REPORT TO THE BOARD OF FISHERIES,

INTRODUCTION TO SHELLFISH FISHERIES

by

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and
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Regional Information Report[1] No. 1J02-45

Alaska Department of Fish and Game
Division of Commercial Fisheries
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[1] The Regional Information Report Series was established in 1987 to provide an information access system for all unpublished divisional reports. These reports frequently serve diverse ad hoc informational purposes or archive basic uninterpreted data. To accommodate timely reporting of recently collected information, reports in this series undergo only limited internal review and may contain preliminary data, this information may be subsequently finalized and published in the formal literature. Consequently, these reports should not be cited without prior approval of the author or the Division of Commercial Fisheries.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

ACKNOWLEDGEMENTS

The crab, shrimp and scallop reports are updates of earlier versions that were written by Tim Koeneman, Catherine Botelho, and Ken Imamura. The shellfish section of the Region I Division of Commercial Fisheries continues to be indebted to them for the strong foundation laid during their tenure as resource stewards.

INTRODUCTION

This report reviews the commercial fisheries for shellfish and miscellaneous dive species in Region I, which consists of Southeast Alaska (Registration Area A) and Yakutat (Registration Area D). Area A encompasses all waters within the Alexander Archipelago and offshore waters from Dixon Entrance to Cape Fairweather, divided into Districts 1 through 16 (Figure 1.1). Area D encompasses state waters from Cape Fairweather to Cape Suckling, divided into Districts 81 through 91. Shellfish fisheries in these areas are primarily in state waters; however, a few fisheries with state management authority, such as weathervane scallops, extend into the Exclusive Economic Zone (EEZ). Data for king and Tanner crab fisheries are summarized in this introduction for comparative purposes, but are not described in later chapters. Fisheries for king and Tanner crab were considered by the board during the previous year (2001-2002).

Shellfish harvests in Region I totaled over 12 million pounds valued at over $18 million during the last completed season or year (Table 1.1). In the top five fisheries, Southeast Dungeness crab was the most valuable, followed by sea cucumbers, Southeast golden king crab, Southeast pot shrimp, and Southeast Tanner crab. In landed poundage, Southeast Dungeness crab was first, followed by sea urchins, sea cucumbers, Southeast pot shrimp, and Southeast Tanner crab.

Most of the shellfish fisheries in Region I are fully developed. Some stocks have been unable to sustain consistent and significant harvests. The red king crab fishery was reopened in 1993 after eight years of closure and provided five years of harvests above the regulatory threshold of 300,000 pounds. The fishery was closed in 1998 and 2000 due to low stock strength in a few harvest areas.

Other fisheries are in various stages of development. The pot shrimp fishery, limited to entry, has seen large increases in harvest and effort in the past decade. The sea urchin fishery is in its seventh season of operation with quotas typically over five million pounds. Geoducks have had fairly stable landings, but their potential for increased value, particularly for live shipments, is increasing the demand for expansion of the fishery. The abalone fishery remains closed with little prospect for rebuilding, particularly with growing populations of sea otter in the region. Yakutat Dungeness and Yakutat Tanner crab fisheries were designated as collapsed and in recovery status 2000 and will remain closed until signs of recovery are apparent and management plan and stock assessment plans are developed to provide for sustained yields.

Limited entry has played a significant role in harvest and effort trends. Recently limited fisheries include Southeast Dungeness crab, Southeast pot shrimp, Southeast trawl shrimp, geoduck, sea urchins and sea cucumbers.

Shellfish Research and Management

The ability of the department to provide for sustained yields varies among the fisheries due to different levels of development of stock assessment programs and management plans. Fisheries for Southeast red king crab, sea cucumbers, sea urchins and geoducks have histories of stock assessment, well-developed management plans, and are the most adequately managed shellfish fisheries in the region. Other shellfish fisheries lack either developed management plans or stock assessment programs or both and have higher risks of over-exploitation. Southeast Tanner crab and Dungeness crab and pot shrimp fisheries have developing stock assessment programs but no abundance-based management plans. Yakutat Tanner and Dungeness crab, Yakutat pot shrimp, scallops, Southeast golden king crab, and Southeast beam trawl shrimp have neither stock assessment programs nor management plans, making them the highest risk fisheries.

Several crab and shrimp stock assessment surveys are currently conducted, including an annual red king crab pot survey in northern Southeast Alaska, an annual Tanner crab pot survey, an annual pot shrimp survey, and an annual Dungeness crab survey. Surveys for Tanner crab, pot shrimp, and Dungeness crab are recent additions and have been conducted for five years or less. Short-term surveys that have been conducted in the past include several Dungeness crab pot surveys, a Tanner crab pot survey to describe the distribution of Bitter crab syndrome, and a trawl survey to estimate stock abundance and size class composition of Yakutat Bay northern and sidestripe shrimp, which was conducted on seven occasions, ending in 1984. Additionally, annual dive surveys are conducted for sea cucumbers, sea urchins and geoducks, mostly in southern and outer-coastal areas of Southeast Alaska. Population estimates of geoduck and sea cucumbers have been expanded to include more areas at the request of industry.

Dockside sampling and skipper interviews are conducted for the crab and shrimp fisheries to gather data and information on size frequency, shell condition, average weight, sex (shrimp only), fishing location, effort levels, and estimates of average catch per unit of effort (CPUE). Until onboard observer programs were implemented these data provided the only biological information for those fisheries that lack stock assessment surveys, which include golden king crab and trawl shrimp. The collected information allows assessment of relative strength of various components (e.g. size, recruits) of the commercially exploited populations, and a qualitative estimate of stock condition. Harvest and effort data is also collected through the fish ticket system.

An onboard observer program was implemented for the golden king crab fishery beginning with the 2000-2001 season and for the beam trawl fishery beginning with the 2001-2002 season. Through this voluntary program, the department obtains information on catch distribution as well as indices of abundance for the non-legal component of the population including pre-recruit and females that are not available for sampling dockside.

Logbook information is collected from the red king, golden king, and Tanner crab, and for the shrimp trawl fisheries in non-traditional areas as well as for the directed sidestripe shrimp trawl fisheries. This type of information is particularly valuable for management of the crab fisheries.

Staff

All Region I shellfish (crab, shrimp and scallops) research and stock assessment programs fall under the responsibility of the regional shellfish staff. This group is also responsible for crab and shrimp fishery management, with the exception of pot shrimp management. The pot shrimp, sea cucumber, sea urchin and geoduck fisheries are managed by area management biologists under the supervision of Scott Kelley, regional management coordinator in Douglas. All other marine fisheries research (non-salmon) and management is under the supervision of Kyle Hebert, regional marine fisheries supervisor, also in Douglas.

SHELLFISH STAFF			
Name	Title	Job Class	Location
Gretchen Bishop	Regional Shellfish Project Biologist	Fisheries Biologist III	Douglas
Janet Rumble	Asst. Shellfish Biologist, Dungeness	Fisheries Biologist II	Douglas
David Love	Asst. Shellfish Biologist, Shrimp	Fisheries Biologist II	Petersburg
Al Tingley	Asst. Shellfish Biologist, King	Fisheries Biologist II	Douglas
Vacant	Asst. Shellfish Biologist, Tanner	Fisheries Biologist II	Douglas
John E. Clark	Shellfish Biometrician	Biometrician II	Douglas
Teresa Stolpe	Shellfish Technician	Fisheries Technician III	Petersburg
Christie Hendrich	Shellfish Technician	Fisheries Technician III	Douglas

Research and stock assessment for the sea cucumber, sea urchin, geoduck and abalone dive fisheries is accomplished by the dive fishery staff, with help from the area management staff.

DIVE FISHERY STAFF			
Name	Title	Job Class	Location
Marc Pritchett	Herring and Miscellaneous Species Project Leader	Fisheries Biologist III	Douglas
Scott Walker	Asst. Herring and Miscellaneous Species Project Leader	Fisheries Biologist II	Ketchikan
Jeff Meucci	Dive Operations Manager	Fish and Wildlife Technician III	Petersburg
John E. Clark	Shellfish Biometrician	Biometrician II	Douglas

Table 1.1. Registration Area A (Southeast Alaska) and Registration Area D (Yakutat): list of fisheries, harvest, and approximate exvessel values from the last completed season or calendar year.

Season or Year	Fishery	Harvest in Pounds	Approximate Exvessel Value in $$[a]
Southeast			
2001/02	Dungeness Crab	4,105,697	7,086,981
2001/02	Pot Shrimp	1,056,891	1,979,373
2001/02	Beam Trawl Shrimp	903,897	286,868
2001/02	Abalone	0	0
2001/02	Geoduck	283,405	204,052
2001/02	Sea Cucumber	1,438,451	2,517,289
2001/02	Sea Urchins	2,720,241	924,882
2001/02	Red and Blue King Crab	298,957	1,200,398
2001/02	Tanner Crab (bairdi)	964,489	1,655,640
2001/02	Golden King Crab	609,510	2,207,978
	SUBTOTAL[b]	12,381,538	$18,063,461
Yakutat			
2001/02	Dungeness Crab	0	0
2001/02	Pot Shrimp	9,740	27,408
2001/02	Otter Trawl Shrimp	0	0
2001/02	Red and Blue King Crab	0	0
2001/02	Scallops	32,163	104,530
2001/02	Tanner Crab	0	0
	SUBTOTAL[c]	41,903	$131,938
GRAND TOTAL		12,423,441	$18,195,399

[a] This column is calculated from the average price per pound of all tickets having values indicated on them.
[b] Totals do not include confidential data.
[c] District 16 is included in Registration Area D for this fishery only.

