



Changing the Tides

How Marine Protections Cultivate Ocean Life



Changing the Tides

How Marine Protections Cultivate Ocean Life



Written by

Kelsey Lamp, Benjamin Grundy and Laura Deehan
Environment California Research and Policy Center

November 2022

Acknowledgments

The authors thank Karla Garibay Garcia, Senior Conservation Manager, Azul; Anupa Asokan, Senior Oceans Advocate, NRDC; Dawn Murray, PhD, Professor at Antioch University for their review of drafts of this document, as well as their insights and suggestions. The authors also wish to thank Meghan Hurley, former Ocean Associate at Environment America Research and Policy Center for her research and contributions to the report, James Horrox of Frontier Group for editorial support. This report is funded in part by the Gordon and Betty Moore Foundation. Environment California Research & Policy Center also thanks the Paul M. Angell Family Foundation and the Ralston Family Foundation for making the report possible. The recommendations are those of Environment California Research & Policy Center. The authors bear responsibility for any factual errors. The views expressed in this report are those of the authors and do not necessarily reflect the views of our funders or those who provided review. 2022 Environment California Research & Policy Center. Some Rights Reserved. This work is licensed under a Creative Commons Attribution Non-Commercial No Derivatives 3.0 Unported License. To view the terms of this license, visit creativecommons.org/licenses/by-nc-nd/3.0



Environment California Research & Policy Center is a 501(c)(3) organization. We are dedicated to protecting our air, water and open spaces. We investigate problems, craft solutions, educate the public and decision-makers, and help the public make their voices heard in local, state and national debates over the quality of our environment and our lives.

For more information about Environment California Research & Policy Center or for additional copies of this report, please visit www.environmentcaliforniacenter.org.



Azul is a grassroots organization working with Latinxs to conserve the ocean and coasts. It was founded in 2011 to bring Latinxs perspectives and participation to ocean conservation and has long advocated for environmental justice and equity in the state of California, across the nation, and at international levels.

Report and Cover Design by Alec Meltzer

Cover Photo by Chad King, NOAA

Contents

Introduction: Why we need protected ocean spaces 4

The Marine Life Protection Act: California is a leader in ocean protection 7

The Channel Islands MPAs 10

Abalone Cove and Point Vicente..... 13

Point Lobos State Marine Reserve 16

Campus Point SMCA and the Snowy Plover 18

Matlahuayl State Marine Reserve 21

Conclusion and Policy Recommendations..... 24

Notes..... 25

Introduction: Why we need protected ocean spaces

WE NEED THE OCEAN.

We need it, apart from anything else, for our own survival. It regulates our climate and weather. It provides us with water, food, and more than half of the oxygen in the air that we breathe. And it helps protect us from the impacts of climate change, absorbing around a third of all the carbon dioxide we emit into the atmosphere.¹

But the ocean does much more for us than that. Home to a spectacular array of life, this vast, mysterious wilderness contains some of the most diverse ecosystems on the planet.² A source of wonder and fascination since the dawn of human history, it is home to the creatures we marvel at, like migrating whales, spectacular coral reefs, and elusive pods of dolphins. Its mystery feeds our imaginations and our spirits, and standing on the edge

Photo by Robert Schwemmer, NOAA.



Orca breaches the water in Monterey Bay National Marine Sanctuary.

of its vastness – both physical and conceptual – makes our own problems seem trivial by comparison.

It's no wonder we breathe easier by the sea.³

But we are destroying it. Pollution, overfishing, offshore oil and gas drilling, and the impacts of climate change are wreaking catastrophic damage on the kaleidoscope of life that calls the ocean home, with serious consequences for the biodiversity on which the health of marine ecosystems depends.⁴

Over the last half century, marine vertebrate populations have declined by nearly fifty percent, and the list of endangered ocean species is growing.⁵ Rising sea levels put coastal communities and habitats at risk of flooding, erode the shoreline and cause our beaches to disappear, at devastating cost to the animals that live and breed on them. Acidification of the water damages the corals that protect our shorelines from erosion and storm surges; it threatens to make the ocean uninhabitable for certain marine species with dire consequences for ecosystems and food webs.⁶ Oxygen depletion from pollution and global warming has disastrous impacts on the plants and animals that depend on marine habitats.⁷ Since the mid-20th century, the volume of ocean entirely depleted of oxygen has quadrupled.⁸

Meanwhile, rampant overfishing threatens to strip the ocean of the biodiversity it needs to maintain healthy stable ecosystems. Already, over 30% of global fish stocks are overfished, while 57% are being fished to the edge of their limits.⁹ Deep-sea mining threatens to destroy delicate, as yet unexplored depths before we even get the chance to discover what wonders they hold – and all the while, as we empty the ocean of fish and of mystery, we are filling it with plastic waste that breaks down into microplastics that end up in the stomachs of fish, turtles and other marine life.¹⁰

Never in the history of this planet has the task of protecting our ocean been more urgent. Fortunately, we have the tools to do so.

Marine protected areas (MPAs) are regions of the ocean and coastline legally protected from human exploitation. These zones can have varying levels of protections: lightly protected areas that prohibit



Sea nettle floats through the ocean in Monterey Bay National Marine Sanctuary.

drilling and mining but allow some degree of commercial fishing, highly protected zones where all industrial extractive activities are banned but recreational fishing and certain other low-impact activities are permitted, fully protected “no-take” zones where all extractive activities are off limits completely.

A growing body of research demonstrates that MPAs – and fully protected no-take zones in particular – can have real impacts in conserving biodiversity and enabling wildlife to live and flourish.¹¹ And the benefits of these protections have been shown to extend well beyond the boundaries of the zones themselves. MPAs can lead to larger fish populations in nearby areas. By protecting important gathering sites and migration corridors for migratory species that move between protected and unprotected areas, between nearshore areas and the high seas, MPAs can also benefit life in remote reaches of the open ocean beyond the jurisdiction of any country, even without directly protecting those places.¹²

While no level of marine protection can make an ecosystem immune to climate change, by providing pockets of respite from human activities, MPAs can enhance the resilience of ocean life and enable marine species to better resist and rebound from natural

disturbances.¹³ Globally, protected coastal habitats, like barrier islands, coral reefs, mangroves and wetlands, can provide crucial protection from storms and other extreme weather events that are set to become ever more frequent and severe over the coming decades. And protections of kelp forests, eelgrass beds, and sandy beaches—often essential to the life cycles of fish and other marine life—can also play a key role in sequestering carbon from the atmosphere.¹⁴

California has been at the forefront of a global movement to implement marine protected areas. In 2004, following the adoption of California's 1999 Marine Life Protection Act (MLPA), the state began a consultation and planning process that would culminate in 2012 in the implementation of the country's first statewide MPA network.¹⁵ Approximately 852 square miles of ocean off the California coast—a little over 16% of the state's waters—were placed under the protection of 124 protected zones.¹⁶ Of the total protected area, approximately 60% (9% of state waters) consists of no-take zones.¹⁷

Scientists are already seeing the benefits these ocean havens are delivering for the fish and other wildlife and the unique habitats off California's coast.¹⁸ Studies have shown marked—and sometimes dramatic—increases in the abundance, density, size and biomass of numerous species in protected areas.¹⁹ In some cases, protections have been instrumental in enabling endangered species to bounce back from the brink of extinction.²⁰ In

addition, MPAs have been found to benefit the ocean around them too, helping to replenish the populations of ocean species in their surroundings.²¹

In short, California's MPA network is working. This report will dive deep into five case studies of highly or fully protected MPAs in this network, showing how marine species have recovered and thrived as a result of protections. These are just five among countless examples of the demonstrated ecological benefits of safeguarding critical regions of our ocean—and this is just the beginning. With continued protection, the effects we're already starting to see can be expected to become ever more apparent over time.

The Marine Life Protection Act is one of the world's most advanced efforts to protect the ocean, and the demonstrated successes of the network of MPAs it created makes it a model that can be emulated elsewhere, both in the United States and abroad. Having seen what these protections can do, however, it is now time to strengthen them. In line with the state's 30x30 initiative, it is time to expand California's network of marine reserves to ensure that 30% of state waters are covered by fully or highly protected MPAs by 2030. By strengthening existing protections of larger ocean spaces, we can minimize our footprint on the ocean and reverse some of the damage we've done to this watery wilderness over the last century.

The ocean is our life. Let's keep it alive.

Photo by NOAA.



Otters swimming in Monterey Bay National Marine Sanctuary.

The Marine Life Protection Act: California is a leader in ocean protection

CALIFORNIA'S COAST AND OCEAN ARE VITAL

to the state's identity. They hold mystery, beauty and wildness that makes California so special, so it is entirely fitting that California has been at the forefront of the country's efforts to implement ocean protections.

This leadership began in 1999, when the California legislature passed the Marine Life Protection Act (MLPA), setting the stage for the creation of the United States' first statewide, science-based MPA network. Prior to this groundbreaking legislation,

only 3% of California's oceans were protected, and most of the protected areas were small and lacked clear goals or meaningful enforcement.²² Furthermore, their ad hoc method of creation meant that they were missing out on the benefits of a network of MPAs, which could be designed to connect ecosystems and species' life cycles along the California current.²³ Given the vibrancy and diversity of life that exists in California's waters, these protections were clearly inadequate.

Photo by Robert Schwemmer, CINMS, NOAA, CC BY 2.0.



Clouds descend on Anacapa Island in the Channel Islands National Marine Sanctuary.



Northern fur seals resting on San Miguel Island which is a part of the Channel Islands National Marine Sanctuary.

