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W10a

December 8, 2015

To: Coastal Commissioners and Interested Parties

From: Alison Dettmer, Deputy Director
Joseph Street, Environmental Scientist

Subject: **Addendum to 9-14-0489 – USC Wrigley Institute Aquaculture Research Facility**

This addendum provides correspondence on the above-referenced staff report and proposed revisions to the staff report. The proposed modifications to the staff report do not change staff's recommendation that the Commission **approve** CDP # 9-15-0489, as conditioned.

Correspondence Received

- Letter from Roberta Marinelli, USC Wrigley Institute for Environmental Studies, to Joseph Street, Coastal Commission, November 19, 2015
- E-mail from Robert Smith, Plauche & Carr, LLP, representing USC Wrigley Institute, to Joseph Street, Cassidy Teufel and Alison Dettmer, Coastal Commission, December 2, 2015
- E-mail from Robert Smith, Plauche & Carr, LLP, representing USC Wrigley Institute, to Joseph Street, Cassidy Teufel and Alison Dettmer, Coastal Commission, December 3, 2015
- E-mail from Bonnie Rogers, U.S. Army Corps of Engineers, to Joseph Street, Coastal Commission, December 4, 2015
- Letter from Dana Murray, Heal the Bay, Jenn Eckerle, NRDC, and Jennifer Savage, Surfrider Foundation, to California Coastal Commission, December 7, 2015

Revisions to the Staff Report

Recommended revisions to the staff report include modifications to **Special Condition 3**, the inclusion findings clarifying the applicant's proposed equipment cleaning and defouling activities, the inclusion of additional information and analysis in the findings addressing both potential impacts to benthic habitats and the potential for non-native oyster establishment in Cat

Harbor, and a number of minor clarifications and corrections. Additions to the staff report are shown below in underline and deletions in ~~strikethrough~~.

The proposed revisions and statements of reasons for the proposed revisions set forth below are recommended findings and will be incorporated into the relevant portions of the staff report as adopted findings.

Page 3, Table of Contents, Exhibits:

"Exhibit 5 – California Department of Fish & Wildlife Authorizations"

Pages 5-6, Special Condition 3B:

"B. Benthic Monitoring

~~(1) monitoring of the quantity, type, and distribution of biological materials from the shellfish facility (such as shellfish, shellfish feces and pseudofeces, shell material, and fouling organisms) accumulating on the seafloor;~~

~~(2) monitoring of the grain size and porosity of the upper 10 cm of seafloor sediments below and in the vicinity of the facility;~~

Visual benthic monitoring of the quantity, type and distribution of biological materials from the shellfish facilities (such as shellfish, shell material, shellfish feces and pseudofeces, and fouling organisms) accumulating on the seafloor shall be conducted quart~~l~~erly at multiple sites beneath the shellfish facility. ~~and at several~~ Monitoring sites shall include at least one location beneath the FLUPSY facility, two locations beneath the long-line array, and two control sites to be selected based on their similarity to the project ~~site~~ area in terms of sediment character and water depth, ~~but at~~ but at least 100 m distant. ~~Grain size and porosity monitoring shall be conducted on an annual basis. The benthic monitoring program shall also include baseline sampling of the project and control sites to establish pre-project conditions.~~ If during ~~any one~~ monitoring ~~event~~ the visible accumulation of a significant ~~changes in the character of the sediments beneath the aquaculture facility~~ amount of oyster shell material, feces or pseudofeces, fouling organisms, or other project-related debris ~~are noted~~ is observed, USC-WIES shall report these observations to the Executive Director and apply for an amendment to this permit. The CDP Amendment shall propose~~ing~~ to redesign the project to avoid recurrence of these changes, and to mitigate any additional impacts to marine resources that may have occurred. Such project changes ~~could~~ shall include ~~the implementation~~ consideration of additional monitoring measures to determine whether significant changes to sediment chemistry and benthic ecology are occurring, the removal of accumulated materials and restoration of benthic habitat, and/or modifications to the management or deployment of project facilities. For the purposes of this condition, a "significant ~~changes~~ amount of oyster shell material, feces or pseudofeces, fouling organisms, or other project-related debris" ~~to benthic sediments beneath the aquaculture facility~~ shall comprise any ~~(a) visible accumulation of oyster shell material, feces or pseudofeces, fouling organisms, or other project-related debris; (b) statistically-significant changes in~~

~~sediment grain size or porosity relative to the pre-project baseline and control sites.~~ accumulation in excess of a handful of scattered occurrences, such as the formation of piles or layers of debris."

Reason for Proposed Revision: Staff is recommending that clause B of **Special Condition 3** be modified to reflect new site-specific information on the character of the sediments at the proposed project site provided by USC-WIES. The coarse, sandy sediments observed at the site are indicative of active currents and water mixing that remove and disperse fine particulate matter, as well as active advection and oxic conditions within the sediments themselves, which tend to limit the accumulation of fine particulates and promote the breakdown of organic matter. In combination with the small size and scale of the proposed aquaculture facility, these site-specific conditions would limit the risk of significant adverse changes to sediment chemistry and benthic ecology as a result of the project. Moreover, the accumulation of coarse debris (e.g., shell material) which would be detected through the visual monitoring proposed by UCS-WIES would presage any major impacts to the sedimentary environment. As a result, the sediment monitoring provisions contained in the original staff recommendation are not necessary and have been removed. At the applicant's request, the parameters of the visual benthic monitoring program required under this condition have also been clarified.

Page 6, Special Condition 3C:

"C. Non-native Oyster Monitoring: monitoring areas outside of cultivation for the potential for local spatfall and establishment of the non-native oysters proposed to be cultivated on the longlines, including:

(1) Regular monitoring of surface water temperatures in the vicinity of the project site;

(2) Monitoring of ~~water-column settlement traps, consisting of oyster shells suspended on lines or in wide-opening mesh bags, at~~ multiple locations within Cat Harbor where oyster establishment is theoretically possible (e.g., piers, rocks, known areas of debris accumulation, portions of Cat Harbor with longer-than-average water residence time, etc.). ~~The settlement traps shall be monitored for Pacific and Kumamoto oyster spatfall, establishment and growth following all likely spawning events but no less than twice per year, once in the autumn following the potential oyster reproductive season (as determined based on water temperature measurements or other evidence), and once in the spring prior to new spawning activity.~~ USC-WIES shall conduct annual visual monitoring and provide photographic evidence of such selected locations to document any establishment and growth of Pacific or Kumamoto oysters.

If any ~~settled~~ Pacific or Kumamoto oyster~~s~~ individuals or populations are observed on ~~a settling trap or other surface~~ or near one of the selected monitoring locations in the Cat Harbor State Marine Conservation Area (other than the aquaculture equipment on which they are planted), USC-WIES shall submit an application for a CDP amendment proposing project modifications necessary to prevent the establishment of the non-native oysters in Cat Harbor SMCA outside the areas of cultivation. Such project changes ~~could~~ shall include consideration of ~~the~~ additional ~~of further~~ monitoring, surveys of suitable

habitat within Cat Harbor for oyster establishment, eradication efforts, studies to determine the origin of the oysters colonizing the ~~settlement traps~~ monitoring locations, and/or modifications to the management ~~or~~ and operation of project facilities.

In addition, observations of settled Pacific or Kumamoto oysters anywhere in the Cat Harbor State Marine Conservation Area (other than the aquaculture facility on which they are planted) shall be immediately reported to the Executive Director. If any observation occurs of Pacific or Kumamoto oysters on or near one of the selected monitoring locations or in the Cat Harbor SMCA away from the project site, USC-WIES shall suspend all cultivation of adult oysters and remove all adult oysters from the ocean. Cultivation may only resume upon Commission approval of a CDP Amendment or if USC-WIES can demonstrate that observed Pacific or Kumamoto oysters are genetically distinct from those it is cultivating."

Reason for Proposed Revisions: Staff is recommending that clause C of **Special Condition 3** be modified to substitute survey monitoring of likely settlement locations within Cat Harbor for the monitoring of larval settlement traps.

In its submitted comments, USC-WIES expressed concern that a monitoring approach using larval settlement traps would be costly, yield equivocal results due to the possibility that non-native oyster larvae within Cat Harbor may derive from sources other than the aquaculture facilities, such as ballast water or other populations in Southern California, and could promote the spread of Pacific oyster within Cat Harbor by creating new artificial settlement surfaces. In its December 2, 2015 comments, USC-WIES proposed to instead develop a plan to conduct annual visual monitoring of likely larval settlement locations within Cat Harbor (e.g., pier pilings, rocks, etc.) for non-native oyster establishment.

A survey approach would avoid the creation of artificial settlement substrate in Cat Harbor, and provide a forewarning of actual establishment. Given the various environmental factors (chiefly water residence time) that would limit larval recruitment within Cat Harbor, and combined with concerted follow-up actions in the event of non-native oyster detection, Commission staff believes that monitoring consisting of annual surveys would be adequate to prevent the establishment of non-native oysters and protect marine resources within Cat Harbor SMCA.

Special Condition 3, clause C would continue to require that USC-WIES apply for a CDP amendment in the event that non-native oysters are detected during monitoring. As part of the amendment application, the applicant would be required to propose project modifications necessary to prevent the establishment of the non-native oysters in Cat Harbor SMCA outside the areas of cultivation, and including consideration of additional monitoring and surveys, eradication efforts, studies to determine the origin of the feral oysters, and/or modifications to the management and operation of the aquaculture facilities. The Aquaculture Monitoring Plan submitted under **Special Condition 3** must be adequate to detect the presence of non-native oysters within Cat Harbor.

In response to concerns about the non-native oyster establishment and the adequacy of Special Condition 3(c) raised in the combined comment letter by NRDC, Heal the Bay, and the Surfrider

Foundation, staff is also recommending that modifications to the final section of the condition to clarify that cultivation of adult oysters is to cease upon observation of oysters in Cat Harbor outside of cultivation. To avoid duplication caused by this change, staff is also recommending the deletion of clauses 3(e) and 3(f) of the special condition.

Pages 6-7, Special Condition 3E:

> "~~E. Observations of settled Pacific or Kumamoto oysters on a settling trap or other surface in the Cat Harbor State Marine Conservation Area (other than the aquaculture equipment on which they are planted) shall be immediately reported to the Executive Director.~~"

Page 7, Special Condition 3F:

> "~~F. If an amendment to this permit is required by this condition, USC-WIES shall submit a complete permit amendment application and cease the operations causing the impacts until that amendment is approved by the Commission.~~"

Page 10, paragraph 2:

> "Bio-fouling inspections would be conducted visually during ~~the~~ routine operations, including the weekly visits for research activities and maintenance (described above), and during seasonal and annual surveys of the facilities. Based on these observations, cleaning of equipment and/or ~~with~~ removal of fouling organisms ~~to~~ would be performed as needed ~~(approximately once per month during the summer high growth season)~~. Removal of bio-fouling would consist primarily of the hand-swapping of fouled components and retrieval of fouled gear to upland locations at the WMSC for scraping, power washing and air-drying, followed by land disposal. Any necessary in-water cleaning would use mechanical (i.e., non-chemical) techniques and employ tarps and/or screens to contain and prevent the release of biofouling organisms and other biological materials. No ~~bio-fouling removal or~~ intentional disposal or discharge of biological materials, untreated wash water or bio-fouling materials would occur ~~on site or~~ in ocean waters during maintenance and cleaning activities."

Reason for Proposed Revisions: Staff recommends the above changes to the project description in response to new information from the applicant clarifying the cleaning procedures that would be used at the proposed aquaculture facilities.

Page 10, paragraph 6, lines 7-11:

> "Third, although Cat Harbor is a designated SMCA, the regulations governing ~~the~~ SMCAs allow for certain research activities within ~~its~~ their boundaries (*see* 14 CCR 632(~~a~~b)~~(131)~~(1)(A); 14 CCR 650), and the California Department of Fish and Wildlife has authorized the proposed project as a research activity by issuing a Scientific Collecting Permit and Letter of Authorization to USC-WIES (Exhibit 5)."

Page 10, paragraph 6, lines 11-13:

> "Big Fisherman Cove, though nearer to the WMSC campus, is also contained within an SMCA - the Blue Cavern SMCA, while Isthmus Cove is immediately adjacent to this MPA. ~~and~~ Both sites would raise similar issues …"

*Page 11, **new** 2nd paragraph:*

> "Public comments submitted by Heal the Bay, NRDC and Surfrider Foundation suggested that the proposed project should be sited outside the Cat Harbor SMCA in order to avoid impacts to marine resources within the MPA. However, as discussed in more detail below, a key part of the reproductive cycle of the oyster species proposed to be cultivated involves the formation and dispersion of larvae in the water column. Because these young oysters can persist in the water column for several weeks before settling, siting the proposed facility outside of the Cat Harbor MPA at other potentially feasible Catalina locations would not remove the potential for these larval oysters to drift into and settle in the MPA. The public commenters also suggested that the project cultivate native (i.e., Olympia oysters), rather than non-native oysters. While this approach would alleviate concerns about the introduction of non-native species into the Catalina marine environment, it would not fulfill the primary goal of the project to conduct genetic and physiological research on commercially-important shellfish species, which the Olympia oyster is not. Additionally, the Commission is not aware of any evidence that Olympia oysters are native to Catalina Island or Cat Harbor; introducing this species might raise similar concerns as the proposal to culture the non-native species. The Commission therefore finds that for a project with the limited duration and scale of USC's proposal, the recommended use of monitoring for non-native oyster settlement as a trigger for corrective action is appropriate (*see* Subsection D – Marine Resources below)."

Page 11, Other Agency Approvals, paragraph 1 (U.S. Army Corps of Engineers), lines 1-10:

> "The U.S. Army Corps of Engineers (ACOE) has regulatory authority over the proposed project under Section 10 of the Rivers and Harbors Act of 1899 (33 U.S.C. 1344) ~~and Section 404 of the Clean Water Act~~. Section 10 of the Rivers and Harbors Act regulates structures or work in navigable waters of the United States. ~~Section 404 of the Clean Water Act regulates fill or discharge of materials into waters and ocean waters~~. The ACOE ~~is~~ has review~~inged~~ the proposed project ~~pursuant to Nationwide Permit #5 (for installation of scientific measurement devices)~~ under an individual permit, and issued a conditional Letter of Permission pending approval of a coastal development permit and Section 401 permit issued by the Los Angeles Regional Water Quality Control Board (see below). ~~, and, as necessary, will~~ The ACOE consulted with the National Marine Fisheries Service (NMFS) under Section 7(a)(2) of the Endangered Species Act and Section 305(b) of the Magnuson-Stevens Fishery Conservation and Management Act to assess any potential project impacts to federal endangered and threatened species or essential fish habitat."

Reason for Proposed Revisions: Staff recommends the above changes in order to correctly characterize ACOE oversight the project. In its November 2 e-mail, USC-WIES indicated that

the ACOE has not required a Section 404 permit for the proposed project. Commission staff confirmed this fact with ACOE staff (*see* attached e-mail), and has removed references to Section 404 permitting. Staff has also made several other minor corrections to the paragraph as recommended by the ACOE.

Page 11, Other Agency Approvals, paragraph 2 (California Department of Fish and Wildlife), line 9:

> "Commission staff coordinated with CDFW throughout its review of this project to ensure that this recommendation is consistent with MPA protection and management goals and the LOA and Scientific Collecting Permit issued by CDFW."

Page 13, paragraph 5, line 9 (also p. 14, paragraph 1):

> "Extensive research has shown that over time, the seafloor below shellfish aquaculture facilities can accumulate large amounts of biological material that becomes dislodged or discharged from the facility above and sinks through the water column. Such material typically includes feces and pseudofeces from the cultivated shellfish (collectively known as biodeposits); fouling organisms such as algae, barnacles, sponges, and other species of shellfish that settle on the artificial hard substrate of the facility and become dislodged due to natural processes or operational activities; and cultivated shellfish or shells that also become dislodged from the cultivation structure during growth, storm events, predation from marine wildlife, cleaning, and harvest activities. However, the degree to which biological material from an aquaculture operation accumulates on the seafloor and alters benthic communities also depends on project scale, operational intensity and site-specific physical characteristics such as water depth, current velocity, substrate grain size and mixing, and the natural chemical and ecological makeup of sediments in the area, and can be difficult to predict in advance."

Page 14, paragraph 2, lines 1-2:

> "~~Overall,~~ ~~t~~The total amount of biological material added to the substrate below a~~n~~ large, active aquaculture facility can be substantial …"

Page 14, paragraph 4:

> "~~Research suggests, however, that the degree to which biological material from an aquaculture operation accumulates on the seafloor and alters benthic communities depends on project scale, operational intensity and site-specific physical characteristics such as water depth, current velocity, substrate grain size and mixing, and the natural chemical and ecological makeup of sediments in the area, and can be difficult to predict in advance.~~
>
> It is important to note that the benthic impacts summarized above have typically occurred as a result of large-scale commercial aquaculture operations, and that the studies cited examined facilities cultivating mussels rather than oysters. In comparison to the commercial operations for which benthic impacts have been documented, the proposed research facility is small, reducing the risk of significant impacts."

Page 14, paragraph 5:

> Several features of the proposed project, including its small size and limited cultivation capacity, and the relatively deep water, moderate currents and relatively short water residences at the project site (Colbert et al. 2008), ~~may serve to~~ will limit the deposition of biological materials and the severity of any resulting impacts on seafloor habitats. Information provided by USC-WIES in a November 19, 2015 letter (USC-WIES 2015d), USC-WIES indicates that the benthic substrate at the project site consists of coarse sand (*see* **Exhibit 4**). Sandy sediments are characteristic of relatively high-energy marine environments in which active currents remove and prevent the accumulation of fine-grained materials. The interstitial environments in the upper layers of sandy sediments are subject to advective flow (water movement) driven by wave and tidal pumping, which serves to flush fine-grained materials into the water column, maintain oxic sediment conditions and promote microbial activity and the decomposition of organic matter (e.g., Huettel and Rusch 2000; Marinelli et al. 1998). In addition, the relatively deep waters (9 - 24 meters) at the project site would allow for the current-driven dispersion (and water-column break-down) of fine-grained organic matter released from the project facilities, resulting in smaller amounts of deposition over a larger area, and reducing the potential for significant accumulation of fine-grained organic material on the seafloor.
>
> To a lesser extent, the water depth and current environment at the project site could serve to disperse some coarse materials (shellfish, shells and shell fragments, fouling organisms, etc.) released from the project facilities, while the design of the FLUPSY to contain very small shellfish seed and the use of culture trays rather than stringers on the long-lines will also limit the amounts of live shellfish and shell material dropping to the seafloor from the facilities. However, the possibility remains that coarse biological materials derived from the project could accumulate on the seafloor and, over time, result in significant changes to the benthic environment below the facility. ~~However, the available site-specific information is not sufficient to rule out the potential for significant adverse impacts to benthic marine resources as a result of the project.~~ Given the substantial scientific evidence ~~that under some conditions,~~ that ~~this~~ such accumulation of materials can alter~~s~~ the character of the benthic substrate and can adversely affect benthic ecosystems, the existing uncertainty about whether such effects will occur at the project cite, and the requirement in Section 30230 of the Coastal Act that special protection be given to areas of special biological significance – a policy that the Commission has found to apply to state designated MPAs -- the maintenance and protection of benthic organisms and habitats within the Cat Harbor SMCA necessitates that measures be taken to limit the potential for adverse effects from the proposed project.

Page 15, paragraph 2, lines 1-5:

> "In order to minimize the quantity of shell and ~~organic~~ other biological material that could accumulate on the seafloor below the proposed facility, USC-WIES has committed to the following: (1) conducting all equipment cleaning and bio-fouling removal activities either

on land or with the use of safeguards (e.g., tarps or screens)~~,~~ to prevent the ~~with no~~ ocean disposal of fouling organisms and other biological materials;"

Reason for Proposed Revisions: Staff recommends the above changes (pp. 14-15) in response to information from the applicant (*see* attached e-mail of November 3) clarifying the cleaning procedures that would be used at the proposed aquaculture facilities. The proposed use of safeguards such as tarps or screens during any in-water cleaning or defouling activities would prevent the discharge of fouling organisms and other biological materials to the ocean.

Page 15, paragraph 3:

"Furthermore, in order to assure that the impacts of the accumulation of biological materials are avoided, the Commission is adopting **Special Condition 3.** This condition requires USC-WIES to develop, and submit for the Executive Director's review and approval, an Aquaculture Monitoring Program that includes visual monitoring of the seafloor below the aquaculture facility to identify the quantity and composition of biological materials, including shellfish, shell materials, shellfish feces and pseudofeces, and fouling organisms, that may accumulate, ~~as well changes to the grain size and porosity of the seafloor sediments~~. If this monitoring demonstrates that the project is resulting in significant ~~changes – comprising either the visible~~ accumulation of shell ~~and~~ or other biological materials ~~or statistically significant changes in sediment grain size and porosity – as compared to the pre-project baseline and control sites~~, **Special Condition 3** requires that USC-WIES seek a CDP amendment proposing project changes to avoid and mitigate these impacts. Such project changes shall include consideration of ~~more intensive~~ additional monitoring measures to better identify the extent of changes to sediment chemistry and benthic ecology, the removal of accumulated materials and restoration of benthic habitat, and modifications to the management and/or operation of project facilities."

