

Sheep Crab

History of the Fishery

Until 1984, the sheep crab (*Loxorhynchus grandis*) was of little commercial or recreational value. Before that, they were occasionally landed as by-catch and were also taken by some recreational divers. Santa Barbara fishermen and processors began to experiment with marketing them and by 1984, 30,000 to 40,000 pounds of whole crabs were landed. The fishery for this underutilized species expanded rapidly, stimulated by development of a market for claws. The fishery peaked in 1988 with landings of 107,609 pounds of live crabs and 385,886 pounds of claws (combination of sheep and rock crab claws; 75 percent and 25 percent respectively). The sheep crab was the only fishery in the United States with sizable landings of claws and whole crabs. However, a 1990 California State Initiative banned the use of gillnets in shallow water. Subsequently, landings of sheep crab claws plummeted to an average of only 5,000 pounds annually once gillnets were completely phased out in 1994. During this same period, landings of live, whole crabs remained fairly constant and relatively low, averaging approximately 75,000 pounds annually.

The California sheep crab fishery is centered in the Santa Barbara Channel and off the northern Channel Islands. The bulk of the landings are in Santa Barbara and Ventura counties although most of the crabs are marketed in the San Pedro and greater Los Angeles area. The fishery primarily operates over sandy bottom, where gear is set in shallow waters (30-70 feet) in spring and summer and then moved to deeper waters (120-240 feet) in fall and winter months. Both male and female adult crabs are taken for the live, whole body fishery. The claw fishery is supported solely by large adult male crabs, as the claws of adult female crabs and small adult males do not reach market size.

Crab and lobster trap fishermen supply the bulk of live crabs. Modified rock crab or lobster traps with an enlarged funnel are used, permitting entry of large adult male and female crabs. Set gill-netters supply the claw market, usually killing the crab in the claw removal process. Sheep crabs are a nuisance to gillnet fishermen because they become tangled in the gear and their removal from the nets is time consuming, usually resulting in damage to the animals. However, with the development of the claw fishery the crabs became a valuable resource for gill-netters.

At the peak of the fishery, the retail value of the combined catch was about \$1.9 million per year, with claws being sold for \$5.75 per pound and whole crabs going for \$3 per pound live and \$4.25 per pound cooked. Claw landings and value far exceeded those of the whole body fishery. However, with the banning of gillnets in shallow

water and the subsequent decline in claw landings, the retail value has substantially decreased. In 1999, the retail value was approximately \$310,000, with whole crabs being sold for up to \$4 per pound live and claws up to \$3 per pound.

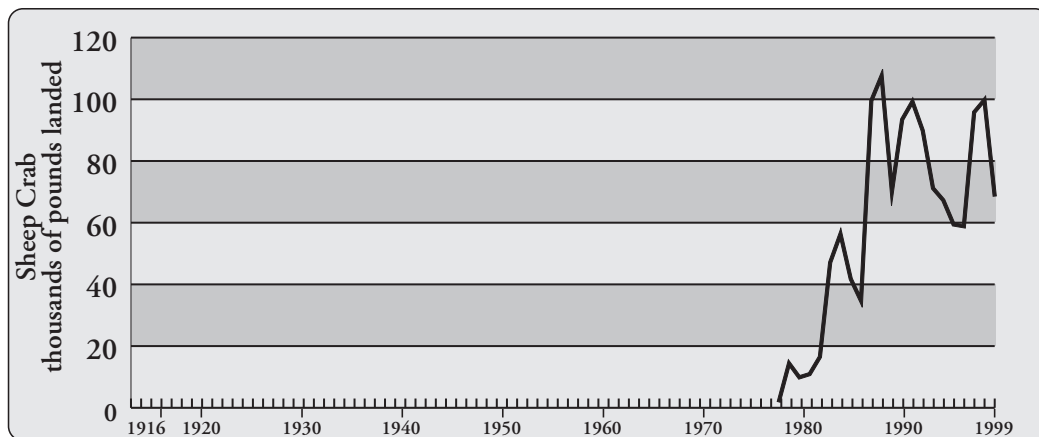
An increase in claw landings seems unlikely given the nature in which the fishery was developed (*i.e.*, to provide some value to a by-catch species). In fact, prior to 1991, rock crab and spider crab claw landings were combined in the landings data, with spider crab claws comprising 75 percent of the landings. In 1991, a size limit went into effect for rock crabs, and fishermen were prohibited from taking any "part" of those crabs. However, the loss of supply of rock crab claws has not been compensated for by an increase in landings of spider crab claws. This is most likely because implementation of the rock crab regulations coincided with the banning of gillnets in shallow water.

