STAFF REPORT
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CONSIDER GRANTING AUTHORITY TO THE EXECUTIVE OFFICER TO ENTER INTO AN AGREEMENT WITH THE UNIVERSITY OF MARYLAND CENTER FOR ENVIRONMENTAL SCIENCE TO SUPPORT A STUDY EVALUATING VESSEL IN-WATER CLEANING AND CAPTURE TECHNOLOGIES TO REDUCE NONINDIGENOUS SPECIES INTRODUCTION RISK

PARTIES:

California State Lands Commission

University of Maryland Center for Environmental Science

BACKGROUND:

Nonindigenous species (NIS) are organisms that are introduced through human activities into areas where they do not naturally or historically occur. NIS can cause a variety of economic, environmental, and human health impacts once established in new areas. Economic costs are estimated at $120 billion in losses and damages annually in the United States (Pimental et al. 2005).

One of the most prolific mechanisms (or vectors) by which NIS are moved to new coastal and estuarine locations throughout the world is vessel biofouling. Vessel biofouling occurs when organisms attach to, or associate with, a vessel's underwater or wetted surfaces (e.g., hull, propeller, thrusters); it is responsible for up to 60 percent of California's currently established coastal and estuarine NIS (Ruiz et al. 2011).

Vessel biofouling can be managed by cleaning the accumulated organisms from the vessel's wetted surfaces while out-of-water in dry dock or in-water between dry dock periods. In-water cleaning can be done relatively quickly and economically in comparison to cleaning while in dry dock. While in-water cleaning removes organisms attached to the wetted surfaces, the removal process can release into the water column large pulses of organisms and heavy metal biocides typically contained within the vessel's underwater paints/coatings. The release of organisms during in-water cleaning can result in the introduction of nonindigenous species into California's coastal and estuarine waters. Similarly,

the release of heavy metals can severely impact water quality in the receiving environment.

Staff has considered developing regulations to limit the release of organisms during in-water cleaning activities, but that approach would address only NIS introduction risk and not the risk of releasing heavy metals, as water quality management is under the purview of the State Water Resources Control Board (State Board). An approach like this would be incomplete and ultimately ineffective. Instead, Commission staff took an alternative approach and has been working closely with staff from the State Board and the Regional Water Quality Control Boards when they consider permits for in-water cleaning operations. In-water cleaning systems that capture and treat debris to remove heavy metals will also capture and remove organisms from the processed water[1] prior to discharge. A water quality-based permitting and regulating approach will therefore address both NIS and water quality concerns.

Although a water quality-based regulatory approach should be more effective in the long term, many local and regional regulatory agencies currently do not allow in-water cleaning because of heavy metal contamination risks, especially in waterbodies like the Ports of Los Angeles, Long Beach, and San Diego that are considered "impaired" for copper and other heavy metals. Complete prohibitions on in-water cleaning prevent the release of organisms and heavy metals that could occur during cleaning operations, but prohibitions also prevent effective long-term strategies to reduce NIS introduction risk. More specifically, a vessel's biofouling community matures over time and can increase the risk of NIS introduction at every port the vessel visits. Removal of a vessel's biofouling community through in-water cleaning is a useful strategy to reduce long-term and repeated risks of NIS introduction. Commission staff are committed to working cooperatively with the State and Regional Water Boards to pursue a path toward responsible in-water cleaning and capture activities that address NIS introduction and water quality risks.

The Regional Water Quality Control Boards will consider issuing permits for in-water cleaning operations, but they require applicants to provide test data showing that heavy metal concentrations in discharged water fall under required thresholds. Without these data, permits will not be issued and the long-term risk of introducing NIS into California waters from unmanaged biofouling communities will continue. Although some in-water cleaning and capture vendors collect water quality samples as part of their internal testing process, independently collected and analyzed data are necessary and are often missing.

[1] During the cleaning process, water containing removed debris and contaminants is collected via an umbilical and processed topside before discharge.

