

5. ROCK CRABS

Overview of the Fishery

Rock crabs are fished along the entire California coast. The catch includes three species: the yellow rock crab, *Cancer anthonyi*; the brown rock crab, *C. antennarius*; and the red rock crab, *C. productus*. The commercial fishery is most active in southern California (from Morro Bay south), where 85% to 90% of the landings occur. Fisheries in Monterey, Half Moon Bay, and Eureka yield 10% to 15% of the rock crab landings. In northern California, fishing is focused more on the valuable Dungeness crab. A major recreational fishery has not developed for rock crab, but recreational crabbing is popular in some areas and is often conducted in conjunction with other fishing activities.

Rock crabs do not appear in Department of Fish and Game records until 1928, and prior to 1950 there was no separate market category for reporting rock crab landings. Crabs landed to the south of Santa Barbara were recorded as rock crabs, and crabs landed to the north of Santa Barbara were recorded as Dungeness crab, regardless of the actual species landed. In 1950, a separate reporting category for commercial rock crab landings was established. Landings rose from 20,000 lb in 1950 to 1.9 million lb in 1986 (Figure 5.1 and Table 5.1). Between 1950 and 1986, a portion of the recorded landings were actually calculated whole-crab weights based on landings of claws. Since 1986, however, whole crabs and claws have been reported separately (Table 7.2). In 1991, it became illegal to land rock crab claws alone. Rock crab landings were approximately 1.1 million lb in 2000 and 1.2 million lb in 2001, and have averaged 1.2 million lb per year since 1991.

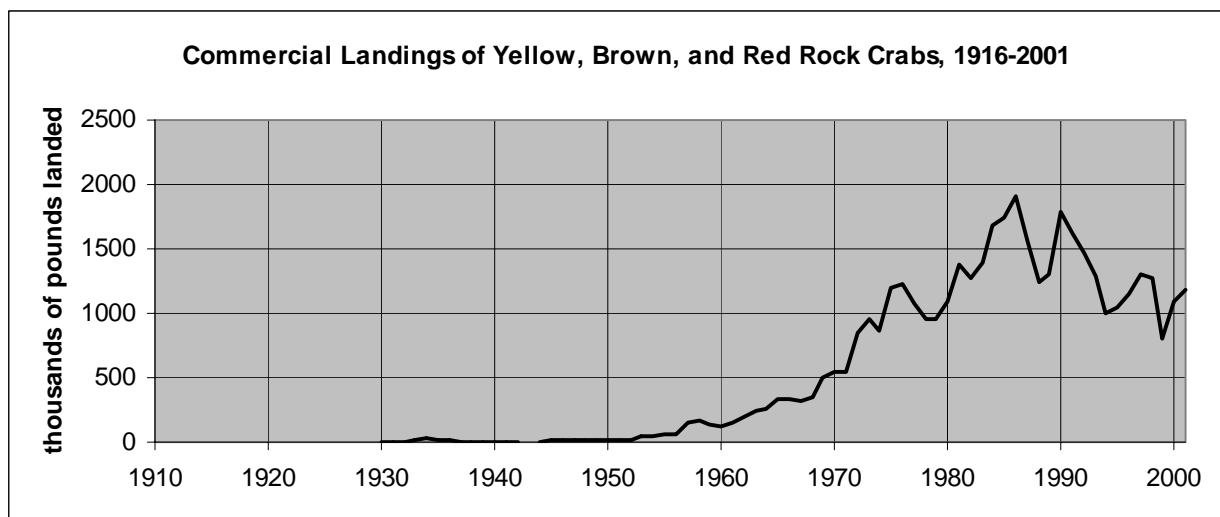


Figure 5.1. Annual commercial landings (pounds) of yellow, brown, and red rock crabs from 1916 to 2001. Data sources are California Department of Fish and Game (DFG) Catch Bulletins (1916-1985) and the DFG commercial landing receipt database (1986-2001).

Commercial rock crabbing has expanded from nearshore areas around major ports such as San Diego, San Pedro, Santa Barbara, and Morro Bay to more distant mainland areas and the Channel Islands. Most rock crabs are landed alive for retail sale in fresh fish markets. Often the crabs are cooked and eaten on site and,

depending on the tastes of the consumer, muscle tissue as well as other organs (ovaries in particular) are consumed. Frozen or canned rock crab meat has not yet been successfully marketed. During 2001, ex-vessel prices for rock crabs averaged around \$1.29 per lb.