The goal of the Marine Life Protection Act was to redesign the state system of MPAs to function as a linked network rather than a disconnected assortment of discrete sites. The MLPA aims to protect ocean life and ecosystems, regenerate depleted populations, protect important heritage sites, and improve opportunities for recreation, research, and education. It also aims to ensure that protections are clear and enforced and the protected areas are managed as a network.²⁴

The MLPA was implemented incrementally between 2004 and 2012. Scientists, tribal communities and stakeholder groups in different regions along the coast weighed in on proposals for new MPAs and the redesign of existing areas, and the California Fish and Game commission subsequently designated the areas, region by coastal region.²⁵

The statewide network includes MPAs with varying levels of protection. Among the most strongly protected areas are 48 State Marine Reserves (SMRs), which are fully protected zones that do not allow any recreational or commercial harvest or damage of marine resources. Of

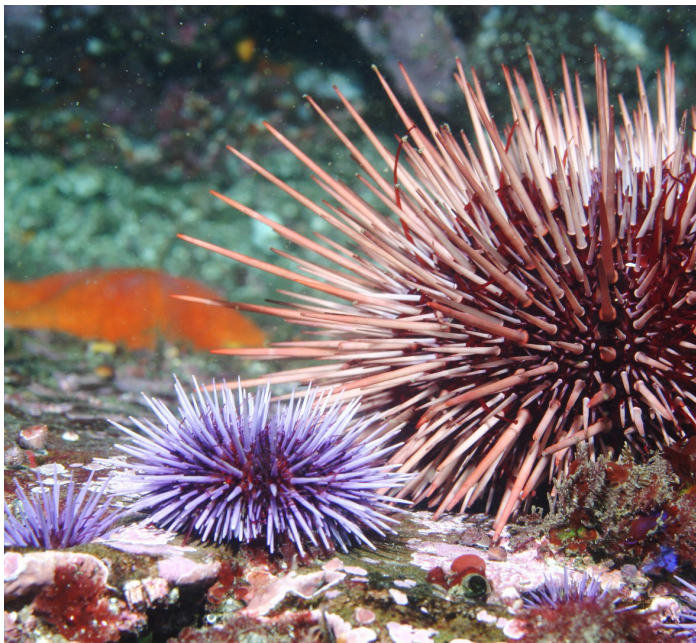
the network's State Marine Conservation Areas (SMCAs), ten are also no-take, which prohibit the harvesting of marine resources but may allow certain maintenance activities, such as removal of sediment build-up.²⁶

The 124 protected zones that make up California's network dot the state's coastline from the Oregon border in the north, down to the border of Mexico. The network is divided into five regions: the Northern California MPAs, the North Central MPAs, San Francisco Bay MPAs, Central California MPAs, and Southern California MPAs. All are located within state waters, which reach up to three nautical miles offshore.²⁷ Together, they cover approximately 852 square miles, or 16% of state waters. Roughly 9% of state waters are protected by no-take areas.²⁸

Since wildlife neither knows nor cares about the boundaries we set in our ocean, marine protected areas are most effective when they are designed with the natural movement of ocean life in mind.³⁰ For example, studies of fish reproduction in kelp forests along the central and southern California coast show that fish eggs travel along currents far from their origins. The



California's MPA network²⁹



Purple and Red Sea Urchins.

path the drifting eggs take needs to be protected to give them the best chance of survival.³¹ California's MPA network was designed with this science in mind, recommending no more than 50-100 kilometers between protected areas with similar habitats that creatures, and their larvae, might move between.³²

The size of the MPAs was determined in much the same way. Studies have recommended that MPAs designed to protect populations of species that don't tend to travel far – i.e., those that wouldn't travel between adjacent MPAs – should be large enough for those species to roam, and to be self-replenishing, within the protected zone itself.³³ Since connectivity is not such a priority in these kinds of MPAs, larger MPAs can be spaced further apart, whereas smaller ones – whose efficacy depends on connectivity – should be located in closer proximity to each other.³⁴

The success of California's MPA network has been attributed in large part to the fact that considerations like these were taken into account during the planning process. With the science-based design and emphasis on ecological connectedness, studies have also noted the importance of the comprehensive, stakeholder-driven planning process that preceded the implementation of the network. This process centered around integrating regional scientific knowledge, engaging local communities, and evaluating the potential economic impacts of marine protections off the California coast. California has also been recognized for its post-implementation management strategy. Since implementing its MPA network, the state has put in place a MPA management program steered by a statewide, multi-agency leadership team, with a focus on “scientific monitoring, interagency coordination, public education and outreach, and enforcement.”³⁵

California's MPAs thus provide a valuable case study in how to plan, implement and manage a successful statewide network of protected areas, potentially providing a template for the design of similar systems in other states and across the world.³⁶ In the following pages, we look at five case study MPAs in California's network, their successes, and the lessons their experience provides.

The Channel Islands MPAs

DIFFERENT OCEAN HABITATS RESPOND DIFFERENTLY TO PROTECTIONS

California's diverse ocean environments are home to a huge array of marine life. The unique variety of conditions beneath the waves means that even within one region, different areas will vary in their response to the same level of protection. The area of ocean around the Channel Islands, off the coast of

southern California, is just such a region, formed of a diverse patchwork of sensitive habitats, including rocky shorelines and sandy beaches, inshore kelp forests, soft bottom habitats and rocky reefs, and deep-sea coral gardens, providing important feeding and breeding areas for numerous marine species.³⁷

In 2003, the State of California designated 10 marine reserves and two marine conservation areas in state

Photo by Robert Schwemmer, NOAA.



A California sheephead explores a kelp forest in the Channel Islands National Marine Sanctuary.

waters within the Channel Islands National Marine Sanctuary – a 1,470 square mile area of ocean around Anacapa, Santa Cruz, Santa Rosa, San Miguel and Santa Barbara islands in the Santa Barbara Channel. In 2006 and 2007, the National Oceanic and Atmospheric Administration (NOAA) extended the protections into the sanctuary’s deeper, federal waters, bringing the total number of marine reserves in the network to 11. Within these reserves, all fishing and other extractive activities are prohibited, while the two marine conservation areas allow limited take of lobster and pelagic fish.³⁸

Within just a few years of the implementation of these protections, their effects were already becoming evident. A study published in 2010 found that in the first five years of the reserves’ existence, the density of previously fished fish species had increased by 50% inside the protected zones, and their biomass by 80%. The biomass of predators inside the reserves was “significantly greater” than in unprotected areas, with 1.8 times more piscivores and 1.3 times more carnivores in these zones.³⁹

Carnivores are often the first to respond to protections, and the increase in their populations here is significant since both piscivores and carnivores play important roles in kelp forest ecosystems. California sheephead and spiny lobsters, for example, are important predators of sea urchins and help prevent kelp beds – which support more diverse communities, complex food webs and

What is biomass?

Biomass is a measure of the amount and size of living things in a certain area. In the ocean, biomass includes everything from phytoplankton and seagrass to fish and otters. Biomass is directly related to ecosystem function, which includes its ability to store carbon dioxide and produce oxygen. More biomass means more ocean life and more of the elements that life needs to survive. Put simply, biomass is a measure of the amount of life in the ocean. Over time, human impacts on the ocean have caused five-fold decreases in marine mammal biomass, for example, weakening the ocean ecosystem and its ability to support life.⁴²

healthy fish populations – from being destroyed through overgrazing by unchecked sea urchin populations.⁴⁰ Over time we can expect these changes to cascade down the food web, benefitting prey and predators alike.⁴¹

These positive impacts clearly show that these reserves are working. But there’s another lesson to be learned here - the equally important reality is that the rich diversity of conditions and habitats in the area means

Photo by Matt Elyash, CDFW, CC BY 2.0



California Sheephead (*Semicossyphus pulcher*).

Photo by Dr. John Butler, NOAA NMFS SWFSC, CC BY 2.0.



Starry rockfish rests on rock in the Channel Islands national Marine Sanctuary,



Overlook of Channel Islands National Park.

the impact of protections may unfold differently in different protected zones around the Channel Islands.

The Santa Barbara Channel region of the ocean is a “transition zone,” where warm waters from the south and cold waters from the north meet.⁴³ Across this range of water temperatures, diverse species of marine life exist, each inhabiting the areas of the ocean where they’re most comfortable.⁴⁴ The waters of San Miguel Island Marine Reserve, for example, are colder than many of the other Channel Islands MPAs, and this reserve is home to large populations of rockfish and California sheephead, both of which are slow-growing, live a long time, and reproduce at an older age than other fish, which means they can be expected to respond more slowly to protections.⁴⁵ Indeed, after about 10 years of protection, marine reserves near San Miguel Island did not show significantly different biodiversity than areas outside of the reserve.⁴⁶

By contrast, the rapid increase in spiny lobster in the warmer waters around Anacapa Island Ecological Reserve reflects the fact that this species is relatively short-lived and reproduces on a shorter timescale, replenishing its population more rapidly than longer lived species that

reproduce later in life, meaning it will respond relatively quickly to protections.⁴⁷ Recent long-term monitoring reports released by California Sea Grant in partnership with the Ocean Protection Council and the California Department of Fish and Wildlife align with this distinction, showing the strongest positive responses to MPA protections in southern California’s warmer waters, though other variables, like differences in historic fishing pressures, may also be contributing factors.⁴⁸

In places with cold waters and long-lived, slowly regenerating fish populations, it will likely take longer for the impact of protections to become apparent than in warmer waters with fish that grow and reproduce quickly. But protecting the full scope of this diversity is nonetheless essential to safeguard marine life, and that means MPAs should exist in a range of oceanographic conditions. Moreover, since not all MPAs across a large, statewide network like California’s are going to respond to protections on an equal timescale, to effectively evaluate the benefits of these places we need both to protect them permanently and ensure that the varying conditions across a network are properly accounted for in evaluations of that network’s performance.⁴⁹

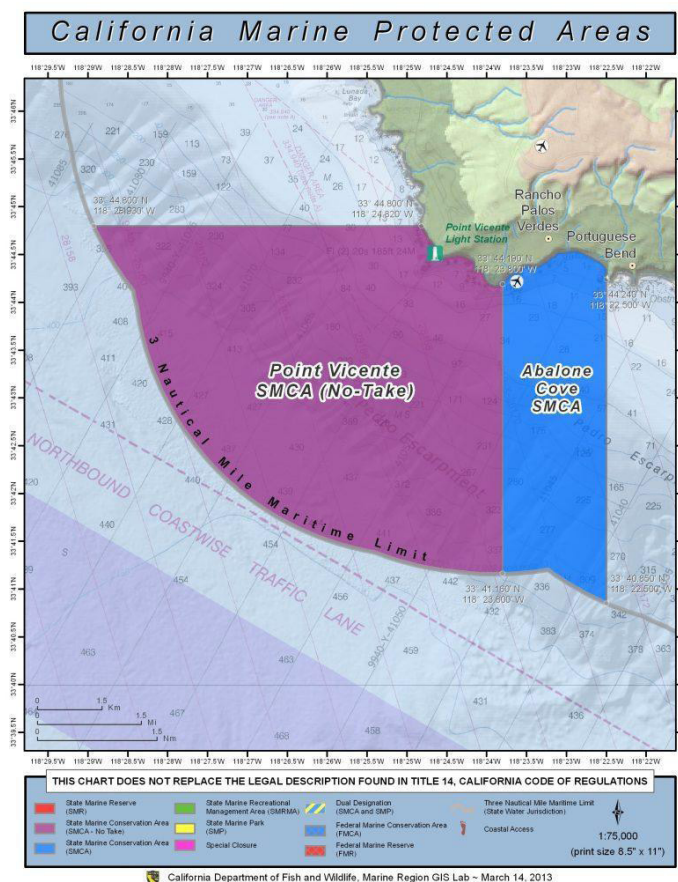
Abalone Cove and Point Vicente

PROTECTING THE SPACE BETWEEN LAND AND SEA

The rocky intertidal zone is one of the most mystical environments on Earth. Colorful sea slugs shimmer in rippling tide pools; sea anemones wave at passersby with vibrant arms. Sea urchins lurk in dark corners and crabs shuffle to and from the breaking waves, fast-moving spots of brightness against a dark, rocky backdrop.