Page 19, paragraph 3, lines 5-6:

"Because both species of shellfish proposed to be grown at the facility are non-native and because invasion of marine systems with non-native species can irreversibly alter both benthic and pelagic habitats and communities of marine species …"

Page 21, paragraph 1, lines 9-12:

"Moreover, ~~a number of~~ wild populations of Pacific oysters have been observed in at least 13 bays and estuaries along the Southern California coast[5] (e.g., Crooks et al. 2015) in which warm season water temperatures overlap the range observed in or near Cat Harbor (e.g., Largier et al. 1997; Elwany et al. 2005; Seale and Zacherl 2009; Crooks and Uyeda 2010; NOAA 2015[6]). Reproduction and recruitment of Pacific oysters has been reported in several of these embayments, including San Diego Bay, Newport Bay and Alamitos Bay (Zacherl et al. 2015), and the presence of multiple age and size classes at others (Crooks et al. 2015) indicative either successful reproduction or multiple recruitment events."

Page 21, footnote 5, lines 3-4:

> "Since that time, Pacific oysters have been found in Alamitos Bay in Los Angeles County, Newport Bay in Orange County (Zacherl et al. 2015), and …"

Page 22, paragraph 2, line 4:

> "However, it is worth noting that the establishment of non-native Pacific oysters on open coastlines has been documented (e.g., Wrange et al. 2009), and that even within embayments with short *average* water residence times, there may be areas (or particular time periods) in which the residence times are longer. Wild Pacific oysters have been observed in outer Agua Hedionda Lagoon (Crooks et al. 2015) despite an average water residence time (2.6 days; Elwany et al. 2005) similar to that of Car Harbor. USC-WIES has also reported occasional observations of isolated Pacific oysters on Catalina Island itself (though not within Cat Harbor) (USC-WIES 2015d). This evidence suggests that while the hydrodynamic characteristics of Cat Harbor may discourage the establishment of non-native oysters, such an occurrence cannot be ruled out."

Page 22, paragraph 3, line 14:

> "The available evidence suggests that Cat Harbor itself is the most likely place for non-native oyster larvae released from the project to settle."

Page 24, paragraph 1, lines 3-15:

> "The monitoring program shall include (a) the regular monitoring of surface water temperatures in Cat Harbor in the vicinity of the project site; and (b) monitoring of ~~settlement traps, consisting of suspended lines or mesh bags containing Pacific oyster shell[7],~~ non-native oyster settlement and establishment at multiple possible settlement locations within Cat Harbor, such as pier pilings, rock outcrops and other natural and artificial hard substrates. ~~The settlement traps shall be monitored for Pacific and Kumamoto oyster spatfall, establishment and growth at least twice per year, once in the fall following the oyster reproductive season, as determined based on water temperature measurements or other evidence, and once in the spring prior to new spawning.~~ USC-WIES shall conduct annual visual monitoring and provide photographic evidence of such selected locations to document any establishment of Pacific or Kumamoto oysters. If any ~~settled~~ Pacific or Kumamoto oysters are observed ~~on a settling trap or other surface~~ in the Cat Harbor SMCA (other than the aquaculture equipment on which they are planted), USC-WIES shall submit an application for a CDP amendment proposing project modifications necessary to prevent the wild establishment of the non-native oysters in Cat Harbor SMCA outside areas of cultivation. Such project changes shall include the consideration of additional monitoring, further surveys of suitable habitat within Cat Harbor for oyster establishment to be followed by eradication efforts if oysters are found, studies to determine the origin of the oysters colonizing the settlement traps, and/or modifications to the management or operation of project facilities. While this recommended approach to non-native oyster monitoring would only detect the oysters after they have settled, previous

work has shown that concerted eradication efforts can successfully eliminate localized populations of Pacific oysters (e.g., Goodwin et al. 2015)."

Page 24, footnote 7:

~~[7] Research indicates that Pacific oyster shells are a preferred settling surface for their larvae, and that the shells secrete a chemical compound that induces larval settlement (Diederich 2005; Vasquez et al. 2013).~~

Pages 32-34, Appendix A – Substantive File Documents

Huettel, M. and A. Rusch (2000). Transport and degradation of phytoplankton in permeable sediments. *Limnology and Oceanography* 45: 534-549.

Marinelli, R.L., R.A. Jahnke, D.B. Craven, J.R. Nelson and J.E. Eckman (1998). Sediment nutrient dynamics on the South Atlantic Bight continental shelf. *Limnology and Oceanography* 43: 1305-1320.

Seale, E.M. and D.C. Zacherl (2009). Seasonal settlement of Olympia oyster larvae, *Ostrea* lurida Carpenter 1864 and its relationship to seawater temperature in two Southern California estuaries. *Journal of Shellfish Research* 28: 113–120.

University of Southern California Wrigley Institute for Environmental Studies (USC-WIES) (2015d). Comment letter from Roberta L. Marinelli, submitted to California Coastal Commission Staff in relation to CDP Application No. 9-14-0489, November 19, 2015.

Zacherl, D., C. Fuentes, S. Briley, C. Whitecraft, T. Champieux and A. Bird (2015). Restoration of Native Oysters, *Ostrea lurida*, in Alamitos Bay, CA. Final Report. Prepared for California State Coastal Conservancy and NOAA Restoration Center, August 2015, 23 pp.

*Exhibits -- **new** Exhibit 5 (CDFW permits and authorizations) added on following pages:*

State of California – Natural Resources Agency
DEPARTMENT OF FISH AND GAME
Marine Region
1933 Cliff Drive, Suite 9
Santa Barbara, CA 93109
(805) 568-1231
FAX (805) 568-1235
www.dfg.ca.gov

EDMUND G. BROWN, Jr. Governor
CHARLTON H. BONHAM, Director

April 25, 2012

Subject: Letter of Authorization to Stock Pacific Oysters (*Crassostrea gigas*) and Kumamoto Oysters (*Crassostrea sikamea*) into Pacific Waters in the vicinity of the USC Wrigley Marine Science Center on Santa Catalina Island, California

Authority:

This Letter of Authorization (LOA) is issued by the Department of Fish and Game (Department) pursuant to Fish and Game Code section 6400 and serves as authorization to stock Pacific oysters, *Crassostrea gigas*, and kumamoto oysters, *Crassostrea sikamea*, at Big Fisherman Cove or Catalina Harbor, Santa Catalina Island, as part of long-term research on the genetics of these species.

Project Manager(s):

Name and title: Dr. Dennis Hedgecock, Professor
Mailing Address: University of Southern California
Department of Biological Sciences
3616 Trousdale Pkwy
Los Angeles, CA 90089-0371
Telephone: 213-821-2091
Email: dhedge@email.usc.edu

Effective Date and Expiration Date of Authorization:

This authorization shall be valid for 5 years, from April 4, 2012, to April 4, 2017.

Project location:

Catalina Harbor and Big Fisherman Cove, Santa Catalina Island

Project Description:

This project would enable Wrigley Marine Science Center to continue long-term research on the genetics of the Pacific oysters (*Crassostrea gigas*) and begin research on the closely related kumamoto oyster (*Crassostrea sikamea*) on Santa Catalina Island. The oysters will be spawned at Wrigley Marine Science Center (WMSC) from controlled laboratory crosses of pedigreed adults imported from Taylor Mariculture LLC, Thorndyke Bay, WA. The oysters will be reared at WMSC and held in flow-through systems for

approximately one month. A FLUPSY (floating upwelling nursery system) is under development that would be used to hold oysters 2-3 mm in size until they reach approximately one inch in size. At that point, the oysters will be placed in ¾ inch mesh growout trays or nets and planted into nearby waters, Big Fisherman Cove or Catalina Harbor, to feed on natural algae and reach adult size. Within two years, the oysters would reach maturity and would be selected for breeding or growth experiments, which are destructive processes. Some oysters would remain in the field as back up to ensure propagation of valuable genetic lines.

Covered Species:

This authorization covers the following species:
Name(s): Pacific oysters (*Crassostrea gigas*)
Kumamoto oysters (*Crassostrea sikamea*)

Conditions of Authorization:

The Department's issuance of this LOA to plant Pacific and kumamoto oysters in state waters is subject to the Project Manager's compliance with and implementation of the following conditions of authorization:

1. The Project Manager shall have a valid Long-term Importation Permit authorizing the importation of Pacific and kumamoto oysters from Taylor Mariculture LLC and will adhere to the conditions of that permit.
2. All oysters shall be held in running seawater tanks that are on separate flow-through systems from any other organisms held in participating marine labs to eliminate the risk of exposure to any non-indigenous species and disease agents.
3. All oysters must be retrieved by the end of the study period or by the expiration of this LOA, whichever is earlier.
4. A copy of this LOA must be carried at all times while conducting the above described activities.
5. The Project Manager shall fully implement and adhere to the conditions of this LOA.
6. The Project Manager shall comply with all applicable state, federal, and local laws in existence on the effective date of this LOA.

Notification and Reporting:

1. Intent to renew this LOA shall be provided by the Project Manager to the Marine Region's Aquaculture Coordinator, 619 Second Street, Eureka, CA 95501, 707-445-5365, kramey@dfg.ca.gov, at least 60 days prior to the expiration date of this LOA.
2. The Project Manager shall submit a completed report of activities during the effective dates of this LOA which provides dates and location of planting efforts, numbers of oysters planted, and results of the final project within 30 days of the expiration of this LOA, by May 4, 2017.

This letter and a valid Scientific Collecting Permit must be in the above listed Project

Manager's possession when conducting any activity authorized by this letter and must be shown upon request to any person authorized to enforce Department regulations. This LOA does not relieve the permittees of the responsibility to obtain other permits, or comply with any other federal, state, or local laws.

Sincerely,

Becky Ota

Becky Ota Acting for
Marija Vojkovich
Regional Manager
Marine Region

ec: Jim Moore, Department of Fish and Game, Bodega Bay
Kirsten Ramey, Department of Fish and Game, Eureka

State of California – Natural Resources Agency
DEPARTMENT OF FISH AND GAME
Marine Region
619 Second Street
Eureka, CA 95501
(707) 445-5365
kramey@dfg.ca.gov

EDMUND G. BROWN, Jr. Governor
CHARLTON H. BONHAM, Director

April 24, 2012

Dr. Dennis Hedgecock, Professor
University of Southern California
Department of Biological Sciences
3616 Trousdale Pkwy
Los Angeles, CA 90089-0371

Subject: Amendment to Letter of Authorization to stock Pacific oysters (*Crassostrea gigas*) and kumamoto oysters (*Crassostrea sikamea*) into Pacific waters in the vicinity of the USC Wrigley Marine Science Center on Santa Catalina Island, California.

Dear Dr. Hedgecock:

This letter serves to amend your Letter of Authorization (LOA), dated April 25, 2012, and is hereby incorporated as part of your authorization. A valid Scientific Collection Permit is not required while conducting any activity authorized by the LOA. This letter must be attached to your LOA and must be shown upon request to any person authorized to enforce Fish and Game regulations.

If you have any questions or need further information, please contact me at (707) 445-5365 or kramey@dfg.ca.gov.

Sincerely,

Kirsten L. Ramey

Kirsten Ramey
Marine Region Aquaculture Coordinator

cc: Jim Moore, Senior Shellfish Pathologist
Department of Fish and Game
2099 Westside Road
Bodega Bay, CA 94923

State of California
The Resources Agency
DEPARTMENT OF FISH AND GAME
1416 Ninth Street
Sacramento, California 95814

Long-Term Importation Permit

Permit No. 2015 - 3617

Issued to : University of Southern California
donal manahan
3616 Trousdale Pkwy
Los Angeles, CA 90089 USA

Phone: (213) 740-5763
Cell:
FAX :

Issue Date : 4/13/2015

Permit Vali : 4/13/2015 thru 4/13/2016

Approved :

James Ray, acting as agent for the Director
California Department of Fish and Game

4/13/2015
(707) 441-5755

Permit Details:

TRANSPORTER :
donal manahan
University of Southern California
3616 Trousdale Pkwy
Los Angeles, CA 90089 USA
(213) 740-5763

SUPPLIER :
Taylor Shelfish

701 Broad Spit Road
Quilcene, WA 98376
(360) 765-3566
Contact: Diane Cooper

DESTINATION / RECIPIENT :
Wrigley Marine Science Center
Wrigley Marine Science Center
Two Harbors Cat. Isl, CA
(213) 740-5763
Contact: Donal Manahan
scientific use

Product(s) Permitted:

Shipment Date : Estimated Arrival Time:
Shipment Route :
Shipment Remarks No shipment Info

SPECIES	AMOUNT	WEIGHT	LIFESTAGE
Pacific Oyster *Crassostrea gigas*			

C. gigas: larvae, seed and broodstock. See comment letter.

VALID PERMIT OR COPY MUST BE IN THE POSSESSION OF THE TRANSPORTER DURING SHIPMENT.

FG789b (04/2006)

Exhibit 5
Application No. 9-14-0489
USC Wrigley Institute
CDFW Authorizations

State of California – Natural Resources Agency
DEPARTMENT OF FISH AND WILDLIFE
Marine Region
619 Second Street
Eureka, CA 95501
(707) 441-5755
James.Ray@wildlife.ca.gov

EDMUND G. BROWN, Jr. Governor
CHARLTON H. BONHAM, Director

April 13, 2015

Donal T. Manahan
Department of Biological Sciences
University of Southern California
3616 Trousdale Pkwy,
Los Angeles, CA 90089-0371

Subject: Permit Condition Letter for Importation of Live Shellfish

Dr. Manahan,

This letter serves to add conditions to your Long-Term Permit (No. 2015-3617) to Import Live Aquatic Animals into California and is hereby incorporated as part of your permit.

You are granted permission to import, from the approved source, the listed species *subject to the following conditions*:

Approved species limited to:

Pacific Oyster	*Crassostrea gigas*

- All adult shellfish must be treated with a solution of 60 parts per million (ppm) sodium hypochlorite mixed with freshwater immediately prior to shipment to California. Shell surfaces should be scrubbed clean of all epibionts prior to treatment.

- This treatment will be performed for not less than one hour and the residual chlorine at the end of the treatment must be at least 2 ppm. The treatment may be followed by a freshwater rinse.

This letter must be attached to your Long-Term Permit (No. 2015-3617) and must be shown upon request to any person authorized to enforce Fish and Wildlife regulations. This permit does not relieve the permittee from the responsibility to obtain any other required permit(s), or comply with any other Federal, State, or local laws and regulations.

Sincerely,

James Ray
Marine Region Environmental Scientist

USC Dornsife
Dana and David Dornsife
College of Letters, Arts and Sciences

WRIGLEY INSTITUTE FOR ENVIRONMENTAL STUDIES
Roberta L. Marinelli, Ph.D.
Director

19 November 2015

Dr. Joseph Street
California Coastal Commission
45 Fremont Street #2000
San Francisco, CA 94105

Dear Joe

The University of Southern California ("USC") appreciates the opportunity to comment on the California Coastal Commission's review of its proposed shellfish aquaculture research project, to be located in Catalina Harbor. While USC appreciates Coastal Commission staff's work on the project to date, USC remains concerned regarding several of the proposed draft conditions. Specifically, USC believes that the limited scale of the project and careful site selection performed by USC avoids many of the potential environmental concerns raised by Coastal Commission staff. Based on the analysis provided below, USC therefore respectfully requests that staff eliminate proposed condition 3, concerning a proposed aquaculture monitoring program, in its entirety. We look forward to discussing these issues with staff in more detail as necessary. Thank you for your continued time and assistance on this project.

1. Project Benefits and Risk Reduction

Increasing global populations are putting greater strain on natural resources and the global food supply; as such, environmentally sustainable and efficient food sources have become part of the national security dialogue. Human ingenuity has led to great advances in land-based agricultural productivity through domesticating crops and continuous improvements in farming techniques and technologies; however, land-based food sources face continuing challenges in land management and water conservation. Further, while California is one of the primary agricultural producers in the world, it suffers from a significant seafood deficit where, similar to the rest of the United States, most of its seafood is imported. Many consumers lack local sustainable seafood options. It is clear that we must invest in and shift reliance to effective avenues of ocean food production that are both sustainable and compatible with local and global ecosystem health.

Aquaculture is an attractive strategy for meeting the world's growing food demand, providing a viable alternative to wild fisheries that have depleted certain wild stocks to the brink of collapse. Today, aquaculture contributes approximately 50% of the global seafood supply, and as populations and seafood consumption continue to increase, reliance on aquaculture must and will continue to grow. But aquaculture efforts vary in location, research investments, and environmental sustainability. Asian nations, particularly China, dominate the production of farmed fish and shellfish, while the United States lags far behind,

contributing globally less than 1% of all food raised through aquaculture (NOAA Fisheries, 2015). New investments in the U.S. aquaculture industry will provide an opportunity to increase our independence from foreign nations, contribute to protein demands worldwide, and lead globally by advancing efficiency, sustainability standards, and quality across the industry. California, with over 800 miles of coastline, is poised to play a key role in this process.

Shellfish aquaculture is both sustainable and efficient, allowing direct conversion of plant material to protein with minimal inputs, no artificial additives, low environmental risk, and the potential for many ecosystem benefits (e.g. water column filtration). The promotion of such efficient and sustainable seafood sources is central to the USC Wrigley Institute's work and purpose. But as with many organisms and ecosystems, shellfish species are under environmental pressure, such as changing water temperatures and ocean acidification. The proposed research infrastructure will support USC studies of the genetic potential for aquaculture organisms to adapt to these changing ecosystems and climates, and will lead to domestication and genetic improvement of shellfish stocks. Importantly, the research also has broad implications for marine systems worldwide, as it will address fundamental questions that are relevant to global ocean health: what traits will allow our organisms to persist, or wither, in a future world?

The principal researchers in USC's *Future of Food from the Sea* project, Dr. Dennis Hedgecock and Dr. Donal Manahan, are internationally-recognized leaders in their fields. They have over 60 years of research experience (combined) with the Pacific oyster *C. gigas* in California. Their research has consistently maintained full compliance and cooperation with the laws of the State of California, in collaboration with industry partners who are also in full compliance with relevant state and federal laws. The program incorporates undergraduate education, graduate research, and postdoctoral training to build a robust and diverse aquaculture research community based in foundational science. Industry partnerships include collaborations with mariculturists such as Taylor Shellfish in Washington State, Hog Island Oyster Co. in Marshall CA, and Carlsbad Aquafarms in Carlsbad CA. Overall, their USC program is a multi-faceted initiative with significant potential for public benefit.

The proposed project would allow USC to continue its research of Pacific and Kumamoto oysters at the Wrigley Marine Science Center through their grow-out phase, permitting research of the entire oyster lifecycle. This research is critical to developing comprehensive studies of commercial shellfish species that can be utilized by the shellfish industry, other West Coast researchers, and regulatory agencies. Based in a rigorous academic understanding of the complexities of environmental science, the proposed research installation has been designed with care for achieving high-value research goals while minimizing coastal impacts. The installation has been sited in a cove with previous and ongoing aquaculture efforts; the success of these other aquaculture efforts have established the cove as suitable for aquaculture activities. The size of the project has been constrained to a fraction of commercial operations (one floating upwelling system or FLUPSY, and one initial longline), to minimize both the number of animals and the footprint of the installation to the bare essentials for research success. Water temperatures, currents, and advanced

understanding of shellfish biology have been used extensively in the biological and physical design of this proposal. Site selection also reflects the availability of critical project resources, such as the close presence of researchers and maintenance staff and local substrate and habitat types. No GMO and/or transgenic organisms will be used or developed, and no hormones, antibiotics or pesticides will be employed.

Our reduced environmental footprint also represents the minimum threshold for scientific success. USC maintains that the environmental risks posed by this project are significantly below the thresholds of risk maintained by numerous other large-scale aquaculture operations throughout the state – and particularly for a project of such short (5-year) duration, this minimal risk is acceptable when weighed against the substantial societal and industry benefits that the research could provide.

2. Monitoring for Establishment of *C. Gigas* Populations is Unwarranted

A. Scientific Evaluation of Potential for Establishment

Historically, four geographic forms or races of Pacific oyster—Hokkaido, Miyagi, Hiroshima, and Kumamoto—were recognized in Japan, based on morphological and physiological characteristics (Imai & Sakai 1961). As the Miyagi type had the most promising results in growth and survival of juveniles and adults (Imai & Sakai 1961), they were imported to the northwestern coast of North America beginning in the early 20th century, and in massive numbers of spat on shell from 1927 to 1977 (i.e. Quayle 1988; Boom et al. 1994). Miyagi-type oysters were the only oysters imported into British Columbia (Quayle 1988) and the predominant type introduced into the State of Washington. Large, naturalized populations of the Pacific oyster were subsequently established in several areas of British Columbia, where the first natural spawning was recorded in 1932 (Quayle 1988), and in areas of Washington State (Chew 1979). Small quantities of Kumamoto type oysters, now recognized as a different species *C. sikamea* (Banks et al. 1994), were also introduced into the State of Washington and are currently cultured in Washington and California; the Kumamoto oyster has not established in any location. In the 80 years since establishing self-recruiting populations in the Pacific Northwest, the Pacific oyster has not expanded its geographic range along the U.S. West Coast south of Willapa Bay, WA, despite commercial aquaculture activities in Oregon and California throughout that period.

It is challenging to assess risk of *C. gigas* establishment through global comparisons, because the species is heavily utilized in aquaculture efforts worldwide; as a result, the corresponding scientific literature spans not only different temperature regimes but water hydrographies, substrate types, marine ecosystems, human and natural vectors, and governmental regulatory systems. However, the existing scientific literature associated with the U.S. West Coast indicates that natural establishment and spread of *C. gigas* is highly unlikely.

Along the U.S. West Coast, the Pacific oyster becomes reproductively mature almost everywhere that it is presently cultured (e.g. Pauley et al. 1988; Guo et al. 1998), and yet it

rarely recruits. What prevents the oyster from being invasive in the eastern Pacific, including in California, is evidently not a block to reproductive maturity but a block to successful larval development and recruitment to suitable habitat (Berg 1971).

