CSU The California State University
COUNCIL ON OCEAN AFFAIRS, SCIENCE & TECHNOLOGY (COAST)

STATE SCIENCE INFORMATION NEEDS PROGRAM (SSINP)
Request for Proposals (RFP)
ROUND 3: Informing Ocean and Coastal Compensatory Mitigation and Associated Restoration

KEY DATES & INFORMATION

Letter of Intent deadline:	Wednesday, September 1, 2021, 5:00 p.m. Pacific time
Application deadline:	Friday, October 1, 2021, 5:00 p.m. Pacific time
Amount available:	Up to $720,000
Award funding range:	$200,000-$360,000
Who can apply:	Lead PIs must be from the CSU; non-CSU co-PIs are permitted. See Grant Guidelines for additional details.
Start date:	Applicant will specify date between July 1, 2022 and September 30, 2022
Project duration:	30 months
Webinar:	A two-part webinar will be held in mid-August 2021, date TBD. For more details and to register, please go to COAST's SSINP webpage.

PROGRAM DESCRIPTION

With funding from a one-time appropriation of funds in the FY 2019-2020 state budget, the CSU Council on Ocean Affairs, Science & Technology (COAST) has established a new research funding program called the State Science Information Needs Program (SSINP). The overall purpose of SSINP is to fund research to support the state of California's highest priority marine, coastal, and coastal-watershed science information needs.

SSINP Grant Guidelines are available on COAST's website and articulate the basic purpose of the grant program, outline program restrictions such as eligibility requirements and award conditions, describe how funds will be administered, and describe the required components of an application. Please be sure to review the Grant Guidelines carefully when preparing your proposal. The Grant Guidelines are incorporated by reference into this present RFP.

RESEARCH PRIORITIES

For Round 3 of SSINP funding, COAST will accept proposals that address the topic of **ocean and coastal compensatory mitigation and associated restoration.**

Many human activities occur along the California coast or in the marine environment, some of which are regulated by local, state, or the federal government. Actions regulated by government entities span a wide diversity of activities (e.g., fishing, dredging, coastal development, wastewater discharge). When a regulated activity is anticipated to cause negative impacts to the environment, the responsible party is obligated by federal and state law to reduce those impacts. For the negative impacts that cannot be avoided, the responsible party must create, restore, enhance, or in some cases preserve[1] ecological resources to offset those negative impacts, a practice known as compensatory mitigation [1].

Compensatory mitigation began in the 1970s and over time, the following general tenets have emerged:

1) on-site mitigation is preferable to off-site, and
2) in-kind mitigation, which refers to restoration of the resource(s) damaged by the impact, is preferable to out-of-kind.

Despite these simple tenets, the management and science of ecological restoration associated with compensatory mitigation is complicated and complex. In 2001, the National Academies of Science published a report citing the poor success of many wetland mitigation projects across the U.S. [2]. This report and a subsequent report by Ambrose [3] concluded that while responsible parties often comply with the compensatory mitigation terms of their permit, the projects often do not result in habitats that ecologically function optimally or similarly to the lost habitat. Ambrose [3] and Alexander [4] found that the lack of success was likely due to the inclusion of monitoring metrics that are easy to obtain (e.g., vegetation cover) rather than those that are better indicators of ecological function such as species composition, hydrology, and soil characteristics.

While on-site mitigation was generally thought to be superior to off-site mitigation, thinking around this changed in the mid-2000s when the U.S. Army Corp of Engineers and U.S. Environmental Protection Agency issued the 2008 Mitigation Rule. The Rule stated that under certain conditions, off-site mitigation was adequate and in some cases even preferable to on-site [5]. This may be the case when projects are larger in area and receive increased scrutiny, and there’s more flexibility on where they can be placed [6].

The development of appropriate out-of-kind mitigation requirements can be complex because it requires the comparison of dissimilar habitats [7]. For example, compensating for impacts to subtidal rocky reef fish by enhancing estuarine fish populations is more straightforward than compensating for the impacts to subtidal rocky reef fish by enhancing bird populations in a salt marsh [7]. Out-of-kind mitigation requires establishing ecological equivalence, or a “common

[1] For the purposes of this RFP, creation, restoration, enhancement, and preservation of ecological resources will hereafter be referred to as “restoration.”

currency" between the impact and the mitigation in order for the mitigation to be recognized as compensatory [6].

COAST's goal in funding projects solicited via this Request for Proposals is to improve the science underpinning mitigation policies, decisions and requirements.

