

by regional stakeholders meant to help achieve the six goals of the MLPA. However, only a few of the MPAs have specific fishery resource objectives despite the fact that the MPA network could affect a large number of marine fisheries and their management. The MLPA Science Advisory Team (SAT) developed a number of science guidelines and associated evaluations for how well MPA proposals achieved the science guidelines and MLPA goals. Nine SAT evaluations were used in the MLPA planning process, and this presentation focused on the five core SAT evaluations including levels of protection, habitat representation, habitat replication, MPA size, and MPA spacing; see the full presentation in Appendix B.

1.3 National Oceanic and Atmospheric Administration Marine Protected Area Science Integration Working Group

Dr. Steve Ralston reported in cooperation with the National Oceanic and Atmospheric Administration (NOAA) National MPA Center and the Pacific Fishery Management Council, among others, the NOAA National Marine Fisheries Service (NMFS) began planning efforts in February 2004 to establish a working group to integrate the science of MPAs with fishery science and management. The overall aim of the working group was to develop scientific information necessary to integrate MPAs within the broader context of fishery science and management, including especially EBFM. An array of scientists with expertise in marine ecology, population ecology, stock assessment, economics, sociology, management, and the private sector were convened for an initial workshop that was held at the NMFS Santa Cruz Laboratory October 6-8, 2004. Following this initial workshop, three individual working groups broke out: 1) Fisheries/ MPAs Ecosystem Modeling, 2) Connectivity, and 3) MPAs for Natural Heritage. An additional two working groups, "Density Ratio" and "Maternal Effects and MPAs" were formed later. The working groups operated mostly independent of each other, each involving a varying number of meetings and written products. The working groups collectively produced over 10 peer-reviewed publications as well as a number of presentations delivered at various conferences and symposiums; see the full presentation in Appendix C.

2. Featured Workshop Fisheries

Nearshore fisheries target a great number of species where MPAs have been established. Nearshore fisheries include finfish as well as invertebrates, and represent a wide range of scientific knowledge, from unassessed data-poor stocks to data-rich assessed stocks. Assessments vary greatly, from relatively simple surveys that track changes in relative abundance to fully assessed stocks that have been evaluated with integrated population models that simultaneously analyze many different types of data to determine the stock status and its ability to support a fishery. Furthermore, some stocks are actively managed under comprehensive Fishery Management Plans (FMPs), while others are regulated with only size, season, and/or bag limits. In order to focus discussions on a manageable subset of species and to maintain a common thread throughout the entire workshop, four species were selected to represent the wide range of life histories, scientific knowledge, and management approaches for fisheries that are expected to be impacted by MPAs:

- Brown rockfish (*Sebastes auriculatus*)
- Cabezon (*Scorpaenichthys marmoratus*)
- California spiny lobster (*Panulirus interruptus*)
- Abalone (*Haliotis* spp.)

While these four species/species group were the focus of workshop discussions, the intent was that any recommendations or outcomes could be more broadly applicable to associated fisheries and similar species.

2.1. Brown Rockfish

Brown rockfish have long been an important component of the marine recreational fishery and the nearshore commercial fishery in California, especially north of Point Conception. They occur in shallow nearshore waters and bays and are associated with sand-rock interfaces and rocky bottoms of artificial and natural reefs. Brown rockfish are managed under California's Nearshore Fishery Management Plan (NFMP) (<http://www.dfg.ca.gov/marine/nfmp/index.asp>) and the federal Pacific Fishery Management Council's Pacific Coast Groundfish Fishery Management Plan (GFMP) (<http://www.pcouncil.org/wp-content/uploads/fmpthru19.pdf>). The commercial fishery is primarily a live fish hook-and-line fishery, which is managed using a restricted access program, annual catch limits, trip limits, and depth restrictions. The recreational fishery is managed using depth restrictions, bag limits, and gear restrictions. At the peak of commercial landings during the 1990s, half of the commercial catch was at or below size at 50% maturity (10.6 inches [in]) (269 millimeters [mm]). However, under current management measures (2005-2010), the average size landed has increased to above the size at 50% maturity. While directed studies have focused on local abundance in certain coastal areas and within bays, the population size and structure has not been comprehensively assessed. Therefore, brown rockfish is categorized as a data-poor stock and managed using precautionary measures; see the full presentation in Appendix D.

2.2. Cabezon

Cabezon is an important component of the recreational fishery and the nearshore commercial live-fish fishery in California. They are the largest member of the Cottidae (sculpin) family, with some reaching lengths of 3.3 feet (ft) (1 meter [m]). They are primarily a nearshore species found intertidally, among jetty rocks, and in and around kelp forests and rocky reefs. Cabezon are also cryptic species, and males guard nests of eggs during the spawning season. Genetic studies have shown there are several sub-stocks of cabezon throughout California. Cabezon, like brown rockfish, are managed under the NFMP and the GFMP. Three stock assessments have been conducted on this species, and the most current assessment in 2009 concluded that cabezon in California are in a healthy state. This species is managed with size limits, bag limits and trip limits; see the full presentation in Appendix E.

