STATE OF CALIFORNIA

CALIFORNIA NATURAL RESOURCES AGENCY

CALIFORNIA FISH AND GAME COMMISSION

MITIGATED NEGATIVE DECLARATION

FOR

SANTA BARBARA MARICULTURE COMPANY CONTINUED SHELLFISH AQUACULTURE OPERATIONS ON STATE WATER BOTTOM LEASE OFFSHORE SANTA BARBARA, CALIFORNIA

Prepared By:

California Fish and Game Commission Staff

This Report has been prepared pursuant to the
California Environmental Quality Act of 1970
State of California
California Natural Resources Agency
California Fish and Game Commission

January 2018

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INITIAL STUDY
AND
MITIGATED NEGATIVE DECLARATION

FOR

Santa Barbara Mariculture Company
Continued Shellfish Aquaculture Operations
On State Water Bottom Lease
Offshore Santa Barbara, California

Project Overview: Since 2005, Santa Barbara Mariculture Company (SBMC) has been culturing shellfish on a state water bottom lease issued by the Fish and Game Commission (FGC) as Lease No. M-653-02, a 72-acre area with an average water depth of 80 feet located approximately 0.75 miles from the coast of Santa Barbara.

The Project would modify the position of the existing 72-acre leased state water bottom through a 26-acre reduction in the deepest portion of the existing parcel and addition of a new parcel of equal size, sited adjacent (northwest) to the existing farm, to create a narrower configuration and a net result of two adjacent parcels totaling 72 acres using the same culture gear to cultivate the same species currently employed.

Approximately 25 acres of the current lease area are in continuous mussel and intermittent oyster production using 12 longlines. If approved, the Project will result in adding 28 new longlines for a total of 40 longlines across the combined, newly configured 72-acre lease.

The Finding: Although the projects may have the potential to cause minor short-term impacts on biological resources, as outlined in the initial study and environmental checklist, the measures that shall be incorporated into the project will lessen such impacts to a level that is less than significant (see initial study, specifically the environmental checklist, and Appendix L).

Basis for the Finding: Based on the initial study, it was determined there would be no significant adverse environmental effects resulting from implementing the proposed project.

The FGC finds that implementing the proposed projects will have no significant environmental impact. Therefore, this mitigated negative declaration is filed pursuant to the California Environmental Quality Act (CEQA), Public Resources Code § 21080 (c2). This proposed mitigated negative declaration consists of this project overview, findings, and basis for the findings, and the attached Initial Study, which analyzes the environmental impacts that might result from implementation of the proposed Project, and serves to address the potential environmental impacts that may occur.

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Initial Study

Project: **Santa Barbara Mariculture Company Continued Shellfish Aquaculture Operations on State Water Bottom Lease Offshore Santa Barbara, California**

Applicant: **Santa Barbara Mariculture Company**
4365 Cuna Drive
Santa Barbara, CA 93110

Lead Agency:

California Fish and Game Commission
P.O. Box 944209
Sacramento, CA 94244-2090

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January 2018

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ACRONYMS AND ABBREVIATIONS

CAPCOA	California Air Pollution Controls Officers Association
CDFW	California Department of Fish and Wildlife
CEQA	California Environmental Quality Act
CPS	Coastal Pelagic Species
CNDDB	Natural Diversity Database
EFH	Essential Fish Habitat
EIR	Environmental Impact Report
FGC	California Fish and Game Commission
GHG	Green House Gasses
HCP	Habitat Conservation Plan
HMS	Highly Migratory Species
MND	Mitigated Negative Declaration
PCG	Pacific Coastal Groundfish
SCB	Southern California Bight
SBCAPCD	Santa Barbara County Air Pollution Control District
SBMC	Santa Barbara Mariculture Company
SCCAB	South Central Coast Air Basin
US	United States

SECTION 1. BACKGROUND

1.1 Summary

Project Title:	Santa Barbara Mariculture Company Continued Shellfish Aquaculture Operations on State Water Bottom Lease Offshore Santa Barbara, California
Lead Agency Name and Address:	California Fish and Game Commission P.O. Box 944209 Sacramento, CA 94244-2090
Contact Person and Phone Number:	Valerie Termini, Executive Director, (916) 653-4899
Project Location:	Leased state water bottom located 0.75 mile offshore from the coast of Santa Barbara, California
Project Sponsor's Name & Address	Bernard Friedman Santa Barbara Mariculture Company 4365 Cuna Drive Santa Barbara, CA 93110
General Plan Designation:	Not Applicable
Zoning:	Not Applicable

1.2 Introduction

The California Fish and Game Commission (FGC) is the Lead Agency for this Initial Study. The Initial Study has been prepared to identify and assess the anticipated environmental impacts of the proposed Santa Barbara Mariculture Company continued shellfish aquaculture operations offshore from Santa Barbara, California (the Project) on a reconfigured and renewed state water bottom lease (#M-653-02) and new adjacent plot. This document has been prepared to satisfy the California Environmental Quality Act (CEQA) (Pub. Res. Code, Section 21000 *et seq.*) and State CEQA Guidelines (14 CCR 15000 *et seq.*). CEQA requires that all state and local government agencies consider the environmental consequences of Projects over which they have discretionary authority before acting on those Projects. Approval of the Project is a discretionary action of FGC. A CEQA Initial Study is generally used to determine which CEQA document is appropriate for a Project (Negative Declaration, Mitigated Negative Declaration, or Environmental Impact Report [EIR]).

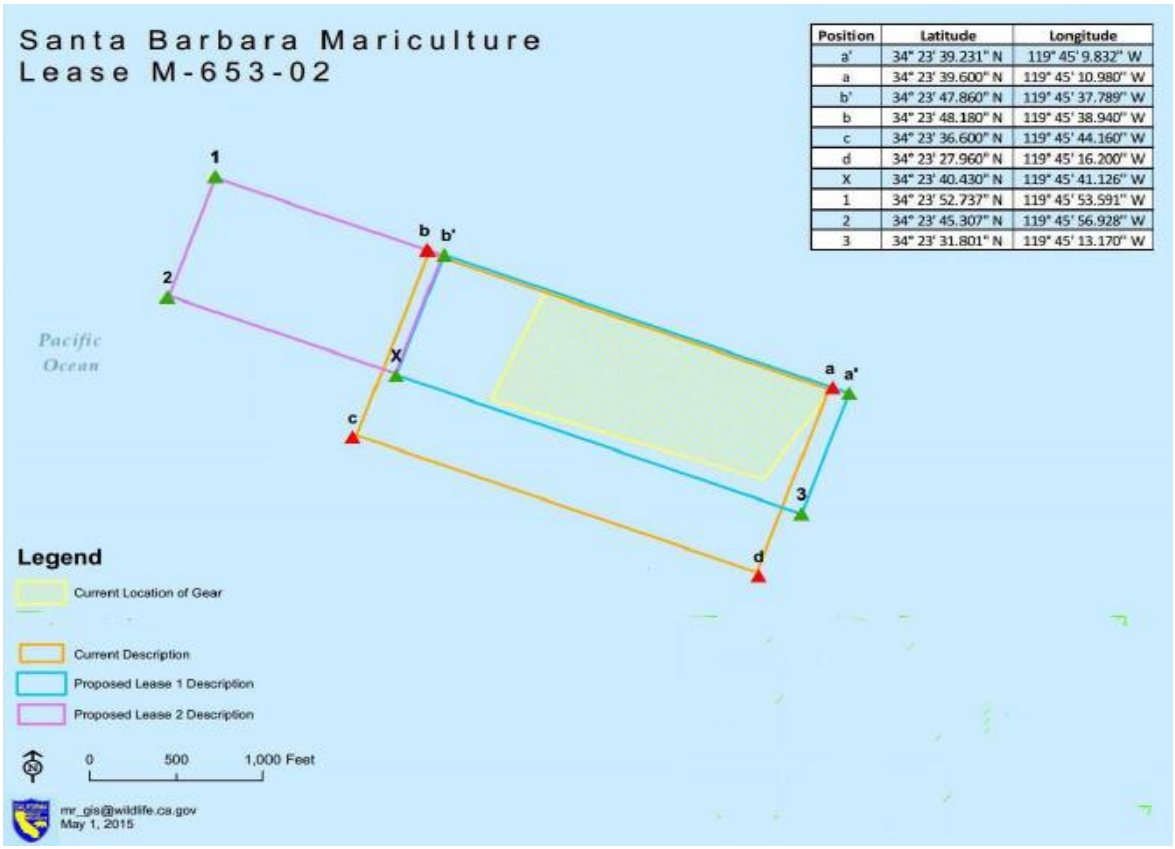
Background: Since 2005, Santa Barbara Mariculture Company (SBMC) has been culturing shellfish on a state water bottom lease issued by FGC as Lease No. M-653-02, a 72-acre area with an average water depth of 80 feet located approximately 0.75 miles from the coast of Santa Barbara (Map 1), although SBMC's predecessors in interest began culturing shellfish at this site beginning in 1984.

This Initial Study is in reference to a proposed change in the existing 72-acre leased state water bottoms established for shellfish cultivation, through a 26-acre reduction in the deepest portion of the existing parcel and addition of a new parcel of equal size, sited adjacent (northwest) to the existing farm, to create a narrower configuration and a net result of two adjacent parcels totaling 72 acres (see Map 2). The existing lease has been in operation for over twelve years using the same culture gear to cultivate the same species as the proposed Project.

Approximately 25 acres of the 72 acre lease area (M-653-02) are in continuous mussel and intermittent oyster production using 12 longlines. If approved, the Project will result in adding 28 new longlines to the existing 12 longlines to a total of 40 longlines across the combined, newly configured 72-acre lease (see Table 2-1).

Map 1: Project Vicinity

Map 2. New proposed lease location.



SECTION 2. PROJECT DESCRIPTION

2.1 Project Objective

The objective of the Project is to continue and expand mussel and oyster production on a newly configured, narrower 72-acre shellfish farm lease. The goal is to site the long axis of this lease roughly parallel with the coast and within ocean depths between 70 to 100 feet, making the anchorages and lines accessible by divers. This depth and orientation would also make the lease more operationally compatible to the operator's cultivation and harvest activities, and reduce conflicts with other marine users such as boat traffic. The Project would enable increased utilization of the lease area for active shellfish production.

2.2 Proposed Project

Background of Existing Lease M-653-02

Santa Barbara Mariculture Company (SBMC) is the current leaseholder of state water bottom lease #M-653-02, issued by FGC. This lease was originally established by Mr. Jeffrey Young, owner of Pacific Seafood Industries (PSI), in 1984 as a one-acre parcel for shellfish production. It was amended by FGC to a 78-acre lease in 1986, and further amended to its current configuration of 72 acres in 1996. In 2005, FGC approved transfer of the lease to SBMC. An amendment to the lease was approved by FGC in December 2014 to correct the location description in the lease using updated GPS coordinates.

Application for Revised Lease Configuration

In June 2013, SBMC requested that FGC renew the existing 72-acre lease with a modified lease footprint. The modified footprint would result from relocating the deepest 26 acre portion of the lease area to an area adjacent to the remaining more shallow lease area, to result in a more narrowly configured lease operation along the same approximate depth contours with no net change in total acreage.

In consultation with FGC and CDFW staff, it was determined that such a shape transformation would require two discretionary administrative actions: a renewal of the existing lease (M-653-02) covering a parcel size reduced by 26 acres (to 46 acres), and approval of a new 26-acre lease parcel adjacent to the reduced existing lease parcel. Taken together, these two areas would result in the more narrowly-configured 72 acre area authorized for shellfish cultivation.

For purposes of CEQA, this document is analyzing all changes from the existing shellfish growing operation in the portion of lease M-653-02 currently utilized to the final, reconfigured 72-acre lease area when fully utilized (see **Map 2**).

A summary of the existing and new lease components and capacities is provided in Table 2-1.

2.3 Project Characteristics

2.3.1 Shellfish Farm: Culture Methods and Species

Current Offshore Submerged Longline System. The offshore farm operation currently occupies about a 25-acre footprint within the current 72-acre lease (M-653-02), and has a total of 12 longlines that are used to farm oysters and mussels. Four 6-foot-high spar buoys with radar reflective material inside delineate the four corners of the farm.

Proposed: The proposed reconfigured lease area will be farmed using similar practices as, and be integrated with, the immediately adjacent existing operations (Map 2 and Table 2-1). The design of the longline and culture gear would also be the same as for the existing longlines, with some modifications of anchoring systems.

The total number of longlines to be installed in the proposed project area includes twelve (12) longlines on the remaining section of lease M-653-02 retained in the revised lease, plus sixteen (16) longlines to be installed on the new proposed lease parcel, bringing the eventual combined total number of longlines between the two parcels to 40 (see Table 2-1). The longlines would lie parallel to shore and be spaced roughly 100 feet apart.

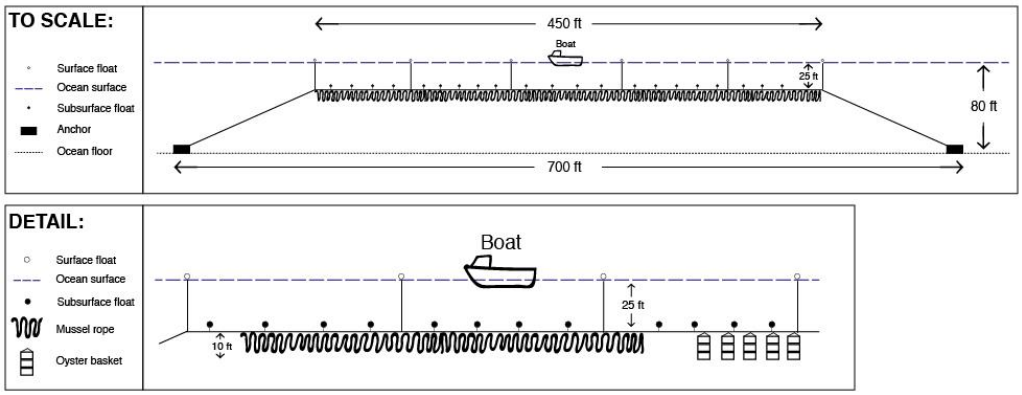
Each longline consists of two anchors, two anchor ropes, and one backbone. The longline measures 700 feet from anchor to anchor. The backbone is 450 feet long and is made of one-inch co-polymer rope, where the culture equipment is attached to grow the shellfish. On each side of the backbone, an anchor rode is attached. These are 150 feet long and made of one-inch co-polymer rope. An anchor is attached at the end of each anchor rode. See **Diagram 1: Existing Longline Configuration** and **Appendix A: SBMC Equipment List.**

Shellfish culture ropes and nets are attached to the backbone and hang to about 10 feet below the backbone (**Figure 2**). Submerged floats are tied on as the shellfish grow and ultimately float about one foot above the backbone. The submerged floats are the shallowest part of the submerged longline, with the top of the floats about 22 feet deep. All floats are made from high-density polyethylene #2 plastic and are round, 16-inches in diameter, and weigh 8 pounds. See **Appendix A: SBMC Equipment List.**

Table 2-1. Summary of Existing and Proposed Lease Components and Capacities

Project Component	Existing Operation (M-653-02)	Proposed Project (after 5 years)		Total Operation after Proposed Project
		Revision to Existing Lease (M-653-02)	New Adjacent Lease	
Lease Area (acres)	72	-26	+26	72
Active Operation (acres)	25	+21	+26	72
No. of Longlines	12	+12	+16	40
Approximate Harvest				
Oysters (number)	(intermittent)[1]			250,000
Mussels (lbs.)	120,000	+120,000	+160,000	400,000

Diagram 1: Existing Submerged Longline Configuration



[1] Growing oysters is a hedge against bad mussel years, and has been done intermittently by SBMC over the last decade. SBMC is proposing to cultivate a total of 250,000 oysters across the entire operation using both leases on either the proposed new lease or on the existing renewing lease or a fraction of the total on each. The amount of oysters grown will vary to keep the company solvent during bad mussel years. Exact cultivation layout and number depends on market and operational conditions but will not exceed the total across the entire new configuration.

Anchors and floats. On the existing lease (M-653-02), twenty (20) of the anchors are made of concrete with a geometric shape approximately 3 feet long, 4 feet wide, and 2 feet high, weighing approximately 1 ton. The other four (4) anchors on the existing lease are 100-kilogram metal fluke anchors. An additional cement clump weight of 120 pounds, ten feet from the anchor, acts as a motion dampener. The backbone (the part of the longline to which the mussels and oysters are attached) also has a 120 pound clump weight on each end, which extends to the ocean floor with 0.5 inch co-polymer rope and a counter float (16-inch submersible), stabilizing the longline and giving it its shape. Six, 16-inch surface floats are also attached to the backbone with 0.5-inch co-polymer rope to stabilize the backbone at 25 feet below the surface.

For the new lease area, the project will use either the Jeyco Stingray 75-kilogram high performance anchors or helical screw anchors, or a combination of the two, depending on cost-benefit analyses as the business progresses (Figure 1, and Appendix A). Concrete block anchors will not be added to the new expansion. Helical screw anchors have reduced surface area available for attachment of fouling organisms, and once installed disturb less of

Figure 1. Anchor Possibilities for New Lease

From top left, clockwise: Stingray anchors, helical screw anchors, concrete block anchors. (Photos from Price report (unpublished)).

the substrate habitat. These are ultra-high holding-power anchors developed especially for the aquaculture and offshore industries and come with a higher cost of installation. Helical screw anchors require an anchor drill to install them on the seafloor with an attached anchor rode. The anchor drill is remotely operated from the boat or by a diver, and is removed after anchor installation. Although screw anchors have the best holding power of any anchor available and make almost no footprint on the ocean floor, they are expensive to deploy and, once set, are expensive to remove or reposition. It is anticipated that if helical screw anchors become more economical to install, they may be adopted in future installations.

For the installation of Jeyco anchors, the anchor rode is attached to one end of the longline's backbone at the surface, and a temporary anchor tether attached before positioning and levering the anchor from the boat. Once the first anchor is secured on the ocean floor, the boat is repositioned to the opposite end of the longline, and the second anchor installed, tensioned, and positioned with the boat until a satisfactory result is attained. The locations

of the anchors are determined by a global positioning system (GPS) on board the boat. Until helical screw anchors become more economical, Jeyco anchors have been shown to perform satisfactorily and will likely be used for the Proposed Project initially.

Structural engineering analysis and field performance. The longline system used by SBMC in the existing lease area, and proposed in the new project, closely parallels designs tested by the University of New Hampshire's Atlantic Marine Aquaculture Center (UNH). UNH deployed longlines and grew mussels on their system in an open ocean environment five miles off the coast of New Hampshire and collected extensive data on the structural performance of these longlines.

According to Dr. Richard Langdon, Director of Coastal and Ocean Technology Programs at UNH, his team of engineers has monitored its offshore longlines for 10 years which have "survived without failure at least 30 Nor'easters, some measured significant wave heights of 40 feet and greater than 25 feet for a 72 hour period." Based on a decade of real world experience and sophisticated modeling, the ocean engineers at UNH developed the "Longline Static and Dynamic Analysis Results" (see **Appendix A1**).

The design and length of the SBMC longline is slightly different than the one modelled by UNH, but it exhibits similar characteristics. However, SBMC longlines will only be loaded with 10,000 lbs. of mussels instead of the 18,000 lbs. of mussels exhibited in the model; oyster longlines will only carry about 5,000 lbs. which will be a further reduction in load. The model calculates that worst-case scenario loading with currents of 140 cm/s and waves of 30 feet at 17 seconds produced a max tension on the anchor line of 12,868 lbs. SBMC longlines will be carrying a lower amount of shellfish, with max loading calculated at 7,077 lbs. SBMC uses one inch ropes for its backbone and anchor lines, which have a minimum breaking strength of 23,000 lbs., providing a built-in safety factor of over the 3 to 1 margin recommended by UNH.

The concrete anchors built and installed on the existing operation by SBMC are of similar design and holding characteristics to Dor-mor anchors (see photo in Appendix A). A 650 lb. Dor-mor anchor has a holding power of 6,500 lbs. SBMC utilizes one-ton concrete anchors that weigh approximately 1,100 lbs. in the water. Counting for the displacement of the iron Dor-mor anchor, the SBMC cement anchors have a holding power of 12,000 lbs.

In 2011, two 50 kg Jeyco stingray anchors were deployed in the longline design to test its practicalities and implementation. These anchors have a published holding power of 8.6 tons (17,200 lbs.) in sand. In 2017, they are still working with minimal corrosion. The farm will utilize 75 kg Jeyco stingray anchors which have a published holding power of 12 tons (24,000 lbs.) in sand. These anchors have a minimum of 3 to 1 built in safety factor for holding the project longlines in place.

To compare the extreme weather conditions under the UNH test to local conditions, storm data was collected from nearby weather stations[2]. Local recorded maximum storm events fall well within the limits described by the UNH Longline Statistic and Dynamic Analysis Model, which analyzed storm conditions of 9.5-meter waves with 17-second periods, and 140 cm/s currents. The data collected from nearby weather stations had lower maximum wave heights (5 meters), longer wave periods (25 seconds), and slower currents (36.7 cm/s). The loads experienced by SBMC culture gear would be considerably less than the loads tested in the model.

Culture species. Mediterranean mussels (*Mytilus galloprovincialis*) and Pacific oysters (*Crassostrea gigas*) are the two species that SBMC has actively been culturing since 2005 and have been approved by CDFW under SBMC's Aquaculture Registration (#0969). In addition, rock scallops *(Crassadoma gigantea*, formerly *Hinnites multirugosus)*, speckled scallop *(Argopectin aequisulcatus)*, Japanese bay scallop *(Patinopectin yessoensis)*, Kumamoto oyster *(Crassostrea sikamea)*, and Manila clam *(Venerupis philippinarum)* are all species that have been approved by FGC for culture on the existing (M-653-02) lease. SBMC proposes no change to the previously-

[2] See Appendix A2: Weather and Oceanographic Data – UNH Tests vs. Santa Barbara Channel Conditions

approved lease's complete list of species and culture methods within the terms of the newly reconfigured lease under this Proposed Project.

2.3.2 Shellfish Farming Operations

General. Farming operations are conducted from a 35-foot aluminum boat specifically designed to install and handle the longlines throughout the farming process. The proposed expanded operations could include up to two 35-foot aluminum boats visiting the farm a maximum of five days a week year-round for approximately eight hours a day, including travel time to the lease from Santa Barbara harbor berth(s) at Navy Pier. A five-year projected plan anticipates the addition of the second boat sometime in Year 4, once the first vessel is operating at maximum capacity and production has grown to 30 installed and stocked longlines. Each vessel makes only one trip per day. Trips by the second boat would mirror those of the first, effectively doubling any emission or vessel impacts. All farming and boating activities take place during the day and, while farming operations change in frequency throughout the year, there are no clear operational peaks as harvesting and seeding take place incrementally throughout the year. Mussel and oyster seed is planted in the fall and the spring, and harvesting

Figure 2. Mussels Hanging from the Backbone

Figure 3. Recovery of Oyster Mesh Net

begins in the late summer to fall of the next year. The shellfish take about a year to reach market size. Throughout the process, the longline is raised to the surface to handle the shellfish and buoys are added to the backbone to maintain consistent depth as the shellfish grow and become heavier. All shellfish product is landed in Santa Barbara harbor and taken to certified cold storage within ten (10) hours from the commencement of that day's harvest activity.

In a typical product cycle, there would be approximately eight longlines dedicated as seed grow-out lines, 32 for harvest production lines. These numbers represent the total farm site including the new and existing lease. Not all longlines would be harvested every year, depending on shellfish size in their growth cycle. No wild seed collection

lines will be utilized on the new or existing operations. All seed is obtained from CDFW-approved commercial hatchery stock which is planted directly to growout lines by the hatchery (for mussels) or into hanging nets (for oysters) by SBMC. Some lines would lie fallow between harvest and re-seeding, for varying periods of time. Specific numbers of fallow/seed/harvest lines for the new projected lease are always in flux. Production cycles would typically be 10 to 16 months, so there would be some overlap every year. At full operation, estimated annual production is approximately 240,000 pounds of mussels and/or up to 250,000 oysters (counted as singles).

Mussel Farming Operations. The mussel culture begins by hanging 10-foot fuzzy ropes on the backbone. The fuzzy ropes are obtained from a shellfish hatchery and already have settled mussels on them. Each rope can carry as many as 50,000 mussels, which are referred to as "spat" once they are permanently attached to a surface. After 3 months, the mussel spat have grown to 0.25-inch in size; the seed ropes are stripped and the mussels are placed into a machine that re-distributes them onto another continuous mussel rope using a biodegradable net sock to hold them in place until the mussels attach themselves to this fuzzy rope. The mussel rope is tied and draped below the backbone in 10-foot loops spaced 3-feet apart (**Figure 2**). About 2,000 feet of fuzzy rope is tied to one longline. At harvest time, the end of the mussel rope is untied from the backbone and inserted into a ship-board harvesting machine run by the boat's hydraulic system. The machine strips the rope of its mussels and rotates them through spinning brushes to break the mussels apart and clean them of any fouling. The most common fouling on mussels is filamentous algae and barnacles, which is washed by seawater and returned to the ocean from whence it came. Washing mussels during harvesting is recommended by the National Shellfish Sanitation Program (FDA, National Shellfish Sanitation Program, 2013). After passing through the machine, the mussels are transferred into a barrel of seawater before being placed onto a sorting table. The market-size mussels are rinsed and placed into 25-pound bags and stored in barrels of seawater for transport back to landing, and undersized mussels collected for re-attachment to ropes for continued grow-out.

Oyster Farming Operations. The culture of oysters begins by placing 0.25-inch oysters into 6-millimeter mesh nets hung from the longline backbone, and are transferred into larger 12-mm mesh nets as they grow (see Figure 3). The oysters reside in a net for no longer than 4 months. Four hundred market-sized oysters can be grown in a net. During harvest, oyster nets are brought onto the boat and dumped on deck (**Figure 3**). The oysters are shoveled onto the sorting table where the market-sized oysters are counted and placed into trays. The undersized oysters are placed back into the net for further growth. The market-sized oysters are washed with seawater and placed into mesh bags for market. After transfer or harvest, each used oyster net is cleaned on board, and then stored on land until the next crop cycle (approximately 120 nets in total). The mesh nets are pressured cleaned on the deck using a hydraulic pump (using Mobile EAL 224H non-toxic and biodegradable hydraulic oil) and hose using ocean water.

2.4 Project Timing

The Proposed Project, including the existing and new lease areas, would enter to full production at the end of a 5-year period of development. Year 1 would consist of installation of 16 longlines on the new lease (and 8 new longlines on the existing lease). This Year 1 installation of these 24 new longlines would take a total of 16 days, spread over the course of three to six months, accounting for weather and other scheduling concerns. Year 2 and 3 would consist of installing the remaining four new longlines. Year 4 would consist of the addition of another boat to support increased production. Year 5 would consist of full production at the target of 400,000 pounds of mussels and/or 250,000 oysters on both leases.

2.5 Regulatory Requirements, Permits, and Approvals

The following approvals and regulatory permits would be required for implementation of the Proposed Project. (See **Appendix D** for expanded list).

AGENCY	PERMIT TYPES
California Department of Fish and Wildlife	Aquaculture Registration
California Fish and Game Commission	State Water Bottom Lease
California Coastal Commission	Coastal Development Permit
United States Army Corp of Engineers	Nationwide 48 permit or Letter of Permission or Standard Individual Permit (at the discretion of USACE)
United States Coast Guard	Private Aid to Navigation permit
California Department of Public Health	Shellfish Growing Area Certificate, and Shellfish Handling & Marketing Certificate

SECTION 3. ENVIRONMENTAL FACTORS POTENTIALLY AFFECTED AND DETERMINATION

This section contains the Initial Study that was completed in accordance with the requirements of CEQA for the proposed project known as "Reconfiguration of offshore State Water Bottom Lease held by Santa Barbara Mariculture Company relating to M-653-02" (Proposed Project). The Initial Study identifies site-specific conditions and impacts, evaluates their potential significance, and discusses ways to avoid or lessen impacts that are potentially significant. The information, analysis and conclusions included in the Initial Study provide the basis for determining the appropriate document needed to comply with CEQA.

The evaluation of environmental impacts provided in this Initial Study is based in part on the impact questions contained in Appendix G of the State CEQA Guidelines; these questions, which are included in an impact assessment matrix for each environmental category (Aesthetics, Air Quality, Biological Resources, etc.), are "intended to encourage thoughtful assessment of impacts." Each question is followed by a check-marked box with column headings that are defined below.

• **Potentially Significant Impact.** This column is checked if there is substantial evidence that a Project-related environmental effect may be significant. If there are one or more "Potentially Significant Impacts," a Project Environmental Impact Report (EIR) would be prepared.

• **Less than Significant with Mitigation.** This column is checked when the Project may result in a significant environmental impact, but the incorporation of identified Project revisions or mitigation measures would reduce the identified effect(s) to a less than significant level.

• **Less than Significant Impact.** This column is checked when the Project would not result in any significant effects. The Project's impact is less than significant even without the incorporation of Project-specific mitigation measures.

• **No Impact.** This column is checked when the Project would not result in any impact in the category or the category does not apply.

For this Project, based on the analysis and information contained herein, the FGC has found that the Initial Study shows that there is substantial evidence that the Project may have a significant effect on the environment but revisions to the Project would avoid the effects or mitigate the effects to a point where clearly no significant effect on the environment would occur.

The environmental factors checked below would be potentially affected by this Project; a checked box indicates that at least one impact would be a "Potentially Significant Impact" except that SBMC has agreed to Project revisions, including the implementation of mitigation measures, that reduce the impact to "Less than Significant with Mitigation."

☐ Aesthetics	☐ Greenhouse Gas Emissions	☐ Population and Housing
☐ Agriculture and Forestry Resources	☐ Hazards/Hazardous Materials	☐ Public Services
☐ Air Quality	☐ Hydrology/Water Quality	☐ Recreation
☒ Biological Resources	☐ Land Use and Planning	☐ Transportation/Traffic
☐ Cultural Resources	☐ Mineral Resources	☐ Utilities and Service Systems
☐ Geology and Soils	☐ Noise	☐ Mandatory Findings of Significance

Agency Determination

Based on the environmental impact analysis provided by this Initial Study:

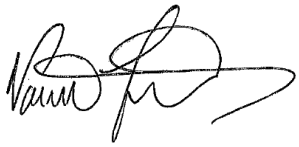
☐ I find that the Project COULD NOT have a significant effect on the environment, and a NEGATIVE DECLARATION will be prepared.

☒ I find that although the Project could have a significant effect on the environment, there will not be a significant effect in this case because revisions in the project have been made by or agreed to by the project proponent. A MITIGATED NEGATIVE DECLARATION will be prepared.

☐ I find that the Project MAY have a significant effect on the environment, and an ENVIRONMENTAL IMPACT REPORT is required.

☐ I find that the Project MAY have a "potentially significant impact" or "potentially significant unless mitigated" impact on the environment but at least one effect 1) has been adequately analyzed in an earlier document pursuant to applicable legal standards, and 2) has been addressed by mitigation measures based on the earlier analysis as described on attached sheets. An ENVIRONMENTAL IMPACT REPORT is required, but it must analyze only the effects that remain to be addressed.

☐ I find that although the Project could have a significant effect on the environment, because all potentially significant effects (a) have been analyzed adequately in an earlier EIR or NEGATIVE DECLARATION pursuant to applicable standards, and (b) have been avoided or mitigated pursuant to that earlier EIR or NEGATIVE DECLARATION, including revisions or mitigation measures that are imposed upon the Project, nothing further is required.



01/05/2018

Signature **Date**

Valerie Termini, Executive Director
California Fish and Game Commission

SECTION 4. INITIAL STUDY ENVIRONMENTAL CHECKLIST AND DISCUSSION

4.1 Resource Areas Dismissed from Detailed Analysis

The following resources are unlikely to be significantly affected by the Project and therefore will not be considered further in this document.

Agriculture and Forestry Resources

The Project site is located in the Pacific Ocean. Other than the aquacultural activities of the Project itself[3], there are no other agricultural or forest land uses near the project site, and it is not located on soils that are identified by the California Resources Agency as Prime Farmland, Unique Farmland, or Farmland of Statewide Importance because it is located in the Pacific Ocean. The Project site is not zoned for, nor prohibited from agricultural use, is not subject to a Williamson Act contract, and is not zoned for forest land, timberland, or timberland production.

Population and Housing

The Project would not induce substantial population growth in the area, either directly or indirectly, nor would it displace housing or people, and thereby not require replacement housing. The reconfiguration of the lease may result in growth of the operation's workforce by an insignificant magnitude in terms of local population and housing requirements (less than ten new workers).

Public Services

The Project would not result in adverse impacts to fire or police protection services, schools, parks, or other public facilities, and would comply with all local regulations. It would not require additional fire or police services beyond those needed for the current operation.

Mineral Resources

The Proposed Project would not result in the loss of any mineral resources, nor any foreseeable loss of mineral resource recovery sites. Although the Santa Barbara Channel is known for its oil and gas resources, the State Lands Commission has not issued a new offshore oil development lease in nearly 50 years, and no such leases exist near the Proposed Project area. Modern drilling technologies would not preclude access to such underground, offshore resources beneath the Proposed Project, should public concern and policies toward new oil and gas development change.