Roughly 27% of California's rocky intertidal habitat falls under the protection of MPAs.⁵¹ While the state only has an estimated total of between five and 15 square kilometers of rocky intertidal habitat in its entire ocean, these areas carry a significance that far outweighs their small geographical scope.⁵² They are a place for birds to find food and for seals to rest. They act as a protective buffer against rising sea levels. And they support a world of biodiversity that is able to withstand unpredictable wave action and drastic temperature changes – all over the course of a single day.⁵³ These incredibly productive and diverse ecosystems have a disproportionately high scientific value, affording unique opportunities for research.

Prior to the Marine Life Protection Act, MPAs in California's rocky intertidal zone did not always adequately protect these rare and fragile ecosystems. Studies carried out in the late 1990s evaluating the effectiveness of MPAs off the coast of Orange County observed human activity at eight sites, four of which had been in existence for nearly three decades as no-take zones.⁵⁴ Researchers regularly witnessed illegal taking at every one of the study sites, and concluded that there was "no statistically discernible difference in

Point Vicente SMCA and Abalone Cove SMCA⁵⁰

the amount of collecting activity between long-standing MPAs and nearby unprotected rocky intertidal zone sites.” The researchers observed that enforcement of MPA regulations was “essentially non-existent” during the period of study.⁵⁵

The Marine Life Protection Act aimed to change all that, and monitoring studies following the progress of



Small crab hides amongst barnacles in Abalone Cove State Marine Conservation Area.

two MPAs designed to protect intertidal habitats off the Palos Verdes peninsula – Abalone Cove and Point Vicente – found evidence that these protections were having the desired effect.

Both of these MPAs were established as State Marine Conservation Areas (SMCAs) in 2012. While Abalone

Cove allows harvest of certain species, with restrictions on types of fishing gear, Point Vicente is a no-take MPA, meaning that within its boundaries, any and all extractive activities are banned.⁵⁶ In the first six months that Abalone Cove existed as an MPA, monitoring by nonprofit Heal the Bay found “overwhelming” compliance” with the new restrictions.⁵⁷ And long-term studies following the first 10 years of protection indicated that targeted species in both areas were responding to protections. California Sheephead, for example, rebounded, while red sea urchin biomass declined, which is significant given the damage that large populations of sea urchins wreak on kelp forests.⁵⁸ Similarly, at Point Vicente, the biomass of targeted species saw a “significant” increase and purple sea urchins declined.⁵⁹

The summer of 2020, however, brought a new kind of disturbance to Southern California’s intertidal zone. Widespread job losses and increased food insecurity due to the coronavirus pandemic led many residents of the Los Angeles area to flock to intertidal areas for a source of free food, some even using invasive and harmful method of extraction like crowbars and



Sunset reflects on water in Abalone Cove State Marine Conservation Area.



Pelicans rest on the rocky intertidal of Abalone Cove State Marine Conservation Area.

screwdrivers in the fragile tide pools.⁶⁰ Abalone Cove and Point Vicente saw an increase in harvest from tidepools, as well as poachers harvesting fish and lobster from boats. Volunteers reported 41 instances of illegal consumptive activity in Point Vicente – a no-take MPA, meaning that any type of extraction here is prohibited – and volunteers suspect that reported instances of poaching majorly underestimate the true extent of the problem.⁶¹

The experience of Abalone Cove and Point Vicente shows that while the protections afforded by MPAs can be effective, they are only as effective as the extent to which they are enforced. The vandalism inflicted on the fragile ecosystems of Southern California's intertidal zone underlines the need for improved enforcement of take restrictions.

MPAs with effectively enforced protections can have special significance in the intertidal zone. Protected regions of this unique and complex ocean habitat, like

MPAs farther offshore, are more resilient to stressors that don't adhere to their boundaries.⁶² Long term monitoring reports of California's MPA network show that protecting intertidal areas can help these areas become more resilient and stable than unprotected areas in the face of large-scale stressors such as marine heat waves – something that will become ever more important with the advance of climate change.⁶³

One key advantage these areas have over remote MPAs out in the open ocean is that the intertidal region is close to land, and therefore, much more visible to people. Protections here are tangible, and one interesting finding to emerge from monitoring studies is an increase in a sense of stewardship among local residents that happens when an area is protected.⁶⁴ Public appreciation for the magic of tide pools is growing.⁶⁵ People value this half-underwater world. Strong, properly-enforced protections make sense and are a crucial tool for safeguarding this ethereal space between land and sea.

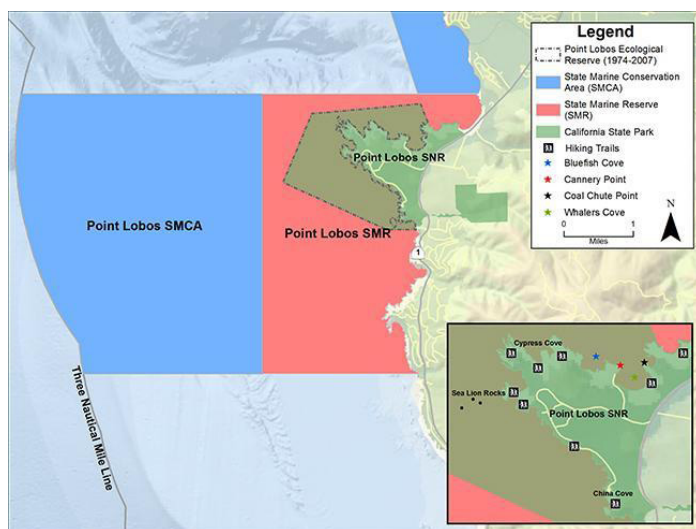
Point Lobos State Marine Reserve

LONG-TERM PROTECTIONS WORK

For centuries, sea otters, sea lions and harbor seals have flocked to the rocky shoreline of Point Lobos, located off the coast of Monterey County just south of Carmel-by-the-Sea. More than 300 species of birds thrive in this area.⁶⁶ Coldwater corals populate its rocky reefs; vast eelgrass beds and kelp forests are home to a plethora of fish species, including California halibut and rainbow seaperch, and Dungeness crabs and brittle sea stars find safety on the soft, sandy seafloor. It is, according to the California Department of Parks and Recreation, “one of the richest marine habitats in California.”⁶⁷

The abundance of life in this patch of ocean is attributable in large measure to the longstanding marine protections that exist there. Recognizing the ecological significance of this place, regulators created the Point Lobos Ecological Reserve in 1974 to protect the abundance of ocean life that exists within it. In 2007, the California Department of Fish and Game expanded the reserve and renamed it the Point Lobos State Marine Reserve (SMR) and Point Lobos State Marine Conservation Area (SMCA). Among the first MPAs designated as a result of the Marine Life Protection Act, the SMR is a 5.5 mi² no-take zone in which all extractive activities are prohibited.⁶⁸ The SMCA covers 8.5 mi², and prohibits most such activities, with the exception of recreational salmon fishing and the commercial take of salmon, albacore and spot prawn.⁶⁹

Now in existence for almost half a century, Point Lobos is one of the oldest marine protected areas in the state. These long-term protections highlight how



Point Lobos SMCA and SMR⁷¹



Harbor Seals rest on shore in Point Lobos State Marine Reserve.

Photo by Don DeBolt, CC by 2.0.

setting aside areas free from fishing can have dramatic results for ocean life.⁷⁰

Abalone – a species of sea snail once numbering in the millions along California’s coast but harvested almost to extinction – is a case in point. Over the course of the 20th century, abalone populations were systematically depleted. In 1997, due to dramatic population declines, authorities closed the commercial and recreational abalone fisheries.⁷² Even today, the abalone population hasn’t fully recovered, but research in California’s MPAs indicates that marine reserves can give hope to California’s iconic mollusk.

A 2013 study of California’s MPAs found that the endangered black abalone increased in numbers and size inside MPAs within five years of these protections being implemented.⁷³ Similarly, within five years of the establishment of the North Central Coast’s Sea Lion Cove State Marine Conservation Area (SMCA) – created in part to protect an important abalone nursery – populations of red abalone had experienced a “sharp increase.”⁷⁴

However, one aspect of the results from Point Lobos most valuable to our understanding of the benefits of MPAs is that this protected area demonstrates the impact of protections over the longer term. A 2008 study of central coast marine reserves, including Point Lobos, found that sites protected for at least 25 years had significantly larger black abalone individuals and significantly more red abalone than unprotected areas.⁷⁵

Research conducted after 34 years, however, found even more striking results, while also showing that the positive effects of the protections at Point Lobos were by no means confined to abalone. A 2015 study of the Point Lobos reserves, based on research conducted between 2007 and 2013, found that fishes in the oldest part of the reserve, closed to fishing since the early 1970s, were “significantly” more abundant and larger than those in nearby unprotected sites. Overall, catch rates in the older part of the MPA were “significantly” higher than outside of it, and nine of the eleven most frequently caught fish species were on average significantly larger and more abundant.⁷⁶ (Greater size



Striped Shore Crab in Point Lobos State Marine Reserve,

is important, often meaning an individual is able to have more babies – which results in a larger number of individuals down the line.⁷⁷)

This long-term reserve shows that closing areas to fishing has a positive impact on the abundance of species targeted by commercial fishers, and that this positive effect can grow as the reserve is maintained. The authors of the 2015 study conclude that while the benefits of the newer reserves will accrue over time, it may take several decades for these benefits to become evident, meaning that long-term monitoring will be needed to fully understand the impacts of MPAs on the diverse array of different habitats that exist in California’s waters.