<u>Improving the science of out-of-kind marine and coastal mitigation</u>

An early step in developing mitigation requirements within permit conditions is to determine the appropriate mitigation ratio, which is the amount of area that must be restored relative to the amount of area that was damaged (area restored: area damaged). The ratio is generally determined by at least two factors: 1) likelihood of restoration success and 2) the time required for the mitigation site to reach the target condition [7]. For example, NOAA Fisheries recommends different mitigation ratios for in-kind eelgrass restoration in different areas of California based upon past eelgrass restoration success rates within those geographic areas [8].

When out-of-kind mitigation is necessary (due to a lack of opportunities for in-kind mitigation) a third component, habitat value, may be added to the ratio calculation. This factor places a relative "value" (e.g. productivity) on an ecosystem[2]. For example, if an acre of mangroves was detrimentally impacted by development and there were no available mangrove restoration sites, the responsible party might be required to conduct out-of-kind mitigation, such as constructing an artificial reef. The mitigation ratio would be calculated based upon the 1) likelihood of restoration success of the artificial reef, 2) estimated time required for the artificial reef to achieve target conditions, and 3) the value of an artificial reef relative to mangroves. If the mangroves were found to be of higher value than the artificial reef, the responsible party would be required to restore an additional area of artificial reef beyond that required if in-kind mitigation had been feasible.

Bond *et al.* [9] presents a method for habitat valuation that can be used to compare the values of different habitats in the Southern California Bight. This paper has been used in environmental permitting decisions, including a 2021 decision by the Santa Ana Regional Water Quality Control Board regarding the proposed Poseidon Resources Huntington Beach Desalination Facility [10]. The paper uses marine fish density, fidelity, and mean size data collected in the Southern California Bight beginning in the 1970s to estimate the value of different marine habitats. Because it is a meta-analysis of disparate data sets, Bond *et al.* [9] includes data collected using varied methodologies: different types of sampling gear, different times of year and/or day, and different sampling frequencies. A better understanding of how different sampling programs affect estimates of habitat value is needed in order to understand the limits of the methodology presented in Bond *et al.* [9] and of other approaches that similarly estimate the value of different habitats for the purposes of out-of-kind mitigation.

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[2] It should be noted that there is not one consensus opinion among California state agencies with respect to placing relative values on different types of ecosystems.

Furthermore, the state of the science would be advanced by an assessment of the most accurate and useful metrics for creating and using habitat valuations across different types of marine habitats. For example, habitat values based on a limited number of taxa or species, may be problematic for agencies that have management or trustee responsibilities for entire ecosystems.

Improving understanding of restoration practices to improve compensatory mitigation outcomes

In addition to improving the science of mitigation, improving restoration practices for particular ecosystems will increase the likelihood that approved mitigation activities will successfully compensate for environmental damages, such as loss of habitat or ecosystem services.

Artificial reefs

Globally, most artificial reefs have been constructed for recreational purposes and few have been built specifically as compensatory mitigation [11]. Similarly, in California only a fraction of the approximately 40 artificial reefs in state waters were constructed for compensatory mitigation purposes [12]. Wheeler North reef is a large artificial reef built off the coast of San Clemente for the purpose of partially mitigating environmental damages for the San Onofre Nuclear Generating Station [13]. The Palos Verdes reef off Whites Point is a recently constructed reef built as mitigation for the illegal dumping of chemicals by the Montrose Chemical Corporation [14].

In recent years, the use of artificial reefs as compensatory mitigation has garnered attention [11]. As recently as April 2021, expansion of the aforementioned Palos Verdes artificial reef was included in the Santa Ana Regional Water Quality Control Board’s permit conditions for the Poseidon Huntington Beach desalination facility [10].

Although there is an extensive monitoring history of the Wheeler North reef and recent monitoring of Palos Verdes reef, the paucity of artificial reefs built for mitigation purposes in California means there is scientific uncertainty with regard to whether artificial reefs can compensate for environmental damages (and best practices for their design and construction). One way to reduce this uncertainty is to build new artificial reefs and assess their performance; for a variety of reasons this option does not appear viable in California. Investigating the known 40 artificial reefs in state waters and comparing them to natural reefs with respect to community composition and ecological function may be the best way to address this question. If it is found that artificial reefs are a mitigation strategy appropriate for wider implementation, the aforementioned research can also assist the state in developing design criteria.

Kelp forest restoration

Kelp forest restoration may be required as mitigation for some types of projects, such as beach nourishment and seawater desalination. Sand used for beach nourishment projects may ultimately be transported offshore, where it can bury nearby reefs. Additionally, if the characteristics of the sand used do not match the native sand, this can result in negative impacts to kelp recruitment due to abrasion [15]. Seawater desalination can impinge and entrain organisms vital to kelp ecosystem health, and brine discharge can increase salinity levels and decrease dissolved oxygen concentrations near kelp beds.