Pacific oysters tolerate broad temperatures from below 0°C to 30+°C, however, spawning does not occur until waters warm to ~20°C (Pauley et al. 1988, Quayle 1988). Spatfall occurs only in restricted locations that retain larvae during their 15 to 30-day larval phase at temperatures higher than 16°C and preferably above 20°C (Pauley 1988). The proposed location at Catalina Harbor, Santa Catalina Island cannot retain larvae long enough to complete development, given that tides regularly flush the embayment and that the residence time of water within the harbor is limited to 3 to 5 days (Colbert et al. 2008).

We note that isolated feral individuals have been observed across California for decades. These Pacific oysters have been observed primarily in San Francisco, San Pedro and San Diego harbors. This proximity to maritime activities suggests that the most likely source for larval delivery at these locations is ballast water. The presence of *C. gigas* in San Pedro, CA, only 20 miles away from Catalina Island, is particularly well documented (Cohen et al. 2005, Moore et al. 2011). Occasional instances of Pacific oysters have also been observed at Catalina Island itself, dating back to at least the early 2000s (Kakajiwala 2005 unpublished USC student BISC 490 report; Dr. David Ginsburg USC, pers comm.). Oysters found in Two Harbors did not have a genetic profile matching the pedigreed lines cultivated at the Wrigley Marine Science Center (D. Hedgecock, unpublished). Populations in the Los Angeles/Long Beach Harbors of San Pedro may provide a recurring source population for areas across the Southern California Bight, occasionally enabling sporadic recruitment in numbers too small to establish self-sustaining populations in the region (Cohen et al., 2005). In summary, while there have been limited documented instances of the occurrence of Pacific oysters in Southern California, there is no scientifically credible information to suggest that self-sustaining populations have established or that aquaculture operations are the cause of these occurrences. There is also no evidence that these populations exhibit invasive characteristics where they will spread and take over the areas in question to the exclusion or harm of other species or uses.

It appears inappropriate to impose conditions on the proposed project based on the conclusions of Crooks *et. al.* (2015), which claims that the Pacific oyster is now established in southern California and that the most likely source is aquaculture. The findings of that paper lack scientific rigor in that they offer no estimates of abundances or size distributions, no genetic evidence supporting the conclusions regarding source populations, and no consideration of alternative hypotheses (i.e. ballast water introductions, misidentification of native oysters as Pacific oyster recruits). USC would support more rigorous scientific scrutiny to determine whether feral *C. gigas* populations in southern California are related or demographically uncoupled from neighboring aquaculture activities. In fact, USC may be interested in seeking grant funding to conduct such a study. However, based on the best science currently available, it appears that imposing a monitoring requirement concerning the potential establishment of Pacific oysters is not supported by the available literature, which evidences a low risk of potential establishment.

B. Evaluation of Risk of Harm

On the western coast of North America, 99.8% of oyster production comes from non-native species, primarily Pacific oysters (Ruesink et al. 2005); these activities have been ongoing for nearly a century. No ecological harm as a result of this activity has been identified (NRC 2004). Seven species of oysters, including the Pacific and Kumamoto oysters, are on the list of approved aquaculture species for the State of California (CDFG Aquaculture Regulations, 2015). This "clean list" regulatory approach is consistent with the lack of evidence for invasiveness or harm to local marine ecosystems or native species over the past century of experience with introduced oyster species on the U.S. West Coast and in California (NRC 2004).

Indeed, the native oyster *Ostrea lurida* has largely failed to recover in southern California and elsewhere, even in the absence of non-native competitors such as *C. gigas* (e.g. Wasson et al. 2015). These results suggest that when non-native oysters do occur, they can provide similar ecological functions as native oysters as opposed to excluding native oysters from local habitats: reef-building creates habitat that supports biodiversity and coastal food webs, altered flow can provide stabilization of sediments and seagrass beds, and filter feeding facilitates nutrient cycling, improves water quality and sequesters pollutants from the coastal waters (Ruesink et al. 2005).

Ultimately, evaluations of risk are social decisions. Managers and society must make value judgments in protecting what they define as "native" coastal environments in an ever-changing biodiversity landscape, and balance those goals against society's uses and needs (Brown & Sax 2004). At the USC Wrigley Institute, we believe that the human dimension cannot be ignored, and conservation and wise resource-use can coexist. Our oyster research is poised at the nexus of these considerations. Knowing that aquaculture growth is critical to the food security of our nation, our work will provide leadership in the research and innovation needed to make sure that the industry grows in efficient, healthy, and sustainable directions. Facilitating these holistic approaches to the crosscutting challenges of our future is the foundation of USC's *Future of Food from the Sea* research program.

C. Monitoring Requirements

As noted above, the advent of reproductive maturity in oysters does not guarantee successful recruitment, given the possibilities of gamete resorption as well as high larval mortality associated with the vicissitudes of life in the plankton, which include predation, starvation, lack of suitable abiotic conditions or settlement cues, and/or the possibility of transport to undesirable sites and advection to the open ocean, etc. (Korringa 1941, 1946). Therefore, assessments of reproductive maturity of longline oysters are not an appropriate indicator of reproductive success.

During several conversations with Coastal Commission staff, it has been suggested that USC place settlement plates in Catalina Harbor, as a means to examine whether the oyster-rearing

facilities are promoting recruitment and establishment. We feel that this approach will be costly and yield equivocal results. As noted above, in Catalina Harbor, tides regularly flush the embayment and the residence time of water is far shorter than the time that larvae spend in the plankton as part of their life history. The physical data indicate that successfully spawned larvae will be advected out of the Harbor into the open ocean, where they will mix with other oyster and invertebrate propagules. Any new *C. gigas* recruits in Catalina Harbor could easily derive from multiple source populations that are mixed within the waters of the Channel Islands. Thus, it would not be possible to determine the origin of newly established individuals, and their presence could be attributed to the availability of a suitable habitat, as opposed to the proximity of the source population. Finally, as we have suggested above, there is little conclusive evidence that aquaculture has been a vector for establishment of *C. gigas*. Given the difficulty in proving the parentage of new recruits, as well as the low likelihood of establishment, we feel it is not necessary to conduct monitoring of the reproductive state of mature oysters in the longline structure or monitor for the potential establishment of *C. gigas* populations.

3. Benthic Monitoring is Unwarranted

The Coastal Commission has raised concerns about possible impact of oyster feces and pseudofeces production and deposition onto the seafloor, and the potential to negatively impact the subsurface diagenetic environment. Our observations and peer-reviewed publications in leading journals suggest this is unlikely because the environment is physically active and non-depositional. This is particularly likely given the size of the proposed operation, which will only include one FLUPSY and initially, one shellfish longline.

Photographs taken during dive surveys show that the seafloor beneath the proposed FLUPSY and longline installation is sandy (see original CDP application). Sandy sediments are characteristic of environments with active currents that prevent accumulation of fine-grained, organic rich sediments. Furthermore, the interstitial environment of sandy sediments is subject to advective (e.g. non-diffusional) flows driven by wave and tidal pumping, which effectively flush the top few centimeters of the sediment column (e.g., Huettel and Rusch 2000, and references therein). Such sediments are generally oxic down to several centimeters (e.g., Marinelli et al. 1998). While small particles can be trapped in the interstices between sand grains, they are readily metabolized by the abundant oxygen supplied by the overlying water, preserving the oxic character of the upper sediment layers.

The potential for deposition would also be limited by the design of the FLUPSY, which is designed to hold very small shellfish seed that limits the amount of material that can fall from the FLUPSY raft. Further, studies of oyster longlines in Humboldt Bay reported a deposition of fine sediments in 5-ft spaced longlines in May (up to 95 mm) that was eroded by July (down to 51 mm) (Rumrill and Poulton 2004). The authors gave no indication whether this was a significant change or if this change persisted. Typically, the detection limit for this type of study is 80 mm (Hannam and Mouskal 2015), so the change observed by Rumrill and Poulton (2004) is likely not significant. Note that this study likely overestimates potential effects as compared to the proposed project, in that the Rumrill and Poulton study

analyzed intertidal longline culture, where oysters were placed approximately 0.5 meters from the bottom, as compared to the proposed project, were oysters will be suspended several meters above the seafloor. The greater distance from the seafloor provides greater opportunity for any bio-deposits to be influenced by currents and spread over a much larger area, thereby reducing potential effects to any particular portion of the benthic habitat.

Based on the existing literature and limited scope of the project, it appears that an extensive and costly benthic monitoring plan is unwarranted. In lieu of a monitoring plan, USC proposes to conduct quarterly visual surveys documented with photographs of the seafloor beneath the project site and selected control areas, and submit the photos to Coastal Commission staff. If significant accumulation is observed, we will consult with the Coastal Commission to determine what additional steps should be taken to examine possible impacts on the seafloor beneath the installations.

4. Fish and Invertebrate Monitoring is Unwarranted

USC is unclear as to the motivation for this condition and proposed monitoring plan. Many organisms are attracted to structures, as they may provide a niche or substrate that is otherwise unavailable in the surrounding environment. While such attractions can be viewed as positive enhancements to biodiversity, structures may also alter ecological interactions or give shelter to undesirable inhabitants; USC would address this concern as stated in proposed condition 2, through cleaning the longlines and disposing of any non-native fouling organisms at an upland facility.

Generally, large-scale commercial aquaculture operations can result in changes to the surrounding habitat and area. These changes can be beneficial to certain fish and invertebrate species and potentially detrimental to others. However, we are aware of no scientific literature that concludes that a project of the limited size and scope as the present project results in significant effects to fish and invertebrate species. As noted above, there are already other aquaculture uses in Catalina Harbor, as well as recreational boats and other overwater structures; therefore, the limited addition of a FLUPSY and shellfish longline would not introduce a new characteristic to the Harbor that is likely to affect fish or invertebrate species. Further, even if certain species chose to avoid the new structures, the limited size of the project would allow such species to avoid the project area with little or no difficulty.

Monitoring for adverse impacts to fish and invertebrate species is also extremely difficult and of limited utility given their mobility. It is very difficult to ascertain the relationship between fish and invertebrate abundance and local conditions, particularly for highly mobile species. These studies frequently have a sampling bias and small data sets for certain species due to mobility and seasonal fluctuation.

5. Conclusion

USC appreciates the work that Coastal Commission staff has performed in reviewing the

project and staff's agreement to eliminate the condition prohibiting grow-out of *C. gigas* to sexual maturity. However, based on our review of the available scientific literature and project site conditions, we continue to believe that the proposed monitoring plan is not warranted or justified based on a documented risk associated with the proposed project. We would be happy to discuss this letter, and USC's position, further with Coastal Commission staff at your convenience.

Best regards,

Roberta L. Marinelli

References:

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From:	Robert Smith
To:	Teufel, Cassidy@Coastal; Dettmer, Alison@Coastal; Street, Joseph@Coastal
Cc:	Roberta Marinelli; Jessica Margot Dutton
Subject:	Conference Call Summary and Proposed Revised Language
Date:	Tuesday, December 01, 2015 5:08:18 PM

Thank you for yesterday's conference call. Below is a summary of the call and some of the proposed language that we would like the Coastal Commission to consider in its Addendum. I apologize in advance for the long email, but hopefully it is helpful.

1. Condition 3.C: USC noted several concerns regarding the proposed condition, including that (1) that the proposed monitoring is not supported by the findings or available science; (2) that available science shows a very small risk of establishment or spread of Pacific oysters; (3) that Pacific oysters do not exhibit invasive characteristics on the U.S. West Coast; (4) that the staff report inappropriately characterizes the acceptable level of risk as "no risk"; (5) that the proposed mitigation measure is not representative of the existing conditions and may be counterproductive (i.e. promote the spread of Pacific oysters); and (6) to the best of USC's knowledge, no other regulatory agency has proposed a similar condition in the United States. Commission staff stated that the mitigation required appears to be feasible and that additional protection is warranted given the area's status as a Marine Conservation Area. USC agreed to consider potential mitigation options that it may consider acceptable, but still has concerns. The Coastal Commission agreed to continue to consider this issue.

   USC Response

   Based upon further consideration, USC proposes the following modifications to Condition 3.C:

C. "Non-Native Oyster Monitoring: monitoring areas outside of cultivation for the potential for local ~~spatfall and~~ establishment of the non-native oysters proposed to be cultivated on the longlines, including:

(1) Regular monitoring of surface water temperatures in the vicinity of the project site;

(2) Monitoring of ~~water-column settlement traps, consisting of oyster shells suspended on lines or in wide-opening mesh bags, at~~ multiple locations within Cat Harbor where establishment is theoretically possible (i.e. piers, rocks, etc.). USC-WIES shall conduct annual visual monitoring and provide photographic evidence of such selected locations to document any establishment and growth of Pacific or Kumamoto oysters. ~~The settlement traps shall be monitored for Pacific and Kumamoto oyster spatfall, establishment and growth following all likely spawning events but no less than twice per year, once in the autumn following the potential oyster reproductive season (as determined based on water temperature measurements or other evidence), and once in the spring prior to new spawning activity.~~

If any ~~settled~~ established, self-sustaining Pacific or Kumamoto oyster

populations that have grown to a size indicative of sexual maturity are observed on a ~~settling trap or other surface~~ on or near one of the selected locations in the Cat Harbor State Marine Conservation Area (other than the aquaculture equipment on which they are planted), USC-WIES shall submit an application for a CDP amendment proposing project modifications necessary to prevent the establishment of the non-native oysters in Cat Harbor SMCA outside of the areas of cultivation. Such project changes could include the addition of further monitoring, surveys of suitable habitat within Cat Harbor for oyster establishment, eradication efforts, or studies to determine the origin of the oysters colonizing the ~~settlement traps~~ selected areas. In the event that documentation establishes that non-native populations are displacing or otherwise interfering with native species, project changes may also include ~~or~~ modifications to the management or operation of project facilities.

In addition to the above requirements, observations of settled Pacific or Kumamoto oysters on a ~~settling trip~~ surface in the Cat Harbor State Marine Conservation Area (other than the aquaculture equipment on which they are planted) shall be immediately reported to the Executive Director."

This would wrap Condition 3.E into Condition 3.C as well; therefore Condition 3.E could be deleted in its entirety.

This would also require some modification of the associated findings. USC would recommend highlighting the importance of the SMCA as a basis for the monitoring, consistent with the comments made on the call.

2. Condition 3.B: The Coastal Commission is going to delete language from the proposed condition regarding monitoring associated with grain size and porosity. Coastal Commission staff provided the following revised language: ~~(1) monitoring of the quantity, type, and distribution of biological materials from the shellfish facility (such as shellfish, shellfish feces and pseudofeces, shell material, and fouling organisms) accumulating on the seafloor; (2) monitoring of the grain size and porosity of the upper 10 cm of seafloor sediments below and in the vicinity of the facility;~~
Visual benthic monitoring of the quantity, type and distribution of biological materials from the shellfish facilities (such as shellfish, shell material, shellfish feces and pseudofeces, and fouling organisms) accumulating on the seafloor shall be conducted quarterly at multiple sites beneath the shellfish facility. Monitoring sites shall include at least one location beneath the FLUPSY facility, two locations beneath the long-line array, and two control sites ~~and at several control sites~~ to be selected based on their similarity to the project ~~site~~ area in terms of sediment character and water depth, but at but at least 100 m distant. ~~Grain size and porosity monitoring shall be conducted on an annual basis. The benthic monitoring program shall also include baseline sampling of the project and control sites to establish pre-project conditions.~~ If during any one monitoring event visible accumulation of oyster shell material, feces or pseudofeces, fouling organisms, or other project-related debris is observed, ~~significant changes in the character of the sediments beneath the aquaculture facility are noted~~, USC-WIES shall apply for an amendment to this permit proposing to redesign the project to avoid recurrence of these changes, and to mitigate any additional impacts to marine resources that may have occurred. Such project changes ~~could~~ shall include

consideration of include the implementation of additional monitoring measures to determine whether significant changes to sediment chemistry and benthic ecology are occurring, the removal of accumulated materials and restoration of benthic habitat, and~~/or~~ modifications to the management or ~~deployment~~ operation of project facilities. ~~For the purposes of this condition, "significant changes" to benthic sediments beneath the aquaculture facility shall comprise: (a) visible accumulation of oyster shell material, feces or pseudofeces, fouling organisms, or other project-related debris; (b) statistically-significant changes in sediment grain size or porosity relative to the pre-project baseline and control sites.~~

USC Response

USC proposes a couple of slight wordsmithing changes to the proposed amended language, for the following reasons: (1) the addition of the words "significant amount" avoids an issue where there could be trace amounts of shell material, gear, or fouling organisms (i.e. after a storm event), that can easily be picked up and remedied as part of USC's existing requirements under Conditions 2 and 4; (2) USC would prefer to leave the "and/or" as previously stated, to provide both Coastal Commission staff and USC the flexibility to consider any of the options listed based on the amount of accumulation. It is not apparent that it would be appropriate to consider all of the stated options in all circumstances. Therefore, USC would propose the following changes to the condition language provided yesterday:

"Visual benthic monitoring of the quantity, type and distribution of biological materials from the shellfish facilities (such as shellfish, shell material, shellfish feces and pseudofeces, and fouling organisms) accumulating on the seafloor shall be conducted quarterly at multiple sites beneath the shellfish facility. Monitoring sites shall include at least one location beneath the FLUPSY facility, two locations beneath the long-line array, and two control sites to be selected based on their similarity to the project area in terms of sediment character and water depth, but at but at least 100 m distant. If during ~~any one~~ monitoring ~~event~~ visible accumulation of a significant amount of oyster shell material, feces or pseudofeces, fouling organisms, or other project-related debris is observed, USC-WIES shall apply for an amendment to this permit proposing to redesign the project to avoid recurrence of these changes, and to mitigate any additional impacts to marine resources that may have occurred. Such project changes shall include consideration of include the implementation of additional monitoring measures to determine whether significant changes to sediment chemistry and benthic ecology are occurring, the removal of accumulated materials and restoration of benthic habitat, and/or modifications to the management or operation of project facilities."

3. Benthic Impact Findings: USC noted several concerns related to the benthic findings, noting that (1) all of the studies cited pertain to mussels rather than oysters; (2) all of the studies cited pertain to commercial-scale mussel operations that are significantly larger and more dense than USC's proposal (in fact, much larger than anywhere on the U.S. West Coast); and (3) the staff report ignores some of the authors' conclusions (for example, both of the Wilding studies conclude that, even at the densities studied, there would not be a significant effect to the benthic environment). The staff report also does not include the most relevant study done in California on the subject. Rumrill and Poulton considered this issue when evaluating oyster

longlines in Humboldt and found no significant effect associated with the benthic environment. USC also specifically requests deletion of the language on page 14: "~~However, the available site-specific information is not sufficient to rule out the potential for significant adverse impacts to benthic marine resources as a result of the project~~."

4. Condition 3.F: USC has concerns that the condition, as written, would prohibit staff from minor modifications of the permit or conducting an investigation into minor issues without USC ceasing all operations, which could ruin its research effort. The Coastal Commission acknowledged this concern and requested revised language. The Coastal Commission still has the authority to require cessation of operations in the event of permit violations, without that being a condition of the permit. USC considered the following modification: "If an amendment to this permit is required by this condition, USC-WIES shall submit a complete permit amendment to the Commission for review ~~and cease the operations causing the impacts until that amendment is approved by the Commission~~." However, note that the requested language is already part of Conditions 3.B and 3.C; therefore, USC requests deletion of Condition 3.F in its entirety.

5. Corps Permitting Process: The Corps generally has not required a Section 404 permit for projects similar to USC's. In the event that the Corps does request such a permit, that is an issue that must be discussed between USC and the Corps. Therefore, USC requests the deletion of references to Section 404 on page 11 of the findings: "The U.S. Army Corps of Engineers (ACOE) has regulatory authority over the proposed project under Section 10 of the Rivers and Harbors Act of 1899 (33 USC 1344) ~~and Section 404 of the Clean Water Act~~. Section 10 of the Rivers and Harbors Act regulates structures or work in navigable waters of the United States. ~~Section 404 of the Clean Water Act regulates fill or discharge of materials into waters and ocean waters.~~"

6. Cleaning and Maintenance: USC requests deletion of language on page 15, which states that "USC-WIES has committed to the following: (1) conducting all equipment cleaning and bio-fouling removal activities ~~on land~~ with no ocean disposal of fouling organisms; and (2) implementation of a regular maintenance and inspection program to ensure that all project-related structures and equipment are kept in good working condition . . ." This revision is consistent with Condition 2 and the project description on page 10. The Coastal Commission requested additional information regarding the proposed cleaning and maintenance of USC's gear. USC will provide additional details ASAP.

Thank you again for your assistance on this project and consideration of USC's proposed changes. We would like to schedule a call as soon as possible to discuss specifically whether the proposed revisions to Condition 3.C are acceptable.

Robert M. Smith / Partner / Plauché & Carr LLP / 811 First Avenue, Suite 630 / Seattle, WA 98104
robert@plauchecarr.com / Phone: (206) 588-4188 / Fax: (206) 588-4255

error, please call (206) 588-4188 x 102 and return this e-mail to Christine Lengele at christine@plauchecarr.com and delete from your files. Thank you.

From:	Robert Smith
To:	Street, Joseph@Coastal; Teufel, Cassidy@Coastal; Dettmer, Alison@Coastal
Cc:	Roberta Marinelli; Jessica Margot Dutton
Subject:	USC - Cleaning and Maintenance
Date:	Wednesday, December 02, 2015 7:29:33 PM

Below is a description of USC's proposed cleaning and maintenance of its proposed facilities:

For the new structures installed by the USC research program, regular fouling inspections will be conducted visually during routine operations; these include weekly small-boat visitations for maintenance and research activities, and seasonal and annual surveys of the installation. Based on these observations, cleaning of equipment and/or removal of fouled materials will be conducted as needed. Methods will include primarily hand-swapping of gear and retrieval to upland locations for cleaning (ex. power washing, scraping, air-drying) and appropriate land-based disposal. In-water cleaning will use mechanical (i.e. non-chemical) techniques, with biofouling organisms and biological materials contained using tarps and/or screens. No discharge of biological materials, untreated wash water, or biofouling materials into Catalina Harbor shall occur during maintenance cleaning operations.

