

REPORT TO THE BOARD OF FISHERIES,
MISCELLANEOUS DIVE FISHERIES



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INTRODUCTION

Southeast Alaska Dive Fisheries

This report provides a general overview of the dive fisheries in Southeast Alaska and Yakutat. Southeast Alaska dive fisheries harvest three species of invertebrates: geoduck clams (*Panope abrupta*), sea cucumbers (*Parastichopus californicus*), and red sea urchins (*Strongylocentrotus franciscanus*). All three fisheries occur primarily in southern Southeast Alaskan waters. The abalone (*Haliotis kamschatkana*) fishery is currently closed to commercial harvest. No dive fishery occurs in the Yakutat area.

The Southeast Alaska/Yakutat area (Region I) consists of Alaska waters between Cape Suckling on the north and Dixon Entrance on the south. The region is divided into two registration areas: Area A, the Southeast Alaska area, extends from Dixon Entrance to Cape Fairweather and Area D, the Yakutat area, extends from Cape Fairweather to Cape Suckling. Southeast Alaska dive fisheries occur in miscellaneous shellfish registration Area A. The Southeast Alaska area is divided into 16 regulatory districts (Districts 1 through 16) with each district divided into several statistical subdistricts for catch reporting. For management purposes, the Ketchikan area office is primarily concerned with fisheries that occur in Districts 1-4, the Petersburg and Wrangell area offices with Districts 5-10 (excluding Section 9-A), the Sitka area office with Section 9-A and District 13, and the Juneau area office with Districts 11-15.

Southeast dive fisheries are relatively recent entrants into the region's commercial fishing industry. The first commercial landings for abalone occurred in the mid 1960s, and red sea urchins, sea cucumbers, and geoduck clams in the early to mid 1980s. Participation in each fishery was often limited to just one or two divers initially and only recently has expanded to current effort levels. Fish ticket information indicates a total of 379 permits reported landings during the 1998/99 season including 219 sea cucumber, 98 geoduck, and 62 red sea urchin permits.

The exvessel value of the 1998/99 Southeast Alaska dive fisheries was estimated at approximately \$3,085,960. This estimate is considered conservative as it is based on the price reported on fish tickets and does not include unreported price adjustments, or situations where price information was not reported. The actual exvessel value will not be known until final processor reports are received and analyzed through the Commercial Fisheries Entry Commission (CFEC). The harvest of sea cucumbers was valued at \$1,636,137 (53% of total 1998/99 dive fishery value), followed by red sea urchins at \$1,213,844 (39%), and geoduck clams at \$235,979 (8%).

Commercial Fisheries Entry Commission

Prior to July 1, 1996, entry into Southeast Alaska's dive fisheries was open access, requiring a permit be issued by the CFEC for participation. Historically, most fisheries started off slowly with little effort but interest grew relatively quickly as exvessel value increased, new markets opened, and fishers explored for new ways to expand beyond the more traditional fisheries such as salmon or groundfish. Effort quickly soared to levels that made it difficult for the department to manage each fishery, and individual fisher's proceeds quickly diminished.

In 1996 the Alaska State Legislature established a four-year moratorium on interim-use permits for the Southeast dive fisheries. The legislation, HB 547, was incorporated into statute as AS 16.43.228. The moratorium specifies a cap on the total number of interim-use permits in the Southeast Alaska abalone, geoduck, sea cucumber, and sea urchin fisheries. The legislation temporarily halts growth in the number of participants in these fisheries and provides specific eligibility criteria to be used in each fishery.

The effective date of the moratorium was July 1, 1996 and is scheduled to expire automatically on June 30, 2000. During the moratorium, the legislation directs the CFEC to consult with the Board of Fisheries, the Alaska Department of Fish and Game (ADF&G), and the participants in these fisheries about a permanent limited entry program. The legislation also directs the CFEC to determine the type of limited entry program that would be most appropriate for these fisheries. These fisheries will return to open access on the expiration date unless the CFEC limits these fisheries under the current limited entry law.

In September 1999, the CFEC proposed to adopt regulations for limiting entry into the geoduck and sea urchin dive fisheries. For these fisheries, the CFEC proposed to establish: 1) the maximum numbers of permits to be issued for each fishery; 2) July 1, 1996 as the date for determining an applicant's qualifications for a Southeast Alaska geoduck or sea urchin dive entry permit; 3) time periods for each fishery in which an individual must have participated in the fishery as an interim-use permit holder to be eligible to apply for an entry permit; and 4) definitions for the proposed limitation of the geoduck and sea urchin dive fisheries. The CFEC originally proposed a return to open access status for the sea cucumber and abalone dive fisheries at the end of the current moratorium with public comment due November 8, 1999. As per a December 1, 1999 CFEC news release, the CFEC met in a public meeting on November 30, 1999 and adopted regulations to limit entry into the geoduck clam dive fishery to a maximum of 104 permits. By adopting these regulations, the CFEC has established a limited entry program to be in place for the geoduck clam fishery when the moratorium ends. The CFEC voted to take no action, at that time, on the proposal to limit entry in the Southeast Alaska sea urchin dive fishery and directed staff to develop alternative options for the CFEC to consider. The CFEC also directed staff to develop proposals for limiting entry in the sea cucumber and abalone dive fisheries for the CFEC to consider.

Southeast Alaska Regional Dive Fisheries Association²

State general funds have not been sufficient to fund the costs of management and research activities required for the dive fishery program. This funding gap has been filled through financial contributions by industry processors, local municipalities, voluntary diver assessments, and test fishing projects in which the resource was harvested and sold by the State. These were ad hoc attempts to keep the dive fisheries open. The industry divers throughout Southeast saw a need to establish an organization and provide for a funding mechanism to meet the funding gap and continue to expand the dive fisheries. Through municipality funding, industry divers hired a project coordinator to develop and promote State legislation addressing this need. The legislation, CSHB 198, passed unanimously in the House and Senate, was signed by the Governor June 20, 1997 and became effective June 21, 1997. CSHB 198 allowed for the creation of the Southeast Alaska Regional Dive Fisheries Association (SARDFA), which is empowered to enact taxes on dive fishery landings to help pay for fishery development.

² Excerpted and summarized from the SARDFA mission statement.

SARDFA is a non-profit, economic development corporation, whose voting members are all licensed Southeast divers (currently approximately 560 industry divers). SARDFA is managed by a Board of Directors, which is elected by the membership. The board is composed of one member from each of five Southeast communities (Ketchikan, Craig, Sitka, Petersburg, and Wrangell), one at-large director, one municipal director, and one processor director, for a total of eight directors.

SARDFA has also created committees to focus on the individual needs of each of the dive fisheries. Currently, the urchin, geoduck, and sea cucumber committees each consist of one member from each community and the at-large position, including one board member. These committees add another eighteen voices with diverse opinions to the management of the fisheries. This diversity helps to air all concerns, ideas, and information about the management of the dive fisheries and allows for public input.

Establishing a democratic, procedural structure has been important to the efficiency and effectiveness of SARDFA. The SARDFA administration collects objectives from individual committee members and supplies the committees with current information concerning dive fisheries throughout North America. The committees then meet and develop recommendations based on this information concerning annual operating plans, survey techniques, and areas, and management plans for the individual fisheries. The committees then report these recommendations to the board of directors. The board reviews and votes on the recommendations. The board then takes approved recommendations to be negotiated with ADF&G dive fisheries managers. The ADF&G is required by the State of Alaska to protect the integrity of the State's fisheries, therefore ADF&G managers will not approve any recommendations which they do not feel coincide with a sustainable fishery.