Given the significant loss of kelp forest cover in California over the last several years because of the 2013-18 marine heatwave and urchin population explosions resulting from sea star wasting disease [16], it is essential that compensatory kelp restoration uses the best available science so as to ensure the resilience of these sensitive ecosystems. Globally, kelp restoration techniques include transplanting, seeding, grazer management, and establishing artificial reefs [17]. To date, kelp restoration efforts in California have focused primarily on grazer management, with the removal or in-water culling of purple urchins being the most common approach.

In 2020, the OPC and California Sea Grant (CASG) co-funded six pilot-level research and restoration projects related to kelp forest ecosystem resilience. While this research is in response to wide-spread climate change-induced loss of kelp in California, the results should inform future permits requiring compensatory mitigation for the loss of kelp. When applying in response to Research Objective 2.2.1 below, please clearly articulate how the proposed activities are distinct from or will provide added value to the OPC-CASG suite of funded projects.

Eelgrass restoration

Eelgrass (*Zostera marina* and *Z. pacifica*) may be negatively impacted by regulated activities such as dredging, dyking, aquaculture operations, coastal discharges, and activities related to boating (e.g., anchoring, dock construction and shading effects). Given California's historical loss of eelgrass since the 1800s, the state has placed a high priority on preserving the 15,000 acres of existing eelgrass habitat and creating additional habitat by 2025 [18].

The NOAA Fisheries' 2014 California Eelgrass Mitigation Policy and Implementing Guidelines (CEMP) specifies mitigation requirements (e.g., mitigation ratios, techniques, and performance milestones) for projects that are anticipated to negatively impact eelgrass [8]. CEMP is widely considered as the definitive document for compensatory eelgrass restoration throughout the state. Despite this detailed guidance, greater scientific understanding of factors that contribute to eelgrass restoration success is needed.

Beheshti and Ward 2021 [19] found that on the U.S. West Coast, site suitability rather than restoration method was the primary driver of success in eelgrass restoration projects. Since depth and sediment characteristics are two factors that determine the distribution of eelgrass, there is interest by state agencies in exploring ways to create more suitable habitat in proximity to existing healthy populations to allow expansion.

While site suitability is paramount, methods play an important role in eelgrass restoration. The most common eelgrass restoration technique in California is transplanting by a variety of means (e.g., bamboo stake, garden staple) [19]. Seed dispersal is a widely used technique on the U.S. East Coast but has not been used extensively in California because of a lack of infrastructure and facilities [19]. There are several questions related to seed viability that would assist restoration practitioners in their efforts to use seed dispersal as an eelgrass restoration tool.

RESEARCH OBJECTIVES

The research objectives below reflect iterative discussions with state of California management and regulatory agency representatives. These objectives have emerged as some of the state's highest priority science information needs within the topic of compensatory mitigation. Please note that the inclusion of these research objectives in the RFP does not constitute a commitment on behalf of COAST to fund projects addressing each of them. If you believe the research objective cannot be fully addressed given the scope of the SSNIP (either in amount of funding or time constraints), please describe in detail how the project will advance the science to a point where the state can derive benefits and/or where a subsequent research project would be further enabled.

1. **Improving the science of out-of-kind mitigation**
    1.1. Assess how different sampling programs for fish populations (density, site fidelity, mean size) influence estimates of habitat valuation when different types of sampling gear are used and sampling is conducted at various times (seasonally, diurnally) and frequencies. How can the value of different habitat types be compared when sampling varies with habitat type?
    1.2. What are recommended methods/approaches and metrics for comparing habitat value among different habitat types (e.g., hard/soft substrate, kelp, eelgrass, estuarine)?

2. **Improving understanding of restoration practices to improve compensatory mitigation outcomes**
    2.1. Artificial reefs
        2.1.1. Assess differences between artificial and natural reefs in California with respect to community composition and ecological function. Comparisons must include:
            - Biological attributes of each reef: species assemblages, species richness, density, and size structure; individual mean size; substrate cover; invertebrate density; and giant kelp density.
            - Physical attributes of each reef: georeferenced data points demarcating reef location (including depth), three-dimensional profiles of the reef, description of the habitats surrounding the perimeter for the purpose of characterizing the ecotone, determination of whether any part of the reef has subsided or been covered via sediment transport, and for artificial reefs determination of the substrate type upon which the reef was placed, and description of the materials used to build the reef
            - See Appendix A for a list of artificial reefs that CDFW has prioritized for study under this research objective.