[3] Several California statutes recognize "aquaculture" as "agriculture". Definitions for "aquaculture" in both Fish and Game Code (Sec. 17) and Food and Agriculture Code, or FAC, (Sec. 25.5) refer to aquaculture as a form of agriculture. FAC further states (Sec. 23.5) that: "…the commercial production of that fish and marine life shall be considered a branch of the agricultural industry of the State for the purpose of any law which provides for the benefit or protection of the agricultural industry of the State except those laws relating to plant quarantine or pest control."

4.2 Aesthetics

AESTHETICS – Would the project:	Potentially Significant Impact	Less than Significant with Mitigation Incorporated	Less than Significant Impact	No Impact
a) Have a substantial adverse effect on a scenic vista?	☐	☐	☒	☐
b) Substantially damage scenic resources, including, but not limited to, trees, rock outcroppings, and historic buildings within a state scenic highway?	☐	☐	☐	☒
c) Substantially degrade the existing visual character or quality of the site and its surroundings?	☐	☐	☐	☒
d) Create a new source of substantial light or glare, which would adversely affect day or nighttime views in the area?	☐	☐	☐	☒

4.2.1 Environmental Setting

Regional Setting

The City of Santa Barbara is located in southern Santa Barbara County between the Santa Ynez Mountains and the Pacific Ocean. It is bordered by the City of Goleta and the unincorporated community of Toro Canyon. The City of Santa Barbara has expansive views of both the mountains and the sea (City of Santa Barbara, 2011).

Visual Setting - Onshore

Santa Barbara has a temperate Mediterranean climate with an abundance of trees and vegetation. The City has a small community feel, with an easily accessible downtown area, numerous parks, museums, and miles of beaches (City of Santa Barbara, 2011).

State Scenic Highways. The California Scenic Highway Program protects and enhances the scenic beauty of California's highways and adjacent corridors. A highway can be designated as scenic based on how much natural beauty can be seen by users of the highway, the quality of the scenic landscape, and if development impacts the enjoyment of the view (Caltrans, 2014). Santa Barbara has one Officially Designated State Scenic Highway, State Highway 154, known as San Marcos Pass Road. United States (US) Highway 101 is designated as an Eligible State Scenic Highway.

Visual Setting - Offshore Project Site

The Proposed Project site is located in the Pacific Ocean approximately one mile southwest from Arroyo Burro Beach County Park. The Proposed Project would be underwater except for a) five spar buoys above the surface demarcating the Proposed Project; b) the boat used for both the installation of the longlines and the farming of the shellfish; and c) approximately 96 surface buoys that sit, at most, 16 inches out of the water. The five spar buoys sit approximately 7 feet from the ocean surface and are 1 ½ inches wide, while the fifth is approximately 3 feet high and 9 inches wide. The radar reflective buoy marker is three feet above the water surface and is 9

inches in diameter. The buoys cannot be seen from the public access beach at Arroyo Burro Beach Country Park but may be seen from the edge of the cliff at Hope Ranch, but it does not rise to the level of significance. On most days, the buoys are not visible and no complaints or inquiries have ever surfaced in the twelve years of operations. The southern end of State Highway 154 is located approximately three miles north of the Project site. The view from State Highway 154 to the Project site is obstructed by a hill. US Highway 101 is located approximately two and a half miles to the northeast of the project site.

4.2.2 Impact Analysis - Aesthetics

a) Have a substantial adverse effect on a scenic vista?

Less than Significant Impact. The Project site is primarily submerged in the Pacific Ocean except for the five surface-visible spar buoys used as necessary for aids to navigation (four buoys are 7 feet high above surface and the fifth buoy is three feet high), and the ninety six surface buoys. The Proposed Project would be built directly south of the Santa Barbara coast and would not obstruct long distance views from any public viewing areas. Equipment loading activities at Navy pier would be consistent with existing uses. Impacts to scenic vistas would be less than significant.

b) Substantially damage scenic resources, including, but not limited to, trees, rock outcroppings, and historic buildings within a state scenic highway?

c) Substantially degrade the existing visual character or quality of the site and its surroundings?

d) Create a new source of substantial light or glare, which would adversely affect day or nighttime views in the area?

b – d) No Impact. No scenic resources such as trees, rock outcroppings, or historic buildings within a state scenic highway would be damaged. The Proposed Project would not change or degrade the existing visual character or quality of the site or its surroundings. The Project includes no nighttime operations and would not create a new source of substantial light or glare.

Mitigation Summary

No significant impacts were identified, and no mitigation measures are required.

4.3 Air Quality

AIR QUALITY – Would the project:	Potentially Significant Impact	Less than Significant with Mitigation Incorporated	Less than Significant Impact	No Impact
a) Conflict with or obstruct implementation of the applicable air quality plan?	☐	☐	☒	☐
b) Violate any air quality standard or contribute substantially to an existing or projected air quality violation?	☐	☐	☒	☐
c) Result in a cumulatively considerable net increase of any criteria pollutant for which the project region is non-attainment under an applicable federal or state ambient air quality standard (including releasing emissions which exceed quantitative thresholds for ozone precursors)?	☐	☐	☒	☐
d) Expose sensitive receptors to substantial pollutant concentrations?	☐	☐	☒	☐
e) Would the project create objectionable odors affecting a substantial number of people?	☐	☐	☒	☐

4.3.1 Environmental and Regulatory Setting

The Proposed Project is located in the South Central Coast Air Basin (SCCAB) and is under the jurisdiction of the Santa Barbara County Air Pollution Control District (SBCAPCD). It is the responsibility of SBCAPCD to ensure that state and federal ambient air quality standards are achieved and maintained in the SCCAB. These standards were established to protect sensitive receptors (i.e.: people who have an increased sensitivity to air pollution or environmental contaminants, and may include, but are not limited to: residents of hospitals, schools, daycare facilities, elderly housing and convalescent facilities) from adverse health impacts due to exposure to air pollution.

Table 4.3-1. Proposed Project estimated daily maximum and annual total emissions from commercial passenger fishing vessels under thresholds set by SBCAPCD*

Table 4.3-1
FINAL PROPOSED PROJECT ESTIMATED DAILY MAXIMUM AND ANNUAL TOTAL EMISSIONS

	NOx	CO	HC	PM10	SO2
Daily Max (lb/day) on During Farming Operations	11.5	142.1	2.1	0.4	0.6
-from Outboard Motors	10.3	1.5	0.3	0.4	0.6
-from Auxiliary Motors	1.2	140.6	1.8	0.0	0.0
Daily Max (lb/day) on During Installation	13.4	2.1	0.3	0.4	0.8
-from Outboard Motors	10.3	1.5	0.3	0.3	0.6
-from Auxiliary Motors	3.1	0.6	0.1	0.1	0.2
Daily Threshold (lb/day) *	**55.0**	**N/A**	**55.0**	**N/A**	**N/A**
Days Threshold exceeded (#)	**0**	**0**	**0**	**0**	**0**
Annual Total (ton/year), Year of Installation	1.7	18.2	0.3	0.1	0
Annual Total (ton/year), Normal Operations Year	**1.5**	**18.1**	**0.3**	**0.1**	**0.1**
Annual Threshold (ton/yr)	N/A	N/A	N/A	N/A	N/A

Usage Data for Emissions Calculations. (see Appendix E for calculation details)

	Existing Activity		Proposed Project Activity	
	Outboard Engines	Auxiliary Engines	Outboard Engines	Auxiliary Engines
Equipment Quantity	2	1	4	2
Farming Operations: Hours/Day	2	6	2	6
Farming Operations: Days/Year	255	255	260	260
Equipment Installation: Hours/Day	n/a	n/a	2	8
Equipment Installation: Days/Year	n/a	n/a	30	30

* Santa Barbara County Air Pollution Control District

4.3.2 Impact Analysis - Air Quality

a) Conflict with or obstruct implementation of the applicable air quality plan?

Less Than Significant Impact. The Proposed Project would consider expansion from the existing baseline activity as of 2017, and which has been consistent for the last 12 years, and potentially increase activity represented by the addition of a second work vessel of the same type in use now. The existing SBMC farm consists of 12 longlines (see Table 2-1), and will be expanded to a total of 40 longlines over the next 4-5 years. Concomitant vessel traffic would gradually increase from the current single vessel with 3-4 days of operation to approximately five days of operation using up to a total of two vessels. Table 4.3-1 reflects the total estimated emissions (daily and annual) of the final Proposed Project. As indicated by the Usage Data section of Table 4.3-1, baseline (existing) emissions reflect less than half of the totals estimated above. Project operation includes planting, harvesting, and inspection activities for approximately eight hours per day, including two hours a day of boat travel and six hours of on-site operation using only the onboard generator. During installation of the longlines, one pickup truck and trailer would be used to bring equipment to the existing aquaculture vessel. The Proposed Project is not expected to produce construction or operations emissions in excess of the threshold values established by the SBCAPCD as shown in Table 4.3-1. As such, the project would not conflict or obstruct implementation of the Draft Santa Barbara County 2013 Clean Air Plan or the

Santa Barbara portion of the California State Implementation Plan (Santa Barbara County, 2015). See **Appendix E** for additional detail. Project emissions would have a less than significant impact.

b) Violate any air quality standard or contribute substantially to an existing or projected air quality violation?

Less Than Significant Impact. Construction of the Proposed Project would cause temporary minor amounts of air emissions related to: a) vehicle exhaust from delivery of equipment (one pickup truck per day), b) the additional boat trips for installation of the new longlines, and c) the increase in daily traffic to the farm as operations increase to full production. The installation activities are temporary, and both the temporary and existing increase in vehicle activity is not expected to exceed SBCAPCD daily threshold values. Impacts would be less than significant.

c) Result in a cumulatively considerable net increase of any criteria pollutant for which the project region is non-attainment under an applicable federal or state ambient air quality standard (including releasing emissions which exceed quantitative thresholds for ozone precursors)?

Less Than Significant Impact. The Proposed Project would not result in cumulatively considerable net increase of ozone or ozone precursors (which include chemical compounds like Carbone monoxide, methane and other hydrocarbons, and nitrogen oxides which, in the presence of solar radiation, react with other similar compounds to form ozone). Emissions of ozone precursors from the boat engine(s) are minor and below SDAPCD thresholds. A less than significant impact would occur.

d) Expose sensitive receptors to substantial pollutant concentrations?

Less Than Significant Impact. The predominant land use surrounding the Project area is the open Pacific Ocean and the Navy Pier, which is zoned for commercial use. Residential land uses exist around the pier to the north. Installation emissions would be temporary. Daily operation emissions would be similar to existing conditions and would not exceed SBCAPCD threshold criteria; therefore, sensitive receptors are not expected to be exposed to substantial pollutant concentrations from the Proposed Project. A less than significant impact would occur.

***e) Create objectionable odors affecting a substantial number of people*?**

Less Than Significant Impact. The Proposed Project would not generate objectionable odors that would affect a substantial number of people. Car traffic, boat traffic, and shellfish offloading at the Navy Pier would be consistent with current use. Odors would remain the same as the current operation; a less than significant impact would occur.

Mitigation Summary

No significant impacts were identified, and no mitigation measures are required.

4.4 Biological Resources

4.4.1 Environmental Setting

Habitats and Sediment Characterization

The proposed Project area, approximately 80 feet deep, contains only soft bottom substrate. Soft bottom habitats are the predominant habitat on the continental shelf and slope throughout the Southern California Bight (SCB). Nearshore and offshore environments include soft-bottom habitats in areas that range from flat expanses to slopes and basin areas. Soft-bottom habitats are more common, yet less diverse than hard-bottom habitats at all depth zones, covering over 60 percent of the entire region. Soft-bottom species are generally bottom-dwelling invertebrates and fishes, and many have special adaptations for the habitat, such as flattened bodies and concealing coloration. The distribution of species in soft-bottom habitats is approximately 80 percent crustaceans, 10 percent microbenthos, 5 percent demersal fish, and 5 percent macrobenthos. In deeper soft-bottom habitats, the population density lowers with depth, while the standing crop increases with depth; this makes for unique species assemblages at the various depths.

Coastal and near shore marine habitats in the vicinity of the proposed lease area can be characterized as the areas from the shoreline intertidal zone, offshore to approximately 120 feet (36 meters) water depth. These areas typically include a variety of different habitats such as coastal salt marsh, mudflats, beaches, rocky intertidal, sea grass, and kelp forest habitat (United States Navy, 2008) common in the SCB. The SCB hosts a wide diversity of species, including at least 481 species of fish, 492 species of algae, 4 species of seagrass, 4 species of sea turtles, 195 species of birds, at least 33 species of cetaceans, 7 species of pinnipeds, and over 5,000 species of invertebrates. This diverse assemblage of species reflects the wide range of habitats in the region. These habitats include the following:

- **Estuarine and intertidal environments**: Intertidal communities, from the wash zone to the lower intertidal zone, vary in composition and structure with tidal height and wave exposure and with underlying geology.
- **Biogenic habitats, such as kelp forests and seagrass beds:** Many kelp species, such as giant kelp (*Macrocystis pyrifera*), create kelp forests along the coast. Giant kelp forests generally form over rocky substrate, thus they are somewhat limited within the SCB. Seagrass habitats are extremely productive ecosystems that support an abundant and biologically diverse assemblage of aquatic fauna. The most common type of seagrass along the open coast is surf grass (*Phyllospadix* spp.), also a flowering plant, which forms beds that fringe sandy and rocky coastline areas from the lower intertidal zone to depths of approximately ten to fifteen feet (though maximum reported depths further from the coast, near the Channel Islands of seagrasses in the Santa Barbara Channel have been reported down to 78ft). Neither seagrass nor kelp beds are found within or in close proximity of the proposed Project.
- **Hard bottom and rocky reefs**: Hard-bottom habitats (also called rocky reefs) are much less common than soft substrata in the SCB at all depth zones, covering about seven percent of the region. Many invertebrates such as deep sea corals, sea fans, sponges, and anemones require hard substratum for attachment in deeper waters. No hard-bottom habitats are found within or in close proximity of the proposed Project.
- G**eologic processes**: Geologic processes, such as oil seeps, are not uncommon in the Santa Barbara Channel.

A dynamic oceanographic context further increases the biological complexity of the SCB, with complicated current patterns, upwelling, retention zones, freshwater plumes, and the interaction of warm and cold biogeographic regimes all playing a role.

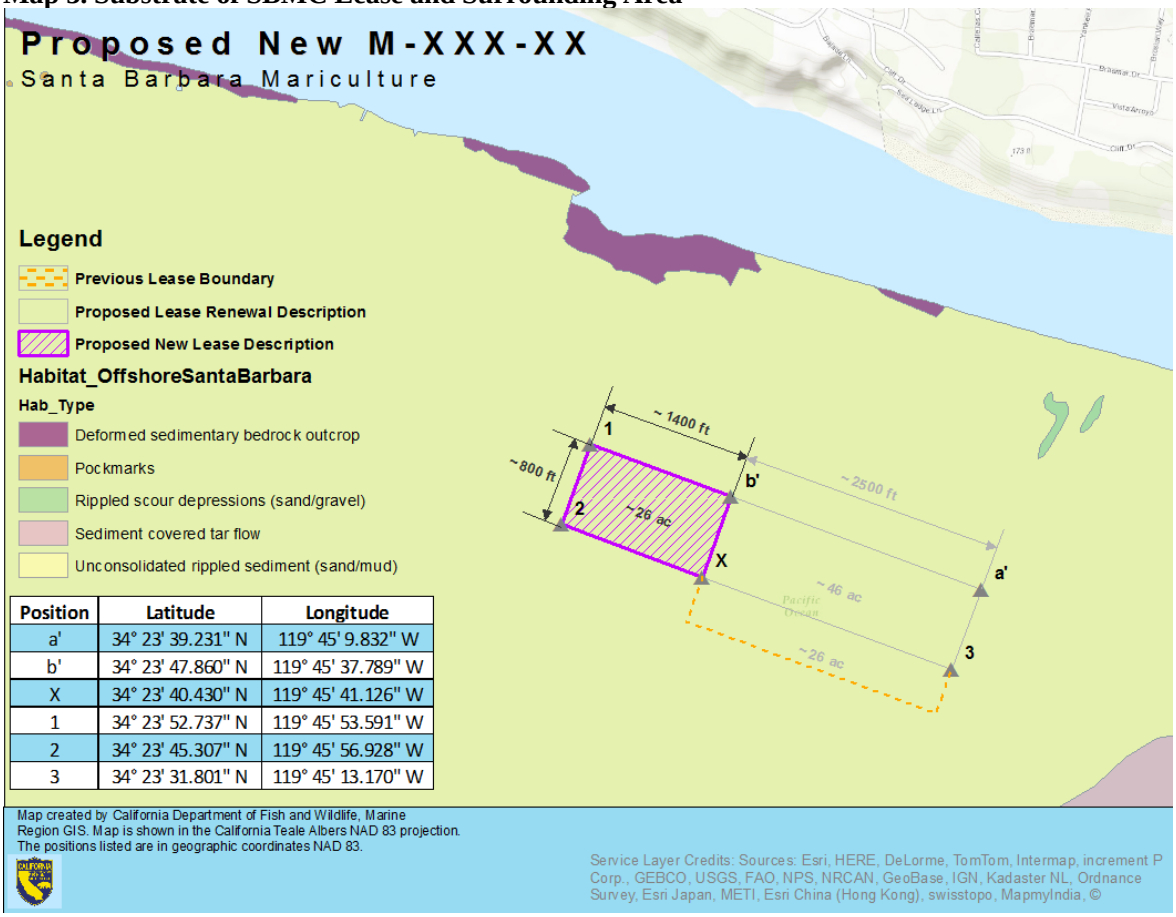
Oceanographic Currents. The California Current system influences much of the primary habitat for living marine resources in the project area. The California Current system is constantly changing in response to

weather systems, seasonal heating and cooling processes, inter-annual episodes such as El Niño/La Niña events, and longer-term or regional-scale climatic changes. The system has a sub-surface, poleward current (the Davidson Current) that is often at a maximum just offshore of, and somewhat deeper than, the Outer Continental Shelf (OCS) break. The advection of warm, high-salinity, low-nutrient and plankton-poor water from the sub-tropics is largely responsible for the warm water flora and fauna and lower productivity characteristic of the nearshore region south of Point Conception.

Like other eastern boundary currents, the California Current experiences extensive coastal upwelling that is primarily driven by spring and summer winds resulting from temperature gradients between the relatively cool sea surface and the warming continental land mass. Equatorial winds, offshore Ekman transport, and coastal upwellings occur nearly all year off Baja California and the offshore region of Southern California; however, within the SCB, wind velocities and offshore transport are lower and upwelling is much reduced. Wind velocities and upwelling are variable but tend to be at a maximum in the spring to early summer in the region between Point Conception (34.5°N) and the Oregon border (42°N).

Substrate at the Proposed Lease Area. Subtidal marine habitats within the proposed lease consist of soft bottom habitat. See **Map 3: Substrate of SBMC Lease and Surrounding Area.** A characterization (physical analyses) of the sediments in the proposed leased area and current lease (farmed and unfarmed) was conducted in July 2014 (**Appendix G**). Physical testing included grain size analysis of four individual samples of sediments from both farmed and unfarmed areas, for a total of eight samples. Samples were captured using a Peterson Grabber. Samples were then sent to a third party lab for analysis. Physical analyses indicate the sediments in both farmed and unfarmed areas are comprised primarily of clay, fine sand, and silts (**Table 4.4-1**).

Map 3. Substrate of SBMC Lease and Surrounding Area



Position	Latitude	Longitude
a'	34° 23' 39.231" N	119° 45' 9.832" W
b'	34° 23' 47.860" N	119° 45' 37.789" W
X	34° 23' 40.430" N	119° 45' 41.126" W
1	34° 23' 52.737" N	119° 45' 53.591" W
2	34° 23' 45.307" N	119° 45' 56.928" W
3	34° 23' 31.801" N	119° 45' 13.170" W

Table 4.4-1. Results of Sediment Grain Size Analyses in Farmed and Unfarmed Areas.

Sediment Type	Farmed*				Unfarmed*			
samples:	a	b	c	d	a	b	c	d
Clay (less than 0.00391mm)	6.73	3.85	7.89	6.41	7.82	3.69	5.73	4.92
Silt (0.00391 to 0.0625mm)	36.79	21.79	35.14	31.76	32.09	19.02	27.09	22.27
Very Fine Sand (0.0625 to 0.125mm)	40.69	50.17	38.65	43.75	44.59	49.36	48.29	49.94
Fine Sand (0.125 to 0.25mm)	15.79	24.19	18.32	18.08	15.50	27.93	18.89	22.87
Totals:	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**
Total Silt and Clay (0 to 0.0625mm)	43.52	25.64	43.03	38.17	39.91	22.71	32.82	27.19

**number are percentages*

Statistical analyses of grain size results and species population indicated no significant difference in character and species diversity between the sediments existing in either the farmed or the unfarmed area. Detailed results of benthic studies are presented in **Appendix H**. See **Appendix I** for inspection survey notes, photos and linked videos of lease bottom area.

Plants

Over 75 percent of the giant kelp (*Macrocystis pyrifera*) ecosystems of the SCB exist within the nearshore waters in the vicinity of the Channel Islands some 25 miles across the Channel from the proposed lease area (Santa Barbara County 2011). No kelp is present on or immediately adjacent to the lease area. Eelgrass (*Zostera marina*) beds can also be found in soft-bottom substrate along the protected shorelines off Santa Barbara and the Channel Islands. The maximum observed depth of eelgrass was observed near the Channel Islands at 22m deep (Engle and Miller, 2005), while the proposed lease sits in waters 24m (~80ft) deep. No eelgrass is present in the proposed leased area. See **Appendix I** for links to video files and photos of the lease bottom area.

Invertebrates

Benthic infaunal communities (aquatic animals that live in the substrate of a body of water, especially in a soft sea bottom) within the Project Area are similar to other nearshore soft bottom habitats in Southern California and are largely differentiated by depth and sediment grain size (Santa Barbara County 2011). Generally, invertebrate communities that reside on and within the sediments of the mainland shelf of Southern California are dominated by polychaetes, crustaceans, echinoderms, and mollusks (Bergen *et al.*, 1998).

The same survey conducted in July 2014 to characterize physical sediment characteristics also was used to characterize benthic infaunal species within the Project Area. **Table 4.4-2** shows combined taxonomic groups for the farmed and unfarmed areas sampled in the grab. Samples were captured using a Peterson Grabber. Four sites were selected for sampling outside the farmed area in the new proposed lease area and four sample sites were selected within the bounds of the currently farmed lease. Samples were then sent to a third party lab for analysis. Overall, the number of infauna species collected from samples in the farmed areas (all taxonomic

groups combined) ranged between 80 and 97, while unfarmed areas had 54 to 74 species. Detailed results of benthic infaunal taxonomic analyses are presented in **Appendix H: Benthic Infaunal Taxonomy Data**.

Table 4.4-2. Average Number of Benthic Infaunal Species by Taxonomic Group in Farmed and Unfarmed Areas.

Taxonomic Group	Farmed	Unfarmed
Annelida	36	31
Arthropoda	21	17
Mollusca	16	11
Miscellaneous	16	10

Similar to infaunal communities, epifauna species composition and abundance in the SCB, including off Santa Barbara and the Project Area, are influenced by water depth and substrate relief. Epifauna are animals that live on the surface of a substrate, such as rocks, pilings, marine vegetation, or a sea or lake floor. In studies reported by the Southern California Coastal Water Research Project (SCCWRP) covering the SCB, over 200 macroinvertebrate species were collected (from all areas) during a 2008 regional monitoring effort (Allen *et al.*, 2011). Abundances varied for specific species and localities, but the benthic assemblage is more or less ubiquitous. Larger invertebrates found offshore over sandy bottom habitat, in the vicinity of the Project Area, include black spotted shrimp (*Crangon nigromaculata*), ridgeback prawn (*Sicyonia ingentis*), black-tailed bay shrimp (*Crangon nigricauda*), Xantus' swimming crab (*Portunus xantusii*), shrimps (*Heptacarpus* spp.), tuberculate pear crab (*Pyromaia tuberculata*), California spiny lobster (*Panulirus interruptus*), yellow rock crab (*Metacarcinus anthonyi*), warty sea cucumber (*Parastichopus parvimensis*), Kellet's whelk (*Kelletia kelletii*), and paperbubble opisthobranch (*Philine* spp.) (SAIC 2010). Along the long expansive sandy beach areas, the most abundant invertebrate species are common sand crab *(Emerita analoga*), with high densities in the swash zone that can account for up to 98 percent of the total invertebrate macrofaunal abundance (Santa Barbara County 2011). No federal or state-listed threatened or endangered or other special status invertebrate species are known to be present in the Project Area.

Culture Species – Mediterranean Mussel *(Mytilus galloprovincialis)* ***and Pacific Oyster*** *(Crassostrea gigas)*

Wild mussels present along the California coast include three main species: Mytilus galloprovincialis (*M. gallo*), Mytilus trossulus (*M. trossulus*), and Mytilus californianus (*M. californianus*). Another species, Mytilus edulis *(M. edulis)*, has historically been cited as the west coast "bay" mussel in state regulatory documents and the scientific literature, conforming with taxonomic understanding at the time. However, *M. edulis* is now recognized by taxonomists as the species found in Atlantic waters, and previous west coast references to *M. edulis* are now, by convention, referring to *M. trossulus* or *M. gallo* as the west coast "bay" mussel. (Suchanek, 1997) Due to morphological similarity, distinguishing between the three mussel species making up the so-called "M. edulis complex": *M. edulis*, *M. trossulus*, and *M. galloprovincialis*, is a continuing challenge for scientists who must rely on genetic testing to do so. The distinction is further complicated by these species' sympatry and readiness to hybridize when found in suitable proximity for such broadcast-spawners (so-called "hybrid zones"), and their similar ecological function (e.g.: congener filter feeders in the same habitats, with many of the same predators and space usages). Recent studies have confounded attempts to correlate oceanographic factors like temperature and salinity in predicting patterns of distribution and relative competitive success of *M. trossulus* and *M. gallo* in locations defining hybrid zones along the California coast (Babry & Somero 2006; Hilbish *et al.*,2010).

Although *M. gallo* is not originally native to California, there is abundant evidence that it is well-established across southern California and has been present in the ecosystem since the early 1900's. Several studies suggest that the native bay mussel, *M. trossulus* was displaced by *M. gallo* in the early part of the twentieth century. *M. gallo* is now the dominant of the two bay mussels (*galloprovincialis* vs. *trossulus*) across the entire

southern half of California. The distribution of *M. gallo* is restricted to more protected and sheltered habitats, as it is not tolerant of wave exposure. Although *M. gallo* can be found in rocky intertidal habitats, the California mussel, *M. californianus* dominates most of the rocky intertidal habitat across the entire coast of California and is well documented to be the competitive dominant in rocky intertidal ecosystems. Not only is *M. gallo* not tolerant of wave exposure, but it is also quickly consumed by a variety of predators and preferred over *M. californianus*, likely due to its weaker shell. (Blanchette, pers. comm., 2014)

The Bay Mussel, and specifically, Mediterranean mussel, (*M. galloprovincialis)*, is an approved culture species under the terms of the existing lease with the FGC and under Aquaculture Registrations issued by the CDFW. Bay Mussel culture has been conducted at the Proposed Project location since 2002 under State Water Bottom Lease #M-653-02 and under the current operator's Aquaculture Registration #0969, since 2005.

The Pacific oyster (*C. gigas*) is the most widely-cultivated oyster species worldwide, with west coast aquaculture production occurring along the Pacific Ocean from Alaska to Mexico. It is an approved culture species under the terms of the existing lease with the FGC and under Aquaculture Registrations issued by the CDFW. Pacific oyster culture has been conducted at the Proposed Project location since 2002 under State Water Bottom Lease #M-653-02 and under the current operator's Aquaculture Registration #0969, since 2005.

Fishes

Over 130 species of fish were collected in the SCB during 2008 regional trawl surveys (Allen *et al.*, 2011). Some of the pelagic (open water) fish species common in the SBMC proposed lease area include Coastal Pelagic Species such as northern anchovy (*Engraulis mordax*), Pacific sardine (*Sardinops sagax*), and topsmelt (*Atherinops affinis*). Many of the common demersal (near the seabed) fish species found in nearshore coastal areas include flatfishes such as California halibut (*Paralichthys californicus*), and other species associated with rocky reef areas such as lingcod (*Ophiodon elongatus*), seaperches, white seabass (*Atractoscion nobilis),* barred sand bass (*Paralabrax nebulifer*) and several species of rockfish (*Sebastes* spp.) (Santa Barbara County 2011). The shallow demersal fish community is dominated by flatfishes such as sanddabs (*Citharichthys* spp.), English sole (*Parophrys vetulus*), rex sole (*Glyptocephalus zachirus*), hornyhead turbot (*Pleuronectes verticalis*), and bigmouth sole (*Hippoglossina stomata*). Other common and abundant fish species include pink surfperch (*Zalembius rosaceus*) and plainfin midshipman (*Porichthys notatus*). (See **Appendix J** for potential fish species in the area).

The proposed lease falls within the range of the federally listed endangered Southern California Distinct Population Segment for steelhead trout (NMFS 2011; CNDDB 2014).

Marine Birds

Birds that use the Santa Barbara Channel include sea ducks (scoters), loons, and western grebes (Santa Barbara County 2011). In addition, the channel supports the northernmost nesting colonies for western gulls (*Larus occidentalis*), California brown pelicans (*Pelecanus occidentalis californicus*), and Xantus' murrelets (*Synthliboramphus hypoleucus*). Coastal bird species such as grebes, cormorants, gulls, and terns make up the greatest portion of the birds that use the Santa Barbara Channel and spend the majority of time within approximately five miles of the shore. Other common birds that spend most of their time in offshore areas include shearwaters (family *Procellariidae*), northern fulmars (*Fulmarus glacialis*), phalaropes (*Phalaropus* spp.), jaegers, and common murres (*Uria aalge*) (Santa Barbara County 2011).

Marine bird species occurring in the Project Area that are protected under the California Endangered Species Act include Xantus' (or Scripps) murrelet. The California brown pelican has been delisted federally, but retains protection under the federal Migratory Bird Treaty Act, and remains a fully protected species under California Fish and Game Code (Sec. 3511.b.2). Other state bird species of special concern include the California gull (*Larus californicus*) and the double-crested cormorant (*Phalacrocorax auritus*). These species are often seasonal visitors to the Project Area.

Marine Mammals and Sea Turtles

More than 40 species of marine mammals use some portion of the SCB, including 34 species of cetaceans (whales, dolphins and porpoises), six species of pinnipeds (seals and sea lions), and the southern sea otter (*Enhydra lutris nereis*) (Carretta *et al.*, 2013). These species migrate through the area on their way to calving or feeding grounds, and are seasonal visitors for a limited time or year-round residents. The most common marine mammals found in Project Area are California sea lions (*Zalophus californianus*), gray whales (*Eshrichtius robustus*), blue whales (*Balaenoptera musculus*), as well as several dolphin and porpoise species (Dall's porpoise, Pacific white sided dolphin, Risso's dolphin, and common dolphin).

In the U.S., two laws currently regulate human activities where marine mammals and turtles might be adversely affected. These include the Marine Mammal Protection Act of 1972 (MMPA), which prohibits the intentional taking, import, or export of any marine mammal without a permit, and the Endangered Species Act of 1973, which extends similar protection to species listed as threatened or endangered.

Five baleen whales found in offshore areas in the vicinity of the Project Area are considered endangered under Federal and State Endangered Species Acts. These include North Pacific right whale (*Eubalaena japonica*), humpback whale (*Megaptera novaeangliae*), fin whale (*Balaenoptera physalus*), sei whale (*B. borealis*), and the aforementioned blue whale. In addition, the southern sea otter population is both a federally-listed threatened species and California fully protected species that occurs in the region (Santa Barbara County 2011). Once only observed north of Point Conception, sea otter's range currently extends south of the Point.

The California gray whale is the most common baleen whale that passes through the project area. In 1994, following the recovery of the stock with the cessation of commercial whaling in the first half of the 20th century, the eastern population of gray whales in the North Pacific was removed from the list of endangered species under the U.S. Endangered Species Act.

Most of the world's population of gray whales passes through the Santa Barbara Channel twice each year on their annual migration between calving grounds in Mexico and feeding grounds to the north. In contrast to most other whale species, gray whales remain relatively close to the coastline, with the majority found close to shore over continental shelf waters, particularly on the northbound portion of their journey (Herzing and Mate 1984; Reilly 1984; Dohl *et al.*, 1983a; Sund and O'Connor 1974).

Gray whale migration corridors generally follow the mainland coast for much of the way. However, they diverge south of Point Conception, with one track extending along the north side of the northern Channel Islands and branching through the islands, and others following the coast through the channel. In general, southbound whales stay farther offshore, while the northbound whales follow the coast more closely, at least north of Point Conception.

Near the Project site, an inshore corridor extends seaward from just beyond the breakers. Other corridors exist four to six nm (6.4 to 9.6 km) offshore, along the northern shores of Santa Cruz, Santa Rosa, and San Miguel islands, and in the passages between these islands. The majority of northbound gray whales follow mid-channel or island migration corridors (Carretta *et al.*, 2013). However, it is expected that gray whales will appear sporadically near the Project site, particularly during the northbound migration. Occasionally, gray whales will stop to feed opportunistically during their migration, particularly in the spring. Whales have been observed throughout the SCB feeding on amphipods in giant kelp beds, sand crabs (*Emerita analoga*) along the surf line, and on krill (*Euphasia spp.*) farther offshore. The vast majority of gray whales do not linger in the region, however, continuing their journey to the feeding grounds of the far north unabated (Santa Barbara County 2011).

