Jones & Stokes

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SUBJECT: Clarification and Additional Scientific Information for Coast Seafoods Continued Oyster Aquaculture Operations

The purpose of this letter is to provide NOAA Fisheries with clarification on the proposed action and additional relevant scientific information on the area of oyster culture referred to in the Biological Assessment as “the remaining 45.49 acres of the total 300 acre operational footprint...”

1. Description of remaining 45 acres

First, we would like to clarify the characterization of the remaining 45 acres, which is inaccurately described in NOAA Fisheries' letter of January 27, 2005 to the U.S. Army Corps of Engineers (Corps). The Corps' letter requesting initiation of consultation (December 16, 2004) correctly characterized the remaining 45 acre as follows: “[Coast Seafoods] Coast proposes to complete conversion of an additional 45 acres of its mariculture operations in Humboldt Bay.” All of the areas in question have been under oyster cultivation (ground culture) for numerous years, and the proposed action entails the *completion of the conversion* from ground culture to off bottom (long line) and is within the original footprint of Coast’s operations. In fact, the proposed action represents a reduction in the overall footprint of Coast’s operations from 500+ acres to 300 acres[1]. NOAA Fisheries characterization of this action as “future expanded operations” is therefore incorrect.

2. Modified longline spacing and location

Second, ongoing discussions with NOAA Fisheries and California Department of Fish and Game (CDFG) have resulted in a proposed approach, with respect to long line bed location and line spacing. Initial discussions (Conference call December 3, 2004 and meeting December 15, 2004) reviewed the 125 acres of Coast's historic ground culture beds currently available for long line planting to determine which beds could be chosen that, in the opinion of the resource agency

[1] As further discussed in this letter, the 300-acre footprint may increase based on the resolution of discussions regarding location and spacing for the remaining 45 acres to be converted from ground culture to long line culture.

personnel, would avoid the most robust or otherwise important eelgrass areas (i.e. used for herring spawning, closest proximity to creek bearing salmonids). The following beds were identified as the most suitable for long line planting:

Table 1: Coast Seafood Beds Available for Conversion

Bed Location					
East Bay (EB)		**Sand Island (SI)**		**Mad River (MR)**	
EB 7-1	9.86	SI 3-1	6	MR 2	6.78
EB 7-2	11.67	SI 3-2	7.33	MR 8-2	6.9
EB 8	5.24	SI 4-1	5.49	MR 9	7.02
Total East Bay	**26.77**	**Total Sand Island**	**18.82**	MR 10	7.88
				Total Mad River	**28.37**
Total All Beds	**73.96**				

The discussions with the NOAA Fisheries and CDFG also addressed a proposed long line spacing schema to avoid and minimize impacts to eelgrass. Because of Coast's unique situation of having available (owned or leased) a large amount of tidelands, an innovative approach to line spacing has been discussed. Under this approach lines would be spaced in a pattern with two lines spaced 1.5-feet apart followed by a 10-foot spacing, followed by an additional two lines spaced 1.5-feet apart, etc. (10/1.5/10-foot spacing). The intent of this line spacing is to avoid/minimize impacts to eelgrass, to minimize overall oyster culture footprint[2], while at the same time maintaining oyster yield[3]. The increased spacing would require approximately 74 acres to be planted to ensure a similar yield as the originally proposed 45 acres at 2.5-foot spacing.