Photo by monterey diver, CC BY 2.0.

Jellyfish drifts in the waters of the Point Lobos State Marine Reserve.

Campus Point SMCA and the Snowy Plover

PROTECTING AN INTERCONNECTED ECOSYSTEM HELPS A THREATENED SPECIES RECOVER

The Western Snowy Plover's little legs are a blur, carrying the bird's round body between patches of seaweed at the edge of the ocean. These tiny shorebirds spend their winters scurrying along the beaches of southern California. They nibble on the crustaceans and beach flies that make their home in tangles of kelp washed ashore, and they build their nests in the ground on unraked beaches – their small, speckled eggs blending in with the sand.

Habitat loss, increases in introduced predators and human disruption of nesting sites have put a tremendous strain on the snowy plover.⁷⁸ In 1993 the

U.S. Fish and Wildlife Service listed the species as threatened. By 2016, in Los Angeles County, their population consisted of a mere 140 birds.⁷⁹ Snowy plovers were disappearing.

On Huntington State Beach, not a single nest had been found for over 50 years – until one was discovered in 2017.⁸⁰ This marked the start of a resurgence for this small, charismatic bird. In 2021, a total of 19 nests were found on Huntington and the nearby Bolsa Chica State Beach.⁸¹

This recovery was dealt a major blow in October 2021, when a pipeline spilled thousands of gallons of oil off the coast of Huntington Beach. For a bird with an already dwindling population, the disaster was a significant setback. The oil infiltrated sandy beaches and seeped into the Talbert Marsh, where many snowy plovers make their home. Kelp along the shore was coated with oil that transfers to the plovers' beaks and into their digestive system, and oil on their feathers can prevent the birds from insulating from the cold and lead to hypothermia. Their food sources, too, are likely to decline as a result of the spill. Even the trauma of getting the oil cleaned off them could have lasting impacts.⁸²

There is another important nesting site for the snowy plover, however, a little further up the coast – this one under the protection of a no-take MPA. Campus Point State Marine Conservation Area (SMCA) was established in 2012 off the coast of Santa Barbara. All harvest of living species is prohibited in this 10.5 mi²

Photo by USFWS Pacific Southwest Region.



Western Snowy Plover.



Overlooking the Campus Point State Marine Conservation Area.

area of ocean, and the area is protected from major human disturbances such as offshore oil drilling.⁸³ The beaches of Campus Point SMCA are “critical habitat” for the snowy plover.⁸⁴ A study conducted between 2019 and 2021 to assess the effects of MPAs on beaches and surf zones throughout California’s MPA network found that average numbers of these birds were more than 30% higher at MPA sites than unprotected areas, and it was at Campus Point that the highest number of snowy plovers seen in a single survey during the study – 94 birds – was observed.⁸⁵

The sandy beaches onshore from Campus Point are an important nesting site for the snowy plover, a place where these threatened birds can lay their eggs, find plentiful nourishment, and replenish their population free from human disturbance. An adjacent protected area on land, Coal Oil Point Reserve, includes roped-off snowy plover nesting sites and educational programs to inform beachgoers of the presence of the species.⁸⁶

The relative abundance of snowy plover at Campus Point is also an indicator of indirect effects of MPA protections offshore. A kelp forest ecosystem thrives farther out to sea, and dislodged kelp washes ashore. Following the implementation of protections, red sea urchin numbers declined at Campus Point, in turn suggesting that the amount of kelp is increasing, since



Figure 1. Campus Point State Marine Conservation Area⁸⁷

sea urchins eat kelp and an overabundance of urchins can decimate kelp forests.⁸⁸ When kelp washes ashore, it delivers food to these waiting shorebirds who pick through its folds for flies and crustaceans that depend on the kelp for their own home.⁸⁹

The interconnectedness of this system shows why no-take MPAs are so important, since they protect a complex and interwoven food web. Disrupting any one piece can unravel the system. In this case, an overabundance of sea urchins in the depths of an MPA can mean there are fewer crustaceans and flies for snowy plovers to find along the shore.

No-take MPAs like Campus Point have proven themselves the most effective way to conserve biodiversity and ecosystem function and to improve ecosystem resilience – including resilience to large scale disruptions that pay no regard to the lines we draw in the ocean – in order to protect the wildlife that depends on an entire intact ecosystem.⁹⁰ The experience of the snowy plover attests to that. This funky little bird is an iconic fixture of California's beaches. Its busy demeanor and adorable appearance bring joy and liveliness to our coast, and it should be allowed to thrive here for years to come.

Photo by Kim F, CC BY-NC 2.0.



Kelp along the shores at the Campus Point State Marine Conservation Area.

Matlahuayl State Marine Reserve

AN OPPORTUNITY TO EXPAND PROTECTIONS FOR A BIOLOGICAL HOTSPOT

In the ocean off the coast of San Diego County lies an undersea wonderland. Rocky reefs and dense kelp forests, sand flats and seagrass beds, and the dark depths of a submarine canyon system provide habitats for kelp bass, lobster, leopard sharks, rock scallop, every species of abalone, and a whole host of other ocean species.⁹¹

This was not always the case. As early as 1940, researchers were beginning to notice a depletion of green abalone, broomtail grouper and giant sea bass in the area.⁹² Later, they found damage to the rim of La Jolla submarine canyon caused by squid trawlers dragging their nets across this sensitive deep-sea habitat – an important nursery for numerous marine species.⁹³ But despite repeated calls for protections and mounting evidence that such protections were needed, the fishing industry successfully prevented the establishment of a reserve.

This was to change in 1971, when the San Diego-La Jolla Ecological Reserve was established “to protect threatened or endangered native plants, wildlife, or aquatic organisms or specialized habitat types.”⁹⁴ Now known as the Matlahuayl State Marine Reserve (SMR), this area of ocean is one of the oldest no-take MPAs in the waters off the southern California coast.⁹⁵ Matlahuayl SMR encompasses the area formerly covered by the earlier reserve and shares its northern

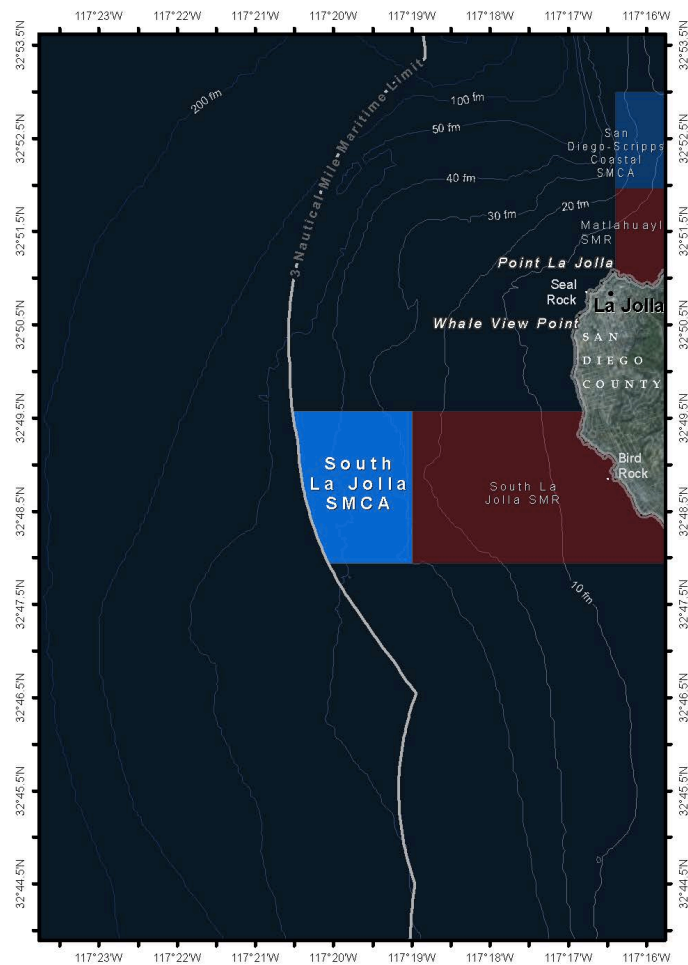


Photo by Adam Obaza, NOAA.

Leopard Sharks in Monterey Bay National Marine Sanctuary.

border with San Diego-Scripps Coastal State Marine Conservation Area (SMCA). The data shows that in the Matlahuayl MPA, protections are working.

Research published in 2005 found higher densities of rock scallops and sheephead in the reserve, moreover male sheephead are significantly larger in protected areas compared to unprotected areas. The study notes that male sheephead in the highest size category observed in the Matlahuayl reserve are rarely seen outside the protected area; that these individuals are typically around 10 to 20 years old suggests the impact of long-term protections.⁹⁷ Researchers observed much larger lobsters in the reserve than almost ever seen outside of it, and within the submarine canyon habitat area, they noted large populations of vermillion rockfish and male sheephead.⁹⁸ Robust sheephead



South La Jolla MPAs⁹⁶



California spiny lobster (*Panulirus interruptus*) in La Jolla Cove.

populations are important from an ecosystem point of view since these fish are sea urchin predators, and sea urchins eat kelp. The presence of predators like sheephead can have knock-on ecosystem effects, improving kelp forest densities through a trophic cascade, though scientists have not yet seen this effect at Matlahuayl.⁹⁹

The reserve also provides crucial protection for green abalone living in its boulder reef habitat. Researchers found a higher density of green abalone, and larger individuals, within the reserve compared to outside.¹⁰⁰ The reserve also protects a critically important green abalone spawning aggregation, essential to replenish drastically depleted populations of this species.¹⁰¹

For all the life it holds, however, and for all its demonstrable successes, the effectiveness of the Matlahuayl reserve has been limited by its small size. Covering only about one square mile, the protected area does not take into account the ranges of many of the species that reside here. The marine life it does the best job of protecting is either immobile or does not travel far.¹⁰² Harvested species that move in and out of the bounds of the reserve, on the other hand, have been on the decline. Because the reserve is so small, fishing around its borders makes it difficult for the reserve to sustain fish populations that travel beyond its one-mile radius – which is most of the harvested species in the reserve.¹⁰³

For example, while kelp within the reserve has increased since the implementation of protections, the protected area only encompasses a small percentage of the kelp forest habitat in this region of the ocean. This has given rise to a decline in kelp bass populations, which rely on intact kelp forests. Despite the fact that Matlahuayl itself is a no-take reserve, since the reserve boundary cuts through kelp forest habitat, these fishes can easily inadvertently move into unprotected ocean where they become a target for fishing. In another example, sculpin populations have also declined, because they migrate several kilometers to spawn.¹⁰⁴

These findings make a case for why the Matlahuayl reserve needs to be expanded. Scientists have



Overlooking La Jolla Cove.

recommended increasing the geographical scope of the protections to cover the southern half of this area's kelp forest habitat, which would protect the most biologically diverse region of the kelp forest and a larger portion of fish species' ranges. They also recommended extending part of the reserve to the far edge of state waters, three nautical miles offshore, so as to protect local spiny lobster populations that migrate offshore in the winter.¹⁰⁵

In addition to its significant ecological benefits, surveys of local residents indicate that expanding the protected area would be met with strong public support. One survey by researchers at UC San Diego found that more than 90% of local residents are in favor of marine reserve protections, and most of those surveyed believe more ocean space is protected than is actually the case.¹⁰⁶

Matlahuayl SMR has provided crucial protections that have been instrumental in the revitalization of a unique ecological hotspot, and is an example of how designing MPAs based on science improves their ability

to conserve and protect ocean life. But it also illustrates why, in order to have the best conservation outcome, MPAs need to protect entire, intact habitats, where the species within them can roam freely and safely without crossing the invisible boundaries we draw in the sea.