SARDFA's broad goals are to develop, expand, and enhance new and existing dive fisheries in Southeast Alaska in a sustainable and economically feasible manner. This will be accomplished through several steps: 1) implementation of a dive fisheries landing tax and acquisition of other appropriate funds; 2) utilization of local knowledge and experience of the industry divers as a primary resource to be used and coordinated by ADF&G to help manage the dive fisheries; and 3) creative use of computers and the internet as a management tool.

Sea Otters

The growing population of sea otters (*Enhydra lutris*) in outer coastal waters of Southeast Alaska is having serious negative effects in the region's dive fisheries. In the mid to late 1960s sea otters were captured near Amchitka Island and in Prince William Sound and transferred to various locations where it was hoped they would subsequently establish new populations. The successful release of 412 otters on the outer coast of Southeast Alaska has resulted in a current population well in excess of 10,000 sea otters. Aerial surveys flown in May of 1997 show a 32% increase in the sea otter population over the previous year in Cross Sound and Icy Strait near Glacier Bay (O'Clair and O'Clair 1998). It can be assumed that similar increases are occurring elsewhere in Southeast. Sea otters are continuing to expand their range and may eventually be common in inside waters.

The diet of male sea otters at the Beardslee Islands in Glacier Bay is composed of clams (70%), crabs (10%), and various invertebrates such as sea urchins and mollusks (15%). In California, sea otters were found to select smaller clams that have shallower burrows rather than larger ones that burrow more deeply. The same researchers found that otters preferred abalone, rock crabs, and sea urchins, but when these became rare they broadened their diets to include less desirable prey such as mussels, sea stars,

chitons, and snails. Studies on captive sea otters have shown that they are able to detect and avoid those butter clams containing high levels of toxins responsible for paralytic shellfish poisoning (O'Clair and O'Clair 1998).

In Southeast Alaska, sea otters prey most heavily on butter clams, but also on barnacles, Dungeness crabs, king crabs, Tanner crabs, hair crab, abalone, Kennerley venus clams, mussels, soft-shell clams, geoduck clams, horse clams, gumboot chitons, sea urchins, and sea cucumbers. At Torch Bay in Southeast Alaska, red, purple, and green sea urchins were plentiful and kelps were rare from 1976 to 1978 in the absence of sea otters. Otters were introduced at nearby Surge Bay and urchins were gone but kelps were abundant during 1978 to 1988 (O'Clair and O'Clair 1998).

The commercial harvest of sea urchins in Sitka Sound has been eliminated by sea otter predation. Sea otters moved into the southern Sitka Sound red sea urchin fishery area in 1992 and, over the next year, apparently removed about 16,000,000 urchins or the majority of the standing stock. This area is currently closed to the harvest of red sea urchins due to lack of available product. The Southeast Alaska abalone population is at very low levels; due in large part to continued predation by sea otters.

With sea otters at or nearing historic population levels, competition for shellfish, crabs, and other subsistence species is high, and native people have expressed concern about those resources. Many people have indicated that sea otters have dramatically and negatively affected their subsistence harvest of shellfish. It is expected that the outer coastline will eventually become continuously populated with sea otters from Dixon Entrance to well north of Cape Spencer (Kelley 1995).

ABALONE

Background

The Alaskan abalone fishery targeted the pinto, or northern abalone (*Haliotis kamschatkana*), which inhabits the rocks, lower intertidal, and subtidal surge zones of the outer coasts of Southeast Alaska. Commercially harvestable quantities of abalone occurred in parts of Districts 1, 2, 3, 4, 5, and 13. Life history information for this species in Alaska is very limited. Information from other North Pacific locations is useful in understanding the basic biology of this species. Tagging studies indicate it is a slow growing, long-lived species. Spawning occurs during the summer and through early autumn in the most productive areas. Size frequency information indicates that, in at least some areas, a climax population may have existed prior to recent commercial exploitation. Recruitment levels appear to be low and sporadic and fecundity increases greatly with increasing shell length. Known predators include rockfish, starfish, octopus, sea otter, and man. Throughout the range of this and various other abalone species, exploitation has usually resulted in stock depletion and restrictive management.

Abalone can be picked by hand from the shoreline during extreme low tides. However, until recently, most of the subsistence and personal use and all of the commercial fishery utilized scuba or hookah umbilical diving gear and most of the harvest occurred subtidally. Current subsistence and personal use regulations prohibit the use of compressed gas systems (e.g. scuba or hookah).

Fishery Development and History

The abalone fishery was marked by a boom in harvests and effort in the late 1970s followed by declining harvests and increasing effort (Table 10.1). The decline in harvests may be attributed to a mix of excessive fishing, predation by a growing sea otter population, and apparent low productivity of abalone stocks when heavily harvested. Driving the effort changes was an increase in value from one dollar a pound in the early 1970s to more than ten dollars a pound in the last four seasons.

The marked increase in harvests and effort came in the 1978/79 season, when effort increased more than three-fold and harvests jumped to 180,000 pounds from a long-term average of about 6,000 pounds. Harvests peaked at 378,685 pounds in the next season, the first of the seasonal accounting year. This peak exceeded the quota of 250,000 pounds adopted by the board in the spring of 1980 and the fishery was closed by emergency order for the first time.

High harvests continued through the 1981/82 season when 371,000 pounds were landed, despite a further reduction in the guideline harvest range (GHR) to a maximum of 125,000 pounds and a season shortened to two months. By the 1984/85 season, it was apparent that the resource might be in trouble when the lower end of the GHR (86,000 pounds) was not reached despite 151 days of fishing.

The 1990/91 through 1995/96 seasons opened on October 1 and with the exception of District 13, which was managed separately and closed by emergency order, the length of the season for the rest of Southeast Alaska was set prior to the opening to avoid overharvest. A harvest of 68,400 pounds during the 1990/91 season was the beginning of a second downward trend that was to continue through the most recent seasons.

As the 1994/95 season progressed, it became apparent that harvests were much lower than anticipated, and dramatically lower than historic levels. Fish ticket data indicated that 15,055 pounds had been harvested during the eight-day opening. Despite requests from harvesters to reopen the fishery, the southern Southeast fishery was not reopened. The District 13 fishery was open from October 1-5, 1994 and October 12-14, 1994 for a total of eight days. A total of 7,824 pounds of abalone were harvested from a Guideline Harvest Level (GHL) of 8,000 pounds. Anecdotal information from harvesters indicated that good harvest areas were difficult to find. Harvest per unit effort for the fishery (lb/diver/day) declined to 64% of the 1993 level.

The 1995/96 southern southeast abalone fishery extended from October 1 - 6, 1995 with an upper GHR of 10,000 pounds. A total of 8,524 pounds was taken by 44 divers with 48 landings in six days. The average price per pound was \$8.99 giving the fishery an exvessel value of \$74,074. Due to poor harvest rates and a concern by some harvesters that abalone populations were greatly reduced from historic levels, the fishery was not reopened despite not reaching the upper end of the GHR. The District 13 fishery extended from October 1 - 5, and from October 15-16, 1995, with an upper GHR of 6,000 pounds. Harvests of 3,833 pounds and 1,995 pounds occurred, respectively, during the two openings (5,828 pounds total). A total of 56 divers made 73 landings with an approximate exvessel value of \$52,452 in the District 13 fishery.

In response to a dramatic decrease in harvest rates observed during the past several seasons, the apparent lack of abalone in many of the important traditional harvest areas as noted by department divers conducting sea urchin assessment surveys, and the numerous comments from subsistence users and commercial divers regarding the diminishing numbers of abalone, the department closed the 1996/97 abalone season by emergency order (1-M-05-96). The emergency closure is consistent with 5 AAC

38.035. AREA CLOSURES. (b) which states “When the commissioner finds that continued fishing effort would jeopardize the viability of miscellaneous shellfish resources in territorial waters of Alaska within any statistical area, he shall close such waters by emergency order.” The closure applied to all of Southeast Alaska including both the Sitka area and southern Southeast fisheries.