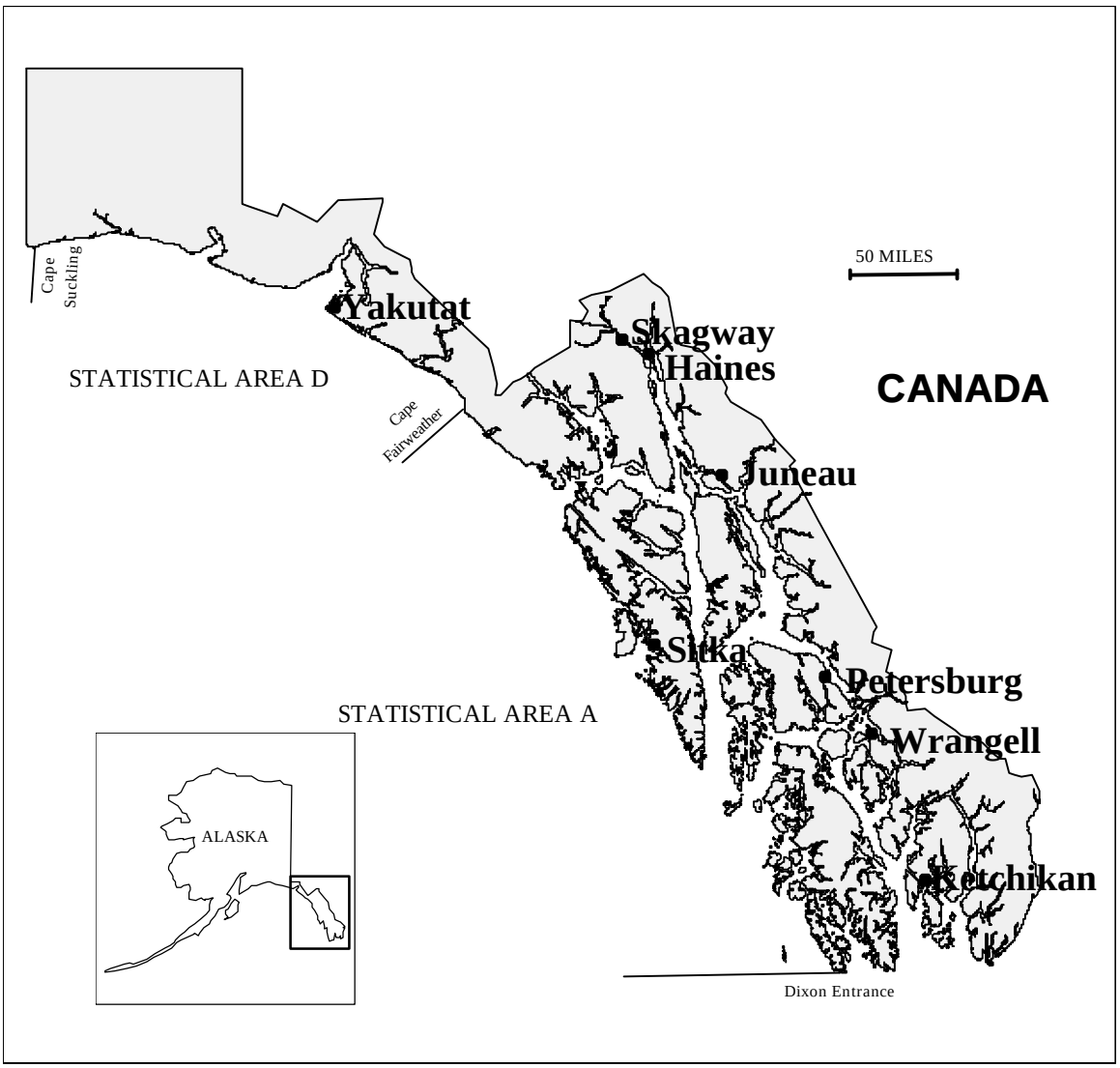

Figure 1.1. Registration Area A (Dixon Entrance to Cape Fairweather) and Registration Area D. (Cape Fairweather to Cape Suckling).

REPORT TO THE BOARD OF FISHERIES,

SOUTHEAST ALASKA DUNGENESS CRAB FISHERY

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TABLE OF CONTENTS

LIST OF TABLES

INTRODUCTION

Dungeness crabs *Cancer magister* are members of the highly evolved brachyuran (true crab) subgroup of the order Crustacea. They are commercially significant and widely distributed in coastal waters of the eastern Pacific Ocean from Baja California to the Aleutian Islands.

Southeast Alaska (Registration Area A) is near the northern limit of the range of Dungeness crab. In Southeast Alaska, Dungeness crabs are found throughout the reporting districts between Dixon Entrance and Cape Fairweather. Their habitat is areas with mud and sand substrate at depths between two and 50 fathoms. Southeast Alaska has produced a long-term average of about 2.2 million pounds per season. Ten-year average harvests for the 1970s, 1980s, and 1990s have been respectively 0.65, 2.34, and 3.26 million pounds.

Southeast Alaska is a super exclusive registration area for Dungeness crab; a vessel registered to fish in this area cannot register or fish in any other area in Alaska during the same registration year. The fishery is also under limited entry. Although there are 319 current Dungeness crab limited entry permit holders, actual participation is variable. In the past five seasons, an average of 216 permit holders have registered and fished in Southeast Alaska. Most vessels are below limit seiner length (58 feet), although they range in size from aluminum skiffs to over 90 feet long. Almost all participants use standard, hatbox-shaped pots constructed with steel frames and webbed with stainless-steel wire. The maximum legal gear limit per vessel is 300 pots.

There are two commercial Dungeness crab fishing seasons, a summer season from June 15 through August 15 and a fall/winter season from October 1 through November 30 or February 28. Most of northern Southeast Alaska has a summer and a fall season closing at the end of November, while southern Southeast Alaska is only open during the fall and winter. The summer season overlaps a portion of the male molting period, which extends into mid-summer, and the female molting period, which extends from August to October. As the major mating period is during late summer to early fall and 80 percent of the annual harvest occurs during the summer season before mating, large males have little chance to participate in mating, which results in a strong selective pressure in favor of slow growing crab.

Fishing during the molting and mating period continues to be a risky strategy, especially given the increases in fishing pressure seen beginning in the 1990s. Historically, information collected has been limited to port sampling of the commercial catch and fish tickets. Partially in response to concern over the high harvest rate, a program of annual pre-and post-season Dungeness crab stock assessment surveys was implemented beginning in June of 2000, for limited areas in central and northern Southeast Alaska. Furthermore, a management plan which allows for inseason adjustments to season length in the case of catastrophic recruitment failure was put into place at the January 2000 BOF meeting. However, as this survey program is still in its infancy, survey information is not currently used in inseason management of the fishery, nor has the Southeastern Alaska Dungeness crab management plan triggered any management actions for the three seasons since its establishment. In recent seasons, prevalence of soft-shelled crab in the catch and harvest at the beginning of the fishery has reached record highs in some areas as indicated by preseason survey and inseason port sampling information.

Many peripheral areas that once served as nurseries or refuges and buffered against the effects of heavy harvest in adjacent areas are now heavily fished. Since the late 1980s, all available fishing grounds, even marginal ones, have been fully utilized, the exploitation rate has climbed, and the fishery is much more dependent on annual recruitment. The effect of poor recruitment of even a single year-class on the fishery is much more pronounced now than it was prior to the mid-1980s.

Conflict between user groups is rising as competitive pressure and gear saturation crowds commercial gear onto grounds traditionally used by non-commercial fishers. This has resulted in commercial closures of numerous small areas around many communities in Southeast Alaska, including (in the order in which they appear in the Commercial Shellfish Fishing Regulations) Juneau, Tenakee Springs, Elfin Cove, Point Baker, Thorne Bay, Gustavus, Ketchikan, Haines, Sitka, and Hollis. There are continuing requests for additional commercial closures.

Most of the product is marketed as whole-cooked and live crab during the summer tourist markets in Washington, Oregon, and California. The extensive summer fishery for Dungeness crab in Alaska has been justified on the basis of the overriding economics of the summer fishery as well as by the dangerous winter weather for the small-boat fleet. Elsewhere on the West Coast, soft shell levels are monitored and must exceed a threshold level prior to the opening of commercial seasons.

In keeping with a federal law that was passed in 1998, commercial Dungeness crabbing was closed in designated wilderness areas in the Glacier Bay National Park and Preserve beginning June 15, 1999. Non-wilderness portions of the bay closed to Dungeness crabbing on September 30, 1999. Permit holders were given compensatory pay if they fished in either the Beardslee Islands or Dundas Bay wilderness areas for at least six of the years between 1987 and 1998. Processors were eligible for compensatory pay to offset losses if they purchased crab from these areas during the same time frame.

Lastly, sea otter populations are expanding their range in Southeast Alaska. With their reintroduction to Southeast Alaska in 1965, their expansion has been accompanied by drastic declines in the availability of many economically important invertebrate species, including Dungeness crab. The decline in the Dungeness crab harvest in Districts 3, 4, and 14 is attributed to sea otters, whose populations remained low until 1987 when their populations began to rapidly increase (Pitcher and Imamura 1990). Sea otters are currently expanding their range into important Dungeness crab fishing Districts 5 and 9 as well.

FISHERY DEVELOPMENT AND HISTORY

The Dungeness crab fishery dates back to the 1930s. Prior to the 1960s, harvest statistics from much of the Gulf of Alaska coast were combined into a single total. Since 1960, commercial Dungeness crab harvests from Southeast Alaska have averaged 2.2 million pounds per season (Table 2.1).

The Dungeness crab fishery in Southeast Alaska has evolved through four distinct periods since the early 1960s. From the early 1960s through the early 1980s, participation was so low that need for formal regulations and other restrictions were minimal. The 1960s were characterized by a few larger vessels in a directed fishery harvesting 2.3 million pounds per year on the average. This was in response to high market demand caused by low harvests in Washington, Oregon, and California. The principal product was canned crabmeat.

During the 1970s, production in Washington and Oregon rebounded and demand for crab from Southeast Alaska declined. With little or no processor support, fishers had to either sell over the dock to the public or make complicated and risky arrangements to airfreight live crab out of state. Although the summer closure was rescinded, only a few dozen small vessels in the 30-foot to 45-foot range fished primarily during the summer. Harvests for this period averaged 0.65 million pounds by 30 permit holders.

Between 1981-1982 and 1990-1991 seasons, the fishery underwent sweeping change. Declining crab harvests in Pacific Coast states and changing markets increased demand for Alaskan frozen sections, whole cooked crabs, and air freighted live crabs. More processors began purchasing crab and supporting the fishery through the entire summer season. Harvests during this period increased, averaging 2.67 million pounds per season, and the numbers of participants increased, averaging 195 permit holders. The fishery grew from a small group of 30 to 45-foot vessels to a larger fleet that included skiff-sized vessels up to 30 feet in length. This resulted in the fishery going from being primary for a relatively small number of single-species participants to being a secondary fishery for a larger number of new and often transitory entrants.

Increasing numbers of participants led to a permit moratorium imposed by the Commercial Fisheries Entry Commission (CFEC) in 1991. During the four years of the moratorium, the CFEC first conducted numerous studies and public meetings to evaluate the need for limited entry into this fishery. Subsequently, CFEC convinced the legislature to authorize use of tiered pot limits to accommodate the large number of qualifying participants while limiting the effort to acceptable effort levels. In January 1996, the moratorium period ended and a tiered pot limit form of limited entry was adopted for implementation by June 15, 1997. Once adjudication of 29 limited-entry permits is completed the maximum number of permits will be 308 and the tiered permit system will be structured to provide a maximum of 48,750 pots to the fishery. As limited entry permits are sold, more fishing days are needed to service fleet debt. Furthermore, since the decline in salmon markets beginning in the early 1990s, some fishers who have historically switched to salmon fishing after the early part of the summer season now remain in the Dungeness fishery through the entire summer season. These two factors are probably most directly causing the increases in harvest levels seen in the 1990s and early new millennium. Between the 1991-1992 and 2001-2002 seasons the average harvest has been a record 3.45 million pounds by an average of 221 permit holders.

REGULATION DEVELOPMENT

All registration areas in Alaska apply generally passive management measures limiting size, sex, and to some extent, the season during which crab may be caught. In Southeast Alaska, seasons are timed to avoid some of the sensitive life history periods while maximizing economic returns.

The Dungeness crab management plan that became effective beginning with the 2001-2002 season is the department's first step towards more active abundance-based management for the Southeast Dungeness fishery. This plan calls for early closure of the Southeast Alaska Dungeness crab season when catastrophic regionwide recruitment failure occurs. The management plan does not address smaller scale stock declines.

Fishing Seasons and Periods

From the early 1930s through 1955, regulations included a prohibition on the taking of females, a minimum size limit for males, and a closed season on the most important grounds for two to four months between May 1 and September 1. Available documentation from that period indicates that molting was thought to occur during the summer. The summer closure was generally acceptable to fishers because of other fishing opportunities in the salmon and halibut fisheries. The summer closure was revoked in the late 1950s.

Since the late 1960s, fishing season closures have been introduced, and then modified, to reduce fishing pressure during sensitive periods in the life history of the species. An example was the closure from March through May in 1976-1977 to protect male crabs during their primary molting period. In the 1980s, management staff explored methods and means to further avoid sensitive life history periods to accommodate the increasing effort as the fleet slowly utilized more of the known habitat and range of the crabs. Management staff felt that as more of the available grounds were exploited, there would be fewer unfished stocks to act as reproductive buffers against local depletion in adjacent fishing grounds. Then, beginning in 1985, the commercial fishery was closed between August 16 and September 30 because field observations suggested that it was the major period when females molted and were mated. In response to increasingly high effort levels and high harvest rates, the season was further shortened in 1989 by reducing the winter season in northern and central districts to October 1 through November 30. The season remained October 1 through February 28 in southern Districts 1, 2, and 13-B. The split seasons have been in effect since this time.