Blue and humpback whales are most commonly sighted in the western portion of the Santa Barbara Channel, especially along the shelf break north of the Channel Islands. In the Santa Barbara Channel, both species appear during the summer months; humpbacks generally arrive in late May, and the first blue whales appear in

June. Both species remain through the summer before heading further north, to the waters off central or northern California. Humpbacks often head farther north in late summer, sometimes reaching the Washington coast; however, the U.S.-Canada border appears to mark the northern range limit for this stock. Regardless, the whales generally leave California by November, although specimens are occasionally reported throughout the year. The stock of both species winter in the waters off Central America and Mexico, where they breed and calve. Blue and humpback whales favor escarpments and basins along the south side of the Santa Barbara Channel and are rarely seen near the mainland coast. In the Santa Barbara Channel, humpbacks have been observed feeding on krill (*Euphasia* spp.), northern anchovy (*Engraulis mordax*) and Pacific sardines (*Sardinops sagax caeruleus*) (Santa Barbara County 2011).

Although whales are often the most highly publicized of the cetaceans found off south-central California, seven species of porpoises actually account for the majority of the cetacean presence found in this region. These include the Pacific white-sided dolphin (*Lagenorhynchus obliquidens*), the northern right whale dolphin (Lissodelphis borealis), Risso's dolphin (*Grampus griseus*), Dall's porpoise (*Phocoenoides dalli*), the harbor porpoise (*Phocoena phocoena*), and the two species of common dolphin. These species vary in their patterns of usage of the area and periods of peak abundances. The two species of common dolphin (*Delphinus delphis*) are by far the most abundant cetacean species off southern California, accounting for 57 to 84 percent of the total seasonal cetacean population in the area. In contrast, Dall's porpoises are a boreal species that only occasionally travels as far south as the Santa Barbara Channel (Santa Barbara County 2011).

Four species of sea turtles, all of which are protected under the federal Endangered Species Act, are present in the eastern North Pacific, including green turtles (*Chelonia mydas*), olive ridley turtles (*Lepidochelys olivacea*), leatherback turtles (*Dermochelys coriacea*), and loggerhead turtles (*Caretta caretta*). The green, olive ridley, and loggerhead turtles are listed as threatened species, while the leatherback is listed as an endangered species. Although marine turtles could occur in the vicinity of the Project Area, these species are infrequently observed and are transient visitors to the waters offshore from Santa Barbara.

4.4.2 Regulatory Setting

Federal Laws, Regulations or Policies

Federal Endangered Species Act. The Federal Endangered Species Act (ESA, 16 U.S.C. § 1531 et seq.) protects fish and wildlife species that have been identified by the United States Fish and Wildlife Service (USFWS) or National Oceanic and Atmospheric Administration National Marine Fisheries Service (NOAA Fisheries) as threatened or endangered. Endangered refers to species, subspecies, or distinct population segments that are in danger of extinction through all or a significant portion of their range. Threatened refers to species, subspecies, or distinct population segments that are likely to become endangered in the near future. The ESA is administered by the USFWS and NOAA Fisheries.

Marine Mammal Protection Act. All marine mammals are protected under the Marine Mammal Protection Act (MMPA, 16 U.S.C. § 1361 et seq.). It prohibits, with certain exceptions, the take of marine mammals in U.S. waters and by U.S. citizens on the high seas, as well as the importing of marine mammals and marine mammal products into the U.S.

Migratory Bird Treaty Act. The Migratory Bird Treaty Act (MBTA) (16 U.S.C. § 703 et seq.) enacts the provisions of treaties between the United States, Great Britain, Mexico, Japan, and former Soviet Union, and authorizes the U.S. Secretary of the Interior to protect and regulate the taking of migratory birds. It establishes seasons and bag limits for hunted species, and protects migratory birds, their occupied nests, and their eggs (16 U.S.C. § 703; 50 CFR 10, 21). Most actions that result in taking or permanent or temporary possession of a protected species constitute violations of the MBTA. The USFWS is responsible for overseeing compliance with the MBTA, and the U.S. Department of Agriculture's Animal Damage Control Officer makes recommendations on related animal protection issues. Take under the MBTA is also a state law violation (Fish and Game Code, § 3513).

Federal Sustainable Fisheries Act. The Sustainable Fisheries Act (Public Law 104-297) of 1996 reauthorized and amended the Magnuson Fishery Conservation and Management Act (now **Magnuson-Stevens Fishery Conservation and Management Act**, 16 U.S.C. § 1801 et seq.). The Magnuson-Stevens Fishery Conservation and Management Act (Magnuson-Stevens Act) was initially enacted in 1976 to define fisheries jurisdiction within federal waters and create the NOAA structure for federal fisheries management. The revisions provided in the 1996 law brought major changes to requirements for preventing overfishing and revitalizing depleted fisheries, mostly through the scientific management and reporting conducted via fisheries management reports

Federal West Coast Management Plans. Various federally-managed fish species in the area of the Proposed Project come under Federal Fishery Management Plans (FMP's), which include FMP's for Coastal Pelagic Species, Highly Migratory Species, and Pacific Coast Groundfish (Groundfish).

The Groundfish FMP (PFMC 2014) seeks to provide a balance between conservation, prevention of overfishing, and maximization of the fisheries' resources. The affected area is defined as the water column from the surface to 400 meters depth, from the shoreline seaward to the 200-mile U.S. Exclusive Economic Zone (EEZ) boundary for eggs and larvae, and the water column and all substrate from the shoreline to 400m depth for juveniles and adults. The plan covers 88 species of fish, including sharks, roundfish, groundfish, and flatfish; sets limits on harvest levels; establishes policies for periodic review and revision of regulatory requirements and limitations; and outlines programs for rebuilding depleted stocks. Management considerations such as licensing and permitting, size and bag limits, and net restrictions are outlined for commercial and recreational activities.

Highly migratory species (PFMC 2011b) are fish that move great distances in the ocean to feed or reproduce. In their migrations, they may pass through the waters of several nations and the high seas. Their presence depends on ocean temperatures, availability of food, and other factors. Highly migratory species are sometimes called "pelagic," which means they do not live near the sea floor, or "oceanic," which means they live in the open sea. They are harvested by U.S. commercial and recreational fishers and by foreign fishing fleets. Only a small fraction of the total harvest of most stocks is taken within U.S. waters.

Coastal Pelagic Species (PFMC 2011a). "Pelagic" means these fish live in the water column as opposed to living near the sea floor. They can generally be found anywhere from the surface to 1,000 meters (547 fathoms) deep, and from the shoreline seaward to the EEZ boundary. Five species (Pacific sardine, Pacific mackerel, market squid, northern anchovy, and jack mackerel) are managed under this FMP.

Essential Fish Habitat. The Magnuson-Stevens Act defines essential fish habitat (EFH) for Federal FMP species as "those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity." NOAA Fisheries guidelines state that "adverse effects from fishing may include physical, chemical, or biological alterations of the substrate, and loss of, or injury to, benthic organisms, prey species and their habitat, and other components of the ecosystem." EFH characterization is dependent upon the various species within the Federal FMP, and by convention, have been grouped into seven composite designations: estuarine, rocky shelf, non-rocky shelf, canyon, continental slope/basin, neritic zone, and the oceanic zone.

Habitat areas of particular concern (HAPCs) are described in the regulations as subsets of EFH that are rare, particularly susceptible to human-induced degradation, especially ecologically important, or located in an environmentally stressed area. These include estuaries, canopy kelp, seagrass, and rocky reef habitats. Although designated HAPCs are not afforded additional protection under the Magnuson-Stevens Act, potential impacts on HAPCs are considered in consultation regarding federal projects that may affect designated HAPCs.

State and Local Laws, Regulations, or Policies

California Legislative Authority, Fish and Game Commission, Department of Fish and Wildlife. The California constitution gives authority to the State Legislature, which may, by statute, provide for the terms and conditions under which aquaculture may be conducted. California law consists of 29 codes, including the Fish and Game Code. Laws in the Fish and Game Code consist of statutes (chaptered bills that

have passed through both houses of the Legislature and ultimately were signed by the Governor and recorded by the Secretary of State) and propositions passed by the voters of the state. FGC was created by the State constitution. The rulemaking powers of FGC are delegated by the Legislature and are implemented through the California Code of Regulations, Title 14: Natural Resources (T14 CCR).

The authority and the responsibility of FGC and CDFW to make and enforce regulations governing aquaculture are provided by the Legislature, through Division 12 of the Fish and Game Code, particularly section 15200, which provides that "the Commission may regulate the placing of aquatic plants and animals in waters of the state."

FGC regulates the sport take and possession of birds, mammals, fish, amphibians, and reptiles. FGC also regulates aquaculture operations, including shellfish cultivation; lease of state water bottoms for aquaculture; kelp harvest leases; and certain aspects of commercial fishing. FGC oversees the establishment of wildlife areas and ecological reserves and regulates their use. It also prescribes the terms and conditions under which permits or licenses may be issued by the Department and considers the revocation or suspension of commercial and sport licenses and permits of individuals convicted of violating Fish and Game laws and regulations.

CDFW is the State agency charged with carrying out legislation, regulations, and policies adopted by the Legislature and FGC, and is the public trustee agency that maintains the Aquaculture Coordinator; maintains aquaculturist registrations; prohibits aquaculture operations at any location where it is determined it would be detrimental to adjacent native wildlife; issues stocking permits; sells wild aquatic plants or animals for aquaculture use; approves the collection of aquatic plants and animals by registered aquaculturists; designates public areas for digging clams; processes water bottom lease applications; conducts activities relating to aquaculture disease detection, control, and eradication; appoints an Aquaculture Disease Committee and an Aquaculture Development Committee; establishes disease quarantines and takes related actions regarding control and eradication; approves the importation of live aquatic plants and animals.

California Endangered Species Act. Under the California Endangered Species Act (CESA, Fish and Game Code, §§ 2050-2116), CDFW has jurisdiction over threatened or endangered species that are formally listed by the state. The CESA is similar to the ESA both in process and substance, with the intention of providing additional protection to threatened and endangered species in California. The CESA does not supersede the ESA, but operates in conjunction with it. Species may be listed as threatened or endangered under both acts, in which case the provisions of both state and federal laws apply. Under the ESA, habitat is protected, while under CESA it is not. Also, independent of the CESA, state law has established "fully protected" status for certain statutorily identified birds (Fish and Game Code, § 3511), mammals (Fish and Game Code, § 4700), reptiles and amphibians (Fish and Game Code, § 5050), and fish (Fish and Game Code, § 5515).

California Marine Life Management Act. The Marine Life Management Act (MLMA) (Assembly Bill 1241; Statutes of 1998, Chapter 1052) was enacted to promote sustainable marine fisheries, primarily through fishery management plans (FMPs) based on the best readily available scientific and other relevant information. Rather than assuming that exploitation should continue until damage has become clear, the MLMA shifts the burden of proof toward demonstrating that fisheries and other activities are sustainable. Also, rather than focusing on single fisheries management, the MLMA requires an ecosystem perspective that includes the whole environment.

California Statutory Policies. Various statutes express general support for aquaculture development in the state, including the Aquaculture Development Act, which "finds and declares that it is in the interest of the people of the state that the practice of aquaculture be encouraged..." (Pub. Resources Code, § 826 et seq.). Fish and Game Code further declares "it is the policy of the state to encourage the conservation, maintenance, and utilization of the living resources of the ocean and other waters under the State's jurisdiction and influence for the benefit of all citizens of the state…including the development of commercial aquaculture." (Fish & GGame Code, § 1700)

The California Coastal Commission (CCC) is a state agency established under Division 20 of the Public Resources Code (Section 30000, et seq.) that is charged with implementing the California Coastal Act ("Coastal Act"), the California Environmental Quality Act (CEQA), and the federal Coastal Zone Management Act throughout California's coastal zone. Several sections of the Coastal Act pertain specifically to aquaculture, including the recognition of saltwater or brackish water aquaculture as a coastal-dependent use which should be encouraged, and the protection and prioritization afforded aquaculture in land-use decisions governed by the Coastal Act (Pub. Resources Code, §§ 30411.c, 30222.5, 30100.2).

Local Coastal Plan, other Ordinances, Santa Barbara County. Santa Barbara County's Local Coastal Plan (LCP) is silent with specific regard to marine aquaculture activity, with the exception of recognizing the importance of the local commercial fishing industry, its harbor, and its support facilities, upon which the Proposed Project depends as a harvester of marine products. The county's LCP also points to the aforementioned Coastal Act's policies that prioritize coastal-dependent industries' use and access to coastal sites, which would include aquaculture sites. Santa Barbara County, however, does address aquaculture under general regulations regarding planning and development, in its Article II Coastal Zoning Ordinance (Div. 7, Sec. 35-136). Its main emphases relate to land-based visual impact minimization and compatibility with natural surroundings.

4.4.3 Impact Analysis and Mitigation Measures - Biological Resources

BIOLOGICAL RESOURCES Would the project:	Potentially Significant Impact	Less than Significant with Mitigation Incorporated	Less than Significant Impact	No Impact
a) Have a substantial adverse effect, either directly or through habitat modifications, on any species identified as a candidate, sensitive, or special status species in local or regional plans, policies, or regulations, or by the California Department of Fish and Wildlife or U.S. Fish and Wildlife Service?	☐	☒	☐	☐
b) Have a substantial adverse effect on any riparian habitat or other sensitive natural community identified in local or regional plans, policies, regulations, or by the California Department of Fish and Wildlife or U.S. Fish and Wildlife Service?	☐	☐	☒	☐
c) Have a substantial adverse effect on federally protected wetlands as defined by Section 404 of the Clean Water Act (including, but not limited to, marsh, vernal pool, coastal, etc.) through direct removal, filling, hydrological interruption, or other means?	☐	☐	☐	☒
d) Interfere substantially with the movement of any native resident or migratory fish or wildlife species or with established native resident or migratory wildlife corridors, or impede the use of native wildlife nursery sites?	☐	☒	☐	☐
e) Conflict with any local policies or ordinances protecting biological resources, such as a tree preservation policy or ordinance?	☐	☐	☐	☒
f) Conflict with the provisions of an adopted Habitat Conservation Plan, Natural Community Conservation Plan, or other approved local, regional, or state habitat conservation plan?	☐	☐	☐	☒

Significance criteria for biological resources, contained in the Appendix G, "Environmental Checklist Form", of the State CEQA Guidelines have been grouped for convenient discussion in this impact analysis section, according to both subject matter and significance of impact. Significance criteria a, b, and d are addressed in one group of potential impacts (sub-sec. 4.4.3.1 – 4.4.3.8), while c, e, and f are addressed in a second group reflecting No Impact by the Proposed Project. Significance determinations are indicated within each impact sub-section ("4.4.3.X Impact BIO-X"); mitigation measures, where warranted, are described in that sub-section ("MM-BIO-X").

The Proposed Project would have a significant impact on biological resources if it would:

a) Have a substantial adverse effect, either directly or through habitat modifications, on any species identified as a candidate, sensitive, or special status species in local or regional plans, policies, or regulations, or by the California Department of Fish and Wildlife or U.S. Fish and Wildlife Service;

See discussion below under 4.4.3.7 Impact BIO-7

b) Have a substantial adverse effect on any riparian habitat or other sensitive natural community identified in local or regional plans, policies, regulations, or by the California Department of Fish and Wildlife or U.S. Fish and Wildlife Service;

No riparian or sensitive habitat, including kelp beds or rocky reefs, occurs within or in close proximity of the Proposed Project.

d) Interfere substantially with the movement of any native resident or migratory fish or wildlife species or with established native resident or migratory wildlife corridors, or impede the use of native wildlife nursery sites.

Activities of the Proposed Project could potentially have the following impacts:

- **Marine species entanglements (4.4.3.1)**
- **Aquatic invasive species spread (4.4.3.2)**
- **Benthic impacts from cultivated animals (4.4.3.3)**
- **Bottom disturbance from installation or structural failure of culture gear (4.4.3.4)**
- **Marine debris (4.4.3.5)**
- **Phytoplankton carrying capacity (4.4.3.6)**
- **Other special status fish species interactions (4.4.3.7)**

4.4.3.1 Impact BIO-1: Marine species entanglements

Recent studies document entanglements involving marine mammals, particularly large baleen whales with fishing gear (Kropp 2013), and marine species with aquaculture gear (Price *et al.*,2016, Young 2015). Based on the outcome of these review studies, distinction is merited when comparing fishing vs. shellfish longline aquaculture gear with regard to entanglements, due to their very different design and deployment, and, importantly, the frequency of observed events globally in each case. The recently-compiled review of known marine species interactions globally with aquaculture gear by NOAA's National Ocean Service (Price *et al.*, 2016) accounts for nineteen total entanglements dating back to 1982. By contrast, fishery entanglements and by-catch of marine mammals has been estimated in the hundreds of thousands *per year* (Reid *et al.*, 2006). Of the nineteen aquaculture-related entanglements, most involved smaller-diameter seed collection lines, which will not be used in the Proposed Project (nor have been in the existing operation). SBMC avoids collection of wild seed by procuring starter mussels from land-based hatcheries, where seed mussels are "pre-planted" onto fuzzy rope growout lines (see Sec. 2.3.2 Mussel Farm Operations) for direct placement onto the farm's longline system.

It is unknown whether the paucity of entanglements from aquaculture gear compared to those from fishing gear is a matter of lower risk due to culture gear design, recognition and avoidance of aquaculture facilities by the animals, or fewer aquaculture installations.

California gray whales have several times been observed passing in close proximity to the lease area, and the Project's distance from shore is consistent with the expected location of the migration route in this area (Bernard Friedman, pers. comm.; Herzing and Mate 1984; Reilly 1984; Dohl *et al.* 1983a; Sund and O'Connor 1974). However, whales and other marine mammals, turtles, and sea birds are transient visitors to the Project Area and are not permanent residents.

After twelve years of farm operation at this location with an approximate 25-acre footprint of longlines installed, no incidents of entanglement by marine mammals, turtles, or birds have been observed or known to have occurred. Nonetheless, in light of known migration and activity patterns of marine species in the area and the enlarged footprint of installed culture gear, the risk of future entanglement by marine species exists and measures should be taken out of precaution to mitigate such risks to a level less than significant.

A large majority of reported entanglements have involved fixed or derelict fishing gear, such as various types of nets and the cables used to attach floats to lobster and crab traps and not the large diameter submerged shellstock longlines that are proposed for this Project. Some generalizations can be made regarding the characteristics of fishing gear with which entanglements have occurred. Lines that float at the surface, small diameter vertical lines such as endlines from a trawl of lobster traps, non-sinking line connecting individual traps in a trawl, and loose twine as found in gillnets, seines, and fish traps have all been associated with entanglements. Though similar to some fishing gear in the sense that it is fixed and remote, the submerged longline shellfish grow out gear differs from fishing gear in a number of ways. Line diameters are much larger and under tension, there are no loose or floating lines, no loose twine, and no bottom lines. (Langan, 1998).

The longline mussel culture gear for the Proposed Project (and existing operation) is designed in such a way that proper tensioning of the backbone and anchorages, and positioning of buoys will minimize entanglements, and if they occur, can be identified quickly from the surface. Longline backbones are spaced 100 feet apart, and mussel growline loops are also relatively short, leaving room for marine species to navigate beneath, above, and through the farm. If longlines were disturbed, abnormalities in the longline would be easily identified based on surface buoy and longline backbone positions. If there was an entanglement, the affected surface buoy would likely appear abnormally low in the water relative to the other surface buoys. This allows the farm operator to identify a problem upon visual inspection of the farm at the surface and through normal handling of the backbone. Regular maintenance, water and mussel sampling for public health requirements, and harvesting activities by the farm operator on a frequent basis (3 to 5 days per week) includes visual inspection of growout lines hung from the longline backbone, and adjustments to the longline system's tensioning and buoyancy if required (see **Sec. 2.3.2 Shellfish Farming Operations** and **Figure 3**).

The farm operator's frequent presence on the water at the Project site presents a first-responder opportunity to observe, record, and report sightings of entanglements originating both on- and off-farm as well, and should be incorporated into mitigation measures that support interagency efforts to resolve entanglements of marine species.

Mitigation Measure (MM) BIO-1: Marine Species Entanglement. To reduce potential impacts of marine species entanglement, the following measures have been proposed. Implementation of **MM BIO-1** will reduce the impact to less than significant.

MM BIO-1: Marine Species Entanglement.
a. Regular inspection and maintenance of gear for proper tensioning and evidence of wear or derelict gear or debris. Mitigation proposed to reduce entanglement risk shall include regular inspections and properly maintained longline system tensioning and buoyancy. Loose or entangled derelict debris and lines will be removed and appropriately disposed of on land.

b. Response training and reporting of incidents. SBMC shall coordinate with and participate in first responder training provided by the NOAA Marine Mammal program. Coordination includes the immediate reporting of entangled marine mammals to the NOAA whale entanglement response hotline at 1-877-SOS-WHALe (1-877-767-9425) or the hailing of U.S. Coast Guard on Channel 16. If possible, SBMC will photograph entangled whales, capturing a side view of its dorsal fin or hump, flukes, head, and any part of the body where gear may be present, and the entangling gear material (e.g.: buoys, tags, lines, netting, etc.), and stand by for responders when appropriate. Entangled sea turtles shall be reported to the NOAA response hotline at 1- 866-767-6114, and similarly documented as described above. Reports of all entanglements shall also be made immediately to the CDFW Aquaculture Program (See Contact Information for Leaseholders) posted online: http://www.wildlife.ca.gov/Aquaculture#22164163-leases.

4.4.3.2 Impact BIO-2: Aquatic invasive species spread

Certain invasive tunicates are of great concern in their potential to rapidly colonize and overwhelm surfaces and benthic organisms that include cultured shellfish, shellfish culture gear, and other natural and artificial hard-substrate habitat and the native colonizers of such habitat. The club tunicate (*Styella clava*), the transparent tunicate (*Ciona savignyi*), sea vase (*Ciona intestinalis*), and the colonial tunicate (*Didemnum vexillum*) represent some of the most important invasive tunicates of potential concern that could colonize the Proposed Project area.

None of these species are currently known to be found in waters near the project site (Curran *et al.*, 2013). Surveys of Didemnum species distribution throughout the US and South Canadian Pacific coast have furthermore not shown it to be present in the Santa Barbara Channel (Bullard *et al.*, 2007) and that is confirmed by a lack of on-farm sitings by the operator (Bernard Friedman, pers. comm.). However, due to the smothering impacts that such invasive tunicates can have on both natural habitats and mariculture production, diligence is called for in both identifying and rapidly reporting new appearances, and the practical and effective removal of such organisms should they occur. Of note is the farm's practice of frequent inspections and maintenance, which may serve as a sentinel site for CDFW coordination of the rapid response to novel sitings in the area of invasive species of concern.

Mitigation Measure (MM) BIO-2: Aquatic invasive species spread. To reduce the potential spread of marine invasive species, such as certain tunicates known to be problematic, resulting from the Proposed Project, the following measures have been proposed. Implementation of **MM BIO-2** will reduce this impact to Less Than Significant.

MM BIO-2: Aquatic invasive species spread.

a. Awareness and Training – SBMC will coordinate with CDFW staff to generate and utilize invasive species identification guides and training materials on board its vessels and educate all farm personnel in the importance of identifying and taking of appropriate action if certain invasive species are encountered. SBMC will maintain updated materials corresponding with applicable CDFW priority invasive species local to the Proposed Project and the appropriate response actions.

b. **Responses** – Upon identification of an invasive species of concern on SBMC aquaculture gear, farm personnel will carefully remove the organism for disposal on land. Care shall be taken to avoid fragmenting such tunicates to reduce their spread. This practice is consistent with management plans in other regions, including the Washington Department of Fish and Wildlife Tunicate Management Plan's effective management practice guidelines, where removal by hand was noted as one of the few proven effective control methods. (Washington Department of Fish and Wildlife, 2009).

c. **Maintenance** – SBMC will continue its practice of frequent inspection, cleaning, and rotation of culture gear to reduce the opportunity for invasive species to colonize its gear.

4.4.3.3 Impact BIO-3: Benthic impacts from cultivated animals: Nutrient regeneration in the water column within mussel farms is high, as phytoplankton consumed by the mussels results in released nutrients supporting new phytoplankton production. Potential benthic impacts from aquaculture can include increased loads on sediment dissolved oxygen and redox conditions, as well as changes to nutrient cycling where benthic species abundance and sediment porosity can be reduced. Increased sedimentation of organic matter from feces, pseudo-feces and organic debris can have ecosystem effects on biogeochemical cycles as well. The effect on benthic nitrogen cycling imposed from organic matter derived from mussel farms is determined by a range of biogeochemical and physical variables, such as water depth, current velocities, and bottom type and composition (Ljungqvist 2005). Generally, mussel farms that are located in areas with greater water depths and current speeds, spread bio-deposits over a larger area without posing the risk of enhanced sediment nutrient release. (Stadmark & Conley 2011). The Proposed Project is located in well-mixed open ocean that averages eighty feet in depth, and is subject to changes in current, upwellling, and migrating sediments, greatly changing the nutrient depositional pattern on the benthos. Benthic impacts would be reflected in measurements and analyses of sediment redox and grain size composition, and the analysis of benthic epifaunal and infaunal diversity and makeup.

After twelve years of mussel farm operation, cultivating some twenty-five acres at the existing site, analysis conducted on sediments within and outside the farm's influence reflects a pattern of similar sediment grain size between farmed and unfarmed areas, and no significant difference in the levels of benthic epifaunal and infaunal biodiversity across both sample sets, indicating no significant benthic impact[4].

SBMC has also conducted benthic monitoring in accordance with the Whole Foods Producer Certification Standard for Farmed Bivalve Molluscs, which aims to ensure that the farms under its certification program maintain healthy benthic communities beneath and surrounding culture sites. This standard provides a method for evaluating the health of the benthos and maintaining healthy conditions under and near farms. The protocol under this standard requires two successive years of annual benthic monitoring, where samples undergo Visual Redox Assessments. This method requires growers to use a clear acrylic tube to take sediment cores and provide location-tagged digital photographs of the sediment cores to an independent, third-party Certification Body (selected by Whole Foods) for evaluation[5]. Photographs enable the Certification Body to remotely measure the depth of the Apparent Redox Potential Discontinuity (ARPD), which is an indicator of the presence of stored mineral sulfides (reflecting anaerobic or anoxic sediment), and monitor changes that may occur due to mussel farm activities over time. In addition, the Certification Body uses the photographs to look for evidence of animals in the sediment, as an indicator of the presence of benthic fauna. SBMC has participated in this benthic monitoring program and has been awarded the Whole Foods Market Quality Standard Certification for Farmed Bivalve Molluscs for the past three years.[6] SBMC will continue with this auditing and monitoring program.

The organic nutrient load and biomass density of cultivated animals on a per-longline basis will remain the same for both the Proposed Project and build-out of the existing lease as it has been during existing farm operations. Benthic impacts from cultivated animals from the Proposed Project are considered Less Than Significant.

4.4.3.4 Impact BIO-4: Bottom disturbance or hazard from installation or structural failure of culture gear.

Installation. Project longline anchoring has the potential to create localized turbidity and affect nearby soft-

[4] See Table 4.4-1. Results of Sediment Grain Size Analyses in Farmed and Unfarmed Areas and Table 4.4-2. Average Number of Benthic Infauna Species by Taxonomic Group in Farmed and Unfarmed Areas.

[5] Certification Body: MRAG Americas; 10051 5th Str. N, Suite 105; St. Petersburg, FL, 33702. Whole Foods Market mollusk certification program for Proposed Project.

[6] See Appendix C and C1: Whole Foods Market Quality Standards for Farmed Seafood Bivalve Molluscs, Jan 2015; SBMC Certificate.

bottom seafloor habitat, and if present, rocky substrate. Potentially significant impacts could occur if anchors drag or migrate, create persistent turbidity that would reduce water clarity and increase sediment deposition, or if anchor lines are placed onto or cut across sensitive habitats. Deeper water rock habitats are considered more sensitive in that they are not routinely subjected to natural disturbances (i.e., storm waves) and they support long-lived, slow-growing organisms that are particularly sensitive to disturbance. Further, placing anchors onto habitats could crush attached organisms and anchor lines that cross habitat features could abrade and remove or damage algae (including kelp) and attached epibiota.

SBMC lease site surveys of the project area by CDFW divers have shown the area to be sandy, soft bottom, with no rocky reefs, hard bottom substrate, nor kelp nearby (other than that which grows directly on the longline system itself)[7]. Installation and engineering specifications of the anchoring systems are described in Section 2.3.1 of the Project Description. Initial deployment of the anchors may create either a short-term turbidity disturbance in the case of helical anchors during drilling installation, or a rather deliberate, vertical-drop approach to the setting of sled or stingray-type anchors with no bottom dragging of chains or anchor rodes (unlike conventional vessel anchoring). Once installed, clump weights, that act as motion dampeners at each end of the longline anchoring systems, may move across the bottom surface in a confined area near the anchors in extreme weather or wave conditions, but will not exert damage over a wider area unless the associated anchor fails. CDFW dive inspection of the lease area has shown the lines comprising the longline systems and anchorages to be in well-maintained condition. Disturbance impacts by installation of the Proposed Project at this soft bottom site are considered Less Than Significant.

Maintenance and Repair Activities. The longline components are anticipated to require very little maintenance, but will receive regular monitoring and when needed, adjustment of tensioning and buoyancy. The system is mostly made of co-polymer rope, plastic, and steel buried in the substrate. Mussel longlines have lasted more than 25 years without replacement. Inspections are carried out during the planting, growing, and harvesting activities, occurring at least biweekly. If a backbone or anchor rode is in need of repair, a new rope would be tied to the attachment points of the damaged section and the damaged section would be cut off and appropriately disposed of on land. A diver would be deployed to attach the new section to the anchor and the other side would be attached and tensioned using the boat.

Structural Failure Risk and Contingency Plan. Engineering specifications, performance analyses, and field testing conditions for the anchors and lines employed in SBMC's longline system compare favorably with the more extreme conditions tested over ten years by the University of New Hampshire's (UNH) Coastal and Ocean Technology Program (see Project Description Sec. 2.3.1 and Appendix A1 for detailed engineering analysis). Twelve years of performance at the Proposed Project location by SBMC employing a very similar longline system design as that tested by UNH provides some indication of structural integrity of the longline system under local conditions. However, structural failure of anchoring or other longline system components may potentially create an increased entanglement or navigational hazard.

Mitigation Measure (MM) BIO-4: Storm preparedness and structural failure response. To reduce the potential impact of aquaculture gear structural failure resulting from the Proposed Project, the following measures have been proposed. Implementation of **MM BIO-4** will reduce this impact to Less Than Significant.

> **MM BIO-4: Storm preparedness and structural failure response.**
> **a. Preparedness** – SBMC will maintain all longline aquaculture gear, including anchoring, tensioning, and buoyancy components to avoid system failures at all times. Extra attention will be directed to storm preparation and inspecting for failures caused by extreme weather, waves, and currents, with full internal accounting for system components and structural integrity.

[7] See: Appendix I: Lease site underwater inspection notes, and bottom survey videos.

b. Structural failure response - Catastrophic failure of the longline system could occur if an anchor fails to hold or if the floats become overburdened or fail due to powerful storm activity. The longline system is naturally redundant; if one anchor fails to hold the culture gear in place, the other anchor serves as back up and works to keep the longline gear from moving far. If an anchor fails to hold, and drags toward the other anchor, the longline will reflect loss in tension (diagnosed by surface and subsurface buoy positions), or in an extreme case, will likely tangle among itself. A single anchor has enough holding force to secure the whole longline system, lowering the likelihood of the entire longline becoming derelict debris off-site. In the case of anchor failure or longline disruption, the tangled longline would be pulled and floated to the surface. The shellfish, culture gear, and floats would be untied or cut from the backbone and transferred to an empty longline. The tangled longline would be cut or untied from the anchor rode or anchor and hauled to the boat. A diver would be used to tie a new rode onto the anchor so that the boat can reposition it to the original position. A new longline would be attached to the anchor or anchor rode and tension would be applied. The boat would then travel along the backbone installing floats and weights to give the longline its proper shape. If floats become overburdened or fail, the longline would sink to the ocean floor. A grappling hook would be used to recover the longline and haul it to the surface where the failed floats can be replaced. Recovery would likely take from one to five days depending on the severity of catastrophic failure. New rope would always be used, and old rope would be repurposed for other uses. Damaged floats are recycled. Culture gear will be mended. Anchors are generally recovered and reused. Every effort is made to recover and re-use all gear. That which is beyond use will be appropriately disposed of on land.

4.4.3.5 Impact BIO-5: Marine debris. Lost or derelict materials from sea-based activities, including the Proposed Project, or fishing, recreation, and industrial activities, as well as land-based sources through run-off or illegal dumping can have serious impacts on wildlife and various fishing activities. Derelict gear and materials from other sources can also potentially become entangled in the longline system of the Proposed Project, creating a secondary impact by compromising its structural integrity, or enhancing the risk of entangling or harming marine wildlife.