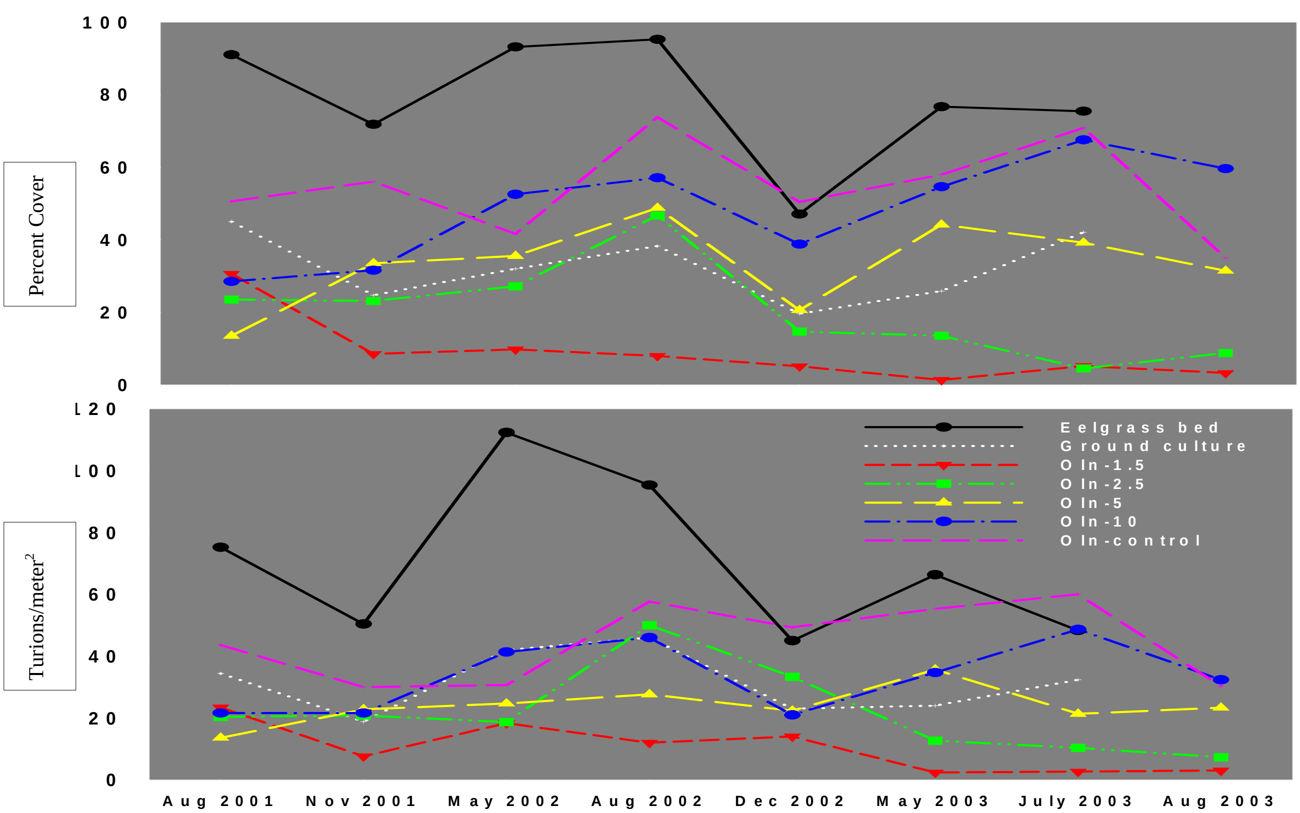
This modified spacing schema is intended to address NOAA Fisheries' concerns over potential impacts to eelgrass from the conversion of the remaining acreage from bottom culture to long line. The recently completed Western Regional Aquaculture Center (WRAC) study compared long line oyster culture utilizing various spacing (1.5-foot, 2.5-foot, 5-foot, and 10-foot) to a control (no-line). This study indicated that 1.5 and 2.5-foot spacing resulted in a reduction in eelgrass density (turions/meter^2) and percent cover. The study concluded that "Eelgrass metrics within the OLN-10 [10-foot spacing] were nearly identical to those within the adjacent control plot (no oyster line; OLN-CON) and very similar to the spatial cover values measured within the five eelgrass reference sites located throughout Arcata Bay." Furthermore, as presented in the Biological Assessment, data from the WRAC study indicate that percent cover and density increased over the course of the study for the 5 and 10-foot spaced lines, while the control plots exhibited a decrease in these parameters for the same time period. These data represent an increase in eelgrass density and percent cover for 5 and 10-foot spaced lines as compared to control (no lines).

[2] The remaining 45 acres for conversion was proposed at a line spacing of 2.5-feet. In order to achieve approximately the same yield of oysters with the wider spacing, additional acreage would be required.
[3] Observations have indicated reduced oyster production on long line plots with singles lines spaced 10 feet apart, this productivity reduction has not been observed with two lines close together followed by the 10-foot spacing.

Table 2: Results of the WRAC study as presented in the Biological Assessment.

Plot Type	**Eelgrass Cover in August, 1 month before oyster culture began (percent)**	**Eelgrass Cover in Aug, 21 months after oyster culture began (percent)**	**Decrease (-) or Increase (+)**	**Eelgrass Density in August, 1 month before oyster culture began (shoots/m²)**	**Eelgrass Density in July, 21 months after oyster culture began (shoots/m²)**	**Decrease (-) or Increase (+)**
Uncultured dense eelgrass	90%	70%[1]	**20 (-)**	75	50[1]	**25 (-)**
Bottom culture on existing bottom culture site.	45%	40%[1]	**5 (-)**	35	30[1]	**5 (-)**
Control –no lines	50%	35%	**15 (-)**	45	30	**15 (-)**
1.5-ft spacing long line on former bottom culture site.	30%	5%	**25 (-)**	25	5	**20 (-)**
2.5-ft spacing long line on former bottom culture site.	25%	10%	**15 (-)**	20	10	**10 (-)**
5-ft spacing long line on former bottom culture site.	15%	35%	**20 (+)**	15	20	**5 (+)**
10-ft spacing long line on former bottom culture site.	30%	65%	**35 (+)**	20	30	**10 (+)**

