions of this section. In addition, support service facilities, and piers are also subject to the provisions of this section. The rafts and the work platform serve as both piers and support service facilities for aquaculture. As such, Coast Seafood Company should be required to mitigate the impacts of these facilities on the bay environment at a 3:1 ratio.

5. Effects of the clam rafts on herring spawning in North Humboldt Bay. The herring spawn in the same vicinity as the clam rafts. There is the potential for causing a significant disruption to the herring spawn and to herring spawn fishery by the presence of these rafts precluding the available area for harvest, and by direct mortality to the herring eggs if clams or other activities take place during the herring spawn. We request that additional information be provided on this subject and additional mitigation measures required to ensure that the herring spawn is protected during critical spawning times.

6. Effects of the clam rafts on the benthic community. There was no documentation provided as to the depth of the channel below these rafts. The rafts do not allow light to penetrate to the bay substrate. These rafts could potentially cause significant alterations to the benthic community. We request that further analysis be conducted on the impacts of these clam rafts on the impacted benthic community.

7. Effects of the clam rafts on navigation. There is no discussion as to whether or not these clam rafts obstruct navigation or create a navigational hazard to those operating within North Humboldt Bay. We request that additional information from the Department of Boating and Waterways, as well as the U.S. Army Corps of Engineers regarding this subject.

8. Cumulative effects. "Cumulatively" or "cumulative effect" means the incremental effects of an individual project shall be reviewed in connection with the effects of past projects, the effects of other current projects, and the effects of probable future projects (PRC 30105.5). The clam rafts are only one portion of Coast Seafood activities. We also object to Coast Seafood locating the FLUPSY in the Entrance Bay. All of Coast Seafood activities should be located within North Humboldt Bay. Coast Seafood does not have a permit for operating the FLUPSY within Entrance Bay and should be forced to move it immediately. The clam rafts are also not the only rafts located in this area of the Mad River channel of North Humboldt Bay. Additional rafts owned by Ted Kuiper are also located in the vicinity. Additional aquaculture activities also take place in Humboldt Bay. However, there has been no review of the cumulative effects of other aquaculture activities in conjunction with Coast Seafood activities. Each aquaculture operator must visit and tend their operations, which varies depending upon the scale of their activities. If there are approximately 6 aquaculture operators in North Humboldt Bay, each making separate boat trips approximately once a month with Coast visiting their operations approximately once a week, that represents a significant amount of boat traffic and disturbance of bird use in those areas of North Humboldt Bay. There is also the danger that these operations are introducing aquatic nuisance species into the Humboldt Bay marine ecosystem, which may cumulatively have a major impact on the aquatic environment. We specifically request a review of the cumulative effects of the clam rafts in connection with all other mariculture activities in North Humboldt Bay.

For these reasons, we believe that the proposed immaterial plan amendment contains major project changes that may result in adverse impacts to marine coastal resources, and visual qualities. These impacts combined could have potentially significant adverse cumulative effects that should be investigated further. If you have any questions, please do not hesitate to call me at (707) 822-1343.

Thank you for the opportunity to comment on this important issue.

Sincerely,

/s/Christine Ambrose
Coastal Advocate

57 RR

RECEIVED

DEPARTMENT OF THE ARMY
SAN FRANCISCO DISTRICT, CORPS OF ENGINEERS
333 MARKET STREET
SAN FRANCISCO, CALIFORNIA 94105-2197

Regulatory Branch

NOV 18 2002

SUBJECT: File Number 26912N

Mr. Greg Dale
Coast Seafoods Company
25 Waterfront Drive
Eureka, California 95501

Dear Mr. Dale:

We have received your permit application dated August 1, 2002 for a Department of the Army authorization to conduct oyster mariculture activities, maintain in-water structures and retain unauthorized oyster mariculture structures and apparatus in Humboldt Bay tidelands, near the Cities of Eureka and Arcata, in Humboldt County, California. The oyster mariculture activities include installation, transfer, replacement, and maintenance of facilities and apparatus for the planting, nursery, and harvest of Pacific and Kumo oysters on approximately 500 acres of Humboldt Bay tidelands at any one time. Annual harvest of oysters from Humboldt Bay growing beds encompasses approximately 125 to 175 acres. Coast Seafoods currently operates and maintains bottom oyster culture and off-bottom oyster culture (off-bottom includes mostly "Pacific long-line" and to a lesser extent "rack and bag" methods of oyster culture).

We have determined your permit application as being complete for the purposes of circulating a 30-day Public Notice of your oyster mariculture operations. Our Eureka Field Office has recently drafted a 30-day Public Notice, which is currently going through supervisory review. We expect to circulate this Public Notice for public comment in the near future.

The California Regional Water Quality Control Board (RWQCB), North Coast Region, has issued Section 401 Water Quality Certification on April 25, 2002 to Coast Seafoods to conduct oyster mariculture operations on Humboldt Bay. In addition, we have been informed that the California Coastal Commission, San Francisco office, has received a permit application from Coast Seafoods and is currently reviewing that application for completeness.

We are advising you that, as of the date of this letter, none of your existing bottom or off-bottom oyster mariculture operations on Humboldt Bay, including all related structures or apparatus (including the floating nursery or "Flupsy" located near the Eureka Boat Yard Dock on the Samoa side of the channel and all existing bat ray fences) are authorized under a Department of the Army permit. No existing or proposed planting, nursery, harvesting or other maintenance activities related to oyster mariculture are currently authorized by the U.S. Army Corps of Engineers (Corps) pursuant to either Section 10 of the Rivers and Harbors Act (33 U.S.C. 403) or

Section 404 of the Clean Water Act (33 U.S.C. 344). Any permits previously authorized by the Corps for any of the above activities have all expired and are no longer valid.

Regardless of what discussions you may have with the California Coastal Commission regarding their jurisdiction or permit authority, you are not excused from compliance with Federal environmental laws. By continuing to maintain, operate and install planting, nursery and harvesting for oyster mariculture in Humboldt Bay, you are in violation of Section 10 of the Rivers and Harbors Act of 1899 as cited above.

We realize that oyster mariculture is a fluid process, and for Coast Seafoods to break a cycle in the planting, grow out and harvest of oysters by halting operations would cause, as you so often state, economic harm to Coast Seafoods. However, the importance of making a living, and sustaining employment in the oyster mariculture industry does not override the equally vital overall public interest in the protection of the environment, specifically the aquatic resources of Humboldt Bay which the Humboldt Bay region depends on for (including but limited to), environmental health, good water quality, protection of recreational and other commercial fishing aquatic resources, and enhancement of recreational use of the bay.

In addition to non-compliance with Corps regulations, your oyster mariculture activities may impact other resources protected by Federal law. Please see attached a copy of a letter from the National Marine Fisheries Service (NOAA Fisheries) under the United States Department of Commerce dated December 12, 2001 (Enclosure 1 with attachment). To summarize that letter, there are three salmonid species that are known to occur in Humboldt Bay and its tributaries: Southern Oregon/Northern California Evolutionarily Significant Unit (ESU)(SONCC) coho salmon (*Oncorhynchus kisutch*), chinook salmon (*O. tshawytscha*), and steelhead (*O. mykiss*), all listed by NOAA Fisheries as threatened under Section 7 of the Endangered Species Act (ESA) of 1973, as amended (16 U.S.C. 1531 et seq.). NOAA Fisheries has also designated Humboldt Bay and its tributaries as critical habitat for coho salmon (we understand that critical habitat for chinook salmon is being re-evaluated by NOAA Fisheries). In addition, Humboldt Bay is Essential Fish Habitat (EFH) under the Magnuson-Stevens Fishery Conservation and Management Act (MSFCMA) for various life stages of fish species federally-managed under the Pacific Groundfish Fishery Management Plan, the Coastal Pelagics Fishery Management Plan, and the Pacific Salmon Fishery Management Plan.

Upon receipt of a complete Department of the Army permit application, the Corps is required under the ESA and EFH to consult with NOAA Fisheries regarding the potential for Coast Seafoods oyster mariculture activities to impact the above mentioned species. A Corps permit cannot be issued until consultation with NOAA Fisheries (and possibly the U.S. Fish and Wildlife Service for the tidewater goby, *Eucyclogobius newberryi*, or other listed species that inhabit Humboldt Bay) has been concluded. The Corps is currently preparing consultation letters to the respective agencies pursuant to ESA and EFH.

We request your cooperation in complying with our permit process and we encourage you to work with the California Coastal Commission to resolve permitting issues. Failure to cooperate under Federal law may result in denial of your permit application and the possibility of the Corps taking enforcement action against Coast Seafoods.

Should you have any questions regarding the Corps permit process or other related issues, please call David Ammerman of our Eureka Office at 707-443-0855. Please address all correspondence to the Eureka Field Office, U.S. Army Corps of Engineers, P.O. Box 4863, Eureka, California 95502, referencing file number 26912N.

Sincerely,

Calvin C. Fong
Chief, Regulatory Branch

Enclosures

Copies Furnished (w/o enclosure):

US EPA, San Francisco, CA
US FWS, Arcata, CA
US NMFS, Arcata, CA
CA RWQCB, Santa Rosa, CA
CA DFG, 619 2nd Street, Eureka, CA (Attn: Ms. Vicki Frey)
CA CC, San Francisco, CA (Attn: Ms. Alison J. Dettmer)
HBHRCD, Eureka

Mr. Samuel W. Plauche
Buck and Gordon LLP
Seattle, WA

December 11, 2002

Peter Douglas, Executive Director
California Coastal Commission
45 Fremont Street, Suite 2000
San Francisco, CA 94105-2219

DELIVERED IN PERSON

epic

Re: Renewal of Coast Seafoods Permit # 1998-3

Dear Commissioners:

Once again we must bring to your attention concerns regarding Coast Seafoods unpermitted activities in Humboldt Bay. Coast Seafoods permit is being considered for renewal today (December 11, 2002) by the Mariculture Monitoring Committee (MMC), and by the Harbor District for final approval on December 17, 2002.

The applicant, Coast Seafoods, stated in a letter within the MMC packet the following regarding their current pending California Coastal Commission (CCC) permit:

"As previously advised, the CCC is preparing an Interim Operating or Settlement Agreement pending completion of the Western Regional Aquaculture Center project and findings. At this time it is unclear as to which direction the CCC is moving with the above mentioned operating agreement." (11-08-02 correspondence from Coast Seafood to the Harbor, Recreation, and Conservation District, pg. 2).