Mitigation Measure (MM) BIO-5: Marine debris. To reduce the potential impact of marine debris resulting from the Proposed Project, the following measures have been proposed. Implementation of **MM BIO-5** will reduce this impact to Less Than Significant.

MM BIO-5: Marine debris.

a. Practices – All fasteners, lines, and components will, when detached from use or found to be compromised from wear, be disposed of appropriately on land. Fasteners, lines, and components of the longline system design and project operation will be chosen to minimize the risk of loss and contribution to marine debris in the ocean environment. Operational inspections of the Project's longline systems will include the retrieval and land disposal of entangled man-made materials, regardless of the materials' origin, to ensure their removal from the ocean environment.

b. Decommissioning Plan – See footnote[8]. Should the farm need to be decommissioned and gear removed, SBMC will harvest and remove all shellfish from the longline. Longline gear removal consists of a boat operator cutting the backbone in half, pulling the line and buoys onto the boat, and hauling in the anchors at the ends of the ropes using vessels of appropriate capacity. All components will be recycled or appropriately disposed of on land.

4.4.3.6 Impact BIO-6: Phytoplankton carrying capacity. An analysis was conducted to determine the impacts of the new lease on the phytoplankton levels in the Santa Barbara Channel by reviewing the standing stock of phytoplankton biomass flowing past the existing facility, and the filtration/consumption rate of

[8] By statute (Fish and Game Code, Sec. 15409), all aquaculture lessees, upon termination of a lease for any reason, are required to remove all structures and restore the area to its original condition, at the lessee's expense. Financial surety measures and lease conditions upholding this requirement are addressed within the lease agreement.

phytoplankton by mussels growing on SBMC's existing and new Proposed Project at full production levels. It was determined that the total production of the reconfigured farm at full build-out would have an inconsequential impact on phytoplankton and zooplankton populations in the Channel. Analysis to determine the reduction on chlorophyll concentrations in water flowing through the leased area attempting to estimate the decrease was so small as to be unmeasurable by any known techniques. The detailed calculations are available in Appendix F: Phytoplankton Population Impact Statement and Calculation (Seigel, 2013). The impact of the reconfigured farm at full build-out on phytoplankton carrying capacity is Less Than Significant.

4.4.3.7 Impact BIO-7: Interactions with special status and federally-managed fish species.
The Proposed Project falls within the range of the federally listed endangered Southern California Distinct Population Segment for steelhead trout (NMFS 2011; CNDDB 2014). Effects of mussel lines on fish populations are not well known. A study of the species and abundance of fish near mussel longlines in New Zealand (Morrisey *et al.*, 2006) used diver and ROV visual sampling, as well as destructive sampling. The study found mostly small, demersal species at the mussel farms, and while the occasional larger pelagic species were seen, the study concluded it was unlikely that larger fish make regular use of the farm. There is no historical, observed precedent at the current lease of fish suffering injury or mortality from mussel long lines. While steelhead trout may be present in the waters surrounding the lease, it is unlikely that the new lease will cause impact on individual fish. No other federal or state-listed threatened, endangered, or special status fish species are known to be present in the Project Area.

Essential Fish Habitat (EFH) for three federally-managed groups of fish have possible interactions with the Proposed Project: Coastal Pelagic Species, Highly Migratory Species, and Pacific Coast Groundfish. Habitat type for each group differs, and should be considered accordingly. Appendix J lists the species within these groups that may potentially be present at the project area.

Coastal Pelagic Species and Highly Migratory Species. The main risk to EFH for Coastal Pelagic Species (CPS) or Highly Migratory Species (HMS) is from suspended gear in the water column. Interactions between fish and mussel longline gear are not well known, though studies of similar gear in New Zealand has found significant impacts on pelagic fish to be unlikely (Morrisey et al, 2006). There is no history of injury or mortality of CPS or HMS at the current lease site. The design of the longline system, and the relatively small size of the fully built-out, reconfigured farm (approx. 72 acres) accounts for an extremely small footprint in contrast with the quite extensive oceanic habitats upon which Coastal Pelagic and Highly Migratory Species rely. The impact to Essential Fish Habitat for Coastal Pelagic and Highly Migratory Species is Less Than Significant.

Pacific Coast Groundfish. EFH for Pacific Coast Groundfish (PCG) covers a range of bottom types, affected species, and rules that control fishing and other anthropogenic activities, with particular attention directed to rocky or hard bottom habitats. Analyses of potential impacts on the benthos and from bottom disturbances by the Proposed Project can be found above in sections 4.4.3.3 and 4.4.3.4. Given the soft-bottom habitat of the project area, and the less than significant impacts the Proposed Project will have on the limited extent of this habitat, the impact to Essential Fish Habitat for Pacific Coast Groundfish is Less Than Significant.

The Proposed Project would have a significant impact on biological resources if it would:

c) Have a substantial adverse effect on federally protected wetlands as defined by Section 404 of the Clean Water Act (including, but not limited to, marsh, vernal pool, coastal, etc.) through direct removal, filling, hydrological interruption, or other means?

No Impact. The Project would have no effect on federally protected wetlands because none exist in the Project Area.

e) Conflict with any local policies or ordinances protecting biological resources, such as a tree

preservation policy or ordinance?

No Impact. The Project would not conflict with any local policies or ordinances protecting biological resources, including the Santa Barbara County Local Coastal Plan.

f) Conflict with the provisions of an adopted Habitat Conservation Plan, Natural Community Conservation Plan, or other approved local, regional, or state habitat conservation plan?

No Impact. No adopted Habitat Conservation Plan (HCP), Natural Community Conservation Plan, or other approved local, regional, or State HCP is in place that includes the Project Area or vicinity.

4.5 Cultural Resources

CULTURAL RESOURCES – Would the project:	Potentially Significant Impact	Less than Significant with Mitigation Incorporated	Less than Significant Impact	No Impact
a) Cause a substantial adverse change in the significance of a historical resource as defined in §15064.5?	☐	☐	☐	☒
b) Cause a substantial adverse change in the significance of an archaeological resource pursuant to §15064.5?	☐	☐	☐	☒
c) Directly or indirectly destroy a unique paleontological resource or site or unique geologic feature?	☐	☐	☐	☒
d) Disturb any human remains, including those interred outside of formal cemeteries?	☐	☐	☐	☒

4.5.1 Environmental Setting

The Proposed Project is located in the Pacific Ocean approximately one mile offshore from the City of Santa Barbara in 80 feet of ocean water.

4.5.2 Impact Analysis - Cultural Resources

a) Cause a substantial adverse change in the significance of a historical resource as defined in §15064.5?

b) Cause a substantial adverse change in the significance of an archaeological resource pursuant to §15064.5?

c) Directly or indirectly destroy a unique paleontological resource or site or unique geologic feature?

d) Disturb any human remains, including those interred outside of formal cemeteries?

a – d): No Impact. There are no known cultural resources or lease conflicts in the area, no archaeological or paleontological resources and no unique geologic features are known to be present at the project site. The Proposed Project would not include grading or soil excavation and, except for minor ocean floor disturbance from the setting of anchors, no native soils would be disturbed.

Mitigation Summary

No significant impacts were identified, and no mitigation measures are required.

4.5a Tribal Cultural Resources

TRIBAL CULTURAL RESOURCES	Potentially Significant Impact	Less than Significant with Mitigation Incorporated	Less than Significant Impact	No Impact
a) Would the project cause a substantial adverse change in the significance of a tribal cultural resource as defined in Public Resources Code 21074?	☐	☐	☒	☐

4.5a.1 Environmental & Regulatory Setting

As required by FGC and CDFW policies, as well as CEQA requirements (see Pub. Resources Code, § 21080.3.1) , both federally recognized and unrecognized Tribal governments have been contacted to invite input on projects being considered for approval with regard to tribal cultural resources.

4.5a.2 Impact Analysis - Tribal Cultural Resources

a) Would the project cause a substantial adverse change in the significance of a tribal cultural resource as defined in Public Resources Code 21074?

No Impact. On September 30, 2015, in compliance with PRC §21080.3.1 and the CDFW Tribal Communication and Consultation Policy, the Department requested a list of Tribes potentially affected by the LMP from the Native American Heritage Commission. Upon receipt of the listed Tribes and their contacts, the Department provided official notification of the LMP to those Tribal contacts, which resulted in no requests for formal consultation on the LMP.

4.6 Geology and Soils

GEOLOGY and SOILS – Would the project:	Potentially Significant Impact	Less than Significant with Mitigation Incorporated	Less than Significant Impact	No Impact
a) Expose people or structures to potential substantial adverse effects, including the risk of loss, injury, or death involving: i) Rupture of a known earthquake fault, as delineated on the most recent Alquist-Priolo Earthquake Fault Zoning Map issued by the State Geologist for the area or based on other substantial evidence of a known fault? Refer to Division of Mines and Geology Special Publication 42.	☐	☐	☒	☐
ii) Strong seismic ground shaking?	☐	☐	☒	☐

GEOLOGY and SOILS – Would the project:	Potentially Significant Impact	Less than Significant with Mitigation Incorporated	Less than Significant Impact	No Impact
iii) Seismic-related ground failure, including liquefaction?	☐	☐	☒	☐
iv) Landslides?	☐	☐	☐	☒
b) Result in substantial soil erosion or the loss of topsoil?	☐	☐	☐	☒
c) Be located on a geologic unit or soil that is unstable, or that would become unstable as a result of the project, and potentially result in on- or off-site landslide, lateral spreading, subsidence, liquefaction or collapse?	☐	☐	☐	☒
d) Be located on expansive soil, as defined in Table 18-1-B of the Uniform Building Code (1994), creating substantial risks to life or property?	☐	☐	☐	☒

4.6.1 Environmental Setting

The Proposed Project is located offshore in approximately 70 to 100 feet of water in the Pacific Ocean; only the anchors would be in contact with the ocean floor.

4.6.2 Impact Analysis - Geology and Soils

a) Expose people or structures to potential substantial adverse effects, including the risk of loss, injury, or death involving:

i) Rupture of a known earthquake fault, as delineated on the most recent Alquist-Priolo Earthquake Fault Zoning Map issued by the State Geologist for the area or based on other substantial evidence of a known fault?

ii) Strong seismic ground shaking?

iii) Seismic-related ground failure, including liquefaction?

iv) Landslides?

i, ii, and iii): Less Than Significant. The Project site is subject to earthquakes and strong seismic ground shaking associated with the Red Mountain Fault and the Lavigia Fault. The Red Mountain Fault is located approximately 1.5 miles to the south of the Project site. The Lavigia Fault is located approximately 1.5 miles to the north of the Project site. There are no mapped faults at the Project site (USGS 2014).

The only portion of the Proposed Project that would be on the ocean floor would be the anchors at approximately 70 to 100 feet deep. Farm operators would operate from boats that would not be subject to direct damage from earthquakes, except in the case of resulting tsunamis. Tsunami wave action has the small potential to cause anchors to fail. If an anchor fails, it may drag until it is otherwise held by the other anchor on the same longline. Due to their submerged nature, there is low risk of injury to operators on boats in the event of anchor failure. This Project is not expected to substantially increase the risk of injury or death to people, or to loss of structures. A Less Than Significant impact would occur.

iv): No Impact. The project equipment is located underwater, and would be accessed from above the water from a boat. The Proposed Project would not be subject to landslide and therefore it would not expose people or structures to potential substantial adverse effects.

b) Result in substantial soil erosion or the loss of topsoil?

No Impact. The Proposed Project would not result in erosion or the loss of topsoil because no topsoil exists on the substrate.

c) Be located on a geologic unit or soil that is unstable, or that would become unstable as a result of the project, and potentially result in on- or off-site landslide, lateral spreading, subsidence, liquefaction or collapse?

d) Be located on expansive soil, as defined in Table 18-1-B of the Uniform Building Code (1994), creating substantial risks to life or property?

e) Have soils incapable of adequately supporting the use of septic tanks or alternative waste water disposal systems where sewers are not available for the disposal of waste water?

c – e): No Impact. The Proposed Project would not create a geologic unit or soil to become unstable, and would not be located on expansive soil that would create substantial risks to life or property. No landslides, lateral spreading, subsidence, liquefaction or collapse would be created by the Proposed Project, nor does the project involve septic tanks or alternative waste water disposal systems.

Mitigation Measures

No significant impacts were identified, and no mitigation measures are required.

4.7 Greenhouse Gas Emissions

GREENHOUSE GAS EMISSIONS Would the project:	Potentially Significant Impact	Less than Significant with Mitigation Incorporated	Less than Significant Impact	No Impact
a) Generate greenhouse gas emissions, either directly or indirectly, that may have a significant impact on the environment?	☐	☐	☒	☐
b) Conflict with an applicable plan, policy or regulation adopted for the purpose of reducing the emissions of greenhouse gases?	☐	☐	☐	☒

4.7.1 Environmental Setting

The Proposed Project is located in the South Central Coast Air Basin (SCCAB) and is under the jurisdiction of the Santa Barbara County Air Pollution Control District (SBCAPCD). It is the responsibility of SBCAPCD to ensure that state and federal ambient air quality standards are achieved and maintained in the SCCAB.

4.7.2 Impact Analysis - Greenhouse Gas Emissions

a) Generate greenhouse gas emissions, either directly or indirectly, that may have a significant impact on the environment?

Less Than Significant. The only increase in sources of greenhouse gas (GHG) emissions associated with the Proposed Project is from the internal combustion engines on the aquaculture boat and the pickup truck used to haul the equipment trailer during installation. The installation phase of the Proposed Project is temporary, but would result in GHG emissions from the use of a pickup truck to haul an equipment trailer. Twenty-eight (28) round boat trips are expected for longline installation. A minor increase in trips to plant, harvest, and maintain the new longlines are anticipated to increase farm operations to approximately five days a week, with two boats for eight hours per day once the farm is at full capacity (over an estimated 5-year timeline). The SBCAPCD has not adopted a GHG threshold for mobile sources. GHG emissions are expected to be below the quantitative GHG emissions threshold of 900 metric tons proposed in the California Air Pollution Controls Officers Association (CAPCOA) White Paper as a minimum threshold below which impacts would not be required to be evaluated. A less than significant impact would occur. See **Table 4.3.-1** and **Appendix E – Proposed Project Estimated Emissions** for specific estimates of emission due to increased farm activity and equipment installation.

b) Conflict with an applicable plan, policy or regulation adopted for the purpose of reducing the emissions of greenhouse gases?

No Impact. The Proposed Project would not conflict with an applicable plan, policy or regulation adopted for the purpose of reducing the emissions of greenhouse gases. The SBAPCD has not adopted a GHG threshold for mobile sources. Emissions for the Proposed Project are expected to be below the GHG emissions threshold of 900 metric tons proposed in the CAPCOA White Paper as a minimum threshold below which impacts would not be required to be evaluated. No impact would occur. See **Table 4.3-1** and **Appendix E – Proposed Project Estimated Emissions** for specific estimates of emission due to increased farm activity and equipment installation.

Mitigation Measures

No significant impacts were identified, and no mitigation measures are required.

4.8 Hazards and Hazardous Materials

HAZARDS and HAZARDOUS MATERIALS Would the project:	Potentially Significant Impact	Less than Significant with Mitigation Incorporated	Less than Significant Impact	No Impact
a) Create a significant hazard to the public or the environment through the routine transport, use, or disposal of hazardous materials?	☐	☐	☒	☐
b) Create a significant hazard to the public or the environment through reasonably foreseeable upset and accident conditions involving the release of hazardous materials into the environment?	☐	☐	☒	☐
c) Emit hazardous emissions or handle hazardous or acutely hazardous materials, substances, or waste within one-quarter mile of an existing or proposed school?	☐	☐	☐	☒
d) Be located on a site which is included on a list of hazardous materials sites compiled pursuant to Government Code Section 65962.5 and, as a result, would it create a significant hazard to the public or the environment?	☐	☐	☐	☒
e) For a project located within an airport land use plan or, where such a plan has not been adopted, within two miles of a public airport or public use airport, would the project result in a safety hazard for people residing or working in the project area?	☐	☐	☐	☒
f) For a project within the vicinity of a private airstrip, would the project result in a safety hazard for people residing or working in the project area?	☐	☐	☐	☒
g) Would the project impair implementation of or physically interfere with an adopted emergency response plan or emergency evacuation plan?	☐	☐	☐	☒

HAZARDS and HAZARDOUS MATERIALS Would the project:	Potentially Significant Impact	Less than Significant with Mitigation Incorporated	Less than Significant Impact	No Impact
h) Would the project expose people or structures to a significant risk of loss, injury or death involving wildland fires, including where wildlands are adjacent to urbanized areas or where residences are intermixed with wildlands?	☐	☐	☐	☒

4.8.1 Environmental Setting

The Proposed Project is an offshore shellfish aquaculture operation approximately 0.75 miles from the coast at Santa Barbara accessible only by boat. Normal farm operations are typically conducted on board the vessel 3 to 5 days per week; the vessel is docked and fueled at the Navy Pier marina in Santa Barbara harbor.

4.8.2 Impact Analysis - Hazards and Hazardous Materials

a) Create a significant hazard to the public or the environment through the routine transport, use, or disposal of hazardous materials?

Less than Significant. Gasoline fuel, oil, and hydraulic fluids for the vessel, longline handling gear, and on-board farm processing equipment used during routine operations may represent a potential hazard to the environment if spilled. Gasoline and oils will only be securely stored on the boat in small quantities in spill-proof (2-5- gallon) containers, and are refilled at the harbor facilities designated for such purpose or on land. The hydraulic fluid used is non-toxic, vegetable-based, and biodegradable. No fuel is stored at the project site. Precautionary measures and protocols are listed in the Spill Prevention and Response Plan (**see Appendix K: SBMC's Spill Prevention and Response Plan**), which provides for emergency response and spill control procedures to be taken to stop or control the source of the spill and to contain and clean-up the spill. Potential hazards to the public or environment through routine transport, use, or disposal of hazardous materials would be Less Than Significant.

b) Create a significant hazard to the public or the environment through reasonably foreseeable upset and accident conditions involving the release of hazardous materials into the environment?

Less than Significant. The Proposed Project would use up to two gasoline-powered boats with hydraulic equipment. These boats are kept in good condition and are inspected by the Coast Guard every other year to decrease risk of operational or mechanical failure. Farm operations and boat travel to/from the project site occur only during daylight hours; non-farm vessel traffic at the Project site is uncommon; nautical rules-of-the road, regulations, and safe boat-handling practices are followed – all to reduce the likelihood of a vessel collision or accident. In the extraordinary event of a boat collision or on-board accident, impacts may potentially range from minor spills on board or into the ocean from disconnected or broken fuel or hydraulic lines, or storage tanks of either; to catastrophic capsize or sinking of the vessel, which may or may not expose fuels or fluids to the environment, depending on the resulting integrity of lines and connections. The relatively small quantities of and use of approved storage containers for fuels, oils, and fluids on board the vessel(s) are typical of a small fishing or recreational boat and are accompanied by a Spill Prevention and Response Plan to minimize risks.

By incorporating the Spill Prevention and Response Plan exhibited in Appendix K as a standard operating procedure, the hazard risk to the public or environment through reasonably foreseeable upset and accident

conditions involving the release of hazardous materials into the environment resulting from the Proposed Project, is Less Than Significant.

c) Emit hazardous emissions or handle hazardous or acutely hazardous materials, substances, or waste within one-quarter mile of an existing or proposed school?

d) Be located on a site which is included on a list of hazardous materials sites compiled pursuant to Government Code Section 65962.5 and, as a result, would it create a significant hazard to the public or the environment?

e) For a project located within an airport land use plan or, where such a plan has not been adopted, within two miles of a public airport or public use airport, would the project result in a safety hazard for people residing or working in the project area?

f) For a project within the vicinity of a private airstrip, would the project result in a safety hazard for people residing or working in the project area?

g) Impair implementation of or physically interfere with an adopted emergency response plan or emergency evacuation plan?

h) Would the project expose people or structures to a significant risk of loss, injury or death involving wildland fires, including where wildlands are adjacent to urbanized areas or where residences are intermixed with wildlands?

c – h) No Impact. The Proposed Project is not located within one-quarter mile of an existing or proposed school, nor is it located on a site included on a list of hazardous materials sites (California Department of Toxic Substances Control 2014). The Proposed Project is not located within an airport land use plan or within two miles of a public airport (Santa Barbara County 1993), nor is it located within the vicinity of a private airstrip (City-data.com 2014). The Proposed Project would not impair implementation of an adopted emergency response plan or emergency evacuation plan, nor is it located in proximity to wildlands and would not expose people or structures to a significant risk of loss, injury, or death involving wildland fires.

Mitigation Measures

No significant impacts were identified, and no mitigation measures are required.

4.9 Hydrology and Water Quality

HYDROLOGY and WATER QUALITY Would the project:	Potentially Significant Impact	Less than Significant with Mitigation Incorporated	Less than Significant Impact	No Impact
a) Violate any water quality standards or waste discharge requirements?	☐	☐	☒	☐

HYDROLOGY and WATER QUALITY Would the project:	Potentially Significant Impact	Less than Significant with Mitigation Incorporated	Less than Significant Impact	No Impact
b) Substantially deplete groundwater supplies or interfere substantially with groundwater recharge such that there would be a net deficit in aquifer volume or a lowering of the local groundwater table level (e.g., the production rate of pre-existing nearby wells would drop to a level which would not support existing land uses or planned uses for which permits have been granted)?	☐	☐	☐	☒
c) Substantially alter the existing drainage pattern of the site or area, including through the alteration of the course of a stream or river, in a manner that would result in substantial erosion or siltation on- or off-site?	☐	☐	☐	☒
d) Substantially alter the existing drainage pattern of the site or area, including through the alteration of the course of a stream or river, or substantially increase the rate or amount of surface runoff in a manner that would result in flooding on- or off-site?	☐	☐	☐	☒
e) Create or contribute runoff water, which would exceed the capacity of existing or planned stormwater drainage systems or provide substantial additional sources of polluted runoff?	☐	☐	☐	☒
f) Otherwise substantially degrade water quality?	☐	☐	☒	☐
g) Place housing within a 100-year flood hazard area as mapped on a federal Flood Hazard Boundary or Flood Insurance Rate Map or other flood hazard delineation map?	☐	☐	☐	☒
h) Place within a 100-year flood hazard area structures that would impede or redirect flood flows?	☐	☐	☐	☒

HYDROLOGY and WATER QUALITY Would the project:	Potentially Significant Impact	Less than Significant with Mitigation Incorporated	Less than Significant Impact	No Impact
i) Expose people or structures to a significant risk of loss, injury or death involving flooding, including flooding as a result of the failure of a levee or dam?	☐	☐	☐	☒
j) Be subject to inundation by seiche, tsunami, or mudflow?	☐	☐	☒	☐

4.9.1 Environmental Setting

The Santa Barbara Channel reaches a maximum of 600 meters in depth and receives input from nutrient-rich and nutrient-depleted sources across its 4,000 km2 area from strong upwelling currents, as well as river runoff from 6,000 square kilometers of the mainland watersheds (Warrick, 2005). The channel is affected by the California Current, and the California Counter Current, and wind-driven upwelling (Beckenbach, 2004). Approximately 100 km long and 50 km wide, the channel has an area of roughly 5,000km (1,235,527 acres) (Browne, 1994).

Water quality is monitored and/or managed by the State Water Resources Control Board and Regional Water Quality Control Boards, the California Department of Public Health, with federal oversight by the U.S. Environmental Protection Agency and U.S. Food and Drug Administration, and with additional oversight by local county agencies.

4.9.2 Impact Analysis - Hydrology and Water Quality

a) Violate any water quality standards or waste discharge requirements?

Less Than Significant. The Proposed Project would be subject to water quality standards established by the State Water Resources Control Board (SWRCB) for the Central Coast Region. Filtration by the mussels cultivated on the farm serve to enhance water quality standards relating to turbidity to a minor extent, given the farm size relative to the surrounding ocean. Water used for shellstock washing will be obtained from the growing area, as dictated by the National Shellfish Sanitation Program (NSSP 2013). A less than significant impact would occur.

b) Substantially deplete groundwater supplies or interfere substantially with groundwater recharge such that there would be a net deficit in aquifer volume or a lowering of the local groundwater table level (e.g., the production rate of pre-existing nearby wells would drop to a level which would not support existing land uses or planned uses for which permits have been granted)?

c) Substantially alter the existing drainage pattern of the site or area, including through the alteration of the course of a stream or river, in a manner that would result in substantial erosion or siltation on- or off-site?

d) Substantially alter the existing drainage pattern of the site or area, including through the alteration of the course of a stream or river, or substantially increase the rate or amount of surface runoff in a manner that would result in flooding on- or off-site?

e) Create or contribute runoff water, which would exceed the capacity of existing or planned stormwater drainage systems or provide substantial additional sources of polluted runoff?

b – e): No Impact. The Proposed Project would not use groundwater supplies or interfere with groundwater recharge, nor would it alter the existing drainage pattern of the Project site because it is located in the Pacific Ocean. While longline shellfish farms have been shown to reduce current speeds within embayments, the proposed farm is located in the open ocean and is not expected to impact current speeds (Plew, 2011). The Proposed Project would not result in erosion or siltation and would not alter the existing drainage pattern of the project site because it is located in the Pacific Ocean. The Proposed Project would not exceed the capacity of existing stormwater drainage systems and would not provide additional sources of polluted runoff.

f) Otherwise substantially degrade water quality?

Less than Significant. Filter feeders can have impacts on water quality by both removing nutrients from the water (in the form of primary production) and excreting nutrients (in the form of pseudo-feces) which may enhance primary production. However, it is unknown if increased productivity is due to shellfish effects on water quality or simply that a suspended shellfish farm offers added habitat for algae and other organisms (McKindsey, 2006). A NMFS EFH assessment evaluated the deposition of feces and pseudo-feces from a similar offshore mussel farm proposal (45 longlines in 100 acres, 110-150 feet deep) in federal waters and estimated the impact on localized nutrient quality to be minimal (McInnis, 2012). A similar conclusion is warranted in this case, with a potential impact to substantially degrade water quality being Less Than Significant.

g) Place housing within a 100-year flood hazard area as mapped on a federal Flood Hazard Boundary or Flood Insurance Rate Map or other flood hazard delineation map?

h) Place within a 100-year flood hazard area structures that would impede or redirect flood flows?

i) Expose people or structures to a significant risk of loss, injury or death involving flooding, including flooding as a result of the failure of a levee or dam?

g – i): No Impact. The Proposed Project is located in the Pacific Ocean and does not involve any housing or structures, would not impede or redirect flood flows, and would not expose people or structures to a significant risk of loss, injury or death as a result of the failure or a levee or dam.

j) Be subject to inundation by seiche, tsunami, or mudflow?

Less than Significant. The Project Area could be subject to tsunami during extreme conditions (CEMA 2009). A structural failure contingency plan is in place in case of catastrophic failure during a storm or a tsunami (see Section 2.3.4). In the unlikely event of tsunami, anchors may be displaced and the longlines may get tangled into a packed ball. The operator estimates clean-up would take approximately one to five days depending on the severity of the catastrophic failure. A less than significant impact would occur.

Mitigation Measures

No significant impacts were identified, and no mitigation measures are required.

4.10 Land Use and Planning

LAND USE and PLANNING Would the project:	Potentially Significant Impact	Less than Significant with Mitigation Incorporated	Less than Significant Impact	No Impact
a) Physically divide an established community?	☐	☐	☐	☒
b) Conflict with any applicable land use plan, policy, or regulation of an agency with jurisdiction over the project (including, but not limited to the general plan, specific plan, local coastal program, or zoning ordinance) adopted for the purpose of avoiding or mitigating an environmental effect?	☐	☐	☐	☒
c) Conflict with any applicable habitat conservation plan or natural community conservation plan?	☐	☐	☐	☒

4.10.1 Environmental and Regulatory Setting

Local Coastal Plan, other Ordinances, Santa Barbara County. Santa Barbara County's Local Coastal Plan (LCP) is silent with specific regard to marine aquaculture activity, with the exception of recognizing the importance of the local commercial fishing industry, it's harbor, and support facilities, upon which the Project operator depends as a harvester of marine products. It also points to the California Coastal Act's policies that prioritize coastal-dependent industries' use and access to coastal sites, which would include aquaculture sites (PRC sec. 30222.5 and 30411). Santa Barbara County, however, does address aquaculture under general regulations regarding planning and development, in its Article II Coastal Zoning Ordinance (Div. 7, Sec. 35-136). Its main emphases appear related to land-based visual impact minimization and compatibility with natural surroundings. (Santa Barbara County 2017)

The Proposed Project is located in the Pacific Ocean less than one mile south of the Santa Barbara coast. There is no designated land use for this Project location which is in the Pacific ocean (City of Santa Barbara 2004; City of Santa Barbara 2011).

4.10.2 Impact Analysis - Land Use and Planning

a) Physically divide an established community?

b) Conflict with any applicable land use plan, policy, or regulation of an agency with jurisdiction over the project (including, but not limited to the general plan, specific plan, local coastal program, or zoning ordinance) adopted for the purpose of avoiding or mitigating an environmental effect?

c) Conflict with any applicable habitat conservation plan or natural community conservation plan?

a – c): No Impact. The Proposed Project would not physically divide an established community, nor would it conflict with any applicable land use plans. The Proposed Project would comply with the City of Santa

Barbara Local Coastal Plan and the City of Santa Barbara General Plan Conservation Element by updating its Coastal Development Permit for the farming of shellfish (City of Santa Barbara 2004; City of Santa Barbara 2011). The Proposed Project would not conflict with any applicable habitat conservation plan or natural community conservation plan. The nearest marine protected area (MPA) is the Campus Point State Marine Conservation Area, located over four miles to the west [CCR Title 14, Sec 632(b)(99)].

Mitigation Measures

No significant impacts were identified, and no mitigation measures are required.

4.11 Noise

NOISE - Would the project:	Potentially Significant Impact	Less than Significant with Mitigation Incorporated	Less than Significant Impact	No Impact
a) Result in exposure of persons to or generation of noise levels in excess of standards established in the local general plan or noise ordinance, or applicable standards of other agencies?	☐	☐	☒	☐
b) Result in exposure of persons to or generation of excessive groundborne vibration or groundborne noise levels?	☐	☐	☐	☒
c) Result in a substantial permanent increase in ambient noise levels in the project vicinity above levels existing without the project?	☐	☐	☐	☒
d) Result in a substantial temporary or periodic increase in ambient noise levels in the project vicinity above levels existing without the project?	☐	☐	☒	☐
e) For a project located within an airport land use plan or, where such a plan has not been adopted, within two miles of a public airport or public use airport, would the project expose people residing or working in the project area to excessive noise levels?	☐	☐	☐	☒
f) For a project within the vicinity of a private airstrip, would the project expose people residing or working in the project area to excessive noise levels?	☐	☐	☐	☒

4.11.1 Environmental Setting

Existing noise sources in the area are primarily vehicle traffic on U.S. Highway 101 and ambient urban noise onshore. The nearest public receptors include recreational boaters and fishermen, and residential homeowners 0.75 miles away from the Project's offshore site. Project activity consists of normal vehicular use at Navy Pier, and vessel and onboard machinery operation on the water.

4.11.2 Impact Analysis - Noise

a) Result in exposure of persons to or generation of noise levels in excess of standards established in the local general plan or noise ordinance, or applicable standards of other agencies?

Less than Significant. The Proposed Project's installation and operational noise would remain similar to the current operations. Although more longlines would be installed, the equipment used would be similar. One additional trailer would be used during the installation process to bring the longlines and other equipment to the Navy Pier in the Santa Barbara Harbor. The boat would then load up the equipment and travel to the Project site, approximately 40 minutes away, some three-quarters of a mile offshore. The addition of the trailer is not expected to increase the noise to a level that would exceed local noise standards. Santa Barbara city code limits noise levels in residential neighborhoods and construction noise levels during certain hours of the night (Santa Barbara Municipal Code Title 9, Public Peace and Safety, Chapter 9.16). As operations would take place on the water, at the Navy Pier (a non-residential area), and during daylight hours, a less than significant impact would occur.

b) Result in exposure of persons to or generation of excessive groundborne vibration or groundborne noise levels?

c) Result in a substantial permanent increase in ambient noise levels in the project vicinity above levels existing without the project?

b – c): No Impact. The Proposed Project would not involve groundborne vibration or noise, and would not result in a substantial permanent increase in ambient noise levels; the noise levels would remain the same. "Noise emissions from commercial and recreational fishing vessels have not been identified as a significant problem to coastal residents or beach goers. This is likely due to the high level of attenuation of noise level on the ocean, and lack of sensitivity by beachgoers and coastal residents to the noise levels generated by boat operation." (South Coast MPA DEIR, 2010).

d) Result in a substantial temporary or periodic increase in ambient noise levels in the project vicinity above levels existing without the project?

Less than Significant. The Proposed Project could temporarily result in a minor noise levels increase with the use of the trailer; however, this increase would not be substantial if detected at all.

e) For a project located within an airport land use plan or, where such a plan has not been adopted, within two miles of a public airport or public use airport, would the project expose people residing or working in the project area to excessive noise levels?

f) For a project within the vicinity of a private airstrip, would the project expose people residing or working in the project area to excessive noise levels?

e – f): No Impact. The Proposed Project is not located within an airport land use plan or within two miles of a public airport (Santa Barbara County 1993), nor is it located within the vicinity of a private airstrip (City-data.com 2014)..

Mitigation Measures

No significant impacts were identified, and no mitigation measures are required.