Regulation Development

Prior to the boom in harvest and effort in the late 1970s, abalone harvests were regulated primarily by response to local market conditions. Quotas, season limitations, and guideline harvest ranges were not imposed until 1980 after harvests began to soar.

The major fisheries are divided into District 13 (northern outer coast) and Districts 3, 4, and 5 (southern outer coast) fisheries. This division was established historically by early fishing and landing patterns that generally persisted throughout the fishery’s history. Closed waters around Craig/Klawock, Ketchikan, Sitka, and Coronation Island were adopted to protect stocks used for subsistence and personal use from commercial exploitation.

Size limits have undergone several increases prior to reaching the present four-inch minimum. The size limit was raised from 3 inches to 4 inches in 1968 for Districts 1 through 6 in 1968 and from 3 inches to 3½ inches for Districts 9 through 14 to in 1976. A general change for all districts to 3½ inches occurred in 1977. The board adopted an increase in minimum size to 3¾ inches in the spring of 1979. In November 1993 the board again increased the legal size limit to 4.0 inches due to concerns that abalone stocks were declining. The intent of the larger size limit was to reduce the harvest rate on mature abalone thereby increasing the potential for improved stock abundance. The board also adopted a regulation prohibiting diving for fourteen days before and after the fishery.

Guideline harvest ranges and season length have dropped in several steps. In 1980 the harvest limit was set at 250,000 pounds and the season was reduced from all year to September 1 through May 31. In the spring of 1981, the GHR was reduced to 100,000-125,000 pounds, and the season was shortened to September 15 through May 15. In 1982 the board split the existing guideline harvest range, allocating 86,000-107,500 pounds to the Ketchikan area, and 14,000-17,500 pounds to the Sitka area. In 1983 the board split the season into autumn and spring segments in each of which 50% of the allowable harvest was to be taken. The BOF restricted the 1985/86 harvest to a range of 25,000-50,000 pounds in the Ketchikan area and a maximum of 8,000 pounds in the Sitka area. The District 13 season was reduced to November 1 to May 15 and all other areas were changed to October 1 to May 15. In 1986 the season was changed to October 1 through May 15 for all areas. The upper GHR was further reduced for the 1995/96 season to 10,000 pounds for southern Southeast and to 6,000 pounds for the Sitka area. The reduction was due to a continued apparent decline in abalone abundance in many areas, especially southern Southeast Alaska, and also to increased otter predation. These conservative GHRs were intended to provide a limited commercial fishery while increasing the potential for increased stock abundance.

Fishery Outlook

The department believes that the current population is far below its historic level because of overfishing and predation by sea otters. As this low level does not promote significant recruitment, we are unsure when, or if, the population will rebuild to a level needed to allow a commercial fishery. A fishery will not be opened until a management plan is developed that addresses the issues and information identified in 5 AAC 39.210, Management Plan for High Impact Emerging Fisheries. As part of that process the department would require: 1) a plan for determining productivity and abundance of abalone, and 2) a harvest strategy that would ensure a sustained fishery. Both of these elements would be difficult to achieve. Even with that information available, the department would be very concerned about local and serial depletion under any kind of open access or limited entry fishery. The department believes that it is highly unlikely that stocks will recover sufficiently to allow commercial fishing to resume.

SEA CUCUMBER

Background

The commercial species of sea cucumber harvested in Southeast Alaska is the giant red sea cucumber (*Parastichopus californicus*). It is a common species distributed from Mexico to Southeast Alaska and has been observed at least as far west and north as Cook Inlet and Kodiak Island. It occupies a broad range of subtidal habitats from nearshore shallows to over 100 fathoms. The sea cucumber's primary food is detritus which it ingests along with significant amounts of fine substrate. Its ecological function seems to include recycling detrital material into nutrients for the primary producers in the marine food chain. *P. californicus* appears to favor locations with moderate current, avoiding mud bottoms and areas subject to inundation by freshwater or glacial runoff. The abundance of sea cucumbers in Southeast Alaska is greatest in the southern and western portions in areas not directly exposed to the open ocean.

Fishery Development and History

The first experimental fishing permits for sea cucumbers were requested in 1981. One or two permits were issued each year between 1981 and 1986, with only one vessel reporting landings during this period. The first fisheries were based in Ketchikan and, over the years, evolution of management strategy resulted in a partition of most of the statistical subdistricts into one of three seasonal rotations. The initial fishery had no established season; harvests are reported in Table 10.2 on an October to September basis for consistency with years since 1990.

Most of the vessels pioneering this fishery were small skiffs of limited range and capability operating in the vicinity of either Ketchikan or Sitka, mostly as a day fishery. Larger vessels with two divers and a crewman

with living quarters and the capability of transporting product and divers during typical fall and winter weather conditions are now the norm. Harvest is conducted by scuba or hookah diving gear usually at depths of 10 to 60 feet. The number of hours each diver can work each day depends on the maximum working depths and may be as little as three or four hours. Harvest consists of collecting sea cucumbers in large mesh bags and transporting the filled bags to the tendering vessels.

Processing is currently conducted in a two step process. The freshly caught animal is eviscerated on the fishing grounds. Drained sea cucumbers are then placed in buckets or totes and transported to the processing facility where they are processed immediately or held for up to two days in a refrigerator, or on ice. Sea cucumbers have been purchased by the bucket in previous years but are now sold exclusively by drained weight. Holding times for the eviscerated, densely packed sea cucumbers are limited by their rapid decomposition even when refrigerated.

Processing at the plant consists of separating the muscle bundles from the skin with a scraper or knife. The major products from this fishery are the longitudinal and transverse muscle bundles or meat, and the skins. Skin processing involves cooking or boiling the skins to a specific texture and drying the product. The dried skins are a preferred item in upscale oriental cuisine. The dried skin product, known in the industry as *trepang* or *beche de mer*, has only been acceptable to the local processing industry during the past few years.

Most of the harvest in Southeast Alaska occurs near the communities of Ketchikan, Sitka, and Craig. Sea cucumbers harvested in Southeast Alaska are processed in Ketchikan, Craig, Petersburg, and Sitka with a significant amount of product processed in British Columbia.

Effort increased in the fishery to a maximum of 424 divers during the 1995/96 season. This high number can be attributed to high prices the previous year and concerns that the fishery was to be limited by the CFEC. Beginning July 1, 1996 the CFEC imposed a moratorium into Southeast dive fisheries that limited the number of divers able to participate in the sea cucumber fishery to 472. The CFEC moratorium is scheduled to end July 1, 2000. The GHL has been approximately 1 million pounds (drained weight) in each of the most recent three seasons (Table 10.2). A decreasing number of divers has taken these harvests in an increasingly shorter season indicating an intensification of the fishery.

Management Strategy and Regulations

The fishery expanded rapidly in the late 1980s and in 1989 the fishery exceeded the ability of the department to manage by the permit system. The department closed the fishery in May 1990 and reopened it in October 1990 following development of the Southeast Alaska Sea Cucumber Commercial Fisheries Management Plan (5 AAC 38.140). This plan seeks to protect subsistence opportunities and provides for sustained commercial fishing harvests. To protect subsistence opportunities, the cucumber management plan established 18 areas closed to commercial fishing (5 AAC 38.140 (k)). There are also provisions to prevent the use of diving gear in the subsistence (5 AAC 02.020 (1)) and personal use (5 AAC 77.010 (l)(3)) fisheries in those areas. Annual commercial fishery guideline harvest levels are approximately 5% of the total sea cucumber biomass taken on a three-year rotational basis (i.e. 15% on a three-year basis). Rotational fisheries have the advantage of lowering overall departmental assessment survey and management costs.