Size Restrictions

From 1924 to 1935, legal harvest of Dungeness crabs was restricted to males over 6 ½-inches in greatest width. From 1936 to 1962, only males over 7 inches in greatest width were legal. Since 1963, the legal size has been 6 ½-inches in shoulder width, measured across the carapace immediately anterior to the tenth anterolateral spines. This is the current standard measuring point in all jurisdictions throughout the range of this crab and is used because the large tenth anterolateral spines are often broken or eroded in older shelled crabs.

Gear Definitions and Specifications

Since 1934, trawls have been prohibited in this fishery. Gear was further limited to pots or ring nets in 1954. A pot limit of 300 pots or ring nets was implemented in 1963. Diving gear was included as legal gear in 1966. Nearly all of the commercial harvest is currently taken with pots.

Starting in 1963, Dungeness crab pot buoys were required to display the registration number of the vessel fishing the gear. In 1988, the minimum size of buoy markings was set at 1 ½- inches in height, in numerals at least 1/4-inch wide that contrasted with the color or texture of the buoy.

In 1977, two escape rings 4 3/8-inches in diameter were required in each pot, and a Dungeness pot was defined by its tunnel eye openings, which individually could not exceed 30 inches in perimeter. In 1978, an escape panel secured by a maximum of 120-thread cotton twine was required. A minimum size for buoy numbers of 1 ½- inch high and ¼-inch wide numbers was implemented in 1989. In 1991, the breaking strap or biodegradable twine for the lid retainers was changed from 120-thread to 60-thread. The intent was to minimize untended ghost fishing of lost or derelict pots. In order to facilitate the enforcement of pot limits, identification tags were required to be attached to every buoy connected to a Dungeness crab pot beginning with the 2001-2002 season.

Dungeness gear development has remained static for many years, with little change in configuration, materials, size, and weight to significantly affect pot efficiency. However, trigger-enhancing devices that minimize escapement of crabs through entrance tunnels have been developed and are being installed on commercial gear and some fishers are using larger pots. In order to avoid further increases in pot size, a maximum pot size of 50-inches in diameter was established effective during the 2001-2002 season. Future comparisons of historical harvest rates will need to account for the possible enhanced efficiency of pots with the new trigger designs and larger volumes.

Other Regulatory Changes

Vessel registration and hold inspection requirements started in 1974. Southeast Alaska was designated a superexclusive registration area in 1983. Hold inspections were rescinded in 1984.

STOCK ASSESSMENT

Pot Surveys

While funding for the current program of annual pre- and post-season stock assessment surveys only recently became available the department has, nonetheless, conducted sporadic historic surveys prior to this time. In July 1987 and May 1988, the Commercial Fisheries Division of ADF&G conducted a cooperative survey with the Game Division to provide baseline data for an assessment of the effects of sea otters on Dungeness crab populations in the Icy Strait area (Pitcher and Imamura 1990). In the spring of 1996 and 1997, the department conducted preseason assessment surveys of the Dungeness stocks in the Stikine River flats area (Statistical Areas 108-40 and 108-41) of central Southeast Alaska. This stock is a consistently important contributor to the overall Southeast Alaska harvests. Using a random transect experimental survey design and commercially-configured pots with smaller than usual mesh, the department collected size, sex, and shell hardness data over a period of several days during late May, preceding the commercial fishery which began on June 15. After the season opened, staff conducted on-board field observations of commercial fishing operations in the same general area. The goal of these initial projects was to develop a method for estimating the prevalence of sub-legal and legal-sized soft-shelled male crabs that would be vulnerable to handling by the commercial fleet early in the summer season.

The department purchased a small research vessel, the *R/V Kittiwake III* suitable for Dungeness crab surveys in 1998. During the summer and fall fishing periods of the 1999-2000 commercial season, the department conducted on-board sampling of Dungeness crab in the Stikine Flats, Thomas Bay, and Duncan Canal areas. The current stock assessment survey program began in April 2000. During survey work, 40 pots, half with open and half with closed escape rings, were set daily in three depth strata. Objectives of the survey program are four-fold, 1) estimate pre-season index of abundance for legal male Dungeness crab, 2) estimate harvest rate by comparing pre- and post-season surveys, 3) more clearly

define timing of female and male molt periods and mating, and 4) determine growth by tagging crab. There have been 14 pot surveys to date. Pre and post-season surveys began in 2000 in Stikine Flats, Duncan Canal, and Kah Sheets Bay and expanded to Peril Strait, Tenakee Inlet, Port Camden, and Berners Bay. In 2001 Kah Sheets was dropped and the survey area was expanded to St. James Bay. Life history surveys in Duncan Canal and Stikine Flats have been conducted in April and December 2000, March 2001, and March 2002. Soak time experiments were conducted in Duncan Canal and Stikine Flats during the June and August 2002 surveys allowing us to compare catch rates from pots with variable soak times. Pre-season surveys should allow prediction of stock strength and the percentage of soft shell male crab for the upcoming season.

Tagging Program

The current tagging program began during the September 2000 survey. To date, tagging has been conducted on six other surveys. Goals of the tagging program are to estimate molt increment and molt frequency for male Dungeness crabs and to compare these growth rates between areas and with those conducted in the early 1970s (Lehman and Osborn 1970). Initially, both male and female crabs were tagged during pre- and post-season surveys. However the tagging protocol has been refined to include tagging on pre-season surveys of sublegal male crab only, to assure that recovered crabs will have grown. This, paired with the extensive port sampling and reward program, has provided the department with valuable growth and molt frequency information. To date a total of 5,663 male and 1,256 female Dungeness crabs have been tagged, a majority from Duncan Canal and Stikine Flats. Recovery of tagged crab is primarily through sampling of the commercial crab fishery. To date 1,162 male crabs have been recovered. The overall recovery rate for male crabs is 21 percent. The highest recovery rate (34 percent) came from Peril Strait while the lowest rate came from Stikine Flats (11 percent).

Port Sampling Program

Since 1985, commercial Dungeness crab landings in Southeast Alaska have been sampled in the ports of Petersburg, Wrangell, Sitka, Juneau, Ketchikan, and Haines. Goals of the port-sampling program are to describe the size and shell age composition, average weight, and catch rates of Dungeness crab in the commercial fishery. From this and knowledge of crab growth the department can determine the recruit or year-class composition of the harvest. During the 2001-2002 season, 16 percent of landings were sampled and 1.1 percent of crabs were measured. The percent of crabs sampled ranged from 0.2 to 2.6 percent, in West Prince of Wales and Lynn Canal respectively. The highest average carapace width was in Tenakee Inlet and the highest average weight was in Thomas and Farragut Bays (Table 2.3). Sampling effort has doubled since the 1997-1998 season with increases in the number of landings sampled from 216 to 476 and the number of crab examined from 13,377 to 23,810. Port samplers measure the crab, determine shell condition, and check for damage to the carapace and legs.

SEASON SUMMARY

2000-2001 Season Summary

The 2000-2001 season was divided into summer, June 15 through August 15, and the fall/winter, October 1 through November 30 and in some areas through February 28. The overall harvest was 2,565,230 pounds (Table 2.1) with an average price of $1.60/pound, yielding an exvessel value of $4.0 million. The summer season landings totaled 2,108,896 pounds, which is 82 percent of the total harvest, and grouped fall and winter season landings totaled 456,334 pounds or 18 percent (Table 2.2). One hundred ninety eight permit holders reported landings for the season (Table 2.1). Harvest in Districts 6, 8, 9 and 10 comprised 57 percent of the total. For the entire 2000-2001 season, 1.4 percent of the commercial harvest was sampled, an increase from the previous season (0.8 percent).

The summer season in Districts 11 and 15 was closed as a conservation measure by emergency order on July 17, 2000. The catch per boat and landed catch during the first two weeks of the fishery in these districts was very low, having declined strongly each year since the 1997-1998 season. The fall season was shortened in these two districts to one month, closing by emergency order on October 31, 2000 for the same conservation concerns. All other areas remained open for the regular period.

2001-2002 Season Summary

The same seasons as for 2000-2001 were in place for the 2001-2002 season. The overall harvest was 4,105,697 pounds (Table 2.1) with an average price of $1.80/pound this yielded an ex-vessel value of $7.4 million. The summer season landings totaled 3,096,068 pounds, which is 75 percent of the total harvest and while the fall/winter season landings totaled 1,009,629 pounds or 25 percent (Table 2.2). This was an unusually high fall/winter season harvest. Two hundred thirteen permit holders reported landings (Table 2.1). Districts 5, 6, 8, and 9 accounted for 67 percent of the total harvest (Table 2.2). For the entire 2001-2002 season, 1.1 percent of the commercial harvest was sampled, a decrease from the previous season.

The pre-season survey indicated that 59 percent of the legal male crabs were in soft shell condition in Duncan Canal and 18 percent in Stikine Flats. Subsequently, during the first few weeks of the fishery substantial amounts of soft-shelled crabs were discarded after being refused by processors. These were not well documented on fish tickets. As the season progressed, the crabs in this area hardened up.

2002-2003 Season Outlook

Preliminary harvest figures indicate that approximately 5.9 million pounds of Dungeness crab were harvested during the 2002-2003 summer season; already this is a record harvest for the entire season. The

number of permits reporting harvest for the summer season was 210, close to the ten-year average of 211 and only one more than the previous season. Sixty-four percent of the harvest came from Districts 6, 8, and 9, each one producing more than one million pounds. The average price per pound during the summer season decreased drastically from $1.85 during the 2000-2001 summer season to $1.00 during the 2001-2002 summer season. Eleven catcher/processors and 72 catcher/sellers were licensed this season with 2 catcher/processors and 19 catcher/sellers reporting harvest. Catcher/processors are permitted to process and sell their crab and catcher/sellers can sell their crab whole.

After nine years of testing, following an incident in 1992 where PSP was found in Dungeness crab in Hoonah, the Alaska Department of Environmental Conservation stopped testing for PSP in Dungeness crab in Southeast Alaska stating that for four years there had been no toxins detected in their samples. This had management implications in that the prohibition on surface shipping of Dungeness crab during the summer season was no longer in effect.

The pre-season survey indicated that 59% of legal males were in soft-shell condition in Duncan Canal and 14% in Stikine Flats. Subsequently, during the first few weeks of the fishery, substantial amounts of soft-shelled crabs were discarded after being refused by processors and were not well documented on fish tickets. As the season progressed, the crabs in this area hardened up.

LITERATURE CITED

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Pitcher, K. W., and K. K. Imamura. 1990. Impacts of sea otter predation on Dungeness crab abundance in Cross Sound-Icy Strait, Southeastern Alaska. United States Fish and Wildlife Service Cooperative Agreement 14-16-009-954:1-18.

Table 2.1 Registration Area A (Southeast Alaska) Dungeness crab harvest, number of permits fished, number of landings, and average harvest per landing, 1960 to present.