Photo by Camille Pagniello, CA Seagrant, CC by 2.0.

Kelp of the cliffs of La Jolla.

Conclusion and Policy Recommendations

CALIFORNIA HAS LONG BEEN A LEADER IN

ocean protection. The state's Marine Life Protection Act is one of the world's most advanced efforts to protect the ocean, and the demonstrated successes of the MPA network it created is a model that can be emulated by other states, and indeed, other countries across the world. California's marine protections have been tried and tested and have proved that they work. It is now time to build on what we've learned and strengthen these protections.

Specifically, authorities should:

- **Expand California's network of marine reserves to ensure that 30% of state waters are covered by highly or fully protected MPAs by 2030.** In line with the state's 30x30 initiative, Governor Newsom should direct the California Department of Fish and Wildlife, California Fish and Game Commission, California Ocean Protection Council and MPA Statewide Leadership Team to expand the existing marine reserve network and designate new highly or fully protected areas based on the results of the MPA Decadal Management Review.
- **Where appropriate, and on the basis of proper scientific evaluation, increase the size of existing MPAs.** Generally, the larger the protected area, the greater the benefits for the wildlife that lives within its boundaries.
- **Ensure that examples of all of California's diverse ocean ecosystems and habitats are protected in fully protected MPAs.** Protected areas should be ecologically linked in regional networks to safeguard the full range of ecosystems and habitats in our oceans and ensure connectivity between spatially fragmented habitats.
- **Adopt a regional management plan to reflect regional variation in wildlife's responses to protections.** California's ocean is made up of incredibly diverse ecological regions, and the data collected from the MPA network to date has shown that different regions, ecosystems and species respond differently to protections, and on different timescales. The design, monitoring and evaluation of MPAs must reflect these differences.¹⁰⁷

Notes

1 Nicolas Gruber et al., “The Oceanic Sink for Anthropogenic CO₂ from 1994 to 2007,” *Science*, 363(6432): 1193-1199, doi: 10.1126/science.aau5153, 2019. United Nations Sustainable Development Goals, *Goal 14: Conserve and Sustainably Use the Oceans, Seas and Marine Resources*, accessed 30 June 2020, archived at <https://web.archive.org/web/20200701060256/https://www.un.org/sustainabledevelopment/oceans/>.

2 United Nations Sustainable Development Goals, *Goal 14: Conserve and Sustainably Use the Oceans, Seas and Marine Resources*, accessed 30 June 2020, archived at <https://web.archive.org/web/20200701060256/https://www.un.org/sustainabledevelopment/oceans/>.

3 Simply being near the ocean has been shown to do wonders for our mental health. See Michigan State University. “Ocean views linked to better mental health,” *ScienceDaily*, 28 April 2016, archived at <https://web.archive.org/web/20220926200938/https://www.sciencedaily.com/releases/2016/04/160428132236.htm>.

4 MarineBio, *Threatened & Endangered Species*, accessed 30 June 2020, archived at <https://web.archive.org/web/20200701061724/https://marinebio.org/conservation/marine-conservation-biology/threatened-endangered-species/>. Climate change: *The ocean and Climate Change*, IUCN Issues Brief, accessed 7 July 2020, archived at <https://web.archive.org/web/20200707224503/https://www.iucn.org/resources/issues-briefs/ocean-and-climate-change>; Rod Fujita, Environmental Defense Fund, *5 Ways Climate Change is Affecting our Oceans*, 8 October 2013, accessed 7 July 2020, archived at <https://web.archive.org/web/20200707224727/https://www.edf.org/blog/2013/10/08/5-ways-climate-change-affecting-our-oceans>.

5 Decline in marine life populations: Jenifer Gray, “Report: Marine Life has Taken Devastating Hit over 40 Years,” CNN, 17 September 2015, accessed 1 July 2020, archived at <https://web.archive.org/web/20200701071301/https://www.cnn.com/2015/09/17/world/oceans-report/>. WWF, *Living Blue Planet Report*, 2015, archived at https://web.archive.org/web/20200103151339/http://ocean.panda.org.s3.amazonaws.com/media/Living_Blue_Planet_Report_2015_08_31.pdf. Endangered species: MarineBio, *Threatened & Endangered Species*, accessed 30 June 2020, archived at <https://web.archive.org/web/20200701061724/https://marinebio.org/conservation/marine-conservation-biology/threatened-endangered-species/>.

6 Harm to aquatic species: Conserve Energy Future, *What is Ocean Acidification?* accessed 7 July 2020, archived at <https://web.archive.org/web/20200706232839/https://www.conserve-energy-future.com/causes-effects-solutions-of-ocean-acidification.php>. United Nations, *United Nations Sustainability Goal 14* (factsheet), archived at https://web.archive.org/web/20200706232954/https://www.un.org/sustainabledevelopment/wp-content/uploads/2019/07/E_Infographic_14.pdf.

7 IUCN, *Ocean Deoxygenation*, accessed 13 January 2021, archived at <http://web.archive.org/web/20210103202305/https://www.iucn.org/resources/issues-briefs/ocean-deoxygenation>.

8 IUCN, *Ocean Deoxygenation*, accessed 13 January 2021, archived at <http://web.archive.org/web/20210103202305/https://www.iucn.org/resources/issues-briefs/ocean-deoxygenation>.

- 9 FAO, *In Brief to The State of World Fisheries and Aquaculture 2022. Towards Blue Transformation*, 2022, accessed 14 October 2022, archived at <https://web.archive.org/web/20220712115842/https://www.fao.org/3/cc0463en/cc0463en.pdf>
- 10 Brigitte Osterath, “5 biggest threats to our oceans – and what we can do about them,” *Deutsche Welle*, 5 October 2021, archived at <http://web.archive.org/web/20220812161323/https://www.dw.com/en/5-biggest-threats-to-our-oceans-and-what-we-can-do-about-them/a-39065307>.
- 11 See James Horrox, Frontier Group, Steve Blackledge and Kelsey Lamp, Environment America Research & Policy Center, *New Life for the Ocean: How Marine Protections Keep our Waters Wild*, February 2021, available at <https://frontiergroup.org/resources/new-life-ocean/>.
- 12 Spillover effect: Rene Abesamis et al., “Density-Dependent Spillover from a Marine Reserve: Long-Term Evidence,” *Ecological Applications* 15(5): 1798-812, doi: <https://doi.org/10.1890/05-0174>, 2005. Helen Fox et al., “Reexamining the science of marine protected areas: linking knowledge to action,” *Conservation Letters*, 5: 1-10, <https://doi.org/10.1111/j.1755-263X.2011.00207.x>, December 2011. Kristina Boerder et al., “Not all who wander are lost: Improving spatial protection for large pelagic fishes,” *Marine Policy* 105:80–90, doi: <https://doi.org/10.1016/j.marpol.2019.04.013>, July 2019.
- 13 See, e.g., Camille Mellin et al., “Marine Protected Areas Increase Resilience Among Coral Reef Communities,” *Ecology Letters*, 19(6): 629-637, doi: <https://doi.org/10.1111/ele.12598>, June 2016. Australian Institute of Marine Science, *Great Barrier Reef No-take Marine Reserves Protect Much More than Just the Fish* (media release), 4 April 2016, archived at https://web.archive.org/web/20200706223741/https://www.aims.gov.au/docs/media/latest-releases/-/asset_publisher/8Kfw/content/04-april-great-barrier-reef-no-take-marine-reserves-protect-much-more-than-just-the-fish. For an overview of MPAs’ ability to increase ecosystem resilience, see James Horrox, Frontier Group, Steve Blackledge and Kelsey Lamp, Environment America Research & Policy Center, *New Life for the Ocean: How Marine Protections Keep our Waters Wild*, February 2021, available at <https://frontiergroup.org/resources/new-life-ocean/>.
- 14 “Life cycles of fish and other marine life”: Philine S. E. zu Ermgassen et al., “Estimating and applying fish and invertebrate density and production enhancement from seagrass, salt marsh edge, and oyster reef habitats in the Gulf of Mexico,” *Estuaries and Coasts* 44, 1588–1603, <https://doi.org/10.1007/s12237-021-00935-0>, 2021. Climate change and carbon sequestration: Kathy MacKinnon et al., “Natural Solutions: Protected Areas Helping People to Cope with Climate Change,” *Oryx*, 45(4): 461-462, doi: <https://doi.org/10.1017/S0030605311001608>, 2011. Stacy Baez, Pew Charitable Trusts, *Seagrass Protections Can Lead to Big Wins for Our Ocean, People, and Governments*, 20 May 2020, accessed 7 July 2020, archived at <https://web.archive.org/web/20200709195921/https://www.pewtrusts.org/en/research-and-analysis/articles/2020/05/20/seagrass-protections-can-lead-to-big-wins-for-our-ocean-people-and-governments>.
- 15 UC San Diego, Scripps Institution of Oceanography, *Early Results Suggest California Marine Protected Areas are a Success*, accessed 7 July 2020, archived at <https://web.archive.org/web/20200709202552/https://scripps.ucsd.edu/news/early-results-suggest-california-marine-protected-areas-are-success>.
- 16 California Department of Fish and Wildlife, *Regional MPA Statistics*, accessed July 7 2020, archived at <https://web.archive.org/web/20200709202726/https://wildlife.ca.gov/Conservation/Marine/MPAs/Statistics>.
- 17 National Oceanic and Atmospheric Administration, National Marine Protected Areas Center, *Marine Protected Areas of the United States: Conserving our Oceans One Place at a Time*, n.d., 4, archived at https://web.archive.org/web/20200709203735/https://nmsmarineprotectedareas.blob.core.windows.net/marineprotectedareas-prod/media/archive/pdf/fac/mpas_of_united_states_conserving_oceans_1113.pdf.
- 18 Samantha Murray et al., “A Rising Tide: California’s Ongoing Commitment to Monitoring, Managing and Enforcing its Marine Protected Areas,” *Ocean & Coastal Management*, 182, doi: <https://doi.org/10.1016/j.ocecoaman.2019.104920>, December 2019.