Based on this statement, it appears that virtually no progress has been made on Coast Seafood's permit since we last presented our concerns to the Commission regarding Coast Seafoods on October 9, 2002. Since we know that Commission staff are competent and able to perform the necessary tasks, we can only conclude that Coast Seafoods has continued to be uncooperative, and have not provided the necessary information.

It appears that the U.S. Army Corps of Engineers have also gotten frustrated with Coast Seafoods unwillingness to comply with the laws and regulations; and have finally taken action. They have informed Coast Seafoods that none of their operations are authorized under a Department of Army permit.

We encourage this Commission to make Coast Seafoods cooperate through an enforcement action. We believe that all of Coast Seafood activities should be reviewed immediately per the Coastal Act, the CEQA, the NEPA, the Rivers and Harbors Act, the Clean Water Act, the Magnuson-Stevens Fishery Conservation and Management Act, and the Endangered Species Act of 1973 as amended (16 U.S.C. 1531 et seq.).

Thank you for your consideration.

Sincerely,

Christine Ambrose

cc: U.S. Army Corps of Engineers
cc: USFWS
cc: CDFG
cc: NMFS

Environmental Protection Information Center
P.O. Box 818 • Arcata, CA 95518 • 707-822-1343
P.O. Box 397 • Garberville, CA 95542 • 707-923-2931 • www.wildcalifornia.org

December 9, 2002

Mariculture Monitoring Committee
Board of Commissioners
Humboldt Bay Harbor, Recreation, and Conservation District
P.O. Box 1030
Eureka, CA 95502-1030

epic

Re: Renewal of Coast Seafoods Permit # 1998-3

Dear Mariculture Monitoring Committee Members & Board of Commissioners:

Please consider the following comments regarding the proposed Renewal of Coast Seafoods Permit # 1998-3. We are concerned about the following:

1. Potential impacts to the marine community, including marine mammals, and avian species.
2. Potential impacts resulting from the introduction of aquatic nuisance species (ANS).
3. Potential impacts to eelgrass communities.
4. Potential changes in hydrology and bay tidal circulation patterns.
5. Potential impacts resulting from increased turbidity and sedimentation in Humboldt Bay.
6. Potential impacts to benthic communities.
7. Potential health impacts resulting from toxic chemicals and other residues that are resuspended when bay sediments are disturbed.
8. Potential impacts to listed species, such as coho salmon, Chinook salmon, and steelhead, and pelicans.
9. Potential impacts resulting from adverse cumulative effects to Humboldt Bay.
10. Because Coast Seafoods is operating without the necessary permits from both the Coastal Commission and the U.S. Army Corps of Engineers, in violation of the Coastal Act, the Rivers and Harbors Act, the Clean Water Act, the Magnuson-Stevens Fishery Conservation and Management Act, and the Endangered Species Act of 1973 as amended, (16 U.S.C. 1531 et seq.) these activities constitute a significant impact on Humboldt Bay resources.

We request the following:

1. The bat ray fences adjacent to Mad River Channel are still in place, and should be removed as soon as possible, along with all other marine debris.
2. Sand Island should have at least a 100-meter buffer from aquaculture activities to protect Caspian tern nesting habitat and to protect waterfowl habitat from disturbance.
3. Coast Seafood should be required by the Harbor District to work "cooperatively" with the Coastal Commission and the Corps of Engineers (i.e. provide requested information in a timely manner).
4. Coast Seafood should be restricted to planting only those areas that have been allowed to recover from past aquaculture activities, and where CDFG and the MMC have conducted a site visit and approved for planting.
5. The full suite of Coast Seafood activities should be reviewed per the CEQA, NEPA, Coastal Act, the Rivers and Harbors Act, the Clean Water Act, the Magnuson-Stevens Fishery Conservation and Management Act, and the Endangered Species Act of 1973 as amended (16 U.S.C. 1531 et seq.).

Thank you for your consideration.

Sincerely,

Christine Ambrose

Environmental Protection Information Center
P.O. Box 818 • Arcata, CA 95518 • 707-822-1343
P.O. Box 397 • Garberville, CA 95542 • 707-923-2931 • www.wildcalifornia.org

Melvin Mckinney
P.O. Box 78
Cutten Calif. 95534

Nov. 17,2003

USACE
Regulatory Branch
District Engineer
333 Market St,,
San Francisco Ca. 94105-2197

RE: 26912N Public Notice

Dear Sir:

I cannot agree for approval for the use of long lines at 2.5 foot spacing on any beds in this permit application. The main reason is that ten foot spaceing has no impact effect on Eel grass. If this permit is allowed then all line spaceing must be at 10 feet. If no ten foot spaceing is acceptable then a ful Environmental Impact Report must be enfirced on each specific site. Each specific site is each site listed in # 1 thru 72 in the tabular summary of all beds status and planting priority on pp. 68 and 69. from the Coast Seafood shellfishing in Humboldt Bay. Revised Plan of Janurary 23, 2002.
If you read this information and history of each oyster bed in Humboldt bay you can see why Coast can say they will not plant on any area that has not been planted on before. All of the existing beds in the plan were at the prime Eel grass elevation and most prevalent Eel grass growing areas. It is well noted that Eel grass grows best at the elevations of 1,5 positive to 1.5 negative elevations. If we had an accurate map of Eel grass in Humboldt Bay this is where we would find the greatest abundance of Ell grass.

There are no mention of the sediment problem and no mention of the effect of shading when long lines are put down in Eel grass elevations and the result to the destruction of Eel grass . Their is no mention of the shadeing of the Rack and Bag applications and the spaceing that would be required for a no impact effect unless this would only take place only away from any Eel grass beds but that is not being addressed at this time . There are more studies to be developed to address shading and sedimentation and i reccomend that no permit be awarded till all of these concerrns are addressed.

Under the section Mitigation for oyster culture impacts Coast will be made to submit an EIR for any new long line activity aside from their 300 acre foot print if and when they conduct oyster harvesting activities on any of these leased lands beyond their 300 acre operational foot print.

Sincerely,

Melvin McKinney

Melvin Mckinney

cc: Northcoast Environmental Center
Redwood Region Audubon Soc.
North Group Sierra Club.
EPIC.

I request a hearing be held to consider this application by Coast Seafood.

P.O. Box 1105
Trinidad, CA 95570
(707) 845-2805
Nov. 21, 2003

RE: 26912N

US Army Corps of Engineers, Regulatory Branch
333 Market St, San Francisco, CA 94105-2197

Dear Sir/Madam;

I am writing to express my concern regarding the application by Coast Seafoods Corp. for an Army Corps 404 Clean Water Act permit, to continue it's oyster bed aquaculture in Humboldt Bay. Coast Seafoods has shown no regard for the environmental consequences of its activities for decades, despite citizen input, and has evaded complying with the Clean Water Act until legally required to 'cease and desist.' This is not a record of environmental responsibility that warrants any sort of 'grandfathered' concessions in terms of meeting existing requirements, and given the extent of impact it's operations has on native oysters, wetland bird species and various marine species, the public should be permitted to attend the hearing on this permit request. The public has a right to hear what is said and to rebuttle. This is a very important issue involving scenic and marine resource that is a landmark of Humboldt County. Birders come from all over the state (and further) during 'Goodwit Days' to enjoy the bird species that reside near, or migrate to, Humboldt Bay.

Under the Dept. of Fish and Game Kelp Harvesting laws, it is illegal to 'take <u>or</u> <u>distrub</u>' eel grass because of the important 'nursery' function it plays in marine environments. The long lines used by Coast Seafood cause direct mortality to eel grass, and

RE: 2691Z-N CONT'D

cause sedimentation due to changes in water flow. Because the company uses non-native oyster species, on a very large scale, the ecological balance is disrupted and native oyster species are forced to compete for nutrients. Further, dioxin has been found in Humboldt Bay shellfish in high concentrations; it is questionable whether consumers should be offered shellfish for consumption cultivated in Humboldt Bay.

Many of the "structures & apparatus" Coast Seafood is requesting approval to retain have never been approved or authorized; they are quite simply illegal and should be removed. There is no justification for granting exceptions to a business that has gone out of its way to evade the law and ignored all evidence of the environmental damage it has done. Wetlands, such as Humboldt Bay, are the first line of water filteration for land runoff in the hydrologic cycle, and impact water quality reaching the ocean along coastal areas. Many people surf, swim, walk and fish near these areas and would like to enjoy clean water and an intact ecosystem. Surfers in Calif. regularly report ear & urinary tract infections due to poor water quality near river & bay outfalls. One business owner should not have the right to subject an entire community to this loss of public resources.

Please entire these comments in the public record, and please hold a public hearing. Thank you for your time in consideration of my thoughts.

Respectfully submitted, MMcLomb
MELINDA McLOMB

Jim Clark
3438 I Street
Eureka, California 95503
November 24, 2003

District Engineer
Attn: Regulatory Branch
333 Market Street
San Francisco, CA 94105-2197

Subject: Comments on Coast Seafoods Company Permit Application 26912N

District Engineer:

My review of the application and accompanying information is consistent with what I know about studies that have taken place, and mitigation measures that have been taken, and will be taken as part of Coast Seafoods mariculture operation. Many of these measures should be considered as standard practice or discontinuance and correction of inappropriate practices for any use of public land or privately held land in navigable waters.

Not in the public notice, however, is recent and critically important information that is emerging from the research on Pacific Long Line (PLL) spacing effects on Eel grass. Preliminary results from the study by Rumrold as of September 2003 indicate that Eel grass density is proportional to the distance between lines, up to a ten foot spacing. At ten feet, there does not appear to be significant, if any, adverse effect on Eel grass using the current cultural and harvesting practices. Although the research has not been completed, the data on the relationship between line spacing and Eel grass growth are becoming more convincing.

Based on the Eel grass study, it appears that widening the PLL spacing from two-and-a-half to ten feet might be the most significant mitigation measure after the elimination of ground culture.

Coast Seafoods requires the equivalent of 300 acres of active culture at the two-and-a-half foot spacing which is the equivalent of 1,200 acres at the ten foot spacing. This radical departure from the requested permit would require reconsideration of areal effects covering 1,200 acres of Humboldt Bay with low density PLL culture on issues such as the effects on Black brant, recreational use, sediment transport and economic viability.

Instead of specifying the PLL spacing at two-and-a-half feet, the permit should specify a PLL spacing that has insignificant impact on Eel grass as shown by the established Eelgrass study. If the study indicates that alternative PLL spacing can provide a no significant impact result, the permit could be amended to allow such

spacing.