    2.2. Kelp restoration
        2.2.1. Identify the most effective methods of kelp restoration in California. Identify the risks of different kelp restoration methods and measures that

can be taken to address those risks. Describe the ecological and environmental circumstances under which each method should be pursued.

2.3. Eelgrass restoration

2.3.1. Assess methods to allow existing patches of eelgrass to expand by 1) beneficially reusing suitable material to construct habitat at an appropriate depth for eelgrass in proximity to current populations, 2) removing shell hash from areas of past aquaculture operations that seem to be excluding eelgrass from what would otherwise be available substrate, or 3) other means to create habitat conducive to eelgrass expansion and/or colonization.

2.3.2. Assess the feasibility and efficacy of using seeding for eelgrass restoration in California. Identify gaps in knowledge regarding seed viability as a first step.

3. Other compensatory mitigation and associated restoration questions

3.1. Proposals addressing state needs for scientific information on compensatory mitigation and associated restoration outside of the priority research objectives listed above will also be accepted. Restoration research questions that are unrelated to compensatory mitigation will not be accepted. A successful proposal must concretely demonstrate the relevance of the research project to state needs, including identification of specific state agencies that will benefit in the form of a detailed letter of support from said agency.

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References

1. 40 CFR §1508.20
2. National Research Council. 2001. Compensating for Wetland Losses Under the Clean Water Act. Washington, DC: The National Academies Press. https://doi.org/10.17226/10134.
3. Ambrose, R., Callaway, J., Lee, S. 2006. "An Evaluation of Compensatory Mitigation Projects Permitted under the Clean Water Act Section 401 by the California State Water Quality Control Board, 1991-2002."
4. Alexander, Tommy. 2020. "Evaluating the Success of Compensatory Wetland Mitigation in the California Coastal Zone". *Master's Projects and Capstones, University of San Francisco*. 997.
5. See the Federal Register for changes to 33 CFR parts 325 and 332 and 40 CFR part 230.
6. Ambrose, R., Bernstein, B., Anderson, S., Carr, M. Murray, S., Nielsen, K. Raimondi, P. 2016. Marine Mitigation in California: going beyond traditional approaches, California Ocean Protection Science Advisory Team, California Ocean Science Trust.
7. California Coastal Commission. 1994. “Procedural Guidance for the Review of Wetland Projects in California’s Coastal Zone” (see chapter 2 and 7).
8. NOAA Fisheries. 2014. “California Eelgrass Mitigation Policy and Implementing Guidelines”.
9. Bond, A., Stephens, J., Pondella, D., Allen, M., Helvey, M. 1999. A Method for Estimating

Marine Habitat Values Based on Fish Guilds, with Comparisons between Sites in the Southern California Bight, *Bulletin of Marine Science* 64:2.

10. Santa Ana Regional Water Quality Control Board. 2021. Attachment G.4 to Draft Tentative Order R8-2021-0011 regarding Poseidon Resources (Surfside) LLC Huntington Beach Desalination Facility.
11. Ambrose, R., Raimondi, P., Anderson, S., Baskett, M., Caselle, J., Carr, M., Edwards, C., Kent, M., Nickols, K., Ramanujam, E., Reyns, N., and Stier, A. (California Ocean Protection Council Science Advisory Team Working Group). 2018. Ocean Restoration Methods: Scientific Guidance for Once-Through Cooling Mitigation Policy. California Ocean Science Trust.
12. Owens, Brian. Senior Marine Biologist, Specialist, Habitat Conservation Program, Marine Region California Department of Fish and Wildlife (CDFW). Personal communication, June 23, 2021.
13. See California Coastal Commission Coastal Development Permit 6-81-330 (formerly 183-73)
14. See California Coastal Commission Coastal Development Permit 9-18-0629.
15. Broad Beach Geological Hazard Abatement District. 2017. "Final Broad Beach Restoration Project: Marine Habitat Monitoring and Mitigation Plan".
16. Rogers-Bennett, L., Catton, C.A. 2019. Marine heat wave and multiple stressors tip bull kelp forest to sea urchin barrens. Sci Rep 9, 15050.
17. California Ocean Protection Council and California Department of Fish and Wildlife. 2021 "Interim Action Plan for Protecting and Restoring California's Kelp Forests".
18. California Ocean Protection Council. 2020. "Strategic Plan to Protect California's Coast and Ocean 2020-2025"
19. Beheshti, K. and Ward, M. 2021. "Eelgrass Restoration on the U.S. West Coast: A Comprehensive Assessment of Restoration Techniques and Their Outcomes". Prepared for the Pacific Marine and Estuarine Fish Habitat Partnership.

