

Once-Through Cooling Mitigation Program
Policy and Science Framework Linking
California's Marine Protected Area Network to OTC Impacts
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Introduction

California's Once-Through Cooling Policy (Policy) was adopted by the State Water Resources Control Board (SWRCB) in 2010 and amended in 2011, 2013, and 2016.¹ The Policy establishes technology-based standards to implement federal Clean Water Act section 316(b) and reduce the harmful effects associated with cooling water intake structures on marine and estuarine life. The Policy originally applied to 19 coastal power plants (including two nuclear plants)[†] that had the ability to withdraw over 15 billion gallons per day from the State's coastal and estuarine waters using a single-pass system, also known as once-through cooling (OTC). Closed-cycle wet cooling has been selected as Best Technology Available and permittees must either reduce intake flow and velocity (Track 1) or reduce impacts to aquatic life comparably by other means (Track 2).² The Policy requires power plants that are not in compliance by October 2015 to either perform or pay for mitigation activities to account for the negative impacts between October 2015 and the date of the plants' full compliance with the Policy (interim mitigation). Section 3(e) of the Policy states, *"It is the preference of the State Water Board that funding is provided to the California Coastal Conservancy, working with the California Ocean Protection Council, for mitigation projects directed toward increases in marine life associated with the State's Marine Protected Areas in the geographic region of the facility."*

This document defines activities related to the management of California's existing statewide MPA Network that could be supported with interim mitigation funds. An effective network of MPAs requires three fundamental elements³; (1) enforcement, (2) education to build compliance and (3) monitoring and assessment. An effective network of MPAs can provide significant benefits to marine habitats, species and ecosystems.^{4, 5, 6} California's MPA Management Program, as documented in the MPA Statewide Leadership Team Work Plan⁷, includes a prioritized list of tasks that require implementation in order to maximize the potential benefits of the MPA Network. Additional benefits are like to accrue with the enhancement of coastal wetlands and salt marshes located in or adjacent to California's Marine Protected Areas due to the important role these habitats play as nursery grounds.⁸ The selected projects to be funded will mitigate for the entrainment and impingement impacts of OTC, which affect marine life, habitats, and ecosystems. The OPC is currently developing a framework to identify and prioritize projects that fulfill the requirements of the Policy and that are consistent with the SWRCB's preference for investment in the State's MPA network.

Document Outline:

1. Once-Through Cooling Impacts on Marine Life, Habitats, and Ecosystems
2. State Water Resources Control Board Once-Through Cooling Policy
3. California's Marine Protected Area (MPA) Network
4. Linking the MPA Management Program to OTC Mitigation Projects

[†] Since adoption of the policy several power plants have shut down, and 11 plants (including one nuclear plant) have yet to come into compliance with the Policy.

Once-Through Cooling Impacts on Marine Life, Habitats and Ecosystems

- The Final Substitute Environmental Document (SED) associated with the adoption of the SWRCB's OTC Policy⁹ determined that coastal power plants that use seawater for once-through cooling are contributing to the decline of fisheries and the degradation of marine habitats in the vicinity of the power plant. An associated loss in the functioning and services provided by coastal marine ecosystems is a likely impact, although currently quantifying that impact is difficult to quantify.⁹ Withdrawal of sea water for once-through cooling systems kills marine organisms by drawing them in with sea water through the power plant (entrainment) and by pinning them against the intake screens (impingement).
- Studies commissioned by the California Energy Commission (CEC) and the SWRCB, including findings from an SWRCB Expert Review Panel convened to inform policy development, provide this summary of OTC entrainment and impingement impacts:
 - The sea water taken in through power plant open ocean intakes is habitat with high biodiversity of zoo- and phytoplankton. Billions of eggs and larvae of marine fishes and invertebrates, and the gametes, spores and seeds of seaweed and marine plants such as eelgrass, are entrained by the OTC process.¹⁰
 - Impingement results in the death of larger fishes and invertebrates and its impacts are similar to those of a fishery.¹¹ For many fish and invertebrate species, larger sized individuals are known to produce more offspring than smaller individuals.^{12,13}
 - Total statewide fish larvae entrainment estimates for 18 power plants, based on the annual average larval concentrations from the recent studies for the average 2000-2005 flows, are 19.4 billion annually and impingement is estimated at approximately 2.7 million fish (84,250 pounds) annually.⁹ It is important to note this only includes fish and does not include the impacts to invertebrates.
 - Each once-through cooling system may interact with other impacts that stress coastal ecosystems, such as fishing pressure, pollution, and invasive species, in ways that are not well understood. The Final SED suggests a study to quantify cumulative impacts with a focus on the southern California Bight where there is a high density of humans and power plants within a relatively small geographic area.
- The SWRCB/CEC 2005 Report summarizes studies quantifying entrainment impacts and notes that entrainment losses are equivalent to the loss of productivity of thousands of acres of coastal habitat.¹¹ Impingement impacts add to the entrainment losses because often the same species that lose early life stages to entrainment lose adults and larger juveniles to impingement. Thermal impacts tend to be site specific and may be significant for some power plants and insignificant for others.