Rack and Bag culture is mentioned in the application but there is no mention of the sedimentation effects under the racks. I have observed accumulation of sediment under the racks six to eight inches higher than the unobstructed surrounding area. The effects of rack and bag culture on sediment deposition and erosion need to be evaluated before a permit is granted for this type of culture.

The proposed 300 acre at two-and-a-half foot spacing application does not include mitigation for documented negative effects effects on Eel grass. Although removal of bottom culture will reduce negative impacts on Eel grass, it has been demonstrated that the proposed permit conditions would continue to have significant negative effects on Eel grass in Humboldt Bay. A permit to allow Coast Seafoods to practice mariculture in Humboldt Bay should not be granted unless it can be shown that there will be no significant negative impacts on Eel grass and sediment dispersal. Current data have only shown that that there will be significant negative impacts under the application permit conditions.

Application 26912N should not be granted without additional information on how Eel grass impacts will be fully prevented or mitigated. Because of this, a public hearing should take place to consider granting Coast Seafood a permit for mariculture in Humboldt Bay.

Sincerely,

Jim Clark

Jim Clark

Cc. David A. Ammerman, Permit Manager, Eureka Project Office, 601 Startare Dr., Eureka, CA
North Coast Environmental Center

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
Southwest Region
501 West Ocean Boulevard, Suite 4200
Long Beach, California 90802- 4213

NOV 24 2003

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Lieutenant Colonel Michael McCormick
District Engineer
U.S. Army Corps of Engineers
Regulatory Branch
333 Market Street
San Francisco, California 94105-2197

Dear Colonel McCormick:

The National Marine Fisheries Service (NOAA Fisheries) has reviewed the Army Corps of Engineer's (ACOE) Public Notice # 26912N regarding Coast Seafoods Company's (Coast) proposed project to conduct the planting, grow out, and harvest of Pacific and Kumo oysters on approximately 300 acres of Humboldt Bay tidelands. The proposed project is located in an area that has been identified as Essential Fish Habitat (EFH) for fish species included in the Coastal Pelagics, Pacific Groundfish, and Pacific Salmon Fishery Management Plans (FMPs), as defined by the Magnuson-Stevens Fishery Conservation and Management Act (MSFCMA).

NOAA Fisheries offers the following comments pursuant to Section 305(b)(4)(A) of the Magnuson-Stevens Fishery Conservation and Management Act (MSFCMA). This response does not relieve the Corps of its obligations to comply with the procedures set forth in the Endangered Species Act, as amended (16 U.S.C. 1531 et seq) or the substantive requirements of Section 7(a), as well as determination of effects on Essential Fish Habitat (EFH), pursuant to Section 305(b)(2) of the MSFCMA.

The Project Description states that Coast proposes to convert its mariculture operations in Humboldt Bay from bottom culture of oysters (harvesting oysters with hydraulic dredge and a modified dragline type dredge) to off-bottom methods of stake (long-line devices, primarily Poly Vinyl Chloride (PVC) pipe-stakes and rope) and rack-and-bag culture. In addition, Coast states it would reduce its operational footprint in Humboldt Bay from a maximum of 500 acres during any given crop cycle to 300 acres within any given crop cycle. Since most of this conversion (500 acres of bottom culture to 300 acres of off-bottom culture), as well as Coast's oyster mariculture operations, has already taken place or is currently taking place without an ACOE permit, Coast is asking for "after-the-fact" authorization for the conversion and continued operations. Coast proposes to conduct planting, grow out, and harvest of Pacific and Kumo oysters on approximately 300 acres

of Humboldt Bay tidelands in any given crop cycle. Although Coast owns 560.9 acres of Humboldt Bay tidelands, and leases another 3,384.5 acres from local entities (Humboldt Bay Harbor, Recreation and Conservation District and City of Arcata) on Arcata Bay (North Humboldt Bay), Coast states that oyster culture will occur only in areas previously subject to oyster culture.

In an effort to consolidate all of Coast's mariculture and operational actions under one ACOE permit, clam raft culture and maintenance dredging adjacent to Coast's loading dock are also included in the Public Notice. NOAA Fisheries recommends that these activities be conducted under a separate permit because they are currently too vaguely defined in the Public Notice. NOAA Fisheries understands that these activities are related to mariculture operations and that Coast may wish to have all of their operations covered in one permit. However, the activities need to be clearly defined in order for a permit, individual or Nationwide, to be issued. The proposed action, a description of the action area, and effects of the proposed action need to be clearly stated. This includes but is not limited to: extent of area and amount of material to be dredged; location of disposal area; method, timing, duration, and frequency of dredging; toxicity of sediments, if any; and proximity and extent of eelgrass beds.

Regarding the remaining project components of the proposed action (i.e. long-line culture, rack-and-bag culture, nursery areas, wet storage floats and FLUPSY), NOAA Fisheries recommends denial of the permit for the project as currently proposed for the following reasons:

1) Adverse impacts to eelgrass habitat

2) Impacts to primary productivity not addressed

3) Impacts on water circulation and sediment dynamics not addressed

4) Inadequate mitigation measures

Each of these reasons is elaborated further in the following sections. Although currently opposed to the authorization of a permit for the proposed project, NOAA Fisheries believes that approval of a revised project is possible, if appropriate measures and conditions are incorporated into the permit.

Adverse Impacts to Eelgrass Habitat

As indicated in the Public Notice, many of Coast's mariculture operations overlap with seagrass habitat (specifically eelgrass, *Zostera marina*). Seagrass has long been recognized as an extremely valuable habitat in the marine and estuarine environment (Zieman, 1982; Thayer and Phillips, 1977; Thayer et al., 1984; Hoffman, 1986; Phillips, 1984; and Fonseca et al., 1998). In fact, seagrass has been documented as one of the most productive ecosystems in the world (Zieman and Wetzel, 1980; Merkel, 1991). Seagrasses are particularly important in estuarine primary productivity (Zieman and

Wetzel, 1980), nutrient regeneration (Klug, 1980), sediment stabilization (Fonseca, 1996), and as habitat for many fish and marine invertebrates (Orth and Heck, 1980; Hoffman, 1986; and Phillips, 1984).

Despite the obvious value of seagrasses, over 90,000 hectares of seagrass loss has been documented throughout the world over the last decade (Short and Wyllie-Echeverria, 1996). Although natural events have been responsible for some of these losses, human-induced disturbances are considered to be most responsible. In order to address these widespread impacts, regulatory authorities have adopted various policies which reduce the impacts to this sensitive and valuable habitat. As stated in the Public Notice, the Environmental Protection Agency (EPA) has designated vegetated shallows (i.e., seagrasses) as Special Aquatic Sites. This status provides special consideration when evaluating permits for dredged or fill material pursuant to Section 404 of the Clean Water Act. Although policy provisions such as this have slowed habitat losses, a decline in seagrasses continues at a gradual but steady rate (Merkel, 1991).

In response to these negative trends in seagrass and other important fishery habitat, NOAA Fisheries Southwest Region (SWR) has developed two policies. First, according to NOAA Fisheries SWR Habitat Protection Policy (HPP), NOAA Fisheries will not recommend approval or authorization of any project that will damage any existing or potentially restorable habitat and associated marine, estuarine, or anadromous resources. Under certain situations, NOAA Fisheries would approve habitat/resource damages to be compensated for through various mitigation strategies. However, NOAA Fisheries only approves compensation when the project incorporates all feasible modifications and construction techniques to minimize adverse environmental impacts. For projects that have the potential to impact eelgrass, NOAA Fisheries SWR, in cooperation with U.S. Fish and Wildlife Service (USFWS) and California Department of Fish and Game (CDFG), developed the Southern California Eelgrass Mitigation Policy (SCEMP) to provide further guidance on the necessary steps an applicant must take to compensate for unavoidable impacts to eelgrass resources. Given that Humboldt Bay has the largest stand of eelgrass and is one of the least impacted major estuaries in California, it is essential that the relevant regulatory and resource agencies properly manage this resource.

The Public Notice identifies potential impacts to eelgrass distribution and density from Coast's activities. Previously, during Coast's permit application process to the Humboldt Bay Harbor, Recreation and Conservation District (HBHRCD), a Mitigated Negative Declaration was developed, which also identified potentially significant environmental effects on eelgrass. In order to address this potential impact, Coast Seafoods was required to cooperate with the Western Regional Aquaculture Center (WRAC) in conducting a four-year study of the effects of mariculture on eelgrass and associated biota. In WRAC's most recent report, Rumrill and Poulton (2003) observed a strong trend of decreasing eelgrass spatial cover and density with decreasing distance between oyster long-lines. Specifically, for the 2.5 foot long-line spacing that Coast is currently proposing to utilize, Rumrill and Poulton (2003) observed an average spatial cover of 4.5 percent and an average density of 10.3 shoots/m^2 compared to an eelgrass control site which reached up to 70 percent spatial cover and 62 shoots/m^2. Results from this study

also indicate that the presence of dense oyster lines (1.5, 2.5, and 5-ft line spacing) generally results in reduced eelgrass blade length and biomass.

In another oyster mariculture-related study conducted in the South Slough Estuary, Oregon, Everett et al. (1995) found that rack culture had a significant negative effect on eelgrass cover and shoot density. After 18 months of rack culture, eelgrass was absent from the interior of the rack plots. A halo of low shoot density was also found around the rack culture, while the surrounding areas remained a dense eelgrass bed. In addition, after 10 months of stake culture, eelgrass shoot densities were significantly lower in culture plots than in reference plots. These impacts were presumably due to changes in the local hydrological conditions, which also had coincidental effects on local sediment deposition. Everett et al. (1995) also determined that the intensive localized activity of workers placing oyster mariculture structures in the substrate was a probable cause for initial temporary low eelgrass cover. In order to better understand the disturbance effects associated with structure placement, maintenance, and harvesting, the proposed action should include a better description of the crop cycle. More specifically, the crop cycle needs to be defined (number of days and Julian dates of typical planting, harvest, etc.) for each type of culture, as well as the frequency and timing of actions prior to harvest in order to determine how many times the areas associated with the stake and rack-and-bag culture are disturbed by walking or other actions associated with mariculture. Assignment of Julian date to actions will permit linking with other seasonal physical factors, such as tides, rainfall, wind, and light levels. Other studies have also indicated that oyster culture negatively affects eelgrass's density and percent cover (see Griffin, 1997, for brief review).