Robert M. Smith / Partner / Plauché & Carr LLP / 811 First Avenue, Suite 630 / Seattle, WA 98104
robert@plauchecarr.com / Phone: (206) 588-4188 / Fax: (206) 588-4255

From:	Rogers, Bonnie L SPL
To:	Street, Joseph@Coastal
Subject:	RE: ARMY CORPS Agency Notification SPL-2015-00329-blr Catalina USC shellfish research Project, Letter of Permission (UNCLASSIFIED)
Date:	Friday, December 04, 2015 12:27:22 PM

CLASSIFICATION: UNCLASSIFIED

Hi Joe,

I reviewed USC's application request and a Department of the Army permit is required. However, because there is no 'discharge of fill material' the permit is only regulated under Section 10 (but your paragraph below is general regarding what we regulate so the language is okay to me). I issued a conditional Letter of Permission (LOP) (not NWP #5), which requires they obtain my review and approval on their CDP and 401 prior to initiating any work in waters of the United States. While they could qualify for Nationwide #5, because the facility is the first we have permitted that I am aware, I determined an LOP was more appropriate.

The permit review process included consultation with the NMFS for EFH which was concluded. I did not initiate any ESA Section 7 consultation with the USFWS nor NMFS because I determined there was No Effect to threatened or endangered species.

You should also add in a sentence to your paragraph that a RWQCB 401 certification is required for the project. Originally they had not applied because one is typically not required for LOPs; but because the project is an aquaculture project, the Board requires one in this case.

Revised paragraph below:
The U.S. Army Corps of Engineers (ACOE) has regulatory authority over the proposed project under Section 10 of the Rivers and Harbors Act of 1899 (33 U.S.C. 1344) and Section 404 of the Clean Water Act. Section 10 of the Rivers and Harbors Act regulates structures or work in navigable waters of the United States. Section 404 of the Clean Water Act regulates fill or discharge of materials into waters and ocean waters. The ACOE is reviewing the proposed project under an individual permit, Letter of Permission, and, as necessary, will consult with the National Marine Fisheries Service (NMFS) under the Magnuson-Stevens Fishery Conservation and Management Act to assess any potential project impacts to Essential Fish Habitat and Section 7 of the Endangered Species Act to assess any potential project effects to federal endangered and threatened species. Pursuant to Section 307(c)(3)(A) of the Coastal Zone Management Act (CZMA), any applicant applying for a federal permit to conduct an activity affecting any land or water use or natural resource in the coastal zone must obtain the Commission's concurrence in a certification to the permitting agency that the project will be conducted consistent with California's approved coastal management program. The subject coastal development permit (#9-14-0489) will serve as Commission review of the project under the CZMA."

Bonnie L. Rogers
Senior Project Manager / Biologist
U.S. Army Corps of Engineers
Regulatory Division
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Homepage: http://www.spl.usace.army.mil/Missions/Regulatory.aspx
You are invited to complete our customer survey:
http://corpsmapu.usace.army.mil/cm_apex/f?p=regulatory_survey
*Our auto out-of-office notices are no longer active.

December 7, 2015

California Coastal Commission
45 Fremont Street, Suite 200
San Francisco, CA 94105

RE: Comments on Item W10a Application No. 9-14-0489 USC Oyster Aquaculture in Cat Harbor, Catalina Island

Dear Chair Kinsey and California Coastal Commissioners:

On behalf of our organizations and the hundreds of thousands of members we represent, Heal the Bay, Surfrider Foundation, and the Natural Resources Defense Council appreciate the opportunity to provide comments on the proposed USC Oyster Aquaculture project in Cat Harbor, Catalina Island. We have reviewed the staff report describing the shellfish aquaculture project and respectfully submit the following comments.

Our organizations understand the importance of research to inform emerging aquaculture industries and the impacts of ocean acidification in California, and we believe that there is potential to pursue aquaculture of some species in a way that finds harmony with local fisheries and the local environment. However, we believe that in this case, the ecological risks of introducing non-native species to a marine protected area (MPA) merit reconsideration of the project scope and site selection.

We thank Commission staff for outlining the potential risks to the natural environment from the proposed project; we share these same concerns. We also appreciate the conditions that staff has recommended, especially those pertaining to implementing a monitoring program and entanglement mitigation actions. However, we have concerns with permitting this project within an MPA given its potential to damage the marine ecosystem, including propagation of non-native marine species within a sensitive and protected island marine habitat. **Therefore, we recommend that the project be revised to site the aquaculture activities *outside* of the Cat Harbor State Marine Conservation Area (SMCA) and to use native, rather than non-native oysters.**

The protection and stewardship of California's coastal resources are among our state government's most important long-term responsibilities. As the mission of the California Coastal Commission is "to protect, conserve, restore, and enhance environmental and human-based resources of the California coast and ocean for environmentally sustainable and prudent use by current and future generations," The proposed project's introduction of non-native, invasive marine species into an MPA is inconsistent with both the Coastal Act and the Coastal Commission's mission.

Site Selection: Marine Protected Area

California recently completed the nation's first science-based, statewide network of marine protected areas to help protect and restore marine life, habitat and iconic ocean places for future generations. Our

organizations participated in the regional stakeholder groups during the statewide Marine Life Protection Act (MLPA) implementation process and we continue to engage in the monitoring and implementation of our MPAs today. Thus, we have a strong interest in the success of MPAs. We appreciate that the Commission and its staff have begun considering impacts to MPAs during CCC project evaluation. A wide variety of projects under Commission jurisdiction may impact MPAs, including seismic surveys, desalination facilities, offshore aquaculture, coastal development, beach nourishment, dredging, and offshore renewable energy. Efforts to avoid or minimize impacts from these activities are critical to the long term effectiveness of the MPA network. Appropriate siting and mitigation must be fundamental tools for avoiding and reducing impacts to MPAs.

The goal of the Cat Harbor research project is to improve sustainable shellfish production. The project is not designed to advance understanding of MPA performance or monitoring. Nor is the project consistent with the regulations or intent of the Cat Harbor SMCA. While MPAs in Morro Bay and Drakes Estero) included explicit regulatory language allowing for ongoing aquaculture activities, the Cat Harbor SMCA regulations do not allow for shellfish aquaculture. We are also concerned about the precedent this project could set for other MPAs throughout California. In summary, we believe this project should be sited in a location outside of MPA boundaries.

Invasive Species

We are concerned about the use of non-native Pacific Oysters and Kumamoto Oysters for cultivation, due to the potential for them to spread across Catalina's valuable island ecosystems and beyond. While these species are prevalent along the mainland coast, they do not appear to have invaded Catalina Island, especially the backside – yet. Though monitoring is proposed, if spreading is detected it will likely already be too late to reverse or mitigate the colonization of non-native species. In reviewing this project, we urge the Commission to determine the typical ranges in larval dispersal for the Pacific Oyster and the Kumamoto Oyster, identify how potential spread will be prevented and how potential colonization of non-native oysters will be monitored and enforced, beyond applicant-reporting. We also urge you to identify what the penalties will be if non-native oyster introduction occurs and consider requiring a bond to safeguard against such as outcome. We recommend that this project utilize native oyster species (i.e. Olympia oyster) for cultivation and research, instead of non-native species to adequately protect the MPA and Catalina's marine ecosystem.

Monitoring

We appreciate staff's recommendation of an Aquaculture Monitoring Program. If approved, it is important that this project is closely monitored for impacts to the marine habitat and establishment of non-native species- especially within an MPA. We request additional clarity regarding the proposed monitoring program: How would impacts be addressed and reported? How would the monitoring program be enforced by the Coastal Commission? How far away will marine resources be monitored, especially in regards to larval dispersal? Based on ocean currents, what impact will the larvae have on Catalina Island's unique and sensitive marine species and habitats?

Since the staff conditions for including a monitoring plan are significant, we request that the public be granted the opportunity to review a draft monitoring plan and provide comments. In addition, because

the Department of Fish and Wildlife's (DFW) scientific collecting permit (SCP) is based on the assumption that the aquaculture research will not significantly affect marine life or habitats within the MPA, monitoring reports provided to the Commission should also be shared with DFW and the Fish and Game Commission so they can assess project effects on MPA ecology and revise or revoke the SCP if adverse impacts are detected. We also request that these reports be available for review by the public.

The proposed project would be the first of its kind in California's MPAs and has the potential to set precedence for more development and aquaculture in MPAs in our state. We urge relocation of the project to an alternative site outside of the MPA. If approved, this project should set forth with the best available practices that are compatible with the MPA and local marine ecosystem, enforcement, monitoring and mitigation measures possible. We appreciate the opportunity to comment on this project. Please contact us at dmurray@healthebay.org and jeckerle@nrdc.org if you have any questions.

Sincerely,

Dana Roeber Murray
Senior Coastal Policy Manager
Heal the Bay

Jenn Eckerle
Ocean Policy Analyst
NRDC

Jennifer Savage
California Policy Manager
Surfrider Foundation

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W10a

Filed:	4/17/15
180th Day:	10/14/15
270th Day:	1/12/16
Staff:	J. Street - SF
Staff Report:	11/20/15
Hearing Date	12/9/15

STAFF REPORT: REGULAR CALENDAR

Application No.:	**9-14-0489**
Applicant:	**University of Southern California Wrigley Institute for Environmental Studies**
Agent:	Robert M. Smith, Plauché & Carr, LLP
Location:	Catalina Harbor, Santa Catalina Island, Los Angeles County.
Project Description:	Install an oyster aquaculture research facility consisting of a floating upwelling system and up to four longline cultivation systems.
Staff Recommendation:	Approval with conditions.

SUMMARY OF STAFF RECOMMENDATION

The University of Southern California Wrigley Institute for Environmental Studies (USC-WIES) is requesting authorization to install and operate, for a period of five years, a shellfish aquaculture research facility within the Cat Harbor State Marine Conservation Area (SMCA), a state designated Marine Protected Area (MPA) located within a coastal embayment on the southwestern shore of Santa Catalina Island, Los Angeles County (**Exhibits 1**, **2**). The proposed facility would be comprised of two main elements: (1) an approximately 480-square foot floating upwelling nursery system (FLUPSY) designed to culture juvenile Pacific oysters (*Crassostrea gigas*) and Kumamoto oysters (*Crassostrea sikamea*); and (2) an array of up to four parallel,

150-foot buoyed longlines with attached trays capable of rearing a total of approximately 48,000 oysters to maturity. Within two years, the oysters would reach reproductive maturity and be used for laboratory breeding or growth experiments. Some oysters would also remain in the longline system to ensure the propagation of genetic lines. No new onshore facilities are proposed. USC-WIES proposes to grow and maintain a stock of Pacific and Kumamoto oysters in order to support its on-going research into the genetics and physiology of these commercially-important shellfish species, and allow for complete life-cycle research on experimental stocks.

The key Coastal Act issue of concern is the potential of the project to adversely affect marine resources within and outside a MPA by (1) altering benthic, water column, and surface water habitat characteristics; (2) providing a source for potential disturbance, injury, and predation to marine wildlife; and (3) promoting the spread and dispersion of non-native marine organisms, including the non-native oyster species being cultivated. Given that the proposed project would occur within a State Marine Conservation Area and Coastal Act Section 30230 instructs that special protection shall be given to areas of special biological significance, staff recommends reasonable measures to ensure the protection of marine resources at this site.

The Commission staff believes that with implementation of **Special Conditions 1-6**, the project can be carried out consistent with the marine resource and water quality protection policies of the Coastal Act. **Special Condition 1** would limit the permit term consistent with the current sub-lease term for the project site, providing the Commission the opportunity to re-assess the coastal resource impacts of the operation after it has been functioning for approximately 5 years. In addition, **Special Conditions 2-5** would avoid and minimize the potential for marine resource impacts by: (1) reducing the potential for release of invasive species into Catalina Harbor during maintenance cleaning and prohibiting the disposal of equipment and debris into the ocean; (2) requiring a monitoring program to assure avoidance of project impacts to marine resources, including the potential for adverse changes to benthic habitats and the potential for establishment of non-native oyster species outside of cultivation (and if unanticipated impacts occur, to mitigate those impacts); (3) requiring regular inspection and maintenance of all project equipment, and the prompt removal of equipment and site restoration following project completion, in order to minimize the risk of entanglement to marine wildlife and the accidental release of equipment in the marine environment; and (4) requiring the employment of a marine wildlife monitor during boat transit and construction activities to reduce the risk of collisions with marine wildlife. The applicant has also committed to the installation of passive wildlife exclusion devices to discourage the use or colonization of project structures by marine mammals or seabirds.

Due to its small size and siting away from the primary navigation channels and mooring areas within Catalina Harbor, operation of the proposed aquaculture facility would not significantly interfere with commercial and recreational fishing or public access and recreation. **Special Conditions 2, 4,** and **6** would avoid and minimize the risk of vessel entanglement, damage to fishing gear, and other recreational impacts by: (1) prohibiting the ocean disposal of project equipment and debris; (2) requiring regular inspection and maintenance of the facility to minimize fugitive debris; and (3) providing for the prompt removal of equipment and site restoration at the end of the project.

Commission staff recommends that the Commission **APPROVE** coastal development permit application 9-14-0489, as conditioned.

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Appendix A – Substantive File Documents

EXHIBITS

Exhibit 1 – Regional Map
Exhibit 2 – Project Location
Exhibit 3a – FLUPSY Diagram and Components
Exhibit 3b – Longline and Suspended Tray Diagrams
Exhibit 4 – Photo of Seafloor at Project Site

I. MOTION AND RESOLUTION

Motion:

*I move that the Commission **approve** Coastal Development Permit 9-14-0489 subject to conditions set forth in the staff recommendation specified below.*

Staff recommends a **YES** vote on the foregoing motion. Passage of this motion will result in approval of the permit as conditioned and adoption of the following resolution and findings. The motion passes only by affirmative vote of a majority of Commissioners present.

Resolution:

The Commission hereby approves the Coastal Development Permit for the proposed project and adopts the findings set forth below on grounds that the development as conditioned will be in conformity with the policies of Chapter 3 of the Coastal Act. Approval of the permit complies with the California Environmental Quality Act because either 1) feasible mitigation measures and/or alternatives have been incorporated to substantially lessen any significant adverse effects of the development on the environment, or 2) there are no further feasible mitigation measures or alternatives that would substantially lessen any significant adverse impacts of the development on the environment.

II. STANDARD CONDITIONS

This permit is granted subject to the following standard conditions:

1. **Notice of Receipt and Acknowledgment**. The permit is not valid and development shall not commence until a copy of the permit, signed by the applicant or authorized agent, acknowledging receipt of the permit and acceptance of the terms and conditions, is returned to the Commission office.

2. **Expiration**. If development has not commenced, the permit will expire two years from the date on which the Commission voted on the application. Development shall be pursued in a diligent manner and completed in a reasonable period of time. Application for extension of the permit must be made prior to the expiration date.

3. **Interpretation**. Any questions of intent of interpretation of any condition will be resolved by the Executive Director or the Commission.

4. **Assignment**. The permit may be assigned to any qualified person, provided assignee files with the Commission an affidavit accepting all terms and conditions of the permit.

5. **Terms and Conditions Run with the Land**. These terms and conditions shall be perpetual, and it is the intention of the Commission and applicant to bind all future owners and possessors of the subject property to the terms and conditions.

III. SPECIAL CONDITIONS

This permit is granted subject to the following special conditions:

1. **Permit Term Limit.** The term of the permit shall be limited to the current term of USC's memorandum of understanding (MOU) with the Santa Catalina Island Company (SCICo) for the marine shellfish cultivation research facilities, which ends on December 31, 2020. If this MOU is extended or a new MOU between USC and SCICo is established and the California State Lands Commission does not determine that operation of the shellfish research facility past 2020 would be inconsistent with the lease it issued to SCICo, an application for a Coastal Development Permit (CDP) amendment may be submitted to request an extension of the CDP term. If an extension is sought, a complete CDP amendment application shall be submitted no later than July 1, 2020, to ensure that adequate time is provided for the amendment application to be considered by the Commission prior to termination of the permit.

2. **Discharge of Materials.** USC-WIES shall not intentionally dispose of or release any equipment or waste, including lines, buoys, cultivation trays, and other equipment, or living or dead shellfish, shells, or non-native fouling organisms into the marine environment. All maintenance cleaning operations of the cultivation facility, including its buoys, ropes, lines, cables, and anchors, shall be carried out onshore or in a contained manner sufficient to capture all dislodged biological materials. All non-native fouling organisms and biological materials from non-native organisms removed during these cleaning operations shall be collected and disposed at an appropriate upland facility. No discharge of untreated wash water or non-native fouling materials shall occur during maintenance cleaning operations.

3. **Aquaculture Monitoring Program.**

   A. PRIOR TO COMMENCEMENT OF DEVELOPMENT, USC-WIES shall submit for review and approval by the Executive Director an Aquaculture Monitoring Program. No development shall commence until the Executive Director has approved the Aquaculture Monitoring Program. The Aquaculture Monitoring Program shall, at a minimum, include the following:

   B. <u>Benthic Monitoring</u>

      (1) monitoring of the quantity, type, and distribution of biological materials from the shellfish facility (such as shellfish, shellfish feces and pseudofeces, shell material, and fouling organisms) accumulating on the seafloor;

      (2) monitoring of the grain size and porosity of the upper 10 cm of seafloor sediments below and in the vicinity of the facility;

      Visual benthic monitoring shall be conducted quartlerly at multiple sites beneath the shellfish facility and at several control sites to be selected based on their similarity to the project site in terms of sediment character and water depth, but at but at least 100 m distant. Grain size and porosity monitoring shall be conducted on an annual basis. The benthic monitoring program shall also include baseline sampling of the project and control sites to establish pre-project conditions. If during any one monitoring event significant changes in the character of the sediments beneath the aquaculture facility are

noted, USC-WIES shall apply for an amendment to this permit proposing to redesign the project to avoid recurrence of these changes, and to mitigate any additional impacts to marine resources that may have occurred. Such project changes could include the implementation of additional monitoring measures to determine whether significant changes to sediment chemistry and benthic ecology are occurring, the removal of accumulated materials and restoration of benthic habitat, and/or modifications to the management or deployment of project facilities. For the purposes of this condition, "significant changes" to benthic sediments beneath the aquaculture facility shall comprise: (a) visible accumulation of oyster shell material, feces or pseudofeces, fouling organisms, or other project-related debris; (b) statistically-significant changes in sediment grain size or porosity relative to the pre-project baseline and control sites.

C. Non-native Oyster Monitoring: monitoring areas outside of cultivation for the potential for local spatfall and establishment of the non-native oysters proposed to be cultivated on the longlines, including:

(1) regular monitoring of surface water temperatures in the vicinity of the project site;

(2) monitoring of water-column settlement traps, consisting of oyster shells suspended on lines or in wide-opening mesh bags, at multiple locations within Cat Harbor. The settlement traps shall be monitored for Pacific and Kumamoto oyster spatfall, establishment and growth following all likely spawning events but no less than twice per year, once in the autumn following the potential oyster reproductive season (as determined based on water temperature measurements or other evidence), and once in the spring prior to new spawning activity.

If any settled Pacific or Kumamoto oysters are observed on a settling trap or other surface in the Cat Harbor State Marine Conservation Area (other than the aquaculture equipment on which they are planted), USC-WIES shall submit an application for a CDP amendment proposing project modifications necessary to prevent the establishment of the non-native oysters in Cat Harbor SMCA outside the areas of cultivation. Such project changes could include the addition of further monitoring, surveys of suitable habitat within Cat Harbor for oyster establishment, eradication efforts, studies to determine the origin of the oysters colonizing the settlement traps, or modifications to the management or operation of project facilities.

D. Compliance with the Aquaculture Monitoring Program shall include annual reporting to the Commission staff through the end of the project term. The first annual report shall be submitted to the Executive Director for review and approval 12 months after completion of construction or initial shellfish planting activities, whichever date is first. These annual reports shall include the data and methods from all sampling and monitoring activities, an analysis of sampling and monitoring results, and a discussion of preliminary or final results and conclusions. Within 60 days of the submittal of the year five annual monitoring report, a final report shall be submitted that includes a summary of all monitoring, sampling and research results and a discussion of the findings of each monitoring and research activity.

E. Observations of settled Pacific or Kumamoto oysters on a settling trap or other surface in the Cat Harbor State Marine Conservation Area (other than the aquaculture

equipment on which they are planted) shall be immediately reported to the Executive Director.

F. If an amendment to this permit is required by this condition, USC-WIES shall submit a complete permit amendment application and cease the operations causing the impacts until that amendment is approved by the Commission.

4. **Marine Debris and Wildlife Entanglement.** During all routine maintenance visits to the aquaculture facilities, USC-WIES shall inspect visible lines and equipment for wildlife entanglement. USC-WIES shall visually inspect all ropes, cables, and longline equipment to determine if any entanglement of a marine mammal has occurred and to ensure that: (a) no lines have been broken, lost or removed; (b) all longlines, anchor lines, and buoy lines remain taught and in good working condition; and (c) any derelict fishing gear or marine debris that collects on the facility is removed and disposed of at an authorized onshore facility. The results of the monthly surveys shall be compiled and submitted to Commission staff in an annual report no later than December 31st of each year.