4.12 Recreation

RECREATION - Would the project:	Potentially Significant Impact	Less than Significant with Mitigation Incorporated	Less than Significant Impact	No Impact
a) Increase the use of existing neighborhood and regional parks or other recreational facilities such that substantial physical deterioration of the facility would occur or be accelerated?	☐	☐	☒	☐
b) Include recreational facilities or require the construction or expansion of recreational facilities, which might have an adverse physical effect on the environment?	☐	☐	☐	☒

4.12.1 Environmental Setting

The City of Santa Barbara manages and maintains 360 acres of developed parkland and 1,183 acres of open space parkland. Recreational facilities in the city include parks, open space, three miles of beaches, playgrounds, and sports fields (City of Santa Barbara 2014).

4.12.2 Impact Analysis - Recreation

a) Increase the use of existing neighborhood and regional parks or other recreational facilities such that substantial physical deterioration of the facility would occur or be accelerated?

Less than Significant. Four spar buoys mark the corner boundaries of the existing lease and the grouped surface floats within the lease alert the recreational angler to submerged gear. Anglers may become entangled in the longlines if they fish within the lease boundaries. When encountered, they have been verbally advised by the Project operator not to fish within the lease area, but may fish alongside the lease. The project area is small enough to allow anglers to fish near the area without affecting or altering their fishing experience. Boats may transit through the lease without impediment. (See also discussion of the buoy requirements and nautical notifications and regulations for leaseholders below in section 4.13.1 under Transportation/Traffic.) A less than significant impact would occur.

b) Include recreational facilities or require the construction or expansion of recreational facilities, which might have an adverse physical effect on the environment?

No Impact. The Proposed Project does not include the expansion or construction of recreational facilities. Fish and Game code section 15411 directs that leaseholders may not unreasonably impede public access to state waters for purpose of navigation, fishing, commerce, or navigation, but may limit access to sites in order to avoid damage to aquatic life cultivation. The new longlines are not expected to increase or impede recreational users aside from the gear warnings stated above. No impact would occur.

Mitigation Measures

No significant impacts were identified, and no mitigation measures are required.

4.13 Transportation/Traffic

TRANSPORTATION / TRAFFIC Would the project:	Potentially Significant Impact	Less than Significant with Mitigation Incorporated	Less than Significant Impact	No Impact
a) Conflict with an applicable plan, ordinance, or policy establishing measures of effectiveness for the performance of the circulation system, taking into account all modes of transportation including mass transit and non-motorized travel and relevant components of the circulation system, including but not limited to intersections, streets, highways, and freeways, pedestrian and bicycle paths, and mass transit?	☐	☐	☒	☐
b) Conflict with an applicable congestion management program, including, but not limited to level of service standards and travel demand measures, or other standards established by the county congestion management agency for designated roads or highways?	☐	☐	☐	☒
c) Result in a change in air traffic patterns, including either an increase in traffic levels or a change in location that results in substantial safety risks?	☐	☐	☐	☒
d) Substantially increase hazards due to a design feature (e.g., sharp curves or dangerous intersections) or incompatible uses (e.g., farm equipment)?	☐	☐	☒	☐
e) Result in inadequate emergency access?	☐	☐	☐	☒

TRANSPORTATION / TRAFFIC Would the project:	Potentially Significant Impact	Less than Significant with Mitigation Incorporated	Less than Significant Impact	No Impact
f) Conflict with adopted policies, plans, or programs regarding public transit, bicycle, or pedestrian facilities or otherwise decrease the performance or safety of such facilities?	☐	☐	☐	☒

4.13.1 Environmental and Regulatory Setting

Setting - Onshore

Navy Pier in Santa Barbara, the location where the Project work boat is moored, is accessed from Interstate 101 and Shoreline Drive.

Setting - Offshore

The Project area is located in the Santa Barbara Channel (Channel) of the Pacific Ocean approximately 0.75 miles from the coast of Santa Barbara (Map 1) with an average water depth of 80 feet. Vessel access to the offshore Project area occurs from Navy Pier in Santa Barbara Harbor. Marine traffic in the broader Channel is comprised of military, commercial (fishing and shipping of oil and gas), and private (recreational) vessels. A Traffic Separation Scheme (TSS) manages large vessel traffic further offshore from the Project region (i.e.: beyond the three-mile, state waters limit at this point along the coast). The TSS is a voluntary route of separate opposing flows of vessel traffic with an additional empty safety lane. TSSs are generally in international waters and must be approved by the International Maritime Organization (IMO). The Channel TSS was established by the US Coast Guard to facilitate the safe movement of ships into and out of the Channel and the Ports of Los Angeles and Long Beach (33 Code of Federal Regulations, Part 167.450 *et seq.*). The TSS is recommended for use by all seagoing vessels, but is not necessarily intended for use by tugs, tows, or other small vessels that traditionally operate outside the usual traffic lanes or close to the shoreline, as is the case for this project's vessel(s).

Fish and Game Code, section 15411 directs that leaseholders may not unreasonably impede public access to state waters for purpose of navigation, fishing, commerce, or navigation, but may limit access to sites in order to avoid damage to aquatic life cultivation. California Code of Regulations (CCR), Title 14, Sec 237(c)(7) requires lease areas to be clearly marked with buoys and requires that lessees obtain approval from the U.S. Coast Guard, Aids to Navigation Branch, for notification and approval of such buoys.

4.13.2 Impact Analysis - Transportation/Traffic

a) Conflict with an applicable plan, ordinance, or policy establishing measures of effectiveness for the performance of the circulation system, taking into account all modes of transportation including mass transit and non-motorized travel and relevant components of the circulation system, including but not limited to intersections, streets, highways, and freeways, pedestrian and bicycle paths, and mass transit?

Less than Significant. During installation, the Proposed Project would use a trailer to bring the longlines to the Navy Pier in Santa Barbara Harbor to load onto the boat. The trailer would be parked at the pier and would not make multiple trips per day. Once the boat is loaded with all the equipment needed for installation, it would travel to the farm site approximately 40 minutes away. Once the boat arrives, the longlines would be installed. This trip takes approximately four hours round trip per line. One line would be installed per day.

The harvesting process would remain relatively the same as the current operation except that 16 additional longlines would be installed, totaling 28 longlines over several years of installation. When the farm is at full capacity, the increased traffic would amount to one additional boat, with both boats operating 5 days a week for approximately 8 hours a day during daylight hours. Not all longlines would be harvest lines; some would be used as nursery for seed and some would lie fallow until the next production cycle. As mandated by the Food and Drug Administration, the entire harvesting process must take place in under 10 hours. The harvest process begins in the summer and lasts approximately 10 to 12 months.

The longlines require little maintenance throughout the process. Routine maintenance checks are carried out by the same boat that does the installation and harvesting every four months.

The Proposed Project would not conflict with any applicable traffic plans, ordinances, or policies. The same boat that is used for current operations would be used during the entire installation and operation of the Proposed Project. One trailer would be used during the installation process and would not affect traffic patterns on I-101 or Shoreline Drive. A less than significant impact would occur.

b) Conflict with an applicable congestion management program, including, but not limited to level of service standards and travel demand measures, or other standards established by the county congestion management agency for designated roads or highways??

c) Result in a change in air traffic patterns, including either an increase in traffic levels or a change in location that results in substantial safety risks?

b) – c): No Impact. The Proposed Project would not conflict with any congestion management programs. The proposed operations would remain similar to the current operations. During installation, one trailer would be used and would not conflict with any congestion management programs. The Proposed Project would not result in a change in air traffic levels or a change in air traffic location that could result in substantial safety risks.

d) Substantially increase hazards due to a design feature (e.g., sharp curves or dangerous intersections) or incompatible uses (e.g., farm equipment)?

Less than Significant. The Proposed Project would not substantially increase hazards due to a design feature. Operations would remain similar to current operations. The longlines would be installed at a depth sufficient to not create a hazard with other harbor boat traffic. The surface spar buoys are light enough to easily deflect to the side of a boat if struck. The surface buoys are made of lightweight material that will either deflect to the side of the boat or collapse when struck. The longline has 5 surface floats and the structure will not be compromised by the loss of one float. If more than one float is compromised, the line may sink to the bottom and a recovery plan would be implemented. A less than significant impact would occur.

e) Result in inadequate emergency access?

f) Conflict with adopted policies, plans, or programs regarding public transit, bicycle, or pedestrian facilities or otherwise decrease the performance or safety of such facilities?

e) – f): No Impact. The Proposed Project would not require street closures or otherwise affect emergency access to Navy Pier, nor would it conflict with any policies, plans, or programs regarding public transit, bicycle transit, or pedestrian facilities..

Mitigation Measures

No significant impacts were identified, and no mitigation measures are required.

4.14 Utilities and Service Systems

UTILITIES and SERVICE SYSTEMS Would the project:	Potentially Significant Impact	Less than Significant with Mitigation Incorporated	Less than Significant Impact	No Impact
a) Exceed wastewater treatment requirements of the applicable Regional Water Quality Control Board?	☐	☐	☐	☒
b) Require or result in the construction of new water or wastewater treatment facilities or expansion of existing facilities, the construction of which could cause significant environmental effects?	☐	☐	☐	☒
c) Require or result in the construction of new stormwater drainage facilities or expansion of existing facilities, the construction of which could cause significant environmental effects?	☐	☐	☐	☒
d) Have sufficient water supplies available to serve the project from existing entitlements and resources, or are new or expanded entitlements needed?	☐	☐	☐	☒
e) Result in a determination by the wastewater treatment provider, which serves or may serve the project that it has adequate capacity to serve the project's projected demand in addition to the provider's existing commitments?	☐	☐	☐	☒
f) Be served by a landfill with sufficient permitted capacity to accommodate the project's solid waste disposal needs?	☐	☐	☒	☐
g) Comply with federal, state, and local statutes and regulations related to solid waste?	☐	☐	☐	☒

4.14.1 Environmental Setting

The Project will not change existing utilities or service systems. Therefore, setting information for existing utilities and service systems is not pertinent to the Project.

4.14.2 Impact Analysis - Utilities and Service Systems

a) Exceed wastewater treatment requirements of the applicable Regional Water Quality Control Board?

b) Require or result in the construction of new water or wastewater treatment facilities or expansion of existing facilities, the construction of which could cause significant environmental effects?

c) Require or result in the construction of new stormwater drainage facilities or expansion of existing facilities, the construction of which could cause significant environmental effects?

d) Have sufficient water supplies available to serve the project from existing entitlements and resources, or are new or expanded entitlements needed?

e) Result in a determination by the wastewater treatment provider, which serves or may serve the project that it has adequate capacity to serve the project's projected demand in addition to the provider's existing commitments?

a) – e): No Impact. The Proposed Project would not exceed the wastewater treatment requirements of the Central Coast Regional Water Quality Control Board. In accordance with Title 17 of the California Code of Regulations (Public Health), sec. 7731, persons aboard the aquaculture boat shall not discharge human waste into the water above the shellfish beds. The Proposed Project would not require wastewater treatment, nor require the construction of new water or wastewater treatment facilities, nor the expansion of existing facilities. The Proposed Project would not require the construction of new stormwater drainage facilities or the expansion of existing stormwater facilities. The Proposed Project would use a brush machine and seawater to clean shellstock and boat equipment as recommended by the National Shellfish Sanitation Program (FDA 2011), and would not require freshwater and no new or expanded entitlements.

f) Be served by a landfill with sufficient permitted capacity to accommodate the project's solid waste disposal needs?

Less than Significant. The Proposed Project would create a minimal amount of solid waste (e.g., fouled or damaged longlines) which would be disposed of in a landfill. Damaged floats are recycled, and anchors are typically salvaged and reused. In general, longlines and other equipment have very long lives; longlines in New Zealand have been known to last more than 25 years. Therefore, a substantial amount of solid waste is not anticipated; the Project would not use sufficient space at the local landfills to affect permitted capacity. A less than significant impact would occur.

g) Comply with federal, state, and local statutes and regulations related to solid waste??

No Impact. The Proposed Project would comply with federal, state, and local regulations related to solid waste; however, no significant amount of additional solid waste would be created.

Mitigation Measures

No significant impacts were identified, and no mitigation measures are required.

4.15 Mandatory Findings of Significance

Mandatory Findings of Significance Would the project:	Potentially Significant Impact	Less than Significant with Mitigation Incorporated	Less than Significant Impact	No Impact
a) Does the project have the potential to degrade the quality of the environment, substantially reduce the habitat of a fish or wildlife species, cause a fish or wildlife population to drop below self-sustaining levels, threaten to eliminate a plant or animal community, reduce the number or restrict the range of a rare or endangered plant or animal or eliminate important examples of the major periods of California history or prehistory?	☐	☐	☒	☐
b) Does the project have impacts that are individually limited, but cumulatively considerable? ("Cumulatively considerable" means that the incremental effects of a project are considerable when viewed in connection with the effects of past projects, the effects of other current projects, and the effects of probable future projects)?	☐	☐	☒	☐
c) Does the project have environmental effects that will cause substantial adverse effects on human beings, either directly or indirectly?	☐	☐	☒	☐

4.15.1 Impact Analysis - Mandatory Findings of Significance

a) Does the project have the potential to degrade the quality of the environment, substantially reduce the habitat of a fish or wildlife species, cause a fish or wildlife population to drop below self-sustaining levels, threaten to eliminate a plant or animal community, reduce the number or restrict the range of a rare or endangered plant or animal or eliminate important examples of the major periods of California history or prehistory?

Less Than Significant. As described in this Initial Study (including Biological Resources section), the Proposed Project would not have a significant impact on fish and wildlife species or their habitats, nor would it eliminate important examples of major periods of California history or prehistory.

b) Does the project have impacts that are individually limited, but cumulatively considerable? ("Cumulatively considerable" means that the incremental effects of a project are considerable when viewed in connection with the effects of past projects, the effects of other current projects, and the effects of probable future projects)?

Less Than Significant. The Proposed Project is a unique operation in its general location in the Santa Barbara Channel, with no cumulatively considerable incremental effects, either from past or current projects.

Another offshore mussel farm (Ventura Shellfish Enterprise) is in the early planning stages, with no candidate location identified more specific than between the cities of Carpenteria and Ventura, potentially placing it some 15 to 20 miles to the east of the Proposed Project, within the Santa Barbara Channel (either in state or federal waters). The probability of regulatory approvals and construction at the size and broad location being considered is uncertain at this time. Environmental analyses have not been completed nor publicly shared as the project is still in its planning stages. The potential size of the Ventura Shellfish Enterprise could be much larger than the Proposed SBMC Project (by a factor of up to twenty), and although it is foreseeable, it is a highly uncertain activity at this time, relative to this analysis, and will undergo its own appropriate environmental review at that point in time. Cumulatively considerable impacts attributable to this Proposed Project are Less Than Significant.

c) Does the project have environmental effects that will cause substantial adverse effects on human beings, either directly or indirectly?

Less Than Significant. Direct and indirect impacts to human beings would be Less Than Significant.

Mitigation Measures

No significant impacts were identified, and no mitigation measures are required.

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SECTION 7. APPENDICES

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APPENDIX A: SBMC EQUIPMENT LIST

Equipment	Description	Location	Existing Quantity on Existing Lease	Total Proposed New Quantity on Renewing Lease	Total Proposed Quantity on New Lease	Installed/ Day Use only
Spar Buoys	18 ft long by 1 1/2 in. wide pvc pole with radar reflective material on top. There is 7 feet of spar buoy that is visible above the waterline to mark corners of the lease.	Four Corners of Lease	4	2	2	Installed
Radio Reflective Buoy	There is one 6 feet long radio reflective buoy marker used for navigational purposes. This buoy is 6 ft long and 9 in. in diameter and sits approximately 3 ft above the water line	South East Corner of Lease	1	1	1	Installed
Concrete Anchors	Geometric shaped, made of concrete, approximately 3 ft long, 4 ft wide and 2 ft wide weighing 1 ton	At the ends of each longline.	24; *to be replaced over time with new helical or Jeyco anchors.*	24; *to be replaced over time with new helical or Jeyco anchors.*	0	Installed
Helical Screw Anchors	Solid steel shaft 12 ft long by 2 in diameter with 12 in diameter disc made by Hafbor Ltd.		0	Up to 32 total; to replace the concrete anchors	There will be a total of 32 new anchors; either screw or stingray anchors	Installed
Jeyco Stingray Anchors	100 kg high performance anchors	Used on two longlines currently. Anchors are placed on each	4	Up to 24 total; to replace the concrete anchors	See above.	Installed.

Equipment	Description	Location	Existing Quantity on Existing Lease	Total Proposed New Quantity on Renewing Lease	Total Proposed Quantity on New Lease	Installed/ Day Use only
		end of two longlines.				
Clump Weights	120 pound concrete clump weight motion dampener for anchors.	4 per longline.	48	96	64	Installed
Long Line Rope including Rode	750 feet of 1 in. co-polymer rope		12	24	16	Installed
Submersible floats	16 in. hollow submersible floats made from high density polyethylene #2 plastic filled with32 psi air , round in shape and weigh 8 lbs.	26 per longline added to the submerged backbone as mussels grow and get heavier.	312	624	416	Installed
Surface Floats	Surface floats are either made from high density polyethylene #2 plastic 16 in. round and inflated with air, or are made of vinyl inflated with air and are 24 in. long by 14 in. wide	6 surface floats for each longline.	72	144	96	Installed
Float Ropes	0.5-inch co-polymer rope 25 feet long	6 per longline attached to each surface float	72	144	96	Installed
3-millimeter oyster mesh nets	5 tier square lantern nets with 3 mm mesh netting. 25 inches in diameter and 5 feet long,	Hung from horizontal "backbone" of	50	50	50	Installed

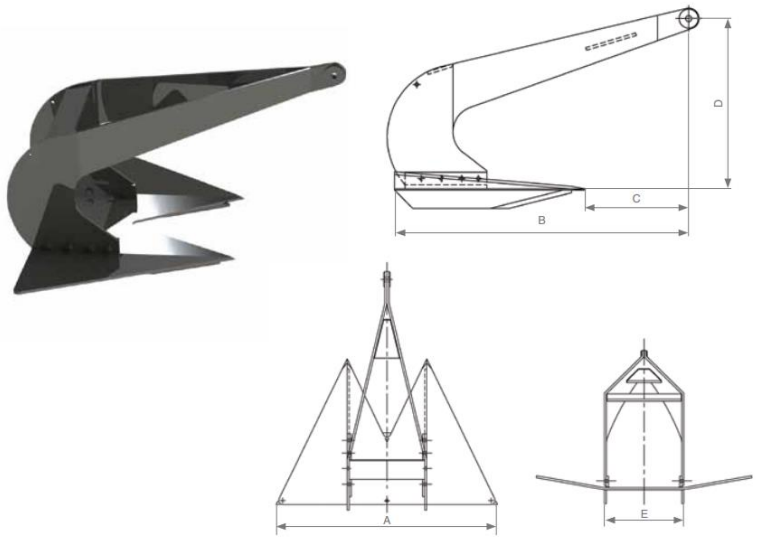
Equipment	Description	Location	Existing Quantity on Existing Lease	Total Proposed New Quantity on Renewing Lease	Total Proposed Quantity on New Lease	Installed/ Day Use only
	connected to longline with 1/4 inch polymer rope	the longline, 50 to a longline				
12 -millimeter oyster mesh nets	5 tier square lantern nets with 12 mm mesh netting; 25 inches diameter and 5 feet long	Hung from horizontal "backbone" of the longline, 50 to a longline	500	500	500	Installed
10 foot fuzzy seed ropes (mussels)	Copolymer rope blend 10 ft. long and 2 1/2 in. in diameter with cotton fabric attached; connected to longline with 1/8 in. polymer rope	Hung from horizontal "backbone" of the longline	120	240	160	Installed
Continuous Fuzzy Mussel Rope	Copolymer rope blend 2,000 ft. long by 2/1/2 inches diameter; each long line gets one 2000 ft rope hung from it in 10 foot loops	Hung from horizontal "backbone" of the longline	12	24	16	Installed
Bag of rocks	1/2 lb. 3/4 inch gravel in mesh bag in order to weigh down the mussel ropes	Hung from each loop of continuous fuzzy mussel rope	1200	2400	1600	Installed
4 millimeter lashing	4 mil polyethylene rope by 6 ft. used to tie continuous mussel rope to backbone	2 ropes per loop	2400	4800	3200	installed
Boat	35 by 11 ft aluminum boat with twin 150 HP outboard motors with a 13 HP auxiliary motor onboard.	Santa Barbara harbor	1	1	1	Day use only on site.
Continuous Mussel Rope Socking Machine	8 ft by 4 ft aluminum machine designed to put mussels on the fuzzy rope and cotton socking material over mussels	Used on boat; in offshore storage when not in use.	1	1	n/a	Day use only onboard the boat.

Equipment	Description	Location	Existing Quantity on Existing Lease	Total Proposed New Quantity on Renewing Lease	Total Proposed Quantity on New Lease	Installed/ Day Use only
Mussel Brush Cleaning & Harvesting Machine	4 ft. by 3 ft. stainless steel machine designed to pull mussel ropes onto boat and strip and clean the mussels.	Used on boat; in offshore storage when not in use.	1	1	n/a	Day use only onboard the boat.
Harbor Drilling Anchor Rig	12 by 4 ft machine designed to install screw anchors	Used on boat; in offshore storage when not in use.	1	1	n/a	Used only during longline installation.
Hydraulic Pump	13 hp Honda engine designed to pump hydraulic fluid to run machinery and boat equipment; using Mobile EAL 224H non-toxic and biodegradable hydraulic oil.	Installed on boat.	1	1	n/a	Day use only onboard the boat.
25 lb Harvest Bags (mussels)	Plastic extruded mesh bags	On board.	Varies	Varies	varies	Day use only onboard the boat.
Sorting Table	4 by 3 foot stainless steel table designed for hand cleaning and bagging mussels	Installed on boat.	1	1	0	Day use only; onboard the boat.

Jeyco Stingray anchors, 75kg, with one-inch co-polymer anchor rodes attached.

High Performance Anchors

Stingray High Performance Anchors



	Holding Power		
Weight (kg)	Sand (tonnes)	Medium Clay (tonnes)	Silt (tonnes)
10	2.39	1.85	1.34
25	4.95	3.83	2.77
50	8.59	6.65	4.80
75	12.03	9.09	6.57
100	14.91	11.54	8.34
150	20.58	15.93	11.51
175	23.26	18.01	13.01
250	30.89	23.92	17.27
375	42.64	33.01	23.84
500	53.60	41.50	29.97
750	73.99	57.28	41.37
1000	93.00	72.00	52.00
1500	128.37	99.39	71.78
2000	161.36	124.93	90.22
3000	222.74	172.44	124.54
4000	279.98	216.76	156.55
5000	334.32	258.83	186.93

	Dimensions						
Weight (kg)	Color	A	B	C	D	E	F
50	Green	1013	1023	347	598	368	54
75	Yellow	1060	1070	363	625	385	58
100	Blue	1171	1182	401	691	426	64
150	Green	1258	1271	432	742	458	69
250	Yellow	1515	1530	519	895	556	83
375	Blue	1748	1765	599	1031	635	96
500	Green	2024	2045	694	1190	736	111
750	Yellow	2222	2243	761	1311	808	122
1000	Yellow	2491	2516	854	1470	905	136
2000	Yellow	3078	3109	1055	1817	1119	168
3000	Yellow	3638	3719	1312	2160	1311	197
5000	Yellow	4248	4291	1456	2504	1544	232

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APPENDIX A1: LONGLINE ENGINEERING ANALYSIS

AZTI Technalia Project: Technical Feasibility Study on Longline Culture Technologies for the Open Ocean of the Bay of Biscay

Report on Activity T4

Engineering Analysis and Operational Design of a Prototype Submerged Longline System for Mussel Culture

Submitted by

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December 13, 2010

AZTI Technalia Project: Technical Feasibility Study on Submerged Longline Culture Technologies for the Open Ocean of the Bay of Biscay

Report on Activity T4: Engineering Analysis and Operational Design of a Prototype Submerged Longline System for Mussel Culture

Table of Contents

Foreword

This report consists of an engineering analysis and recommendations for the design, deployment and operation of a submerged longline system for mussel culture in the Bay of Biscay. Our recommendations are based on the oceanographic data provided by AZTI, our best professional judgment, and our experience with the design, construction and operation of submerged longlines in open ocean environments in the USA.

With regard to materials and equipment, we have tried to make our recommendations as specific as possible given our knowledge of what is available in Spain or neighboring countries. In instances where we were unable to obtain complete information on products or equipment, we have provided specifications such as buoyancy and working depth of submersible floatation, or equipment functionality rather than recommendations for specific products and vendors. We have assembled a list of companies in Section V of this report and suggest that you contact these companies, beginning with those located in Spain, to communicate your materials and equipment requirements to them and make your acquisition decisions based on what they are able to provide. If your discussions with suppliers raise questions, please feel free to contact us for consultation. We wish you great success with your project

I. Engineering Analysis and Longline Design

A submerged longline mussel system was analyzed to determine component tensions under a variety of environmental conditions. The long line system consists of two 56.5 m anchor lines and a 120 meter backbone line (see figure 1). The system is supported 10 meters below the surface by two 500 kg flotation elements. 100 mussel ropes 12 m in length are suspended from the backbone in 1 meter increments, with the mussel weight at harvest size offset by ninety-five 50 kg spherical floats.

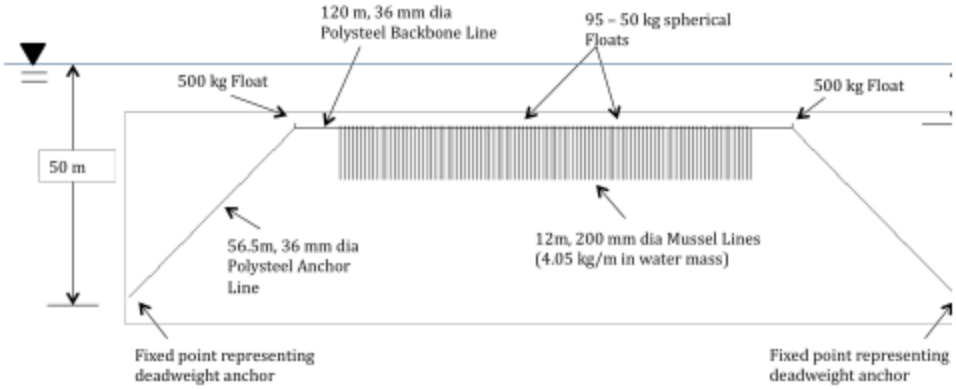

Figure 1: The long line system analyzed in the study. Note that line diameters were selected for output tension results only and may be different than those specified in the drawing.

Several load cases were analyzed:

- Static Longline Tensions: The mussel line was first analyzed in a static condition (no waves or currents). The system was examined with and without the suspended mussel ropes.
- Corner Float Geometry Sensitivity Study: Next, two mussel longlines were analyzed under a 50 cm/s current. The models were similar except for the corner flotation geometry: one model had a spherical buoy, the second a cylindrical buoy. The anchor and backbone line tensions and vertical displacement of the floats were compared.
- Mussel Harvest Tensions: A simulated harvest procedure was initiated to investigate the line tensions created by an attached service vessel at three points in the long line. The longline with and without mussels was examined.
- Current Only Loading: The long line was then analyzed under three current velocities. The system was aligned parallel to the current, simulating system orientation and water velocities in the field.
- Storm Events: The longline system was analyzed under storm current and wave condition data provided by the client. The applied storm waves simulated the 100 year storm event. Two mussel lines were analyzed and possible interaction and tangling of the long line elements was monitored.

- Extreme, Worst Case Analysis: Finally, the system was analyzed with waves and a co-linear current profile acting on a sole anchor leg to examine the worst possible loading in the field.

Note the units employed in this document. It is standard industrial practice to label the minimum breaking load, working load or yield strength of a material in kg opposed to Newtons (N) or kilo-Newtons (kN). For reference, 1 Newton = 0.102 kg. 1 kN = 102 kg.

STATIC LONG LINE TENSIONS

The system was analyzed with and without mussel ropes with no waves and current applied. The deformed geometries are shown in figures 2 and 3. The results of the analysis are presented in table 1.

Figure 2: The deformed, steady state geometry of the long line system without mussel ropes.

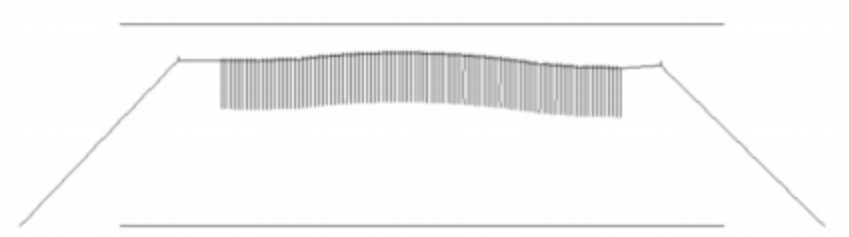

Figure 3: The deformed, steady state geometry of the long line system with mussel ropes.

Table 1: Static tensions in the long line system.

	No Mussel Ropes		With Mussel Ropes	
Tension in Anchor Line	708.7 kg	(1562 lb)	692.2 kg	(1526 lb)
Tensions in Backbone Line	495.3 kg	(1092 lb)	479.9 kg	(1058 lb)

Corner Float Geometry Sensitivity Study

Two similar systems were then analyzed under a 50 cm/s linear decreasing with depth current profile. One system had spherical flotation element, the other had cylindrical. The output longline component tensions and float displacement were compared. The results of the analysis can be seen in figure 4 and Table 2.

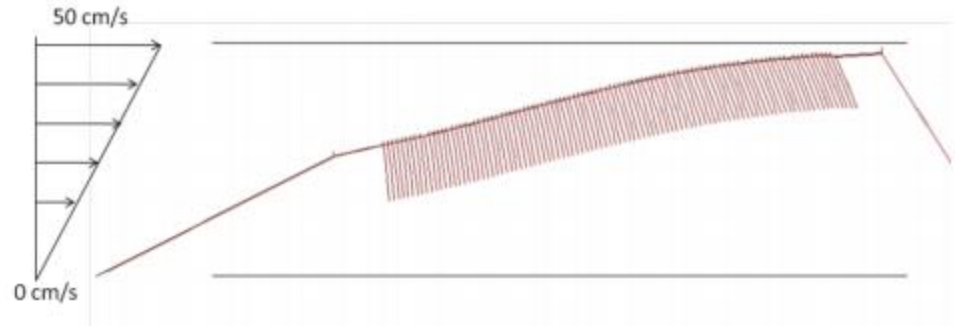

Figure 4: The steady state deformed geometry of the both long line configurations. The system with the cylindrical float is shown in red and spherical float in black. Note that the systems are aligned over each other.

Table 2: Sensitivity study results comparing the influence of the corner float geometry on the systems response.

	Cylindrical Floats	Spherical Floats
Tension in Anchor Line	2034 kg (4485 lb)	2035 kg (4487 lb)
Tensions in Backbone Line	1860 kg (4100 lb)	1862 kg (4105 lb)
Max Vertical Float Displacement	-14.3 m	-14.25 m
Max Horizontal Float Displacement	11.1 m	11.1 m

It can be seen that the systems have a similar response. Therefore, no significant difference in the dynamic or mooring load response is expected when using spherical or cylindrical buoys for the corner flotation elements.

Mussel Harvest Tensions

The force required to raise the backbone to the surface and associated component tensions exerted by a service vessel were also examined. To simulate a harvest procedure, buoyancy was added at three separate positions along the backbone line. The tensions and force required to bring the line to the surface were then determined.
Three positions along the backbone line were investigated:

- 10 meters from the corner float (first mussel sock),
- 35 meters from the corner float,
- 60 meters from the corner float (middle of the backbone line).

The results of the analysis are shown in figures 5 and 6. Output tensions and surfacing force can be found in Tables 3 and 4.

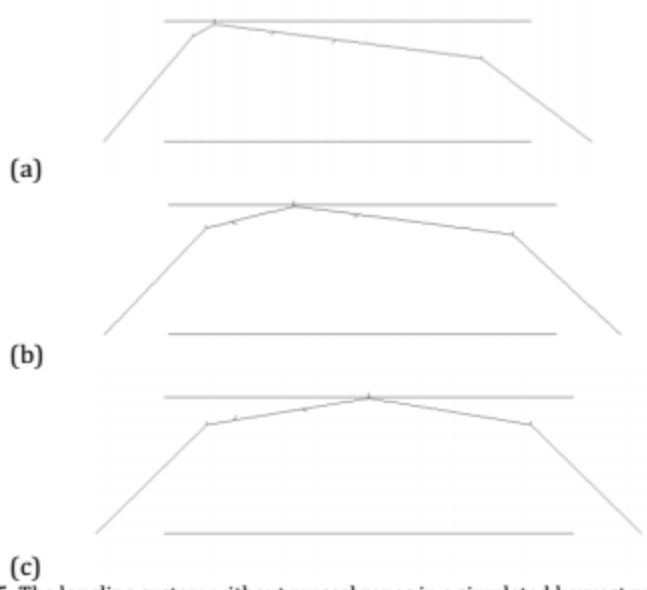

Figure 5: The longline system without mussel ropes in a simulated harvest procedure when the backbone is lifted to the surface. Buoyancy was added, representing a vertical force, at three locations: (a) 10 meters from the corner float, (b) 35 meters from the corner float, and (c) 60 meters from the corner float. Note that the buoyancy in the simulation, when not in use, was set to neutral.