Another potential mechanism for impacts to eelgrass and other benthic habitats may result from bio-deposition. Oysters (8-10cm) can produce up to 120g of feces in dry weight in a given year. Some of the feces will be decomposed into dissolved matter and carried away from the culture site, but most will accumulate under the suspension culture, which may change the textural composition of the benthos. In turn, these textural changes in the seabed have impacts on the benthic species assemblages. Comparisons by Tang and Fang (2002) of historic vegetation and invertebrate biomass compared to present levels under suspended culture show dramatic declines. Accumulation of bio-sediment from intensive suspending culture is presumably one of the most important factors leading to the decline of eelgrass along portions of China's coastline (Tang and Fang, 2002).

Reductions in density and/or coverage of eelgrass habitat from mariculture activities could result in concomitant losses in associated ecological functions. Of particular concern to NOAA Fisheries are potential reductions in the quantity and quality of habitat available for fish species managed under the Coastal Pelagics, Pacific Groundfish, and Pacific Salmon FMPs and their prey items. Based upon the Barnhardt et al. (1992) report, the following Federally managed species have been documented to occur in Humboldt Bay: leopard shark (*Triakis semifasciata*), soupfin shark (*Galeorhinus zyopterus*), spiny dogfish (*Squalus acanthius*), big skate (*Raja binoculata*), lingcod (*Ophidon elongatus*), cabezon (*Scorpaenichthys marmoratus*), kelp greenling

(*Hexagrammos decagrammus*), black rockfish (*Sebastes melanops*), blue rockfish (*Sebastes mystinus*), bocaccio (*Sebastes paucispinis*), brown rockfish (*Sebastes auriculatus*), copper rockfish (*Sebastes caurinus*), grass rockfish (*Sebastes rastrelliger*), vermillion rockfish (*Sebastes miniatus*), yellowtail rockfish (*Sebastes flavidus*), butter sole (*Isopsetta isolepis*), Dover sole (*Microstomus pacificus*), English sole (*Parophrys vetulus*), Pacific sanddab (*Citharichthys sordidus*), sand sole (*Psettichthys melanostrictus*), starry flounder (*Platichthys stellatus*), northern anchovy (*Engraulis mordax*), coho salmon (*Oncorhynchus kisutch*), and chinook salmon (*Oncorhynchus tshawytscha*). Of these, English sole, copper rockfish, and rockfish larvae/juveniles are considered 'resident' users of eelgrass beds and black rockfish, kelp greenling, lingcod, cabezon, butter sole, Dover sole, sand sole, starry flounder, northern anchovy, chinook salmon, coho salmon, and spiny dogfish are considered 'transient' users, as described in Phillips' (1984) description of eelgrass meadows in the Pacific Northwest.

Multiple studies have demonstrated higher faunal densities within seagrass habitat compared to unvegetated sand or mud substrates (Hoffman, 1986; Orth et al., 1984; Lazzari, 2002). More recently, studies have shown that the structural complexity of seagrass meadows has the greatest influence on faunal densities. Wyda et al. (2002) demonstrated a significantly higher abundance, biomass, and species richness of fish assemblages within sites that have high levels of eelgrass habitat complexity compared to sites with reduced eelgrass complexity or sites without any eelgrass. Similarly, Hovel et al. (2002) found that seagrass shoot biomass had a significant influence on species' densities. As described earlier, research has demonstrated that oyster aquaculture generally causes a reduction in the structural complexity of eelgrass beds via decreases in shoot density and percent cover. Thus, Coast's activities may result in reduced abundance, biomass, and/or species richness within aquaculture areas that overlap with eelgrass habitat.

In addition to the physical structure of seagrasses, the structural complexity and food resources provided by epiphytes are an important factor in faunal utilization. For instance, caprellid amphipods, which are attached to eelgrass blades, are a major source of food for shiner perch (*Cymatogaster aggregata*). Another unique component of eelgrass epiphyte assemblages in the Pacific Northwest are harpacticoid copepods, which serve as important prey items of juvenile salmon (*Oncorhyncus* spp), Pacific herring (*Clupea harengus pallasi*), Pacific sand lance (*Ammodytes hexapterus*) and surf smelt (*Hypomesus pretiosus*) (Simenstad, 1994). Thus, habitat modification by oyster mariculture can reduce the number of prey items for various predatory fish, thus leading to a potential reduction in the carrying capacity of these predators (Simenstad and Fresh, 1995).

In light of the fact that certain coastal fish assemblages have been in severe decline, evidenced by the most recent Pacific coast groundfish stock assessments and the Pacific Fishery Management Council's subsequent Pacific Groundfish closure, sensitive nursery habitats should be a priority for conservation and protection. Love et al. (2002) identified seagrass beds, in addition to kelp beds and rock outcrops, as essential habitat for young rockfishes (*Sebastes* spp.) by providing an important nursery function. In addition,

Moore et al. (2000) determined that eelgrass supported high biodiversity and provided important habitat for juvenile rockfish and other fish species. As noted in Love et al. (2002), "Loss or alteration of these nursery habitats, which are already limited in abundance, could have long-lasting detrimental consequences to the survival of rockfishes and the replenishment of their populations."

In addition to potential impacts to eelgrass directly utilized as habitat by Federally managed fish species, there are a number of ecosystem-level impacts that could indirectly affect Federally managed fish species. For instance, impacts to the detrital-based food web associated with eelgrass beds could disrupt linkages between organisms within other habitats of the estuary and coastal nearshore habitats. Prolonged disturbances to the eelgrass community can also lead to marked shifts in community structure. For instance, persistent disturbance of eelgrass by oyster aquaculture activities in Willapa Bay may have promoted the expansion of burrowing shrimp (Simenstad and Fresh, 1995). Once the burrowing shrimp become established in an area, they may inhibit future eelgrass colonization (Harrison, 1987).

Impacts to Primary Productivity Not Addressed

The effect of shellfish culture on natural ecosystem processes has not been examined in the Pacific Northwest. Simenstad and Fresh (1995) suggest estuarine management would benefit by considering aquaculture (and its effects) as a disturbance factor to be compared with other natural disturbances in the ecosystem. However, an ecosystem approach has been used in France, China, and the Netherlands (Smaal et al., 2001; Leguerrier et al., 2003; Grant and Bacher, 2001) through the application of an exploitation carrying capacity concept for an estuary with shellfish culture. The exploitation capacity of ecosystems depends on the availability of food, in this case primary production in the form of phytoplankton and microphytobenthos, and the number of competitors, and reflects a balance between particle depletion and renewal (Grant and Bacher, 2001; Smaal et al., 2001). Smaal et al. (2001) further defines the exploitation carrying capacity as the stock size at which the maximum marketable cohort is achieved. Within an estuary, primary production is not an unlimited natural resource (Fontenelle, 2003). Leguerrier et al. (2003) modeled a coupled pelagic-benthic food web of an intertidal mudflat ecosystem in France to estimate annual average carbon flows between compartments which are often linked by physical processes such as sedimentation and resuspension. Inputs of carbon in this food web are primary productivity (phytoplanktonic and microphytobenthic) and the suspended detritus supplied from tributaries, wetlands and redistributed by tidal currents. Exports of carbon included respiratory losses, material exports and burial. Material export occurs in the form of secondary production or biomass (harvested oysters, fish, birds), unused primary production, and detrital export and secondary production.

In a mesocosm study conducted at the Marine Ecosystem Research Laboratory near Narragansett Bay, oysters affected phytoplankton species composition and increased rates of sedimentation (Pietros and Rice, 2003). Similar results were found in the Thau lagoon, where food consumption by oysters modified food concentrations and primary

production (Gangnery et al., 2001). Changes in phytoplankton abundance and diversity will influence the marine ecosystem by restraining secondary production, which in turn will affect fisheries resources. Smaal et al. (2001) demonstrated that under certain circumstances, shellfish culture of mussels can be exploited at maximum capacity. If this were to happen, intensive bivalve mariculture may decrease the quantity of phytoplankton to such an extent that primary production decreases. Without sufficient phytoplankton in the coastal seawater, the growth and reproduction of zooplankton and other herbivorous marine animals will be affected, which can lead to changes in the ecosystem (Tang and Fang, 2002).

Oyster mariculture (growth and subsequent harvest) in Humboldt Bay removes carbon from the ecosystem and alters the natural carbon cycle. Coast has not indicated how many oysters and clams are placed in Humboldt Bay, either in past bottom culture or current oyster culture. Information on both the number and duration of oysters and clams placed in the various culture areas will be needed so that the effect of both the filter feeding of the organisms, as well as the physical effect of the organisms and their structural supports (long-lines; rack-and-bag; nursery pallets; Flupsy; clam rafts) on both abiotic and biotic ecosystem processes in Humboldt Bay can be estimated. Coast does not address the impact of oyster and clam mariculture on the primary productivity (phytoplankton and microphytobenthos, and epiphytic production on eelgrass), and more importantly carbon cycling, within Humboldt Bay. The applicant states that oyster mariculture has a positive effect on the overall water quality of Humboldt Bay (oysters are filter-feeding animals and require nearly pollution-free and high standards of water quality for optimum oyster growth). Water quality has a number of interpretations, depending on one's framework of thought. This statement reflects the economic aspect of the business relative to the ecosystem they are exploiting, and is more clearly stated in the following two sentences. In order for optimal growth of (filter-feeding animals) oysters, an abundant supply of phytoplankton is required. In order for oysters to be sold commercially, they must be free from contaminants or harmful bacteria. Filtration effects differ depending upon the location of the oysters in the water column. For instance, Ruesink et al. (2003) demonstrated that off-bottom culture filters a different component of the primary production in the ecosystem than oysters cultured on the bottom and may decrease food availability for other suspension feeding species in Humboldt Bay.

Impacts on Water Circulation and Sediment Dynamics Not Addressed

The physical effects caused by drag and/or roughness of the long-line and rack-and-bag culture on water circulation and sediment dynamics in Humboldt Bay have not been acknowledged, examined or mitigated for in the proposed action. Off-bottom oyster culture has the potential to affect water circulation within Arcata Bay at a small (less than 1 m) as well as at larger scales (e.g., 10-100 m). Grant and Bacher (2001) identified the frictional effects of aquaculture on water and particle flux as one of the most neglected areas of study in culture systems. They used a suspended bivalve (scallop) and kelp culture in a two-dimensional finite simulation model of circulation in Sungo Bay, China to predict effects of culture on tidal current speed and flow pattern and implication for carrying capacity estimates as related to food delivery by local flow. Model output

indicated suspended aquaculture resulted in a 20 percent reduction in current speed in the main navigation channel and a 54 percent reduction in speed in the midst of the culture area. In addition, mussel rope culture (similar to oyster long-lines) with spacings of 60 cm (23.6 in) were found to drastically reduce current flow (Saxby, 2002).