PROPOSED AGREEMENT:

The proposed agreement would be part of a larger collaborative technology evaluation study aimed at producing independent data on the ability of in-water cleaning and capture technologies to collect, contain, and remove the organisms and heavy metals that are released from a vessel's hull during in-water cleaning operations. The study will be led by the Alliance for Coastal Technologies and the University of Maryland Center for Environmental Science's Maritime Environmental Resource Center, with collaborators from the California State Lands Commission, U.S. Maritime Administration, U.S. Naval Research Lab, Smithsonian Environmental Research Center, Hawaii Department of Land and Natural Resources, and the Port of Baltimore. The evaluation will include quantitative assessments of each participating technology's ability to:

- Remove all the organisms on a vessel's hull
- Collect and contain all the organisms and heavy metals removed from the vessel's hull
- Remove and retain all the organisms and heavy metals from the waste water prior to discharging back into the receiving environment

The proposed agreement between the Commission and the University of Maryland Center for Environmental Science would fund part of these evaluations, specifically the analysis of heavy metals in samples collected during the trials, as described below. These heavy metal analyses are critically needed to ensure that responsible in-water cleaning and capture technologies can be permitted and regulated in California and help the Commission reduce NIS introduction risk.

Staff proposes to provide funds in the amount of $69,424 from the Marine Invasive Species Control Fund to the University of Maryland Center for Environmental Science to support an examination of vessel in-water cleaning and capture technologies to reduce the risks of nonindigenous species introduction and heavy metal contamination.

The proposed funds would contribute to a larger collaborative study of in-water cleaning and capture technologies. Commission staff requested the inclusion of the collection and analysis of water quality data to the draft testing protocols to ensure that the resulting data would be relevant to California. Commission staff has also ensured that some of the tests will occur in Alameda, California, to allow the State and Regional Water Boards to observe the tests firsthand. Other tests will occur in Baltimore, Maryland, but the data collected will still be relevant to California.

The proposed funds would specifically be used to fund the analysis of chemical contaminants released during cleaning operations, a concern that specifically limits the application of in-water cleaning in California ports. This concern can be addressed only via independent data on how well these technologies can remove heavy metals and organisms from the processed water prior to discharge. The ability of Commission staff to influence and contribute to the regulation of in-water cleaning in California relies on the availability of independent water quality data. Without these water quality data, Regional Water Quality Control Boards in California cannot issue permits to operate and the long-term risk of repeated NIS introduction will continue.

REFERENCES CITED:

Pimentel, D., Zuniga, R., Morrison, D. 2005. Update on the environmental and economic costs associated with alien-invasive species in the United States. Ecological Economics 52:273-288.

Ruiz, G.M., Fofonoff, P.W., Steves, B., Foss, S.F., Shiba, S.N. 2011. Marine invasion history and vector analysis of California: a hotspot for western North America. Diversity and Distributions 17:362-373.

STAFF ANALYSIS AND RECOMMENDATION:

Authority:

Public Resources Code section 6106 and 71213; State Administrative Manual section 1200; State Contracting Manual (rev. 01/14)

Public Trust and the State's Best Interests Analysis:

The proposed research will further the interests of the Public Trust by providing data that will allow for greater protection against the introduction of nonindigenous species and heavy metal contaminants to California waters. Currently, the introduction of nonindigenous species to California's waters threatens Public Trust resources and values, including ecosystem preservation and the promotion and protection of fishing, water-related recreation, maritime commerce, and water-dependent tourism. The proposed research will likely lead to more effective evaluation of the risks and benefits of in-water cleaning operations occurring in California waters, including providing much-needed data on the ability of emerging technologies to reduce the risks of introducing NIS and heavy metals into California's waters. This research will give the Commission, State Water Resources Control Board (a Marine Invasive Species Program sister agency), and the Regional Water Quality Control Boards more information to protect Public Trust resources and values.

The proposed research will also satisfy the purpose of the Marine Invasive Species Act (Pub. Resources Code, § 71201, subd. (d)) "to move the State expeditiously toward elimination of the discharge of nonindigenous species into the waters of the State." Thus, staff believes that granting authority to the Executive Officer to enter into an agreement with the University of Maryland Center for Environmental Science to conduct research, as proposed, would further enhance and protect Public Trust resources and is in the State's best interests.

