

Appendix B:

**PERFORMANCE  
EVALUATION  
QUESTIONS  
AND METRICS**

**TABLE B1:** Performance objectives, questions, and metrics for network evaluation at meeting the goals of the Marine Life Protection Act (MLPA).

<b>MLPA GOAL 1:</b> PROTECT THE NATURAL DIVERSITY AND ABUNDANCE OF MARINE LIFE, AND THE STRUCTURE, FUNCTION, AND INTEGRITY OF MARINE ECOSYSTEMS		
PERFORMANCE OBJECTIVE	MEASURABLE QUESTION	LONG-TERM MONITORING INDICATOR
<b>Protect areas of high species diversity and maintain species diversity and abundance, consistent with natural fluctuations of populations in representative habitats</b>	Do focal and/or protected species inside of MPAs differ in size, numbers, and biomass relative to reference sites?	Size/age structure of focal species, abundance, and biomass measures
	Does functional diversity differ in MPAs relative to reference sites?	Functional diversity metrics
	Do MPAs that include multiple habitat types harbor higher species abundance or more diverse communities than those that encompass a single habitat type or less diverse habitat types?	Size/age structure, abundance, and biomass of focal species, community diversity measures in MPAs with high habitat diversity and low habitat diversity
<b>Protect natural trophic structure and food webs in representative habitats</b>	Do the abundance, size/age structure, and/or diversity of predator and prey species differ inside MPAs, or outside areas of comparable habitat?	Trophic structure metrics
<b>Protect ecosystem structure, function, integrity, and ecological processes to facilitate the recovery of communities from both natural and human disturbances</b>	Does the nature or timing of recovery of natural communities from disturbance events differ in different types of MPAs relative to outside areas?	Ecosystem structure and function metrics and their diversity

## MLPA GOAL 2:

HELP SUSTAIN, CONSERVE, AND PROTECT MARINE LIFE POPULATIONS, INCLUDING THOSE OF ECONOMIC VALUE, AND REBUILD THOSE THAT ARE DEPLETED

PERFORMANCE OBJECTIVE	MEASURABLE QUESTION	LONG-TERM MONITORING INDICATOR
<p><b>Protect, sustain, and conserve regional populations of selected harvested or non-harvested species and the habitats on which they depend</b></p>	<p>How does spatial variability in fishing effort and fishing mortality rates prior to and after MPA implementation affect the abundance and/or size/age structure of harvested species in MPAs?</p>	<p>Logbook data, California Recreational Fisheries Survey (CRFS) data, local fishing mortality rates, size/age structure of focal species, abundance and biomass measures</p>
	<p>How do species differ in their rate of response to MPA implementation?</p>	<p>Population models, size/age structure of focal species, abundance and biomass measures</p>
	<p>What is the relationship between MPAs and the displacement, compaction, and concentration of nearshore fishing efforts? Did overall fishing effort/mortality rates and yield change since MPA implementation?</p>	<p>Fishing effort and catch data, local fishing mortality rates, catch-per-unit-effort</p>
	<p>Do differences in fishing distribution, magnitude, and mortality rates prior to MPA implementation affect changes in the abundance and/or size/age structure of populations of focal species within MPAs relative to reference sites over time?</p>	<p>Fishing effort and catch data, local fishing mortality rates, size/age structure of focal species, abundance, and biomass measures</p>
	<p>What is the rate and distribution of adult spillover of targeted fishery species from MPAs into adjacent areas?</p>	<p>Tagging studies, density patterns relative to distance across MPA boundaries</p>
	<p>Is the implementation of MPAs as a habitat-based approach to marine fisheries management more or less effective in maintaining sustainable fisheries than traditional management strategies such as limiting harvest in a non-spatially explicit manner?</p>	<p>Logbook data, CRFS data, local fishing mortality rates, stock assessments</p>
	<p>What are the economic effects of MPA placement; specifically distance from ports and location relative to fishing grounds?</p>	<p>Fishing effort and catch data, local fishing mortality rates, catch-per-unit effort, distance from port to fishing grounds</p>
	<p>What is the value of the ecosystem services provided by California's MPAs?</p>	<p>Examples include measures of the role MPAs play in climate change resilience, recreation and tourism, cultural uses, science and educational uses, and conservation of economically important fisheries</p>