Year/ Season	Harvest in Pounds	Number of Permits	Pounds per Permit	Number of Landings	Pounds per Landing
1960	1,449,405	-			
1961	671,455	-			
1962	2,985,939	-			
1963	3,296,362	-			
1964	3,996,100	-			
1965	2,392,395	-			
1966	1,968,117	-			
1967	2,033,156	-			
1968	1,900,690	-			
1969/70	1,149,111	24	47,880	392	2,931
1970/71	776,617	21	36,982	380	2,043
1971/72	452,681	23	20,576	315	1,437
1972/73	597,587	31	19,277	315	1,897
1973/74	748,519	41	18,257	483	1,549
1974/75	713,995	55	12,982	453	1,576
1975/76	611,621	36	16,989	344	1,177
1976/77	515,378	25	20,615	174	2,961
1977/78	127,345	12	10,612	87	1,463
1978/79	754,759	25	30,190	208	3,628
1979/80	801,753	37	21,669	313	2,561
1980/81	521,247	26	20,048	227	2,296
1981/82	2,932,427	75	39,099	749	3,915
1982/83	3,668,062	129	28,435	1,303	2,815
1983/84	2,150,692	131	16,417	1,530	1,405
1984/85	1,843,502	180	10,242	1,583	1,164
1985/86	2,314,618	216	10,716	2,073	1,116
1986/87	2,453,055	224	10,974	2,330	1,052
1987/88	3,391,699	241	14,070	2,746	1,235
1988/89	3,321,734	264	12,535	2,683	1,238
1989/90	1,918,880	245	7,831	2,096	915
1990/91	2,662,840	243	10,787	2,342	1,136
1991/92	4,705,314	316	14,890	3,379	1,392
1992/93	3,089,398	247	12,508	2,492	1,239
1993/94	2,536,701	198	12,812	1,956	1,296
1994/95	1,921,689	182	10,559	1,786	1,075
1995/96	4,404,519	201	21,913	2,737	1,609
1996/97	5,005,840	203	24,659	2,896	1,728
1997/98	4,062,423	232	17,510	4,042	1.005
1998/99	2,320,030	244	9,508	3,127	743
1999/00	3,276,647	196	16,718	2,911	1,126
2000/01	2,565,230	198	12,956	2,380	1,078
2001/02 [a]	4,105,697	209	19,644	3,061	1,341

[a] Most recent seasons data should be considered preliminary.

Table 2.2a. Registration Area A (Southeast Alaska) 2000-2001 season; Dungeness crab harvest in exvessel pounds by month and district.

	2000								2001		
Dist.	May	June	July	Aug	Sept	Oct	Nov	Dec	Jan	Feb	Total
1	Closed	Closed	Closed	Closed	Closed	42,723	17,604	12,414	5,884	*	*
2	Closed	Closed	Closed	Closed	Closed	37,040	18,055	*	*	4,718	63,157
3	Closed	6,050	22,396	2,790	Closed	0	*	Closed	Closed	Closed	*
4	Closed	*	*	0	Closed	0	0	Closed	Closed	Closed	1,878
5	Closed	45,458	59,137	12,886	Closed	16,568	12,568	Closed	Closed	Closed	146,617
6	Closed	195,373	102,707	21,549	Closed	22,939	11,868	Closed	Closed	Closed	354,436
7	Closed	34,929	9,220	*	Closed	*	0	Closed	Closed	Closed	46,745
8	Closed	354,383	179,947	29,479	Closed	33,970	16,102	Closed	Closed	Closed	613,881
9	Closed	117,434	201,024	84,772	Closed	52,655	27,804	Closed	Closed	Closed	483,689
10	Closed	101,892	200,691	51,423	Closed	17,106	7,138	Closed	Closed	Closed	378,250
11	Closed	9,160	11,298	*	Closed	4,230	0	Closed	Closed	Closed	*
12	Closed	24,745	36,414	23,098	Closed	13,493	*	Closed	Closed	Closed	*
113	Closed	43,113	53,005	24,554	Closed	29,696	21,369	Closed	Closed	Closed	171,737
14	Closed	11,379	13,476	9,173	Closed	12,097	8,652	Closed	Closed	Closed	54,777
15	Closed	5,724	7,323	0	Closed	*	0	Closed	Closed	Closed	*
16	Closed	Closed	Closed	Closed	Closed	Closed	Closed	Closed	Closed	Closed	0
Total	0	*	*	259,724	0	282,517	141,160	*	*	*	2,565,410

* Where number of vessels participating is less than three, the information is considered confidential.

Table 2.2b. Registration Area A (Southeast Alaska) 2001-2002 season; Dungeness crab harvest in exvessel pounds by month and district.

	2001								2002		
Dist.	May	June	July	Aug	Sept	Oct	Nov	Dec	Jan	Feb	Total
1	Closed	Closed	Closed	Closed	Closed	40,860	22,759	8,943	4,447	1,271	78,280
2	Closed	Closed	Closed	Closed	Closed	60,205	*	*	*	3,581	89,828
3	Closed	5,464	21,100	14,540	Closed	0	0	Closed	Closed	Closed	41,104
4	Closed	0	0	*	Closed	0	0	Closed	Closed	Closed	*
5	Closed	68,366	128,016	54,966	Closed	86,780	35,869	Closed	Closed	Closed	373,997
6	Closed	530,204	368,099	104,697	Closed	120,098	43,598	Closed	Closed	Closed	1,166,696
7	Closed	111,209	67,810	9,170	Closed	11,361	23,171	Closed	Closed	Closed	222,721
8	Closed	461,671	194,007	40,714	Closed	60,535	35,113	Closed	Closed	Closed	792,040
9	Closed	101,599	159,508	61,731	Closed	57,778	53,609	Closed	Closed	Closed	434,225
10	Closed	56,743	60,543	25,326	Closed	9,942	6,595	Closed	Closed	Closed	159,149
11	Closed	10,339	36,891	31,976	Closed	129,212	66,881	Closed	Closed	Closed	275,299
12	Closed	49,721	59,880	30,848	Closed	19,346	10,745	Closed	Closed	Closed	170,540
13	Closed	17,387	69,972	45,034	Closed	18,944	10,459	Closed	Closed	Closed	161,796
14	Closed	10,583	38,165	19,777	Closed	23,031	10,388	Closed	Closed	Closed	101,944
15	Closed	11,656	14,931	2,213	Closed	5,123	2,943	Closed	Closed	Closed	36,866
16	Closed	Closed	Closed	Closed	Closed	Closed	Closed	Closed	Closed	Closed	0
Total	0	1,434,942	1,218,922	*	0	643,215	*	*	*	4,852	4,105,697

*Where number of vessels participating is three or less, the information is considered confidential.

Table 2.3. Summary of Dungeness crab port sampling by fishery area during the 2001-2002 commercial season.

Ranges represent 90% confidence intervals around the average.

Fishery Area	Number Landed	Percent Sampled	Number Sampled	Sampling Goal	Avg CW (mm) [a]	Avg wt. (Pounds)	Percent Recruit
Behm Canal, Portland Canal	42,440	2.33%	988	900	173 ± 0.35	1.83 ± 0.04	90 ± 0.6%
East Coast, Prince of Wales	45,710	0.55%	250	300	175 ± 0.77	1.97 ± 0.04	95 ± 1.3%
West Prince of Wales	20,493	0.24%	50	550	181 ± 2.28	2.08[b]	92 ± 4.9%
Port Camden/West Kuiu	412,911	0.80%	3,296	2,150	175 ± 0.22	1.92 ± 0.02	96 ± 0.2%
Duncan Canal	582,925	1.21%	7,075	4,550	174 ± 0.14	1.90 ± 0.01	98 ± 0.1%
Ernest Sound/ Clarence Strait	150,588	0.30%	450	1,150	174 ± 0.57	1.89 ± 0.07	96 ± 0.8%
Stikine Flats	416,892	0.84%	3,499	2,100	174 ± 0.22	1.89 ± 0.02	95 ± 0.2%
East Admiralty/ Mainland Bays	189,981	1.34%	2,540	2,250	176 ± 0.27	1.99 ± 0.03	85 ± 0.3%
Tenakee Inlet	53,657	1.49%	799	350	182 ± 0.56	2.26 ± 0.07	80 ± 0.7%
Peril Strait	89,408	0.56%	499	1,150	181 ± 0.69	2.18 ± 0.10	86 ± 0.9%
Icy Strait/Glacier Bay	62,147	1.04%	648	750	176 ± 0.51	1.82 ± 0.05	92 ± 0.7%
Lynn Canal	18,763	2.59%	486	600	178 ± 0.72	2.20 ± 0.17	79 ± 1.1%
Thomas/Farragut Bays	30,912	0.81%	249	2,800	181 ± 0.93	2.27 ± 0.16	87 ± 1.5%
No Associated Fishery	280		2,943		175 ± 0.23	1.98 ± 0.03	94 ± 0.2%
Total	2,117,107	1.12%	23,722	19,600	175 ± 0.09	1.94 ± 0.01	93 ± 0.0%

REPORT TO THE BOARD OF FISHERIES

SOUTHEAST ALASKA SHRIMP BEAM TRAWL FISHERIES

by

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[1] The Regional Information Report Series was established in 1987 to provide an information access system for all unpublished divisional reports. These reports frequently serve diverse ad hoc informational purposes or archive basic uninterpreted data. To accommodate timely reporting of recently collected information, reports in this series undergo only limited internal review and may contain preliminary data; this information may be subsequently finalized and published in the formal literature. Consequently, these reports should not be cited without prior approval of the author or the Division of Commercial Fisheries.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

INTRODUCTION

The beam trawl fishery targets primarily northern shrimp *Pandalus borealis* and secondarily larger sidestripe shrimp *Pandalopsis dispar*. Other species incidentally captured and landed in smaller quantities are the coonstripe shrimp *Pandalus hypstinotus*, humpy shrimp *P. goniurus*, and the spot shrimp *P. platyceros*.

Productive beam trawling has historically been limited to four major fishing areas in Southeast Alaska. These areas are District 8, portions of Districts 6 (Duncan Canal and Kah Sheets Bay), District 7 (Eastern Channel), and District 10 (Thomas and Farragut Bays), all located in the Petersburg-Wrangell Management Area (Figure 3.1). The concentration of the fishery in these areas is due to the abundance of the resource, the presence of the major processors, and limited vessel capabilities. Most vessels are less than 60 feet in length, utilize small horsepower engines, do not have refrigerated holds, and have a crew of two or three. One vessel that had fished up until the 1999-2000 season had been participating since the inception of the fishery in 1915. Vessels strive to provide a high quality product through daily deliveries. Most of the participants are residents of Petersburg or Wrangell.

When compared to the more common otter trawl, the beam trawl is a relatively simple gear type in appearance and function. A strong wooden or metal beam acts as a head rope, and metal "shoes" connected directly to each end of the beam act as the breast of the trawl. Thus, rigid members control two important net dimensions: 1) the width of the mouth is determined by the length of the beam; and 2) the opening height of the net is determined by the height of the metal "shoes." Vessel length limits beam length. Most beam trawls are deployed with a single bridle and fish best on flat substrates. However, they can effectively fish some gradual side slopes and irregular bottoms. When not deployed, the beam trawl is stored on the vessel bulwarks, somewhat compromising the sea-keeping capabilities of the vessel.

Management is based on a closed season designed to prevent fishing on major stocks during the egg-hatch period from February 15 through April 30, guideline harvest levels determined by historic harvests, and three fishing periods in three of the major fishing areas. A fourth fishing period occurs in the Stikine Flats area. The fishing periods were based upon industry input to spread out the harvest and processing requirements. Multiple fishing periods also take advantage of growth and recruitment.

FISHERY DEVELOPMENT AND HISTORY

The first documented beam trawl harvest of shrimp in Southeast Alaska occurred in Thomas Bay (located in District 10) in 1915. Floating canneries also located in Thomas Bay processed this harvest. By 1921 five processors were operating. Fleet size, production capacity, and expansion of fishing grounds occurred well into the 1950s. Prior to the development of the Westward Area (Statistical Area J) shrimp fisheries in 1959, the beam trawl fishery in Southeast Alaska was the major shrimp fishery in the state. Cook Inlet and Westward Region fisheries dominated the statewide production figures with harvests exceeding 100 million pounds through the 1970s. Cook Inlet and Westward harvests declined after that period and closed prior to the 1982-1983 season and the Southeast Alaska beam trawl shrimp fishery is once again the major trawl shrimp fishery in the state.