- 19 California Ocean Science Trust et al., *State of the California Central Coast: Results from Baseline Monitoring of Marine Protected Areas 2007–2012*, 2013, archived at <https://web.archive.org/web/20200709204109/https://nrm.dfg.ca.gov/FileHandler.ashx?DocumentID=133101&inline>.
- 20 California Ocean Science Trust et al., *State of the California Central Coast: Results from Baseline Monitoring of Marine Protected Areas 2007–2012*, 2013, archived at <https://web.archive.org/web/20200709204109/https://nrm.dfg.ca.gov/FileHandler.ashx?DocumentID=133101&inline>.
- 21 Alice E. Harada et al., “Monitoring Spawning Activity in a Southern California Marine Protected Area Using Molecular Identification of Fish Eggs,” *PLoS ONE* 10(8): e0134647, doi: <https://doi.org/10.1371/journal.pone.0134647>, 2015.
- 22 Mary Gleason et al., “Designing a network of marine protected areas in California: Achievements, costs, lessons learned, and challenges ahead,” *Ocean & Coastal Management*, 74: 90–101, doi: <https://doi.org/10.1016/j.ocecoaman.2012.08.013>, March 2013.
- 23 Mary Gleason et al., “Designing a network of marine protected areas in California: Achievements, costs, lessons learned, and challenges ahead,” *Ocean & Coastal Management*, 74: 90–101, doi: <https://doi.org/10.1016/j.ocecoaman.2012.08.013>, March 2013.
- 24 California Department of Fish and Wildlife, *Marine Life Protection Act*, accessed 26 September 2022, archived at <http://web.archive.org/web/20220901022825/https://wildlife.ca.gov/Conservation/Marine/MPAs/MLPA>.
- 25 California Department of Fish and Wildlife, *Marine Life Protection Act*, accessed 26 September 2022, archived at <http://web.archive.org/web/20220901022825/https://wildlife.ca.gov/Conservation/Marine/MPAs/MLPA>.
- 26 California Department of Fish and Wildlife, *Regional MPA Statistics, Statewide Totals*, accessed 26 September 2022, archived at <https://web.archive.org/web/20220926234217/https://wildlife.ca.gov/Conservation/Marine/MPAs/Statistics>. See also Mary Gleason et al., “Designing a network of marine protected areas in California: Achievements, costs, lessons learned, and challenges ahead,” *Ocean & Coastal Management*, 74: 90–101, doi: <https://doi.org/10.1016/j.ocecoaman.2012.08.013>, March 2013.
- 27 California Department of Fish and Wildlife, *California’s Marine Protected Area (MPA) Network*, accessed 27 September 2022, archived at <http://web.archive.org/web/20220918172110/https://wildlife.ca.gov/Conservation/Marine/MPAs/Network>. Three nautical miles: Jonathon Gurish, *Overview of California Ocean and Coastal Laws with Reference to the Marine Environment*, California Ocean Protection Council, n.d., p.139, accessed 27 September 2022, archived at http://web.archive.org/web/20220401031455/http://www.opc.ca.gov/webmaster/ftp/pdf/docs/Documents_Page/Noteworthy/Overview_Ocean_Coastal_Laws.pdf. N.B., in a small number of cases, certain areas outside of the three-mile limit are also considered state waters. For example, the Channel Islands, off the coast of Southern California, are a special case, as California courts have deemed an area three miles surrounding them as falling under the jurisdiction of the state.
- 28 California Department of Fish and Wildlife, *Regional MPA Statistics, Statewide Totals*, accessed 26 September 2022, archived at <https://web.archive.org/web/20220926234217/https://wildlife.ca.gov/Conservation/Marine/MPAs/Statistics>.
- 29 California Department of Fish and Wildlife, *California’s Marine Protected Area (MPA) Network*, accessed 27 September 2022, archived at <http://web.archive.org/web/20220918172110/https://wildlife.ca.gov/Conservation/Marine/MPAs/Network>.
- 30 See, e.g., Mark H. Carr et al., “The central importance of ecological spatial connectivity to effective coastal marine protected areas and to meeting the challenges of climate change in the marine environment,” *Aquatic Conservation: Marine and Freshwater Ecosystems*. 27: S1, 6–29. Doi: <https://doi.org/10.1002/aqc.2800>, September 2017.

31 See, e.g., Mark H. Carr et al., “The central importance of ecological spatial connectivity to effective coastal marine protected areas and to meeting the challenges of climate change in the marine environment,” *Aquatic Conservation: Marine and Freshwater Ecosystems*. 27: S1, 6–29. Doi: <https://doi.org/10.1002/aqc.2800>, September 2017.

32 Mark H. Carr et al., “The central importance of ecological spatial connectivity to effective coastal marine protected areas and to meeting the challenges of climate change in the marine environment,” *Aquatic Conservation: Marine and Freshwater Ecosystems*. 27: S1, 6–29. Doi: <https://doi.org/10.1002/aqc.2800>, September 2017.

33 Mark H. Carr et al., “The central importance of ecological spatial connectivity to effective coastal marine protected areas and to meeting the challenges of climate change in the marine environment,” *Aquatic Conservation: Marine and Freshwater Ecosystems*. 27: S1, 6–29. Doi: <https://doi.org/10.1002/aqc.2800>, September 2017.

34 Mark H. Carr et al., “The central importance of ecological spatial connectivity to effective coastal marine protected areas and to meeting the challenges of climate change in the marine environment,” *Aquatic Conservation: Marine and Freshwater Ecosystems*. 27: S1, 6–29. Doi: <https://doi.org/10.1002/aqc.2800>, September 2017.

35 Samantha Murray et al., “A Rising Tide: California’s Ongoing Commitment to Monitoring, Managing and Enforcing its Marine Protected Areas,” *Ocean & Coastal Management*, 182, doi: <https://doi.org/10.1016/j.ocecoaman.2019.104920>, December 2019.

36 Samantha Murray et al., “A Rising Tide: California’s Ongoing Commitment to Monitoring, Managing and Enforcing its Marine Protected Areas,” *Ocean & Coastal Management*, 182, doi: <https://doi.org/10.1016/j.ocecoaman.2019.104920>, December 2019.

37 James Horrox, Frontier Group, Steve Blackledge and Kelsey Lamp, Environment America Research & Policy Center, *New Life for the Ocean: How Marine Protections Keep our Waters Wild*, February 2021, available at <https://frontiergroup.org/resources/new-life-ocean/>.

38 James Horrox, Frontier Group, Steve Blackledge and Kelsey Lamp, Environment America Research & Policy Center, *New Life for the Ocean: How Marine Protections Keep our Waters Wild*, February 2021, available at <https://frontiergroup.org/resources/new-life-ocean/>.

39 Scott L. Hamilton et al., “Incorporating Biogeography into Evaluations of the Channel Islands Marine Reserve Network,” *Proceedings of the National Academy of Sciences USA*, 107(43): 18272–18277, doi: 10.1073/pnas.0908091107, October 2010.

40 Scott L. Hamilton et al., “Incorporating Biogeography into Evaluations of the Channel Islands Marine Reserve Network,” *Proceedings of the National Academy of Sciences USA*, 107(43): 18272–18277, doi: 10.1073/pnas.0908091107, October 2010.

41 Scott L. Hamilton, “Incorporating biogeography into evaluations of the Channel Islands marine reserve network,” *PNAS*, 107:43, <https://www.pnas.org/cgi/doi/10.1073/pnas.0908091107>, October 2010.

42 Yinon M. Bar-On et al., “The biomass distribution on Earth.” *Proceedings of the National Academy of Sciences*, 115:6506–6511, <https://doi.org/10.1073/pnas.1711842115>, May 2018.

43 California Sea Grant, “The ocean environment,” accessed 18 October 2022, available at <https://web.archive.org/web/20221018224206/https://caseagrants.ucsd.edu/california-commercial-fisheries/ocean-environment>

44 University of California, “Restoring ocean health: Analysis of 10 years of monitoring data from marine protected areas in the Channel Islands finds positive results,” *Science Daily*, 16 September 2016, archived at <https://web.archive.org/web/20220927232507/https://www.sciencedaily.com/releases/2015/09/150916162928.htm>.

45 Julie Cohen, UC Santa Barbara, *Marine Protected Areas aid Channel Islands fishes*, Natural Reserve System, University of California, September 2015, archived at <https://web.archive.org/web/20210916181126/https://ucnrs.org/marine-protected-areas-aid-channel-islands-fishes/>. Jennifer Caselle et al., “Recovery trajectories of kelp forest animals are rapid yet spatially variable across a network of temperate marine protected areas,” *Scientific Reports*, 5, September 2015.

