

# Wavy Turban Snail

## History of the Fishery

The California commercial fishery for wavy turban snails (*Megastrea undosa*) is a small emerging fishery that began in the early 1990s. Today, turban snails are of commercial value in southern California and Baja California, Mexico. Although still in its infant stages with a small number of participants and a limited market, this fishery has the potential for rapid growth in light of the snail's increased market value and the closure and decline of other dive fisheries. Archaeological evidence suggests that native peoples fished wavy turban snails prior to European and Asian settlement of California.

Wavy turban snails are harvested by divers, and the fishing gear is identical to gear used in the commercial fishery for red sea urchins. Participants in the fishery are also commercial sea urchin harvesters. Recorded landings of this species began in 1992 with overseas markets for the meat (foot) and the shell (made into buttons). Landings peaked in 1993 and crashed the following year with the loss of market demand. Landings fluctuated between 1995 and 1997 with the development of new markets and peaked again at a higher level in 1998. The snail fishery is centered in the area off San Diego with most of the landings coming from Point Loma.

Current market demand for the species is for the foot, which is processed and sold to restaurants as an abalone-like product called wavalone. Other potential markets occur in Mexico, where a fishery for this species "caracol panocha" has existed for years. In Mexico, the wavy turban snail fishery produces a canned meat product. Future expansion of the California fishery may rely on export of snails to Mexico for the canned product market.

In California, the wavy turban snail fishery has virtually no regulations governing the harvest of the species. Fishery participants need only a valid California commercial fish-

ing license to harvest these snails. The only regulations that restrict harvesting are the commercial tidal invertebrate regulations that prohibit the harvest of any snail species within 1,000 feet of the low tide mark on shore. This regulation has prevented expansion of the fishery from the San Diego area to the Channel Islands where most of the snail habitat occurs within this restricted zone.

## Status of Biological Knowledge

Little is known about the biology of the wavy turban snail. Its classification is problematic, as there have not been analyses of related genera worldwide. This results in a question of whether *Megastrea* is proposed as a full genus, as we have done here, or is recognized as a subgenus of *Astraea*. A closely related species is *M. turbanica*, which was first discovered on the outer coast of Baja California, Mexico.

This species of snail is one of the largest turbinid gastropods living in California waters. Shells reach six inches in diameter and have heavy, sculptured, undulating ridges. The base of the shell is flat and the operculum is hard, thick, oval, and uncurved, with well-defined rough ridges. The shell is covered with a fibrous periostracum that gives the shell a light brown or tan color. The periostracum is often covered with coralline algae and other epiphytes. Wavy turban snails are commonly found on rock substrate from Point Conception, California to Isla Asuncion, Baja California. They range in depths from the intertidal zone down to over 250 feet.

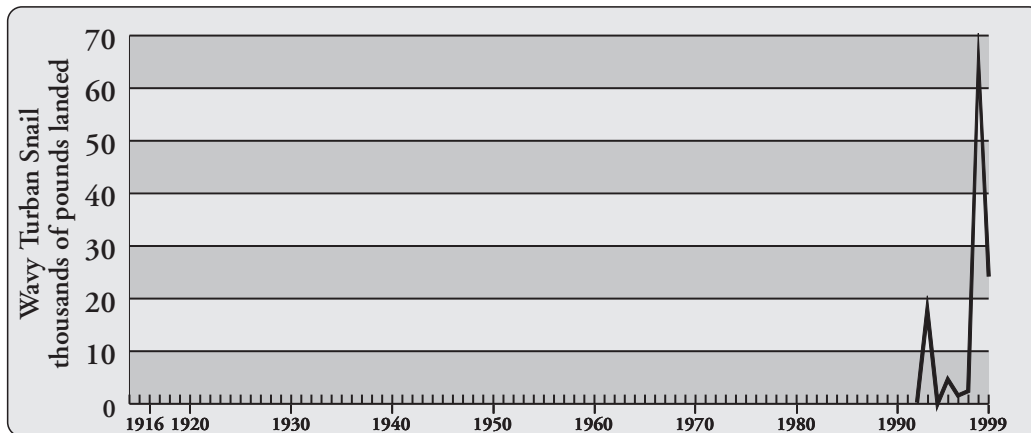
The wavy turban snail is a herbivorous generalist and individuals have been observed feeding on kelp and coralline algae. Predators of this snail are likely the sea stars and the Kellet's whelks based on demonstrated escape responses in laboratory experiments. Other predators include octopuses, lobsters, and fishes.

Wavy turban snails exhibit differential distribution in size and density by depth, which may be correlated with physical (water motion) and biological (intraspecific competition, predation) processes. Smaller snails are found in shallow areas with a high density of individuals, and larger snails are found in deeper depths at lower densities. In extreme shallow (less than 10 feet) and deep portions of the depth range, snail densities are also very low. To escape predation within kelp forests wavy turban snails crawl or migrate up into the canopy of the giant kelp plants each night. Large snails can be found in deep water. For example, a six-inch diameter snail weighing 2.7 pounds was recently collected from Farnsworth Bank, near Santa Catalina Island, in 120 feet of water.

A growth study on a population of wavy turban snails at Santa Catalina Island indicates that these snails are



Wavy Turban Snail, *Megastrea undosa*  
Credit: DFG



**Commercial Landings**

**1916-1999,**

**Wavy Turban Snail**

Prior to 1996, there was no specific species code for wavy turban snail landings on the DFG Commercial Landing Receipts. Therefore, wavy turban snail data for 1992-1996 were derived from commercial landing receipts that were recorded under the miscellaneous sea snail and commercial dive gear codes. Data Source: DFG Catch Bulletins and commercial landing receipts.

slow growing. Growth rates in this study varied both by snail size and density. As is typical for many marine invertebrates, growth rates are higher for smaller sized snails and progressively slower as size increases. Aside from a slow growth rate, this study also reports sexual and seasonal variations in growth. Two different growing periods during the year were identified, a low growth period in the spring and summer months and a high growth period in fall and winter. Sexual differences in growth rate were observed with females growing more slowly than males.

Studies on reproduction conducted in Baja California suggest that reproductive activity is year-round with major peaks in the spring and fall. Immature gonads were observed in juveniles less than 2.2 inches in shell diameter. Fully mature gonads were observed in females with shell diameter greater than 3.5 inches and males greater than 3.1 inches. Histological examination of gonad samples showed that the snails might spawn either completely, partially, incompletely, or not at all. In shallow water, partial spawners were more abundant than in deeper water (60 feet). Complete spawners were dominant. Three reproductive phases occur during the year. Gonad growth and maturity take place during the spring and early summer, followed by spawning in late summer. Somatic growth occurs during the fall and winter. Recruitment of new juveniles has been observed from January to April.

**Status of the Population**

Almost nothing is known about the population densities of wavy turban snails in California. Estimates of population abundance of wavy turban snails are made periodically by the Channel Islands National Park Kelp Forest Monitoring Program each year. These fishery-independent surveys from the northern Channel Islands and Santa Barbara Island have been conducted since 1982. Density surveys indicate interesting temporal patterns in abundance with abundance in 1998 and 1999 the greatest in the time series.

**Management Considerations**

See the Management Considerations Appendix A for further information.

**Ian Taniguchi and Laura Rogers-Bennett**

California Department of Fish and Game

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