From 1955 through 1967 annual beam trawl harvests ranged from 1,800,000 to 7,600,000 pounds, with an average of 3,600,000 pounds per year (Table 3.1). The number of vessels participating ranged from 10 to 22. The peak production year was 1958 when 14 vessels caught over 7,600,000 pounds. During the late 1960s and early 1970s harvest and effort declined. Seasonal harvests averaged 916,300 pounds and effort averaged 12 vessels during the 1970s. Through the 1980s the harvest and effort increased to an average of 1,409,500 pounds by an average of 19 vessels. During the 1990s the harvest has averaged 2,674,500 pounds by an average of 34 permit holders. Some of the participants that were involved in the fishery between 1992 and 1997 were speculating on qualification into the limited entry program. Relatively few of the maximum of 51 vessels contributed substantially to the harvest or were dependent upon the fishery for a major portion of their fishing income. The effects of the limited entry program are evident in the 1998-1999 fishery when only 24 permit holders participated. Fisheries conducted during the 2000-2001 through 2002-2003 seasons have averaged 990,000 pounds delivered by an average of 14 active participants worth on average about $280,000 annually. Effort and participation in the fishery continues to decline, mostly due to low prices per pound as a result of large harvests from the Eastern seaboard and the western coast of North America.

During the 1970s, harvest opportunities occurred in all major fishing areas throughout the year (Table 3.2). As substantial and consistent increases in effort began in 1980, guideline harvest levels were achieved quickly and it became necessary to close major fishing areas by emergency order. Fishing opportunities were no longer available in major fishing areas throughout the year, especially during the winter months. Typically, the months of May, July, and September received high effort, with each month providing harvests exceeding 500,000 pounds (Table 3.2). Seasonal harvests for the region approached 1,000,000 pounds prior to 1980 and averaged about 2,700,000 pounds during the 1990s. Harvests have declined to an average of 990,000 pounds during the first few years of the 21st century.

Prior to 1970 Districts 6 and 10 produced the majority of the beam trawl harvest and District 8 produced relatively low harvests. Harvests from District 10 occur in Farragut and Thomas Bays, and harvests from District 6 included Duncan Canal and Kah Sheets Bay. With the decline in abundance in District 10, the fishery became almost totally dependent upon District 6 and harvests from District 8 began to increase. From the 1969-1970 through the 1978-1979 fishing seasons, District 6 harvests averaged almost 600,000 pounds per season while District 8 harvests averaged less than 250,000 pounds per season (Table 3.3a). During this ten-season period, harvests from District 8 exceeded harvests from District 6 only once. Regulatory guideline harvest levels were increased in 1978. In the following decade through the 1988-1989 season, average shrimp harvests from Duncan Canal were nearly 900,000 pounds, more than double that of the Stikine Flats area (Table 3.3b). Three fishing periods were established in regulations in 1989 for the four major fishing areas. During the 1990s, the pattern of high harvests in District 6 relative to District 8 has continued, District 6 averaging 1,200 pounds per year and District 8 averaging 800 pounds (Table 3.3c.). As price per pound and processing capacity have declined in recent years, fewer permit holders have found this fishery to be worth the effort, thus harvest and participation from all areas has declined. Recent harvests from District 10, mostly of larger shrimp species, have continued and non-traditional fisheries in Districts 3, 5, 7, 9, 10, and 11, have also produced sporadic harvest. There are a few catcher-processor vessels beginning to develop their markets and processing methods, but none of these vessels has begun producing frozen-at-sea product. Once this occurs, the pace and value of the fishery is likely to increase.

REGULATION DEVELOPMENT

Documentation describing shrimp fishing regulations is available since 1924. Regulations prior to that date are unknown. Regulations from 1924 through 1932 primarily concern fishing seasons. Size restriction regulations were first implemented in 1941. During the next decade closed areas were added and from 1947 through 1949, Duncan Canal, now a major shrimp fishing area, was closed to commercial fishing.

The beam trawl fisheries occur primarily in the vicinity of Petersburg and Wrangell. Until recently, most other areas were not significantly constrained by restrictive fishing seasons, fishing periods, or guideline harvest ranges (GHRs).

Fishing Seasons and Periods

Traditional Northern Shrimp Fisheries

A fishing season from May 1 through March 15 was established by 1924. A similar season has since been in place with some modifications to beginning and ending dates. The season is now May 1 to February 14. The purpose of the closed period is to protect female shrimp during the egg hatch period when fishing would reduce the reproductive potential of the stock.

As the fishery intensified during the 1980s, the GHR was taken in successively fewer days. In response, three fishing periods were established beginning in 1989. These periods were May 1 through June 30, July 1 through August 31, and September 1 through February 14. A fourth fishing period, December 1 through February 14, was added in 1997 for Stikine Flats of District 8 only. These regulatory periods were established for several reasons: to protect shrimp during the critical egg hatch period, to lengthen the total fishing season in these districts by spreading harvest over a longer period of time, to reduce effort during recruitment and growth periods in the spring and summer months, and to increase overall harvest in District 8.

Non-Traditional Northern Shrimp Fisheries

Prior to 1994 all fishing districts in Southeast Alaska, except District 8 and a portion of District 6 (Duncan Canal and Kah Sheets Bay), District 7 (Eastern Channel), and District 10 (Thomas and Farragut Bays), were open throughout the year. During the early 1990s large otter trawling catcher-processors requested permits to fish for shrimp in the region, leading to requests to the commissioner to close shrimp fisheries in outside waters. The controversy surfaced because some members of other fishing organizations felt that trawlers were using a loophole in the regulations to either prospect or target other species, like rockfish. Initial closures were made by either emergency regulation or emergency order. The issue was brought before the Board of Fisheries and resulted in the closure for Districts 1, 2, 4, and 12 through 16, which had low and sporadic historical effort and harvests.

At the request of industry in 1997, regulations were developed by the Board of Fisheries to provide additional fishing time during the egg-hatch period in most of the non-traditional areas if their respective guideline harvest levels have not been achieved during the normal fishing time of May through mid-February. Justification for the change was that these areas required more exploration, time, and expense than the traditional fishing areas, the months of March and April were generally free of commercial and personal use shrimp and crab pots, and weather was improved over the sometimes harsh winter conditions. The additional fishing time period, opened by emergency order only, is from February 15 through April 30. Logbooks are required and must be attached to the corresponding fish tickets.

Directed Sidestripe Shrimp Fisheries

In 1997, regulations were adopted to provide for directed sidestripe shrimp fisheries by beam trawl only during fishing seasons and periods and in areas established by the commissioner by emergency order. Additional conditions include limiting the vessel from participating at the same time in a directed northern shrimp fishery, a larger minimum mesh size, and mandatory logbook completion. Incidental shrimp species harvest cannot be greater than 10 percent, and fishers must notify the department two hrs before landing to allow for biological sampling of the harvest. If necessary, the commissioner may require an onboard observer during fishing operations. The department will evaluate opening a directed sidestripe shrimp fishery on a case-by-case basis. Since the sidestripe shrimp component of the Gulf of Alaska and South-central stocks seemed to be the most susceptible to overharvest and stock collapse, these measures were required in Southeast to collect the necessary information needed to manage sidestripe shrimp harvest conservatively. To date, fishing opportunities have been provided during eight fishing periods in District 8 since the 1997-1998 season, during one fishing period in District 6 during the 1997-1998 season, and once in Section 11-B during the 2001-2002 season. Only once during these openings has the upper end of the GHR (50,000 pounds) been reached, requiring an emergency closure prior to the regulatory closure date.

Size Restrictions

As early as 1941, regulations specified that not more that 50 percent of the shrimp harvested could be less than three inches total length. These regulations were altered to no more than 25 percent in 1942, and in 1948 the size was changed to less than 2.5-inches total length. By 1952 there were no size regulations and size of shrimp landed was only controlled by industry through price.

By 1979 the Board of Fisheries adopted a policy to discourage the harvest of shrimp less than two years of age. This policy exists today and instructs the department to take action when the fishery targets on segregated schools of small shrimp. Management measures are to optimize the harvest of larger female northern shrimp while minimizing retention of male, transitional, and smaller female shrimp.

In 1997, new regulations in Southeast Alaska defined the minimum average size of shrimp that could be sold. Shrimp taken by beam trawl gear must be at least 150 count per pound. To determine the average count per pound, one sample of at least one pound in weight of unbroken shrimp must be taken from each 500 to 1,000 pounds of shrimp, up to a maximum of 20 samples.

Traditional Northern Shrimp Fisheries

In 1977, harvest quotas for each of the four major fishing areas (District 8 and portions of Districts 6, 7, and 10) were first established. These quotas were based on historical harvest records with potential adjustment based on stock conditions. Strict quotas were difficult to monitor and regulate. In 1978, quotas were replaced by GHRs that provided more flexibility for inseason management, which was based upon fishery performance and size-class distribution. The fishery continued to intensify through the influx of effort and increased processing capacity. In some districts, specifically Districts 8 and a portion of District 6, the seasonal GHR was achieved early in the fishing season, necessitating an emergency order closure for the remainder of the season.

In 1988 the GHRs were evenly distributed through three fishing periods to lengthen the fishery and to take advantage of growth and recruitment which occurred during the spring and summer months. Guideline harvest ranges for each of the three fishing periods were: a portion of District 6 from 80,000 to 400,000 pounds; a portion of District 7 from 15,000 to 50,000 pounds; a portion of District 10 from 5,000 to 75,000 pounds; and all of District 8 from 25,000 to 175,000 pounds. In 1997, with the addition of a fourth fishing period in District 8 and an increase in the upper GHR from 175,000 to 250,000 pounds, the seasonal harvest potential increased by half a million pounds, increasing the total allowed season harvest to 1.2 million pounds, more than double the previous GHR.

Non-Traditional Northern Shrimp Fisheries

In 1994, seasonal GHRs of 0 to 100,000 pounds were established for Districts 3, 5, 9, and 11 and remaining portions of Districts 6, 7, and 10. In 1997, at the request of industry, the total District 11 GHR was increased and is now more than triple the 1994 GHR. Seasonal GHRs were established by section: 11-A, 11-B, and 11-C from 25,000 to 75,000 pounds in each, and 11-D from 50,000 to 150,000 pounds.

Directed Sidestripe Shrimp Fisheries

With the implementation of the directed sidestripe shrimp fishery in 1997, a limit of 50,000 pounds of shrimp may be taken from any district or section during a season, during that fishery. Participants cannot concurrently participate in a northern shrimp fishery, must use a large mesh net, and complete logbooks.

Gear Restrictions

In 1962 regulations defining a minimum mesh size used in beam trawls were established for a portion of the Petersburg-Wrangell area. By 1969 similar regulations were in place for all areas. In 1997 the minimum mesh size was increased. The current regulatory mesh size is approximately 1.35-inches stretched measure. Due to the relatively low market value of small northern shrimp, many fishers are currently using web between 1.38-inches and 1.50-inches stretched mesh, to reduce their harvest of small northern shrimp.

Under the regulations provided in the directed sidestripe shrimp fishery that was adopted in 1997, shrimp trawl webbing must be a least 1 7/8 inch stretched measure, or no more than 13 meshes per foot and the head rope may not be longer than the length of the beam plus 10 percent. Trawl web used during the directed sidestripe shrimp fishery was initially required, after the 1997 Board of Fisheries meetings, to be square hung at the beam selvage (where the mesh is connected to the breastlines of the trawl), the intent being to allow the development of the directed sidestripe shrimp fishery while minimizing the impact on other smaller shrimp species. The regulation further provides that no more than 10 percent of the total pandalid shrimp harvest may be comprised of other species of shrimp. However, during the 2000 Board of Fisheries meeting this regulation was eliminated, allowing diamond hung meshes to be used for the directed sidestripe shrimp fishery. It is not known what effect this change in net construction has on retention of small shrimp. A minimum mesh size of 2-inch stretched measure may be advisable as a precaution against retention of small shrimp in this fishery.