OTHER PERTINENT INFORMATION:

1. This action is consistent with Strategy 1.1 of the Commission's Strategic Plan to deliver the highest levels of public health and safety in the protection, preservation and responsible economic use of the lands and resources under the Commission's jurisdiction.

2. The staff recommends that the Commission find that this activity is exempt from the requirements of the California Environmental Quality Act (CEQA) as a categorically exempt project. The project is exempt under Class 6, Information Collection; California Code of Regulations, title 14, section 15306.

   Authority: Public Resources Code section 21084 and California Code of Regulations, title 14, section 15300.

EXHIBIT:

A. Proposal for chemical analyses for the evaluation of ship in-water cleaning and capture.

RECOMMENDED ACTION:

It is recommended that the Commission:

CEQA FINDING:

Find that the activity is exempt from the requirements of CEQA pursuant to California Code of Regulations, title 14, section 15061 as a categorically exempt project, Class 6, Information Collection; California Code of Regulations, title 14, section 15306.

PUBLIC TRUST AND STATE'S BEST INTERESTS:

Find that granting authority for the Executive Officer to enter into agreement with the University of Maryland Center for Environmental Science for research, as proposed, will not substantially interfere with the public rights to navigation or fishing or the Public Trust needs and values at this time; is consistent with the common law Public Trust Doctrine; and is in the best interests of the State.

AUTHORIZATION:

1. Authorize the Executive Officer or her designee to award and execute an agreement with the University of Maryland Center for Environmental Science in accordance with state policies and procedures to evaluate vessel in-water cleaning and capture technologies to reduce nonindigenous species introduction risk.

2. Authorize and direct the Executive Officer or her designee to take whatever action is necessary and appropriate to implement the provisions of the agreement with the University of Maryland Center for Environmental Science.

EXHIBIT A

CBL2018-063CSLC

PROPOSAL

Chemical Analyses for the Evaluation of Ship In-Water Cleaning and Capture

SUBMITTED TO: Chris Scianni
California State Lands Commission
(Chris.Scianni@slc.ca.gov).

SUBMITTED BY: University of Maryland Center for Environmental Science/ORAA
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INVESTIGATOR: Dr. Mario Tamburri, Professor
Chesapeake Biological Laboratory / UMCES
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PERIOD OF SUPPORT: May 1, 2018 through April 30, 2019

AMOUNT REQUESTED: $69,424

Ginger Steelman 3.12.2018

Ginger Steelman, Assistant Director
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EXHIBIT A

University of Maryland Center for Environmental Science
Chesapeake Biological Laboratory
Proposal to California State Lands Commission

Chemical Analyses for the Evaluation of Ship In-Water Cleaning and Capture – $69,424

Performance Period – May 1, 2018 through April 30, 2019

Background:

Ship biofouling, or the colonization of surfaces exposed to water by microbes, protists and higher organisms, presents significant problems for the maritime industry. The biofouling of vessels can interfere with operations and result in increased corrosion, drag and fuel consumption. Vessel biofouling is also a significant, if not the most dominant, vector for the global-scale transfer and introduction of non-native aquatic species, which can have enormous ecological and economic impacts on coastal environments. Thus, there is a critical need to identify emerging in-water biofouling cleaning systems and to quantity their efficacy and reliability in removing fouling organisms, and capturing material, from complex vessel structures.

The Alliance for Coastal Technologies (ACT) and Maritime Environmental Resource Center (MERC), in collaboration with the:

- US Naval Research Laboratory (NRL),
- Smithsonian Environmental Research Center (SERC),
- California State Lands Commission (CSLC),
- Hawaii Department of Land and Natural Resources,
- US Maritime Administration (MARAD), and
- Maryland Port Administration (MPA),

will provide an independent evaluation of ship in-water cleaning and capture (IWCC)

technologies designed to remove and capture fouling organisms. Commercial ship biofouling—or the colonization of wetted surfaces by aquatic organisms—presents significant problems for the maritime industry. A number of IWCC technologies and approaches have been developed over the past 10 years, focused mostly on hull husbandry to reduce drag and fuel consumption and to support the maritime industry. However, new innovations are now also targeting biofouling removal and capture from vessel niche areas, with biosecurity and environmental protection as an additional goal (including the capture of biocides in the effluent, usually copper or zinc). There is now a critical need to provide thorough, independent evaluations of ship in-water biofouling cleaning systems to quantify their efficacy and reliability in removing fouling organisms, including the capture of debris and potential contaminants, from complex vessel structures.