Initially the Sea Cucumber Management Plan provided for a season that began October 1 in 1990 with two 48-hour openings per week. The season was changed to a November opening in 1993, and in order to

extend the season, weekly fishing periods were reduced to seven daylight hours on Mondays in November, plus an additional four daylight hours on Tuesdays from December through March. The current version of the Sea Cucumber Management Plan was amended by the board for the 1997 season. The plan provides for an October 1 opening date with weekly fishing periods of seven daylight hours on Mondays in October, plus an additional four daylight hours on Tuesdays from November through March. There are also provisions for limiting the numbers of divers per vessel to two, providing fishing period trip limits of 2,000 pounds per person, and limiting gear to scuba, surface-supplied systems, or snorkels.

1998/99 Season Summary

The 1998/99 season opened by regulation on October 5, 1998. A combined total of 965,345 pounds was available for this season. A total of 1,055,572 pounds of sea cucumbers were harvested by 219 divers with a total exvessel value of \$1,636,137. Average exvessel value per pound was \$1.55. The number of divers and number of open periods decreased from the 1997/99 season's fishery while the average pounds harvested per diver increased indicating increasing effort within this fishery.

1999/2000 Season

Biomass estimates made during the summer of 1999 indicate a harvestable surplus of 1,580,000 pounds of sea cucumbers is available for the 1999/2000 season. This is the highest GHL on record and is partly due to the inclusion of two wholly new areas and the expansion of two previous fishing areas. The two new areas collectively added an additional 118,000 pounds to the GHL. The fishery opened by regulation 8:00 a.m., October 4, 1999.

GEODUCKS

Background

Known geoduck clam (*Panopea abrupta*) beds have a patchy distribution in the central and southern portions of Southeast Alaska, primarily in protected waters near the outside coast (Figure 10.2). Studies conducted in Washington State, British Columbia and more recently in Southeast Alaska indicate this clam may live to be over 100-years old. Southeast Alaska is the extreme northern limit of the geographic range of this species and recruitment is sporadic or very low seasonally. Sporadic recruitment, low growth rates, and high maximum age makes this species susceptible to overharvest.

A troubling problem is the tendency for geoduck clams to bioaccumulate undesirable microorganisms or compounds. In particular, high levels of paralytic shellfish poisoning (PSP) have been found in geoducks in Southeast Alaska, most strongly associated with the viscera. However, the mantle and necks are the usual body parts consumed and PSP concentrations are lower in these parts. Though this situation permits the sale of processed clams with viscera removed, exvessel value for processed clams is significantly less than that for whole, live product.

In order to protect consumers, the state requires that each individually delivered lot of commercially harvested clams be tested by the Alaska Department of Environmental Conservation (ADEC) laboratory in Palmer and certified to be within acceptable levels of PSP prior to release for marketing. In addition, water quality for commercial beds is tested for human pathogenic microorganisms and certified safe by the ADEC. Waste portions of the clam must be disposed of safely. The need to securely quarantine lots subject to approval for sale, the time required for transport and testing of samples, and the relatively short shelf life of the fresh product, require a closer working relationship between government and industry to successfully market the product than is necessary for most other seafood products.

Fishery Development and History

Starting in 1978 with the Noyes Island survey, state grants were used to find and qualitatively assess commercial beds in the Ketchikan, Craig, Petersburg-Wrangell, and Sitka areas. A number of potential commercial beds were located near Ketchikan, Craig, and Sitka. Procedures for testing and certifying the product for human consumption were established by the ADEC. Population assessment surveys were conducted on three beds on Noyes Island near Craig, a harvestable biomass estimated, and the ADEC completed sanitation surveys on these areas. Two processors conducted the required modifications to their facilities and procedures to handle batch processing, lot testing, and product quarantine and were certified to process geoducks. In late 1985, the first permit was issued for the commercial harvest of geoduck clams. During the 1985/86 season almost 144,000 pounds of the 300,000 pounds five-year quota (Table 10.3) were harvested by eight divers in the Noyes Island area. During the 1986/87 season, only 28,191 pounds were harvested by only three divers. The decline was mainly due to poor marketing conditions and high operational costs. Increased interest in this fishery began after the department completed a population estimate on the west side of Gravina Island in 1987. During the 1987/88 season all harvest occurred in the spring of 1988 with a harvest of 124,568 pounds from Vallenar Bay on Gravina Island, and 60,577 pounds from Noyes Island. Biorka Island near Sitka was included in the geoduck fishery during the 1989/90 season, Kah Shakes was included in the 1990/91 season, and the Goddard area entered the fishery during the 1998/99 season. Pending ADEC water quality testing, Nakat Bay and Sea Otter Sound will enter the fishery during the 1999/2000 season.

The 1991/92 geoduck fishery saw an increased interest in participation and harvest by divers from Washington State. Prior to the 1991/92 season non-resident participation was minimal. Exvessel value and the number of divers began to increase with the 1992/93 season. Approximately 100 divers currently participating each season though exvessel value has decreased. All miscellaneous shellfish dive fisheries in Southeast Alaska are currently under a limited entry moratorium (July 1996 through June 2000) with 169 divers eligible to participate in geoduck fisheries. Each diver is required to have a current Interim Use Permit and a Miscellaneous Shellfish Species Registration/Permit Form during fishing operations.

Management Strategy and Regulations

The objective of geoduck fishery management is to allow only a very low exploitation rate because the species is long-lived and recruitment is sporadic and low. Harvests are by permit only and have been allowed from October through May 31, to avoid the summer spawning and recovery period and to minimize PSP toxin levels.

Harvests are restricted to beds for which biomass estimates are available. Only four areas had been surveyed prior to 1997: Symonds Bay on Biorka Island in the Sitka Management Area, West Gravina Island, Kah Shakes, and northern Noyes Island (Ulitka Bay, Little Steamboat Bay, and Steamboat Bay) in the Ketchikan Management Area. The GHL for each area is estimated as 2% of the harvestable adult population. Following reassessment dive surveys during the summer of 1997, it became apparent that the abundance of geoducks in areas currently being fished was much lower than expected and the distribution of geoduck clams more limited than previous surveys had indicated. These preliminary results suggested that previous GHLS established for the geoduck clam fishery may not be sustainable. As a result, the department delayed the opening, originally scheduled for October 1, 1997, until further analysis and review of the survey results were completed.

The department held public meetings to discuss possible management options for the fishery including a season opening date. Representatives of the CFEC, Fish and Wildlife Protection (FWP), and the ADEC also attended. These meetings were held in the Ketchikan ADF&G office but were teleconferenced by numerous individuals (e.g. Sitka and Petersburg area offices). An opening date and daily open hours were agreed on as well as a GHL for each area. Generally, the 2% per year harvest rate was maintained for all areas but the number of years an area would remain fallow was increased to four years in Symonds Bay and 13-16 years on west Gravina Island with Big Steamboat Bay and Kah Shakes remaining on a two-year rotation. This expanded rotational cycle in Symonds Bay and west Gravina Island allowed for a viable fishery and provided an opportunity for industry self assessment; potentially providing funds for future reconnaissance and assessment surveys (see below).