In 1959 otter trawls were not allowed in the Petersburg-Wrangell area in major locations utilized by the beam trawl fishery. Prior to the 1963-1964 fishing season this regulation was altered to the present district boundaries.

In 1980 beam trawling was prohibited in waters of Lituya Bay (District 16) by the Alaska Board of Fisheries and in 1985 the National Park Service prohibited trawling in waters of Glacier Bay. Beginning in mid 1986, trawling was prohibited in the waters of Tenakee Inlet (in District 12). During the 1997 Board of Fisheries meeting, otter trawls were eliminated as a legal gear type in Southeast Alaska, effective May 8, 1998.

Limited Entry

The Commercial Fisheries Entry Commission, in response to petitions received from beam trawl fishers during 1995 and 1996, established January 1, 1997 as the qualification date for limited entry with the four years immediately preceding being the qualification period. Therefore, to be eligible to apply for an entry permit, an individual would have had to be a permit holder during at least one of the years during the qualification period of January 1, 1993 through December 31, 1996. To date, 28 permits have been issued with 22 additional applicants either undergoing hearings or administrative review for additional points or vying for the remaining 13 permits that will be available. Of the 28 permits that were granted, 5 are non-transferable and 23 are transferable (CFEC website, B6410P-C State of Alaska 2002-10-31 Commercial Fisheries Entry Commission Limited Fisheries Status Report).

STOCK ASSESSMENT PROGRAM

The beam trawl fishery stock assessment program is still in its infancy. Although dockside sampling and collection and sexing of shrimp samples has been conducted since 1986 and sampling by onboard observers was initiated in spring of 2002, to date no fishery-independent surveys have been conducted. More information is needed on northern and sidestripe shrimp stock size and life history in Southeast Alaska. Information is also needed on the effects of mesh size and gear configuration on catch size and species composition, what constitutes a sustainable harvest strategy, and bycatch and discard levels. The department plans to continue the dockside sampling and sampling by onboard observers during the upcoming 2003-2004 season.

Present information does not allow the department to project future abundance. Stock assessment data is not available, and shrimp samples obtained through dockside sampling are not analyzed in sufficient time to effect management decisions. But, it is possible to make a general qualitative statement concerning stock strength. Relatively strong year-classes have been evident in major stocks and have supported relatively strong harvests during the late 1990s. Reduced harvests during the past few fishing seasons do not appear to be a function of reduced shrimp biomass. Major stocks are expected to remain strong for the near term.

SUMMARY OF RECENT SEASONS HARVESTS

Traditional Northern Shrimp Fisheries

Harvest and Effort by Area

Reported harvest from fish tickets and port-sampling data provide the information summarized for the traditional beam trawl fishing areas of Duncan Canal (District 6), Eastern Channel (District 7), the Stikine Delta (District 8) and Thomas and Farragut bays (eastern District 10). The majority of the commercial harvest reported from District 6 comes from Statistical Areas 106-42, 106-43 and 106-44, in District 7 from Statistical Area 107-45, and in District 8 from Statistical Areas 108-40, 108-50, and 108-60. Thomas and Farragut Bays in District 10 support the majority of harvest in that district.

Total harvest and number of permits fished have generally declined in nearly all of the traditional beam trawl fishing areas for the 1991-1992 through 2001-2002 seasons (Table 3.1). Declines in total harvest are likely due to less effort due to the low prices for northern shrimp in the recent past, a lack of processing capacity, and fewer active participants in the fishery. Harvest is composed primarily of northern shrimp, *Pandalus borealis*, which competes in the market place with large harvests of north Atlantic *P. borealis*, (thought by some to be a different species), and *P. jordani* from British Columbia and Oregon. Average harvest per landing for the last five years in Southeast Alaska for northern shrimp has remained fairly consistent in all areas fished, with a slight increase in harvest per landing for the Duncan Canal and Eastern Channel areas, stable harvests from the Stikine delta and declining harvest from the bays of Frederick

Sound. The increases in harvest per landing in Duncan Canal may be due to the declining number of permits fished that are targeting northern shrimp, leaving a larger biomass available. More fishers fishing Districts 7 and 8 appear to be fishing larger meshed nets which catch fewer of the smaller northern shrimp and an increasing proportion of the larger, more valuable species such as sidestripe and coonstripe shrimp. Fewer boats fishing in Frederick Sound and a declining average harvest per landing since the 1995-1996 season have resulted in lower overall harvests from this area, however, catch rates are often not reliable indicators of abundance as fishing methods and efficiency improve. Fewer deliveries from this area have been port-sampled.

Harvest during the spring egg-bearing period, February 15 to April 30, prior to the traditional period of fishing has occurred in Districts 6, 7, and 10. Harvest consists primarily of northern shrimp, with sidestripe, coonstripe, and spot shrimp also harvested in all areas fished.

Species Composition

The composition of harvest for Districts 6, 7, 8, and 10 has varied over the past 11 seasons. Duncan Canal has supported and continues to support primarily a northern shrimp fishery, which make up over 99 percent of the species harvested since the 1991-1992 season. Eastern Channel is also primarily a northern shrimp fishery, with an average of 94 percent of the harvest made up of northern shrimp, 5 percent sidestripe shrimp and the other species making up the remaining 1 percent. Sidestripe, coonstripe, and spot shrimp have been harvested in higher proportions in Blake Channel than in any of the other districts since the 1995-1996 season for those years that data is not confidential with an increasing proportion of sidestripe shrimp in the harvest since the 1991-1992 season. Harvest by species for Blake Channel averages 49 percent for northern shrimp, 37 percent for sidestripe shrimp, 7 percent for coonstripe, and 7 percent for spot shrimp for all seasons combined since 1991-1992. Sidestripe, and to a lesser extent coonstripe and spot shrimp, have generally occurred in an increasing proportion of the harvest since 1991 from the Stikine Flats. Harvest by species for Stikine Flats averaged 93 percent for northern shrimp, slightly less than 7 percent for sidestripe shrimp, and less than 1 percent for coonstripe and spot shrimp for the 1991-1992 through 1996-1997 seasons. Proportional harvest by species for the period from 1997 to 2002 has averaged 85 percent northern shrimp, 14 percent sidestripe shrimp, and less than 1 percent for coonstripe and spot shrimp. More coonstripe and spot shrimp are being reported for the Stikine Flats since 1996-1997 primarily due the directed sidestripe shrimp fishery allowed by the Board of Fisheries in January of 1997. A directed sidestripe shrimp fishery has been opened in Districts 6 and 8 during the 1997-1998 season, Districts 8 during 1998-1999, Districts 8 and 10 during 1999-2000, Districts 8 and Section 11-B during the 2000-2001 season, and District 8 during the 2001-2002 season. The harvest from District 10 bays also shows a trend towards increased harvest of the larger species of shrimp.

Harvest and Effort by Fishing Period

Total harvest for the season, total number of landings, and total number of permits fished for all species of shrimp combined has steadily declined in all districts since the 1996-1997 season. This was prior to the qualification date for limited entry in the beam trawl fishery which was January 1, 1997, with required participation in the fishery during January 1, 1993 through December 31, 1996. The harvest is typically spread evenly between the 3 to 4 periods that the fishery is open, with slightly less being taken during the

last period of the season, in the fall. The average total annual harvest for the five years since limited entry went into effect by district was about 795,000 pounds for District 6, 170,000 pounds for District 10, and approximately 83,000 pounds for District 7. These averages were lower than the 10-year averages for Districts 6, 7, and 10 respectively 1,066,609, 100,900 and 209,357 pounds. However, average harvest per landing during the last three commercial seasons for District 6 was about 500 – 900 pounds greater than the 10-year average harvest per landing. District 7 average harvest per landing during the last 2 years was also higher at approximately 200 to 500 pounds greater than the ten-year average of 2,146 pounds per landing. As processing capacity for northern shrimp has been limited during the past five years, total harvest has been declining, possibly leaving more biomass on the fishing grounds and thus keeping average catch rates higher. Harvest from these two areas, Duncan Canal and Eastern Channel, has primarily been of northern shrimp for the entire 10-year period. The five-year average harvest for District 8 of 790,000 pounds is slightly higher than the 10-year average for District 8 of 776,066 pounds due to an exceptionally large harvest of northern shrimp during the 1997-1998 season. However, the harvest per landing in District 8 for the last two seasons has been approximately 800 to 1,000 pounds lower than the five-year average, as more boats use larger nets to catch the larger, more valuable species such as sidestripe, coonstripe, and spot shrimp during the directed sidestripe shrimp fisheries established by regulation in 1997. This trend is also evident in Thomas/Farragut Bays where catch rates for shrimp (all species combined) are lower possibly due to fishers focusing their efforts on the larger shrimp species.

Non-Traditional Northern Shrimp Fisheries

Beam trawl fishing has occurred at low and sporadic levels outside the Petersburg-Wrangell area since at least the 1969-1970 season. These non-traditional beam trawl fishing areas include South Zarembo and Sumner Straits (District 6), Eastern Channel (District 7), Upper Frederick Sound (western District 10), and District 11, all Sections (Table 3.5). Fishing opportunities exist in Districts 3, 5, 9, 11, and portions of Districts 6, 7, and 10 during the normal fishing season. These districts are managed with a single fishing season and generic guideline harvest levels not to exceed 100,000 pounds. During the past three seasons these other districts contributed an average harvest of about 60,000 pounds by six permit-holders (Tables 3.4a, b, and c). The majority of this harvest was reported from District 11. Most harvests from Districts 3, 5, 9, and 11 (all sections) have been made by fewer than three boats, thus annual harvests are mostly confidential.

Directed Sidestripe Shrimp Fisheries

Since May 1997, there have been eight openings of the directed sidestripe beam trawl fishery in District 8, and one opening in each of Districts 6, 10, and Section 11-B to date. Although the openings were each about a month long, only one of them achieved the established GHL of 50,000 pounds. The harvest in District 8 has ranged from 4,706 to 41,981 pounds of sidestripe shrimp harvested; averaging 18,589 pounds of sidestripe shrimp per season taken by an average of 0.4 permit holders. The bycatch of other pandalid shrimp has averaged 26 percent ranging from 12 to 64 percent.

OUTLOOK

Fishery Trends

The increased use of larger mesh web in trawl construction could increase the quality of the northern shrimp available, and possibly increase the exvessel value of the harvest. Even larger web is being used to target sidestripe shrimp, with some significant bycatches of coonstripe shrimp. However, the use of larger mesh web does have potential negative biological consequences. Larger web will tend to target more strongly on the female portion of the stock. The removal of female shrimp at an increasing rate could reduce the reproductive potential of the stock and result in smaller populations during future seasons. Without pre-season stock assessment methods, inseason monitoring tools, and with management based on historic harvests, which included a broader segment of all year-classes, it is possible to over-exploit some stocks prior to taking appropriate management action. Using beam trawls to target spot shrimp could have detrimental effects on the habitat and future spot shrimp production.

The continued development of beam trawl fisheries in districts outside the boundaries of the four major fishing areas could provide more product to the fishery, particularly with the high proportion of larger and more valuable sidestripe shrimp found in some locations. Regulation changes may be needed to adequately control the expansion of the fishery and to prevent high-grading of some species of shrimp while dumping the less desirable species or smaller shrimp.

Effort has decreased from 23 permits in the 1999-2000 season to 8 permits fished during the 2002-2003 season. This decrease is due in part to low prices at the cannery and a reduction in processing capabilities, or the need to use existing facilities to process product from other fisheries. A portion of this decrease is undoubtedly because the limited entry permit qualification period is over. With the implementation of the limited entry program, permits have been and will continue to be purchased by fishers desiring diversification. This may result in higher effort levels, more efficient and species-specific gear, and eventual development of non-traditional product forms such as value-added frozen-at-sea shrimp to garner a higher price from a currently undervalued resource. In turn, these changes identify the need to establish a research program for necessary biological information, a more active management program, and the development of a management plan to ensure future conservation goals are achievable.