   Any wear or fatigue of materials shall be remedied as soon as feasible. All equipment and materials accidentally released or found to be missing from the facility during monthly inspections, including buoys, floats, lines, ropes, chains, cultivation trays, wires, fasteners, and clasps, shall be searched for, collected, properly disposed of onshore, and documented in the annual inspection report. All incidents of observed marine mammal entanglement shall be immediately reported to the National Marine Fisheries Service's Regional Stranding Coordinator for California (http://www.nmfs.noaa.gov/pr/health/coordinators.htm#westcoast) and Commission staff. All incidents of potential entanglement (including dislodged, broken, or missing ropes, equipment, or gear) or lost gear shall be detailed in a written letter and submitted to Commission staff within two days of their occurrence.

5. **Construction Monitor.** A qualified marine wildlife observer approved by the Executive Director shall be onboard all project construction vessels during the installation of the FLUPSY, longlines and anchoring systems, and during transit to and from the staging areas. The observer shall monitor the presence of large marine wildlife (mammals and reptiles) and shall have the authority to halt or modify operations, including boat transit, if marine wildlife is observed or anticipated to be near a work or transit area and installation or transit activities have the potential to result in injury or entanglement of marine wildlife.

6. **Site Restoration**. At least 30 days prior to the termination of this permit, or at least 30 days prior to the cessation of operation of the aquaculture research facility, whichever occurs first, USC-WIES shall submit a complete Coastal Development Permit application for the timely recovery and removal of all of project structures, anchors, and materials.

IV. FINDINGS AND DECLARATIONS

A. BACKGROUND AND PROJECT DESCRIPTION

The University of Southern California Wrigley Institute for Environmental Studies (USC-WIES) proposes to install and operate a new shellfish aquaculture facility within the Cat Harbor State Marine Conservation Area ("Cat Harbor"), a state designated marine protected area (MPA) in a narrow inlet on the southwestern shore of Santa Catalina Island, not far from the existing USC-WIES campus in the village of Two Harbors (**Exhibits 1**, **2**). The purpose of the new facility is to support on-going research into physiology and genetics of two commercially-important oyster species, the Pacific oyster (*Crassostrea gigas*) and Kumamoto oyster (*Crassostrea sikamea*).

Shellfish research conducted by USC-WIES occurs primarily at the Wrigley Marine Science Center (WMSC) in Two Harbors. Shellfish research at the center currently uses experimental stocks at early life history stages, from gametes to approximately one month of development. Beyond that point, experimental oysters cannot be maintained in significant numbers since juvenile and adult oysters require food at levels that exceed the ability of WMSC's indoor algal facility. Installation of the new offshore aquaculture facility would allow USC-WIES to rear older juvenile, adult, and reproductively-active oysters, and to expand the scope of its program to include full life-cycle and multi-generational research.

The proposed new facility would consist of (1) a **fl**oating **up**welling **sy**stem (FLUPSY) to hold juvenile bivalves from 2-3 mm in size until they reach approximately 2.5 cm in size, and (2) a small, four-line suspended longline and tray system for rearing bivalves to maturity. The total area occupied by the facilities, including anchors and lines, would be approximately 40,000 square feet (400 ft x 100 ft; 0.9 acre), though the surface expression of the facilities would be much smaller.

Solar-Powered FLUPSY

Juvenile oysters beyond a size of 2-3 millimeters consume more algae than can be supplied from land-based algal culture facilities at the WMSC. In order to cultivate oysters to later life-stages, USC-WIES proposes to install a FLUPSY in the protected shallow waters (9-24 meters) of Catalina Harbor (**Exhibit 2**), for the rearing of juvenile oyster seed to a size suitable for planting into a final grow-out system. A FLUPSY is an in-water floating structure designed to upwell nutrient rich water through upwelling bins to provide a consistent source of nutrients to growing shellfish. The submerged trough, upwelling bins and shellfish trays, propeller and drive-train, circulation pumps, and other equipment comprising the FLUPSY would be supported on a floating barge (29 feet L x 16.5 ft W x 5.5 ft H) and powered by a solar panel array with back-up battery storage (in secondary containment) installed on the barge deck. The FLUPSY would be moored by line and chain to four 200-pound Danforth anchors embedded in the seafloor. Deterrents (fencing, netting, etc.) would be placed on and around the FLUPSY to prevent aggregation and haul-out behavior on the structure by marine wildlife. A diagram and list of components of the FLUPSY facility is provided in **Exhibit 3a**.

Longline Grow-out Facility

Adult shellfish grow-out in Cat Harbor would consist of off-bottom, suspended longlines similar to those used at commercial aquaculture facilities. An array of up to four parallel, 150-foot

buoyed longlines, composed of commercial-grade 1-inch polypropylene line, would be placed in shallow waters (9-24 m) adjacent to the proposed FLUPSY (**Exhibit 2**). Up to 15 stacks of 8 high-density polyethylene shellfish culture trays would be suspended along each longline, at 10-foot intervals. This array would provide a total capacity of 120 grow-out trays per longline. Each tray can hold up to 100 adult oysters, for a maximum of 12,000 adult oysters on each longline. Assuming each whole oyster weighs 50 grams, the maximum mass of total living oyster tissue per line, discounting for shell weight at a shell-to-meat weight ratio of 6:1 (Quayle, 1988), would be approximately 100 kg (220 lbs). USC-WIES anticipates that the longlines would be installed in stages, with one longline placed in the first year of the project, and up to three additional longlines placed during years two to four as needed to support research activities. The four longlines would be anchored to the seafloor by two 200-pound Danforth anchors each, with an extra anchor at each end of the array for a total of ten anchors. Each longline will have a buoy at either end from the anchor line, with fifteen 20kg buoyancy floats along the length for a total of seventeen buoys. In total, the four longlines would be supported by 68 buoys and floats. At most, the longline array would have a total surface area of approximately 9,000 square feet (150 ft L × 60 ft W × 6 ft H). However, because the longline tray stacks would be submerged to a depth of 6 feet, the surface expression of this grow-out facility would be minimal. A diagram of the longline and suspended tray facility is provided in **Exhibit 3b**.

Installation, Staging and Operation

Installation of the FLUPSY and longline systems would be staged onshore at Wells Beach and/or the WMSC campus (*see* **Exhibits 1** and **2**), in paved or disturbed dirt/gravel areas. Components and equipment would be carried to the Catalina Harbor site using USC Facilities boats, and assembled on site. The setting of anchors (and other sub-surface work) would be carried out by USC divers. A GPS unit would be used to position each anchor at pre-selected, surveyed locations, and a small crane would be used to deploy the anchors and lower them to the seafloor. The dive team would then check each anchor to ensure a secure placement before rigging the FLUPSY and longlines. A wave modeling and anchoring analysis conducted by USC-WIES indicates that the proposed anchoring system provides sufficient hold capacity to withstand the wave and current forces likely to be encountered during the term of the project (USC-WIES 2015b). All large pieces of gear, including buoys and stacked culture trays, would be clearly marked as the property of USC-WIES.

Once installed, the aquaculture facility would be accessed approximately two to three days a week during the active research season (late spring through early fall) for routine planting and harvesting of research organisms, with additional visitation as necessary. All planting and harvesting would be conducted by hand from a small boat equipped with a davit for hoisting the culture tray stacks. Adult shellfish would be maintained in the longline trays year-round, requiring regular visits approximately once per week during the winter. Routine inspection and maintenance of the FLUPSY and longline facilities would be conducted at least two to three times per week during the summer months, and approximately once per week during the winter, in association with research activities. Additional inspections and maintenance would be performed as necessary, for instance following winter storms or high wave events. Most facility components and equipment are designed to last for the full five-year research program; shorter-lived components (e.g., FLUPSY pump motors, batteries, etc.) would be replaced as needed. All

lines, anchors, chains and shackles would be inspected at least once per year and replaced as necessary.

Bio-fouling inspections would be conducted visually during the routine visits described above, with removal of fouling organisms to be performed as needed (approximately once per month during the summer high growth season). Removal of bio-fouling would consist of the hand-swapping of fouled components and retrieval of fouled gear to upland locations at the WMSC for scraping, power washing and air-drying, followed by land disposal. No bio-fouling removal or disposal would occur on site or in ocean waters. USC-WIES has also proposed to conduct quarterly visual and video monitoring of the seafloor beneath the aquaculture facilities to evaluate changes to the benthic environment.

Installation of the aquaculture facilities is proposed to begin in the fall of 2015. The project term is approximately five years, with an end date of December 31, 2020.

B. SITE SELECTION AND PROJECT ALTERNATIVES

The project is proposed to be sited in the southwestern, seaward portion of the Cat Harbor SMCA, adjacent to an existing fish pen operated by the Hubbs-Sea World Research Institute (**Exhibit 2**). USC-WIES and Commission staff evaluated several alternative sites to determine if potential impacts associated with the proposed project could be avoided or further minimized.

Location alternatives considered included both other Catalina Island sites and sites on the Southern California mainland. As a general matter, locating the project along the mainland coast or at a more distant Catalina location would introduce significant logistical difficulties without necessarily reducing the project's potential adverse effects on coastal resources. Most of the USC-WIES shellfish research occurs at the WMSC campus near Two Harbors. An off-site project location would require moving the existing research operation (potentially including existing facilities) or transporting shellfish from the cultivation site back to the WMSC. While this second option might prove to be feasible, the long transport times and variable environmental conditions that would occur during transport would be likely to undermine the research program supported by the project, which depends on the survival of the research subjects and close monitoring of the environmental conditions experienced by the shellfish.

Among the potential locations in close proximity to the WMSC campus, including Isthmus Cove and Big Fisherman Cove on the northern side of the island, and Cat Harbor on the southern side, Cat Harbor possesses a number of advantages. First, Cat Harbor is the more protected inlet, reducing the likelihood of the accidental release of gear and equipment from the facility during storm events. Second, due to its more distant location on the "backside" of the island, Cat Harbor typically experiences lighter boat traffic than the more heavily-used Isthmus Cove, reducing the potential for conflicts with recreational boating and navigation. Third, although Cat Harbor is a designated SMCA, the regulations governing the SMCA allow for certain research activities within its boundaries (*see* 14 CCR 632(b)(131)), and the California Department of Fish and Wildlife has authorized the proposed project as a research activity by issuing a Scientific Collecting Permit and Letter of Authorization to USC-WIES. Big Fisherman Cove, though nearer to the WMSC campus, is also contained within an SMCA - the Blue Cavern SMCA and would raise similar issues with regard to potential adverse impacts to MPA resources. Concerns

about the potential for establishment of non-native species (see below) as a result of the project would apply equally to the several Catalina Island locations.

As discussed in more detail below, the proposed project location within Cat Harbor was selected in order to avoid sensitive species and habitats (including critical habitat for endangered black abalone, rocky intertidal zones, aquatic vegetation and eelgrass beds) and the primary navigation, mooring areas, and recreational use areas inside the embayment.

C. OTHER AGENCY APPROVALS

U.S. Army Corps of Engineers

The U.S. Army Corps of Engineers (ACOE) has regulatory authority over the proposed project under Section 10 of the Rivers and Harbors Act of 1899 (33 U.S.C. 1344) and Section 404 of the Clean Water Act. Section 10 of the Rivers and Harbors Act regulates structures or work in navigable waters of the United States. Section 404 of the Clean Water Act regulates fill or discharge of materials into waters and ocean waters. The ACOE is reviewing the proposed project pursuant to Nationwide Permit #5 (for installation of scientific measurement devices), and, as necessary, will consult with the National Marine Fisheries Service (NMFS) under Section 7(a)(2) of the Endangered Species Act and Section 305(b) of the Magnuson-Stevens Fishery Conservation and Management Act to assess any potential project impacts to federal endangered and threatened species or essential fish habitat. Pursuant to Section 307(c)(3)(A) of the Coastal Zone Management Act (CZMA), any applicant for a required federal permit to conduct an activity affecting any land or water use or natural resource in the coastal zone must obtain the Commission's concurrence in a certification to the permitting agency that the project will be conducted consistent with California's approved coastal management program. The subject coastal development permit (#9-14-0489) will serve as Commission review of the project under the CZMA.

California Department of Fish and Wildlife

On April 25, 2012, the California Department of Fish and Wildlife (CDFW) issued a Scientific Collecting Permit as well as a Letter of Authorization (LOA) to the USC Wrigley Institute. The Scientific Collecting Permit allows for the take of certain marine organisms within a state MPA and the LOA was issued pursuant to Fish and Game Code 6400 for the proposed project, allowing the USC Wrigley Institute to stock Pacific and Kumamoto Oysters in Cat Harbor and/or Big Fisherman Cove for a period of 5 years, expiring on April 4, 2017. Intent to renew the LOA must be provided to CDFW 60 days prior to expiration. CDFW has also issued a Long-Term Importation Permit (Permit No. 2015-3617) authorizing USC to import Pacific Oysters from Taylor Mariculture in Washington State.

California State Lands Commission

The bottom lease for submerged state lands in Catalina Harbor is held by the Santa Catalina Island Company (SCICo). The California State Lands Commission (CSLC) recently approved a revised lease agreement (PRC 3639.1, February 21, 2014; Calendar Item C49) allowing for "one future shellfish aquaculture research facility" in the area covered by the lease, and allowing SCICo to arrange a sub-lease for the proposed shellfish aquaculture research activities proposed by USC. An MOU between USC and SCICo is in place (signed September 23, 2013), and is due to expire on December 31, 2020.

D. MARINE RESOURCES & WATER QUALITY

Section 30230 of the Coastal Act states:

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

Section 30231 of the Coastal Act states:

> *The biological productivity and the quality of coastal waters, streams, wetlands, estuaries, and lakes appropriate to maintain optimum populations of marine organisms and for the protection of human health shall be maintained and, where feasible, restored through, among other means, minimizing adverse effects of waste water discharges and entrainment, controlling runoff, preventing depletion of ground water supplies and substantial interference with surface water flow, encouraging waste water reclamation, maintaining natural vegetation buffer areas that protect riparian habitats, and minimizing alteration of natural streams.*

Placement and operation of the proposed facilities has the potential to adversely affect marine species, habitats, biological productivity and water quality through disturbance, loss, and alteration of benthic habitat; deposition of biological materials; alteration of water column habitat; disturbance and entanglement of marine wildlife; release of marine debris; filtration of marine waters; attraction and growth of invasive fouling organisms; release of reproductive materials from and establishment of non-native species; and collision of project vessels with marine mammals or sea turtles.

Benthic Habitat

The proposed shellfish cultivation facilities would be installed on the western side of the Cat Harbor SMCA, approximately 650 yards from the mouth of the inlet and 30 – 100 yards from the western shore, in 28 – 79 feet (9 – 24 meters) of water (**Exhibit 2**). Cat Harbor is a relatively long (1 mile), narrow (100 – 750 yards wide) inlet on the northwestern shore of Santa Catalina Island, ranging in depth from just a few feet near the head of the harbor to over 150 feet at the mouth.

Most of the seafloor within Cat Harbor is composed of low-relief soft bottom habitat, varying in grain size from mud and silt to coarse sand, depending on location. Hard-bottom substrates are largely limited to rocky intertidal and subtidal habitats along the shoreline, especially in the more seaward reaches of the inlet. Eelgrass has previously been documented at two locations within Cat Harbor, outside the bounds of the proposed project. A relatively large (1.5 acre) eelgrass bed is located in the south-central part of the inlet, approximately 215 feet east of the proposed project site, while a smaller bed (0.45 acre) is located just outside the Ballast Point sand spit further inside the inlet (Engle and Miller 2005; J. Engle, UCSB, pers. comm.). **Exhibit 2** shows the approximate area in which the eelgrass beds are located.

Rocky intertidal and subtidal habitat within Cat Harbor to a depth of 6 meters (19.7 feet) is designated as critical habitat for federally-endangered black abalone (50 CFR Part 226). However, black abalone are not currently believed to be present in Cat Harbor, with the last documented occurrence in 1975-78; no black abalone have been documented anywhere at Santa Catalina Island since 1989 (J. Engle, UCSB, pers. comm.).

USC scientific divers surveyed a 260 ft x 575 ft (80 m x 175 m) area of seafloor beneath and adjacent to the proposed project location in August of 2014. The surveys indicate that the benthic substrate in this area consists entirely of coarse sand, with no significant rocky outcrops and little submerged aquatic vegetation (**Exhibit 4**). No eelgrass (neither beds nor individual plants) were observed anywhere within the 150,000 square foot survey area. No invasive *Caulerpa* was observed in the area during surveys conducted by NMFS-certified USC divers.

Several aspects of the proposed project have the potential to affect benthic habitat below the aquaculture facility and in surrounding areas. These include the placement of the proposed anchoring devices for buoys and longlines, and the accumulation on the seafloor of biological material from the facility (such as shellfish, shells, and fouling organisms that may become dislodged during cultivation, harvest, or maintenance activities and shellfish feces, pseudofeces, and nutrients released by the cultivated shellfish).

Anchor Placement
Placement of anchoring devices on the seafloor would result in disturbance of seafloor habitat and displacement of epifaunal and infaunal organisms from within the footprint of each anchor. USC-WIES proposes to use up to fourteen 200-lb Danforth anchors to secure the proposed FLUPSY and longlines to the seafloor. The footprint of each of these anchors would be roughly 4.5 square feet in size, spread along either side of the longline array and the four corners of the FLUPSY. Although all 14 of the potential anchor sites would be within areas of soft substrate, adverse impacts to epifauna and infauna in these habitat areas would be minimal. The total footprint of the proposed anchors would amount to only 66 square feet, and by design much of each anchor would be embedded in the seafloor and would not prevent colonization of the sediments both above and below the anchor blade. While some temporary adverse impacts to benthic invertebrates would occur if these organisms are present within an anchoring footprint at the time of anchor installation, the total soft-bottom habitat area to be disturbed by the proposed project would be small and regionally insignificant when compared to the geographical extent of this habitat type within Cat Harbor and the Southern California Bight at large. In addition, research indicates that many soft substrate organisms are mobile and can re-colonize and recover quickly after initial disturbances related to the placement of anchors and other structures in soft sediments, particularly those in shallower waters subject to frequent natural disturbance (e.g., Underwood and Anderson 1997). Based on these considerations, the proposed placement and presence of the anchors on 66 square feet of seafloor will be carried out in a manner that will sustain the biological productivity of coastal waters and maintain healthy populations of marine organisms, consistent with the requirements of Coastal Act sections 30230 and 30231.

Accumulation of Biological Materials
Extensive research has shown that over time, the seafloor below shellfish aquaculture facilities can accumulate large amounts of biological material that becomes dislodged or discharged from

the facility above and sinks through the water column. Such material typically includes feces and pseudofeces from the cultivated shellfish (collectively known as biodeposits); fouling organisms such as algae, barnacles, sponges, and other species of shellfish that settle on the artificial hard substrate of the facility and become dislodged due to natural processes or operational activities; and cultivated shellfish or shells that also become dislodged from the cultivation structure during growth, storm events, predation from marine wildlife, cleaning, and harvest activities.

Overall, the total amount of biological material added to the substrate below an active aquaculture facility can be substantial and can lead to the alteration of the physical structure, composition and chemistry of seafloor sediments, and changes to the community structure of benthic organisms (e.g., Wilding 2012, Wilding and Nickell 2013). Perhaps most significantly, shellfish aquaculture can result in the deposition and accumulation of intact and broken shells beneath the facility (e.g., Tenore et al 1982; Kaspar et al 1985; Stenton-Dozey et al 2005). As these shells are fed upon and deteriorate further they are broken into a matrix of calcium carbonate fragments known as shell hash. As the proportion of shell hash in the substrate increases, it may influence the type and abundance of invertebrate species that live on and in it, thus altering the trophic structure and productivity of the benthic community in the affected area.

The deposition of organic material beneath shellfish farms has been observed to increase sediment oxygen demand (as this biological material decomposes), resulting in oxygen depletion and an upward shift in the zone in which sulfides are formed (Pearson and Rosenberg 1978). Such chemical changes can result in the loss of larger, more complex sediment dwelling organisms, and a shift towards a lower-diversity assemblage of sulfide specialist species (Weston 1990; Tenore et al 1982). Increased organic deposition beneath a shellfish farm may also trigger an influx of predatory and scavenging species that are able to exploit the organic material as a food source. Species such as polychaete worms and starfish have been observed in high densities in areas both beneath and adjacent to aquaculture facilities within just weeks to months after the start-up of an aquaculture operation (Inglis and Gust 2003; Wilding and Nickell 2013). In some cases, the direct and indirect ecological effects of the accumulation of biological materials beneath shellfish aquaculture installations can extend beyond the footprint of the facility itself.

Research suggests, however, that the degree to which biological material from an aquaculture operation accumulates on the seafloor and alters benthic communities depends on project scale, operational intensity and site-specific physical characteristics such as water depth, current velocity, substrate grain size and mixing, and the natural chemical and ecological makeup of sediments in the area, and can be difficult to predict in advance.

Several features of the proposed project, including its small size and limited cultivation capacity, and the relatively deep water, moderate currents and relatively short water residences at the project site (Colbert et al. 2008), may serve to limit the deposition of biological materials and the severity of any resulting impacts on seafloor habitats. However, the available site-specific information is not sufficient to rule out the potential for significant adverse impacts to benthic marine resources as a result of the project. Given the substantial scientific evidence that under some conditions aquaculture operations can adversely affect benthic ecosystems, the existing uncertainty about whether such effects will occur at the project cite, and the requirement in

Section 30230 of the Coastal Act that special protection be given to areas of special biological significance – a policy that the Commission has found to apply to state designated MPAs -- the maintenance and protection of benthic organisms and habitats within the Cat Harbor SMCA necessitates that measures be taken to limit the potential for adverse effects from the proposed project.