Historically, oyster harvesting practices have caused a change in sediment distribution (Barnhart et al., 1992). If these changes continue, it could impact fish and invertebrate species whose distribution is regulated by sediment characteristics. For instance, English sole, an important Federally managed commercial species that almost exclusively utilize estuarine areas for nursery habitat, appear to consistently be found in sediments composed of medium sand (500 μm to 1 mm) or very fine sand (250 μm to 500 μm) (Rooper et al., 2003).

Mitigation Measures Inadequate

The majority of the mitigation measures proposed by Coast in the Public Notice are measures already imposed upon them through HBHRCD's permit and the California Environmental Quality Act (CEQA) process. The HBHRCD produced a Mitigated Negative Declaration (MND) pursuant to CEQA for the Coast's mariculture operations in 1999. In this document, the HBHRCD claimed there was not enough available information to accurately identify potential impacts or effective mitigation measures. Therefore, they developed a program that identified a number of study projects that they believed would provide the necessary information to determine the level of impacts and the most appropriate mitigation measures. The bulk of the research associated with potential impacts to eelgrass was coordinated and funded through the Western Regional Aquaculture Center (WRAC). Specifically, the WRAC funded a study by academic and agency researchers from Washington and Oregon who are investigating the effects of oyster mariculture on estuarine ecosystems. The main goals of this investigation are: 1) compare the species diversity, density, and biomass of infaunal and epifaunal macro-invertebrates among oyster cultivation plots in Humboldt Bay and representative control areas; 2) conduct field experiments to directly examine the ecological impacts of Coast's oyster bottom culture and long-line operations on eelgrass and their associated infaunal and epifaunal communities; and 3) assess the relative capacity of Coast's oyster cultivation areas and control areas to serve as habitat and forage areas for various fish and invertebrates such as juvenile salmon and Dungeness crabs.

Many of the proposed mitigation measures are studies addressing marine impacts or characterizations of the study area. NOAA Fisheries supports these studies and characterizations in concept, but has questions and concerns about some of the proposed measures. First, it is unclear why some of the measures are considered 'mitigation' measures. For instance, Coast proposes as mitigation to provide: 1) maps depicting the details of their operational footprint; 2) results from the WRAC study of the impacts of long-line culture on eelgrass; 3) results from the WRAC study on substrate elevation changes; and 4) funds towards an ongoing fishery utilization study. These measures provide information regarding project operations and their impacts, which are examples

of the types of information necessary for developing mitigation, but do not provide mitigation by themselves.

Secondly, NOAA Fisheries is concerned that the ongoing studies will not provide the information necessary for a comprehensive mitigation plan. For instance, the WRAC study, which analyzes the impacts of long-line culture on eelgrass, is hindered by a pseudo-replicated experimental design. Although various statistical techniques may be utilized to differentiate relative impacts between treatments with confidence, NOAA Fisheries does not believe the current study will be capable of predicting absolute impacts associated with each treatment. Thus, there will be no reliable, quantitative estimate of the actual impact associated with long-line culture. However, on the positive side, the study may provide information useful for establishing future best management practices (BMPs), such as the appropriate line spacing for minimizing impacts to eelgrass. In fact, when discussing how to communicate results of this project to growers and managers, Dumbauld (2002), the WRAC work group chair, wrote: "Our primary goal is not to communicate "impacts" of aquaculture, but to provide a range of options for estuarine management." This was also opined in the HBHRCD's MND: "The WRAC studies are anticipated to produce 'best management practices' for oyster mariculture that will be applicable in other west coast estuaries having ecologies similar to that of Humboldt Bay."

Third, as discussed in the previous sections, many of the impacts associated with Coast's proposed activities are either not well quantified or not addressed. Specifically, there are no reliable, quantifiable estimates of Coast's impacts to eelgrass and fishery resources. In addition, impacts to primary production, water circulation, and sediment dynamics are not adequately addressed. Therefore, it is unclear how Coast developed the mitigation measure involving the transfer of 50 acres of tidelands and cessation of activities on the remainder of their owned and leased tidelands. Coast presents no scientific justification for how this measure compensates for impacts. In order to develop a more defensible mitigation plan, Coast needs to better quantify the impacts to eelgrass, fishery resources, primary productivity, sediment dynamics, and water circulation. In addition, the habitat value of the oysters and their associated structures should be determined. Any positive benefits associated with Coast's operations should be considered for incorporation into the final mitigation plan.

Conclusion

Based upon existing knowledge of oyster aquaculture impacts in Humboldt Bay and impacts of similar operations in other regions, NOAA Fisheries believes the proposed project will have an adverse impact on EFH. In addition, NOAA Fisheries believes many of the impacts are not adequately addressed. Lastly, there is no evidence that the proposed mitigation measures will compensate for Coast's environmental impacts. Therefore, NOAA Fisheries recommends denial of the project as currently proposed. However, NOAA Fisheries is eager to work with Coast, ACOE, California Department of Fish and Game (CDFG), U.S. Department of Fish and Wildlife (USFWS), California Coastal Commission (CCC) and other relevant state agencies and interested parties to

develop measures that would adequately safeguard the environment while also promoting an environmentally sound oyster mariculture operation. In order to facilitate the development of a project that would satisfy our concerns, NOAA Fisheries requests an expanded EFH consultation with ACOE and intends to provide EFH Conservation Recommendations after receiving an EFH Assessment, as described in 50 CFR Part 600 §600.920 and §600.925.

Thank you for considering our comments. If you have any questions, please contact Bryant Chesney at (562) 980-4037 or Bryant.Chesney@noaa.gov or Diane Ashton at (707) 825-5185 or Diane.Ashton@noaa.gov.

Sincerely,

Valerie L. Chambers
Assistant Regional Administrator
for Habitat Conservation

Enclosure (References)

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the Northcoast Environmental Center

November 25, 2003

In Re: USACE PN# 26912N, copy via email toDavid.A.Ammerman@spd02.usace.army.mil
Attn: Regulatory Branch
U.S. Army Corps of Engineers
333 Market Street
San Francisco CA 94105-2197

Gentlepersons:

Thank you for this opportunity to comment on the longstanding issues surrounding the operations of Coast Seafoods Company (hereafter Coast) in Humboldt Bay. We are requesting that the U.S. Army Corps of Engineers (USACE) conduct a public hearing on this noticed permit action because of the multi-year delays that have been associated with this action.

The scope and history of Coast's activities in the Humboldt Bay are complex and should be best addressed in an environmental impact statement (EIS) in compliance with the National Environmental Policy Act. To date, Coast has avoided full California Environmental Quality Act (CEQA) compliance.

NEPA compliance could deal with all of the outstanding issues that Coast has either danced around or sought "after the fact" approvals.

For example the Northcoast Environmental Center first engaged Coast and the permitting authorities in 1995 after Coast's daytime trawl for bat rays that shocked observers. Our review found that some 40,000 bat rays had been killed under a depredation permit issued by the California Department of Fish and Game (DFG).

We note in your permit notice a reference to our letter. But you wrote that we said Coast killed "millions of bat rays." We believe that we have always said 40,000 rays were killed under permit, and in some cases merely said tens-of-thousands.

The more important point is that Coast failed to include reports about non-

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target species or collateral damage to sponges, benthic invertebrates, sharks, halibut, green sturgeon or other fish as the DFG permit required.

The trawl was predicated on the idea that bay rays were eating oysters. Yet the written record is weak on evidence that bat rays were or are eating oysters. It is possible that bat rays disturbed the on-bottom culture in search of rock crabs which they are known to eat. Coast still holds a depredation permit for crabs, and during the nearly 50 years they have held that permit, they may have trapped and killed millions of crabs.

No mention is made in the permit notice of existing depredation permits and whether or not Coast has complied with the reporting terms of those permits.

Another issue not mentioned in the permit notice has to do with the ongoing colonization of Humboldt Bay by invasive species. Recently, for example, an exotic species of Japanese eelgrass was discovered in the bay. How it got here no one seems to know.

Since the oyster business in the bay commonly moves living biological material in and out of the area on a regular basis, it is fair to ask where the detailed and reasoned discussion of the impacts of aquaculture vis-a-vis the establishment of exotic estuarine organisms will take place. This is too serious of an issue to overlook.

We want to applaud the efforts of the Army Corps of Engineers to apply pressure to Coast to get its permits in order. Aquaculture for many years was represented as being relatively benign in terms of its environmental ill effects, and Coast and others in the oyster growing business routinely tout oysters as being a creator of clean water, or at least a good reason for preserving clean water in Humboldt Bay.

Add to this the general notion that aquaculture is okay and you can see why elected officials who have been msiled about the impacts of "salmon farming," the replacement of mangrove swamps around the world with "prawn farms" and the use by "oyster farmers" in some areas of herbicides to get rid of that inconvenient eelgrass. In Washington they even routinely spray pesticides like carbaryl to kill ghost shrimp that burrow below the oyster beds.

As with many things that are benign at a small scale, they can become a serious problem when they become big operations.

Coast clearly has a history of thinking that it doesn't need to get its operation in order. Apparently, it also has used political pressure to try to limit its degree of regulatory compliance.

over

We are not of the opinion that the oyster business should be run out of Humboldt Bay, but it must be able to coexist with healthy eelgrass meadows that are the keystone for so many other species, including many that are the basis for important area fisheries.

Thank you for this opportunity to participate in the process. To reiterate, we do request a public hearing on this matter, as well as attention to the depredation issue and invasive species questions. We would like a full and reasoned explanation as to why the USACE should not require an EIS to be prepared and circulated regarding the conduct of aquaculture in Humbold Bay.

Sincerely,

Tim McKay, executive director

TM/me

CC:
Congressman Mike Thompson
Senator Dianne Feinstein
Senator Barbara Boxer
California Fish and Game Commission
California Coastal Commission
California Department of Fish and Game
Humboldt Bay Wildlife Refuge
U.S. Fish andWildlife Service
NOAA Fisheries

State of California - The Resources Agency
ARNOLD SCHWARZENEGGER, Governor
DEPARTMENT OF FISH AND GAME
350 HARBOR BOULEVARD
BELMONT, CA 94002-4018
(650) 631-7730 FAX: (650) 631-6793

December 1, 2003

Lieutenant Colonel Michael McCormick
District Engineer
U.S. Army Corp of Engineers
333 Market Street
San Francisco, California 94105-2197

Subject: Public Notice File No. 26912N, Coast Seafoods Oyster Culture in Humboldt Bay

Dear Lieutenant Colonel McCormick:

The California Department of Fish and Game (Department) has reviewed a Public Notice (PN) for a Department of the Army individual permit application for Coast Seafoods Company (Coast) to retain unauthorized structures, to maintain existing structures and apparatus, and to conduct oyster mariculture operations in Humboldt Bay, California.