### MLPA GOAL 3:

TO IMPROVE RECREATIONAL, EDUCATIONAL, AND STUDY OPPORTUNITIES PROVIDED BY MARINE ECOSYSTEMS THAT ARE SUBJECT TO MINIMAL HUMAN DISTURBANCES, AND TO MANAGE THESE USES IN A MANNER CONSISTENT WITH PROTECTING BIODIVERSITY

PERFORMANCE OBJECTIVE	MEASURABLE QUESTION	LONG-TERM MONITORING INDICATOR
<b>Ensure MPAs are accessible for recreational, educational, and study opportunities</b>	Are researchers accessing MPAs, and has research increased over time in MPAs?	Trends in number of research studies conducted in MPAs over time; dissemination of results of research studies within MPAs
	Has the magnitude and variety of recreational/educational use increased over time in MPAs?	Visitor use surveys
	How has non-consumptive use and enjoyment of marine ecosystems changed since MPA implementation? Has the public's perceived value or desire to visit the areas where the MPAs have been implemented changed due to their presence?	Contingent valuation studies (willingness to pay for access to MPAs)
	Are recreational consumptive users able to mitigate short-term costs of displacement from MPAs by conducting activities along the edge of MPAs? Will there be long-term benefits from the edge effect?	Changes in use patterns and catch of targeted species by consumptive users over time
	How are knowledge, attitudes, and perceptions regarding the MPAs changing over time?	Public and user group knowledge, attitudes, and perceptions of MPAs
<b>Protect or enhance recreational experience by ensuring natural size and age structure of marine populations</b>	Are non-consumptive recreational experiences in areas subject to reduced fishing improving? What are the attitudes and perceptions of users and their recreational experience and how has that changed over time?	Predicted increase in user group satisfaction based on user group surveys
	Is the size/age structure of recreationally valued species increasing in MPAs over time?	Differential size/age structure of selected species inside and outside MPAs over time; onboard and dockside sampling of recreational catch, location and effort

**MLPA GOAL 4:**

**PROTECT MARINE NATURAL HERITAGE, INCLUDING PROTECTION OF REPRESENTATIVE AND UNIQUE MARINE LIFE HABITATS IN CALIFORNIA WATERS FOR THEIR INTRINSIC VALUE**

PERFORMANCE OBJECTIVE	MEASURABLE QUESTION	LONG-TERM MONITORING INDICATOR
<b>Protect representatives of all marine habitats identified in the MLPA across a range of depths</b>	Have unique habitats been adequately represented and protected by the current distribution and designation of MPAs?	Habitat mapping within MPAs to groundtruth what is captured in MPAs
	Does the abundance or quality of habitat (geologic, oceanographic, biogenic) increase or remain the same within an MPA?	Habitat metrics (e.g., derived from seafloor maps, water quality, and species that form biogenic habitat)
<b>Protect marine natural heritage</b>	Have endangered species and/or culturally significant species benefited from the presence of California's MPAs?	Population trends of special status species (Section 2.3, Indicator Species Selection)
	Do MPAs limit the spread of invasive species?	Comparison of the presence and abundance of invasive species inside and outside of MPAs (Refer to list of current invasive species in California) <sup>1</sup>

<sup>1</sup> <https://www.wildlife.ca.gov/Conservation/Invasives>

## MLPA GOAL 5:

ENSURE CALIFORNIA'S MPAS HAVE CLEARLY DEFINED OBJECTIVES, EFFECTIVE MANAGEMENT MEASURES, AND ADEQUATE ENFORCEMENT, AND ARE BASED ON SOUND SCIENTIFIC GUIDELINES