As a result of the meeting held prior to the 1997-98 season, the Southeast Alaska Geoduck Task Force was formed. During the January 7, 1998 meeting, the task force voted to assess themselves \$0.25 on the pound for the February 1998 commercial opening. Through a cooperative agreement between ADF&G and SARDFFA, portions of funds generated through the voluntary self-assessment were used to estimate the geoduck clam biomass in Port Alice (summer 1998), and Turn Point, Cone Bay, and Nakat Inlet (Summer 1999). Port Alice was scheduled to open during the 1998-99 season but ADEC water quality sampling was not available in time for the general opening on November 15, 1998 and this area was therefore not opened. Without ADEC approval for Port Alice for the 1998-99 season, the general industry consensus during the October 14, 1998 Geoduck Task Force meeting was to delay opening Port Alice until the 1999-2000 season.

A cooperative agreement was also entered into between the ADF&G and the Sitka Harvest Divers Association (SHDA). Using funds provided by the SHDA, ADF&G conducted a survey of the geoduck clam populations on the west coast of Baranof Island and nearby islands in portions of Subdistricts 113-31 and 113-41. This area has since become known as the Goddard area due to the proximity of the Goddard Hot Springs.

Reconnaissance surveys within Sea Otter Sound, Nakat Inlet, and the Goddard area were conducted by SARDFFA and SHDA prior to population assessment surveys by the Department of Fish and Game. The purpose of the reconnaissance surveys was for industry to identify the most likely sites capable of

supporting commercial geoduck fisheries. This data was then given to the ADF&G for use in preparing biomass assessment surveys. The department does not have the funds to provide for reconnaissance of new areas and therefore must rely on industry to provide accurate, preliminary surveys of areas they expect may have commercial potential.

Current regulations (5 AAC 38.110.) refer to the general harvest of clams; requiring a permit that specifies the species, method of fishing, area of operation, and harvest levels. There are no regulations that specifically address the Southeast geoduck clam fishery. Board Proposal 281, submitted by the department for the January 2000 Board of Fisheries meeting, attempts to address this problem.

1998/99 Season Summary

During the 1998/99 season, all geoduck clam fisheries were under a limited entry moratorium with 169 divers eligible to participate. Each diver was required to have a current Interim Use Permit and a Miscellaneous Shellfish Species Registration/Permit Form during fishing operations. Working from a total of 56 boats, 98 divers landed an estimated 111,311 pounds of whole geoduck clams with an estimated exvessel value of \$235,979 (Table 10.3).

The SARDFA Geoduck Committee requested the department start the 1998/99 season as of Sunday, November 15, 1998 and fish one day each week to avoid conflicts with the sea cucumber and sea urchin dive fisheries. Initial openings were limited to 9:00 a.m. to 3:00 p.m. as suggested by the geoduck task force. By mid-November, when the geoduck fishery started, the majority of the sea cucumber GHL had been reached. Initial effort resulted in a limited number of open fishing periods: Foggy Bay (3 openings, 16 hours total), Nehenta Bay (1 opening, 6 hours), Little Steamboat Bay (1 opening, 6 hours), and Goddard (10 openings, 60 hours total). In the Ulitka Bay area the open fishing period was expanded later in the season due to inclement weather affecting harvest and subsequent low effort levels. The Ulitka Bay GHL was eventually taken after the area was opened for a total of 399 hours, closing 10:00 a.m., February 2, 1999.

1999/2000 Season

The department has established a total GHL for the 1999/2000 season of 250,400 pounds of whole geoduck clams, assuming all areas to be opened by the department meet ADEC water quality standards. The fishery opened November 28, 1999 and as of December 1999 the Sea Otter Sound area remained to be certified by the ADEC. The GHL minus the Sea Otter Sound area is 204,900 pounds of whole geoduck clams.

SEA URCHINS

Background

Two commercial species, red sea urchins *Strongylocentrotus franciscanus* and green sea urchins *S. drobachiensis*, are common in Southeast Alaska. The red sea urchin occurs primarily on rocky shorelines of the outside coast with largest concentrations in southern Southeast Alaska. Green sea urchins are most common in protected waters of Southeast Alaska in a wider variety of habitats. The red sea urchin population is kept at very low levels by sea otters on many areas of the outside coasts, including Chichagof Island, the Maurelle Islands, the Barrier Islands, southern Prince of Wales Island, and nearby areas. The only commercial fishery for urchins in recent years in Southeast Alaska has been for red sea urchins. Urchins are harvested for their gonads, commonly called roe or uni, with no distinction made between males or females. The product is most valuable fresh and is marketed primarily in Japan.

Fishery Development and History

Harvests of red sea urchins in Southeast Alaska began in 1981 near Ketchikan, primarily around Gravina Island. Both red and green sea urchins were harvested, with the vast majority of the harvest comprised of red urchins. Participation and harvest built through the mid-1980s (Table 10.4), expanding to include Districts 1, 2, 3, and 4. Harvests peaked at 890,092 pounds in 1986-87 and then tapered off due to difficulties in marketing. In 1988, harvests were restricted to District 1, Gravina Island, and District 3, the West Coast of Prince of Wales Island due to lack of staff time and budget support. Once the major processor ceased operations in 1989 the fishery was closed.

Interest in establishing a commercial urchin fishery in Southeast Alaska resurged in 1990 due to the success of urchin fisheries in California, Washington, and British Columbia. This interest was directed towards the Sitka area; however, lacking basic stock information, further commercial harvest was postponed until completion of a test fishery there in late 1990 and early 1991 to estimate population size and to gather size frequency data. A limited commercial fishery opened in southern Sitka Sound in January 1991 with a harvest of 174,233 pounds by closure in April. Subsequent fisheries were opened in 1992 and 1993, and then closed indefinitely due to extreme predation by sea otters. All other areas of Southeast Alaska remained closed pending development of a management plan, stock assessments, harvest quotas, and means of monitoring and managing the fishery.

The department initiated a test fishery in District 1 near Ketchikan during the 1995-96 season as a method to pay for population assessment surveys. The test fishing contract was awarded to Ocean Fresh Seafoods of Fort Bragg, California, the sole bidder. Under the contract, Ocean Fresh paid the department \$139,567 in exchange for the opportunity to harvest 3,000,000 pounds of red sea urchins. The test fishery spanned 14 months from March 1995 through April 1996, and harvested 2,988,647 pounds of red sea urchins (Table 10.4). Monthly roe recovery averaged between 5.5% and 12.2%. The average price per pound ranged from \$0.29 to \$0.81. The test fishery provided considerable employment and revenues to Southeast Alaska, and was estimated to have an exvessel value of \$1,400,000 paid to dive harvesters.

Since the test fishery, regular population assessment surveys have been completed in parts of Districts 1, 2, 3, 4, and 13 on a three-year rotational basis. Surveys are conducted only in subdistricts where commercially viable populations exist. Fully developed red sea urchin fisheries have been conducted during the 1996-97, 1997-98, and 1998-99 fishing seasons. The overall quota has remained stable between 4.4 and 6.1 million pounds, however, selected areas have seen reductions in biomass due to sea otter predation. Most areas in Southeast Alaska supporting red sea urchin populations are threatened by the rapidly expanding sea otter population. The numbers of participating divers and landings have decreased over the past three years (Table 10.4), most likely due to poor market conditions in Japan and Asia.

One of the most notable changes affecting the red urchin fishery has been the formation of the Southeast Regional Dive Fishery Association (SARDFA) in February 1998. Industry divers in Southeast Alaska recognized the need for a mechanism of funding newly established dive fisheries, funding that the ADF&G was unable to provide. SARDFA was formed by legislative action (CSHB 198) to allow taxation of dive-harvested product, to be used primarily for funding management and research activities of dive fisheries. Prior to the SARDFA formation, funding of the sea urchin fishery was obtained through industry processors, local municipalities, and test fishing conducted by the state. Currently, sea urchin landings are assessed by SARDFA at 7%.