State Water Resources Control Board Once-Through Cooling Policy

The OTC Policy established two immediate impact reduction requirements for existing plants to reduce entrainment and impingement impacts prior to compliance with the Policy: reducing intake flow rate while not generating electricity and installing large animal exclusion devices. Owners or operators of regulated power plants are also required to implement measures to reduce the impacts of entrainment and impingement starting October 1, 2015 until "*final compliance is achieved*".¹

The mitigation requirement is also intended to incentivize prompt or even early compliance with the OTC Policy's requirements prior to final compliance deadlines. OTC Policy Section 2.C.(3)(a)-(c) describes three ways in which an owner or operator can comply with this interim mitigation requirement:

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- (a) Demonstrating to the SWRCB's satisfaction that they have compensated for impingement and entrainment impacts through existing mitigation efforts;
- (b) Providing funding to the California Coastal Conservancy which will work with the Ocean Protection Council to fund an appropriate mitigation project; or
- (c) Developing and implementing their own mitigation project.

A "mitigation project" under the OTC Policy is defined as a project: *"to restore marine life lost through impingement mortality and entrainment. Restoration of marine life may include projects to restore and/or enhance coastal marine or estuarine habitat, and may also include protection of marine life in existing marine habitat, for example through the funding of implementation and/or management of Marine Protected Areas."*

Section 2.C (3)(e) states, *"It is the preference of the State Water Board that funding is provided to the California Coastal Conservancy, working with the California Ocean Protection Council, for mitigation projects directed toward increases in marine life associated with the State's Marine Protected Areas in the geographic region of the facility."*

There are opportunities to restore estuarine wetlands and marine habitat in the vicinity of the once through cooling power plants. Many of these projects would be located in MPAs and others would provide regional benefits to the MPA network. It is important to note that when the OTC Policy was adopted, the OPC was housed within the Coastal Conservancy. In 2012, the OPC was relocated within the California Natural Resource Agency. The OPC currently is obtaining spending authority and a mechanism is in place to receive interim mitigation funds directly, which allows for the reduction of administrative costs and ensures funds are spent on mitigation projects that address requirements of the OTC policy.

Habitat restoration projects are explicitly identified as an appropriate use of the once through cooling interim mitigation funds and the calculation of the interim fee for the impingement and entrainment impacts is based on an Area of Production Foregone (APF) calculation. The expert panel charged with establishing the OTC policy fee structure used APF based on their conclusion that habitat restoration was the best way to compensate for all of the organisms impacted by the entrainment. *"This fee is based on the cost of creating or restoring habitat that replaces the production of marine organisms killed by entrainment. The APF method is preferred because creation and restoration of coastal habitats compensates for all organisms impacted by entrainment, not just select groups such as fishes."*¹⁴ The MPA Network was not completed prior to the analysis used to calculate the fees for the OTC policy. Newer data supports that maximizing the ecological benefits of the existing MPA Network will be a key component in restoring the production of marine organisms impacted by OTC.

