

THE PINK SHRIMP

Compiled by  
Jack G. Robinson

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The housewife knows the little shrimp used for seafood cocktails and salads as the north Pacific cocktail shrimp. Fishermen harvesting them along Oregon's coast call them pink shrimp, and scientists identify them as *Pandalus jordani*. By any name, this crustacean is the object of Oregon's newest seafood fishery. This fishery began in 1957, and by 1973 it had expanded to a value of \$5.4 million. The fishery has really boomed since 1966, when the Russians began fishing off Oregon. Biologists don't know what caused this shrimp bonanza, but it is possible that the hake and ocean perch caught by the Soviets are predators on shrimp. As their number declined, the shrimp may have benefitted.

### Life History

Typically, shrimp begin life as a tiny, nearly transparent larval form called a zoea. They are "hatched" from eggs carried on the female abdomen or "tail" in February to April. The zoea presumably drift with the ocean currents for the first two to four months of life. Pink shrimp undergo 11 or 12 molts, in which they shed their tough outer skin, before reaching their final adult form. They normally mature first as males at about 1-1/2 years old, mate, and begin changing their sex to female the following spring and summer. By October (at about 2½ years old), the transition to females is complete, mating again occurs, and 1,500-3,000 blue, oval eggs are extruded. The eggs are carried on the pleopods or swimmerettes, abdominal limbs used for swimming, which are specially equipped with long setae or hairs to hold the eggs. Eggs are carried until the following spring, when they hatch. Sex is difficult to determine, but an expert can do it by examining the shape of the first pair of pleopods and the presence of certain spines on the first three segments of the abdomen. Sometimes pink shrimp skip the male phase and develop directly into 1-year-old females. Occasionally large numbers of 2-year-old males function another

year as males before changing sex. They live up to 4 years, and may function three times as a female.

Pink shrimp grow rapidly. When they are 1, 2, and 3 years old, they "weigh" about 325, 110, and 70/lb., (1.4, 4.1, and 6.5 gm) respectively. Growth appears to vary within age groups with males growing slower than transitionals which in turn grow slower than females.

### Behavior

Off the Oregon coast pink shrimp feed at night on tiny drifting animals and plants known as plankton, and may also feed on small bottom-dwelling creatures during the day. They exhibit a daily vertical movement which appears related to feeding. At night they leave the bottom, and within 2 hours after sundown some may swim several hundred feet to the surface. At dawn an equally rapid descent to the bottom apparently occurs. They do not burrow into the bottom during the day time. During "brown" water periods when coastal upwelling and heavy plankton blooms occur, usually in mid-summer, pink shrimp have also been found off the bottom during day time. Lateral movements undoubtedly occur also, as they are subject to strong currents when off the bottom.

### Distribution and Abundance

Pink shrimp live in the Pacific Ocean from Alaska to San Diego. They are found in fishable concentrations between Queen Charlotte Sound and Trinidad Head, California, a distance of almost 700 nautical miles. Large numbers occur off Oregon between Cape Arago and Heceta Head in areas with a green mud or muddy sand bottom at depths of 35 to 160 fathoms. Rocky bottoms seem inhospitable to shrimp.

We estimate that this population has a biomass of 18-25 million pounds. The largest shrimp ground is between the Columbia River and Yaquina Head where we estimate the population ranges from 20-70 million pounds. Other good shrimp areas

occur to the north and south of Cape Blanco and near the California border.

The populations, like many other marine animal stocks, fluctuate in numbers from year to year. Shrimp, because of their short (3-4 years) life span and environmental changes, may show very drastic changes in abundance annually and by era, or groups of years. Reasons for the fluctuations are not well understood.

### The Fishery

One hundred seventeen vessels manned by about 410 fishermen landed shrimp in Oregon in 1974. Not all of these were Oregon boats; about 5-10% were from California, and a few appeared from the Gulf Coast. Some of these vessels fished all season for Oregon processors. Oregon fishermen fish not only off Oregon, but also off California, Washington, and British Columbia. Even so, the majority of shrimp landed in Oregon are caught off Oregon.

The vessels used in shrimping off Oregon are typical combination fishing boats suitable for use in more than one fishery. Most shrimp fishermen also fish for Dungeness crab or trawl for groundfish such as rockfish and sole during the winter. A few quit shrimping in favor of albacore tuna fishing in the summer. Most boats are between 50 and 80 feet long, wood or steel, and of the western seiner type, but these are gradually being replaced by larger, modern steel boats of western or gulf class. A few are schooner-type vessels used in halibut fishing years ago, and some are of the Gulf of Mexico type.

Fishing occurs between April 1 and October 15 off Oregon. During these months, the weather normally permits vessels to stay at sea up to 4 days per trip. From two to ten 1-2 hour tows are made daily, yielding an average of about 1,000 lbs per tow. Other fish and invertebrates such as rockfish, sole, smelt, hake, anchovy, and sea urchins are also caught. The net is brought aboard over the side of the boat, the catch dumped onto a sorting table, and the net immediately reset for another tow.

The catch is then sorted between tows. Shrimp and marketable fish are stowed and iced in the hold. Unmarketable and nonfood fish are usually discarded. On many vessels, especially in the ports south of Newport, shrimp are stowed in boxes holding 75-110 lbs. Boxing tends to reduce handling and smashing, and it encourages better icing operations at sea. In other boats, mostly those based in Newport and to the north, shrimp are "bulk stowed" loose in bins located in the hold. Shrimp are unloaded after a 1-4 day trip, often iced again at the dock, and then processed, frequently the following day.

Since 1967 machines have replaced hand processing, especially at Newport and south. The high quality of modern machine-peeled shrimp, high labor costs, and stiffer sanitation standards enforced by the FDA have combined to encourage use of machines.

Traditionally, the hand-peel operation in southern ports demanded a fresher, firmer product than the machine-peel operation in northern ports. The machines mechanically separate the head and tail, "squeeze" the meat from the tail shell, and wash and cook the meats. Tails are packaged in tins of 4-1/2 oz. and 1-5 lbs capacity. About 400-500 persons are employed in Oregon to process the catch.

Shrimping has increased dramatically since the fishery landed 0.5 million pounds in 1954. The catch reached 5.5 million pounds in 1964 and averaged 11 million pounds from 1967-71. Landings jumped to 20.6 million pounds in 1972 and reached a record 24.5 million pounds in 1973.

#### Management

The shrimp fishery in Oregon is managed by the state Department of Fish & Wildlife (ODFW). Fishing regulations have been liberal, because the shrimp population off Oregon has consistently maintained a high level despite large catches to date. Since the complicated sex change typical of pink shrimp means that the fishery must harvest

females or potential females, waters off Oregon are closed to shrimping from October 16 to March 31 to protect egg-bearing females. Oregon has also supported management of the shrimp fishery off California by enforcing regulations adopted by that state.

Oregon fishermen and processors are licensed by the ODFW. Fishermen are required to keep a log of their fishing activities, and processors must submit weekly records of deliveries of shrimp. In addition to compiling information on fishing effort, landings, and location of catch, ODFW biologists conduct studies relating to the life history and abundance of pink shrimp populations. Some of these studies have been conducted in cooperation with Oregon State University. Information on harvest levels and abundance of Oregon's pink shrimp is essential in maintaining a continuing fishery on this valuable resource.

#### Acknowledgements

Thanks are due to the many fishermen and processors whose cooperation through the years has been very helpful in increasing knowledge of this species.