

# SEA URCHINS: A New Fishery Develops In California

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Sea urchins, long considered pests in southern California because of their overabundance, are relished by people throughout the world. Much time, energy, and money are spent trying to eradicate sea urchins in California waters. Rather than simple destruction, the National Marine Fisheries Service is promoting the utilization of sea urchin roe. The author describes the operations involved in the developing California fishery for sea urchins. A fishery for the domestic market is firmly established; effort to break into the large Japanese market is continuing.

In southern California, large numbers of sea urchins have long plagued the marine plant and animal community. Researchers have found a direct cause-and-effect relationship between the superabundance of sea urchins and the failure of underwater plants to proliferate (North and Pearse, 1970). Sea urchins feed on seaweed and young kelp and sometimes even destroy mature kelp by feeding on the "hold fasts" that anchor them to the bottom (fig. 1).

Kelp and other seaweeds provide food and shelter for many species of invertebrates and fishes, and marine anglers take advantage of the concentrations of game fish often found in densely forested kelp beds. In addition to their ecological importance, kelp is a useful ingredient in a wide variety of industrial products, such as ice cream, beer, antibiotics, dyes, and welding rods. In California, about 150,000 tons of kelp are harvested annually. In order to maintain the kelp environment, California law restricts harvesters to taking only surface fronds down to a depth of four feet (Frey, Ed., 1971).

Because of the harmful effect of sea urchins on kelp and, indirectly, on fishes and invertebrates, researchers started an eradication program several years ago to control sea urchin populations. Soon kelp harvesters and sport fishermen joined in the effort to

destroy sea urchins. The eradication program appears to have resulted in speedy restoration of some kelp beds in southern California that had been in poor condition (North, 1965).

## The Other Side of the Coin

In Japan, sea urchins are protected rather than destroyed. A complex system of regulations, imposed by government and by fishery cooperatives, limits the numbers and areas open to harvesting and on harvesting methods. In addition, artificial reefs have been created in many areas to provide suitable habitat for sea urchins (Matsui, 1966). The sea urchins are prized for their roe, which is eaten in Japan and in many European and South American countries. The Japanese are the largest producers and consumers of sea urchin roe; well over 20,000 tons of sea urchins are harvested annually.

The chief use is in restaurants that specialize in "sushi," a canape made with a small ball of vinegar-flavored rice, and topped with cooked, raw, or pickled sea food. When sea urchin is used, the rice ball is partially covered with seaweed to form a cup, into which the roe is placed. Sea urchin roe is also preserved with salt or alcohol and salt; the preserved roe is often made into a paste, which is eaten with plain rice or mixed

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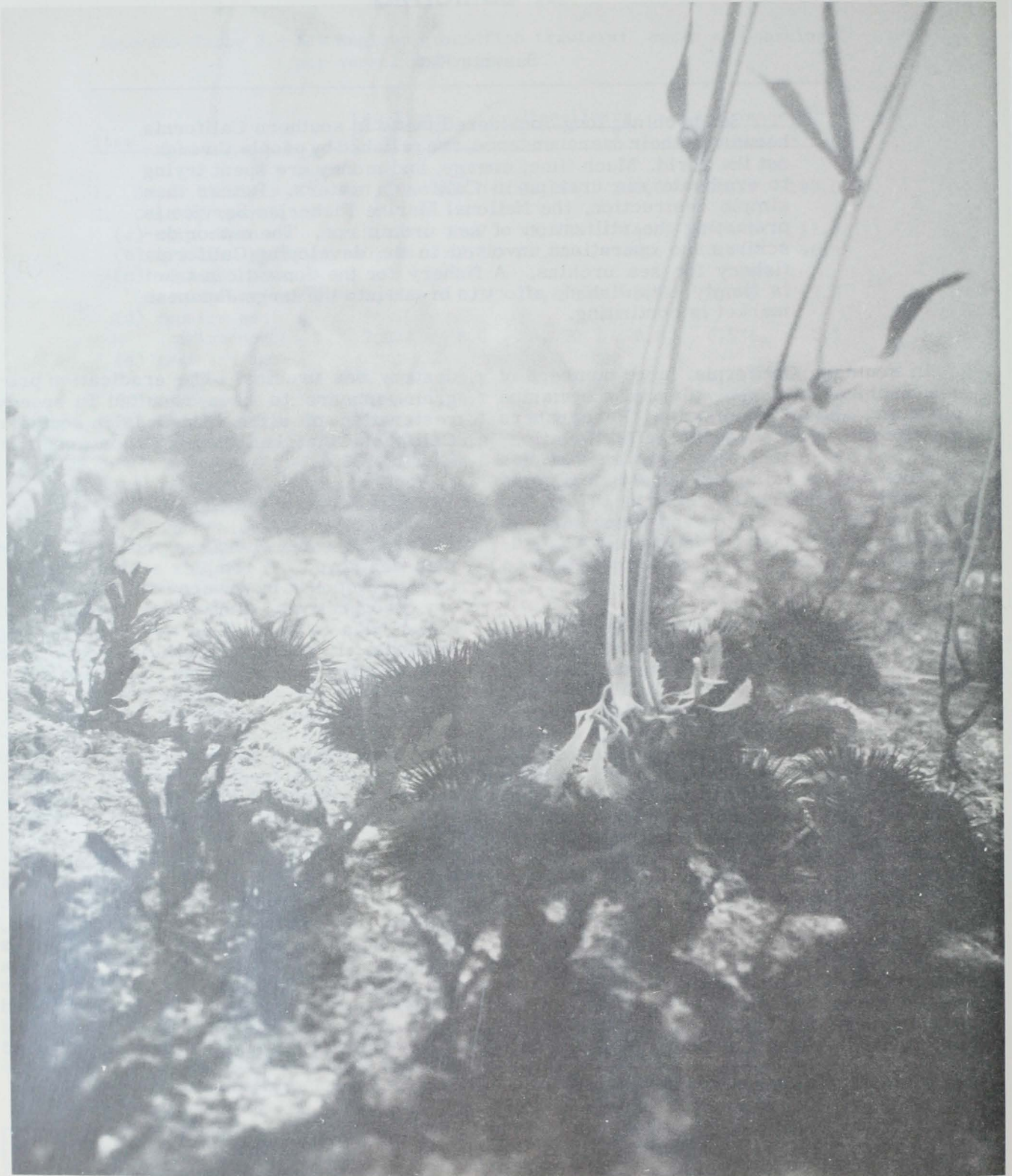


