4. Ridgeback Prawn

Review of the Fishery

During the early 1960s, bottom trawlers operating in the Santa Barbara Channel noticed incidental catches of ridgeback prawn, *Sicyonia ingentis*, in their groundfish catch. By 1967, a directed bottom trawl fishery was operating under the authority of a prawn trawl permit and was regulated with area restrictions, gear specifications, and incidental catch limits for non-target species. However, it was a minor fishery until 1978 due to low market demand. An increase in demand in 1979 resulted in 356,700 pounds (162 metric tons) being landed (Figure 4.1). Since then, landings have fluctuated with two major peaks; one in 1985 of 896,500 pounds (406 metric tons) and a record high in 2000 of 1,565,000 pounds (710 metric tons). By 2004, landings declined to their lowest level in 25 years and have remained flat since then. This fishery is characterized as being low in volume and high in value when compared to the California fishery for Pacific ocean shrimp, *Pandalus jordani*.

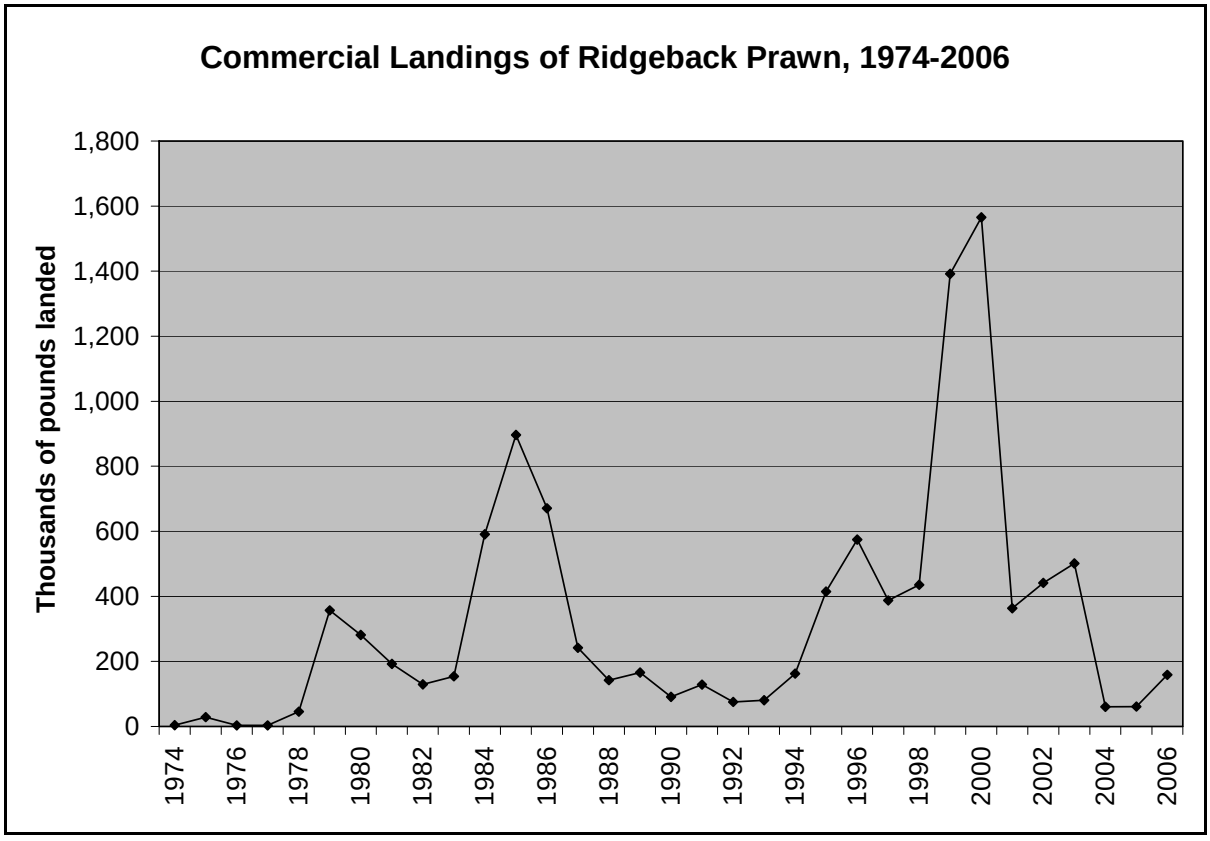

Figure 4.1. Annual California commercial landings (pounds) of ridgeback prawn, 1974-2006. Data source: CDFG commercial landing receipts.