Appendix A: List of known artificial reefs for potential study under Research Objective 2.1.1 (source: California Department of Fish and Wildlife).

Please note that in some instances the coordinates are skewed due to a conversion from Loran to GPS positioning. Additionally, many reefs are modular acting as a single reef and in some instances have multiple sets of modules to form a reef complex (e.g., Huntington Beach). Reefs that were constructed as mitigation (e.g., Wheeler North reef, Palos Verdes reef) are not included in this list because there is either an extensive history of monitoring or a monitoring plan is in place.

NAME	Depth (ft.)	Size (ac.)	Material	Centroid LAT	Centroid LONG
Atascadero	55	0.4	3,500 tons quarry rock	35.393333	-120.8755555
Bolsa Chica	85-100	220	10,400 tons concrete rubble & 8 barges	33.65	-118.1
Carlsbad	37-60	6	10,000 tons quarry rock	33.086153	-117.320747
Channel Islands Habor	60	unknown	60,000 tires	34.1552777	-119.2672222
Hermosa Beach	60	0.5	330 tons quarry rock	33.853611	-118.413333
Huntington Beach A	60	3.7	1,000 tons quarry rock each	33.614444	-117.983056
Huntington Beach B	60	3.7	1,000 tons quarry rock each	33.621389	-117.9975
Huntington Beach C	60	3.7	1,000 tons quarry rock each	33.619167	-117.988056
Huntington Beach D	60	3.7	1,000 tons quarry rock each	33.624444	-118.001111
International Reef (augmented)	165	75	25,000 tons quarry rock, concrete, steel missile tower and 300 tons of concrete rubble	32.544294	-117.247544

NAME	Depth (ft.)	Size (ac.)	Material	Centroid LAT	Centroid LONG
La Jenelle	90-100	unknown	Vessel superstructure La Jenelle	34.125	-119.294444
Malibu	60	0.5	333 tons quarry rock	34.030278	-118.650556
Marina Del Rey 1	65	3.2	2,000 tons quarry rock/4,000	33.965	-118.486111
Marina Del Rey 2	65	6.9	10,000 tons quarry rock	33.968333	-118.486389
Mission Bay Park "AKA wreck alley"	80-90	173	3 sunken ships	32.766667	-117.275278
Newport Beach Center	72	8	10,675 tons concrete blocks, pilings,& rubble	33.603611	-117.963611
Oceanside 1	82-100	4	2,000 tons quarry rock	33.1825	-117.416667
Oceanside 2	42-72	256	10,000 tons quarry rock	33.211158	-117.428839
Pacific Beach	42-72	109	10,000 tons quarry rock	32.793056	-117.276389
Palawan	120	0.6	450 ft ship	33.823611	-118.414722
Paradise Cove	50	0.5	20 car bodies	34.016666	-118.766666
Pitas Point	28	1.1	7,200 tons quarry rock	34.302222	-119.368333
Redondo Beach	72	1.6	1,000 tons quarry rock	33.837222	-118.408889
Redondo/Palos Verdes	60	0.1	6 street cars	33.813333	-118.405
Rincon Island	40+	unknown	120 car bodies augmented with 10,000 tires	34.3472222	-119.4447222

NAME	Depth (ft.)	Size (ac.)	Material	Centroid LAT	Centroid LONG
San Clemente	unknown	unknown	Likely boulders and modules wrapped around the end of the pier	33.41722	-117.6242
San Luis Obispo County	42'-52	13	27,000 tons concrete "tribar" and rubble	35.19028	-120.8319
Santa Monica Bay	42-72	7	20,000 tons quarry rock	34.013056	-118.5425
Santa Monica	60	0.1	330 tons quarry rock/100 tons pier pilings	34.009444	-118.529722
Silver Strand, San Diego County	50	0.3	2,000 tons quarry rock	Exact coordinates unknown	
Soquel Cove	45	0.6	480 Concrete culvert pipes	36.95	121.955
Topanga	28	2	10,000 tons quarry rock	34.027222	-118.5325
Torrey Pines 1	67	1	1,000 tons quarry rock	32.886667	-117.263889
Torrey Pines 2	44	1	3,000 tons quarry rock	32.893056	-117.259722
Ventura	60	8.8	2000 ton quarry rock	34.302222	-119.368333
Yukon	100		366 ft Navy destroyer	32.766667	-117.283333