Figure 1: Results of the WRAC Study (Rumrill 2004)



The Biological Assessment presents the results of numerous studies establishing the value of shellfish habitat and oyster culture (both long line and bottom culture) in terms of its beneficial role in water quality/clarity, physical processes, and nursery and refugia habitat for juvenile fishes, shrimps, crabs, and other invertebrates (Ambrose and Anderson, 1990; Doty, Armstrong, and Dumbauld, 1990; Breitburg and Miller, 1998; Dumbauld, Armstrong and McDonald, 1993; Eggleston and Armstrong, 1995; Simenstad and Fresh, 1995; and Dumbauld, 1997). The Biological Assessment discusses the abundance and diversty of nekton (fish, crab, and shrimp), epibenthic meiofauna, and benthic macrofauna found in oyster culture (see Section 5.1.1.4 Biological Condition: Prey Base and Benthic Faunal Communities of the Biological Assessment). Study results are presented that indicate species abundance and diversity are comparable in oyster and eelgrass habitats, both of which are higher than mudflat, sand and several other habitats sampled (Hosack, 2003; Ferraro and Cole, 2001; Ferraro and Cole, 2003).

The analysis in the BA is further supported by a recent study published in *The Journal of Shellfish Research* (Dealteris et al., 2004; attached). The study investigated the habitat value of shellfish aquaculture gear in comparison to eelgrass and non-vegetated areas. Abundance of marine organisms and species diversity was used to compare habitat value. The study indicated that aquaculture 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. Habitat value for both aquaculture gear and eelgrass were significantly higher than non-vegetated areas. The study concluded, “shellfish aquaculture gear has substantially greater habitat value than a shallow nonvegetated seabed, and has habitat value at least equal to and possibly superior to submerged aquatic vegetation.”

The WRAC study (2004) similarly found that the “overall similarity of the invertebrate communities among the oyster long line and eelgrass reference sites provides evidence that oyster long line culture activities are not particularly stressful to the benthic infaunal communities of Arcata Bay” and that “there were only negligible changes in the overall composition of invertebrate communities.” However this study indicated that the highest invertebrate biomass was found in the experimental oyster long-line sites and that more species were present in eelgrass and oyster habitat than in open mud. While it may be difficult to differentiate the value of oyster habitat in comparison to eelgrass habitat, there is substantial evidence that both eelgrass and oyster areas have higher habitat value (species abundance and diversity) than mudflats or sand. Escapa et.al. (2004) found that most epifaunal organisms had higher densities inside oyster beds compared with areas outside of the beds. This study also found that numerous species of birds were found at higher densities within the oyster beds. These scientific studies, along with those previously cited in the BA, indicate that, even if some amount of eelgrass is displaced by Coast's longlines at the proposed spacing, the habitat value of that eelgrass is at least replaced by the habitat value of Coast's longlines, resulting in no net loss of habitat or loss of managed species. Furthermore, it is important to note that in the context of Coast’s operations, much of the oyster aquaculture subject to the current permit application is occurring or proposed in areas that are currently nonvegetated. The scientific evidence (described above and in the Biological Assessment) fully supports a finding that oyster culture in these nonvegetated areas produces a substantial increase in habitat value. As such, the overall effect of Coast's proposal, based on these studies, is an increase in habitat for managed and listed species.

In the evaluation of potential impacts to biological resources, it is also important to consider impacts at a variety of scales from local (<1 to 10s of meters) to landscape (100 to 1000s of meters) and even larger scales (embayments and estuaries). The regulatory (ESA and MSA) context of the proposed action focuses primarily on fish species, including salmonids, coastal pelagic, and groundfish species and the habitats upon which they depend (designated critical habitat and essential fish habitat). The highly mobile nature of the ESA listed and MSA managed species, which routinely move 10s to 1000s of meters and much farther, is significant. When comparing eelgrass areas to other eelgrass areas, studies investigating abundance of faunal assemblages generally indicate the species abundance is positively correlated with the plant canopy and the root-rhizome mat (see literature summary in Orth et al. 1984). These parameters have often been translated by resource mangers into percent cover and shoot density in subsequent mitigation policies (e.g., Southern California Eelgrass Mitigation Policy). However, evaluating change in eelgrass habitat value using only two parameters without consideration of scale or regard to the surrounding environmental context (i.e., abundance or limitation of eelgrass habitat) is narrow and does not follow an ecosystem or watershed approach recommended in regulatory guidance (see Consultation Handbook, “Making Endangered Species Act Determinations of Effect for Individual or Grouped actions at the Watershed Scale,” NMFS, 1996; and “The Habitat Approach,” NMFS, 1999).