Several trap designs are used in the rock crab fishery. The most popular is a single chamber, rectangular trap of two-by-four- or two-by-two-in. welded wire mesh. Molded plastic traps that collapse or nest together are used by some fishermen for ease of storage. Traps are set and buoyed singly or in pairs. Most trapping occurs in depths of 90 to 240 ft on open sandy bottom or near rocky reefs. Two hundred or more traps may be fished by one boat, with a portion pulled up and emptied each day. Traps are usually left in the ocean for 48 to 96 hr prior to pulling. Commercial crab boats are usually small, but range from skiff-sized boats to vessels of 40 ft or more.

Recreational gear for trapping rock crab includes baited hoop nets, collapsible star traps, or scaled-down commercial-type traps (north of Point Arguello) fished from piers, jetties, and boats. Rock crabs are also captured by hand in the intertidal zone, and when diving. Most recreational effort takes place along the shallow, nearshore open coast and in bays. Some increased recreational take has occurred in central and northern California in recent years as commercial passenger fishing vessels combine finfishing trips with crab trapping. These combination trips mainly target Dungeness crabs; however, depending on location and season, rock crabs (brown and red) are often taken as well.

Commercial laws and regulations protect crabs that are below reproductive size. The law presently requires a minimum harvest size of 4.25-in. carapace width (widest part of the body shell), and each trap must include escape rings that measure 3.25 in. across. The minimum harvest size and escape ring size were chosen to accommodate the different characteristics of the three rock crab species. Other laws and regulations designed to conserve crab populations include requiring that traps be raised and emptied every 96 hr, weather permitting, and prohibiting the use of commercial rock crab traps in portions of Humboldt, San Pedro and San Diego bays, in Santa Monica Bay, and in certain areas around Santa Catalina Island. Recreational rock crab fishery regulations include a 4-in. minimum carapace width and a bag and possession limit of 35 crabs per day.

A law was enacted in 2002 that authorized the Fish and Game Commission to adopt regulations to manage the rock crab resource in a manner consistent with the Marine Life Management Act of 1998. To date, no regulations have been proposed for this purpose.

Status of Biological Knowledge

Yellow rock crabs range from Humboldt Bay (Humboldt County) to southern Baja California, Mexico, brown rock crabs from northern Washington to central Baja California, and red rock crabs from Kodiak Island, Alaska to central Baja California. All three species inhabit waters from the low intertidal zone to depths of 300 ft or more. Although these species may occur together throughout much of their range, yellow rock crabs are most abundant in southern California, brown rock crabs in central California and red rock crabs in northern California. Yellow rock crabs prefer open sand or soft-bottom habitat, while brown and red rock crabs prefer rocky or reef-type habitat.

Rock crabs, like other crustaceans, grow in a step-wise fashion with each molt (shedding of the external shell). Yellow and brown rock crabs molt 10 to 12 times before reaching sexual maturity at about 3-in. carapace width. Crabs of this size may molt twice a year, but as they grow older and larger they molt less frequently. Crabs as large as 6 in. across may molt once a year or less. Molting frequency and size at maturity is not known for the red rock crab.

Growth per molt decreases with size and age. Males of all three species attain sizes 10% to 15% larger than females. Yellow rock crabs grow to exceed 7 in. in carapace width, brown rock crabs reach 6.5 in., and red rock crabs 8 in. While the longevity of rock crabs is not well known, they are thought to live for at least five or six years.

Mating takes place when females are in soft-shell condition, after molting. In southern California, mating is most common in the spring, but occurs throughout the year. About three months after mating, the female lays eggs and then fertilizes them with a sperm packet left by the male during mating. The developing eggs are carried in a mass attached to the female's abdomen. Depending on size and species, nearly four million eggs may be carried by a female rock crab. A nemertean worm is known to prey on eggs carried by female rock crabs, but egg mortalities are generally low, averaging less than 6%. After six to eight weeks, the eggs hatch into tiny free-floating larvae which undergo seven developmental molts before settling to the bottom as juveniles.

Rock crabs are both predators and scavengers, feeding on a variety of other invertebrates. Strong, crushing claws allow them to prey on heavy-shelled animals such as snails, clams, abalone, barnacles, and oysters. Rock crabs have a well-developed sense of smell, which allows them to detect and locate food at a distance.

Rock crabs, especially juveniles, are preyed upon by a variety of other marine organisms. Fishes such as cabezon, barred sand bass and several species of rockfish are known to feed on rock crabs. Invertebrate predators include octopus and certain sea stars. As rock crabs grow, they generally become less susceptible to predators except during the soft-shelled, post-molt period. Sea otters are one of the few effective predators on large, hard-shelled rock crabs.

Rock crabs do not appear to migrate or undertake large-scale movements. Tagged adults have moved several miles, but no pattern is apparent. Some local movements may also occur during mating or molting. Egg-bearing yellow rock crabs are known to congregate in rock-sand interface habitats.