PERFORMANCE OBJECTIVE	MEASURABLE QUESTION	LONG-TERM MONITORING INDICATOR
For the MPA Network, develop objectives and a long-term monitoring plan that includes a strategy for MPA evaluation	Are efforts to collect long-term monitoring data coordinated sufficiently such that cohesive conclusions can be formed about MPA Network performance?	Results from funded long-term monitoring studies
	Does the MPA Monitoring Action Plan produce sufficient information that enables the evaluation of Network performance and informs adaptive management?	Peer review of the MPA Monitoring Action Plan; cost-efficient spending and funding
Ensure adequate enforcement and compliance with MPA regulations	Is monitoring of human activity and enforcement adequate for preventing illegal take in MPAs?	Trends in number of citations/enforcement actions for violations of MPA regulations
	Do penalties for non-compliance deter users from violating regulations?	Trends in number of citations/enforcement actions for violations of MPA regulations
	How has the level of compliance changed over time since the MPAs were first implemented and what factors influence variation in compliance within and among MPAs?	Trends in number of citations/enforcement actions for violations of MPA regulations as a function of MPA features (e.g., size, location, level of protection, enforcement), socioeconomic factors, and human uses in proximity to MPAs
	Does locating a boat ramp or other access point affect the level of enforcement and compliance with MPA regulations?	Trends and spatial distribution of number of citations/enforcement actions for violations of MPA regulations
	Are there incentives that can help reduce noncompliant behavior inside MPAs?	Evaluate if incentive programs exist for ensuring compliance with MPA regulations
	Do State Marine Reserve (SMR)/State Marine Conservation Area (SMCA) clusters provide greater protection than stand-alone SMRs?	Size/age structure of focal species, abundance and biomass measures; evaluate clusters in comparison to stand-alone MPAs as part of Network evaluation
	Does the level of compliance differ between SMRs and SMCAs?	Trends and spatial distribution of number of citations/enforcement actions for violations of MPA regulations

## MLPA GOAL 6:

ENSURE THAT THE STATE'S MPAS ARE DESIGNED AND MANAGED, TO THE EXTENT POSSIBLE, AS A NETWORK

PERFORMANCE OBJECTIVE	MEASURABLE QUESTION	LONG-TERM MONITORING INDICATOR
<p>Evaluate network functionality and MPA sizing and spacing guidelines that were implemented under the MLPA</p>	<p>What are the demographic effects of siting MPAs in larval source or sink locations, and how do demographic responses to MPAs contribute to larval production and connectivity of MPAs in the network?</p>	<p>Demographic-connectivity model for determining linkages of MPAs in the network and their effects on population; evaluation of demographic-connectivity projections with size/age structure of focal species, abundance and biomass data collected through long-term monitoring</p>
	<p>How does the distance and larval contribution between a source MPA and sink MPA influence the ecosystem response inside the sink MPA?</p>	<p>Evaluation of demographic-connectivity model with size/age structure of focal species, abundance and biomass data collected through long-term monitoring</p>
	<p>How does the level of connectivity and larval supply from an MPA to areas outside of MPAs affect fisheries?</p>	<p>Demographic-connectivity model projections of larval supply from MPAs to areas outside MPAs</p>
	<p>Are MPAs with higher connectivity more resilient to sudden environmental disturbance as compared to more isolated MPAs with higher self-retention?</p>	<p>Size/age structure of focal species, abundance and biomass data, evaluation dependent on stressor</p>
	<p>How do other stressors impact the management of MPAs over time (e.g., water quality, oil spills, desalination plants, ocean acidification, sea level rise)?</p>	<p>Size/age structure of focal species, abundance and biomass data, evaluation dependent on stressor</p>
	<p>Do MPAs with higher connectivity have lower variability in population trends compared to more isolated MPAs?</p>	<p>Evaluation of demographic-connectivity model with size/age structure of focal species, abundance and biomass data collected through long-term monitoring</p>