Regulation Development

Prior to 1996, permits to fish for sea urchins were given under authority of 5 AAC 38.062. In 1984, the first year with significant landings of red urchins, there was a size limit of 3-5 inches test diameter to protect small urchins for recruitment, to provide large urchins as a protective spine canopy for small urchins, and to give processors the desired size urchin. An interim management plan was in place in 1987 for the Ketchikan area with a 3-year area rotation and size limits modified slightly to 3-4.5 inches. A second interim plan was developed for 1991 through 1993 for the Sitka area. The Sitka area plan included a 3.2% annual harvest rate on the estimated biomass, 3-year area rotations, weekly fishing periods of noon, Saturday through noon Thursday, and no size limits.

In 1996, the department, in cooperation with the sea urchin fishing industry, developed interim regulations and a management plan for a commercial fishery in Southeast Alaska beginning with the 1996/97 season. The regulations were adopted by the commissioner under authority of 5 AAC 39.210 for High Impact Emerging Fisheries and became effective in December, 1996. The Alaska Board of Fisheries formally adopted the red sea urchin management plan during their regular meeting in January 1997. The core elements were:

1. Annual guideline harvest levels are 6% of the biomass estimate, which is the lower bound of the 90% confidence interval for biomass. Fisheries will only be opened where biomass surveys have been conducted in the previous three years.
2. Harvest opportunities are to be distributed to each week of every month that the fishery is open. The fishery is to be managed to span approximately four months, subject to needs for conservation, law enforcement, reducing waste, and promoting fishery development. Size limits and trip limits may be imposed if needed to slow the pace of the fishery.
3. Processing vessels must carry observers, and vessels transporting unprocessed product out of Registration Area A must first obtain a transport permit.

4. In addition to fish ticket requirements, processors must submit records of the roe recovery within 30 days of landing.

Since the management plan became effective in December 1996, no major regulatory changes have been made to the red urchin fishery.

1998/99 Season Summary

The 1998/99 season opened by regulation on October 1, 1998, however the fishery did not begin until November 22, 1998 due to lack of management funds. The combined total guideline harvest level was 4,843,610 pounds. A total of 3,034,610 pounds of red sea urchins were harvested by 62 divers with an estimated exvessel value of \$.40 per pound for a total exvessel value of \$1,213,844. The number of divers decreased from 129 during the 1997-98 season, probably due to continued poor market conditions in Japan. The inability to harvest the total quota may have been a combination of market conditions and a late fishery opening.

1999/00 Season Outlook

The 1999/00 season is the fourth under the current management plan. The GHL for the 1999/00 season is 4,958,678 pounds for Districts 1, 2, 3, 4, and 113. Biomass surveys were conducted in the portions of those districts with commercially viable red urchin populations between April 1997 and July 1999. Under the 4-year moratorium on entry to dive fisheries in Southeast Alaska, effective July 1, 1996-June 30, 2000, there are 557 eligible participants in the urchin fishery. The CFEC, as per a December 1, 1999 news release, voted to take no action at this time on the proposal to limit entry in the Southeastern Alaska sea urchin dive fishery and directed staff to develop alternative options for the CFEC to consider.

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- O'Clair, R. M., C. E. O'Clair. 1998. Southeast Alaska's rocky shores – animals. Plant Press.

Table 10.1.Registration Area A (Southeast Alaska) commercial abalone harvests, effort, value, and season length, 1970/71 through 1996/97.

Season	Guideline Harvest Range or Quota (lb)	Southern Southeast Harvest (lb)	District 13 Harvest (lb)	Total Southeast Harvest (lb)	Number of Divers	Exvessel Value	Season Length (days)
70/71							365
71/72		Confidential Data – Less than 3 divers reporting landings					365
72/73		65	2,610	2,675	6	\$2,675	365
73/74			3,000	3,000	3	\$4,500	365
74/75			13,826	13,826	3	\$20,739	365
75/76		55	8,497	8,552	8	\$17,104	365
76/77		Confidential Data – Less than 3 divers reporting landings					365
77/78		805	10,861	11,666	10	\$14,816	365
78/79		130,607	49,320	179,927	35	\$253,697	365
79/80		316,952	61,733	378,685	43	\$408,980	287
80/81	250,000	233,589	18,382	251,971	40	\$420,792	273
81/82	100,000-125,000	338,305	32,589	370,894	54	\$445,073	59
82/83	100,000-125,000	100,458	12,826	113,284	41	\$240,162	36
83/84	100,000-125,000	99,294	8,735	108,029	31	\$302,481	126
84/85	100,000-125,000	59,237	8,379	67,616	25	\$165,659	151
85/86	25-58,000	32,817	7,720	40,537	18	\$117,963	71
86/87	25-58,000	47,404	13,820	61,224	24	\$168,366	146
87/88	25-58,000	57,209	10,406	67,615	42	\$208,930	36
88/89	25-58,000	65,928	10,172	76,100	45	\$307,444	33
89/90	25-58,000	57,784	4,020	61,804	67	\$330,651	40
90/91	25-58,000	62,779	5,607	68,386	97	\$374,071	9
91/92	25-58,000	35,987	8,095	44,082	95	\$267,578	35
92/93	25-58,000	26,905	9,083	35,988	99	\$386,151	19
93/94	25-58,000	27,680	7,172	34,852	85	\$487,928	7
94/95	25-58,000	15,055	7,824	22,879	101	\$330,373	8
95/96	0-16,000	8,524	5,828	14,352	101	\$125,580	7
96/97	closed						

Table 10.2. Southeast Alaska historic seasonal sea cucumber harvests, effort, and value.

Season ^a	Guideline Harvest Level (lb)	Total Pounds Landed	Average Price Per Pound ^b	Estimated Exvessel Value ^b	Number of Divers	Number of Landings	Total Days Open	Average Pounds per Diver	Average Earnings per Diver ^b
Data prior to 1986/87 season is confidential.									
86/87		34,043	\$0.21	\$7,149	7	44	na	4,863	\$1,021
87/88		65,056	\$0.21	\$13,662	11	143	na	5,914	\$1,242
88/89		801,405	\$0.21	\$169,096	57	922	na	14,060	\$2,967
89/90		2,318,305	\$0.42	\$969,142	205	2,263	na	11,309	\$4,728
90/91	704,491 ^c	804,184	\$0.59	\$472,386	143	890	80	5,624	\$3,303
91/92	839,160 ^c	869,988	\$0.80	\$697,970	187	704	56	4,652	\$3,732
92/93	1,100,440	1,249,621	\$0.79	\$988,628	240	1,003	29	5,207	\$4,119
93/94	799,235	964,343	\$1.03	\$995,783	320	949	18	3,014	\$3,112
94/95	1,351,000	1,322,219	\$1.79	\$2,361,541	261	1,379	39	5,066	\$9,048
95/96	1,157,500	1,332,095	\$1.39	\$1,846,556	424	1,582	13	3,142	\$4,355
96/97	939,300	909,789	\$1.29	\$1,169,612	294	1,234	14	3,095	\$3,978
97/98	892,410	894,739	\$1.63	\$1,458,425	226	976	10	3,959	\$6,453
98/99	1,026,345	1,055,572	\$1.55	\$1,636,137	219	971	9	4,820	\$7,471

^a Season = October 1 thru September 30. Experimental fishing program prior to 1990/91 season.

^b Based on CFEC data except 1998/99 based on fish ticket data

^c Quota originally calculated in numbers of sea cucumbers.