Status of the Populations

Information is not available on the stock sizes, recruitment rates, mortality rates, the effects of different oceanographic regimes, or potential yield for any of the three of rock crab species. The commercial fishery, however, has had a localized effect on crab abundance and size. Areas intensively exploited over an extended period produce fewer crabs per trap, and have a reduced size-frequency distribution compared to lightly-exploited areas. In Santa Monica Bay, which has been closed to commercial crab fishing for decades, experimental catch rates were higher, crab sizes larger and size-frequencies broader than in adjacent areas open to commercial trapping. Further research should increase our understanding of rock crab population parameters.

Management Considerations

The rock crab fishery is currently one of the few remaining significant nearshore fisheries not subject to some form of restricted access. Open access and relatively low capital requirements for entry could result in large increases in effort for rock crabs as fishermen seek opportunities to diversify their fishing activities. The multi-species nature of the rock crab fishery presents a number of challenges to implementing meaningful management measures. Future management activities that could be considered to enhance the health of this resource and fishery include:

- Establishing a system for obtaining periodic fishery-independent data on rock crab abundance, species and size composition, recruitment patterns, and bycatch characteristics.
- Monitoring the commercial fishery for species and size composition, geographic and temporal patterns in catch and effort, and bycatch characteristics.
- Investigating whether a restricted access program for the commercial fishery is needed. Currently, rock crabs may be taken under a general trap permit which is issued annually. The Fish and Game Commission has authority over trap permits.
- Exploring gear modifications to reduce bycatch of other species.

David O. Parker
California Department of Fish and Game

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Further Reading

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Table 5.1. Commercial landings (pounds) of yellow, brown, and red rock crabs, 1916-2001

Year	Pounds	Year	Pounds	Year	Pounds	Year	Pounds	Year	Pounds
1916	-----	1933	14,818	1950	20,007	1967	324,386	1984	1,676,298
1917	-----	1934	24,570	1951	22,592	1968	351,657	1985	1,739,835
1918	-----	1935	12,817	1952	16,977	1969	504,076	1986	1,913,788
1919	-----	1936	16,202	1953	49,300	1970	539,579	1987	1,567,101
1920	-----	1937	1,710	1954	39,058	1971	542,732	1988	1,239,273
1921	-----	1938	3,847	1955	54,051	1972	843,530	1989	1,309,975
1922	-----	1939	3,984	1956	59,171	1973	955,788	1990	1,788,657
1923	-----	1940	3,460	1957	151,131	1974	864,033	1991	1,623,246
1924	-----	1941	2,645	1958	166,962	1975	1,201,867	1992	1,468,309
1925	-----	1942	80	1959	129,534	1976	1,227,766	1993	1,287,378
1926	-----	1943	-----	1960	120,903	1977	1,083,015	1994	1,002,373
1927	-----	1944	540	1961	151,782	1978	956,874	1995	1,047,316
1928	270	1945	12,188	1962	200,304	1979	953,590	1996	1,154,869
1929	-----	1946	11,600	1963	240,611	1980	1,083,957	1997	1,296,764
1930	12	1947	15,244	1964	263,885	1981	1,375,227	1998	1,276,863
1931	56	1948	20,938	1965	328,686	1982	1,277,872	1999	798,096
1932	145	1949	18,636	1966	330,843	1983	1,397,109	2000	1,090,763
								2001	1,184,739

----- No landings were reported from 1916 to 1927, 1929, and 1943.

1. Data sources: DFG Catch Bulletins (1916-1985) and DFG commercial landing receipt database (1986-2001).
2. Only one market category (reporting category) existed for crabs from 1916 to 1949. All crab landed in the San Diego, Los Angeles and Santa Barbara regions were assumed to be rock crab, and all crab landed in the Monterey, San Francisco and Eureka regions were assumed to be Dungeness crab.
3. In 1950, a separate market category was created for rock crab; all three species of rock crab were combined in this category.
4. From 1950 through 1985, the landings of rock crab also include any crab claws that were landed. The crab claws converted to whole crab weight using a 1:4 ratio (one pound of crab claws equaled four pounds of whole crab).
5. In 1986, a new market category was created for crab claws. Between 1986 and 1990, this category contained claws from both sheep crab (spider crab) and rock crab, with sheep crab claws more prevalent than rock crab claws. On January 1, 1991, it became illegal to take rock crab claws and the category became exclusively sheep crab claws. In this table, landings from 1928 to 1949 and from 1986 to 2001 do not include crab claws.
6. In 1994, three additional market categories were created: red rock crab, yellow rock crab, and brown rock crab. The landings from 1994 through 2001 are the sum of the combined rock crab market category and the three additional categories.