Such a narrow analysis is particularly problematic in the context of the Coast operations. As previously discussed, NOAA Fisheries has expressed concern over potential reduction in eelgrass associated with the long line culture on the remaining acreage proposed for conversion from bottom culture. Data has been presented which substantiates that oyster culture provides habitat value in and of itself. Determining which habitat has higher “value” or attempting to ascribe loss or gain is dependent on each particular species and their many life history stages. To summarily determine that a reduction in eelgrass equates to a “likely to adversely effect” determination is unsupported.

The problems with focusing on percent cover and shoot density is illustrated by discussions presented in Orth et al. (1984), which show that several species of fish are found in higher densities in patchy eelgrass beds versus continuous dense beds of eelgrass. Holt et al. (1983; as reported in Orth et al. 1984) suggests that this is because some species of fish require open feeding areas as well as areas for protection from large predators and that patchy vegetation with a high percentage of edges therefore may support higher densities of some mobile foraging species. Thus, it could be argued that modest displacement of eelgrass resulting in some patchiness may be beneficial for certain species, provided that an abundance of eelgrass was present in the surrounding environment to ensure that none of the other ecological functions provided by eelgrass were reduced.

There are several other issues that should be considered when evaluating the “effects” of potential localized reductions in eelgrass from long lines in the context of Humboldt Bay.

- Humboldt Bay contains some of the most robust and healthy eelgrass beds on the entire West Coast. Although there is ample evidence documenting the dramatic reduction in eelgrass over the last 50 years in the majority of estuaries along the West Coast and elsewhere, this is not the case for Humboldt Bay. In fact, eelgrass beds in Humboldt Bay are at a historical high, with over 2700 acres in Arcata Bay alone (CDFG 2000). These beds are thriving despite (or perhaps partially as a result of) ongoing oyster culture operations over that same time period.

- Interannual variability exhibited in eelgrass coverage in Humboldt Bay is dramatic. Eelgrass coverage was 840 acres in 1959 (Keller 1963), 1,220 acres in 1961, 1,975 acres in 1962, 900 acres in 1963 (Waddell 1964), 1,075 acres in 1972 (Harding and Butler 1979), 1,000 acres in 1979 (Shapiro and Associates 1980), and 1,011 acres in 1992 (Ecoscan 1992). Surveys completed by CDFG in 1997 and 2000 indicate 1,048 ha (2,589 ac) and 1,105 ha (2,730 ac) respectively. These estimates represent an average eelgrass cover of 1,378 acres with a standard deviation of 776 acres, with no discernible long-term trend. The large changes in eelgrass coverage, which naturally occur from year to year, are important when considering the thresholds for ecological relevance to listed and managed species. It is also important to consider this natural variability when determining what amount of change rises above the threshold of “insignificant and discountable.”

- Eelgrass exhibits large seasonal variability, with larger areas of coverage, greater shoot density, and higher biomass occurring in the spring and summer as compared to winter and fall. Oyster culture and its habitat value are present year-round. Oyster culture habitat is eliminated or reduced during harvest and initial planting respectively, however this change in habitat value occurs at a frequency between 18 and 36 months in comparison to every 6 months for eelgrass[4]. The combination of the two habitats is complimentary in that one or the other habitat is likely to be present in the Bay during any given time of the year.

Oyster culture provides a diversity of habitats (i.e., hard substrate, three-dimensional biological structure) for Humboldt Bay. As discussed above, and presented in the Biological Assessment and attached study, oyster culture provides a myriad of beneficial habitat value to Humboldt Bay. Furthermore, the presence of both eelgrass and oyster culture in a patchy structure throughout Arcata Bay provide robust heterogeneous habitats both spatially and temporally. This increased habitat diversity makes the entire system more resilient to disturbance from both natural and anthropogenic causes. The discussion should not be focusing on which habitat is “better” or more “valuable” but should be striving to maximize the benefits that each of the unique habitat types can provide the listed and managed species.

Sincerely,

Chris Cziesla
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[4] It should also be noted that during oyster harvest all of the attached biological community associated with the oyster culture is removed from the system, unlike eelgrass and its attached community which is primarily displaced during fall storm events and decomposes over time. However, much of this detritus from eelgrass is exported from the Bay through tidal exchange.