In order to minimize the quantity of organic material that could accumulate on the seafloor below the proposed facility, USC-WIES has committed to the following: (1) conducting all equipment cleaning and bio-fouling removal activities on land, with no ocean disposal of fouling organisms; and (2) implementation of a regular maintenance and inspection program to ensure that all project-related structures and equipment are kept in good working condition, thus limiting the potential for the accidental breakage or release of cultivation gear, shellfish, and associated bio-fouling. In addition, the Commission is adopting **Special Condition 2**, which prohibits USC-WIES from intentionally discharging any biological materials to the ocean.

Furthermore, in order to assure that the impacts of the accumulation of biological materials are avoided, the Commission is adopting **Special Condition 3.** This condition requires USC-WIES to develop, and submit for the Executive Director's review and approval, an Aquaculture Monitoring Program that includes monitoring of the seafloor below the aquaculture facility to identify the quantity and composition of biological materials, including shellfish, shell materials, shellfish feces and pseudofeces, and fouling organisms, that may accumulate, as well changes to the grain size and porosity of the seafloor sediments. If this monitoring demonstrates that the project is resulting in significant changes – comprising either the visible accumulation of shell and other biological materials or statistically-significant changes in sediment grain size and porosity – as compared to the pre-project baseline and control sites, **Special Condition 3** requires that USC-WIES seek a CDP amendment proposing project changes to avoid and mitigate these impacts. Such project changes shall include consideration of more intensive monitoring measures to better identify the extent of changes to sediment chemistry and benthic ecology, the removal of accumulated materials and restoration of benthic habitat, and modifications to the management or operation of project facilities.

Marine Wildlife

The proposed location of the aquaculture research facility on Catalina Island is within a region known to be used on a year-round and/or seasonal basis by a variety of species of marine mammals, sea birds, and sea turtles. As a narrow and relatively shallow coastal inlet, Catalina Harbor is unlikely to be used by larger mammals such as whales, but has the potential to be used by smaller marine mammals such as seals, sea lions, and dolphins. Based on information provided by USC-WIES, harbor seals are occasionally sighted within Cat Harbor, but do not use the inlet as a haul out area. Two species of sea turtle, the green sea turtle and leatherback sea turtle, also have the potential to be found near the project site, along with 195 species of birds known to occupy coastal and/or offshore aquatic habitats in the Southern California Bight (Clark et al. 2005).

The proposed project has the potential to adversely affect marine wildlife in the project area in several ways, including through entanglement with the facility, collision with project vessels, and disturbance from operational activities.

Entanglement
Research conducted by Commission staff during the review of a recent offshore aquaculture proposal in the Southern California Bight (Consistency Certification CC-035-12, KZO Sea Farms) indicated -- based largely on reports from outside of California -- that aquaculture facilities may pose a low but non-negligible risk of entanglement to marine wildlife, primarily from flexible, small-diameter lines or lines with slack or open loops. The accidental release of lines or other equipment from a facility, such as during a storm event, may pose an additional hazard. The proposed USC-WIES facility, though small and not located in an area known to support a high density of marine mammals or sea turtles, would nonetheless result in the placement of hundreds of feet of line, as well as other equipment, into the waters of Cat Harbor. In particular, any loose, hanging, slack, or disconnected lines on the facility could pose a risk of entanglement. Thus, in order to avoid the potential for harm to marine wildlife, the Commission is adopting **Special Condition 4,** which requires that regular visual inspections of the proposed facility's lines, ropes, anchors, and cultivation equipment are carried out and that any observed maintenance issues or wear or fatigue of materials are remedied as soon as feasible. **Special Condition 4** also provides that all lines and equipment are maintained taut and in good working condition and that all observed or suspected entanglement events are recorded and reported to appropriate resource management agency staff for review and consideration.

In addition, **Special Condition 5** provides that USC-WIES include a qualified marine mammal observer on all project construction/installation vessels and that this observer be authorized to halt operations if marine wildlife is observed or anticipated to be near a work area and installation activities have the potential to result in injury or entanglement. Entanglement risk would also be minimized by **Special Condition 2**, which prohibits the intentional release or disposal of equipment, including ropes and lines, from the facilities. As part of its proposal, USC-WIES has also committed to implementing search and clean-up protocols in the event of the accidental loss or release of equipment and materials, and the marking of all project lines, equipment and materials with USC-WIES's contact information to facilitate recovery and clean-up. These commitments are incorporated into **Special Condition 4**. Finally, **Special Condition 6** provides for the removal of the facility if and when operations cease or prior to the expiration of the CDP, so that it does not become abandoned and derelict.

Water Column Habitat
The placement of artificial structures, including lines, ropes, buoys and cultivation equipment, in the water has the potential to alter water column habitat. Previous studies have shown aquaculture facilities can function as mid-water artificial reefs, providing foraging habitat, food sources, refuge from predators, and breeding habitat, potentially altering the composition and abundance of wild fish assemblages and affecting fish aggregation behavior (Dealteris et al. 2004). In some cases, shellfish aquaculture facilities have been shown to enhance fish abundances (e.g., Dealteris et al. 2004), while in others, aquaculture facilities had little or no effect on fish and macroinvertebrate assemblages, diversity or abundance (e.g., Keeler et al. 2009; Clynick et al. 2008).

Due to its small size and short project term (five years), the proposed aquaculture facility is not expected to result in significant adverse effects on water column habitat or species. While it is

possible the project would result in fish aggregation around the facilities, this effect would be temporary and would dissipate upon removal. In order to assure that any such effects do not become permanent, the Commission is adopting **Special Condition 1**, which limits the term of the CDP to five years (terminating on December 31, 2020). If USC-WIES desires to retain the project beyond this date, it may apply for a CDP amendment supported by information addressing the potential for adverse effects to water column habitat and species over longer timeframes.

Disturbance from Operational Activities
Depending on the methods used to carry them out, several operational aspects of an aquaculture facility have the potential to result in disturbance to marine wildlife. For example, operations requiring the use of artificial night lighting may result in adverse impacts to marine wildlife, especially seabirds, which may be attracted by artificial illumination. Another potential source of disturbance to marine wildlife is the use of active deterrent devices, such as acoustic harassment devices, to exclude or displace predatory species that may be attracted to the cultivated shellfish. USC-WIES does not propose to conduct night operations or make use of artificial lighting beyond what is required by the U.S. Coast Guard for navigational safety, nor employ active deterrent methods that would disturb or harass marine wildlife.

Ship-Strikes
As a small, nearshore project, the USC-WIES aquaculture facility would require the use of a single, 18-foot vessel during normal operations. The project vessel would be stationed at nearby Wells Beach (**Exhibit 2**) for the duration of the project, and would make the less than 0.5 mile trip to and from the facility up to three times per week during the summer season, and approximately once per week during the winter. Due to the short distances involved, the low speeds at which the project vessel would travel, and the infrequent occurrence of large marine mammals and sea turtles within Cat Harbor, project operations would not create a significant risk of ship-strike. Construction and installation of the aquaculture facilities, which could involve the use of multiple small vessels and marine transport through open water from the WMSC campus, on the other side of the island, would present a small risk of ship-strike during transit and installation activities. In order to minimize this risk, and ensure development is carried out in a manner that will maintain and protect marine resources, the Commission is adopting **Special Condition 5**, which requires that a qualified marine wildlife observer, with the authority to halt operations if marine wildlife is potentially at risk, be on-board all project vessels during installation and construction activities.

Non-native Species
At maximum capacity, the proposed oyster cultivation facilities could support approximately 48,000 adult oysters on the longlines, and an estimated 100,000 juvenile oysters in the FLUPSY. These shellfish, the Pacific oyster (*Crassostrea gigas*) and Kumamoto oyster (*C. sikamea*), are both non-native species, originally from East Asia, that are among the most popular commercial shellfish species worldwide. Both are currently being cultivated in California at a number of locations, including Humboldt Bay, Tomales Bay, Morro Bay, and the Agua Hedionda Lagoon in Carlsbad.[1] Both species are also included on the California Department of Fish and Wildlife

[1] The Commission has issued coastal development permits for the majority of operations in Humboldt and Tomales Bays but Commission staff is currently evaluating permitting status and compliance for those located in Morro Bay and Agua Hedionda.

(CDFW) and California Fish and Game Commission "List of Approved Plants and Animals That May be Propagated by Registered Aquaculturists" in the state. The Pacific oyster has been cultivated in California for over a century, and for many years was thought not to pose a risk of naturalization (e.g., Barrett 1963). However, the species has established naturalized, self-sustaining populations outside of cultivation at a number of locations from Los Angeles Harbor south to the Tijuana River Estuary (Grosholz et al. 2012, 2015; Crooks et al. 2015).). Although these populations appear to be of limited size and dispersion, large-scale directed surveys have not been carried out. The CDFW, in its California Non-native Estuarine and Marine Organisms (Cal-NEMO)[2] database, describes the typical pattern of spread of Pacific oyster into new locations as follows:

> *In introduced locations, C. gigas often starts by being confined to culture areas, with only sporadic and limited reproduction, but later becomes a major biomass component and ecosystem engineer. This process, which has taken 3-10 decades, has occurred in British Columbia, Washington, the North Sea, the Atlantic coast of Patagonia, Hawaii, and Australia. In some cases, C. gigas poses risks to native oyster populations, including competition, hybridization, and introductions of associated organisms (e.g. parasites, fouling species and oyster predators).*

The Kumamoto oyster has been cultured sporadically on the west coast of the US and Mexico since at least the 1970s, but without any documented natural reproduction outside of hatcheries. No naturalized populations of Kumamoto oyster have been documented in California or other parts of the world outside their native range (Cal-NEMO).

The proposed cultivation of these two species in Cat Harbor has the potential to affect marine resources in several ways: through the filtration and removal of phytoplankton from the water column; through the release of nutrients to the water column; through the release of potentially viable reproductive material that could lead to the establishment of these species outside of cultivation; through the accumulation and release of potentially invasive species, parasites, and pathogens in imported seed materials; and through the accumulation and growth of invasive fouling organisms on the submerged structure of the cultivation facility.

Filtration

Oysters, including the species proposed for cultivation in Cat Harbor, feed primarily on phytoplankton filtered from the water column. With each individual capable of filtering over 20-gallons of seawater per day (Quayle 1988; Bougrier et al. 1995), the large concentrations of oysters found in shellfish farms can remove a significant proportion of available phytoplankton and particulate matter from the water column in an area, potentially causing localized phytoplankton depletion (Grant and Filgueira 2011). The magnitude and extent of this depletion is likely to vary in response to the size and stocking density of the shellfish cultivation facility, and site-specific characteristics such as water depth, current speed and direction. The effects of filtration may also be exacerbated by the additional filtration capacity and food demands of filter feeding biofouling organisms that can colonize the submerged structures of an aquaculture facility shortly after its installation (Mazouni et al. 2001). The depletion of phytoplankton within

[2] Fofonoff, P.W., Ruiz, G.M., Steves, B, and Carlton, J.T. (2003). California Non-native Estuarine and Marine Organisms (Cal-NEMO) System. http://invasions.si.edu/nemesis/. Accessed on November 18, 2015. Hereafter referenced as "Cal-NEMO".

an area may also adversely affect the abundance and diversity of zooplankton, and of organisms on higher trophic levels that depend on plankton for food.

The proposed aquaculture facilities in Cat Harbor would be relatively small in terms of both physical dimensions and the populations of shellfish that would be supported (e.g., maximum of 48,000 adult oysters on the longlines), and is not expected to have a significant impact on biological productivity or phytoplankton stocks within the inlet. Calculations provided by USC-WIES indicate that at maximum biomass, oysters on the longlines would remove phytoplankton from only 2.5 parts of every 1000 parts of seawater passing through the longline facility. This very low removal rate (0.25%) is due in large part to the relatively high current velocity (10 cm/s) assumed in the analysis, but even if a very conservative value of 0.2 cm/s is used (based on horizontal advection rates estimated inside Cat Harbor, *see* Colbert et al. 2008), the longline oysters would remove phytoplankton from 12.6% of the volume of seawater passing though the facility each day. Similar calculations made for the FLUPSY indicate that a maximum population of 100,000 juvenile oysters could clear 12.7% of the total volume of water passing through the FLUPSY. In this particular project, the Commission emphasizes that the proposed cultivation facilities would occupy a tiny fraction of the total area and volume of Cat Harbor, and that the total amount of seawater passing through the facilities and being cleared of phytoplankton would also be small compared to the amount seawater moving in and out of the inlet on a daily basis. Thus, any depletion of phytoplankton that may occur as a result of the proposed project would be highly localized and would not significantly reduce phytoplankton abundance within Cat Harbor.

Source of reproductive material & non-native oyster establishment

Cultivation of large numbers of reproductively viable non-native species in a coastal marine system may contribute to the proliferation, spread, and persistence of those species outside of cultivation if they are able to release viable eggs, larvae, or other reproductive material. Because both species of shellfish proposed to be grown at the facility are non-native and because invasion of marine systems with non-native species can irreversibly alter both benthic and pelagic communities of marine species (e.g., Carlton 1989; Cohen and Carlton 1998; Ruesink et al. 2005; Troost 2010), the potential for these species to become established, compete with native species and alter coastal marine ecosystems needs to be carefully considered. This is particularly true in light of Cat Harbor's status as a State Marine Conservation Area, a marine area of special biological significance that requires special protection under Section 30230 of the Coastal Act.

Potential for Non-native oyster establishment

The Pacific oyster has been widely translocated from its native range in East Asia for use in aquaculture operations. As a result of its ability to escape from cultivation, it has established permanent and self-sustaining wild populations on five continents (e.g., Ruesink et al. 2005; Carrasco and Barón 2010). Pacific oysters are also thought to have spread to new locations as a result of hull fouling on ocean-going vessels, larval transport in ship ballast water, and natural dispersal from previously colonized sites (Troost 2010; Herbert et al. 2012; Crooks et al. 2015; Cal-NEMO). The use of the Kumamoto oyster in aquaculture is less widespread than that of the Pacific oyster, and neither the Commission nor its staff are aware of any instances of naturalization outside of cultivation in western North America, the region where it is most commonly grown, or elsewhere in the world (Cal-NEMO).

The likelihood that the non-native oyster species proposed for the long-line facility would escape from cultivation and establish within Cat Harbor and/or surrounding areas depends on a number of factors, including the reproductive biology of the oysters, the environmental characteristics of the site, and the features of the proposed project itself. At reproductive maturity, typically occurring during the summer months when water temperatures warm, *Crassostrea* spp. oysters release large numbers of spawn (eggs and sperm) into the water column with an extremely low cumulative likelihood that any one gamete will be fertilized, develop into a larva, survive the physical stressors to which it is subjected, avoid predation, encounter suitable settlement habitat, and successfully settle and grow to adulthood. Under such circumstances, successful establishment outside of cultivation would depend in part on the total number of gametes released, and thus the size of the "source" population of adults. At most, the proposed long-line facilities would support 48,000 adult oysters, and in the early years of the project, substantially fewer. While not insignificant, the adult population on the long-lines would be small in comparison to those supported at commercial aquaculture operations and large natural oyster reefs. Additionally, the USC-WIES project is proposed to be in place for only five years, limiting the number of seasons in which reproduction could occur. Previous studies support the concept that successful Pacific oyster invasions usually occur as a result of repeated or frequent "inoculations" of larvae from multiple and different sources, rather than from a single source or event (e.g., Reise et al. 2005; Herbert et al. 2012). Under the proposed project, the single, relatively small source population (the long-lines) and short project duration, combined with the extremely low survivorship of oyster larvae in the water column, would limit the likelihood of successful establishment outside of cultivation areas.

The potential for naturalization of the non-native oysters in Cat Harbor and/or the surrounding area would also be limited by the physical and environmental characteristics of the site. USC-WIES has argued that environmental conditions in Cat Harbor, including low summer water temperatures, relatively oligotrophic (low productivity) waters, strong currents and rapid tidal flushing, and a lack of suitable settlement substrate, would prevent Pacific and Kumamoto oysters from becoming established at or near the project site. USC-WIES states that summer water temperatures in excess of 20 ºC (68 ºF) are required for Pacific oyster gonad maturation and gamete release, and that "waters do not typically reach this temperature in Cat Harbor during the summer months" (USC-WIES 2015a, c). This position reflects a former consensus among marine scientists and the aquaculture industry that cool summer waters related to coastal upwelling inhibit the spawning, larval development and recruitment of Pacific oysters, and that successful reproduction and significant spatfall is rare in California (e.g., Barrett 1963; Berg 1971; Conte 1996).

Numerous previous studies have shown that water temperature is an important control on reproductive development and gametogenesis in Pacific oysters, as well as on the survivorship and settlement of oyster larvae, and that cold water temperatures present an impediment to reproduction and successful establishment. However, more recent studies indicate that successful reproduction and naturalization can occur over a wider range of temperatures than was previously understood. For example, Shatkin et al. (1997) and Castaños et al. (2009) have reported that gonad maturation and gamete release can occur at temperatures as cool as 16 – 17 ºC (61 – 63 ºF), while a recent global study of naturalized Pacific oyster populations identified a

broad range of warmest month average water temperatures – approximately 14 – 29 ºC (57 – 84 ºF) – within which the species has successfully established and reproduced (Carrasco and Barón 2010). Water temperatures in this range are commonly observed in Southern California. In the Southern California Bight, sea surface temperatures exceed 14 ºC (57 ºF) for much of the year, and typically range between 17 – 22 ºC (63 – 71.5 ºF) from late spring through early fall (May – October).[3] Observed water temperatures near Catalina Island (Gelpi and Norris 2008)[4], and within Cat Harbor itself (13 – 24 ºC; 55 – 75 ºF) (M. Drawbridge, Hubbs-Sea World Research Institute, pers. comm.), are within previously observed limits for Pacific oyster reproduction, larval development, and establishment. Moreover, a number of wild populations of Pacific oysters have been observed in bays and estuaries along the Southern California coast[5] (e.g., Crooks et al. 2015) in which warm season water temperatures overlap the range observed in or near Cat Harbor (e.g., Largier et al. 1997; Elwany et al. 2005; Crooks and Uyeda 2010; NOAA 2015[6]). Although temperatures below an "ideal" of approximately 20 ºC may slow or reduce spawning activity (e.g., Castanos et al. 2009), temperature does not appear to be a reliable safeguard against the establishment of this species in the Southern California region. Increased ocean temperatures related to climate change could also increase the number of years and extend the seasons during which water temperatures on the Southern California coastline are sufficient to support Pacific oyster reproduction and establishment. As a general matter, Kumamoto oysters require higher temperatures for successful reproduction than Pacific oysters (Robinson 1992; Cal-NEMO), and at present pose a lesser risk of naturalization in California.

However, water temperature is not the only environmental control on the Pacific oyster life-cycle, and available evidence suggests that other conditions characteristic of Cat Harbor, including low food availability and relatively short water residence times, would greatly reduce the likelihood of successful or widespread establishment as a result of the proposed project. USC-WIES has contended that the relatively oligotrophic (low productivity) conditions within Cat Harbor would reduce the chances of successful reproduction, a contention which is supported by previous research demonstrating enhanced oyster fertility and gamete quality in eutrophic versus oligotrophic environments (e.g., Kang et al. 2000; Fabioux et al. 2005).

Globally, successful invasions of Pacific oyster have typically, though not exclusively, occurred within protected bays, estuaries or shallow-water habitats with relatively low wave exposure and slow mixing of coastal waters with the open ocean (e.g., Robinson et al. 2005; Ruesink et al.

[3] National Oceanic and Atmospheric Administration (NOAA) National Data Buoy Center (NDBC), Station 46222 (San Pedro Channel) historical data, 2004 – 2015. http://www.ndbc.noaa.gov/station_page.php?station=46222. Accessed April 7, 2015.

[4] Maximum seasonal water temperatures near Catalina Island are typically observed in August, with an average monthly temperature of ~69-70 ºF.

[5] In the early 2000s, Pacific oysters were discovered growing in Los Angeles Harbor, San Diego Bay, and Mission Bay (LaGrange 2002; Cohen et al. 2005; Crooks et al. 2015), followed several years later by occurrences in Oceanside Harbor, San Francisco Bay, and the Tijuana River Estuary (Goodwin et al. 2010; Crooks et al. 2015). Since that time, Pacific oysters have been found in most coastal embayments in San Diego County, including Oceanside Harbor, Agua Hedionda, Batiquitos, San Elijo, San Dieguito, and Los Peñasquitos lagoons, Mission Bay, the San Diego River flood control channel, San Diego Bay, and the Tijuana River Estuary (Crooks et al. 2015). Observed individuals have ranged in size from recruits to adults, and in some instances multiple-year classes were present, indicating that reproduction is likely occurring (Goodwin et al. 2010; Crooks et al. 2015). It remains unclear what factors have contributed the spread of Pacific oysters in Southern California over the past fifteen years, and why there should be successful establishments now, after decades of cultivation and several past deliberate attempts to introduce the species in California.

[6] NOAA NDBC historical temperature data for Stations SDBC1 (San Diego Bay, 2005-2012), OHBC1 (Los Angeles Harbor, 2005-2012). http://www.ndbc.noaa.gov. Accessed November 17, 2015.