Table 10.3. Southeast Alaska historic seasonal geoduck harvests, effort, and value.

Season ^a	Guideline Harvest Level (lb)	Total Pounds Landed	Average Price per pound ^c	Estimated Exvessel Value ^c	Number of Divers	Number of Landings	Total Days Open	Average Pounds per Diver	Average Earnings per Diver ^c
1985/86	^b	143,868	\$0.20	\$28,774	8	40	240	17,984	\$3,597
1986/87	^b	28,191	\$0.25	\$7,048	3	9	240	9,397	\$2,349
1987/88	125,000	185,674	\$0.30	\$55,702	6	156	240	30,946	\$9,284
1988/89	189,232	143,188	\$0.30	\$42,956	9	127	240	15,910	\$4,773
1989/90	199,000	207,083	\$0.51	\$105,612	18	165	240	11,505	\$5,867
1990/91	196,000	189,585	\$0.51	\$96,688	15	130	176	12,639	\$6,446
1991/92	219,000	193,074	\$0.63	\$121,637	20	131	33	9,654	\$6,082
1992/93	196,000	189,379	\$1.12	\$212,104	22	109	19	8,608	\$9,641
1993/94	219,000	209,322	\$1.48	\$309,797	39	115	10.5	5,367	\$7,944
1994/95	195,000	197,246	\$1.64	\$323,483	64	190	14	3,082	\$5,054
1995/96	209,000	229,681	\$2.25	\$516,782	109	401	10	2,107	\$4,741
1996/97	196,000	203,017	\$2.55	\$517,693	97	359	6	2,093	\$5,337
1997/98	196,000	180,440	\$4.00	\$721,760	110	312	3	1,640	\$6,561
1998/99	112,500	111,311	\$2.12	\$235,979	98	206	66	1,136	\$2,408

^a Season = October 1 thru September 30.

^b Only Noyes Island open (Subdistrict 103-70). Five-year GHIL established of 300,000 pounds for all three areas. Separate GHILs first established for 1988/89 season. Therefore, 1987/88 GHIL does not include remaining GHIL from Noyes Island (e.g. 125,000 for Gravina Island only).

^c Based on CFEC data except 1998/99 based on ADF&G fish ticket data.

Table 10.4. Registration Area A (Southeast Alaska) red sea urchin harvest, permits, landings, and value, 1980-1999.

Year	Harvest	Permits	Landings	Value
1980-81 ^a		Confidential		
1981-82 ^a		Confidential		
1982-83 ^a		Confidential		
1983-84	23,303	4	9	\$2,796
1984-85	188,023	16	84	\$31,906
1985-86	58,303	8	32	\$7,288
1986-87	890,092	26	459	\$125,335
1987-88 ^a		Confidential		
1988-89	223,883	11	128	\$91,106
1989-90	23,617	9	33	\$5,833
1990-91	174,233	6	91	\$45,823
1991-92	428,220	37	256	\$128,894
1992-93	143,485	17	108	\$41,467
1993-94	0	0	0	0
1994-95 ^b	2,088,395	1	1,391	\$944,329
1995-96 ^b	877,212	1	705	\$458,508
1996-97	4,929,280	150	3,483	\$1,878,056
1997-98	4,083,877	129	2,465	\$1,408,397
1998-99	3,034,610	62	1,510	\$1,213,844

^a When number of permits participating is three or less, the information is considered confidential.

^b Department test fishery.

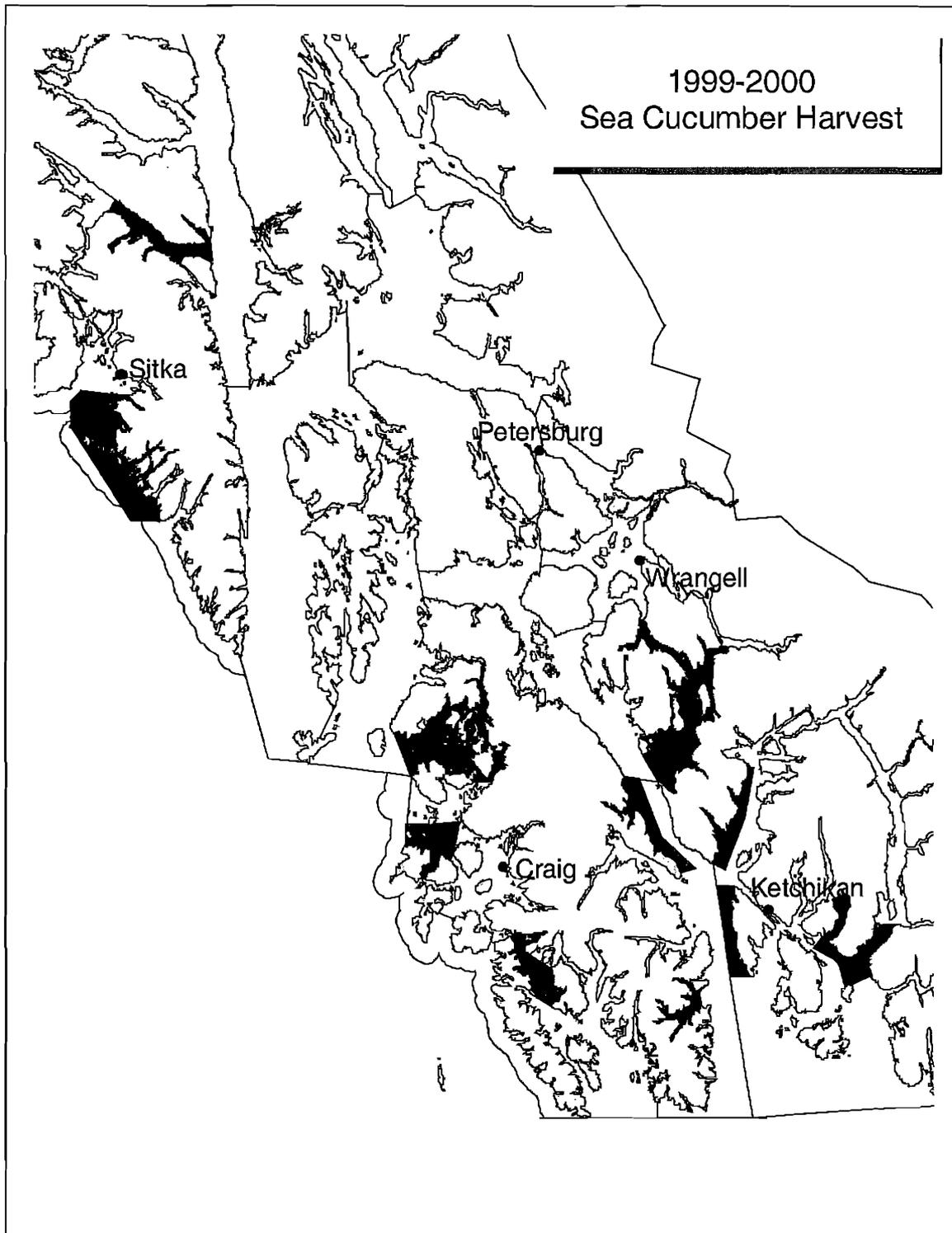


Figure 10.1. Sea cucumber fishery open areas in Southeast Alaska during the 1999/2000 season.