Table 3: Harvest simulation results at three points along the backbone line for the system WITHOUT mussels.

	10 m from Corner Float	35 m from Corner Float	60 m from Corner Float
Anchor Line Tensions	2141 kg (2738 lb)	916 kg (2020 lb)	860 kg (1897 lb)
Backbone Line Tensions	914 kg (2016 lb)	655 kg (1445 lb)	622 kg (1371 lb)
Vertical Travel Distance	8.73 m	9.39 m	9.48 m
Required Surfacing Force	584 kg (1288 lb)	254 kg (561 lb)	210 kg (462 lb)

5

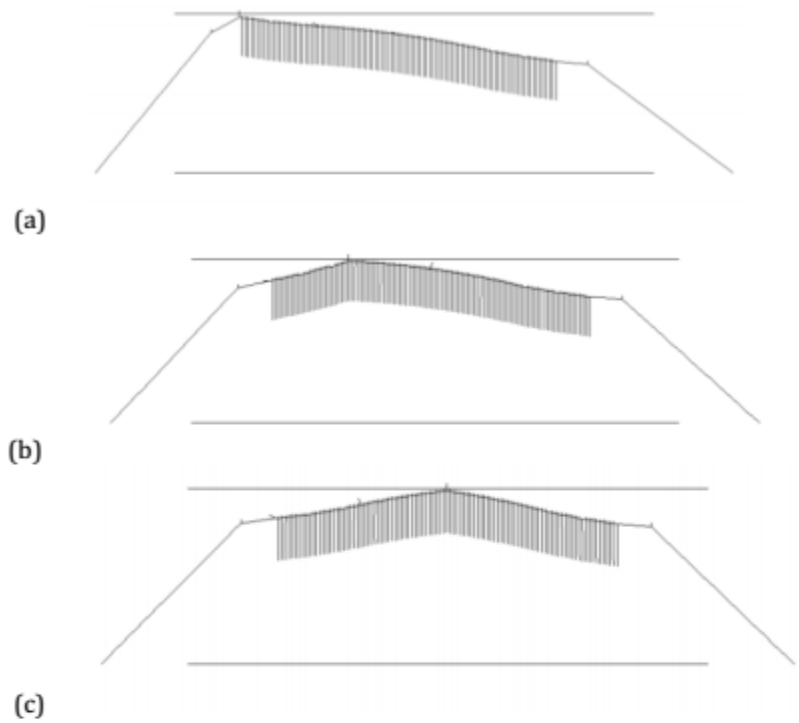

Figure 6: The longline system with mussel ropes in a simulated harvest procedure when the backbone is lifted to the surface. Buoyancy was added, representing a vertical force, at three locations: (a) 10 meters from the corner float, (b) 35 meters from the corner float, and (c) 60 meters from the corner float. Note that the buoyancy in the simulation, when not in use, was set to neutral.

Table 4: Harvest simulation results at three points along the backbone length for the system WITH mussels.

	10 m from Corner Float	35 m from Corner Float	60 m from Corner Float
Anchor Line Tensions	1211 kg (2670 lb)	883 kg (1946 lb)	817 kg (1800 lb)
Backbone Line Tensions	885 kg (1950 lb)	814 kg (1794 lb)	583 kg (1284 lb)
Vertical Travel Distance	8.81 m	9.45 m	9.49 m
Required Surfacing Force	545 kg (1200 lb)	225 kg (495 lb)	204 kg (451 lb)

Current Only Loading

The long line system was then analyzed under three current velocities: 15 cm/s, 50 cm/s and 140 cm/s. All water velocities applied to the system had a linearly decreasing with depth profile and approached the longline along a single anchor leg, as shown in figure 7. The output geometry and component tensions for each simulation are shown in figure 7 and table 5, respectively.

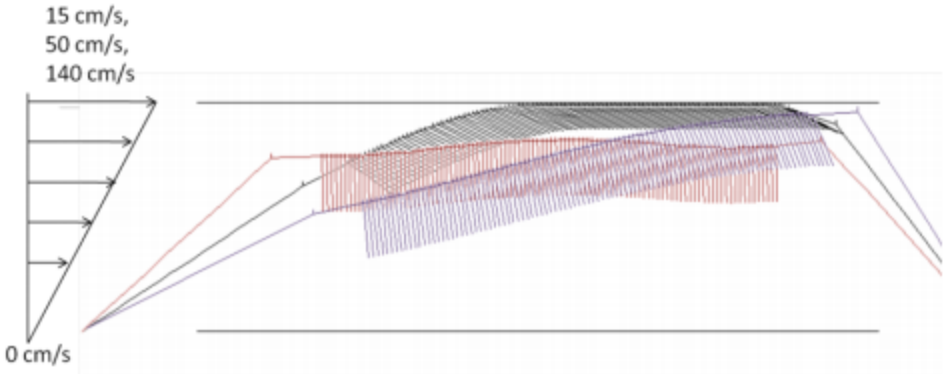

Figure 7: Three current profiles were applied to the system. The deformed geometry of the system can be seen under water velocities of 15 cm/s (red), 50 cm/s (blue) and 140 cm/s (black).

Table 5: Results of the current only loading on the mussel long line system.

	15 cm/s	50 cm/s	140 cm/s
Anchor Line Tensions	770 kg (1697 lb)	2034 kg (4485 lb)	3831 kg (8446 lb)
Backbone Line Tensions	565 kg (1245 lb)	1860 kg (4100 lb)	3575 kg (7880 lb)
Float Vertical Displacement	-1.5 m	-14.3 m	-8.77 m
Float Horizontal Displacement	1.79 m	11.1 m	8.58 m

Storm Events

The next analysis examined two parallel mussel line systems under storm conditions. The long lines were spaced 25 meters apart. Waves and currents were applied to the system, simulating the worst case water velocity and wave loading. The waves and currents were applied to the system as shown in figure 8. The mean and maximum tensions in the system were recorded and can be seen in figure 9 and table 6.

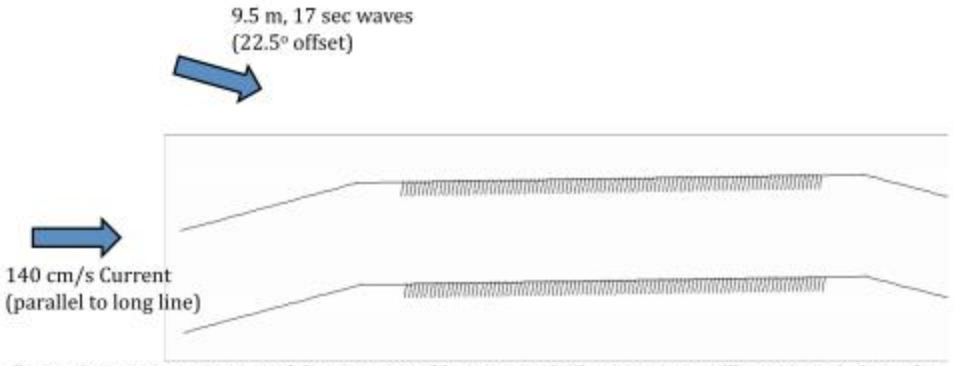

Figure 8: An isometric view of the two mussel lines spaced 25 meters apart. The 140 cm/s, linearly decreasing with depth current profile was applied parallel to the long line; waves were offset by a 22.5 degree angle representing the worst case wave direction from obtained environmental data provided by the client.

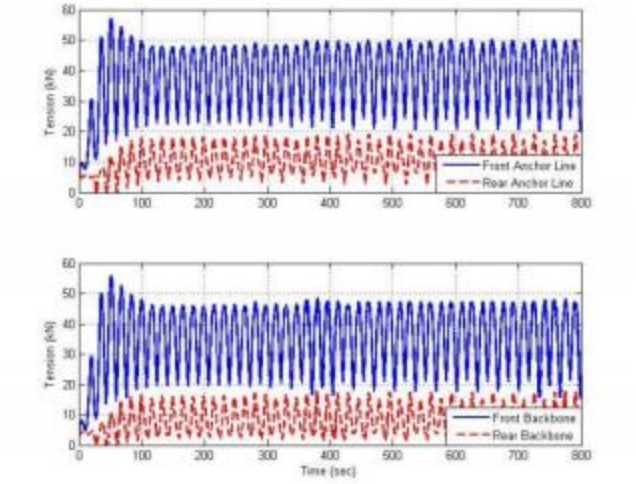

Figure 9: The time series component tensions results from the storm simulation. Note that 1 kN = 102 kg.

Table 6: Results of the storm event loading: 140 cm/s current with 9.5 meter, 17 second waves.

Maximum Anchor Line Tensions	5837 kg (12,868 lb)
Maximum Backbone Line Tensions	5697 kg (12,560 lb)
Mean Anchor Line Tensions	3828 kg (8440 lb)
Mean Backbone Line Tensions	3556 kg (7840 lb)
Float Vertical Displacement	-8.51 m
Float Horizontal Displacement	8.48 m

8

EXTREME, WORST CASE ANALYSIS

The final load case investigated a hypothetical extreme storm event where the maximum wave regime was applied parallel to the system. A co-linear 140 cm/s CONSTANT WITH DEPTH current profile was also applied simulated (figure 10). The long line component tensions are presented in figure 11 and table 7. This load condition is not expected in the field but provides an upper bracket on possible forces the longline can experience.

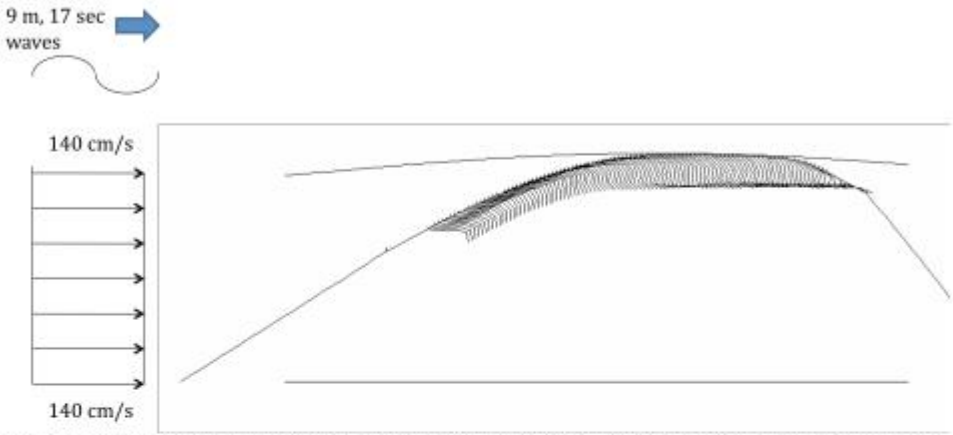

Figure 10: The extreme load case applied 9.5 meter, 17 second waves and a constant with depth 140 cm/s current profile to the long line system. The deformed geometry is shown.

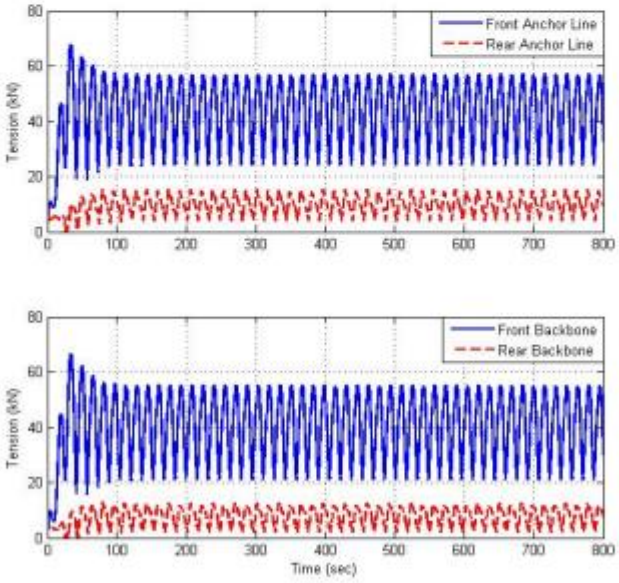

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Figure 11: Time series results of the long line component tensions. Note that 1 kN = 102 kg.

Table 7: Results of the extreme event loading: 140 cm/s current (constant with depth) with 9.5 meter, 17 second waves.

Maximum Anchor Line Tensions	6904 kg (15,220 lb)
Maximum Backbone Line Tensions	6772 kg (14,930 lb)
Mean Anchor Line Tensions	4316 kg (9514 lb)
Mean Backbone Line Tensions	4018 kg (8860 lb)
Float Vertical Displacement	-9.05 m
Float Horizontal Displacement	8.96 m

Anchor Holding Power Calculations

It was necessary to determine the size of the deadweight anchors used to secure the long line system. The approach presented in the "Marine Geotechnical Handbook" by Karl Rocker, Jr. was employed. To properly size the deadweights, the following information is required:

- Angle (above horizontal) the anchor line force is applied to the weight
- Anchor line tension
- Safety factor
- Sediment buoyant weight
- Sediment friction coefficient
- Shear key length (if any)
- Embedment depth of the anchor
- Area of the weight in contact with the seafloor

The angle and tension of the anchor line were determined from the numerical analysis. The deadweights were sized assuming two safety factors: 1.0 and 1.5. The sediment's (sand) buoyant weight was assumed to be 1041 kg/m^3. The sediment coefficient of friction was 0.69, based upon published values of rough concrete. It was assumed that no shear keys would be used with the anchor blocks. As the seafloor sediment is sand, no embedment depths are expected or included in this analysis. As such, the area of the dead weight in contact with the seafloor is not required. The table below shows a few variations of the analysis with different assumptions regarding the mass of the blocks, the mooring force, etc. The values provided in the table assume a single concrete block secures the long line (one at each end).

Anchor Holding Power[b]	Environmental Conditions	Safety Factor 1.0		Safety Factor 1.5	
		Dry Weight[a]	Wet Weight	Dry Weight[a]	Wet Weight
5,840 kg	Worst case storm (140 cm/s current, 9 m waves)	17,780 kg	10,210 kg	24,000 kg	13,830 kg
4,540 kg	Something in-between	13,610 kg	7,940 kg	18,600 kg	10,750 kg
3,860 kg	140 cm/s current, no waves	11,790 kg	6,800 kg	15,875 kg	9,075 kg
2,040 kg	50 cm/s current	6,215 kg	3,580 kg	8,400 kg	4,760 kg

[a]Note that the dry weight of anchor blocks shown assumes that concrete blocks have a density of 2500kg/m^3.

[b] Assumes the anchor line angle is approximately 32 degrees (determined from deformed geometry).

It can be seen that the mooring block required to secure the long line system in the worst case storm (140 cm/sec current velocity throughout the water column and a 9.5 m wave) would have to be very large and would present difficulties in deployment. While it is unlikely that current velocities would be uniform throughout the depth of the water column, a conservative approach is to assume that forcing of this magnitude is possible. Therefore, in an effort to limit the size of the deadweight component, a drag embedment anchor was incorporated into the design. Using the worst case storm anchor line tensions as input, the following anchoring gear is required in the long line system.

- A 6000 kg dead weight anchor is required on both ends of the long line. The block should have the following dimensions: 2.0 m x 2.0 m x 0.6 m (assuming a density of 2500 kg/m^3 for reinforced, marine grade concrete). Approximately 2.4 m^3 of concrete is required for each block. Additional holding power can be achieved by creating a concavity on the bottom of the block during construction as described in Section II, Longline construction and assembly.
- 60 meters of chain should be attached to the concrete block on the load bearing (main storm current direction) end of the longline. The chain should have a working load of 4945 kg (10,900 lb) or breaking strength of 14,830 kg (32,700 lb). This would translate into, for example, 19 mm long link standard grade chain.
- A drag embedment anchor having a holding power of 4945 kg . For example, a 160 kg Danforth anchor could be employed.
- Shackles should be used to secure the anchor, chain and deadweight having a working load of 4945 kg. This translates into a standard grade 19 mm shackle.

RECOMMENDATIONS FOR DEPLOYED SYSTEM

The following recommendations are proposed based upon the numerical analysis:

LINE SIZES:

- A safety factor of three (3) should be utilized to specify the mooring line components.
- Based upon the maximum predicted anchor line force of 5837 kg, the anchor lines must have a minimum breaking load (M.B.L) of 17,511 kg. This would translate into, for example, the use of 36 mm Polysteel line with a M.B.L. of 21573 kg.
- One continuous length of line (235 m) with the breaking strength described above can be used to span the distance from block to corner buoyancy (56.5 m); corner buoy to second corner (120 m), and second corner to second block (56.5 m). One meter of the line on each end is needed for attachment to the rope loops on the concrete blocks.
- Line tensions during simulated harvest procedures were reasonable and should not pose an operational problem.

FLOTATION

- The corner flotation elements should have a net buoyancy of 500 kg and have a submerged working depth of 20 m at minimum. The floats can be cylindrical or spherical as minimal difference in the system dynamics was observed.
- Ninety-five, 50 kg floats, also with a working depth of >20 m are required to offset the mussel weight (assumes a fully grown mussel rope weight of 4.05 kg/m in water).
- In addition, it would be very useful to have a number (50 or so per line) smaller submersible floats (25-35 kg buoyancy) as the 50 kg floats may distort the line geometry in the first few months post seeding when mussels are small and weight is minimal.
- Our information on specific floats and vendors is incomplete at this point. We have inquired with several companies and have not received entirely satisfactory responses. Please see buoy suppliers listed in Section V.
- Care should be taken to monitor the growth rate of the mussels and increasing mass as a line this length is subjected to sinking if too few floats are added to the system. See figure 12 below detailing the static configuration of the mussel ropes with 90, 95 and 100 floats added to the backbone line.

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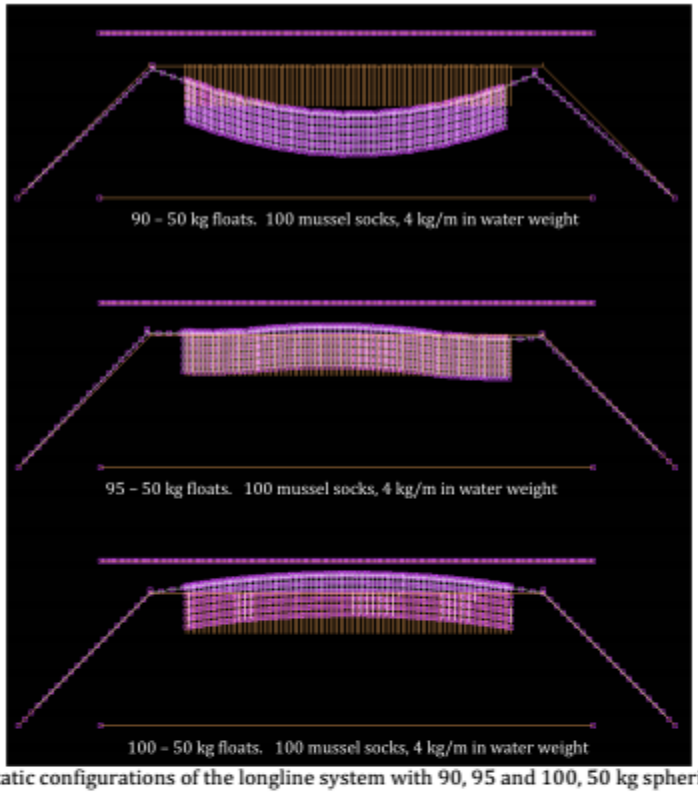

Figure 12: Static configurations of the longline system with 90, 95 and 100, 50 kg spherical flotation elements distributed along the backbone line.

- Note that under large currents, the "bow" or load bearing side of the system is driven deeper into the water column. This provides slack in the mussel longline, allowing the trailing portion of the backbone to rise to the surface (Figure 7). Therefore care should be taken to limit auxiliary flotation to not aid this "surfacing" dynamic initiated by high currents and waves.

ANCHORS:

- It was determined that 158 kg drag embedment anchors were required on the load bearing side of each mussel longline.
- The drag embedment anchors were sized to absorb the horizontal anchor line force, with the chain and deadweight offsetting the vertical.
- The concrete blocks were sized to have the height of the unit be approximately 25% of the base dimensions to resist tipping.
- The anchoring gear was sized such that the anchors will drag before any component fails.
- Two anchor blocks are specified, each with 2 connection points.

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- Ballast 1 utilizes one rope loop for long line attachment and one rebar loop for anchor chain attachment. Both the rope and rebar should be properly secured to the internal rebar of the concrete ballast weight. Note that the rebar and rope loop are placed "in-line" to reduce internal forcing on the concrete block.
- Ballast 2 utilizes two rope loops, as seen in the figure 13 below, similarly secured to the internal rebar reinforcements.

Figure 13: Concrete block with 2 rope loops embedded into the concrete (on top). The rope is tied to the internal rebar supports. Note that the block geometry shown here should not be utilized with this design, as it can be susceptible to tipping.

- The long line is attached to the concrete ballast block (1 and 2) using a double sheet bend knot (figure 14) through the rope loop. The same knot should be employed for the anchor pick-up line (line 2) in ballast 2.

Figure 14. A double sheet bend knot

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- For the anchor chain attachment in ballast 1, a shackle should be secured within the rebar loop connection point and secured to eliminate the possibility of loosening. For example, the shackle can be "moused" closed (see Figure 15).

Figure 15: An example of a shackle (shown beneath the yellow float) "moused" with wire to keep the pin from becoming loose during the deployment.

- Finally, note that no calculations or analysis were performed on the internal support (rebar) for the deadweight concrete anchors. We have made a recommendation in Section II, Longline construction and assembly, however the client may choose alternative designs as they see fit.

BILL OF MATERIALS

All items are referenced to the longline drawing.

#	Item	Description	Qty.
1	Anchor 1	Drag Embedment Anchor, minimum holding power of 4950 kg (10,900 lb)	1
2	Ballast 1	2.0 x 2.0 x 0.6 m^3 Concrete Block (6000 kg dry weight) with internal reinforcement rebar; one exterior 19 mm rebar "loop" welded to internal rebar, and one exterior rope loop MADE OF SAME LONGLINE ROPE MATERIAL, DIAMETER AND M.B.L. as indicated in #9, line 1 (e.g. 36 mm Polysteel) secured to internal rebar. Total required loop line length is 3 meters (2 x 1 meter length for attachments to internal rebar and 1 meter for exterior block rope loop). See discussion of anti-chafing material recommendation for rope loops in Section II, Longline Construction and Assembly	1
3	Ballast 2	2.0 x 2.0 x 0.6 m^3 Concrete Block (6000 kg dry weight) with internal reinforcement rebar; two (2) exterior rope loops MADE OF SAME LONGLINE ROPE MATERIAL, DIAMETER AND M.B.L. (e.g. 36 mm Polysteel) secured to internal rebar. Total required loop line length is 3 meters (2 x 1 meter length for attachments to internal rebar and 1 meter for exterior block rope loop).	1
4	Chain 1	Anchor Chain, 60 m length, M.B.L. of 14,800 kg OR working load of 4950 kg	1
5	Dropper Line	Mussel Dropper Line, Galicia pegged rope 12 m length OR if continuous method is used, 1,300 meters of growing rope (see discussion in description of equipment and operational methods)	100
6	Float 1	500 kg buoy	2
7	Float 2	35 kg buoy	7
8	Float 3	50 kg buoy	95
9	Line 1	Main longline, 248 m length total, M.B.L. of 17,500 kg (38,500 lb); e.g. 36 mm Polysteel. Note: length includes 235 m for long line, 4 m for splicing in two (2) float connection loops at long line corners, and 9 m for concrete ballast rope loops.	1

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. 10	Line 2	Anchor pick-up line, 60 m length, M.B.L of 12,000 kg ; e.g. 28 mm Polysteel	2
. 11	Line 3	Center backbone pick-up line, 20 m length, M.B.L. of 2250 kg; e.g. 14 mm Polysteel	1
. 12	Line 4	Corner float marker line, 10 m length, M.B.L. of 2250 kg; e.g. 14 mm Polysteel	2
. 13	Shackle 1	19 mm Shackle; M.B.L. of 14,800 kg OR working load of 4950 kg	3

Note:

- M.B.L. = Minimum Breaking Load
- No line was specified to attach the small floats (float 3) to the long line. There are a number of options depending on what is available locally. We have used a double strand of 6 mm braided nylon tire cord to attach floats to a backbone with good results. We have also used this same material to attach continuous growing ropes to the backbone.
- The attachment method for line 2 to the drag embedment anchor was not specified, as it will be unique to the drag embedment anchor selected for this system.

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II. Longline Construction and Assembly

Deadweight Moorings

Deadweight moorings are constructed of marine grade concrete with internal reinforcement rebar. Wet concrete is poured into 2 m x 2m x 1m forms created from plywood and 38 x 89 mm lumber planks as shown in Figure 17. The forms are held together using spikes through the crossed planks and 3 mm galvanized wired passed through the form 20 cm from the bottom. The wire can then be used to support the reinforcement rebar structure. The client may choose any reinforcement design they see fit, however, we propose the following for consideration. Two grids of 15 mm rebar are welded or coupled into a mesh as shown in figures 18 a and b. The two grids should be connected to each other at a minimum seven points using rebar sections 25 cm in length. For Ballast 1, a 19 mm diameter rebar "loop" welded to both tiers of the internal rebar frame so that it protrudes from the top of the mooring block at 10-15 cm at midpoint. One exterior rope loop made of same longline rope material, diameter and M.B.L. as indicated in #9, line 1 in the Bill of Materials (e.g. 36 mm Polysteel) is secured to internal rebar. Total required loop line length is 3 meters (2 x 1 meter length for attachments to internal rebar and 1 meter for exterior block rope loop). The rope loop should be passed through two sections of snug fitting abrasion-resistant rubber hose that are arranged at the points at which the two ends of the loop meet the top of the mooring block to minimize chafing. The wet concrete should also be slightly beveled at the exit points of the loop after pouring. To create a slight concavity on the bottom of the mooring block, a mound of sand 120 cm in diameter and 10 cm in height at center point should be placed on the ground and covered with heavy sheet plastic prior to setting the wooden form and rebar above it. For Ballast 1, the rebar loop and rope loop should be set in-line as shown in Figure 16. For Ballast 2, two rope loops are used, and they are set in parallel as they appear in Figure 13. Cement should be poured into the forms to a height of 0.6 m to achieve the desired weight.

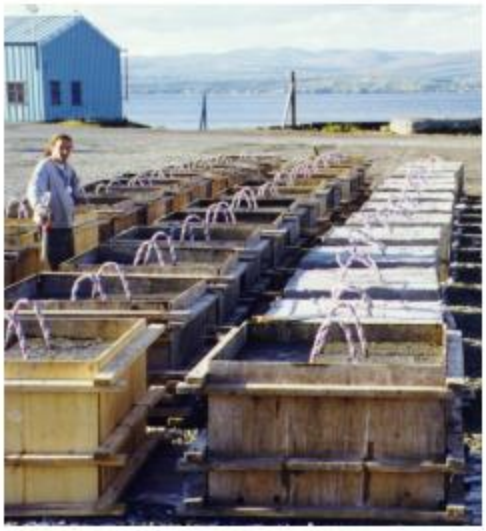

Figure 17. Plywood and lumber forms for the construction of concrete moorings

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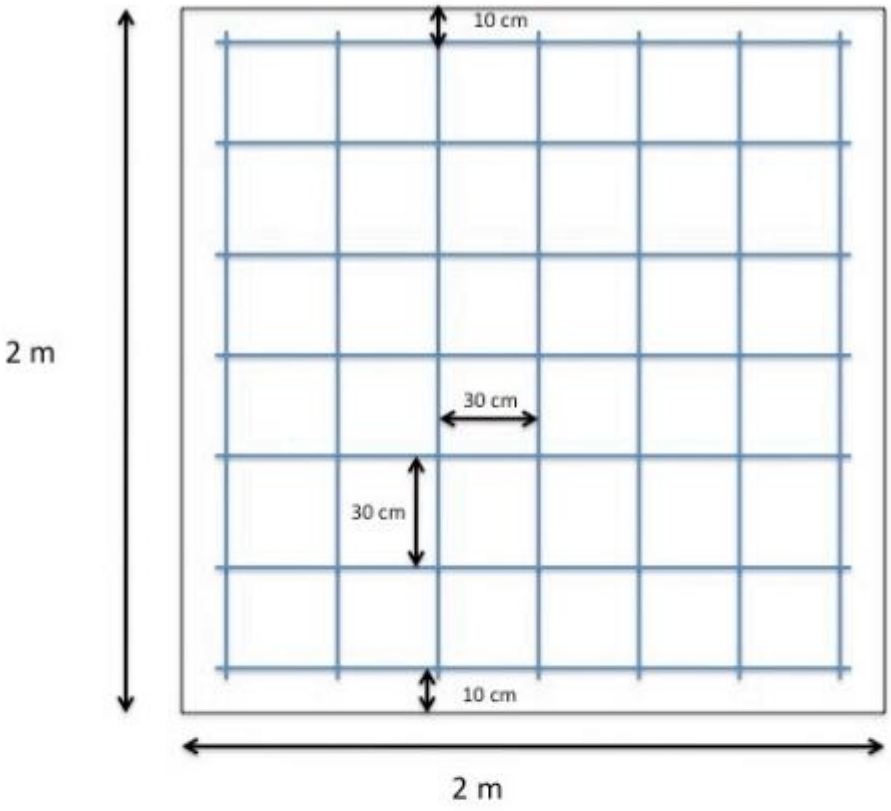

Figure 18. Top view (a) and side view (b) of arrangement of internal reinforcing rebar. Rebar elements are shown in blue.

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Assembly of longline components*

The main line (Line 1, #9 in Bill of Materials) will have a total length of 239 m after 9 m is removed to fabricate the rope loops for the concrete moorings.

Step 1.
Two, 2 m lengths are removed to fabricate the eye splice loops for corner float attachment, leaving 235 m of line.

Step 2.
Using up to 1 m of line, secure one end of Line 1 to the rope loop on Ballast 1 using a double sheet bend (Figure 14), leaving enough rope to pass the end 2 times through the lay of Line 1. Make sure the sheet bend is tightened as much as possible before passing the line through the lay of the rope.

Step 3.
Measure out 56.5 m from the attachment to Ballast 1 on Line 1 mark the spot. Splice both ends of the 2 m section into the longline on either side of the 56.5 m marker starting at about 10 cm on either side of the marker to form a loop for attaching the corner floats. Use 5 tucks on the splices.

Step 4

Measure 120 from the first corner marker and put in another marker. Repeat step 2 to make the second loop for attaching corner floatation.

Step 5

Measure 56.5 m from the marker and using up to 1 meter of line, attach Line 1 to one of the rope loops in Ballast 2 as described in Step 2.

Step 6.

Attach one of the shackles (#13, Shackle 1) to one end of #4, Chain 1 and the rebar loop on Ballast 1. Attach the other shackle to the other end of the chain and to the attachment point on #1 Anchor 1. Shackles need to be secured to eliminate the possibility of loosening. For example, the shackle can be "moused" closed (see figure 15).

Step 7

Anchor lines: attach one end of # 10, Line 2 to the lifting point of Anchor 1. This may require creating an eye splice around a thimble and an additional shackle depending on the anchor configuration. Attach the other end of Line 2 to Float #2 using a clove hitch secured by 2 half hitches and pass the end of the line through the lay of the rope 2 times (* see note below). Measure 40 m from anchor attachment point of Line 2, and attach a subsurface float (also Float #2). This can be done using

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a length of 6 mm braided nylon tire cord or equivalent using a prussic knot or a clove hitch and half hitches with passage of the nylon cord through the lay of Line 2.

Attach the other 60 m length of Line 2 to the vacant loop on Ballast 2 using procedures described in Step 2. Attach surface marker float and subsurface float as described above.

* Note on anchor marker buoys. We have recommended 35 kg floats to mark the anchor lines, however, you may be required to install private aids to navigation in the form of lighted or radar reflective buoys. You should substitute whatever is required or whatever you choose for the anchor marker buoys, so as long as the buoyancy does not affect the holding power of the embedment anchor.

Step 8

Corner floats (# 6, Float 1): attach one end of a 2 m length of 14 mm Polysteel (see specifications for Line 4), to the corner loops fabricated in Step 3, using a double sheet bend, leaving enough rope to pass the end 2 times through the lay of the 14 mm line. Make sure the sheet bend is tightened as much as possible before passing the line through the lay of the rope. Attach the other end of this line to the eye on Float 1 using a clove hitch secured with 2 half hitches. Pass the free end of the line through the lay of the rope 2 times.

Corner float markers: Since the final configuration of Float 1 is undetermined, it is not known whether it will have one or two eyes, therefore the procedure for attaching corner float markers will address both possibilities.

For Float 1 with two eyes: attach one end of a 10 m length of 14 mm Polysteel (Line 4) to the top eye of Float 1 using a clove hitch secured with 2 half hitches. Pass the free end of the line through the lay of the rope 2 times. Attach the other end of this line to Float 2 using the same knots used for Float 1 attachment.

For Float 1 with a single eye: attach one end of Line 4 to Float 2 using a clove hitch secured by 2 half hitches and pass the end of the line through the lay of the rope 2 times. Pass the other end of the line through the lay of Line 1 approximately 2 m toward the center of the backbone (horizontal portion) from the corner. Tie a clove hitch around the longline and secure with 2 half hitches, then pass the end through the lay of the buoy rope 2 times. Repeat for the other corner float marker.