2006; Troost 2010; Herbert et al 2012; Kochmann et al. 2013). Such water bodies, with water residence times on the order of weeks to months, are more likely to retain the oyster larvae and remain calm enough for settlement to occur than a site on the open coast. Because the planktonic larvae of Pacific oysters require two to four weeks in the water column before becoming competent to settle (Quayle 1988), they are unlikely to settle in their bay of origin if the embayment has an average residence time much shorter than the duration of the planktonic phase. Kochmann et al. (2013) have noted that enhanced Pacific oyster settlement can be expected in bays exceeding a residence time of 21 days, where larvae can remain entrained for the duration of their planktonic phase. Notably, each of the California locations where wild populations of Pacific oysters have been observed is a protected estuary, coastal lagoon, or harbor (Crooks et al. 2015). Cat Harbor, in contrast, is an open inlet that experiences relatively rapid wave- and tidally-driven flushing. The surface water residence time in the middle reach of Cat Harbor has been estimated at a maximum of approximately 3 days (Colbert et al. 2008); the actual residence time of water at the project location nearer to the mouth of the inlet is likely to be significantly shorter. In comparison, the average water residence times in mid-San Diego Bay (near Tuna Harbor) and Mission Bay, both sites of successful establishment (Crooks et al. 2015), have been estimated at approximately 9 days and 13 days, respectively (Largier et al. 1997). (In contrast, the average water residence time (2.6 days) in outer Agua Hedionda Lagoon, another mainland site where wild Pacific oysters have been observed, is more similar to that of Cat Harbor).

In summary, if spawning did occur, currents within Cat Harbor would be expected to remove the large majority of Pacific oyster spawn and larvae to the open ocean before they matured to the point of being able to settle, and water movement within the embayment would be expected to hamper the settlement of any larvae remaining.

Once outside of Cat Harbor, the long pelagic phase of Pacific oyster larvae means they could be transported to other coastal sites by ocean currents. However, in the present case the risk of off-site establishment on Catalina Island is low due to a lack of low-energy habitats on the exposed coastline northwest of Cat Harbor, in the direction of the prevailing current, and on the island in general. Moreover, Cat Harbor is located near the southwestern shore of the island, such that most of the larvae escaping the bay would be transported away from Catalina toward the open open ocean rather than the mainland coast. Due to their long (2-4 week) pelagic phase, Pacific oyster larvae could, in theory, disperse great distances from their point of origin. However, research has shown that under a variety of current conditions, dispersal distances are usually less than 20 – 40 km (Brandt et al. 2008; North et al. 2008; Shanks 2009; Herbert et al. 2010). Given that there are no other land areas within 50 km of Cat Harbor (the other Channel Islands and the Southern California mainland are more than 50 km distant even without accounting for currents), it is unlikely that oyster larvae flushed from Cat Harbor would encounter another landmass, settle, and successfully establish.

Effects of Non-native Oyster Establishment

In some locations, the establishment of introduced Pacific oysters has significantly altered the form, function and biodiversity of coastal ecosystems. These effects stem in large part from the species' tendency to build large, extensive aggregates or shell reefs, which can substantially alter the bottom substrate (e.g., convert soft-bottom areas to hard substrate) and trap sediment and

restrict water movement in shallow areas (e.g., Ruesink et al. 2005; Cognie et al. 2006; Wrange et al. 2009; Troost 2010; Cal-NEMO). The physical changes induced by the widespread establishment of Pacific oysters also have consequences for local biodiversity and native species. In a number of locations, the Pacific oyster has outcompeted, displaced or hindered the recovery of native shellfish species (e.g., Ruesink et al. 2005; Molnar et al. 2008; Carrasco and Barón 2010; Troost 2010; Cal-NEMO). For example, the Pacific oyster has shown the ability to exclude local oysters (*C. glomerata*) in New Zealand (Leffler and Greer 1991; Ruesink et al. 2005) and native blue mussels on the coasts of Germany and the Netherlands (Diederich 2005). In addition to changing the shellfish community composition, Pacific oysters have been observed to alter the productivity, nutrient cycling and microbial diversity of ecosystems in which they become established (e.g., Ruesink et al. 2005; Green et al. 2012).

However, in many instances, Pacific oysters have become naturalized in coastal areas without becoming widespread, forming extensive reefs or displacing native shellfish or other species (e.g., Escapa et al. 2004; Ruesink et al. 2005; Nehls & Büttger 2007; Cal-NEMO). In other cases where large Pacific oyster reefs have formed, these new, complex hard-substrate habitats created have been observed to enhance local biodiversity and productivity (Ruesink et al. 2005).

Potential for Establishment in Cat Harbor

As discussed above, the successful establishment outside of cultivation of the non-native oyster species proposed to be grown as part of this project is unlikely due to the small size and short duration of the project, environmental conditions at Cat Harbor and Catalina Island more generally, and the life-cycle of the oysters themselves. However, the possibility of establishment, particularly within Cat Harbor, which is the most protected embayment on Catalina Island, cannot be ruled out entirely. While the effects of the introduction of non-native oysters to Cat Harbor cannot be predicted in advance, there are numerous past examples of substantial changes to coastal ecosystems resulting from the establishment of non-native species in general and the Pacific oyster in particular. The Commission recognizes that the most significant potential effects, such as oyster reef establishment and major alteration of benthic habitat, the exclusion or native species, and changes to nutrient cycling, phytoplankton assemblages, or productivity in the bay, are unlikely to emerge unless Pacific oysters become widespread with Cat Harbor, and that establishment of a small wild population within the bay may result in very localized impacts. However, the Commission also notes that the ecosystem-altering changes associated with Pacific oyster introductions elsewhere in the world were often unanticipated, took many years to emerge, and began with small seed populations (Cal-NEMO). The proposed project would occur within a State Marine Conservation Area, created in order to "protect the natural diversity and abundance of marine life, and the structure, function and integrity of marine ecosystems" and "protect marine natural heritage, including … representative and unique marine life habitats … for their intrinsic value" (Marine Life Protection Act of 1999, California Fish and Game Code Section 2853). Given that the proposed project would occur within a State Marine Conservation Area and Coastal Act Section 30230 instructs that special protection shall be given to areas of special biological significance, the Commission finds that it is necessary to take reasonable measures to ensure the protection of marine resources at this site.

Based on these considerations, and in order to better assure that the risk of non-native oysters becoming established within the Cat Harbor SMCA is avoided, the Commission is adopting

Special Condition 3, which requires that USC-WIES prepare an Aquaculture Monitoring Program that includes the regular monitoring of the potential for local spatfall and establishment of the non-native oysters proposed to be cultivated on the longlines. The monitoring program shall include (a) the regular monitoring of surface water temperatures in Cat Harbor in the vicinity of the project site; and (b) monitoring of settlement traps, consisting of suspended lines or mesh bags containing Pacific oyster shell[7], at multiple locations within Cat Harbor. The settlement traps shall be monitored for Pacific and Kumamoto oyster spatfall, establishment and growth at least twice per year, once in the fall following the oyster reproductive season, as determined based on water temperature measurements or other evidence, and once in the spring prior to new spawning. If any settled Pacific or Kumamoto oysters are observed on a settling trap or other surface in the Cat Harbor SMCA (other than the aquaculture equipment on which they are planted), USC-WIES shall submit an application for a CDP amendment proposing project modifications necessary to prevent the wild establishment of the non-native oysters in Cat Harbor SMCA. Such project changes shall include the consideration of additional monitoring, surveys of suitable habitat within Cat Harbor for oyster establishment to be followed by eradication efforts if oysters are found, studies to determine the origin of the oysters colonizing the settlement traps, and modifications to the management or operation of project facilities. The Commission finds that compliance with this condition will assure avoidance of non-native oyster establishment in the Harbor.

Additionally, the Commission is imposing **Special Condition 1**, which limits the term of the CDP to five years (terminating on December 31, 2020). A five-year period of authorization will allow the applicant sufficient time to realize its project goals and gather monitoring data pertinent to any future extension of the project, while also limiting the window of opportunity for non-native oysters to establish outside of cultivation.

Contaminated Seed

Historically, shellfish aquaculture operations in California have led to a variety of intentional and unintentional introductions of non-native and invasive marine species. As a recent example with potentially severe consequences, in the 1980s an abalone parasite (sabellid worm) was accidentally introduced to a single farm in California along with a shipment of South African abalone and escaped into the wild. Fortunately, the worm species infestation was discovered at the release point before extensive spread had occurred and a successful eradication was carried out before it had been transmitted to populations of California abalone with resulting economic and ecological damage. Other previous examples of invasive species introduced in association with shellfish culture materials include an oyster parasite (*Haplosporidium nelson)* and salt marsh snail (*Batillaria attramentaria*) (NRC 2009).

As a result of these introductions, California developed and adopted a variety of regulations to monitor and control the importation of shellfish and culture materials. These regulations limit the importation of biological material and the distribution and planting of shellfish from hatcheries and are primarily managed and implemented by the CDFW. CDFW requires that importations of aquaculture materials such as shellfish seed be carried out under an importation permit that

[7] Research indicates that Pacific oyster shells are a preferred settling surface for their larvae, and that the shells secrete a chemical compound that induces larval settlement (Diederich 2005; Vasquez et al. 2013).

assures the import comes from a hatchery or facility certified to be disease and parasite free. USC-WIES has satisfied this requirement and has obtained a long term importation permit establishing that it would purchase and import shellfish seed from Taylor Mariculture in Washington. USC-WIES's adherence to CDFW regulations regarding seed importation would minimize the potential for the project to cause accidental releases or introductions of invasive species, pathogens, or parasites and thereby assure that development is carried out consistent with the requirements of Section 30230, in a manner that sustains the biological productivity of marine resources.

Invasive Biofouling Species
Shellfish farms and other artificial structures in marine environments provide three dimensional habitats for colonization by fouling organisms and associated biota (e.g., Costa-Pierce and Bridger 2002; McKindsey et al. 2006), and in many cases may provide a larger surface area of suitable hard substrate for attachment of fouling organisms than is available in the natural benthos (e.g., in soft-bottom areas). In addition, the fouling communities that develop on artificial structures can be quite different from those in adjacent rocky areas (Glasby 1999; Connell 2000). Artificial structures in southern California, including pier, docks and oil platforms, support a wide variety of invasive marine fouling species, including species known to present significant economic and ecological risk to marine areas along the west coast. Maintenance activities for in-water structures and vessels that involve periodic removal of fouling organisms without proper collection and disposal protocols may result in increased dispersal and propagation opportunities for these species. Such opportunities for dispersion and spread pose a particular risk with some algal species and colonial species (such as *Didemnum* spp.) that may break apart into many pieces when disturbed, each of which may be capable of surviving, growing, and reproducing on its own.

In order to minimize the risk of spreading and dispersing invasive species, USC-WIES proposes to conduct all cleaning, biofouling removal and maintenance of project equipment (e.g., FLUPSY, longlines, floats, buoys, lines) onshore, with no disposal of fouling organisms into the ocean. In order to further guard against the spread and dispersion of non-native organisms in Cat Harbor, the Commission is also adopting **Special Condition 2**, which prohibits USC-WIES from intentionally disposing of any equipment or waste, including living or dead shellfish, shells, or non-native fouling organisms, into the marine environment, and requires that all biological materials removed during cleaning operations be collected and disposed at an appropriate upland facility and that no discharge of untreated wash water or non-native fouling materials occur during maintenance cleaning operations.

Conclusion
With the implementation of the conditions described above, the Commission finds that the proposed project will be conducted in a manner that will protect and maintain the marine environment, give special protection to areas of special biological significance, sustain the biological productivity of coastal waters, and avoid adverse effects on water quality, and, therefore, is consistent with Coastal Act Sections 30230 and 30231.

E. PLACEMENT OF FILL IN OPEN COASTAL WATERS

Section 30233(a) of the Coastal Act states in part:

> *The diking, filling, or dredging of open coastal waters, wetlands, estuaries, and lakes shall be permitted in accordance with other applicable provisions of this division where there is no feasible less environmentally damaging alternative, and where feasible mitigation measures have been provided to minimize adverse environmental effects, and shall be limited to the following:*
>
> *(1) New or expanded port, energy, and coastal-dependent industrial facilities, including commercial fishing facilities.*
> *(2) Maintaining existing, or restoring previously dredged depths on existing navigational channels, turning basins, vessel berthing and mooring areas, and boat launching ramps.*
> *(3) In open coastal waters, other than wetlands, including streams, estuaries, and lakes, new or expanded boating facilities and the placement of structural pilings for public recreational piers that provide public access and recreational opportunities.*
> *(4) Incidental public service purposes, including but not limited to, burying cables and pipes or inspection of piers and maintenance of existing intake and outfall lines.*
> *(5) Mineral extraction, including sand for restoring beaches, except in environmentally sensitive areas.*
> *(6) Restoration purposes.*
> *(7) Nature study, aquaculture, or similar resource dependent activities.*

Coastal Act Section 30108.2 defines "fill" as "earth or any other substance or material … placed in a submerged area." As part of its project, USC proposes to install 14 200-pound Danforth anchors (each approximately 2.75 feet long by 1.7 feet wide) on the seafloor within Catalina Harbor. These anchors would maintain the proposed long lines and FLUPSY in place. Installation of these anchors into the submerged nearshore zone constitutes "fill" of open coastal waters, as that term is defined in the Coastal Act.

The Commission may authorize a project that includes filling of coastal waters if the project meets the three tests of Coastal Act Section 30233. The first test requires that the proposed activity fit within one of seven use categories described in Coastal Act Section 30233(a)(1)-(7). The second test requires that no feasible less environmentally damaging alternative exists. The third and final test mandates that feasible mitigation measures are provided to minimize any of the project's adverse environmental effects.

Allowable use

The purpose of the anchors is to support rafts and floating structures that would be used to cultivate shellfish, an aquaculture activity. Aquaculture is identified as an allowed use in Coastal Act Section 30233(a)(7). Therefore, the Commission finds that the project meets the allowable use test for fill of open coastal waters under Coastal Act Section 30233(a).

Alternatives
The Commission must further find that there is no feasible less environmentally damaging alternative to placing fill in open coastal waters. Coastal Act Section 30108 defines "feasible" as "…capable of being accomplished in a successful manner within a reasonable period of time, taking into account economic, environmental, social and technological factors."

The proposed anchoring system would result in the fill of approximately 66 square feet of soft-bottom submerged tidelands. As described above, USC conducted benthic surveys within Cat Harbor and has sited the project in order to avoid adverse impacts to hard-bottom substrates and other sensitive marine habitats (e.g., kelp beds, etc.). Alternative anchoring systems providing a comparable amount of holding power, such as concrete blocks, would require the fill of a larger area of seafloor, while the installation of wood or metal piles as mooring posts would require pile driving, which would generate elevated levels of underwater sound that could adversely affect marine wildlife. Both of these alternatives would be more environmentally damaging that the proposed anchoring system. While attaching mooring lines to an existing pier or land-based structure would avoid the need to fill open coastal waters, no such structures exist in the immediate project area, and placing the project at a more distant site with an existing pier or boat launch (such as at Wells Beach) would increase the potential for interference with navigation and recreational boating (*see* section E, below). Additional alternatives analysis (i.e., alternative locations), is provided in section B (above). None of the alternatives are less environmentally damaging than the proposed project as conditioned.

For the reasons described above, the Commission finds that the proposed project, as conditioned is the least environmentally damaging feasible alternative and therefore satisfies the second test of Coastal Act Section 30233(a).

Mitigation Measures
The final requirement of Coastal Act Section 30233(a) is that filling of coastal waters may be permitted if feasible mitigation measures have been provided to minimize any adverse environmental impacts. The impact of the fill (from the proposed anchors) on the lightly-vegetated, sandy-bottom seafloor at the project site would be temporary, and confined to the small areas occupied by the anchors. Further, as described in greater detail in the marine resources section of this report, the mitigation measures associated with this project consist of marine wildlife protection measures and non-native species management measures. These feasible mitigation measures will minimize the project's adverse environmental impacts. Thus, with the imposition of the conditions of this permit, the Commission finds that the third and final test of Coastal Act Section 30233(a) has been met.

Conclusion
Because the three tests have been met, the Commission finds the proposed project consistent with Section 30233 of the Coastal Act.

F. COMMERCIAL AND RECREATIONAL FISHING

In addition to the protection afforded under Section 30230 (quoted above on page 16), Sections 30234 and 30234.5 of the Coastal Act contain specific policies protecting commercial and recreational fishing.

Section 30234 of the Coastal Act states:

> *Facilities serving the commercial fishing and recreational boating industries shall be protected and, where feasible, upgraded. Existing commercial fishing and recreational boating harbor space shall not be reduced unless the demand for those facilities no longer exists or adequate substitute space has been provided. Proposed recreational boating facilities shall, where feasible, be designed and located in such a fashion as not to interfere with the needs of the commercial fishing industry.*

Section 30234.5 of the Coastal Act states:

> *The economic, commercial, and recreational importance of fishing activities shall be recognized and protected.*

Potential project impacts to commercial and recreational fishing in Cat Harbor include the displacement of fishing activity from fishing grounds and the loss/damage of fishing gear due to accidental contact with the facility.

Due to its protected, calm water conditions and proximity to the village of Two Harbors, Cat Harbor is a relatively popular Catalina destination for recreational fishing. SMCA regulations allow the recreational take of finfish and squid by hook, line or spear, and take of spiny lobster and sea urchin. According to sport fishing websites consulted by Commission staff, recreational fishermen fish Cat Harbor for spiny lobster, halibut, sharks and sheepshead, among other species. Pursuant to the SMCA regulations (14 CCR 632(b)(131)), commercial fishing within Cat Harbor is limited to the collection of spiny lobster and sea urchin, and of sea cucumber by diving only. Although commercial take of these species is allowed, commercial fishing activity is conducted only on a very small scale.

As discussed in Section B, above, the proposed aquaculture facilities would be sited near the southwestern side of Cat Harbor, adjacent to the existing Hubbs-Sea World fish pen and away from the main navigation channel and mooring areas. Along with the small size of the facility, representing a very small fraction of the total area within the bay, the proposed location is expected to avoid most conflicts with recreational and commercial fishing activities. Moreover, given the light gear (i.e., hook and line, lobster traps, small vessels, diving) associated with fishing in Cat Harbor, it is likely that some fishermen would continue to fish at or near the project site despite some increased risk of entanglement of fishing gear.

In order to reduce the potential for project equipment and materials to be released and abandoned into the marine environment, where they could adversely impact fishing gear and activities, USC-WIES has developed procedures for debris minimization and recovery which include: (a) regular visual inspections and maintenance of project equipment and gear (1-3 times per week);

(b) SCUBA inspections of underwater anchoring system components (once per year); (c) follow-up inspections of all gear after major storm events; (d) the labeling of all major components (facility infrastructure, lines, ropes, buoys, etc.) with USC-contact information; (e) the tracking, retrieval and clean-up of fugitive materials if loss of shellfish cultivation facility materials, equipment, and/or infrastructure occurs.; and (f) reporting of incidents to the Coast Guard and Santa Catalina Island Company. USC-WIES has also stated that the University's general liability policy will cover incidents of damage attributable to the failure of the installation.

In addition, the Commission is adopting **Special Condition 2**, which prohibits the disposal of project equipment and debris into the ocean, and **Special Condition 4** to ensure that USC-WIES carries out routine maintenance inspection and repair activities to minimize the potential for loose cables, ropes, or materials on the facility that could pose an increased entanglement or snagging risk. Finally, **Special Condition 6** provides for the removal of the facility if and when operations cease or prior to the expiration of the CDP, so that it does not become abandoned and derelict. As conditioned, the proposed development will not significantly reduce commercial fishing and recreational harbor space consistent with the commercial and recreational fishing policies (Sections 30230, 30234, and 30234.5) of the Coastal Act.

G. Coastal Access and Recreation

Section 30210 of the Coastal Act states:

> *In carrying out the requirement of Section 4 of Article X of the California Constitution, maximum access, which shall be conspicuously posted, and recreational opportunities shall be provided for all the people consistent with public safety needs and the need to protect public rights, rights of private property owners, and natural resource areas from overuse.*

Section 30211 of the Coastal Act states:

Development shall not interfere with the public's right of access to the sea where acquired through use or legislative authorization, including, but not limited to, the use of dry sand and rocky coastal beaches to the first line of terrestrial vegetation.

Section 30220 of the Coastal Act states:

> *Coastal areas suited for water-oriented recreational activities that cannot readily be provided at inland water areas shall be protected for such uses.*

Water-oriented or ocean-based recreation activities in and around the project area include wildlife viewing, sailing, boating, fishing (discussed above in the previous section of this report), snorkeling and diving, and other water sports. The proposed project has the potential to adversely affect coastal access and recreation by restricting water-oriented recreational activities from occurring within the footprint of the facility due to the presence of surface and submerged gear and the risk of possible collision or entanglement.

Preclusion of Vessel Activity
The proposed shellfish cultivation facility would have a surface footprint limited to the FLUPSY raft (about 480 square feet) and approximately 30 floats and buoys proposed to be used to maintain the longline cultivation trays at submerged depths of up to 6 feet. USC-WIES selected the project site, along the western shoreline of outer Catalina Harbor near the existing Hubbs-Sea World fish pens, in order to avoid the areas of highest boat traffic and minimize risks to navigation. Furthermore, USC-WIES does not proposed to restrict the passage of vessel traffic at the project site and anticipates that recreational vessels would be able to pass freely around the proposed facilities with little risk of collision or entanglement. Despite the fact that vessel transit around the proposed site would not be restricted, and that safe passage of all but large deep-draft vessels would be accommodated by the project design, some recreational ocean users may avoid the area due to a desire for additional caution. USC-WIES would work with the U.S. Coast Guard to install marker buoys of proper size and design on the corners of the proposed facility to clearly demarcate its location to boaters and minimize the area that would be avoided.

While the presence of the facility may redirect some boaters and recreational users, the proposed location of the facility, outside of more heavily used areas of Cat Harbor, as well as its limited size when compared to the abundance of open water in the project area, would limit any adverse impact on boating and other recreational activities that the facility may have.