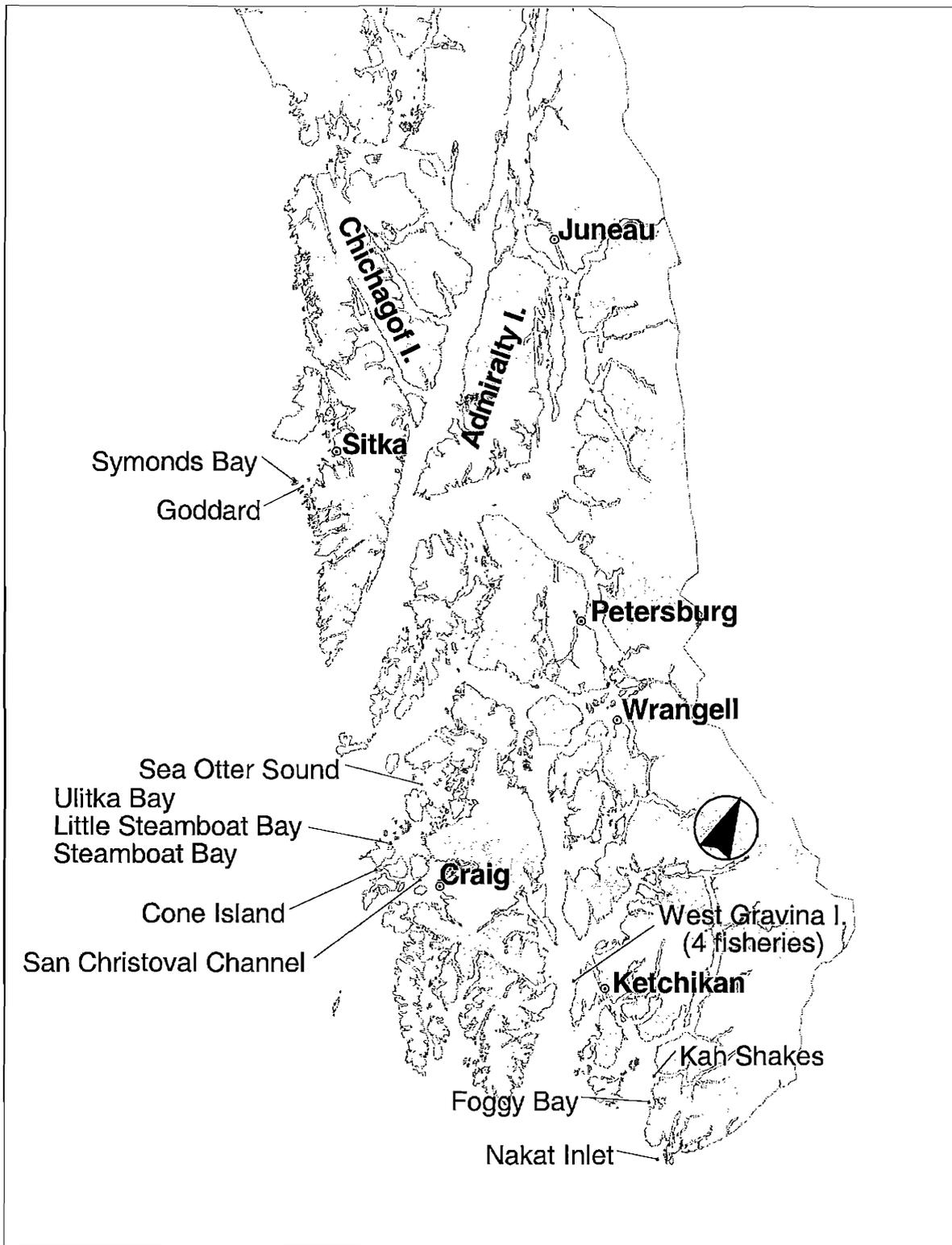


Figure 10.2. Geoduck clam bed locations and fisheries in Southeast Alaska.

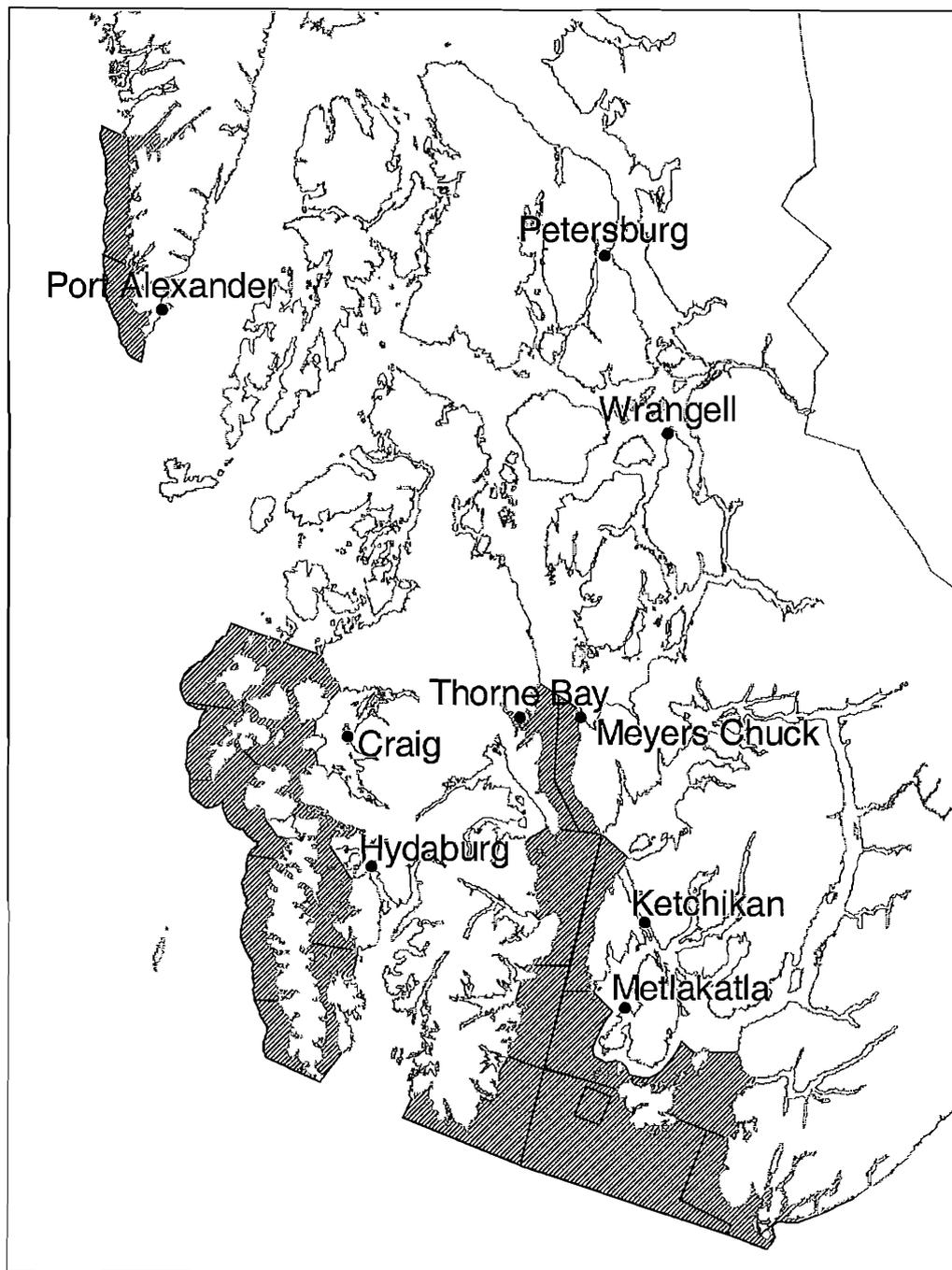


Figure 10.3. Red urchin fishery open areas in Southeast Alaska during the 1999-2000 season.