Marketing this product was difficult in the early years of the fishery due to an enzymatic breakdown of the prawn flesh after death, causing an unappealing, "blackening" discoloration (Figure 4.2). Since the 1980s, new handling techniques were developed, such as keeping the prawn chilled or selling the prawn live, which enabled the product to expand beyond the Santa Barbara and Ventura ports to markets throughout southern California. The average annual ex-vessel price increased from $0.60 per pound in the 1970s to $1.00 per pound in the 1980s and peaked at $2.80 per pound in 1992. Since 1992, the annual ex-vessel price has averaged $1.70 per pound. In 2006, the average ex-vessel price was $2.01 per pound for live and dead prawn.

Figure 4.2. Ridgeback prawn, *Sicyonia ingentis*. The "blackening" discoloration, as observed in the head region, occurs after death. It is a byproduct of enzymatic activity that breaks down the color pigment. Photo credit: CDFG.

Since the species does not freeze well, it is primarily sold live or as fresh whole prawns. The live market is considered the best way to prevent discoloration and generates the highest ex-vessel value. Since 1995, live landings have been an important component of the fishery, averaging $2.11 per pound. In 2004, the live landings hit a peak of 71 percent of the total reported catch but dropped to only 7 percent in 2006. The decrease in market deliveries of live ridgeback landings resulted in market prices ranging from $1.50 to $4.00 per pound in 2006.

Fishing revenues from the 2006 commercial harvest of ridgeback shrimp were about $332,000 (ex-vessel 2006 dollars). The contribution to total business output for the State from the 2006 commercial harvest is estimated to be $641,000

and total employment and wages from ridgeback shrimp is estimated to be the equivalent of 11 jobs and $295,000 respectively.

The Santa Barbara Channel is considered the center of the fishery, and ports within Ventura and Santa Barbara counties receive the majority of the ridgeback prawn landings from year to year. In 1981, Morro Bay became the first port to record landings north of Santa Barbara. These vessels were most likely fishing in the Santa Barbara Channel and landing their catch in Morro Bay. The total landings were relatively low and they have been insignificant since then. By 1984, the fishery expanded south of Santa Barbara into waters adjacent to Los Angeles County, with most of the activity occurring in Santa Monica Bay. A nominal amount of effort also occurred in San Diego County in the 1980s and 1990s, but no catch has been recorded there since 2000.

Vessels participating in the current fishery range from 29 to 63 feet (9 to19 meters) in length. The primary gear used in the fishery is a single-rig shrimp trawl with a single-walled net with mesh sizes ranging from 1¾- to 2¼ -inches (4.5- to 5.7-centimeters). Vessels deploying double-rigs are generally larger than vessels using single-rigged nets. Catch efficiency of a double-rigged vessel is as much as 60 percent higher than a single-rigged vessel. However, double-rigged gear is not preferred in this fishery because they are too costly to operate when the harvestable biomass is not available in high concentrations.

A season closure from June 1 through September 30 was adopted in 1983 by the Fish and Game Commission (Commission) to protect the ridgeback during their peak spawning months (Title 14, Section 120.3). During the closed season, incidental take of ridgeback prawns is allowed while fishing for other species, however, no more than 50 pounds (23 kilograms) or 15 percent of the weight of the load of fish is allowed to be taken. During the open season, no more than 1,000 pounds (454 kilograms) per trip of any non-groundfish including no more than 300 pounds (136 kilograms) of groundfish may be possessed on any vessel operating under provisions of the permit. Any amount of sea cucumbers may be landed with ridgeback prawn, as long as the vessel owner/operator has a valid sea cucumber permit. Trawling for ridgeback prawn has not been allowed in state waters (0 to 3 nautical miles from mainland shore, and off shore islands), since the development of the fishery. In 1983, a depth restriction was implemented to prevent trawling in any waters less than 150 feet (25 fathoms). Recent area/depth closures implemented to protect overfished groundfish stocks have further restricted trawling effort for ridgeback prawn.

