The Nearshore Ecosystem Invertebrate Resources: Overview

California's marine invertebrate fisheries range among the crustaceans, mollusks, echinoderms and to a limited extent, the polychaetes. This section deals with most of them, with the notable exception of squid, classified as a coastal pelagic in this publication. Invertebrate resources usually associated with bays and estuaries are considered in another section. Commercial and recreational fishermen spend thousands of hours annually in pursuit of these species, which are among the most highly prized of our marine resources. Harvest methods include trawls pulled by large ocean-going vessels (shrimp), traps fished from smaller boats (lobsters, crabs, and prawns), ring nets, and bare hands (recreational lobsters and crabs). In 1999, commercial invertebrates (excluding squid) accounted for only about six percent of the state's total commercial catch by weight, but over 30 percent of its ex-vessel value at over $44 million. Commercial catch records for invertebrate species, like most of California's fisheries, are more complete than for their recreational counterparts. Spiny lobster is the only invertebrate fishery with both a substantial sport and commercial component. However the magnitude of the sport component of that fishery is poorly known. The Marine Life Management Act recognizes the importance of allocating marine resources fairly between commercial and recreational users and so an improved understanding of the amount of sport take and effort will be a necessity in the future. Many other species of invertebrates that are not the target of fisheries inhabit California's marine waters where they nevertheless form important functional components of marine ecosystems.

In 1999, over half of the marine crustacean catch of 16.4 million pounds consisted of Dungeness crab. Dungeness crab and Pacific ocean shrimp have comprised the majority of the crustacean catch each year since the 1950s. In recent years there have been over 330 boats taking Dungeness crabs in the center of the catch range from Crescent City to Fort Bragg. Boats average 200 crab pots each, but some carry as many as one thousand pots. In contrast, the spiny lobster catch was almost 500,000 pounds in 1999, and ranged from 600,000 to 800,000 pounds through most of the 1990s. Recreational harvests of crustaceans also center around crabs and spiny lobster. Dungeness and rock crabs are targets of scattered recreational effort throughout California. It is estimated that sport fishermen take less than one percent of the Dungeness crab catch and that the sport lobster catch, while significant, is substantially less than the commercial catch. While the size of the recreational lobster harvest is not known, a NMFS-sponsored survey estimated over 115,000 individual trips targeting spiny lobster in 1989. Divers catch most lobsters with their hands, although baited ring nets are also used, usually from skiffs, piers or jetties. A commercial passenger fishing vessel (CPFV) industry catering to divers schedules special trips during lobster season. CPFVs in the SF Bay area have in recent years been offering combo-trips for rockfish and Dungeness crabs, where crab pots are set at the beginning of the fishing trip and pulled on the way back to port. These trips could significantly increase the sport crab catch in this region. In addition to these major fisheries, sand crabs and red rock shrimp are the target of small but high value-per-unit bait fisheries.

California's nearshore echinoderm fisheries developed in the 1970s as a response to the growing demand for fishery export products but were little utilized domestically. They have been dominated by the red sea urchin fishery which saw almost 15 million pounds landed in 1999, the second lowest total during the 1990s, down from a high of 45 million pounds in 1990. Sea cucumber landings have averaged about 500,000 pounds during the 1990s, with cucumbers taken by both commercial divers and trawlers, mostly in southern California. There has been very little interest in the sport take of echinoderms, other than small amounts of sea urchins. Purple sea urchins, whose unregulated take can cause localized depletions, have been the target of scientific collectors for years.

Other species not considered in this section, such as limpets, jackknife clams, mussels and rock scallops, are frequently harvested by sport fishers and have been seriously impacted by California's expanding human population. Water quality problems, both natural and man-caused, may prevent commercial and sport harvest of bivalve mollusks, primarily clams and mussels. Since most bivalves are filter feeders, they ingest microscopic plant and animal matter from the water column. At certain times during the year, particularly during the spring and summer upwelling season, heavy plankton blooms occur in nearshore waters, and filter feeders may ingest and concentrate toxins, which are harmful to humans if consumed. The levels of toxic plankton are monitored by the California Department of Public Health and warnings are issued when appropriate.

Natural predation may significantly reduce a population if a prey species increases its density or range. A well-documented example is the return of the sea otter population to its historic range and its impact on central California's Pismo clam and abalone resources. Disease has not often been implicated in reducing populations of

California's mollusks. However, the "withering syndrome" in the black abalone population, coupled with fishing pressure, has resulted in a drastic decline in the southern California stock. Periodic oceanographic disturbances such as the warm-water event known as El Niño can have severe impacts on nearshore invertebrates, especially southern populations.

California's commercial abalone fishery was the leading molluscan fishery for the decades up until its collapse and closure in 1997. Indeed, the MLMA was drafted in part as a response to this tragedy. A robust recreational-only abalone fishery remains in northern California where an estimated 1.2 million pounds was taken by 33,000 divers annually during the past decade. A punch card reporting system was established in 1999, which should make tracking catch and effort in this fishery much easier in the future.

California's nearshore ecosystem has been the target of an onslaught of exploitation, both extractive and non-consumptive, since the end of World War II. California's population has exploded during that time period and concentrated along the coastal zones of central and southern California. Intertidal areas here, particularly rocky tidal pools, have been trampled and stripped of their flora and fauna despite the efforts of regulatory agencies to protect them. Offshore mineral extraction, pipelines and tanker traffic increase the likelihood of major fouling incidents along our coastline. Fisheries management agencies have been largely concerned with controlling the type and amount of marine organisms available for harvest. However, the demands of ecosystem management will require a greater vigilance over all the elements of nearshore ecology, including the habitats of the organisms.

The collection of timely and accurate biological and fishery information can be a costly and challenging endeavor. As a consequence, management of nearshore invertebrate resources in California has proceeded largely on an *ad hoc* basis. Measures such as minimum sizes, closed seasons, gear or equipment restrictions, bag limits and closed areas have been used in an effort to protect stocks, sustain harvests and allocate the resource. For some of our fisheries, management systems based on annual or seasonal quotas and a fixed harvest rate may be more desirable. Following a worldwide trend, during the last decade most of our commercial fisheries for invertebrates have come under limited access or entry regulations, and consequently opportunities for entry into these fisheries have been reduced.

A variety of life-history patterns, which need to be considered when making management decisions, are found among California's invertebrate resources. Some resources are long-lived and slow growing (spiny lobster, sheep crab, abalone, sea urchins); others have short life spans and can undergo rapid increases or declines in population size (ocean shrimp and ridgeback prawn). Separate subpopulations of Dungeness crabs and ridgeback prawns may exist within California. The spiny lobster population is shared with Mexico, and ocean shrimp and Dungeness crab populations span the Oregon border. Management and fishing practices in those political entities may affect California's portion of such shared resources.

Future management and research on California's invertebrate resources should focus on more frequent and efficient resource assessment methods and a better understanding of the various factors, both natural and human-induced, which determine population levels and patterns of change. With such information at hand, resource managers will be better able to match the growing demands on California's nearshore invertebrates with their productive capacity. Future management will undoubtedly address the issue of marine protected areas as a tool for ecosystem protection and enhancement of degraded areas.

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