The Department has the following concerns, comments, and recommendations regarding the proposed project and Public Notice:

Project Description Section

- Oyster culture with long line devices should be referred to as "Pacific Long Line or PLL", not "stake" culture. Stake and PLL are distinctly different methods.
- Coast proposes to reduce its operational footprint to 300 acres "within any given crop cycle". The Department previously understood that Coast was proposing a fixed area of 300 acres would be utilized at all times, not a rotational 300 acres. The Department requests clarification of "within any given crop cycle".
- The Public Notice states that Coast leases 3,384.5 acres from the Humboldt Bay Harbor District and the City of Arcata. The Department understands that Coast actually leases tidelands from the Humboldt Bay Harbor District, City of Eureka, and the Karamu Corporation. The property owners and associated leases need to be clarified.
- Coast proposes to plant 45.49 acres out of 123 acres of former ground culture plots in areas designated as "cleaned off and ready for replant proposed PLL". The Department recommends that planting of new PLL oyster plots on the 45.49 acres should not occur until all agency permits are in place and a mitigation plan has been approved by the resource agencies. In addition, Coast proposes that the selection of the 45.49 acres would be determined by majority vote of the Humboldt Bay Mariculture Monitoring Committee (MMC). The Department

recommends that selection of the 45.49 acres should be determined by a consensus of the resource agencies (CDFG, NOAA Fisheries, USFWS) with Coast. The MMC is strictly an advisory group to the Humboldt Bay Harbor District.

- Page 3: The PN states that a second nursery at the Arcata Channel location is needed. Does this mean additional acreage is required?
- Page 4: The PN states the MMC monitors two beds with varying line spacing intervals which were planted in an effort to determine the optimum long-line spacing for ecological and economic concerns. Other than an annual site visit to observe the plots, there is no scientific monitoring by the MMC. However, WRAC is using these sites to supplement the data in their study. The PN should be corrected accordingly.
- Page 6: The Department recommends that dredging of the Coast Seafoods facility dock be considered a separate project which would require a separate permit. Maintenance dredging is a completely different project than oyster culture with different effects on biological resources which should be evaluated separately.

Potential Project Impacts Section

- Page 10: The PN states that "[t]he MMC and WRAC groups are currently studying what the actual impacts are and how areas removed from harvest are recovering from past oyster culture." WRAC is doing this study, not the MMC. The MMC reviews the reports that the WRAC researcher provides and evaluates the study results. This error needs to be corrected in the PN.
- No studies have been performed in Humboldt Bay to evaluate the impacts of the "rack and bag" culture method. However, personal observations have shown sediment accumulation and lack of eelgrass underneath the rack and bag structures (see Attachment 1). The Department recommends that Coast move the "rack and bag" operation to areas outside of eelgrass habitat.
- The WRAC study (Rumrill and Poulton 2003) suggests that long line spacing intervals of less than ten feet negatively affects eelgrass growth. This suggests that the proposed project, as described with 2.5 foot line spacing, will have a negative effect on eelgrass growth in areas of long line operations. If there is a likelihood of impacts to eelgrass, then mitigation is required.
- Page 11: The PN states that the actual acreage of eelgrass is not accurately quantified at this time in the 182.14 acres of long line plots. This statement indicates that Coast should be required to perform a thorough survey of the operational area to determine the quantity of eelgrass. Eelgrass surveys should be an ongoing requirement to determine changes over time and potential negative or positive effects of the operation.
- Page 11: "Kumo oyster culture covers 55.94 acres". Kumomoto oyster culture utilizes the Pacific long line method. The only difference between Kumo culture areas and Pacific long line plots is the type of oyster grown on the lines.

- Page 11: Nursery areas have not been studied to determine effects on eelgrass and the benthic habitat. Potential effects include shading, removal of open space for recruitment of marine organisms, compression of the sediments, changes in hydromorphology. These impacts should require mitigation as well.
- Page 12: Past ground culture plots should be studied to determine eelgrass recovery rates. Excessive residual oyster shell could be removed as a mitigation measure.
- Page 12: Debris from oyster culture activities continues to litter the mudflats in Arcata Bay. Coast should be required to remove from the Bay all PVC, mesh bags, and other debris that is not actively involved in oyster culture.
- See attached literature list (Attachment 2) for other studies on impacts to biological resources and habitat by oyster culture.

Mitigation for Oyster Culture Impacts Section

- Page 12: Coast has completed a change in their operations by converting to off bottom culture methods. The mitigation measures that address the termination of ground culture, dredging, shell deposition, bat ray fences, and bat ray/rock crab depredation have already taken place. These operational changes have certainly minimized impacts to biological resources from oyster culture in Arcata Bay, and Coast can be commended for these changes. However, off-bottom oyster culture presents other impacts to biological resources (eelgrass and benthic habitat reduction) that are not addressed in this permit application. The impacts to biological resources on the 300 acres of off-bottom oyster culture must be mitigated for by Coast Seafoods.
- The Department agrees with and commends Coast for the mitigation measures for the Harbor Seal Avoidance Protocol, identification of all harbor seal haul-out and pupping locations near Coast's operations, and the Caspian tern nesting protective distance of 100 meters around Sand Island.
- Page 13: Large scale maps using GPS technology of the 300-acre operational footprint should be updated on a regular basis (annually). This requirement needs to be outlined in the permit, rather than left at Coast's discretion ("...after any material change").
- The WRAC study results should be submitted to the Corp by August 2004, rather than April 1, 2005, since August 2004 is when the Final Report is due to the Humboldt Bay Harbor District.
- The Department understands that Coast already committed $7,000 for 2003-2004 portion of the salmonid study by US Fish and Wildlife Service. Why does the PN state that Coast would not contribute this money until 180 days after issuance of the Corp permit? The salmonid/fish study is a requirement of the Humboldt Bay Harbor District Mitigated Negative Declaration (1999) and should be in progress.
- Continuing to lease tidelands not utilized for the 300 acres of oyster culture is a prudent practice for Coast in order to protect a "good feeding pasture" for their oysters. Coast agrees to continue the leases until 2015. Will this mitigation

measure cease to exist after 2015? As a mitigation measure, it does not address the impacts on the 300 operational acres.

- Donation of 50 acres of tidelands to an "appropriate entity" for permanent protection is a good mitigation measure. However, since 50 acres are proposed to mitigate for impacts on 300 acres, it should be considered as just one element of an overall mitigation plan. In addition, donation of lands for environmental protection should go to an appropriate conservation agency approved by CDFG and USFWS.

State Approvals Section

- The Department regulates commercial aquaculture in the State. That regulation includes importation, transportation, and sale of aquaculture products in addition to registration of all commercial aquaculture production facilities. Coast has been continuously registered since the registration requirement (FGC 15101) was enacted in 1981. The Department may prohibit any operation that is detrimental to native wildlife (FGC 15102). The Department concerns about Coast's bottom culture impacts to eelgrass and other wildlife resources influenced Coast's transition from bottom to off-bottom culture methods. The Department will continue to evaluate Coast's impacts on wildlife resources when considering annual renewal of their aquaculture registration.
- The Fish and Game Commission has determined that Coho salmon in California warrant protection as a threatened species north of Punta Gorda and as an endangered species south of Punta Gorda under the California Endangered Species Act. The Fish and Game Commission has directed the Department to develop a coho salmon recovery strategy plan. Once the coho recovery plan is completed, coho salmon may be listed under the California Endangered Species Act. If coho become listed as threatened or endangered prior to completion of the project, an incidental take permit will be required pursuant to Fish and Game Code Section 2081(b). As an alternative to obtaining an incidental take permit, the project proponent may request a consistency determination from the Department under Fish and Game Code Section 2080.1 if a federal biological opinion and incidental take statement have been obtained for this species. In the latter instance, care should be taken to ensure that the biological opinion includes measures to both minimize and fully mitigate the impacts resulting from the take of coho salmon.

Summary of Department Concerns

In summary, The Department is concerned primarily about Coast's operations in eelgrass habitat. The proposed mitigation measures in the PN do not adequately address all impacts to biological resources in Humboldt Bay. The WRAC studies have shown that Pacific Long Line oyster culture can have a negative effect on eelgrass

growth. Documentation in the scientific literature shows that eelgrass beds provide essential habitat for numerous species of fish and invertebrates and a food source for black brant and other bird species. Therefore, an overall mitigation plan for oyster culture impacts to biological resources must be prepared. Other suggested mitigation measures include, but are not limited to,

- Residual shell removal from abandoned culture areas.
- Relocation of "rack and bag" operations to unvegetated mudflat.
- Confirmed funding towards the completion of the USFWS salmonid/fish study.
- Annual eelgrass surveys within the operational area to document density and cover of eelgrass.
- A long term monitoring program for the health of biological resources and geomorphological changes within the operational area in Arcata Bay.
- Filtration of nutrients and total suspended solids (TSS) by oysters improves the water quality in Arcata Bay. This improved water quality helps to prevent macroalgae blooms and limits epiphyte loading on the eelgrass itself. If the filtration rates could be quantified and estimates gained of the quantity of nutrients and TSS removed, then this filtration function might be used as a mitigation measure to offset eelgrass impacts.

The Department would like to commend Coast Seafoods for making the operational changes which have reduced impacts to the biological resources of Humboldt Bay, and for reducing the operational area to 300 acres. We hope that Coast will continue to work cooperatively with the resource agencies to create a satisfactory mitigation plan for their project in Humboldt Bay.

The Department appreciates the opportunity to comment on this application for authorization. As always, Department personnel are available to discuss our concerns, comments, and recommendations in greater detail. To arrange for discussion, please contact Ms. Vicki Frey, Environmental Scientist, Department of Fish and Game, 619 2nd St., Eureka, CA. 95501, (707) 445-7830.

Sincerely,

ERIC J. LARSON
Northern California Manager
Marine Region-Belmont

Attachment 1
Photographs of Coast Seafoods
Mad River "rack and bag" operations
May 20, 2003

Attachment 2

Literature List for Eelgrass and Oyster Culture

Aitkin, J.K. 1998. The importance of estuarine habitat to anadromous salmonids of the Pacific Northwest: A literature review. USFWS Western Washington Office, Aquatic Resources Division, Lacey, WA.