2.3 California Spiny Lobster

The California spiny lobster fishery occurs between Point Conception and the Mexican border and at all the Channel Islands and offshore banks in southern California. Lobsters are found in shallow rocky areas from the intertidal out to 240 ft (73 m) or more. In the winter months, lobsters are in deeper water. Mating takes place from January through April. Females move into shallow water in late March and April to release and fertilize their eggs, which they carry under their tail for eight weeks. Females carry the eggs until they hatch into tiny, transparent larvae known as phyllosomas. The phyllosoma drifts with the prevailing currents, feeding on other planktonic animals. It may drift offshore out to 350 mi (563 km), and may be found from the surface to a depth of over 400 ft (122 m). After 7 to 10 months, the phyllosoma transforms into the puerulus larva. The puerulus actively swims inshore where it settles to the bottom in shallow water and molts into a juvenile lobster if suitable habitat is found. Surfgrass beds are preferred habitat. Lobsters grow by molting, shedding their external exoskeleton. After they reach a carapace size of 2.5 in (64 mm) the lobsters usually molt annually in August through October after completing their reproductive cycle. Lobsters spend the first two years of their lives in nearshore surfgrass beds. Adult lobsters usually inhabit rocky areas and search sandy areas for food. During the day, spiny lobsters usually reside in a crevice or hole, dubbed a den. More than one lobster is usually found in a den. At night, the animals leave their dens to search for a wide range of food. Adult lobsters will consume algae and a wide variety of marine invertebrates such as snails, mussels, sea urchins, clams, and injured or newly molted lobsters. Lobsters are eaten by California sheephead (*Semicossyphus pulcher*), cabezon (*Scorpaenichthys marmoratus*), kelp bass (*Paralabrax clathratus*), giant sea bass (*Stereolepis gigas*), southern sea otters (*Enhydra lutris nereis*), two spotted octopuses (*Octopus bimaculoides*), California moray eels (*Gymnothorax mordax*), horn sharks (*Heterodontus francisci*), leopard sharks (*Triakis semifasciata*), and people.

Both a commercial and a recreational fishery in southern California target lobster. The CDFG has had a commercial logbook system in place for the commercial fishery since 1976. The commercial fishery is a trap only fishery with restricted access and has 200 permittees. Both sexes can be landed, and there are no trip limits, trap limits, or quotas. The recreational season starts the weekend before commercial season and uses hoop nets and diving to take lobsters. Traditional management tools are used in the recreational fishery including a minimum size of 3.25 in (83 mm) carapace length (the same as the commercial fishery), a bag and possession limit of seven, and a lobster report card. Recreational fishermen may use baited hoop nets to catch lobsters from shore, vessels, or man-made structures such as piers. Modified hoop nets with rigid supports have recently become popular in the fishery. This component of the recreational lobster fishery is growing. The CDFG is currently working on a lobster stock assessment that should be ready for peer review in 2011. Lobster is currently being used as a MPA indicator species in the northern Channel Islands. The lobster's lengthy planktonic stage, slow growth, and long life make it vulnerable to environmental changes and overfishing. Such developments as new hoop net designs, climate change (the lobster is a warm temperature species that doesn't flourish in prolonged

cold water), and a soon to be established network of MPAs must be considered to make informed management decisions; see the full presentation in Appendix F.

2.3 Abalone

California has seven species of abalone that are distributed along the coast in response to water temperature and habitat. Five of these species were targeted commercially: red (*H. rufescens*), pink (*H. corrugate*), green (*H. fulgens*), white (*H. sorenseni*), and black (*H. cracherodii*). All except the blacks were also popular with recreational divers. The pinto (*H. kamtschatkana*) and flat (*H. walallensis*) are less common in coastal waters off California. Withering Foot Syndrome, a bacterial infection that emerged in the warm water years in the 1990s, particularly had an effect on black abalone. The black is joined on the Federal Endangered Species list by the white, the deepest species found in southern California in dwindling numbers. Pinks, greens, and pintos are on the Federal List of Species of Concern. Reds are found along the entire California coast. North of Point Conception reds occur from the intertidal out to at least 60 ft (18.3 m). South of Point Conception, they are found subtidally out past 100 ft (30.5 m). The red abalone in northern California is currently the only abalone species being harvested recreationally. Abalones are dioecious, and during spawning events, they broadcast their egg and sperm into the water column. As the size of the animal increases, so does egg production. A fertilized egg hatches into a free-swimming larva that drifts for 4-15 days before it settles to the bottom and develops into an adult form if suitable habitat is located. Very high mortality rates are associated with settlement. Sexual maturity occurs at 3-4 in (76-102 mm), ages 3-5 years. Growth rate slows with age, and especially with older animals, some may only maintain their current size.

An Abalone Recovery and Management Plan (ARMP) was adopted by the Commission in 2005. The ARMP has both recovery and fishery management goals. A Minimum Viable Population was established which is measured in terms of density or number of abalone per hectare = 2000 abalone/hectare. A decision matrix for evaluating the north coast recreational fishery based on red abalone densities from eight dive survey index sites was created. The north coast fishery is managed with a total allowable catch (TAC). The TAC is adjusted whenever trigger levels are approached or hit in the decision matrix based on the results of the densities from the independent dive surveys. The management of the recreational fishery north of San Francisco Bay utilizes traditional tools such as a 7 in (178 mm) minimum size limit, a seven month split season, free diving or shore picking only, a maximum of 3 abalone a day, and a maximum of 24 abalone per year. Every angler must carry an abalone report card and immediately tag any abalone they keep. MPAs are identified in the ARMP as useful management tools for both abalone recovery and fishery management. Populations in southern California are considered to be in recovery, and in the north in management. Central California is excluded from consideration because of the presence of sea otters, which eliminate the number of abalone required to support a fishery; see the full presentation in Appendix G.