Status of Biological Knowledge

The ridgeback prawn gets its name from its hard stony exoskeleton. It is the only species of rock shrimp that can be found along the west coast of the United States. This species ranges from Monterey Bay, California, to Isla Maria Madre, Mexico, including the Gulf of California. Major concentrations occur in the Santa

Barbara Channel which is considered to be the most suitable habitat, as well as Santa Monica Bay, and ocean waters off Baja California, Mexico. They are distributed between the inner to outer continental shelf between 16 and 984 feet (5 and 300 meters) but they are most abundant between 131 and 525 feet (40 and 160 meters). The species occurs primarily on soft bottom habitat composed of green mud, shell and sand, and can tolerate temperature and salinity gradients ranging from 39 to 86 ºF (4 to 30 ºC) and 33-35 $^{0}/00$, respectively.

This species is the largest in its genera with the females attaining larger sizes than the males. The maximum length for females is 1.8-inches (4.6-centimeters) carapace length (CL) and the maximum length for males is 1.5-inches (3.8-centimeters) CL. Length-weight ratios for both sexes are equivalent. They typically recruit into the fishery after one year, although a majority of the catch is documented to be composed of two and three year olds. They have a maximum life span of five years and are dioecious (having separate sexes) unlike ocean shrimp which are protandrous hermaphrodites that change from male to female during their life cycle.

Ridgeback prawns are broadcast spawners, as opposed to other shrimp that carry their fertilized eggs. Females store packets of sperm (spermatophores) deposited by the males and release both the eggs and sperm into the water column where fertilization and embryonic development occurs. Spawning can occur after the first year of growth, but a majority of the spawning occurs upon reaching 1.2-inches (3.1-centimeters) CL in their second year of growth. The spawning season takes place from June through October, and individuals can spawn multiple times during this period. Females are known to produce 86,000 eggs on average during the spawning season. Observations of spawning events indicate that ridgeback prawn spawn in the water column at night during a new moon. Both sexes molt prior to and after the spawning season in the spring and late fall. A majority of females display synchronous molting right after the spawning season, but molting patterns of males are less discernable through out the year. Molting is rarely observed in either sex during the summer months.

This species is a benthic omnivore that feeds on organic surface sediments, diatoms, infaunal polychaetes, gastropods, and crustaceans. In Baja California, the ridgeback prawn is preyed upon by several species of searobins (Family Triglidae). Observations made in southern California found California scorpionfish, *Scorpaena guttata*, also feed on this species and it is presumed that rockfishes also feed on them. Other groundfish, such as lingcod, *Ophiodon elongatus*; sharks, rays and skates; as well as California halibut, *Paralichthys californicus*; and potentially octopus, may also prey on this species.

Status of Population

There have been no formal studies in recent years to determine the population status of the ridgeback prawn. However, there have been bottom trawl surveys performed by several city and county water quality agencies within the

Southern California Bight (SBC) that provide anecdotal information on the population. Results from these surveys from 1971 to 1985 showed that the ridgeback prawn was the second most abundant invertebrate species in the northern and central regions of the SBC on the outer shelf and upper slope of the continental shelf (148 to 1,033 feet (45 to 315 meters)). Another series of large scale bottom trawl surveys in SCB conducted by the Southern California Coastal Water Research Project in 1994 and 2003 found ridgeback prawn to be the second most abundant species on the middle shelf (85 to 328 feet (26 to 100 meters)); and it was the third most abundant macro-invertebrate species caught in the outer shelf (331 to 656 feet (101-200 meters)).

California has required ridgeback prawn trawl logbooks since the inception of the fishery in 1967. Since then, the reported Catch-per-Unit-Effort (CPUE) has varied and three major peaks have occurred; a high of 254 pounds (115 kilograms) per tow/hour during the 1984/1985 fishing season (33 active vessels); 161 pounds (73 kilograms) per tow/hour during the 1994/1995 season (35 active vessels); and 202 pounds (92 kilograms) per tow/hour during the 1999-2000 season (38 active vessels). The CPUE trend following the 1999/2000 season has been one of decline, averaging 63 pounds (30 kilograms) per tow/hour (Figure 4.4). The number of vessels also decreased from 38 vessels in the 1999/2000 season to 11 vessels by the 2005/2006 season.

The El Niño Southern Oscillation (ENSO) appears to play a major role in the population structure of the ridgeback prawn. This species' biological productivity is greatest during warm water years and is depressed during the cooler water regimes. An examination of both the commercial landing receipts and the trawl logbook data suggests a positive correlation between ENSO conditions and catch success. After the two biggest ENSO events of the past 30 years, the 1982-1983 and the 1997-1998 events, ridgeback prawn landings, along with CPUE, dramatically increased one to two years following these events. Since ridgeback prawn recruit into the fishery at around age one or two, it seems apparent that the oceanographic conditions, during very warm water ENSO years, have resulted in relatively successful reproductive seasons in the SCB.