Step 9

Attach one end of Line 3 to Float 2 buoy using the same procedure as described above for the corner marker buoys. Find the center point of the backbone (60 m from corners) and secure the other end of the pickup line using the same procedure described above for attaching the corner marker lines for Float 1 with one eye.

*Note: We recommend that all basic components of the longline with the exception of items #5 and #8 in the Bill of Materials be assembled prior to deployment

III. Longline deployment

Deployment will require a staging area, cranes of sufficient size to lift 6000 kg moorings and a vessel with sufficient deck space to accommodate the components of at least one longline. Ideally, you should try to use a vessel with an open stern so you can tip or slide the blocks off the deck. If you have to lift the blocks over the stern rail, avoid picking them up by the rope components of the longline as three stranded line will start to unravel if a heavy weight is suspended from it. You should try to lift the blocks by the loops with an auxiliary line or wire rope and a hook that has a quick release mechanism (e.g. pelican hook). See Figure 19 for an example of a quick release hook. As mentioned in section II, all components need to be assembled prior to deployment. Load the components so that the anchor line, embedment anchor, and Ballast 1 are closest to the stern as they will be the first components to go overboard. Make sure all lines and chain are flaked so there are no tangles and the rope and chain components go overboard smoothly. The vessel will need an accurate GPS for positioning and a good depth sounder to check the depth and geometry of the line after deployment. It is highly recommended that you pick the calmest day possible for deployment.

Deployment Steps:

1. Find the desired position for the embedment anchor using GPS coordinates
2. Put the anchor pickup line overboard and drop the embedment anchor, allowing the chain to flake off the deck
3. Slowly maneuver the vessel in the desired direction to set Ballast 1
4. Drop Ballast 1 overboard, allowing the line to pay out freely
5. Slowly feed out the backbone line as the vessel maneuvers to the second mooring block position
6. Deploy Ballast 2 as close to the desired location as possible, keeping the anchor pickup line fast to the boat
7. Pull on the Ballast 2 anchor pickup line for until the corner marker floats start to go under the surface. Stop and release the Ballast 2 pick line.
8. Slowly cruise over the longline using the depth sounder to validate the depth and alignment of the backbone line.
9. Go back to the anchor pick up line attached to the embedment anchor and slowly pull it away from Ballast 1 to make sure the chain is stretched
10. Set your positioning for the second line parallel to and a minimum of 25 m away from the first line
11. Repeat the process for the second longline

Figure 19. An example of a quick release hook. This is a DAYTON 2YPG3 quick release, for lifting with a working load limit 8,200 kg.

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IV. Operational Equipment and Materials

The recommendations in this section of the report are shaped by our understanding of the desire to adapt existing vessels to work in the mussel industry. While we agree that this is a logical and appropriate place to start, we also feel that it is important to covey our opinion that if you are planning on large scale development into the future, purpose built catamaran vessels with a high level of mechanization and automation will be critical to insure production efficiency and worker safety. Though some technologies and methods may not be relevant to open ocean production, the evolution of the inshore mussel industry in New Zealand provides a good model for industry development.

Lifting and line tending

The service vessels must be equipped to raise the backbone of the line to the surface and enable mobility along the length of the line to provide access to the vertical growing ropes. In our recommended design, the line is brought to the surface using the center pickup line. Raising the backbone with the center pick up line is best achieved using a hydraulic hauler or power block attached to the end of an articulating crane. Examples of this type of equipment are shown in Figures 20-22. If service vessels are to be used that do not have or cannot be equipped with a crane, an alternative means of raising the line is required. One such method is a hauler that is typically used for raising lobster or crab traps (Figure 23). If this equipment is used to raise the center line, another piece of equipment would be needed to set the backbone in the starwheels. Haulers and power blocks must be sized appropriately to lift the weights associated with a fully loaded longline.

Figure 20. A mussel service vessel in PEI Canada with a hydraulic hauler fixed to the end of an articulating crane 24

Figure 21. A hydraulically powered starwheel fixed to the end of a crane on a small mussel tending vessel. The starwheel also provides mobility along the line for tending the crop.

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Figure 22. A hydraulic power block on a purse seine vessel. While this equipment is used for another purpose, it may be adapted to raising the backbone if specialized equipment is not available.

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Figure 23. An example of a trap hauler that can be used to raise the center line attached to the backbone. The hauler must of sufficient power and be securely mounted for safe operation. Some other means of lifting and placing the backbone in starwheels, such as a mast and boom, would also be required.

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Mobility along the length of the backbone can be achieved with the use of starwheels. A single starwheel mounted on a crane as shown in Figure 21 can be used, however it is not recommended for use with heavy loads of market-sized mussels or in anything other than very calm sea conditions. We recommend a pair of starwheels, sturdily fixed to the rail of a vessel for greater safety and stability. The diagram shown in Figure 23 depicts the principle of using side-mounted starwheels.

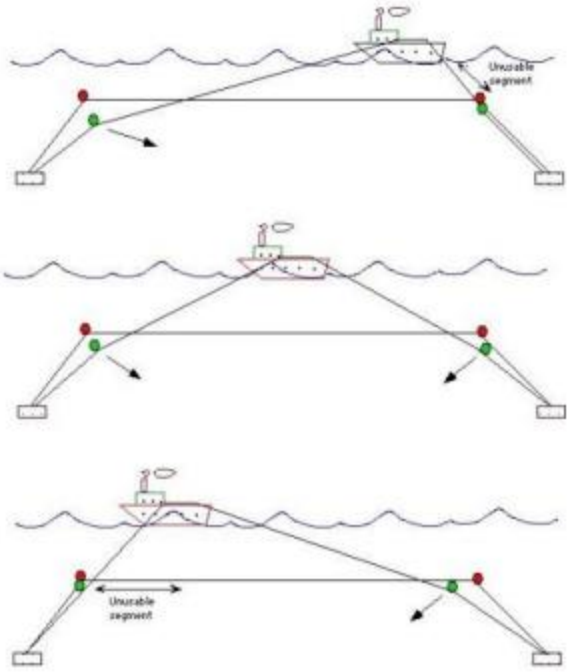

Figure 24. Schematic depiction of a vessel using starwheels for mobility along the backbone of a longline (from Bonardeli, 1996)

A starwheel pair typically consists of a hydraulically powered wheel mounted on the forward part of the vessel, and an idler on the aft portion. A crane or some other lifting mechanism is used to set the backbone into the wheels and the powered wheel is used to move the vessel along the line in both forward and aft directions. Figures 25 through 27 illustrate the design of the wheels and a backbone secured in the wheels.

Figure 25. An example of a hydraulically driven starwheel mounted on forward portion the starboard rail of a service vessel. The stainless steel bars on this and in Figure 26 deflect the growing ropes away from the wheel to prevent tangling

Figure 26. An example of an idler starwheel mounted on the aft portion of the rail of a service vessel.

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Figure 27. A photo of the backbone of a longline set into the aft (foreground) and forward starwheels (background).

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We have been unable to confirm whether starwheels are available for purchase from Spanish or European equipment distributors. We suggest that you contact companies in Spain such as Talleres Aguin S.L. A listing of other materials and equipment distributers in Spain, Europe, North America and New Zealand can be found in Section V of this report. Alternatively, our technicians have fabricated a number of starwheel systems and could provide them for you if desired.

Seeding (tubing) lines for growout

Since you have made the decision to source mussel seed from the industry in Galicia until you have better information on the timing and abundance of natural spat fall, our recommendations for the production cycle will begin with the stage at which juvenile mussels are prepared for growout. While our initial thoughts were to recommend using New Zealand style continuous seeding methods and equipment, we acknowledge that it will be in your interest to take advantage of knowledge and resources available in Spain and suggest you consider using seeding methods and growout ropes used in raft culture in Galicia. In concept, the New Zealand and Spanish methods are similar in that they use a rope core and machines that apply mussel seed that is temporarily held in place with a biodegradable cotton stocking material until the mussels attach themselves with byssal threads. The materials (ropes) and machinery however, are quite different and not interchangeable. We recommend that you contact companies such as Talleres Aguin S.L., JJ Chicolino, and ITSASKORDA, review their product lines and make a decision on which method to pursue based on your professional judgement. The two options and the associated equipment and materials are described below.

1) Single droppers of pegged Galician rope

The advantages of using this method lie primarily in the availability of the materials and equipment from companies in Spain, the long experience of use of these ropes in raft culture, and the ability to seed the ropes at slightly higher densities (1,000 seed/m) that can provide a higher yield than non-pegged continuous rope methods. It is also more appropriate for use with larger seed (> 35 mm). The disadvantage is that there is some loss of efficiency using single droppers, both with the seed attachment process and harvesting. Seeding (tubing) machines for pegged rope are manufactured in Spain by Talleres Aguin S.L. (Figures 28 and 29).

Figure 28. Model A4 seeding (tubing) machine for pegged rope manufactured by Talleres Aguin

Figure 29. A Talleres Aguin model A4 in use at a raft culture site in Galicia

2) Continuous method using unpegged rope

This method originated in New Zealand and uses a continuous length of rope that is attached to the backbone using a series of long and short loops (Figure 30). It is a very efficient production method and can be used for seed from10 mm to 30 mm shell height, seeded to densities of approximately 800 seed/m. In my experience, it does not work well with larger (>35 mm) seed. Growing ropes for this method are available in Spain from ITSASKORDA (Figure 31) and there is a distributor of New Zealand rope in the Netherlands (see Section VI for contact information). Talleres Aguin manufactures a continuous seeding machine (Figure 32), however, I have been unable to obtain any detailed information on its performance. Again, I suggest contacting the company to inquire about this equipment. The same company in the Netherlands (Bakker) that sells New Zealand rope also sells a New Zealand seeding machine (Figure 33).

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Figure 30. Photo of attachment of continuous seeding rope to the backbone of a longline

Figure 31. "Looped" growing rope for continuous seeding methods from ITSASKORDA, Spain

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Figure 32. Continuous seeding machine model A6 manufactured by Talleres Aguin

Figure 33. A New Zealand continuous seeding machine from Bakker in the Netherlands

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Post seeding buoyancy compensation

Auxiliary buoyancy (#8, Float 3 in Bill of Materials) must be periodically added to the backbone to compensate for additional mass as the mussels grow. There is no set formula for this since growth rates will vary by location, but in our experience, additional buoyancy is needed approximately every three weeks to a month, though line depth should be monitored more frequently. Depth of the backbone can be easily measured by a vessel with depth sounding equipment and should be done weekly, particularly during the initial stages of production and during times of rapid growth. Line depth should also be closely monitored if storms are forecast, since the section of the backbone farthest from the direction of waves and currents may rise to the surface if that section of line has too much buoyancy. Maintaining the line deeper in the water column in winter months is advisable.

Auxiliary buoyancy must have a working depth of at least 20 m and preferably more. As mentioned in the buoyancy discussion in Section I, our information on sizes and depth tolerance of buoys that are available in Spain is incomplete, and more research on buoyancy options is needed (please refer to the list of suppliers in Section V). Submerged buoyancy is probably the most critical component of open ocean longline systems and will make the difference between success and failure. A single buoy imploding may cause a chain reaction and the line will sink to the bottom.

Our design calls for auxiliary buoys of a 50 kg (liter) size, however, smaller buoys of 25-35 kg are also recommended for use in early stages of production to avoid distortion of line geometry.

Auxiliary buoyancy can be secured to the backbone using a variety of ropes or lines. We have had good success using a double strand of 6 mm braided nylon tire cord. We secure the ends of a 2 m length of cord with an overhand knot to form a loop, attach the knotted end of the loop to the eye of the buoy with a clove hitch and a half hitch, and then pass the buoy through the loop going over the backbone. That way buoys can be moved or removed without cutting the attachment line.

Harvesting and bulk processing

Harvesting and bulk processing requires several pieces of specialized equipment and depending on the level of processing completed at sea, can occupy a considerable amount of deck space. The steps required are:

1. Hauling and stripping the lines
2. Washing and declumping
3. Debyssing
4. Grading
5. Bulk containment
6. Packing/bagging for distribution

We recommend that you strive to complete the harvesting and processing on the vessel through step 5 if possible to avoid the high cost of shore-based processing. It is important that the equipment is arranged on deck to complete these steps sequentially,

and that an automated means of conveyance between machines is used to move mussels through these steps.

1. Hauling and stripping

Specialized equipment is required to haul and strip or pegged rope and is available from Talleres Aguin. The equipment consists of an access ramp that is placed overboard and a combined hauler and stripper as shown in Figures 34 and 35. We recommend that you contact this company as well as mussel farmers in Galicia that utilizing this equipment if you choose to use pegged Galicia rope.

Figure 34. Access ramp manufactured by Talleres Aguin. The ramp is placed overboard and the mussel ropes are pulled up the ramp by the hauler.

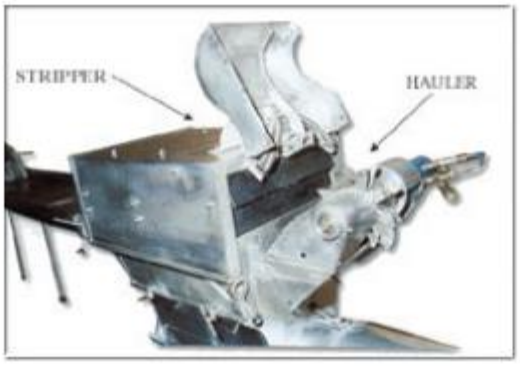

Figure 35. Hauler and stripper manufactured by Talleres Aguin.

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For continuous rope culture methods without pegs, you will also need a hauler and access ramp or conveyor belt to bring the mussel ropes on board, plus a stripper to remove the mussels. There are a number of options for performing this step with a wide range of associated costs. We suggest that you contact the companies listed in Section V that distribute harvesting equipment to select something the fits your needs and budget. An example of a low cost hauler and stripper is shown in Figures 36 and 37. This machine was design and fabricated by the University of New Hampshire and consists of an aluminum ramp and a hydraulic hauler that pulls the mussel ropes through a slot with stiff rubber flaps in the rear of the hopper that remove the mussels.

Figure 36. A mussel harvesting machine designed and built by the University of new Hampshire to harvest mussels from continuous New Zealand type growing ropes. The stripped mussels fall out of the bottom of the machine into containers or onto a conveyor belt.

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Figure 37. A rear view of the University of New Hampshire's harvesting machine showing the hydraulic hauler. The growing rope is pulled through the slot with stiff rubber flaps to the right of the hauler wheel.

An open ocean mussel grower in California, USA uses a combination of a hauler and a roller rather than an access ramp to lift the mussel ropes. The mussels are stripped directly into a declumper (Figure 38). A conveyor belt can also be substituted for the access ramp. Bakker in the Netherlands also makes a venturi system for harvesting continuous ropes. While we do not recommend this for the scale of the project, it may be worth looking into if the industry grows.

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Figure 38. A rail mounted roller used in place of an access ramp. The mussel rope is pulled through a brush stripper. The hauler and stripper are mounted directly above a declumper. The machinery is manufactured by Talleres Aguin.

2. Declumping and washing

The next step in the process is breaking up the clumps of mussels and washing off sediment and debris. There are many types of declumpers available, however, for simplicity and local availability, we recommend the rubber paddle and brush type declumper manufactured by Talleres Aguin (Figure 39). The stripped mussels can be moved into to the declumper with a conveyor belt or stripped directly into the declumper as shown above in Figure 38. Washing is accomplished by attaching a seawater hose to the end of the machine (Figure 40)

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Figure 39. Rubber paddle and brush type declumper manufactured by Talleres Aguin.

Figure 40. Photo of the Talleres Aguin declumper with seawater hose attached for washing the mussels

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3. Removing the byssus

In the USA, mussels with byssus threads are not marketable. If this is not the case in Spain, this step can be skipped. The debyssing step is accompanied by a second wash to remove any remaining silt and debris. As with declumpers, there are many manufacturers of debyssing machines, though most are large and designed for use in onshore processing facilities. Most debyssing machines use embossed stainless steel rollers to grab and snip the byssal threads as the mussels are tumbled across the machine. We recommend contacting the mussel processing equipment suppliers listed in Section V to choose a debysser of an appropriate size for on board processing. An example of a debysser is shown in Figure 41.

Figure 41. An example of a debyssing machine. This machine is available from Mulot in France.

4. Grading

Again, there are many types of size grading machines ranging from very sophisticated and expensive machines (Figure 42) to simple tables with spaced bars. For the scale of the project we recommend simple and suggest the table with adjustable spacing bars available from Talleres Aguin (Figure 43)

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Figure 42. Size grading machine manufactured by Ansco in New Zealand

Figure 43. Grading table manufactured by Talleres Aguin

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5. Bulk Containment

You may choose to place mussels directly into 5 or 10 kg mesh bags that will be ready for distribution, however, we recommend containment in 1 ton bags for ease of handling and deck storage. The bags can be easily moved around the deck using a crane and facilitate the efficiency of offloading when the harvest vessel reaches port. Mussels can be repackaged in the desired quantities at a shoreside facility. A New Zealand harvest vessel with the bulk bags on board is shown in Figure 44.

Figure 44. A catamaran harvest vessel in New Zealand with 1 ton mussel containment bags for bulk storage and handling.

V. Mussel Equipment Suppliers

Spain

Itsaskorda, Spain
Polig. Kareaga 1, Pab.2 - 48.270 Markina (Bizkaia) SPAIN
Tel. +34 94 6169408 - Fax. +34 94 6169410
itsaskorda@itsaskorda.es
Products: mooring lines, mussel rope, braided lines.

J.J. CHICOLINO, S. L.

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VILARIÑO S/N 15930 - BOIRO
A CORUÑA - SPAIN
TELF:0034 981 84 99 00
FAX: 0034 981 84 57 00
WWW.CHICOLINO.COM
E-MAIL: EXPORT@CHICOLINO.COM
Products: Mooring equipment, mussel lines, sacks, netting and wraps. Buoys and plastic pegs.

TALLERES AGUIN, S.L.
Ardia, 178
36989 O Grove (Pontevedra) - Spain
Or you can phone/fax us:
Phone Number: **(+34) 986 73 10 91**
Fax: **(+34) 986 73 13 80**
http://www.aguin.com/ingles.htm
Products: Mussel declumping, seeding and harvesting equipment

Italy

Advanced Aquaculture
Via dell'Artigianato, 39
25030 Erbusco (Bs) IT
Tel. ++39 0307731187 - Fax ++39 0307248749
info@adaq.it
P.IVA 03582850172
http://www.adaq.it/uk/page.asp?id_cat=89
Products: Surface and deep-water buoys

Netherlands
Bakker machinefabriek
Dregweg 10
4401 Yerseke
The Netherlands
+31 113 571521
info@bakker.nl
http://www.wbakker.com/index.php/en/shellfish
Products: Ropes, buoys, harvesting and processing equipment

Floatex Nederland B.V.
Floatex KSC B.V.
Baanhoek 22
3361 GK Sliedrecht
The Netherlands
Phone : +31 78 699 93 64

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Fax : +31 78 699 93 69
E-mail : info@floatex.nl
http://www.floatex.nl/Aqua/Aqua.html
Products: Floats and submersible buoys – up to 1000 kg.

Flying Dutchman Marine
PHONE: + 31 (0) 547 38 18 75
FAX: + 31 (0) 847 12 24 30
MOBILE: + 31 (0) 653 78 26 08
http://www.fdmarine.nl/?id=1
Products: Ropes, buoys, harvesting equipment

France

S.A.S. MULOT
ZA des brassons - BP 79 - 17390 La Tremblade
Tél. : 00 (33) 05 46 36 08 89 - Fax : 00 (33) 05 46 36 21 82
http://www.mulot.fr/liste-famille-moules-uk.html
Products: Farming and processing equipment

Iceland

Sæplast hf.
Sudurlandsbraut 24
108 Reykjavik
Iceland
Tel: +354 460 5000
Fax: +354 460 5051
URL: www.saeplast.com
Products: Insulated plastic boxes

Canada

Rainbow Net and Rigging
New Brunswick, CA
4 Magaguadavic Drive
St. George N.B.
Canada E5C 3H8
Tel: (506) 755-3584
Fax: (506) 755-3599
http://www.rainbownetrigging.com/categories.php?PCAT=Buoys+%26+Floats&submit=go&offset=8
Products: Surface and submersible buoys (42kg), cotton socking, fuzzy and hairy loop growing rope.

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Go Deep International
10 Watertower Road
Saint John, NB
E2M 7K2
Phone:
Toll Free: (877) 446-3337
Telephone: (506) 633-7850
Fax: (506) 633-7859
Skype: godeepinternational
http://www.godeepintl.ca/aquabuoys.html
Products: Submersible buoys to 20 m depth (30kg and 112kg), surface buoys and navigation aids. Note, price per 30kg buoy was $13.50 and you can place 700 of them into a 20' container.

New Zealand

Ansco Engineering Ltd.
79 Pascoe St, Nelson, New Zealand Phone: + 64 3 548 5161 Fax: + 64 3 546 4292 | ansco@ansco.co.nz
http://www.ansco.co.nz/product.html?sid=33
Products: seeding, harvesting and processing equipment

Marine and General Engineering Nelson Limited
Vickerman Street, Port Nelson, New Zealand
Phone +64 3 548 9138 Facsimile +64 3 546 9942
E-mail admin@marineandgeneral.co.nz
Web www.marineandgeneral.co.nz
Products: vessels, seeding, harvesting and processing equipment

Reference for figure 24, page 28.

Bonardelli J (1996) Longline Shellfish Culture in Exposed and Drift ice Environments. In: Open Ocean Aquaculture: proceedings of an International Conference. May 8-10, 1996, Portland, ME. Marie Polk editor. New Hampshire/Maine Sea Grant College Program Rpt. #UNHMP-CP-SG-96-9, pp. 235-253.

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APPENDIX A2: WEATHER AND OCEANOGRAPHIC DATA - UNH TESTS VS. SANTA BARBARA CHANNEL CONDITIONS

To compare the extreme weather conditions under the UNH test to local Santa Barbara Channel conditions near the Proposed Project, storm data was collected from nearby weather stations.
The East Channels Buoy is located about 11 miles to the south of the SBMC existing farm, at coordinates 34.248 N and 119.841 W. Data collected from 1994 to 2008 showed maximum wind speed recorded was 35 knots with max wind gusts to 40 knots. Maximum significant wave height was 5 meters with max wave period of 25 seconds. Santa Barbara had a significant El Nino event which happened in 1998 and was recorded by this buoy.
The Goleta point buoy is located about 4.5 miles to the south of SBMC, at coordinates 34.334 N and 119.804 W. Data collected from 2002 to 2013 showed max wave height was 16 ft (4.9 meters).
Current data was collected at Mohawk reef 1.3 miles Northeast of the farm at coordinates 34.394 N and 119.729 W. Data analyzed spanning March 29, 2006 to December 22, 2011 showed the average current was 0.136 m/s and the maximum current was 0.367 m/s. These were calculated from near-surface values. The maximum was calculated using the average plus 2 standard deviations.
Local recorded maximum storm events fall well within the limits described by the UNH Longline Statistic and Dynamic Analysis Model, which analyzed storm conditions of 9.5 meter waves with 17 second periods, and 140 cm/s currents. The data collected from nearby weather stations had lower maximum wave heights (5 meters), longer wave periods (25 seconds), and slower currents (36.7 cm/s). The loads experienced by SBMC culture gear would be considerably less than the loads tested in the model.

The reference for the data is:
Washburn, L. 2012. SBCLTER: Ocean: Currents and Biogeochemistry: Moored CTD and ADCP Data from Mohawk Outside Spar (MKO).
Santa Barbara Coastal Long Term Ecological Research Project. knb-lter-sbc.2007.2 (http://metacat.lternet.edu/knb/metacat/knb-lter-sbc.2007.2/lter).

APPENDIX B1: NOTES ON TAXONOMY, ECOLOGY, AND CULTURE OF NON-NATIVE MUSSEL SPECIES (M. GALLOPROVINCIALIS) IN PROJECT AREA

Culture Species – Mediterranean Mussel (Mytilus galloprovincialis)

Wild mussels present along the California coast include three main species, all of which are capable of hybridization; Mytilus galloprovincialis (*M. gallo*), Mytilus trossulus (*M. trossulus*), and Mytilus californianus (*M. californianus*). Another species, Mytilus edulis *(M. edulis)*, has historically been cited as the west coast "bay" mussel in state regulatory documents and the scientific literature, conforming with taxonomic understanding at the time. However, *M. edulis* is now recognized by taxonomists as the species found in Atlantic waters, and previous west coast references to *M. edulis* are now, by convention, referring to *M. trossulus* or *M. gallo* as the west coast "bay" mussel. (Suchanek, 1997) Due to morphological similarity, distinguishing between the three mussel species making up the so-called "M. edulis complex": *M. edulis, M. trossulus,* and *M. galloprovincialis,* is a continuing challenge for scientists who must rely on genetic testing to do so. The distinction is further complicated by these species' sympatry and readiness to hybridize when found in suitable proximity for such broadcast-spawners (so-called "hybrid zones"), and their similar ecological function (eg: congener filter feeders in the same habitats, with many of the same predators and space usages). Recent studies have confounded attempts to correllate oceanographic factors like temperature and salinity in predicting patterns of distribution and relative competitive success of *M. trossulus* and *M. gallo* in locations defining hybrid zones along the California coast (Babry & Somero 2006; Hilbish *et al.*, 2010).

Although *M. gallo* is not originally native to California, there is abundant evidence that it is well-established across southern California and has been present in the ecosystem since the early 1900's. Several studies suggest that the native bay mussel, *M. trossulus* was displaced by *M. gallo* in the early part of the twentieth century. *M. gallo* is now the dominant of the two bay mussels (*galloprovincialis* vs. *trossulus*) across the entire southern half of California. The distribution of *M. gallo* is restricted to more protected and sheltered habitats, as it is not tolerant of wave exposure. Although *M. gallo* can be found in rocky intertidal habitats, the California mussel, *M. californianus* dominates most of the rocky intertidal habitat across the entire coast of California and is well documented to be the competitive dominant in rocky intertidal ecosystems. Not only is *M. gallo* not tolerant of wave exposure, but it is also quickly consumed by a variety of predators and preferred over *M. californianus,* likely due to its weaker shell. (Blanchette, pers. comm., 2014)

APPENDIX C: QUALITY STANDARD CERTIFICATE FOR WHOLE FOODS MARKET

Certified Responsibly Farmed

CERTIFICATE NO:
MRAG-1415

CERTIFICATE ISSUE DATE:
19 DECEMBER 2014

CERTIFICATE EXPIRY DATE:
30 SEPTEMBER 2017

MRAG Americas, INC.
10051 5th St. N, Suite 105
St. Petersburg, FL 33702
Tel: 727-563-9070
Fax: 727-563-0207
www.mragamericas.com

This Certifies that

Santa Barbara Mariculture Co.
4365 Cuna Drive
Santa Barbara, CA 93110

Meets the Whole Foods Market Quality Standards for Farmed Bivalve Molluscs

Certified Farm Site Details

Species: Pacific Oysters (*Crassostrea gigas*)
Mediterranean Mussels (*Mytilus galloprovincialis*)

Authorizations: One lease site off Santa Barbara

Signature Robert J Trumble

MRAG Americas

This schedule is the property of MRAG Americas, and its use is subject to conformance with the standards of the Whole Foods Market.

APPENDIX D: AGENCIES INVOLVED IN PERMITTING PROCESS

California Department of Fish and Wildlife

- Aquaculture Registration

California Fish and Game Commission

- State Water Bottom Lease

California Coastal Commission

- Coastal Development Permit

United States Army Corps of Engineers

- Nationwide 48 Permit or Letter of Permission or Standard Individual Permit

California Department of Public Health

- Shellfish Growing Area Certificate
- Shellfish Handling & Marketing Certificate

United State Coast Guard

- Private Aides to Navigation permit

State Lands Commission

- Confirmation to Fish and Game Commission that lease area is not otherwise encumbered, nor privately owned, so as not to preclude its use for the proposed culture.

Central Coast Regional Water Quality Board

National Oceanographic and Atmospheric Administration

United States Fish & Wildlife Service

Local Tribal Authorities

APPENDIX E: PROPOSED PROJECT ESTIMATED EMISSIONS

Table 4.4-1 PROPOSED PROJECT ESTIMATED DAILY MAXIMUM AND ANNUAL TOTAL EMISSIONS

	NOx	CO	HC	PM10	SO2
Daily Max (lb/day) on During Farming Operations	11.5	142.1	2.1	0.4	0.6
-from Outboard Motors	10.3	1.5	0.3	0.4	0.6
-from Auxiliary Motors	1.2	140.6	1.8	0.0	0.0
Daily Max (lb/day) on During Installation	13.4	2.1	0.3	0.4	0.8
-from Outboard Motors	10.3	1.5	0.3	0.3	0.6
-from Auxiliary Motors	3.1	0.6	0.1	0.1	0.2
Daily Threshold (lb/day)	55.0	N/A	55.0	N/A	N/A
Days threshold exceeded (#)	**0**	**0**	**0**	**0**	**0**
Annual total (ton/year), Year of Installation	1.7	18.2	0.3	0.1	0.09
Annual Total (ton/year), Normal Operations Year	**1.5**	**18.1**	**0.3**	**0.1**	**0.1**
Annual threshold (ton/yr)	N/A	N/A	N/A	N/A	N/A

Use Calculations

	Existing Activity		Proposed Project Activity	
	Outboard Engines	Auxiliary Engines	Outboard Engines	Auxiliary Engines
Equipment Quantity	2	1	4	2
Farming Operations: Hours/Day	2	6	2	6
Farming Operations: Days/Year	255	255	260	260
Equipment Installation: Hours/Day	n/a	n/a	2	8
Equipment Installation: Days/Year	n/a	n/a	30	30

Equipment Data and Conversions

KW of Outboard Engine	112	151
Horse Power of Aux Engines	13	
Grams/Lbs	453.592	
Pounds/ton	2000	
Load Factor for Outboard Engines	0.52	

Notes

1. Emission Factors Source: NONROAD2008 Emission Inventory Model, US Environmental Protection Agency (EPA), 2008;

Exhaust and Crankcase Emission Factors for nonroad Engine Modeling Compression Ignition, NR-010f, July 2010

2. Outboard Engines are Dual F150 TXR Yamaha 150HP Outboard Engines

3. Auxiliary Engines are 13 HP Honda GPX 390CC

4. Expansion plan will include an additional boat to assist with harvesting and maintenance activities.

5. Travel time to farm is approximately 45 minutes.

6. Outboard engines are only running during travel time to farm. Onsite engine activity is limited to auxiliary engines.

7. Total emissions/day formula = EMMISION FACTOR X HP(OR KW) X LOAD X HOURS PER DAY X ENGINES PER DAY

8. Assume only one trip to farm per day by any boat.

9. Reference for Load factor: http://www.arb.ca.gov/msei/chc-appendix-b-emission-estimates-ver02-27-2012.pdf

APPENDIX F: PHYTOPLANKTON POPULATION IMPACT STATEMENT AND CALCULATION

Statement, Analysis and Calculations by Dave Siegel, Bob Miller and Tom Bell - April 5, 2013
Contact:
David A. Siegel, PhD
Director, Earth Research Institute, and
Professor of Marine Science, Department of Geography
University of California, Santa Barbara

A. STATEMENT

Subject: Statement concerning impacts of SB Mariculture expansion on plankton levels in the Santa Barbara Channel

Dear Bernard,

Last April, you asked me what the impacts of the expansion of your mariculture facility could be to phytoplankton in the Santa Barbara Channel. This kind of calculation is something I am well versed at as I have long been assessing the impacts of kelp forests on the pelagic ecology of the Channel as a coPI of the Santa Barbara Coastal Long Term Ecological Research site (http://sbc.lternet.edu).

Working with Dr. Bob Miller of the UCSB Marine Science Institute, we estimated what the maximum impacts of the mussel farm could be to the standing stock of phytoplankton biomass flowing past your facility. We assumed that your mussel farm is fully stocked and that the mussels are operating at their maximum clearance rates and ingestion efficiencies to calculate the time scale which sea water will flow through the mussels. We then compared that to an estimate the maximum residence time for water to flow through the farm. We found that these two time scales differ by more than two orders of magnitude and that the mussel farm will have an inconsequential impact on phytoplankton (and for that matter zooplankton populations) in the Channel. Taking it one step further, we calculated the maximum expected reduction in chlorophyll concentrations of water flowing through your facility. We found approximately a 0.06% reduction which corresponds to 0.0012 mg /m3 reduction in chlorophyll concentrations from a baseline value of 2 mg /m3 (a typical value for the Santa Barbara Channel). This decrease is unmeasurable by any techniques I know of. A copy of this calculation is attached.

In summary, I cannot see how your proposed expansion in isolation would have any measurable impact on the plankton distributions of the Santa Barbara Channel. When you first told me about it I thought you were joking. Of course if your proposed expansion were maybe 1000 times larger there would likely be actual impacts that are measurable and need to be considered. But this action in isolation should result in no measurable changes to the plankton communities of the Santa Barbara Channel.