Conclusion
The Commission finds that the proposed project, as conditioned, would not significantly restrict or close coastal waters to recreation boating activities, vessel transit or other recreational activities, and is consistent with Coastal Act Sections 30210, 30211 and 30220.

H. CALIFORNIA ENVIRONMENTAL QUALITY ACT
Section 13096 of the Commission's administrative regulations requires Commission approval of coastal development permit applications to be supported by a finding showing the application, as modified by any conditions of approval, to be consistent with any applicable requirements of the California Environmental Quality Act ("CEQA"). Section 21080.5(d)(2)(A) of CEQA prohibits approval of a proposed development if there are feasible alternatives or feasible mitigation measures available that would substantially lessen any significant impacts that the activity may have on the environment.

The Commission incorporates its findings on Coastal Act consistency at this point as if set forth in full. These findings address and respond to all public comments regarding potential significant adverse environmental effects of the project that were received prior to preparation of the staff report. As discussed in detail above, the proposed project, as conditioned, is consistent with the policies of the Coastal Act. Feasible mitigation measures which will minimize all adverse environmental impacts have been required as special conditions. As conditioned, there are no feasible alternatives or feasible mitigation measures available, beyond those required, which would substantially lessen any significant adverse impact that the activity may have on the environment. Therefore, the Commission finds that the proposed project, as conditioned to mitigate the identified impacts, can be found to be consistent with the requirements of the Coastal Act to conform to CEQA.

Appendix A – Substantive File Documents

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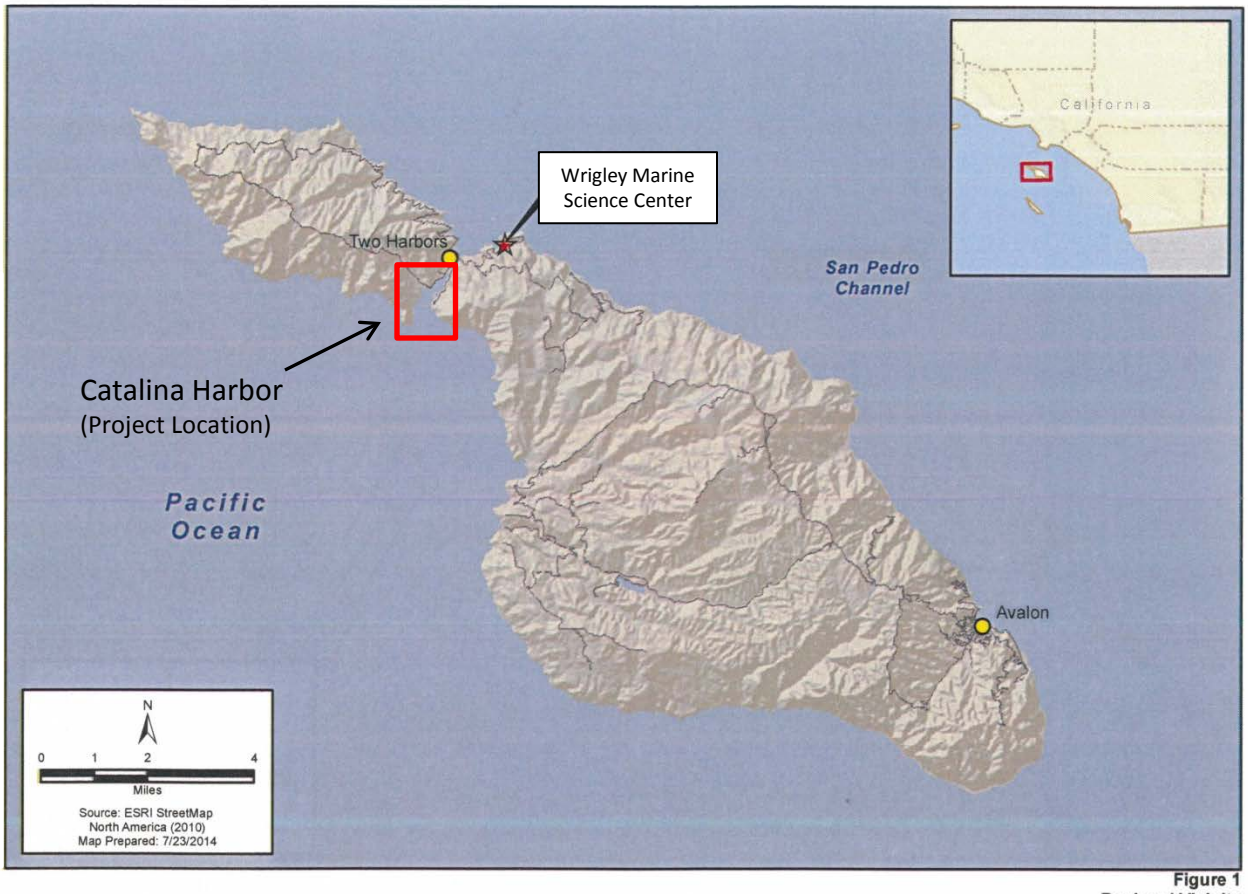
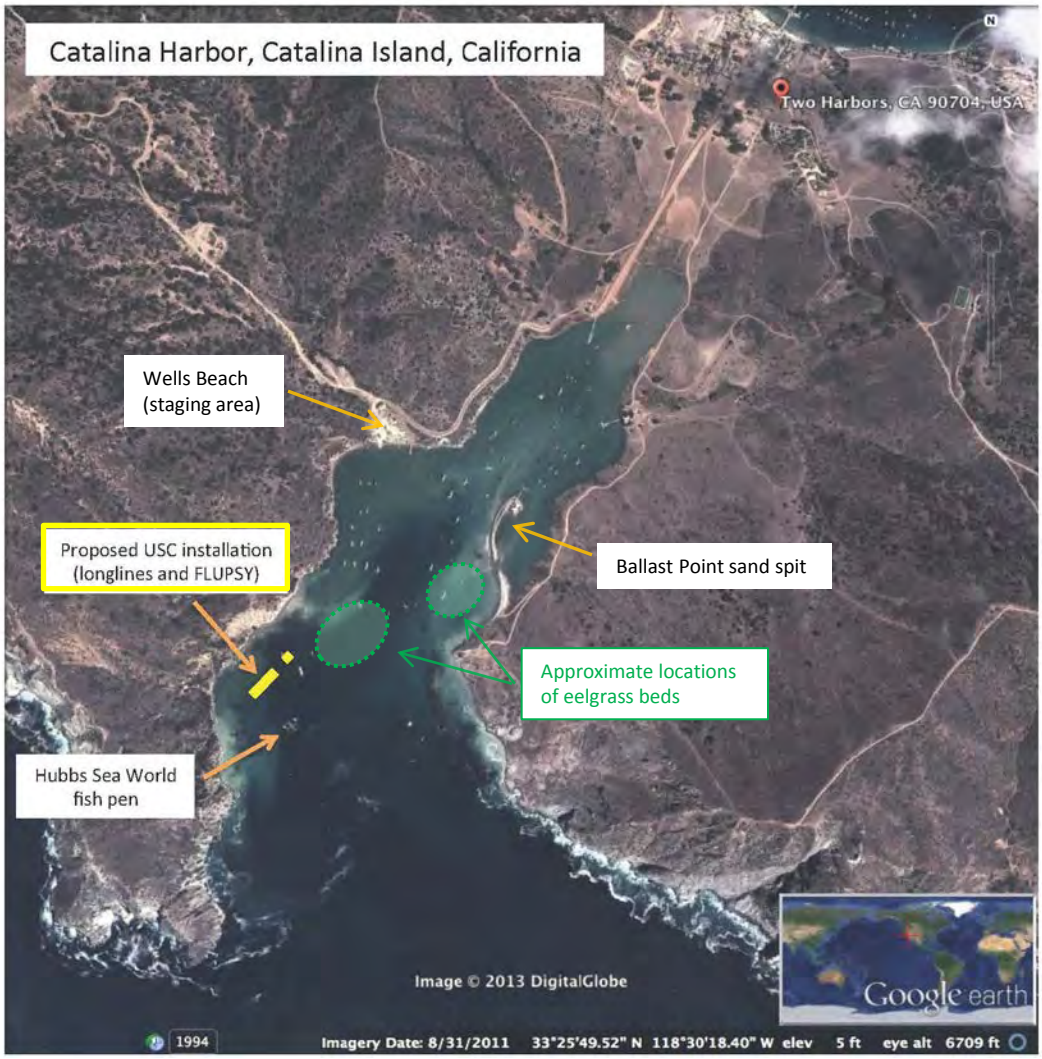


Figure 1
Regional Vicinity

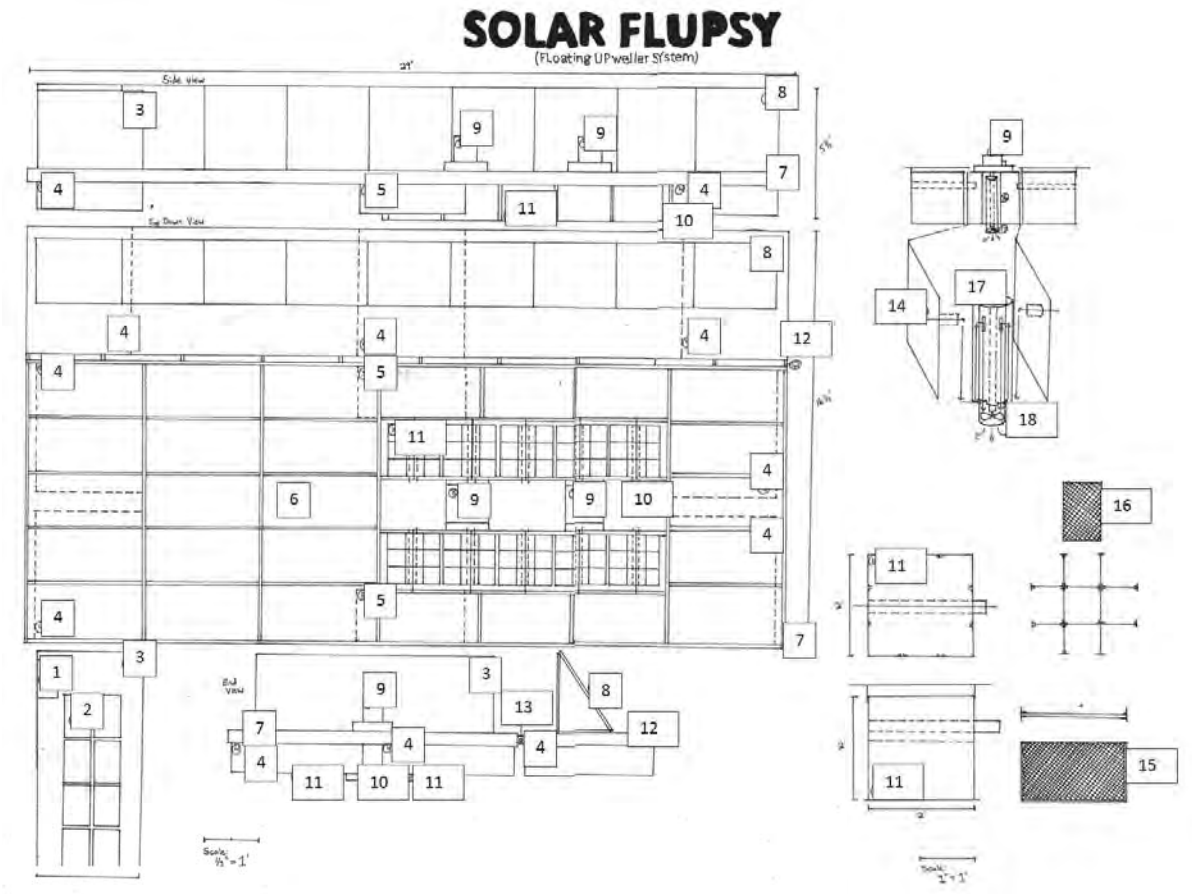
Exhibit 1
Application No. 9-14-0489
USC Wrigley Institute
Regional Map
Page 1 of 1



Aerial View of Catalina Harbor and the proposed project site

Exhibit 2
Application No. 9-14-0489
USC Wrigley Institute
Project Location

Schematic drawing of FLUPSY



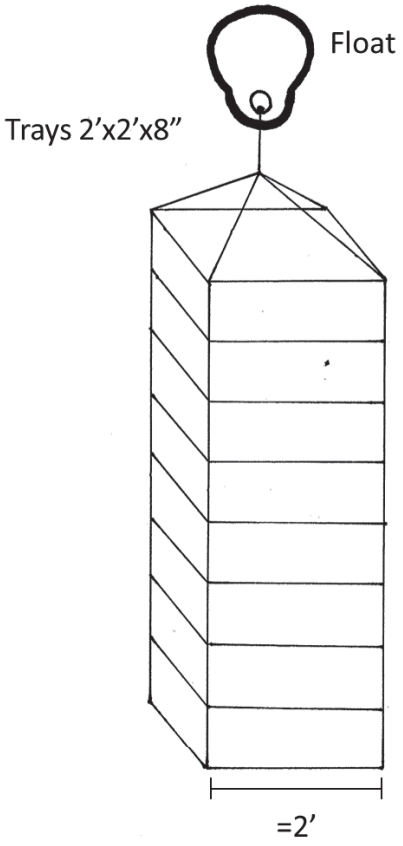
Overall dimensions: 29′×16.5′×5.5′ LxWxH

Numbered item	Description
1. Fuse Box:	Contains fuses for propellor motors (will be referred to as 'pumps'), charge controller, and meter for solar panels and battery bank and will be the wiring connection point between solar panels, batteries and pumps.
2. Battery Bank:	18 Batteries: Rolls HT-8D 12V 221amp/h Deep Cycle direct current marine batteries. 4 batteries in series, 2 series of 96VDC in parallel. Wet weight of lead acid batteries is 167lbs x 18 = 3006lbs
3. "Doghouse":	Small housing structure for battery bank, fuse box, and tools. Constructed of 2″×4″ and ½″plywood sheeting.
4. 5′×4′×20″ Floats:	7 total; 2 on either end of FLUPSY BARGE, 3 evenly spaced on PANEL BARGE. Buoyancy capacity approximately 1900lbs each.
5. 2′×4′×20″ Floats:	2 Total. Evenly spaced in the center side of FLUPSY BARGE. Buoyancy capacity approximately 719 lbs each.
6. 4′×8′×20″ Float:	1 total. Under Battery Bank. 3076lb capacity.
7. FLUPSY BARGE:	Framework constructed of 2″×4″, 2″×6″, 4″×4″ beams with metal brackets and joists. Contains FLUPSY components and holds doghouse on top.
8. Solar Panel Array:	9 Astronergy 240W modules, model# CHSM 6610P, lined up in a row, 3 panels per series, 3 series in parallel. Depicted in hypothetical 60^{o} angle.

(Continued on next page)

Numbered item	Description
9. Pump Housing:	2 pumps, Leeson 1/6hp 1750 full load RPM 90VDC 34E56C motors. Housing constructed of ½″ plywood and 2″×4″
10. Center Trough:	Fiberglass trough. Holes cut in sides and bottom for Silo drains and pumps. 2′×10′
11. Silos:	10, 2′×2′×2′ fiberglass silos. Aluminum handle on top for carrying, moving, and hanging when mounted in FLUPSY. 4″ drain pipe with holes cut into it allows water to flow out of silos. Bottom is constructed of mesh of variable sizes, ranging from 4mm-10mm. Silos can also be partitioned in order to store small, separate groups.
12. PANEL BARGE:	Framework contructed of 2″×6″, 4″×4″, 2″×4″, ½″ plywood, and metal brackets and joists. Platform for Solar Panel Array.
13. Barge Shackles:	Both barges built and manuevered serperately. Large shackles with pin hold barges together, allowing some flex in system and reducing torque on barges during foul weather.
14. Arrows:	Arrows depict water flow through silos, into center trough, through propellor shaft housing and out bottom of center trough.
15. Mesh Partition, Large:	Large Mesh Partition to separate groups of animals from each other. Mesh size will match what is used in the bottom of corresponding silo. Slots constructed of plastic angle built into silo walls guide and hold mesh partitions. 2 large mesh partitions without small partitions separate silo into 3 zones of equal area.
16. Mesh Partition, Small:	Small Mesh Partition used in conjunction with large partitions. 2 small partitions separate 1 of three zones created by large partitions into 3 smaller zones of equal area. Plastice angle slots built into large mesh partitions and silo guide and hold small partitions. Up to 9 zones of equal area can be created within each silo.
17. Propellor-shaft Housing:	10″ PVC pipe outside sheath with slots around bottom and near bottom of sheath. Inside 10″ pipe is a 6″ PVC pipe with slots in the top to that water must first flow through bottom of 10″ and up to the top of 6″ pipe before being pumped out. Although slots in 10″ pipe will keep out large debris, flow is not great enough to lift solids through to damage propeller shaft and propeller. The 6″ pipe reduces to 4″ past the propeller and has a large-hole wire screen mounted on the end to keep large solids or animals from getting into the propeller shaft housing from the outside of the system, especially during times the pumps are shut down.
18. Propeller:	3.5″ diameter propeller fits inside 4″ PVC pipe, which carries an average inside diameter of 4.026″ for schedule 40 pipe. “Hydrilla Hacker”

Long-line and suspended tray system



Long-line tray system. 4 rows of 15 columns, 8 trays per column. 20' between rows, 10' between trays within rows.

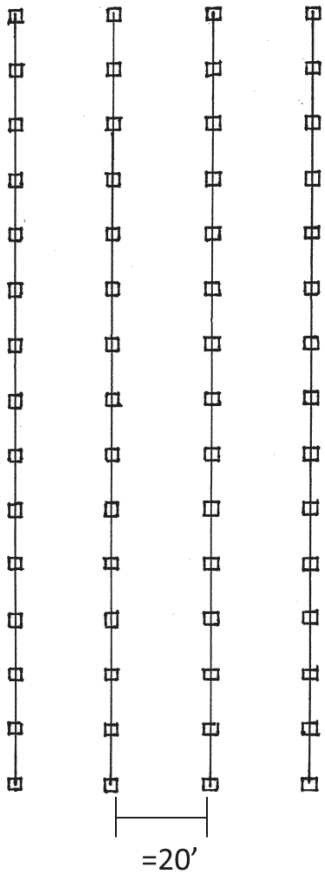
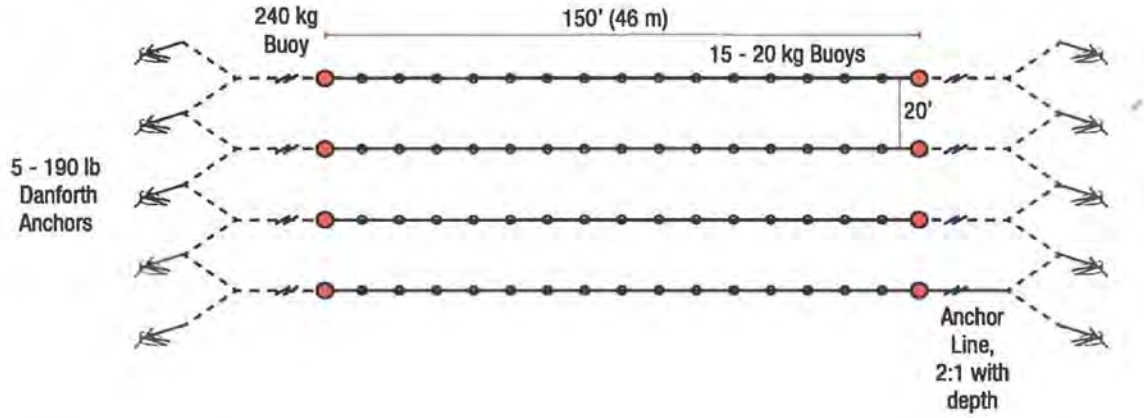
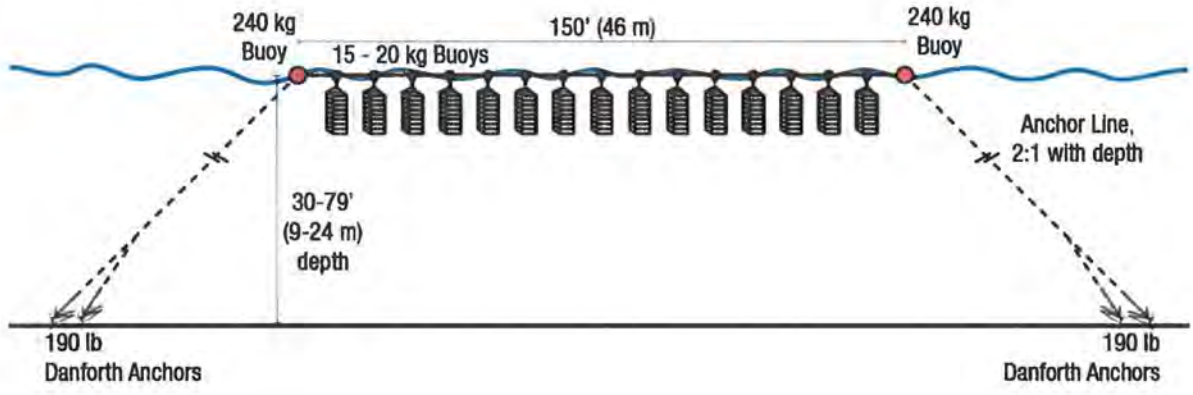


Exhibit 3b
Application No. 9-14-0489
USC Wrigley Institute
Longline and Suspended Tray System Diagrams

Top View:



Cross View (1 longline):



General Layout and Dimensions of the Wrigley Institute Aquaculture Longline

Figure 4. Photograph of Cat Harbor bottom under the proposed facility (taken March 30, 2013 by Professor James Haw, USC).