Crawford, C.M., C.K.A. Macleod, I.M. Mitchell. 2003. Effects of shellfish farming on the benthic environment. Aquaculture 224:117-140.

Everett, R. A., G. Ruiz and J. Carlton. 1995. Effect of oyster mariculture on submerged aquatic vegetation: an experimental test in a Pacific Northwest estuary. Marine Ecology Progress Series, Vol. 125: 205-217.

Fourqurean, J.W., T.O. Moore, B. Fry, and J.T. Hollibaugh. 1997. Spatial and temporal variation in C:N:P: ratios, ^{15}N, and ^{13}C of eelgrass *Zostera marina* as indicators of ecosystem processes, Tomales Bay, California, USA. Mar Ecol Prog Ser. 157:147-157.

Frost, M.T., A.A. Rowden, and M.J. Attrill. 1999. Effect of habitat fragmentation on the macroinvertebrate infaunal communities associated with the seagrass *Zostera marina* L. Aquatic Conserv: Mar. Freshw. Ecosyst. 9:255-263.

Griffin, Kerry. 1997. Eelgrass ecology and commercial oyster cultivation in Tillamook Bay, Oregon: A literature review and synthesis. Tillamook Bay National Estuary Project Oyster Report.

Hoffman, Robert S. 1986. Fishery utilization of eelgrass (*Zostera marina)* beds and non-vegetated shallow water areas in San Diego Bay. NMFS, Southwest Region Administrative Report SWR-86-4.

Keller, Mathew. 1963. The growth and distribution of eelgrass (*Zostera marina* L.) in Humboldt Bay, California. MS Thesis, Humboldt State University.

Kelly, John P., Evens, Jules G., Stallcup, Richard W. and David Wimpfheimer. 1996. Effects of aquaculture on habitat use by wintering shorebirds in Tomales Bay, California. California Dept. of Fish and Game, Vol. 82(4):160-174.

Lin, H. J., Nixon, D.I., Taylor, D. I., Granger, S. L., Buckley, B. A. 1996. Responses of epiphytes on eelgrass, *Zostera marina L.* to separate and combined nitrogen and phosphorus enrichment. Aquatic Biology, Vol. 52: 243-258.

McGlathery, L.J. 2001. Macroalgal blooms contribute to the decline of seagrass in nutrient-enriched coastal waters. J. of Phycology 37:453-456.

Merkel and Associates, Inc. 2000. Environmental controls on the distribution of Eelgrass (Zostera marina L.) in South San Diego Bay: An assessment of the relative roles of light, temperature, and turbidity in dictating the development and persistence of seagrass in a shallow back-bay environment.

Moore, K.A., Neckles, H.A., Orth, R. J. 1996. Zostera marina (eelgrass) growth and survival along a gradient of nutrients and turbidity in the lower Chesapeake Bay. MEPS, Vol. 142: Abstract only.

Pregnall, M.M. 1993. Regrowth and recruitment of eelgrass (*Zostera marina*) and recovery of benthic community structure in areas disturbed by commercial oyster culture in the South Slough National Estuarine Research Reserve, Oregon. MS Thesis. Bard College, Annandale-On-Hudson, New York.

Rumrill, Steven S. and V. Poulton. 2003. Ecological role and potential impacts of molluscan shellfish culture in the estuarine environment of Humboldt Bay, CA. Annual Report 2002-2003, Western Regional Aquaculture Center.

Simenstad, C.A. and K.L. Fresh. 1995. Influence of intertidal aquaculture on benthic communities in Pacific Northwest estuaries: scales of disturbance. Estuaries vol. 18(1A): 43-70.

Thayer, G.W., D.A. Wolfe, and R.B. Williams. 1975. The impact of man on seagrass systems. American Scientist, Vol. 63: 288-296.

Thorne, A.J. 1998. Alterations in the structure of macrobenthic communities related to the culture of oysters (Crassostrea gigas). Zoology. Univ. of Tasmania, Hobart. p.102.

Trianni, Michael S. 1996. The influence of commercial oyster culture activities on the benthic infauna of Arcata Bay. MS. Thesis. Humboldt State University.

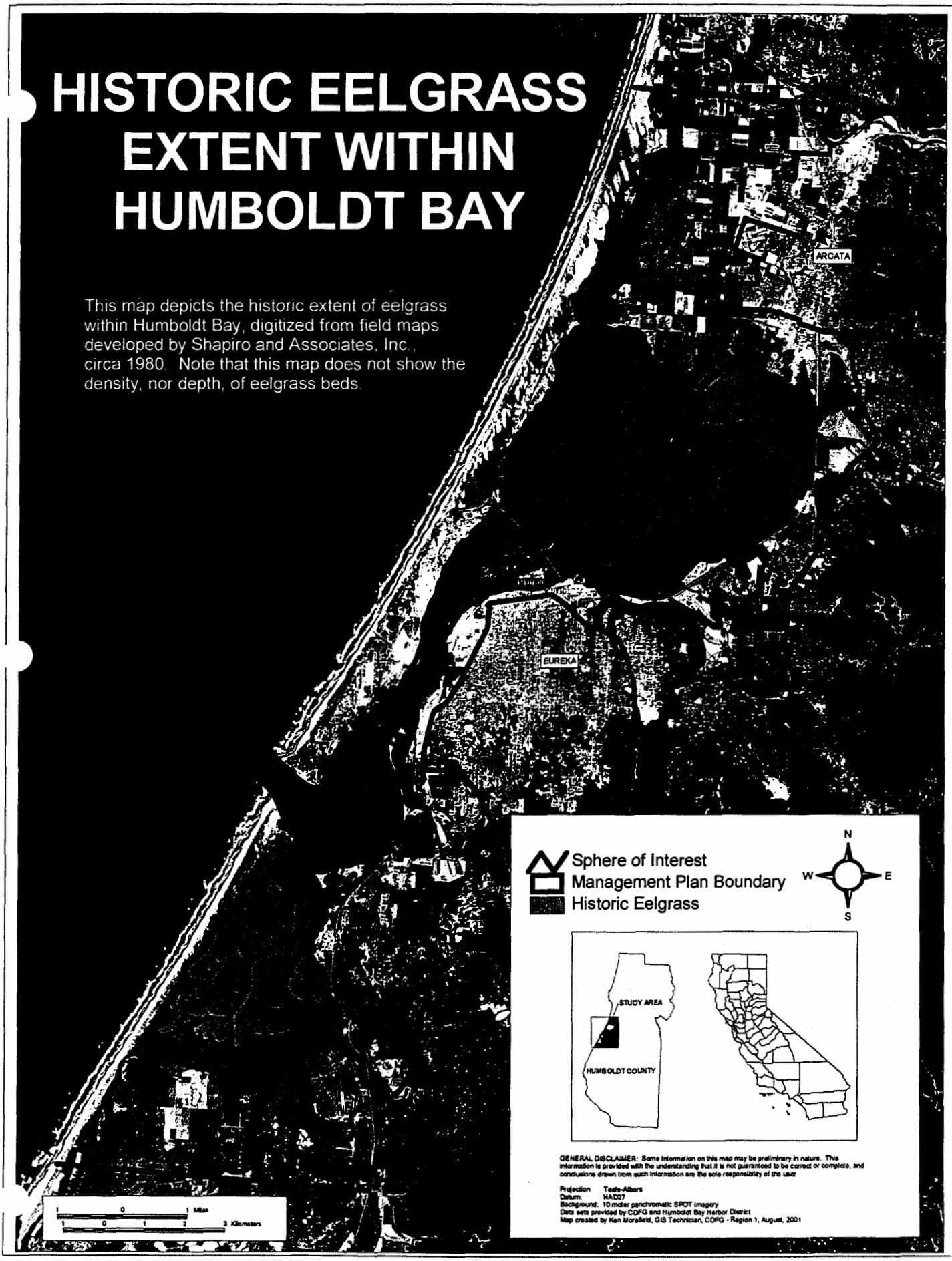
Waddell, J.E. 1964. The effect of oyster culture on eelgrass (*Zostera marina* L.) growth. Masters Thesis, Humboldt State University.

Webster, P.J., A.A. Rowden, and M.J. Attrill. 1998. Effect of shoot density on the infaunal macro-invertebrate community within a *Zostera marina* seagrass bed. Estuarine Coastal and Shelf Science 47:351-357.

Wyda, J.C., et al. 2002. The response of fishes to submerged aquatic vegetation complexity in two ecoregions of the mid-Atlantic bight: Buzzards Bay and Chesapeake Bay. Estuaries 25 (1): 86-100.

HISTORIC EELGRASS EXTENT WITHIN HUMBOLDT BAY

This map depicts the historic extent of eelgrass within Humboldt Bay, digitized from field maps developed by Shapiro and Associates, Inc., circa 1980. Note that this map does not show the density, nor depth, of eelgrass beds.