Fig. 1 - Red sea urchins surrounding "hold fast" of giant kelp. (Photo: L. Taylor.)

with other seafood products, such as fishcake and jellyfish. Many Japanese restaurants in the U.S. serve sushi, often using sea urchins and other seafood imported from Japan.

### A Fishery Develops

The development of a sea urchin fishery in southern California seemed logical. The harmful effects of sea urchins to the marine communities called for a reduction in their numbers. Further, a market was available in Japan, in the U.S., and possibly in Europe. Small-scale fisheries for sea urchins have sprung up sporadically in California and have existed for many years in Maine (Scattergood, 1961); however, no attempt had been made to initiate a large-scale fishery for the domestic markets or to develop an export trade.

Recently the National Marine Fisheries Service took a leading role in helping to develop a fishery. NMFS personnel taught potential suppliers how to process the roe, helped obtain preliminary data on processing costs, supplied samples of the product to potential buyers, and brought sellers and buyers together. To date, with NMFS aid, fisheries have been initiated in San Diego and Avila Beach. Following the increased activity caused by these developing fisheries, other firms have started harvesting sea urchins in San Pedro, Santa Barbara, Morro Bay, and San Francisco.

### Two Species Common Off California

Two species of sea urchins, the red (*Strongylocentrotus franciscanus*) and purple (*S. purpuratus*), are common in shallow waters off California. Both species have been implicated in the decline of kelp beds (North, 1965). The red sea urchin is harvested commercially because of its larger size and higher yield of roe, although both are edible. Male and female sea urchins discharge sperm and eggs into the sea, where fertilization occurs. After development, a planktonic larva is formed, which later settles on the bottom to grow into the familiar spiny sea urchin. The red sea urchin feeds primarily on diatoms and seaweed, but it can also subsist on plankton, detritus, and free amino acids (Pearse, et al., 1970). The size of the roe appears to be governed principally by the relative abundance of food. In some localities, marked seasonal variations occur but, in other areas, the roe maintains a rather

stable size. Sea urchins found in kelp beds typically are large and healthy and have robust roe. Male and female roe are difficult to differentiate and both are utilized.

### Fishing & Processing Methods at Avila Beach

Divers collect sea urchins with the aid of conventional "hooka" gear, which consists essentially of an air compressor mounted aboard a small boat with air hoses leading to the face plates of the divers. Wearing dry or wet diving suits to protect themselves from the cold water (fig. 2), divers use short-handled rakes to dislodge the sea urchins from the substrate. The sea urchins are collected underwater in large mesh netting and, after a suitable quantity is collected, the tender hauls the net to the surface and unloads the sea urchins into the vessel. In areas of high concentration, two divers with a tender can harvest about 2,000-2,500 sea urchins per day.