Management Program and Concerns

A preseason review of each season's fish tickets allows for some harvest trend description. Other components of the current management system include inseason harvest monitoring which allows the manager to estimate the initial level of harvest and to make informed decisions about timing of closures relative to the guideline harvest levels established for the different areas. Summary of fish ticket totals document the actual, reported harvest levels. Developing programs, such as the logbook program required for the non-traditional areas and the beam trawl observer trips will allow the department to assess the harvest levels and collect biological information from area fisheries.

Not unlike the management of the pot shrimp fisheries, beam trawl harvest levels are set based on average historical harvest levels, not population estimates. While this fishery has sustained itself for almost 80 years, the size composition of the harvest appears to be changing. The establishment of directed beam-trawl fisheries and use of larger mesh sizes appears to be focusing more effort on the larger species and larger individual shrimp. Additionally, there has been interest in harvesting shrimp earlier in the spring when more of the female shrimp are bearing eggs and when a larger proportion of the population appears to be undergoing the spring molt. The trend towards harvest by vessels processing at sea could eventually make the timely tracking of cumulative harvest more difficult, requiring additional reporting to the department by the fleet.

Table 3.1. Registration Area A (Southeast Alaska) shrimp beam trawl harvest, number of permits, number of landings, pounds per permit, and pounds per landing, 1955 to present.[a]

Year/Season	Harvest in Pounds	Number of Permits	Landings	Pounds per Permit	Pounds per Landing
1955[b]	1,777,122	15		118,475	
1956	3,301,598	15		220,107	
1957	2,350,499	10		235,045	
1958	7,605,871	14		543,277	
1959	5,518,843	22		250,857	
1960	3,343,373	21	1,007	159,208	3,320
1961	4,212,300	20	1,394	210,615	3,022
1962	3,884,050	22	1,400	176,548	2,774
1963	3,110,340	20	1,080	155,517	2,880
1964	2,793,101	13	1,092	214,854	2,558
1965	2,941,429	13	1,338	226,264	2,198
1966	3,784,597	14	1,663	270,328	2,276
1967	2,203,753	13	1,105	169,519	1,994
1968-69	2,003,753	12	925	166,979	2,166
1969-70	1,840,727	11	952	167,339	1,933
1970-71	742,404	11	477	67,491	1,556
1971-72	1,050,978	9	592	116,775	1,775
1972-73	797,387	9	421	88,599	1,894
1973-74	674,386	8	460	84,298	1,466
1974-75	1,205,617	20	434	60,281	2,777
1975-76	983,609	12	450	81,967	2,185
1976-77	768,930	14	476	54,924	1,615
1977-78	949,043	10	404	94,904	2,349
1978-79	1,033,325	9	519	114,814	1,990
1979-80	956,927	17	982	56,290	974
1980-81	843,737	21	920	40,178	917
1981-82	919,275	15	524	61,285	1,754
1982-83	1,397,026	15	455	93,135	3,070
1983-84	1,756,533	18	667	97,585	2,633
1984-85	1,294,545	23	811	56,285	1,596
1985-86	429,224	16	252	26,827	1,703
1986-87	2,203,935	16	435	137,746	5,066
1987-88	1,761,636	25	388	70,465	4,540
1988-89	1,675,643	18	527	93,091	3,179
1989-90	1,813,032	21	645	86,335	2,810
1990-91	2,494,957	23	793	108,476	3,146
1991-92	2,934,341	28	1,036	104,798	2,832
1992-93	2,375,742	41	922	57,945	2,576
1993-94	2,135,500	25	705	85,420	3,029
1994-95	3,223,791	25	814	128,952	3,960
1995-96	3,053,316	48	793	63,611	3,850
1996-97	2,536,985	51	884	49,745	2,869
1997-98	3,051,197	42	983	72,648	3,103
1998-99	2,264,641	24	834	94,360	2,715
1999-00	1,893,815	23	566	82,340	3,346
2000-01	1,413,264	16	543	88,329	2,603
2001-02 [a]	903,897	19	358	47,574	2,525

[a] Most recent year's data should be considered preliminary.

[b] Data from 1955 through the 1968-1969 seasons is from annual reports. Harvest and effort data from 1969-1970 to the present is from the ADF&G Integrated Fisheries Data Base (IFDB).

Table 3.2. Registration Area A (Southeast Alaska) shrimp beam trawl harvest in thousands of pounds by month and season, 1969-1970 to present.

Season	Month												
	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	Total
1969-70	326.7	280.2	78.8	129.1	184.7	241.2	119.6	165.2	160	100.6	32.4	22.4	1,840.70
1970-71	131.3	105.1	65.4	79.8	49.7	64.3	54.8	59.2	59.9	56.8	*	13.2	742.4
1971-72	139	106.3	144.5	106.5	69.7	78.3	101.6	71.1	66	121.1	38.7	*	1,051.00
1972-73	168.5	126.4	77.2	*	*	44.7	64	46.3	81.6	42.2	6.1	8.5	797.4
1973-74	96.3	124.1	*	*	*	*	59.1	64.8	60.3	29.2	*	8.4	674.4
1974-75	160.9	199.2	202.4	168	120.1	61.4	73.9	90.8	104.2	21.6	*	*	1,205.60
1975-76	180.7	130.3	67.2	*	112.3	154.5	73	77.8	38.9	46.1	*	6.7	983.6
1976-77	78.8	171.7	120	118.8	61.8	37.4	55.2	33.3	65	25.7	*	*	768.9
1977-78	73.7	235.3	147.9	166.6	126.2	48.3	29.5	18.7	81.2	21.7	0	0	949
1978-79	107	130.9	140.6	240.2	112	93.1	67.8	36	72.3	22.5	8.3	*	1,033.30
1979-80	98.2	154.9	146.6	177.4	104.2	55.1	58.4	39.6	66.3	48.1	*	*	956.9
1980-81	153.8	168.6	164.9	153.7	54.2	30.2	35.5	12.2	33.6	31.6	5.5	0	843.7
1981-82	165.1	183.4	124	168.8	81.1	52.7	36.5	48.3	33	22.3	0.9	3.1	919.3
1982-83	181.1	171.7	168.8	159.4	134	50.1	60.7	82	152.6	119.8	64.4	52.5	1,397.00
1983-84	436.3	249	287	218.2	127.5	132	83.3	86.9	101.7	16.2	9	9.6	1,756.50
1984-85	156.3	252.5	272.5	232.8	132.9	59.5	61.8	49.7	51.9	22.5	*	*	1,294.50
1985-86	125.6	105.3	46.1	23.2	39.1	13.8	31.3	29.8	*	8.4	*	*	429.2
1986-87	294.4	508.2	576	446.8	372	*	*	*	*	*	*	*	2,203.90
1987-88	634	721	291.2	90.8	*	*	*	*	*	6	*	*	1,761.60
1988-89	647.2	369	258.4	137.9	*	2.5	82.8	127.3	37.8	*	*	*	1,675.60
1989-90	473.6	236.2	259	173.4	224.3	115.8	*	38.4	167.8	53.4	*	*	1,813.00
1990-91	546.7	336.5	386.5	357.8	293.3	147.4	161.2	148.7	16.8	9.4	17.1	73.4	2,495.00
1991-92	611.6	325.5	887.2	79.1	336.4	219	167.2	165.6	114.8	17.1	6.4	15.6	2,934.30
1992-93	469.3	253.7	404.4	295.7	194.5	186.4	136.8	112.4	131.8	65.5	58.3	67	2,375.70
1993-94	548	215.4	372	239.2	121.3	86.9	104.5	100.3	147.4	85.7	112.1	*	2,135.50
1994-95	560	266.2	574.6	468.2	196.3	96.9	149.3	188.5	387	41.9	231.6	63.5	3,223.80
1995-96	686.6	338.2	522.3	344.7	515	66.7	137.8	55.8	62.7	157.9	104.1	61.3	3,053.30
1996-97	782.8	262.2	609	162.8	510.3	100.3	73.3	7.6	*	1.4	*	*	2,537.00
1997-98	727.8	237.8	637.6	183.9	677.6	142.2	129	261	*	41.6	*	0	3,051.20
1998-99	524.8	260.8	501.3	317.7	348.7	138.8	102.6	3.4	22.3	15.5	*	*	2,264.60
1999-00	581.9	231.4	385.4	313.2	224.9	64.4	29.3	6.9	3.5	47.1	1.6	4.2	1,893,815
2000-01	486.3	172.6	219.6	185.8	92.0	78.5	118.7	*	25.4	25.9	*	*	1,413,264
2001-02[a]	363.0	149.3	11.3	41.0	97.9	*	93.1	17.9	42.6	9.0	*	0.0	903,897

[a] Most recent year's data should be considered preliminary.

* Where number of permits participating is less than three boats, information is considered confidential.

Table 3.3a. Registration Area A (Southeast Alaska) shrimp beam trawl fishery harvest in thousands of pounds by season and district, 1969-1970 through 1978-1979 seasons.

	Season									
District	1969-70	1970-71	1971-72	1972-73	1973-74	1974-75	1975-76	1976-77	1977-78	1978-79
1	0.0	*	*	0.0	*	*	*	1.6	0.0	*
2	0.0	0.0	0.0	0.0	0.0	1.3	0.1	0.0	0.0	0.0
3	0.0	*	*	*	0.0	0.0	*	*	0.0	0.0
4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
5	*	0.0	0.0	0.0	0.0	0.0	*	0.0	0.0	0.0
6: Duncan	865.5	344.4	442.4	450.3	260.0	973.2	554.2	610.2	669.7	625.0
6: Sumner	0.0	0.0	0.0	*	0.0	0.0	257.6	10.7	*	*
7: Eastern	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
7: Blake	0.0	38.1	67.0	35.7	48.7	10.4	14.6	29.2	40.3	140.1
8: Stikine	609.7	158.5	285.7	219.6	323.4	212.4	84.5	85.5	176.0	261.9
9	*	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
10: Thomas	350.1	198.6	252.3	89.9	*	*	*	27.9	*	3.4
10: Upper Fred	0.0	*	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
11	*	0.0	0.0	0.0	0.0	*	*	*	*	*
12	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
13	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
14	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
15	0.0	0.0	0.0	0.0	0.0	*	0.0	0.0	0.0	0.0
16	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total	1,840.7	742.4	1051.0	797.4	674.4	1,205.6	983.6	768.9	949.0	1,033.3
Landings	952	477	592	421	460	434	450	476	404	519
Permits	11	11	9	9	8	20	12	14	10	9

* Where number of permits participating is less than three boats, information is considered confidential.

Table 3.3b. Registration Area A (Southeast Alaska) shrimp beam trawl fishery harvest in thousands of pounds, by season and district, 1979-1980 through 1988-1989 season.

