

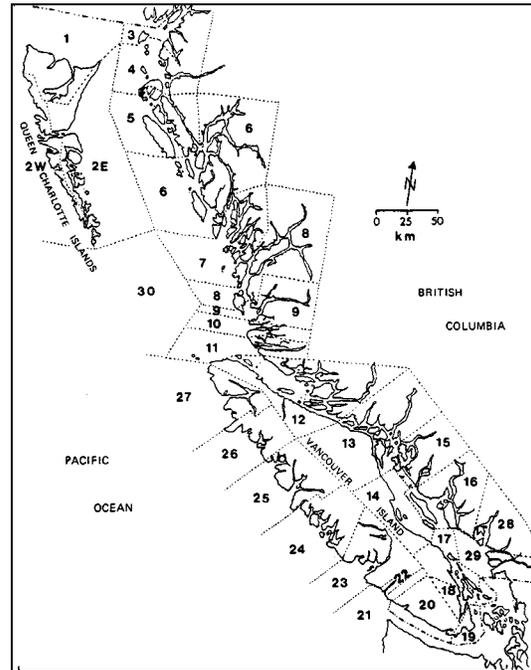
GEODUCK CLAM

Background

The geoduck clam, *Panopea abrupta*, occurs from Alaska to the Gulf of California in the northeast Pacific, in depths from the intertidal to at least 110 m. They are buried up to a metre deep in beds coinciding with the distribution of soft substrates. The fishery occurs throughout British Columbia and is conducted with HOOKA dive gear.

Geoducks have separate sexes. Spawning occurs annually, mostly from June to July in association with increases in seawater temperature. Females release from seven to 10-million eggs. The fertilized eggs develop through several stages in the water column until settlement on the bottom within 40 to 50 days. At a shell length of two to 2 mm, they burrow into the substrate. Fast growing clams can bury to a refuge of 60 cm or more in two years. The end of the burrowing stage coincides with the beginning of annual reproductive activity. Ripe gonads are found in clams ranging from seven to 107 years old, suggesting that individuals may be capable of reproducing over a century.

Individuals can be aged from growth rings using a validated procedure. They are among the longest-lived animals in the world, often reaching ages in excess of 100 years. Geoducks grow rapidly in the initial 10 to 15 years, after which time the growth in shell length almost ceases while total weight increases at a slow rate through a thickening of the shell. Geoducks begin to recruit to the fishery at age four and are fully recruited at 12 years.

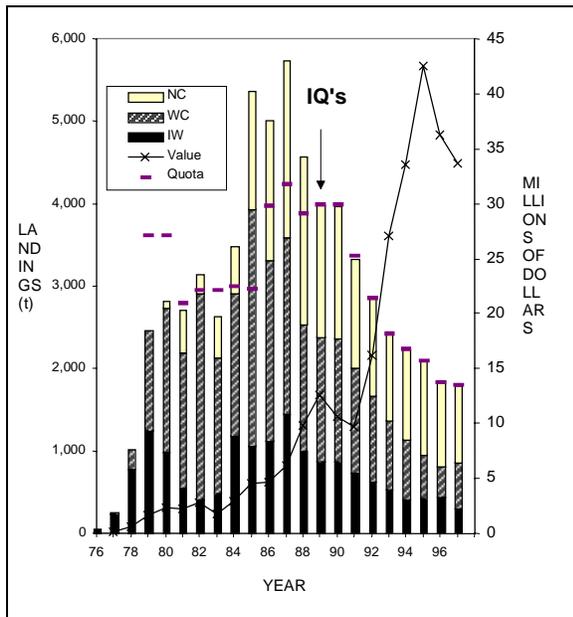


Fisheries Statistical Areas for the coast of B.C.