This evaluation of IWCC systems will focus on biofouling removal, debris and biocide chemical capture efficacy, and follow the ACT (www.act-us.info) and MERC (www.maritime-enviro.org) approaches for independent testing, including the establishment of a Technical Advisory Committee (TAC), a Test Protocol Workshop, and field testing on MARAD ships in Baltimore Maryland and Alameda California. As part of this evaluation, participating technology

developers and/or service providers will conduct the in-water cleaning on test ships, with the testing team conducting underwater ship surveys and various related sampling (before, during and after), as agreed to in the final Test Protocols. Like all ACT Technology Evaluations, participation in this effort will be voluntary and free of charge (with some participation support available) for qualifying applicants, and results will be made available to the public in individual reports for each of the technologies or service providers that agree to participate.

Specifically, assessments of IWCC technologies that manually and/or mechanically remove both soft- and hard- biofouling from ship hulls and/or niche areas, and collect and dispose or treat captured debris, biocide chemicals and effluent water will be conducted using the methods described below. This Test Protocols was developed with the aid of participating technology and service providers and a Technical Advisory Committee (TAC). Although some performance standards for the removal of biofouling exist (e.g., Georgiades and Kluza, 2017, Evidence-based decision making to underpin the thresholds in New Zealand's craft risk management standards: Biofouling on vessels arriving to New Zealand, Mar. Tech. Soc. J. 51:76-88), there are currently no accepted US or international in-water biofouling cleaning standards. Therefore, this evaluation will provide data on IWCC technology performance in the form of percent removal (before and after surveys), capture efficacy (captured material versus estimates of removed material) and treatment efficacy (dependent on in-water cleaning systems) and in the context of test methods detection limits. This evaluation will also measure chemical contaminants in-water resulting from the use of IWCC systems on ship coatings and in effluent from the cleaning systems but not the impacts of IWCC systems on the coatings themselves.

Depending on the design and intended application of the in-water cleaning technology, this evaluation will include assessments of performance on (a) flat sides of the hull, (b) curved and angled areas of the hull, and/or (c) niche areas, including propellers and shafts, rudders, and gratings. Test locations on the test ships will be identified with the goal of providing the highest level of biofouling targeted by the individual in-water cleaning technologies. Ship biofouling will be characterized using the US Navy Fouling Rating (FR) scale (Navy Ship Technical Manual, 2006). No distinction will be made between living and dead fouling organisms found on test ship surfaces – only the presence or absence, number of individuals and percent cover will be considered in these assessments, which will provide the most conservative estimate of the likelihood of biofouling release and establishment.

This evaluation will only consider IWCC systems that capture biofouling that is cleaned/ removed from vessels and not in water grooming technologies (designed for periodic biofilm wiping or removal to prevent higher organism biofouling growth), which will focus of a proposed future evaluation. Any system that does not attempt capture and containment of removed biofouling will not be considered. This evaluation will also only consider external submerged surfaces of ships. It does not consider the cleaning or removal of biofouling from internal surfaces - such as sea chests, seawater intakes and internal piping – and it does not consider biofouling removal from smaller craft like recreational boats.