-David Siegel

B. CALCULATIONS

Estimating the Maximum Effect of a Mussel Farm on Phytoplankton:

Use estimates of maximum clearance rates of mussels, scale up to show how much water passes through mussels in the farm and using minimum flow rates assess how much phytoplankton is removed by the mussel farm. This will be a MAXIMUM estimate of the effects of a mussel farm on phytoplankton. We use the maximum clearance rate for mussels in the mariculture study of Brigolin *et al.*, (2009). From their table 2, they use a maximum clearance rate (CR_max) of 107 liters / (day g DW). Source info for the CR_max estimates are in Brigolin *et al.*, (2009). Table 2 also provide various conversion ratios for wet to dry weight (17.4; which includes the shell weight). From the planning document, SB Mariculture wants to grow a maximum of 360,000 pounds of mussels at a time. This is equivalent to 163,000 kg or 9400 kg DW (using the conversion rate

above). The maximum volume of seawater flowing through mussels is 1.0e9 liters/day or ~1e6 m3 / day (= 9400 kg DW * 107 liters/(day g DW)). This assumes the mussels are filtering seawater at their maximum rate. The turnover time (how long it takes the entire volume seawater at the farm to go through mussels) is equal to...Turnover time thru mussels = volume_farm / farm_clearance_rate Volume_farm = Area(=72 acres) * Depth (=27m) = 72 acre * (4047 m2

The turnover time is therefore equal to...= volume_farm / farm_clearance_rate = (7.9e6 m3/acre) * 27 m = 7.9e6 m3)/(1e6m3/day) = 8 days

So how does this 8 day turnover time compare with how long seawater is resident in the farm itself? To do this we will use a MINIMUM velocity scale (10 cm/s) to assess MAXIMUM residence time of water in the farm. The minimum flow rate estimate comes from many years of measurements off Arroyo Burro by the SBC LTER. It is the ratio of the two time scales that is important here.

Max_res_time = Farm_size(sqrt(72acre)) / Min_Speed(10 cm/s ~10 km/d) = 0.5 km / 10 km/d = 0.05 day = 1.2 hour

Note that the time scales differ by many orders of magnitude (1.2 h & 8 d) and the mussels will not clear much of the water passing through the farm. That said, we can continue... The phytoplankton concentration entering the farm will range from 1 to 20 mgChl/m3 average from the Plumes and Blooms program). The total amount of chlorophyll in farm = Chl_conc * Volume_farm = (2 mg/m3) * (7.9e6 m3).Over the 0.05 days of transit of a water parcel through the farm, the mussels will have cleared 5000 m3 of seawater based upon the maximum total farm clearance rate calculation above.

Assuming 100% efficiency for removing phytoplankton during ingestion and a uniform water column, the total amount of pigment ingested by the mussels is...Total_phyto_lost = (2 mg/m3). So the normalized change in chlorophyll concentration is...Fraction_phyto_removed = Total_phyto_lost / Total_phyto_present= (0.01 kgChl) / (16 kg Chl) = 0.06%.

There is no way this is even MEASURABLE. You'd have to be able to. For now lets call it 2 mg/m3 for now (near the long term) = 16 kg Chl) * 5000 m3 = 0.01 kg Chl. measure the difference between 1.9988 mgChl/m3 and 2.0000 mgChl/m3, which is very much impossible – even if you could sample the volume appropriately (which you cannot). This is obviously a bad idea.

APPENDIX G: BENTHIC SAMPLING DATA

Santa Barbara Mariculture Benthic Sampling Data							
Drop #	**Date**	**Time**	**Depth (ft)**	**Station ID**	**Latitude (N)**	**Longitude (W)**	**Comments**
1	7/9/2014	9:35:00 AM	90	0709_SBM_1	34 deg 23.612	119 deg 45.283	off line #4 (middle)
2	7/9/2014	10:01:00 AM	83	0709_SBM_2	34 deg 23.679	119 deg 45.284	off line #1 (west end)
3	7/9/2014	10:21:00 AM	93	0709_SBM_3	34 deg 23.617	119 deg 45.467	off line #12 (middle); collected a midshipman
4	7/9/2014	10:40:00 AM	89	0709_SBM_4	34 deg 23.684	119 deg 45.412	off line #8 (east end)
5	7/9/2014	10:58:00 AM	89	0709_SBM_5	34 deg 23.702	119 deg 45.681	unfarmed
6	7/9/2014	11:18:00 AM	76	0709_SBM_6	35 deg 23.702	119 deg 45.696	unfarmed
7	7/9/2014	11:32:00 AM	85	0709_SBM_7	36 deg 23.702	119 deg 45.797	unfarmed
8	7/9/2014	11:52:00 AM	80	0709_SBM_8	37 deg 23.702	119 deg 45.921	unfarmed

APPENDIX H: BENTHIC INFAUNAL TAXONOMY DATA

Santa Barbara Mariculture
SPECIES DATA
For ECORP
By Marine Taxonomic Services
July, 2014

	Station							
	SMB-01	**SMB-02**	**SMB-03**	**SMB-04**	**SMB-05**	**SMB-06**	**SMB-07**	**SMB-08**
ANNELIDA								
Ampharete acutifrons	1							
Ampharete labrops						5		1
Ampharteidae	1					2		1
Arabella sp indet					2			
Aricidea sp indet			1	2				
Artacama coniferi					1			
Bipalponephtys cornuta					2	2		
Boccardia pugettensis					1			1
Brada sp indet						1		
Capitella capitata Complex	1							
Chloe pinnata	1	1	2			1		1
Cirratulidae	5		10	1	11	2	2	
Cossura candida	2	15	7	4	8	2	2	2
Diopatra ornata	3		1					2
Diopatra sp indet		1		1		2		
Dipolydora caulleryi				1	1			
Dipolydora socialis							1	
Dorvillea sp.	1							
Drilonereis longa	1							
Drilonereis sp Indet					2			
Eranno bicirrata	1	2						1
Euclymeninae			1					
Eulalia californiensis						1		
Eumida longicornuta	2	1				1		
Eusyllis sp	1	1						

Exogone sp indet		1						
Glycera macrobranchiata	4	1	1	1	2			
Glycera sp indet	2	2						2
Glycinde armigera			1					
Glycinde picta	1							
Heterospio catalinensis						1		
Laonice cirrata		1	1			1	1	
Lepidonotus spiculus						1		
Levinsenia gracilis	2	2			2			
Lumbrineridae		1			2			
Lysippe sp		4	1		1	2		2
Magelona sp indet		2						
Maldane sarsi	6	8	4	4	5	4	1	4
Marphysia sp indet	8	26	3	6	2	10	9	7
Megalomma pigmenta		1		1				
Melinna oculata	2			1				
Metasychis disparadentatus	4	2				1		1
Mooreonuphis nebulosa						1		
Naineris sp indet				2				
Neosabellaria cmentarium	6	1	5	1	5	1		3
Nephtys caecoides	1				1	1	1	
Nereis procera					1			
Nereis sp A				1	1			
Notomastus hemipodus								1
Notomastus linatus						1		1
Odontosyllis phosphorea							1	
Oligochaeta	2	4	1		2	1		1
Paraexogone breviseta	1		1	2			1	1
Parandalia fauveli	2	2				1		1
Paraonidae	6	7	5	5	4	4	3	5
Paraprionospio alata	4	3						
Pectinaria granulata	13	7		3	2	11	3	3
Pherusa neopapillata	1		1		2			
Pholoides asperus					1			
Phyllodoce groenlandica	1							1

Phyllodoce pettiboneae	5	12	1	1	3		1	
Phyllodoce sp Indet				2				
Phyllodocidae	1					1		
Pilargis maculata	1	2						
Pista brevibranchiata	1						1	
Pista moorei				2				
Pista sp indet		1	1	1				
Platynereis bicanaliculata				1				1
Podarkeopsis glabrus					1	4		
Poecilochaetus sp indet			1		2			
Polycirrus sp indet	2		2	4	3		1	1
Polynoidae	9	7	5	2	3	4		2
Rhodine bitorquata		1						
Sabellidae	1		3		1	1		
Scoloplos armiger Complex		3			1			
Sphaerosyllis ranunculus	5	1	1		3	2	2	2
Spiochaetopterus pottsi			1					3
Spionidae		1						
Spiophanes bombyx	2	5	10	3	4	4	1	2
Spiophanes sp Indet	5	2	4	3	3	1	1	2
Sternaspis affinis	2		6	2	2	7	4	8
Sthenalais fusca	1	2				1		
Sthenelanella uniformis			8	4	4	1		
Streblosoma crassibranchis	3		4	4	4		2	1
Syllidae	9	1	1	4		2		2
Terebellidae			3	1	1			
Typosyllis hyperioni			1					
Typosyllis sp indet		2						
ARTHROPODA								
Ampelisca agassizi	4							
Ampelisca brevisimulata	4	1	6	3	3		2	5
Ampelisca lobata		1						
Ampelisca sp		5		4				
Ampelisiphotis podophalma		8		8	11	7	11	12

Amphideutopus oculatus	4	4	4	13	6		4	3
Aoridae sp						1		
Argissidae sp.		1		1			1	
Aruga oculata	1							
Byblis millsi			1	1				
Caprella incisa	1							
Caprella sp		1			1			
Cirripedia sp		5						
Cylindroleberidinae sp	1	1	1			1	3	
Decapoda sp juv							1	1
Diastylis californica		5			1			2
Diastylis sp.					1			
Edotia sp	3	2		2				2
Euphilomedes carcharondonta	20	25	14	8	17	29		61
Forxiphalus golfensis	9	2		4	2	3		
Foxiphalus obtusidens	2	23	5	9	2	7	2	5
Gammaropsis sp.	2			3		20	4	1
Gnathia crenulatifrons		1			2		3	8
Gnathia sp		3	1		2		5	2
Haliophasma geninatum	3	2	3	1	2		1	
Heterophoxus oculatus	3	4	2	2	2			
Idaecturus sp.		6	1	4				1
Isaeidae sp.						2		
Ischyroceridae sp						1		
Leptochelia sp cf savignnyi	3	14	1	5	3		3	2
Listriella sp	1	1	2					2
Nebalia sp		1						2
Ostracoda sp.			1					
Photis brevipes				3		3		
Photis cf californica		3						3
Photis macrotica	1						1	
Photis sp -	4	18	2	23	1	9	4	11
Rhepoxynius bicuspidatus					2			
Rhepoxynius bicuspidatus								
Rhepoxynius menziesi						1		

Rhepoxynius stenodes	1	3	1	1		1	2	3
Sarsiellidae sp.	1	2		1			1	2
Stenothoidae sp.	1			1				
Westwoodilla tone		2		1	1	1	3	2
MOLLUSCS								
Axinopsida serricata			1		1			
Aeolidiacea sp.				1				
Bivalvia sp		1		1	1			
Boreotrophon sp								
Calyptraea fastigiata								
Chaetodermatidae sp		1	1	1				
Clinocardium sp juv								
Compsomyax subdiaphana	4					1		
Crepidula sp				2		1	6	1
Cyclostromella sp.							1	
Cylichna attonsa		2	2	2	3			1
Ensis myrae								
Epitonium spp.	2							
Eulima raymondi	1						1	
Gadila aberrans	4			1			2	
Kurtzia arteaga				1				
Lasaeidae sp juv								
Lepidizona sp								
Leptochiton sp								
Lucinoma annulatum	2							
Macoma sp juv					2			
Macoma nasuta		1						
Macoma yoldiformis	3	6	1	7	4	3	4	1
Megasurcula spp.		1	1					
Melanella montereyensis								
Melanochlamys diomedea								
Modiolus neglectus								
Modiolus sp								
Mya arenaria								

Mytilidae spp. Juv.	1							
Naticidae sp juv				1				
Neaeromya rugifera								
Nuculana taphria	4	3	6	5	2			2
Odostomia sp	1	1	1			1		1
Onchidorididae sp								
Ophiodermella inermis								
Parvilucina tenuisculpta	6	3	8	7	1	2	1	4
Polygireulima rutila	1	1				1		
Pulsellum salishorum	3	4	2	1		4	5	3
Rictaxis punctocaelatus								
Rochefortia tumida	1	1	7	8	12	1	1	
Scaphopoda sp								
Solamen columbianum	1		1					
Solen rostriformis			1	1				2
Solen spp. Juv.		1						
Tellina idae?	1	2				1		
Tellina modesta	2	4			2	4	3	5
Thracia trapezoides	6	6	2	9	1	3	2	2
Thyasira flexuosa								
Turbonilla spp.	1		1			1		
Volvulella californica		1			1			
MISCELLANEOUS								
Amphiodia sp	9	4	6	1	4		1	7
Amphiodia urtica		2	1					1
Amphioplus sp								2
Amphioplus strongyloplax			1	1				
Amphipholis sp				2				
Amphiporus sp	1	2	1	1				1
Amphiuridae	5	2	2			5	2	
Astropecten armatus	8	8	5		2	3	1	1
Athenaria								1
Carinoma mutabilis								1
Cerebratulus sp	3			1				

Cerianthidae	1		1					1
Chiridota sp				1	1			
Echinoidea	1			1	1			
Enteropneusta					1	1		
Glottidia albida	2	2	7	9	1	7	7	9
Hoplonemertea					1			
Leptoplanidae		1					1	
Lineidae			2					
Metridium sp				1				
Micrura sp	2	3	1	3		1		
Molgula pugettiensis	2	1						1
Molpadia intermedia							1	
Nematoda		2						
Ophiopteris papillosa				1				
Ophiothhrix spiculata						1		
Ophiura sp						1		
Paranemertes californica	5	3	1	1		2		2
Phoronis sp			2	1				
Schizocardium sp	1	2	3		1			
Tetrastemma nigrifrons		1	1	1		2		
Tetrastemma sp			2					
Thenaria	1							
Thysanocardia nigra			1					
Tubulanus polymorphus	2	1	5	3			3	
Tubulanus sp	4	4	5	1	3	1	1	1

APPENDIX I: SBMC LEASE INSPECTIONS AND BOTTOM SURVEYS

Field Note: Inspection of State Water Bottom Lease M-653-02 in Santa Barbara County by CDFW Marine Region staff.

19 October 2015

Andrew Weltz
Aquaculture and Bay Management Project (ABMP)
Marine Region, California Department of Fish and Wildlife (CDFW)
(photos marked with * taken by Derek Stein)

Inspection of Lease M-653-02

On October 6th, 2015, I worked with local Department Marine Invertebrate Management Staff (Derek Stein, Julia Coates, environmental scientists, and Jorge Gross, volunteer) to inspect State Water Bottom Lease M-653-02 in order to help inform a Staff Recommendation related to Santa Barbara Mariculture's proposed renewal of said lease. Staff performed a total of 3 dives in between 80 and 90 feet of seawater to inspect the condition of the infrastructure associated with the operation and that of the water bottom over which the infrastructure occurs (Fig. 1).

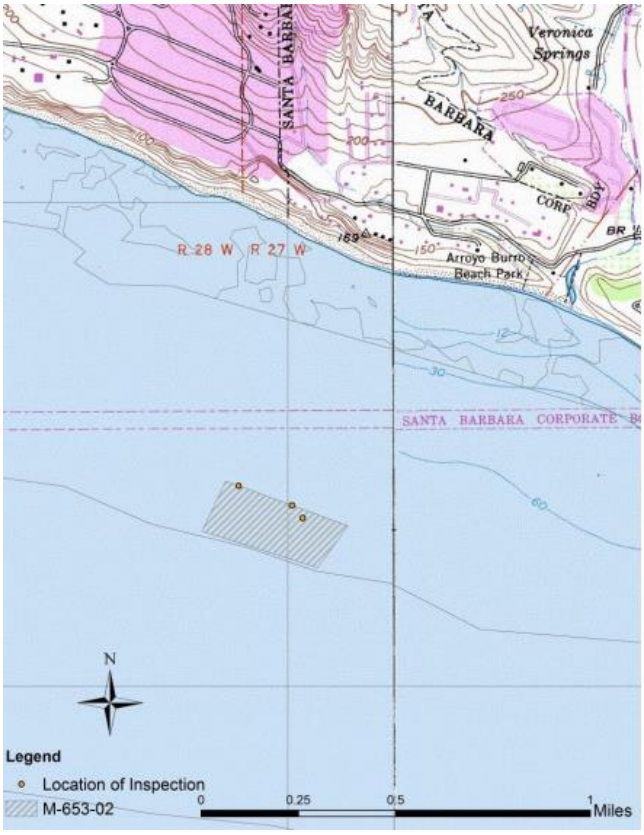


Figure 1. Location of Santa Barbara Mariculture lease (M-653-02; roughly 0.5 miles offshore of the City of Santa Barbara) and locations of inspection dives performed on site.

Figure 2.
Characteristic fouling observed on lines and floats.

The Santa Barbara Mariculture lease's infrastructure consists of a series of lines, running parallel across the lease area from the southeast to the northwest, anchored on the ends and held up by floats along their lengths. Some of these floats are larger, with sufficient buoyancy to maintain a position at the surface, while others are smaller and float roughly 10 feet below the surface. Lines and floats both are covered by the invertebrate fouling organisms typically found on artificial hard substrate in marine environments. Prominently among those observed are anemones (*Metridium senile*), and even giant kelp (*Macrocystis pyrifera*) is able to utilize the hard substrate provided by some of the smaller floats (Fig 2).

Despite the fouling, however, lines and floats seemed to be maintained and in good condition. Staff were able to observe two types of anchors being employed on the bottom: a cement block-type anchor and a sled-type anchor (Figs. 3 and 4).

Figure 3. Block-type anchor with small float and market squid eggs attached

Staff observed two methods of mussel (*Mytilus* sp.) culture along these anchored and floating lines. In one method, mussels are grown on weighted 'strings', which are attached to the long floating lines and held intermittently by small bags of rocks which serve as anchors, the overall arrangement approximating a shape somewhere in between a sin and a square wave (Figs. 5 and 6).

Figure 4. Sled-type anchor, observed in vicinity of the northwest corner of M-653-02.

*Figure 5. Strings of mussels on floating line. **

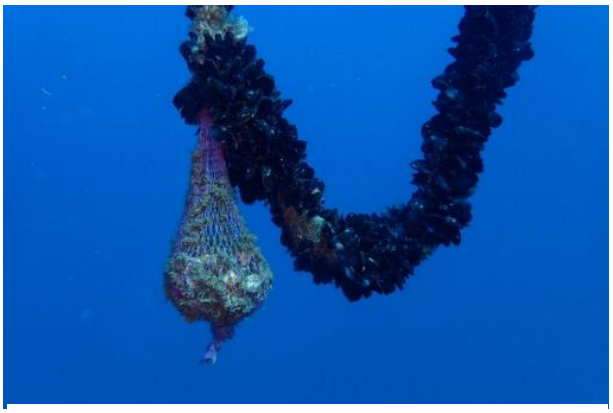


*Figure 6. 'Weight' on mussel string. **

These strings hang below the surface at a depth between 15 and 25 feet. Additionally, mussels were observed being grown in stacked 'baskets', also hanging from the long floating lines in roughly 10 feet of water (Figure 7).

Figure 7. Stacked basket of mussels hanging on floating line.

The water bottom over which lease M-653-02 occurs is sandy and mostly devoid of prominent features. Staff accessed the bottom by making dives to a maximum depth of 86 feet on the shoreward (shallow) side of the lease, although the seaward (deeper) side of the lease extends into over 90 feet of water. No natural hard substrate was observed. Benthic species encountered were typical of soft/sandy nearshore substrate in southern California, and include Kellet's whelk (*Kelletia kelletii*), sea pen (*Stylatula elongata*), tube-dwelling anemone (*Pachycerianthus finmbriatus*), California lizardfish (*Synodus lucioceps*) and various species of sea star (class Asteroidea). Staff also observed market squid (*Doryteuthis opalescens*) in the form of egg cases that had been laid on an anchor (Fig. 3) Some debris were observed on the bottom that likely found their origin in the aquaculture operation, the extent of which amounted to a small amount of line (Fig. 8) and a clump of large mussel shells (Fig. 9). The size of these shells is much larger than those that were observed under active culture on the strings described above, and likely originated from the infrastructure's anchor lines, on which clumps of large mussels were observed growing in a similar fashion.

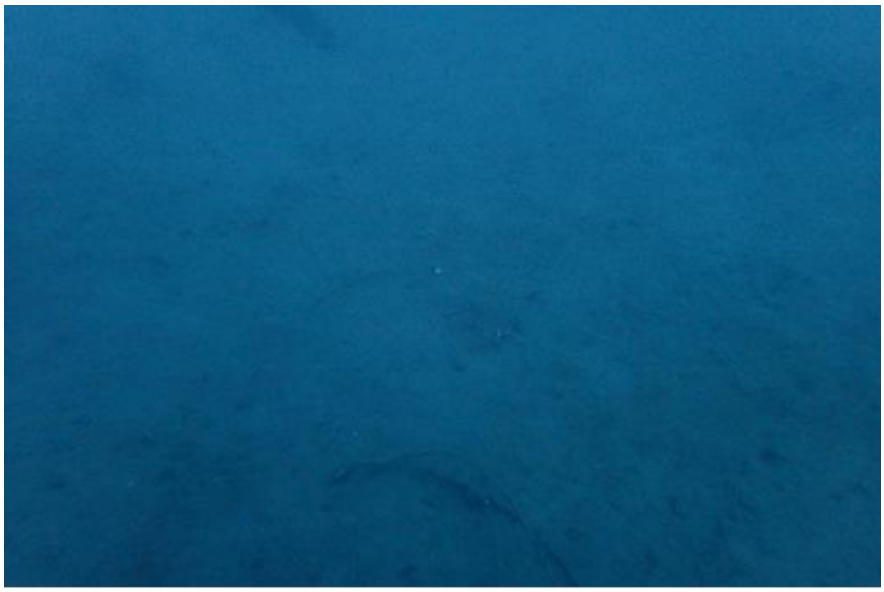


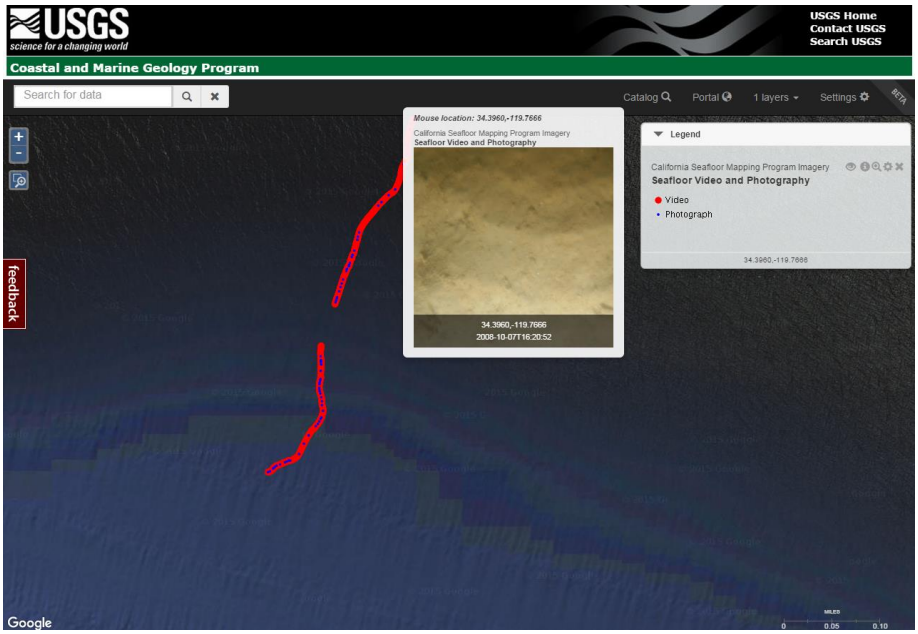
Figure 8. Sandy bottom typical of the site, with a small amount of line visible in the bottom middle of the image.

Figure 9. A clump of large, empty mussel shells found near the northwestern edge of the lease infrastructure. Dive mask included to indicate scale.

USGS California Seafloor Mapping Program video and photography portal: Map Portal

http://www.axiomdatascience.com/maps/usgs.php#map?lg=5b9152b0-673d-11e2-b541-00219bfe5678&p=proj3857&b=google_hybrid&z=15&ll=34.39394%2C-119.76716

- Video is available for water bottom directly east of the current and proposed lease sites.



SB Mariculture Anchor Survey Video, June 2013
https://youtu.be/ngcxQFSJw78

APPENDIX J: EFH SPECIES POTENTIALLY PRESENT WITHIN THE SBMC OFFSHORE SHELLFISH FARM PROJECT AREA.

Common Name	Scientific Name	FMP
Flatfishes		
Arrowtooth flounder	*Atheresthes stomias*	G
Butter sole	*Isopsetta isolepis*	G
Curlfin sole	*Pleuronichthys decurrens*	G
Dover sole	*Microstomus pacificus*	G
English sole	*Parophrys vetulus*	G
Flathead sole	*Hippoglossoides elassodon*	G
Pacific sanddab	*Citharichthys sordidus*	G
Petrale sole	*Eopsetta jordani*	G
Rex sole	*Glyptocephalus zachirus*	G
Rock sole	*Lepidopsetta bilineata*)	G
Sand sole	*Psettichthys melanostictus*	G
Starry flounder	*Platichthys stellatus*	G
Rockfishes		
Aurora rockfish	*Sebastes aurora*	G
Bank rockfish	*Sebastes rufus*	G
Black rockfish	*Sebastes melanops*	G
Black-and-yellow rockfish	*Sebastes. chrysomelas*	G
Blackgill rockfish	*Sebastes melanostomus*	G
Blue rockfish	*Sebastes mystinus*	G
Bocaccio	*Sebastes paucispinis*	G
Bronzespotted rockfish	*Sebastes gilli*	G
Brown rockfish	*Sebastes auriculatus*	G
Calico rockfish	*Sebastes dallii*	G
Canary rockfish	*Sebastes pinniger*	G
Chameleon rockfish	*Sebastes phillipei*	G
Chilipepper	*Sebastes goodie*	G
China rockfish	*Sebastes nebulous*	G
Copper rockfish	*Sebastes caurinus*	G
Cowcod	*Sebastes levis*	G
Darkblotched rockfish	*Sebastes crameri*	G
Dusky rockfish	*Sebastes ciliates*	G
Dwarf-red rockfish	*Sebastes rufinanus*	G
Flag rockfish	*Sebastes rubrivinctus*	G
Freckled rockfish	*Sebastes lentiginosus*	G
Gopher rockfish	*Sebastes carnatus*	G
Grass rockfish	*Sebastes rastrelliger*	G
Greenblotched rockfish	*Sebastes rosenblatti*	G
Greenspotted rockfish	*Sebastes chlorostictus*	G
Squarespot rockfish	*Sebastes hopkinsi*	G
Starry rockfish	*Sebastes constellatus*	G
Stripetail rockfish	*Sebastes saxicola*	G
Swordspine rockfish	*Sebastes ensifer*	G

Common Name	Scientific Name	FMP
Tiger rockfish	*Sebastes nigrocinctus*	G
Treefish	*Sebastes serriceps*	G
Vermillion rockfish	*Sebastes miniatus*	G
Widow rockfish	*Sebastes entomelas*	G
Yelloweye rockfish	*Sebastes ruberrimus*	G
Yellowmouth rockfish	*Sebastes reedi*	G
Yellowtail rockfish	*Sebastes flavidus*	G
Scorpionfish		
California scorpionfish	*Scorpaena guttatta*	G
Thornyheads		
Longspine thornyhead	*Sebastolobus altivelis*	G
Shortspine thornyhead	*Sebastolobus alascanus*	G
Roundfishes		
Cabezon	*Scorpaenichthvs marmoratus*	G
Kelp greenling	*Hexagrammos decagrammus*	G
Lingcod	*Opiodon elongatus*	G
Pacific cod	*Gadus macrocephalus*	G
Pacific hake	*Merluccius productus*	G
Sablefish	*Anoplopoma fimbria*	G
Skates, Sharks and Chimeras		
Big skate	*Raja binoculata*	G
California skate	*Raja inornata*	G
Finescale codling	*Antimora microlepis*	G
Leopard shark	*Triakis semifasciata*	G
Longnose skate	*Raja rhina*	G
Pacific rattail	*Coryphaenoides acrolepis*	G
Soupfin shark	*Galeorhinus zyopterus*	G
Spiny dogfish	*Squalus acanthias*	G
Spotted ratfish	*Hydrolagus colliei*	G
Coastal Pelagics		
Jack mackerel	*Traxchurus symmetricus*	CPS
Krill	Euphausiids	CPS
Pacific mackerel	*Scomber japonicus*	CPS
Pacific sardine	*Sardinops sagax*	CPS
Market squid	*Loligo opalescens*	CPS
Northern anchovy	*Engraulis mordax*	CPS
Sharks		
Bigeye thresher shark	*Alopias superciliosus*	HMS
Blue shark	*Prionace glauca*	HMS
Common thresher shark	*Alopias vulpinus*	HMS
Pelagic thresher shark	*Alopias pelagicus*	HMS
Shortfin mako shark	*Isurus oxyrinchus*	HMS
Tunas		
Albacore tuna	*Thunnus alalunga*	HMS
Bigeye tuna	*Thunnus obesus*	HMS
Northern bluefin tuna	*Thunnus orientalis*	HMS
Skipjack tuna	*Katsuwonus pelamis*	HMS
Yellowfin tuna	*Thunnus albacares*	HMS
Billfishes		

Common Name	**Scientific Name**	**FMP**
Striped marlin	*Tetrapturus audax*	HMS
Broadbill swordfish	*Xiphias gladius*	HMS
Dolphinfish		
Dorado (mahi mahi)	Coryphaena hippurus	HMS

G= Groundfish FMP (PFMC 2014);
CPS = Coastal Pelagic Species (PFMC 2011a);
HMS = Highly Migratory Species (PFMC 2011b)

APPENDIX K: SANTA BARBARA MARICULTURE SPILL PREVENTION AND RESPONSE PLAN

SBMC operates at sea, aboard a small vessel equipped for the unique work of an offshore mussel farm. Its Spill Prevention and Response Plan includes measures and practices to reduce the likelihood of problems arising in the first place.

The boat has a 130-gallon gasoline fuel tank made of ¼ -inch aluminum and built into the hull of the boat. The fuel tank is sealed with a waterproof cap to prevent liquid from entering or leaving the tank and the vent is screened. The boat is refueled at the Santa Barbara harbor fuel dock with absorbent pads in place to catch any incidental spills.

The boat also carries an 8-gallon hydraulic tank made of aluminum bolted to the boat hull filled with vegetable based hydraulic oil approved for use in food processing equipment, and is non-toxic and biodegradable. The tank is sealed with a waterproof cap to prevent fluid from entering or escaping.

A 13-hp auxillary honda engine is bolted to the boat hull and carries a 1.8 gallon steel tank which is sealed with a waterproof cap. The fuel used to refill this auxillary engine is held in a 5 gallon spill-proof, Department of Transportation (DOT)-approved plastic container. The engine is shut down and an absorbent pad is used to catch any incidental spills during this process.

a) Procedures and response equipment, that prevent potential spills and protect marine and shoreline resources in the event of a spill shall be updated continually and adhered to by SBMC personnel.

b) Spill prevention and response equipment shall be kept on board project vessels at all times. Absorbent pads will be used to quickly mop up any incidental spills. Absorbent pads are stored with the spare lubricants and are used during all refueling of equipment.

c) Spare lubricants such as grease and oil are held in a sealed aluminum stowage compartment. The spare lubricants stored on board shall only be of quantities necessary for short-term operation and maintenance so as to minimize the amounts at risk at any given time.

d) Emergency response and notification procedures, including a list of contacts to call in the event of a spill shall be kept at hand, on board project vessels at all times. In case of an oil or fuel spill where absorbent materials cannot accomplish the task, the Santa Barbara Harbor patrol will be hailed on Channel 12 to help contain the spill.

e) Daylight-only farm operations, including vessel transit to and from the farm site, as well as obeyance of all boating laws, nautical rules of the road (aka: Navigation Rules), and safe handling practices that will minimize the risk of boating accidents shall be adhered to.

f) Outfitting and training in all procedures outlined above will be conducted for all new vessels and crew members. Practices will be updated as needed.

APPENDIX L: POTENTIALLY SIGNIFICANT IMPACTS AND CORRESPONDING MITIGATION MEASURES RELATED TO THE PROPOSED PROJECT

	Section	Impact #	MitMeas	Determ
1 Entanglement (marine wildlife)	4.4.3.1	Bio - 1		LSMM
Regular inspection of gear, frequency, proper tensioning			MM - BIO-1	
Response training and reporting of incidents			MM - BIO-1	
2 Aquatic invasive species prevention (monitor, report changes)	4.4.3.2	Bio -2		LSMM
Awareness and training - ID guides (w/ DFW), crew training			MM - BIO-2	
Responses - coordinate with DFW, careful removal and land disposal			MM - BIO-2	
Maintenance - gear inspection			MM - BIO-2	
3 Benthic impacts - nutrients, DO/ORP, etc	4.4.3.3	Bio - 3		LS
4 Bottom disturbance or hazard from installation or structural failure of gear	4.4.3.4	Bio - 4		
Installation, Maintenance & Repair				LS
Storm preparedness and structural failure response			MM - BIO-4	LSMM
5 Marine debris	4.4.3.5	Bio -5		LSMM
Practices			MM - BIO-5	
Decommissioning plan			MM - BIO-5	
6 Spill prevention & response plan	4.8.2.1	Std Oper'g Procedure		LS
7 Phytoplankton carrying capacity	4.4.3.7	Bio - 7		LS
8 Interactions with special status and federally-managed fish species	4.4.3.8	Bio - 8		LS