- 46 University of California, "Restoring ocean health: Analysis of 10 years of monitoring data from marine protected areas in the Channel Islands finds positive results," *Science Daily*, 16 September 2016, archived at <https://web.archive.org/web/20220927232507/https://www.sciencedaily.com/releases/2015/09/150916162928.htm>.
- 47 Mary Gleason et al., "Designing a network of marine protected areas in California: Achievements, costs, lessons learned, and challenges ahead," *Ocean & Coastal Management*, 74: 90–101, doi: <https://doi.org/10.1016/j.ocecoaman.2012.08.013>, March 2013.
- 48 Mark H. Carr et al., *Monitoring and Evaluation of Kelp Forest Ecosystems in the MLPA Marine Protected Area Network*, report submitted to California Sea Grant Ocean Protection Council Marine Protected Areas (MPA) Monitoring Program, California Department of Fish and Wildlife Marine Resources Division, 30 December 2021, archived at http://web.archive.org/web/20220217103719/https://caseagrant.ucsd.edu/sites/default/files/R_MPA-43_Kelp%20Forest%20Technical%20Report%20Narrative.pdf.
- 49 Mark H. Carr et al., *Monitoring and Evaluation of Kelp Forest Ecosystems in the MLPA Marine Protected Area Network*, report submitted to California Sea Grant Ocean Protection Council Marine Protected Areas (MPA) Monitoring Program, California Department of Fish and Wildlife Marine Resources Division, 30 December 2021, archived at http://web.archive.org/web/20220217103719/https://caseagrant.ucsd.edu/sites/default/files/R_MPA-43_Kelp%20Forest%20Technical%20Report%20Narrative.pdf.
- 50 California Department of Fish and Wildlife, *Point Vicente SMCA (No-Take)*, accessed 27 Sept. 2022, archived at <https://web.archive.org/web/20221021171102/https://californiampas.org/mpa-regions/south-coast-region/point-vicente-smca-no-take>
- 51 California Department of Fish and Wildlife, *California's Ocean Habitats: The Rocky Intertidal Zone*, 4 August 2021, archived at <https://web.archive.org/web/20220928054028/https://cdfwmarine.wordpress.com/2021/08/04/californias-ocean-habitats-the-rocky-intertidal-zone/>.
- 52 Sea Grant California, *MPA Update: Observing the Space Between Land and Sea*, 9 July 2020, archived at <https://web.archive.org/web/20220928054259/https://caseagrant.ucsd.edu/news/mpa-update-observing-space-between-land-and-sea>.
- 53 Carol A. Blanchette et al., "Chapter 18: Intertidal," in Harold Mooney and Erika Zavaleta (eds.), *Ecosystems of California*, University of California Press, 2016. Available online at https://web.archive.org/web/20220928061140/https://homes.msi.ucsb.edu/~blanchette/pdfs/ecosystems_of_california_intertidal.pdf.
- 54 Darwin C. Hall et al., "Contingent valuation of marine protected areas: Southern California Rocky intertidal ecosystems." *Natural Resource Modeling* 15(3), Fall 2002, 335–368, archived at <https://web.archive.org/web/20220928015106/https://home.csulb.edu/~dhall/CVMarineProtectedAreasl.pdf>, p.336.
- 55 Murray et al., cited in Darwin C. Hall et al., "Contingent valuation of marine protected areas: Southern California Rocky intertidal ecosystems." *Natural Resource Modeling* 15(3), Fall 2002, 335–368, archived at <https://web.archive.org/web/20220928015106/https://home.csulb.edu/~dhall/CVMarineProtectedAreasl.pdf>, p.336.
- 56 Abalone Cove: California Department for Fish and Wildlife, *Abalone Cove State Marine Conservation Area* (factsheet), March 2016, archived at http://web.archive.org/web/20201016202713/https://www.rpvca.gov/DocumentCenter/View/16125/120_Abalone-Cove-SMCA-Overview_3_2016. Point Vicente: California Department of Fish and Wildlife, *Point Vicente State Marine Conservation Area* (factsheet), September 2022, archived at <https://web.archive.org/web/20220928064724/https://nrm.dfg.ca.gov/FileHandler.ashx?DocumentID=98203&inline>.
- 57 Teresa Watanable, "More than 20 anglers accused of lobster poaching this season," *Los Angeles Times*, 13 October 2012, archived at <https://web.archive.org/web/20220928070811/https://www.latimes.com/local/la-xpm-2012-oct-13-la-me-1014-lobster-poaching-20121014-story.html>.

58 California Sheephead rebounded: Mark H. Carr et al., *Monitoring and Evaluation of Kelp Forest Ecosystems in the MLPA Marine Protected Area Network*, report submitted to California Sea Grant Ocean Protection Council Marine Protected Areas (MPA) Monitoring Program, California Department of Fish and Wildlife Marine Resources Division, 30 December 2021, archived at http://web.archive.org/web/20220217103719/https://caseagrants.ucsd.edu/sites/default/files/R_MPA-43_Kelp%20Forest%20Technical%20Report%20Narrative.pdf, p.60. Red sea urchins declined: Ibid, p.63;

59 Biomass of targeted species increased: Mark H. Carr et al., *Monitoring and Evaluation of Kelp Forest Ecosystems in the MLPA Marine Protected Area Network*, report submitted to California Sea Grant Ocean Protection Council Marine Protected Areas (MPA) Monitoring Program, California Department of Fish and Wildlife Marine Resources Division, 30 December 2021, archived at http://web.archive.org/web/20220217103719/https://caseagrants.ucsd.edu/sites/default/files/R_MPA-43_Kelp%20Forest%20Technical%20Report%20Narrative.pdf, p.44. Purple sea urchins, Ibid., p.61.

60 Don Sweeney, “Desperate people’ poach starfish, mussels from California tide pools, officials say,” *Sacramento Bee*, 20 September 2020, archived at <https://web.archive.org/web/20201030144811/https://www.sacbee.com/news/coronavirus/article245874495.html>. “Crowds swarm San Pedro tide pools in search of free seafood,” *Los Angeles Times*, 17 July 2020, archived at <http://web.archive.org/web/20220726140624/https://www.latimes.com/environment/story/2020-07-17/unprecedented-crowds-are-harvesting-sea-creatures-from-san-pedros-famous-tide-pools>.

61 MPA Watch, *Marine Protected Area (MPA) Watch Regional Report LA County Shore-Based January 1, 2020 – December 31, 2020*, accessed 27 September 2022, archived at <https://web.archive.org/web/20220928065805/https://mpawatch.org/wp-content/uploads/2021/02/Los-Angeles-County-Land-Based-2020-Annual-MPA-Watch-Report.pdf>.

62 Elyse DeFranco, *California’s Marine Protected Areas are safeguarding rocky intertidal zones*, California Sea Grant, 13 October 2021, archived at <https://web.archive.org/web/20211202035811/https://caseagrants.ucsd.edu/news/californias-marine-protected-areas-are-safeguarding-rocky-intertidal-zones>.

63 Elyse DeFranco, *California’s Marine Protected Areas are safeguarding rocky intertidal zones*, California Sea Grant, 13 October 2021, archived at <https://web.archive.org/web/20211202035811/https://caseagrants.ucsd.edu/news/californias-marine-protected-areas-are-safeguarding-rocky-intertidal-zones>.

64 Peter Raimondi, Professor in the Ecology and Evolutionary Biology Department at U.C. Santa Cruz, quoted in Elyse DeFranco, *California’s Marine Protected Areas are safeguarding rocky intertidal zones*, California Sea Grant, 13 October 2021, archived at <https://web.archive.org/web/20211202035811/https://caseagrants.ucsd.edu/news/californias-marine-protected-areas-are-safeguarding-rocky-intertidal-zones>.

65 Elyse DeFranco, *California’s Marine Protected Areas are safeguarding rocky intertidal zones*, California Sea Grant, 13 October 2021, archived at <https://web.archive.org/web/20211202035811/https://caseagrants.ucsd.edu/news/californias-marine-protected-areas-are-safeguarding-rocky-intertidal-zones>.

66 California Department of Parks and Recreation, *Point Lobos State Marine Reserve and State Marine Conservation Area*, accessed 28 September 2022, archived at http://web.archive.org/web/20220911000705/https://www.parks.ca.gov/?page_id=27221.

67 California Department of Parks and Recreation, *Point Lobos State Natural Reserve*, accessed 28 September 2022, archived at http://web.archive.org/web/20220927235150/https://www.parks.ca.gov/?page_id=571.

68 California Department of Fish and Wildlife, *Point Lobos State Marine Reserve* (factsheet), September 2022.

69 California Department of Fish and Wildlife, *Point Lobos State Marine Conservation Area* (factsheet), September 2022.

70 California Department of Fish and Wildlife, *Exploring California’s Marine Protected Areas: Point Lobos State Marine Reserve*, 16 August 2016, archived at <http://web.archive.org/web/20220928054038/https://cdfwmarine.wordpress.com/2016/08/16/exploring-californias-mpas-point-lobos-state-marine-reserve/>.

71 California Department of Fish and Wildlife, *Point Lobos SMR*, accessed 27 Sept. 2022, archived at <https://web.archive.org/web/20221021171431/https://californiampas.org/mpa-regions/central-coast-region/point-lobos-smr>