EXHIBIT A

Proposal:

Our proposal to the California State Lands Commission is specifically to support the analyses of samples collected for the assessment of IWCC technologies to capture/removal potential biocide chemicals released during in-water cleaning operations during the first set of trials in Baltimore, MD. We will provide a full copy of the complete IWCC Evaluation Test Protocols once compete, but the protocols will include the following in section 3.3 *Biocide chemicals capture/removal.*

This evaluation will quantify the release or discharge of heavy metal biocides from anti-fouling coatings during IWCC activities. The critical control points for the release or discharge of biocides are:

- The release of biocide from the primary in-water cleaning unit while cleaning is underway
- The discharge of biocides at the end-of-pipe portion of the treatment system (i.e., the effluent)

To measure the release and dispersal of heavy metal biocides, samples will be collected at the following distances from the hull, cleaning unit, or effluent end-of-pipe discharge point:

- 0.5 meters, to measure release of biocides in the immediate area
- 5 meters, to measure the dispersal or dilution of biocides from the point source
- 50 meters, to serve as an unaffected reference point

Environmental Sampling and Analysis - All samples will be collected in one-liter polyethylene bottles and all bottles will be acid washed prior to sample collection. All sample bottles will be labeled with unique identification numbers prior to sampling. Samples may be collected via SCUBA or by deploying Niskin bottles from the dock or a small vessel.

Approximately one hour prior to the test, the following samples (9 total replicates) should be collected at the proposed cleaning depth:

- At proposed cleaning location, approximately 0.5 meters from the hull (three replicates)
- Approximately 5 meters from the hull (three replicates)
- Approximately 50 meters from the hull to serve as pre-cleaning reference (three replicates)

During the cleaning trial, the following samples (21 total replicates) should be collected:

- At the cleaning location, approximately 0.5 meters down current from the unit and at three intervals during the cleaning trial:
    - Interval one, approximately one minute after trial commences (three replicates)
    - Interval two, approximately mid-point during the cleaning trial (three replicates)
    - Interval three, approximately one minute prior to the end of the trial (three replicates)
- Approximately 5 meters down current from the unit and at three intervals during the cleaning trial:

    - Interval one, approximately one minute after trial commences (three replicates)
    - Interval two, approximately mid-point during the cleaning trial (three replicates)
    - Interval three, approximately one minute prior to the end of the trial (three replicates)
- Approximately 50 meters down current from the unit to serve as cleaning trial reference. Samples should be collected approximately one minute prior to the end of the cleaning trial (three replicates)

Approximately one hour after the end of the trial, the following samples (9 total replicates) should be collected:

- At the cleaning location, approximately 0.5 meters from the hull at the mid-point location of the trial (three replicates)
- Approximately 5 meters from the hull at the midpoint location of the trial (three replicates)
- Approximately 50 meters from the hull to serve as the post-trial reference (three replicates)

Sample Storage and Transfer - All samples should be stored at a temperature of 4 degrees Celsius or less and delivered to the analytical laboratory within 48 hours of sample collection.

Sample Analysis - All samples should be analyzed for dissolved and total metals. The list of metals to be analyzed and the acceptable limits of detection are included in the table below.

Metals to be analyzed:

Metal	Method	Acceptable Limit of Detection
Copper (Cu)	EPA 200.8	0.03 ug/L
Zinc (Zn)	EPA 200.8	0.2 ug/L

Effluent Sampling and Analysis - All samples must be collected in one-liter polyethylene bottles and all bottles must be acid washed prior to sample collection. All sample bottles shall be labeled with unique identification numbers prior to sampling.

End-Of-Pipe Discharge - The following samples (9 total samples) should be collected from the end-of-pipe discharge (i.e., the effluent) at three intervals during the cleaning trial:

- Interval one, approximately one minute after discharge begins (three replicates)
- Interval two, approximately mid-point during the discharge (three replicates)
- Interval three, approximately one minute prior to the end of the discharge (three replicates)

Dilution/Mixing Zone - Samples described in this subsection are necessary to determine the immediate and short-term impacts of the effluent discharge on the local water quality.