The sea urchins are brought to the processing plant where workers crack the shells with a knife and mallet. The internal parts, including the five gonadal sections, are then removed with a spatula (fig. 3). The roe and other internal parts are then placed on a wire mesh screen and quickly rinsed in salt water to remove most of the extraneous material. The final cleaning process, that of removing the intestinal mesenteries attached to the roe, is done with tweezers (fig. 4). A minimum of salt water is used to rinse the roe. The cleaned roe is drained (fig. 5), then packed in compartmentalized plastic trays (fig. 6), and frozen. Because color is an important factor in the grading of roe, only those of similar color are packed in a tray. A bright yellow color is preferred, but roe with an orange color are also acceptable. Brown roe are discarded or used in secondary products. The processed roe is shipped to a buyer in Los Angeles, who then distributes it throughout the country to specialized Japanese restaurants.

### Future of California Fishery

The future of the budding sea urchin fishery is dependent on several factors. The most important of these is the acceptability of the frozen product in the Japanese and European markets. Initial reaction to trial shipments sent to Japan have been favorable; the color, texture, and flavor were deemed

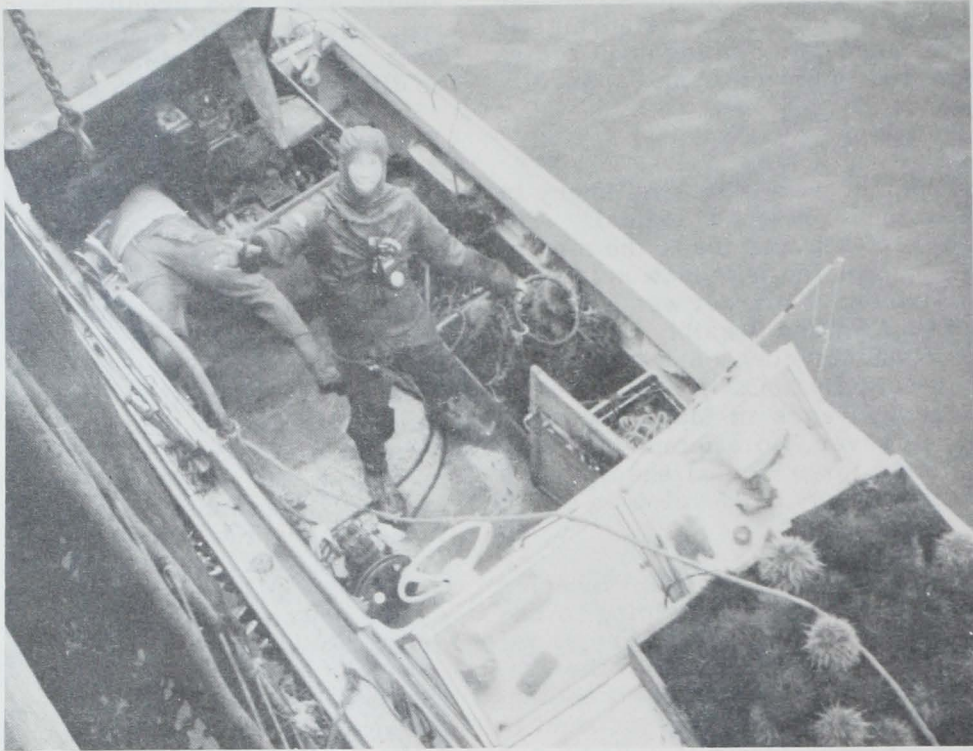


Fig. 2 - Sea urchin diver.



Fig. 3 - Workers split shell of sea urchins and scoop out the roe.



Fig. 4 - Tweezers are necessary to remove intestinal membranes from the roe.



Fig. 5 - Sea urchin roe are drained on a wire screen.



Fig. 6 - Plastic trays with compartments for individual roe are used for packing.

acceptable. In addition to quality, economics and effect of competition from other export nations and local fisheries in Japan will determine the feasibility of establishing an export trade. NMFS will continue to investigate methods to improve efficiency of harvesting and processing. It will try to determine which of several products is most suitable for a viable U.S. fishery.

#### Tips on Pursuing This Fishery

A schematic flow diagram (fig. 7) is given to aid persons interested in pursuing this fishery. About 20 percent of the sea urchins are discarded because of discolored or undeveloped roe. Eight good sea urchins (forty segments of roe) yield about a pound of fin-

ished product. Using this diagram, one can obtain an approximate cost for producing the processed roe. Note that in some localities the yield might be quite different; also, seasonal variations, presumably connected with reproductive activity, might affect the yield of roe. Large roe, although economical to process, are not suitable for the sushi trade and, consequently, must be used in other products. Broken pieces of roe can be used in products which utilize sea urchin paste.

In California, divers must obtain special experimental permits from the State Fish and Game Commission to enter the fishery. Processors need a permit from the Department of Fish and Game for handling seafood products, and clearance from the county Department of Public Health.