The Fishery

Geoducks have been fished commercially in British Columbia since 1976. The fishery began in the Inside Waters (Statistical Areas 12 to 19, 28, 29), expanded to the west coast of Vancouver Island (Areas 21 to 27) the following year and to the North Coast (Areas 1 to 11) in 1980. The fishery was initially unregulated and expanded rapidly until 1979 when limited entry was effected and arbitrary catch limits were set for conservation. Quotas since 1984 have been based on fisheries and survey data. Licence limitation reduced the fleet to 55 in 1981. Individual vessel quotas (IVQ's) were introduced in 1989 and all landings since then have been monitored by port observers. Also in 1989, a three-year rotational fishery was implemented, where only one third of the coast was fished in any one year, at three times the annual rate.

The geoduck fishery continues to be one of B.C.'s most valuable. In 1995, landed value peaked at approximately \$42 million (ex-vessel price). The product is sold live to Asian markets and the value of the fishery is largely market-driven. The costs associated with port validation of vessel landings, on-grounds observer coverage, market sample and biological sample collection and processing, and survey data collection are recovered from the industry.



Annual quotas, value and catch by region of British Columbia. NC=North Coast, WC= west coast of Vancouver Island, IW=inside waters of Van. Is.

Resource Status

Annual fishery updates and stock assessments are prepared. Geoduck quotas are based on a fixed-exploitation rate strategy, which rely on estimates of virgin biomass. Virgin stock biomass for each geoduck bed is calculated as a product of estimates of the bed area (m^2), mean virgin geoduck density ($\#/m^2$) and mean individual geoduck weight (kg). Annual quotas are determined by applying an annual harvest rate of 1 percent to the biomass estimate, on a bed-by-bed basis.

Geoduck bed area is measured by digitizing the polygons drawn on reference nautical charts, which are provided by individual fishers via harvest log reports as a condition of licence. The accuracy of these estimates is affected by the accuracy with which fishers initially record the information, the interpretation of this information and the variable imprecision of the nautical charts used.

Estimates of mean geoduck density were initially based on surveys conducted in Washington State, USA and on reports of fishers. The earliest transect survey which was designed to measure density was conducted in B.C. in 1992 and, since that time, standard surveys of geoduck beds are conducted annually throughout the coast. As the results from these become available, density estimates used to calculate biomass are modified.

Area-specific mean geoduck weight is determined from market samples of harvested geoducks. The harvest rate of 1 percent per annum was derived from yield-per-recruit analysis. Pending the analysis of on-going research data designed to examine recruitment and production characteristics and the effect of fishing on recruitment, the harvest rate is maintained at 1 percent.

Individual geoduck beds are grouped and managed by Geoduck Management Areas. Over time, the number of these has increased in order to spread out fishing effort and to reduce the potential for local overharvesting. Some beds are calculated to have been overharvested, according to current estimates of area and density, and are closed to allow recovery. Approximately 9 percent of the total coastwide bed area of 26,400 hectares has been removed from the fishery for this reason.

The commercial fleet has explored and discovered most of the productive ground in the south coast, whereas new beds are still being discovered in the north coast of B.C.

Outlook

Continued improvement in the estimates of geoduck density and total geoduck bed area are anticipated through results of surveys and on-grounds observer reports. The steady decline in quotas seen in the last decade has eased and it is expected that quotas for the near future will remain around the levels set for the 1997 fishery.

There are large numbers of geoducks that inhabit natural refugia. These include deep water stocks, since fishers are limited to depths of less than 60 feet, aggregations that are found in gravel- or shell-packed substrates from which geoducks are too difficult to extract, geoducks that are of inferior aesthetic quality and unacceptable to the market and stocks that inhabit contaminated areas and parks. These form a breeding pool, additional to the populations in harvested areas, which may act as a buffer against the risk of overfishing.

Experimental work on the effect of fishing on recruitment is in progress. Age compositions from biological samples obtained from heavily harvested beds indicate that there has been a strong recruitment event in recent years, suggesting that the negative impacts of fishing on recruitment may be minimal.

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