Fishing effort for, and landings of whole crabs remain relatively low since fishermen generally have to establish their own live markets and be able to hold the crabs alive for up to a week or more. In addition, because of the heavily calcified carapace of the crab, processing the body meat is presently uneconomical. Thus, current landing patterns may increase if new marketing efforts expand



Sheep Crab, *Loxorhynchus grandis*
Credit: Diane Pleshner
CA Seafood Council

**Commercial Landings
1916-1999, Sheep Crab**
Sheep crab landings are recorded by DFG as spider crab. Data Source: DFG Catch Bulletins and commercial landing receipts.



economically feasible. Such expansion seems likely given the continued interest in the California fishery and the recent development of an experimental sheep crab fishery off Baja California.

Status of Biological Knowledge

Sheep crab is the common name of one species within a family of crabs (Majidae), which collectively are often called spider crabs. Consequently, the sheep crab is often called a spider crab and is the largest member of the California majid crabs. They range from Cordell Bank (Marin County) south to Cape Thurloe, Baja California, in depths of 20 to 410 feet. It is not known whether the entire resource consists of just one or of a number of different populations. Sheep crabs are apparently most abundant off southern California.

Longevity is currently unknown, but many adults appear to be at least four years old. In contrast to most other commercially important crustaceans, most majid crabs are believed to cease molting upon reaching maturity. Studies of molt staging, limb regeneration, and molting frequency support the existence of a terminal molt in sheep crab. After this molt, crabs do not increase in size nor do they regenerate limbs. This phenomenon is an important biological characteristic that may require development of a management scheme different from those of other California crab fisheries.

Maturation is defined only in morphometric terms. At maturity the relative width of the abdomen of females and the length of the claw of males increase markedly when compared to a standard measure of body size such as carapace length. Females become morphometrically mature between 4.2 and 6.8 inches carapace length (from margin of orbit). Adult males range in size from 4.2 to 9.6 inches. However, morphometrically juvenile male crabs

can reach a length of 6.8 inches; thus, size alone is insufficient to determine maturity. The presence of a gap in the serrated gape of the claw of adult male crabs distinguishes them from juvenile males. It is uncertain how morphometric maturity relates to physiological and behavioral maturity.

The abundance of berried females peaks in late spring and remains high throughout the summer, although they can be found throughout the year. Adult females are able to mate when soft or hard shelled. Sperm storage allows for multiple broods to be oviposited even in the absence of males. Egg numbers probably increase with size of brooding female crabs. Small broods contain 125,000 eggs, whereas large broods can have as many as 500,000 eggs. Laboratory observations suggest that sheep crabs feed on a variety of prey. They readily eat dead fish, crushed mussels, and kelp. Cannibalism of newly molted animals occurs in the laboratory when crabs are not well fed. No observations are available on foraging behavior in nature, nor have gut contents been analyzed.

Predatory interactions have not been observed in the field either, but it is likely that small crabs are preyed upon by cabezon, sheephead, octopus, sharks and rays. Small sheep crabs disguise themselves by decorating their carapace with algae, sponges, or other encrusting materials. Large crabs probably have few predators.

Two parasitic infections could potentially impact recruitment – an undescribed species of nemertean or ribbon worm and a rhizocephalan barnacle. The former consumes the developing embryo in the egg. The latter eliminates reproductive output and also inhibits growth of the crab. Preliminary observations indicate that certain areas contain a high prevalence of individuals parasitized by the rhizocephalan and that crabs are infected as juveniles.

Male crabs winter in deep water. Both sexes migrate onshore in early spring, and piles of adult females have

been observed in spring and summer. Large adult males have been seen on the perimeter of these aggregations. The biological significance of the piles is apparently related to mating, as the majority of females are gravid, the males often exhibit competitive behavior for mates and there are many obstetrical pairs (a mating behavior where a male and female crab are hooked together back-to-back by the males back limbs). Similar aggregate mating phenomena have been reported for other spider crabs.

Status of the Population

The abundance of sheep crabs is unknown. Abundant populations have been reported off Los Angeles and San Diego. Furthermore, although this spider crab has been a by-catch for many years, there is no evidence of declining populations in the Santa Barbara Channel where most fishing takes place. However, some have reported a decrease in overall crab size. Such a phenomenon could be due to the immense fishing pressure on large males both for claws and whole body. Because this species undergoes a terminal molt, removal of large crabs may leave only small animals to contribute to the gene pool. If the terminal molt is genetically regulated, this could result in a population of smaller crabs.

Management Considerations

See the Management Considerations Appendix A for further information.

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