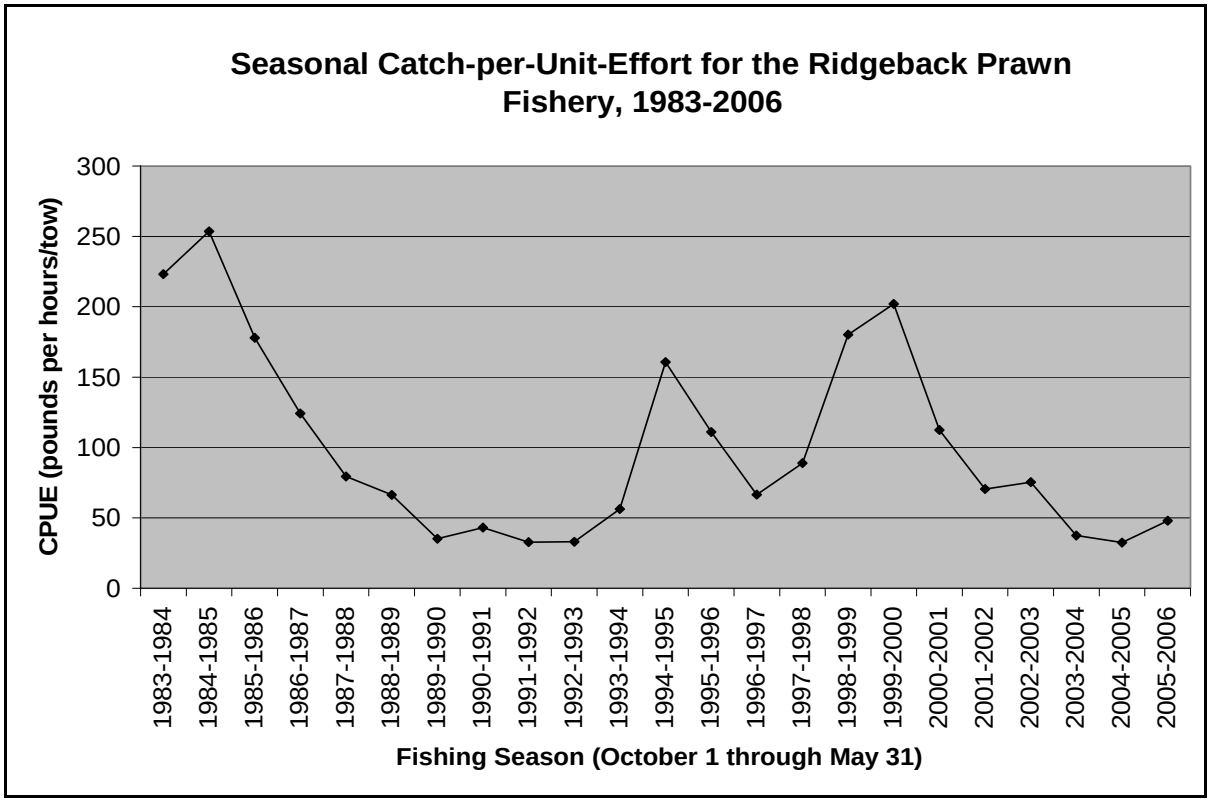

Figure 4.4. Catch-per-Unit-Effort for ridgeback prawn by fishing season (October 1 through May 31) from 1983-2006. Data source: CDFG commercial trawl logbooks.

Management Considerations

Since April 2006, bottom trawlers targeting ridgeback prawn have been required to use a rigid-grate fish excluder device to minimize bycatch (Fish and Game Code Section 8841). Section 8841 authorizes the Commission, the Pacific Marine Fishery Management Council, or the National Marine Fisheries Service to approve another type of fish excluder device if it is equal to or more effective in reducing bycatch. The current rigid-grate is not preferred by the fishery's participants because it becomes damaged when wrapped on the net reel. Future management considerations could explore alternative bycatch reduction devices that provide for the sustainable harvest of ridgeback prawn, reduces bycatch below current levels, and meets the needs of the industry.

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Further Reading

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