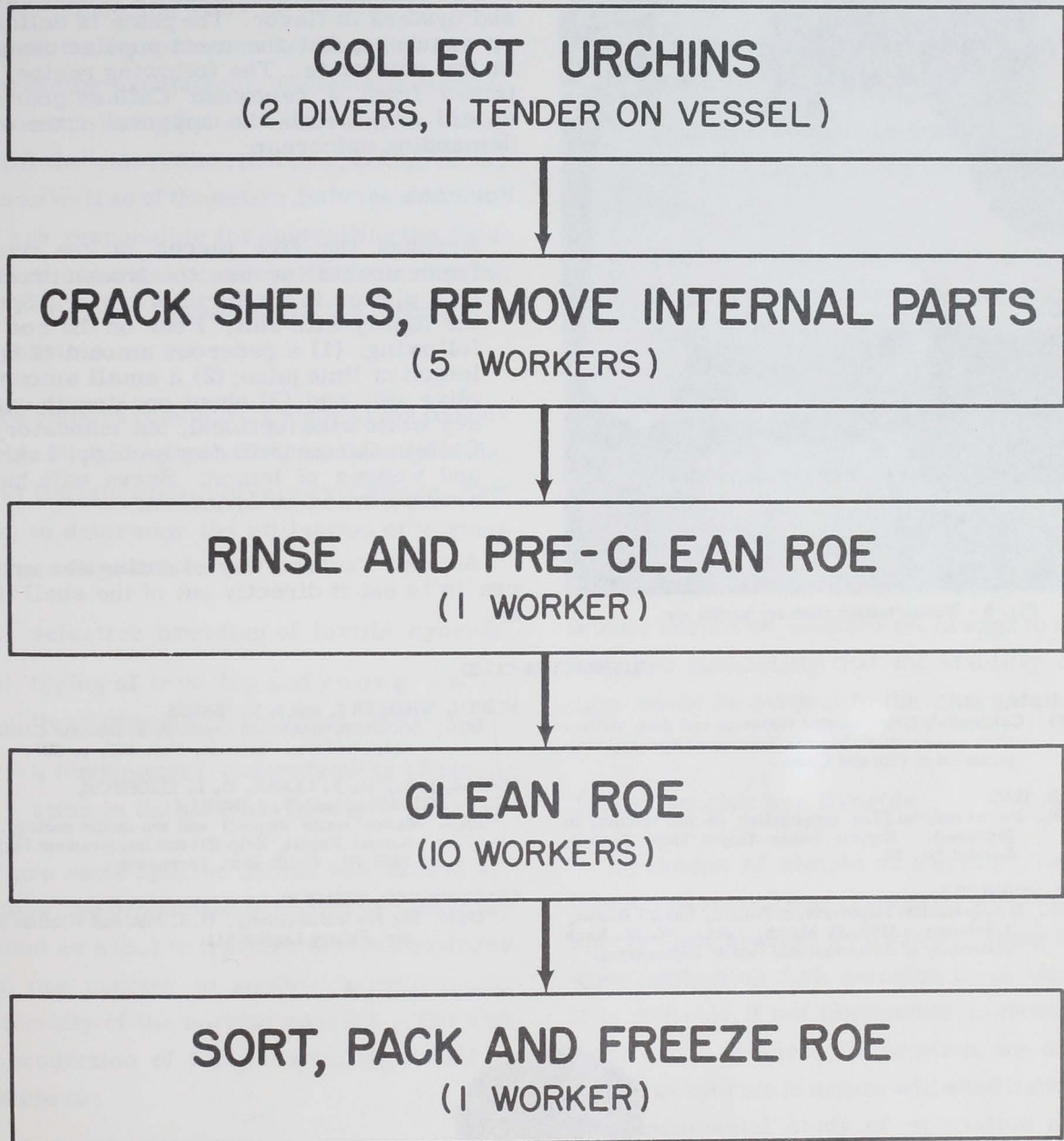


Fig. 7 - Flow diagram, vessel and manpower requirements to collect and process 2,500 sea urchins per day, yielding 200 pounds of roe in trays, and 50 pounds of bulk-packed broken pieces of roe.



Fig. 8 - Worker tasting fresh sea urchin roe.

### Recipe For Preparing Sea Urchin

Sea urchins have been touted to beat caviar and oysters in flavor. The paste is delicious on crackers, but the most popular usage is in the raw state. The following recipe, obtained from a renowned Chilean gourmet, should meet with the approval of the most demanding epicurean:

For each serving,

Arrange the five pieces of roe from a fresh urchin (or use the frozen product) on a platter in the form of a star. Sprinkle lightly with salt. Pour on the roe the following: (1) a generous amount of fresh lemon or lime juice; (2) a small amount of olive oil; and (3) about one-fourth cup of dry white wine (optional, but mandatory in Chile). Garnish with finely chopped chives and wedges of lemon. Serve with hard-crusted bread or crackers.

Another favored way of eating sea urchin roe is to eat it directly out of the shell (fig. 8).

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