California's Marine Protected Area Network

The Marine Life Protection Act (MLPA), adopted in 1999, directed California to create a statewide, science-based network of marine protected areas that protects, sustains, and restores marine life, habitats and ecosystems. The MPA Network was completed in 2012 and consists of 124 ecologically-connected MPAs with varying levels of protection, including approximately 9% of state waters in no-take reserves. California's MPA network was designed to maximize, to the extent feasible, ecosystem, community, population and individual benefits to marine species. Scientific guidelines developed during network design required minimum size and spacing of MPAs, replication of habitat types, protection of rare habitats and ecological connectivity through larval transport.¹⁵ An ecologically connected network allows for the replenishment and sustainability of marine populations across the entire network both in protected and unprotected areas.^{16,17,18,19,20} California's MPA network can provide several ecological benefits that have the potential to partially or fully mitigate the effects of once through cooling. Ecological benefits include:

- providing refuge from fishing for individuals allowing larger body size and in many cases higher reproductive output,^{21, 22, 23, 24, 25, 17, 26, 27, 28}
- serving as both sources and sinks for larvae/offspring across the network;^{24, 25, 27, 29, 30}
- protecting high quality habitat that supports high species diversity;³¹
- and allowing for the persistence of ecological communities that are replicated across a wide geographic scope, which could help buffer against the impacts of climate change and other catastrophic events.^{17, 27, 32, 33}

Linking the MPA Management Program to OTC Mitigation Projects

In order to offset the negative impacts of OTC on coastal environments, California's MPAs must be ecologically functioning as a network, which requires effective MPA management. There are three key components to California's MPA Management Program that are required to ensure effective network management^{Error! Bookmark not defined.} which will maximize the potential ecological benefits:

- Enforcement and Compliance
- Outreach and Education
- Research and Monitoring

Investment of OTC interim mitigation fees in the State's MPA Management Program would contribute to improved effectiveness of the MPA network and help to maximize the potential ecological benefits of the interim mitigation program. An effective MPA network would fully or partially mitigate for the population and habitat losses caused by OTC impacts.

- Enforcement and compliance of the MLPA and associated laws and regulations is necessary to ensure a successful, functioning MPA network. Recurring poaching of marine life in MPAs can decrease diversity, populations, reproductive output and affect an ecosystem's ability to recover from negative impacts.
- Outreach and education to users is a critical component of establishing and maintaining compliance with MPA rules and regulations. Improved education to users about MPA regulations can serve as OTC impact mitigation because it increases protection of marine life within MPAs, which in turn maximizes the expected ecological benefits from these areas.
- Research and monitoring supported by OTC fees will be necessary in order to establish and quantify the expected ecological benefits of the MPA network. It will be essential in understanding the scale and scope of the benefits provided by the MPA network to mitigate OTC impacts.
 - Little is known about how climate change impacts these MPA ecological benefits. Utilizing OTC mitigation funds for implementing monitoring projects that specifically target increasing our understanding of climate change impacts, such as ocean acidification and hypoxia and their influence on ecosystems both inside and outside MPAs will be key to ensuring a comprehensive evaluation of the MPA network as a mitigation tool.

The reduction of environmental stressors such as poor water quality, marine debris and other anthropogenic impacts and the restoration of habitats such as salt marshes and estuaries would also help to improve the effectiveness of the MPA network. Habitat restoration is identified as preferred form of mitigation in the 2015 Ocean Plan³⁴ and has been used to mitigate for entrainment and impingement impacts in other projects in California.

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Next Steps in developing guidelines to select OTC Mitigation Projects

A working group composed of SWRCB, California Department of Fish and Wildlife (CDFW), Coastal Conservancy (CC), OPC and key non-governmental partners is currently working to develop discrete guidelines that could be adopted to guide selection of OTC Mitigation Projects. This group is utilizing agency scientists and experts as well as considering a wider vetting of the guidelines being developed to ensure the best readily available science, legal analysis and policy is being incorporated. Discussions are also underway between the OPC, CC and SWRCB to draft an MOU that will outline the details of how OTC mitigation fees will be distributed among the CC and OPC to be used to fund OTC mitigation projects as defined in the SWRCB OTC Policy.¹

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