EXHIBIT A

Approximately one hour prior to the test, the following samples (6 total replicates) should be collected:

- Approximately 0.5 meters from the end-of-pipe discharge location (three replicates)
- Approximately 5 meters from the end-of-pipe discharge location (three replicates)
- The pre-cleaning reference collected in section can serve as a pre-cleaning reference here as well; there is no need to collect another set of replicates

During the cleaning trial, the following samples (18 total replicates) should be collected:

- Approximately 0.5 meters up current from the end-of-pipe discharge location at three intervals during the discharge:
    - Interval one, approximately one minute after discharge begins (three replicates)
    - Interval two, approximately mid-point during the discharge (three replicates)
    - Interval three, approximately one minute prior to the end of the discharge (three replicates)
- Approximately 5 meters up current from the end-of-pipe discharge location at three intervals during the discharge:
    - Interval one, approximately one minute after discharge begins (three replicates)
    - Interval two, approximately mid-point during the discharge (three replicates)
    - Interval three, approximately one minute prior to the end of the discharge (three replicates)
- The cleaning trial reference collected in section can serve as a discharge reference here as well; there is no need to collect another set of replicates

Approximately one hour after the discharge ceases, the following samples (6 total replicates) should be collected:

- Approximately 0.5 meters upstream from the end-of-pipe discharge location (three replicates)
- Approximately 5 meters upstream from the end-of-pipe discharge location (three replicates)
- The post-cleaning reference collected in section 3.3.1 can serve as a post-cleaning reference here as well; there is no need to collect another set of replicates

Sample Storage and Transfer -All samples should be stored at a temperature of 4 degrees Celsius or less and delivered to the analytical laboratory within 48 hours of sample collection.

Sample Analysis - All samples should be analyzed for dissolved and total metals. The list of metals to be analyzed and the acceptable limits of detection are included in the table above.

A total of 78 samples, for each IWCC systems tested, will be collected and analyzed for both total and dissolved copper and zinc.

EXHIBIT A

Budget:

Budget Category	Cost
Salary	$7,500
Benefits	$1,875
Analytical Services, Heyes CBL	$36,000
Total Direct Cost	$45,375
Indirect Costs	$24,049
Total Costs	$69,424

Salary - Salary - Dr. Mario Tamburri, the Principal Investigator and MERC Director, at 2 weeks. Dr. Tamburri's duties involve general oversight and coordination of all MERC activities, collaborations and chemical analyses at CBL assist in test plan development, data analysis and report writing.

Fringe Benefits - Fringe benefits for key personnel are estimated on the current and average anticipated rates for UMCES employees during the duration of requested support and are calculated as a percentage of salary. UMCES does not have a federally negotiated fringe rate agreement. The calculation of the fringe benefit rate is determined by FICA, unemployment insurance, health insurance and retirement system chosen and is unique to each individual. Terminal leave is charged at a fixed rate per the UMCES F&A agreement and is included in these fringe benefit rates as appropriate. The salaries and fringe benefits rates used in this budget reflect the standard University of Maryland Center for Environmental Science guidelines. A 25% rate has been estimated for Mario Tamburri, PI

Total salaries and benefits are estimated at $9,375.

Contract Analytical Services - A total of 78 samples, for each IWCC systems tested, will be collected and analyzed for both total and dissolved copper and zinc (approximately $75/sample, estimated total of $12,000/IWCC system) by Dr. Andrew Heyes at the Chesapeake Biological Laboratory. Three IWCC systems will be evaluated in Baltimore, MD, for an estimated total chemical analytical cost of $36,000

Total Direct Costs - Total Direct Costs for this proposal is $45,375.

Indirect Costs **-** UMCES has a negotiated indirect cost rate agreement with the U.S. Department of Health and Human Services (HHS) dated October 4, 2016. Our current Facilities and Administrative Costs (F&A) rate for on-campus sponsored research is 53% of the modified total direct costs (MTDC). The MTDC base of expenses includes all direct costs except equipment (each item over 5k), tuition remission, rental of off-site facilities, capital expenditures, scholarships and fellowships, portion of each subaward in excess of 25K, participant support costs, and UMCES research vessel operations. To calculate the indirect cost on this proposal, the UMCES on-campus rate of 53% has been applied to the MTDC of the project. Based on this rate, Indirect Costs associated with the funds requested in this budget component would be $24,049.