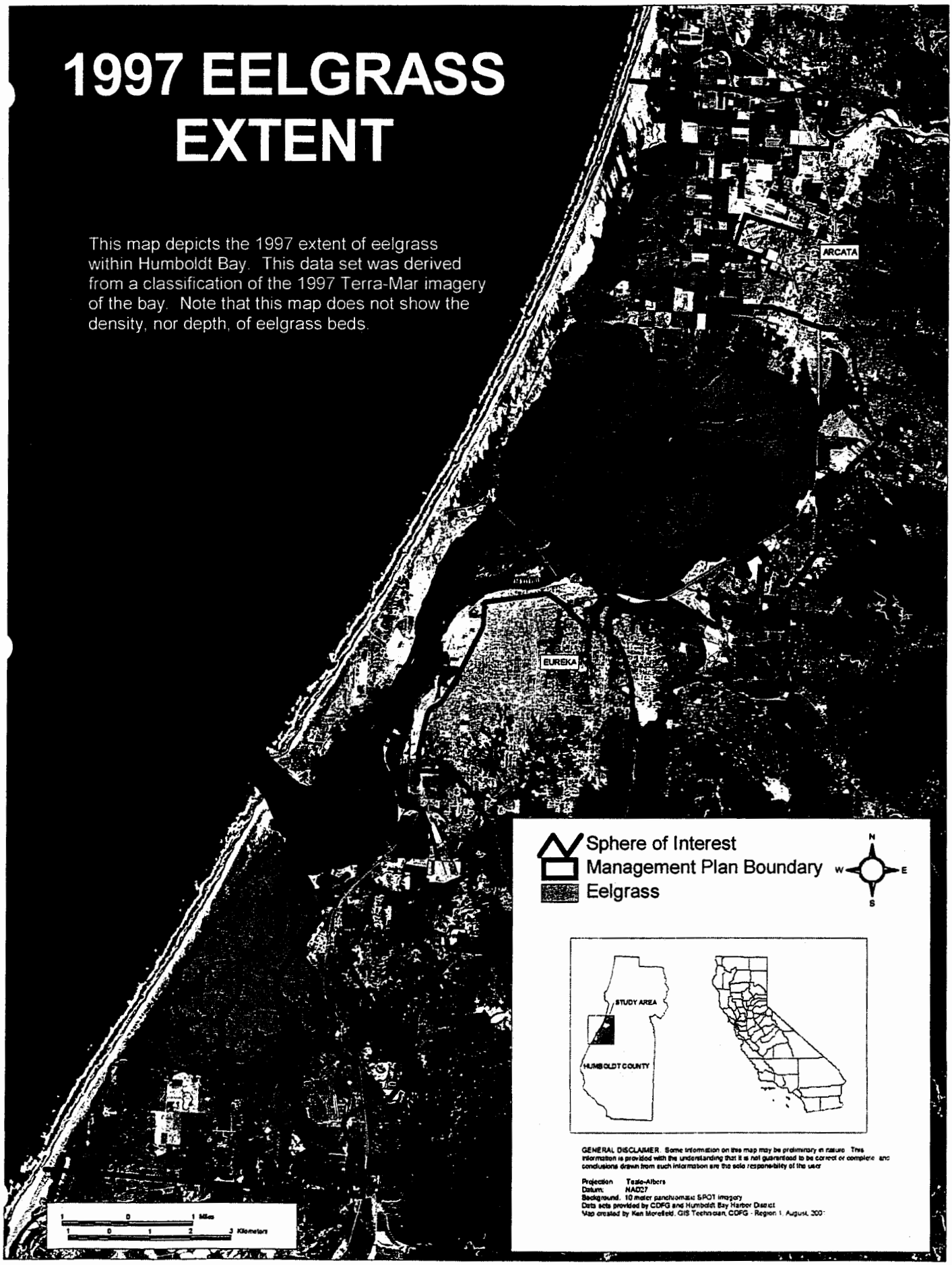


GENERAL DISCLAIMER: Some information on this map may be preliminary in nature. This information is provided with the understanding that it is not guaranteed to be correct or complete, and conclusions drawn from such information are the sole responsibility of the user

Projection Teale-Albers
Datum: NAD27
Background: 10 meter panchromatic SPOT imagery
Data sets provided by CDFG and Humboldt Bay Harbor District
Map created by Ken Morefield, GIS Technician, CDFG - Region 1, August, 2001

1997 EELGRASS EXTENT

This map depicts the 1997 extent of eelgrass within Humboldt Bay. This data set was derived from a classification of the 1997 Terra-Mar imagery of the bay. Note that this map does not show the density, nor depth, of eelgrass beds.



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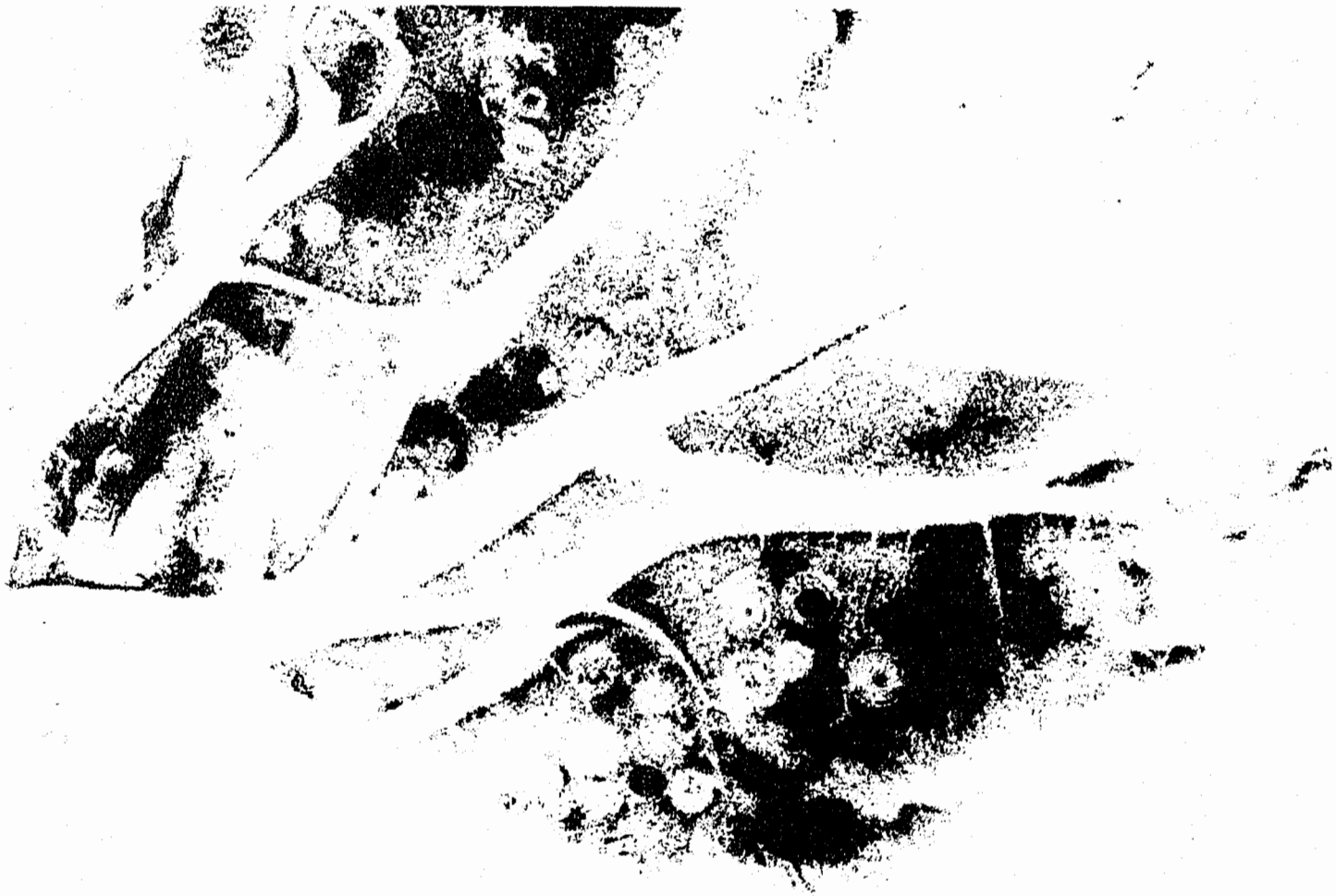
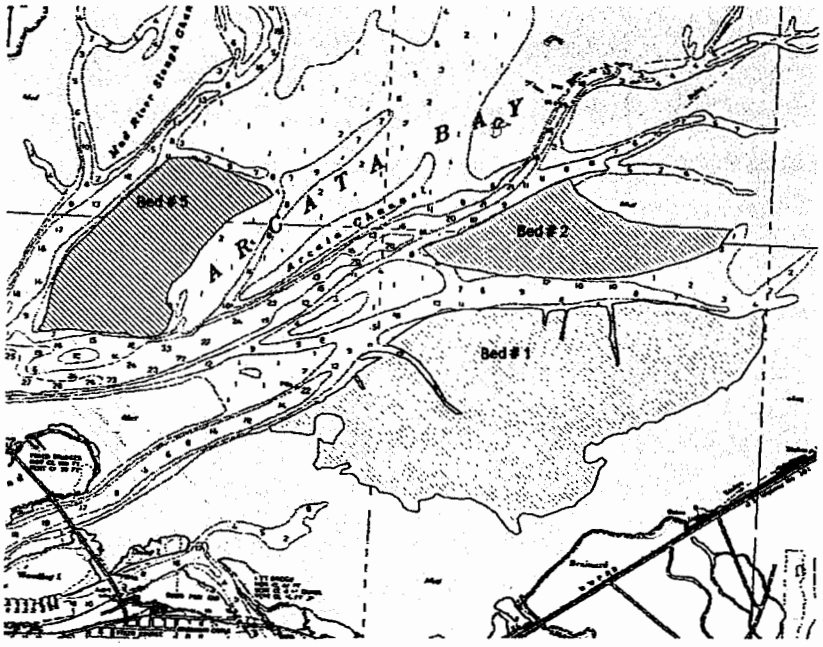
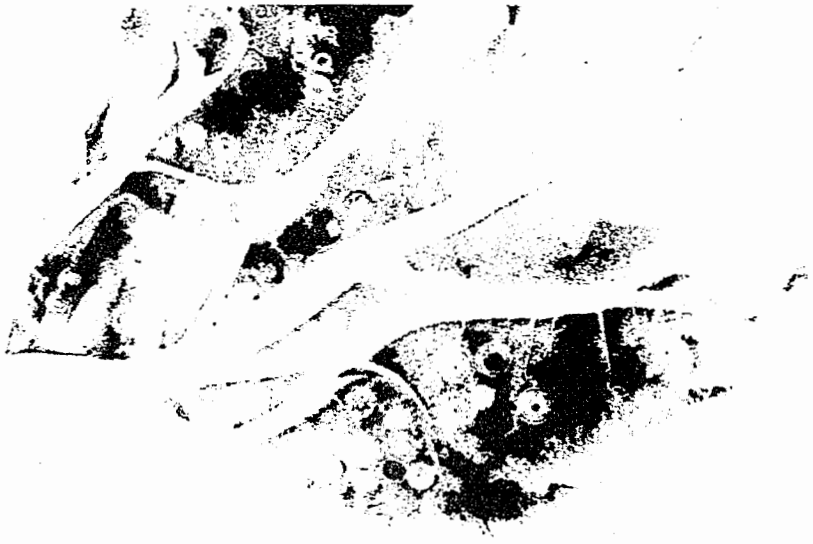


Eelgrass coverage derived from 1997 arial photographs in north Humboldt Bay herring spawning area.

Key Pacific Herring Spawn Areas in Humboldt Bay for the Year 2001



NOAA chart of north Humboldt Bay with overlay showing extent of mid-February herring spawn event.



Eelgrass coverage derived from 1997 arial photographs in north Humboldt Bay herring spawning area.