- 72 Konstantin A Karpov et al., “Serial depletion and the collapse of the California abalone (*Haliotis* spp.) fishery,” *Canadian Special Publication of Fisheries & Aquatic Sciences*, 130:11-24, January 2000, available at https://www.researchgate.net/profile/Laura-Rogers-Bennett/publication/228491870_Serial_depletion_and_the_collapse_of_the_California_abalone_Haliotis_spp_fishery/links/00b49530555a44df9c000000/Serial-depletion-and-the-collapse-of-the-California-abalone-Haliotis-spp-fishery.pdf.
- 73 California Ocean Science Trust et al., *State of the California Central Coast: Results from Baseline Monitoring of Marine Protected Areas 2007–2012*, 2013, archived at <https://web.archive.org/web/20200709204109/https://nrm.dfg.ca.gov/FileHandler.ashx?DocumentID=133101&inline..>
- 74 California Ocean Science Trust and California Department of Fish and Wildlife and Ocean Protection Council, *State of the California North Central Coast A Summary of the Marine Protected Area Monitoring Program 2010-2015*, 5, archived at <https://web.archive.org/web/20200709204815/https://og-production-open-data-cnra-892364687672.s3.amazonaws.com/resources/953d0edd-7d41-4558-9bb6-3242eb3cec93/ncc-state-of-the-region-report-nov-2015.pdf?Signature=pi6p5Wt26uUgb%2FTz23Fsbme9GGI%3D&Expires=1594331282&AWSAccessKeyId=AKIAJJIENTAPKHZMIPXQ>.
- 75 Fiorenza Micheli et al., “Persistence of depleted abalones in marine reserves of central California,” *Biological Conservation* 141(4):1078-1090, DOI: 10.1016/j.biocon.2008.01.014, April 2008. Full article available at https://sanctuarysimon.org/regional_docs/monitoring_projects/100182_2008paper.pdf.
- 76 Richard M. Starr et al., “Variation in Responses of Fishes across Multiple Reserves within a Network of Marine Protected Areas in Temperate Waters,” *PLOS One*, <https://doi.org/10.1371/journal.pone.0118502>, March 2015, archived at <http://web.archive.org/web/20220619235244/https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0118502>.
- 77 Fiorenza Micheli et al., “Persistence of depleted abalones in marine reserves of central California,” *Biological Conservation* 141(4):1078-1090, DOI: 10.1016/j.biocon.2008.01.014, April 2008, p.1088. Full article available at https://sanctuarysimon.org/regional_docs/monitoring_projects/100182_2008paper.pdf.
- 78 Audubon, *About the Western Snowy Plover*, accessed 28 September 2022, archived at <http://web.archive.org/web/20220609145624/https://ca.audubon.org/birds-0/about-western-snowy-plover>.
- 79 Thomas Ryan et al., State of California Natural Resources Agency Department of Fish and Wildlife, *The Western Snowy Plover in Los Angeles and Orange Counties, California: September 2014 to February 2017*, archived at <https://web.archive.org/web/20220929043940/https://static1.squarespace.com/static/5c0dc82225bf0243064f21a9/t/5c1d8711758d46eaf18ab578/1545439004489/SNPL-LAC-OC-Report-2014-2017.pdf>.
- 80 Robin Estrin, “Snowy plovers, already a threatened bird, are caught up in Orange County oil spill,” *Los Angeles Times*, 9 October 2021, archived at <http://web.archive.org/web/20220927172346/https://www.latimes.com/california/story/2021-10-09/snowy-plovers-already-threatened-bird-are-caught-up-in-orange-county-oil-spill>.
- 81 Robin Estrin, “Snowy plovers, already a threatened bird, are caught up in Orange County oil spill,” *Los Angeles Times*, 9 October 2021, archived at <http://web.archive.org/web/20220927172346/https://www.latimes.com/california/story/2021-10-09/snowy-plovers-already-threatened-bird-are-caught-up-in-orange-county-oil-spill>.
- 82 Robin Estrin, “Snowy plovers, already a threatened bird, are caught up in Orange County oil spill,” *Los Angeles Times*, 9 October 2021, archived at <http://web.archive.org/web/20220927172346/https://www.latimes.com/california/story/2021-10-09/snowy-plovers-already-threatened-bird-are-caught-up-in-orange-county-oil-spill>.
- 83 California Department of Fish and Wildlife, *Campus Point State Marine Conservation Area* (factsheet), September 2022.
- 84 California MPAs, *Visit Campus Point No-Take State Marine Conservation Area*, accessed 28 September 2022, archived at <https://web.archive.org/web/20220929045757/https://californiampas.org/v1/pages/resources/cool-visitsc-CampusPoint.html>.

- 85 Jenifer E. Dugan et al., *Final Report: Evaluating performance of California's MPA network through the lens of sandy beach and surf zone ecosystems*, Sea Grant California, accessed 28 September 2022, archived at <http://web.archive.org/web/20220217103937/https://caseagrant.ucsd.edu/sites/default/files/FinalMPAReporBeachesSurfZones2022.pdf>, p.69.
- 86 Annelise Hanshaw, "Snowy plovers released at Coal Oil Point Reserve," *Santa Barbara News-Press*, 21 September 2021, archived at <http://web.archive.org/web/20211025002116/https://newspress.com/snowy-plovers-released-at-coal-oil-point-reserve/>.
- 87 California Department of Fish and Wildlife, *Campus Point State marine Conservation Area*, accessed 27 Sept. 2022, archived at <https://web.archive.org/web/20221021171855/https://wildlife.ca.gov/Conservation/Marine/MPAs/Network/Southern-California>
- 88 Mark H. Carr et al., *Monitoring and Evaluation of Kelp Forest Ecosystems in the MLPA Marine Protected Area Network*, report submitted to California Sea Grant Ocean Protection Council Marine Protected Areas (MPA) Monitoring Program, California Department of Fish and Wildlife Marine Resources Division, 30 December 2021, archived at http://web.archive.org/web/20220217103719/https://caseagrant.ucsd.edu/sites/default/files/R_MPA-43_Kelp%20Forest%20Technical%20Report%20Narrative.pdf.
- 89 Jenifer E. Dugan et al., *Final Report: Evaluating performance of California's MPA network through the lens of sandy beach and surf zone ecosystems*, Sea Grant California, accessed 28 September 2022, archived at <http://web.archive.org/web/20220217103937/https://caseagrant.ucsd.edu/sites/default/files/FinalMPAReporBeachesSurfZones2022.pdf>,
- 90 Jérôme Petit and Johnny Briggs, *Studies Show Powerful Benefits of Fully Protected Ocean Areas*, Pew Charitable Trusts, 2 June 2021, archived at <http://web.archive.org/web/20220826203437/https://www.pewtrusts.org/en/research-and-analysis/articles/2021/06/02/studies-show-powerful-benefits-of-fully-protected-ocean-areas>.
- 91 California Department of Fish and Wildlife, *Matlahuayl State Marine Reserve* (factsheet), accessed 29 September 2022 at <https://nrm.dfg.ca.gov/FileHandler.ashx?DocumentID=98226&inline>.
- 92 P. Ed Parnell et al., "Effectiveness of a small marine reserve in southern California," *Marine Ecology - Progress Series*, 296, 39–52, doi: 10.3354/meps296039, 2005, p.40. Available at <http://web.archive.org/web/20210919082917/https://www.int-res.com/articles/meps2005/296/m296p039.pdf>.
- 93 P. Ed Parnell et al., "Effectiveness of a small marine reserve in southern California," *Marine Ecology - Progress Series*, 296, 39–52, doi: 10.3354/meps296039, 2005, p.40. Available at <http://web.archive.org/web/20210919082917/https://www.int-res.com/articles/meps2005/296/m296p039.pdf>.
- 94 P. Ed Parnell et al., "Effectiveness of a small marine reserve in southern California," *Marine Ecology - Progress Series*, 296, 39–52, doi: 10.3354/meps296039, 2005, p.40. Available at <http://web.archive.org/web/20210919082917/https://www.int-res.com/articles/meps2005/296/m296p039.pdf>.
- 95 Matlahuayl State Marine Reserve was named in honor of the Kumeyaay, the local Native Americans, and their culture. Their original name for La Jolla was mat kulaaxuuy or "land of holes" perhaps in reference to the sea caves that dot the coastline. Source: California MPA Educational Resources, "Visit La Jolla Marine Protected Areas", accessed 17 October 2022, available at <https://web.archive.org/web/20221017234740/https://californiampas.org/v1/pages/resources/cool-visitsc-LaJolla.html>
- 96 California Department of Fish and Wildlife, *South La Jolla State Marine Conservation Area*, accessed 27 Sept. 2022, archived at <https://web.archive.org/web/20221021171855/https://wildlife.ca.gov/Conservation/Marine/MPAs/Network/Southern-California>
- 97 P. Ed Parnell et al., "Effectiveness of a small marine reserve in southern California," *Marine Ecology - Progress Series*, 296, 39–52, doi: 10.3354/meps296039, 2005, p.48. Available at <http://web.archive.org/web/20210919082917/https://www.int-res.com/articles/meps2005/296/m296p039.pdf>.
- 98 Lobsters: P. Ed Parnell et al., "Effectiveness of a small marine reserve in southern California," *Marine Ecology - Progress Series*, 296, 39–52, doi: 10.3354/meps296039, 2005, p.50. Available at <http://web.archive.org/web/20210919082917/https://www.int-res.com/articles/meps2005/296/m296p039.pdf>.

99 Trophic cascade: P. Ed Parnell et al., “Effectiveness of a small marine reserve in southern California,” *Marine Ecology - Progress Series*, 296, 39–52, doi: 10.3354/meps296039, 2005, p.48. Available at <http://web.archive.org/web/20210919082917/https://www.int-res.com/articles/meps2005/296/m296p039.pdf>.

100 P. Ed Parnell et al., “Effectiveness of a small marine reserve in southern California,” *Marine Ecology - Progress Series*, 296, 39–52, doi: 10.3354/meps296039, 2005, p.45. Available at <http://web.archive.org/web/20210919082917/https://www.int-res.com/articles/meps2005/296/m296p039.pdf>.

101 California Department of Fish and Wildlife, *Abalone*, accessed 29 September 2022, archived at <https://web.archive.org/web/20201026132520/https://www.dfg.ca.gov/marine/pdfs/response/abalone.pdf>.

102 P. Ed Parnell et al., “Effectiveness of a small marine reserve in southern California,” *Marine Ecology - Progress Series*, 296, 39–52, doi: 10.3354/meps296039, 2005, available at <http://web.archive.org/web/20210919082917/https://www.int-res.com/articles/meps2005/296/m296p039.pdf>.

103 P. Ed Parnell et al., “Effectiveness of a small marine reserve in southern California,” *Marine Ecology - Progress Series*, 296, 39–52, doi: 10.3354/meps296039, 2005, available at <http://web.archive.org/web/20210919082917/https://www.int-res.com/articles/meps2005/296/m296p039.pdf>.

104 P. Ed Parnell et al., “Effectiveness of a small marine reserve in southern California,” *Marine Ecology - Progress Series*, 296, 39–52, doi: 10.3354/meps296039, 2005, p.49. Available at <http://web.archive.org/web/20210919082917/https://www.int-res.com/articles/meps2005/296/m296p039.pdf>.

105 Paul K. Dayton, “Ghost Forests in the Sea: The Use of Marine Protected Areas to Restore Biodiversity to Kelp Forest Ecosystems in Southern California,” UC San Diego Research Summaries, June 2005, archived at <https://web.archive.org/web/20220929211636/https://escholarship.org/content/qt9c9092sc/qt9c9092sc.pdf>.

106 Paul K. Dayton, “Ghost Forests in the Sea: The Use of Marine Protected Areas to Restore Biodiversity to Kelp Forest Ecosystems in Southern California,” UC San Diego Research Summaries, June 2005, archived at <https://web.archive.org/web/20220929211636/https://escholarship.org/content/qt9c9092sc/qt9c9092sc.pdf>.

107 This report has focused on the ecosystem and environmental benefits of MPAs. We recognize that the human elements that impact and the communities that benefit from these protections are varied and important. For those looking to learn more, we recommend viewing the following resources: <https://www.nrdc.org/resources/healthy-ocean-all-promise-30x30-california>