District	Season									
	1979-80	1980-81	1981-82	1982-83	1983-84	1984-85	1985-86	1986-87	1987-88	1988-89
1	*	*	*	*	*	*	*	*	0.0	*
2	1.5	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0
3	*	*	*	*	0.0	0.0	0.0	0.0	0.0	0.0
4	0.0	0.0	0.0	0.0	0.3	0.0	0.0	0.0	0.0	0.0
5	*	0.0	0.0	0.0	0.0	*	0.0	0.0	0.0	0.0
6: Duncan	427.4	415.0	693.8	1,199.6	1,015.4	523.9	235.7	1,645.3	1,225.7	1,043.9
6: Sumner	0.0	*	*	0.0	0.0	17.7	*	*	*	*
7: Eastern	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	*
7: Blake	109.8	77.9	31.5	11.8	138.6	101.3	30.6	100.6	75.8	15.9
8: Stikine	405.7	342.5	88.6	51.0	545.0	610.8	160.9	432.4	436.3	590.0
9	0.0	*	0.0	*	*	0.0	0.0	0.0	0.0	0.0
10: Thomas	2.8	0.0	0.0	*	26.3	33.8	*	*	*	*
10: Upper Fred	*	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
11	0.0	*	*	0.0	0.0	0.0	0.0	0.0	*	0.0
12	0.0	0.0	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0
13	*	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
14	0.0	0.0	0.0	0.0	0.0	0.0	0.0	*	0.0	0.0
15	*	*	*	*	2.0	*	*	0.0	0.0	0.0
16	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total	1,840.7	742.4	1,051.0	797.4	674.4	1,205.6	983.6	768.9	949.0	1,033.3
Landings	952	477	592	421	460	434	450	476	404	519
Permits	11	11	9	9	8	20	12	14	10	9

* Where number of permits participating is less than 3 boats, information is considered confidential.

Table 3.3c. Registration Area A (Southeast Alaska) shrimp beam trawl fishery harvest in thousands of pounds, by season and district, 1989-1990 to present.

District	Season												
	1989-90	1990-91	1991-92	1992-93	1993-94	1994-95	1995-96	1996-97	1997-98	1998-99	1999-00	2000-01	2001-02[a]
1	*	*	0.0	0.0	*	*	*	---------- Closed ----------					
2	0.0	0.0	0.0	*	---------- Closed ----------								
3	0.0	80.1	20.4	125.3	18.9	31.6	19.2	69.9	24.2	47.3	*	*	*
4	0.0	0.0	0.0	0.0	---------- Closed ----------								
5	0.0	0.0	0.0	*	0.0	*	182.0	74.1	11.7	0.0	*	0.0	0.0
6: Duncan	1,006.9	1,565.5	1,680.5	1184.8	829.0	1,406.7	1,355.6	1,285.2	1,250.6	989.1	838.9	585.8	222.5
6: Sumner	0.0	*	0.0	13.8	*	*	0.0	*	0.0	0.0	0.0	0.0	0.0
7: Eastern	17.5	55.5	74.1	42.4	*	232.2	168.1	115.2	174.7	62.7	45.8	89.2	57.7
7: Blake	70.8	40.5	101.5	60.1	50.6	0.0	3.6	8.4	*	0.8	*	*	*
8: Stikine	676.7	652.0	697.9	683.6	834.3	848.5	905.7	611.9	1,347.8	818.8	704.7	562.3	583.1
9	0.0	*	*	19.6	*	0.0	*	*	*	*	*	*	5.9
10: Thomas	*	*	321.3	148.7	219.7	241.7	239.7	280.8	240.1	*	247.1	64.1	23.2
10: Upper Fred	0.0	0.0	*	0.0	0.0	*	*	28.4	16.9	*	*	*	*
11	0.0	*	9.6	98.0	112.4	295.0	170.3	57.4	13.9	36.2	26.0	81.9	*
12	0.0	0.0	*	0.0	---------- Closed ----------								
13	0.0	0.0	*	0.0	---------- Closed ----------								
14	0.0	0.0	0.0	0.0	---------- Closed ----------								
15	*	*	0.0	*	---------- Closed ----------								
16	0.0	0.0	0.0	0.0	---------- Closed ----------								

* Where number of permits participating is less than 3 boats, information is considered confidential.
a most recent year's data should be considered preliminary.

Table 3.4a. Registration Area A (Southeast Alaska) shrimp beam trawl harvest and landings by district and month, 1999-2000.[a]

Month	Fishery								
	Duncan Canal	Sumner Strait	Eastern Channel	Blake Passage	Stikine Flats	Thomas Bay	all Others Southeast	Total Permits	Total Harvest
May	174,057 (44)		37,235 (18)	*	282,495 (81)	*	6,192 (7)	17	581,866
June	185,724 (41)		*		9,592 (8)	*	23,508 (13)	13	231,429
July	100,347 (26)				197,308 (51)	*	*	8	385,412
August	240,659 (42)		*		68,625 (16)		3,660 (7)	7	313,180
September	*				61,902 (13)	*	3,597 (5)	7	224,905
October	*				*	*		4	64,365
November	*				*	*	*	5	29,294
December					3,520(4)		*	4	6,897
January					*			*	*
February					44,886(37)		*	6	47,147
March	Closed	Closed	Closed	Closed	Closed	Closed	*	*	*
April	Closed	Closed	Closed	Closed	Closed	Closed	*	*	*

* Where number of permits participating is less than 3 boats, information is considered confidential.

Table 3.4b. Registration Area A (Southeast Alaska) shrimp beam trawl harvest and landings by district and month, 2000-2001.

Month	Fishery								
	Duncan Canal	Sumner Strait	Eastern Channel	Blake Passage	Stikine Flats	Thomas Bay	all Others Southeast	Total Permits	Total Harvest
May	99,912 (20)		30,675 (17)	*	282,906 (71)	24,769(28)	47,696 (15)	13	486,336
June	104,928 (23)		*		*	*	33,899 (14)	8	172,610
July	*		*		33,754 (26)	*	2,744 (8)	7	219,576
August	125,315 (27)				51,038 (26)	*	*	6	185,802
September	*				45,431 (34)	*	*	6	91,988
October	*				56,009 (22)		*	5	78,502
November	*		*		44,877 (24)	*	*	5	118,746
December	*						*	*	*
January	*				16,933 (22)		*	7	25,350
February				*	22,029 (29)		*	9	25,893
March	Closed	Closed	Closed	Closed	Closed	Closed	*	*	*
April	Closed	Closed	Closed	Closed	Closed	Closed	*	*	*

* Where number of permits participating is less than 3 boats, information is considered confidential..

** Confidential where totals can be used to calculate confidential catch.

Table 3.4c. Registration Area A (Southeast Alaska) shrimp beam trawl harvest and landings by district and month, 2001-2002.

Month	Fishery								
	Duncan Canal	Sumner Strait	Eastern Channel	Blake Passage	Stikine Flats	Thomas Bay	all Others Southeast	Total Permits	Total Harvest
May	78,824 (20)		4,777 (4)	*	251,342 (85)	17,757 (14)	9,358 (8)	126	363,009
June	94,579 (19)		*		*		*	39	149,307
July			*	*	*	*	*	19	11,294
August	*				30,128 (17)		*	22	40,998
September	*		*		65,507 (28)	*	*	36	97,870
October	*				*			14	78,031
November	*		*		83,672 (32)			34	93,102
December			*		16,979 (24)			29	17,933
January			*		39,821 (28)		*	29	42,563
February			*		8,876 (8)			9	9,006
March	Closed	Closed	Closed	Closed	Closed	Closed	*	*	*
April	Closed	Closed	Closed		Closed	Closed	Closed	Closed	Closed

a Recent season's data should be considered preliminary.
* Where number of permits participating is less than 3 boats, information is considered confidential.
** Confidential where totals can be used to calculate confidential catch.

Table 3.5. Beam trawl fishing areas and associated statistical areas (districts and all associated statistical areas) for the harvest information from fish tickets for the 1991-1992 to 2001-2002 seasons.

Traditional fishing areas	**Statistical areas**
District 6	
Duncan Canal	106 - 42, 43, 44
District 7	
Blake Channel	107 - 10, 20,30, 35, 40
District 8	
Stikine Flats	108 - 10, 20, 30, 40, 41, 45, 50, 60, 70, 80
District 10	
Thomas & Farragut Bays	110 - 11, 12, 134, 14, 15, 16
Non-traditional fishing areas	
District 6	
South Zarembo	106 - 10, 20, 21, 22, 25, 30
Sumner Straits	106 - 41
District 7	
Eastern Channel	107 - 45
District 10	
Upper Frederick Sound	110 – 17, 21, 22, 23, 24, 31, 32, 33, 34
Districts 3, 5, 9	
Entire district	All statistical areas
District 11	
Sections 11A, 11B, 11C, 11D	All statistical areas

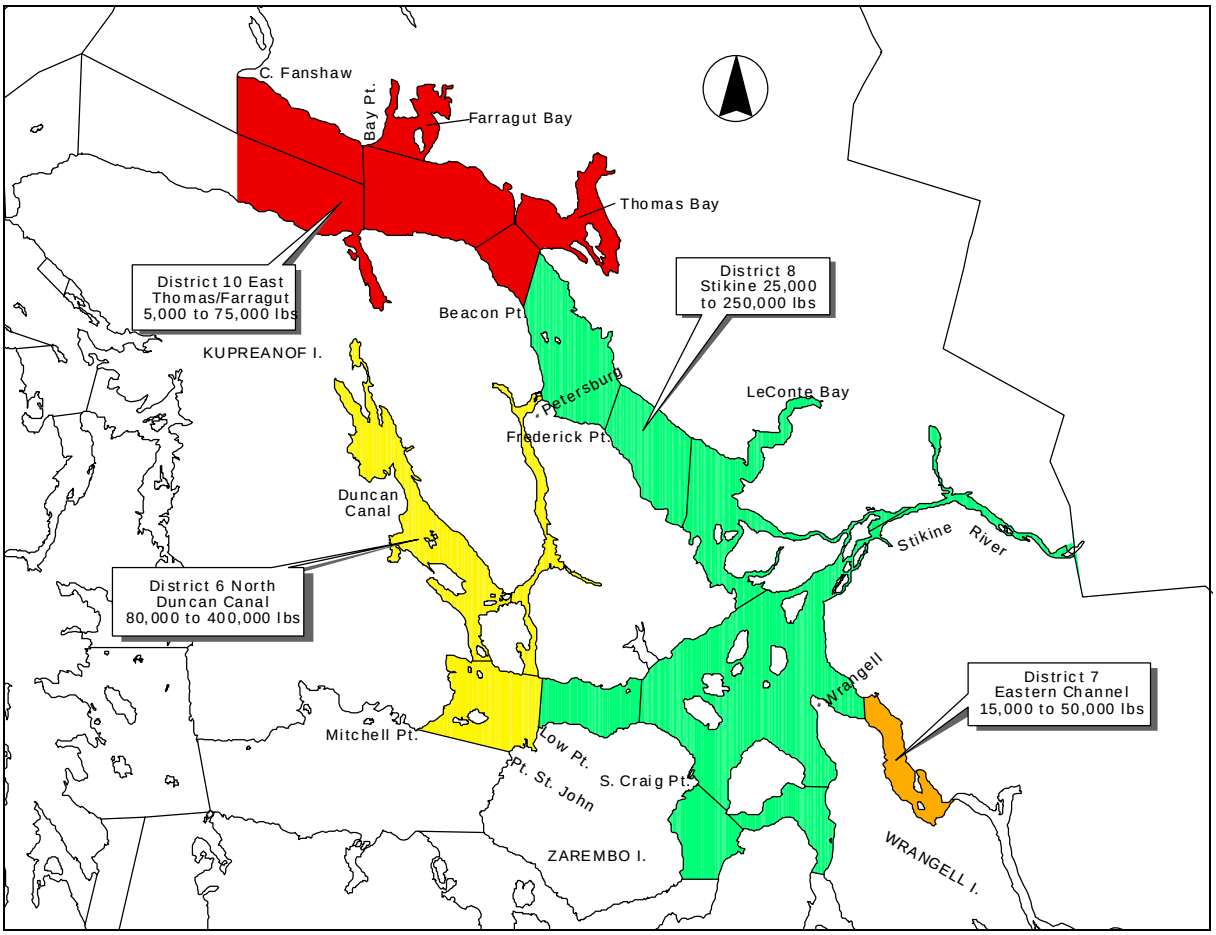

Figure 3.1. Traditional beam trawl shrimp fishery areas and fishing period guideline harvest ranges for Southeast Alaska.

REPORT TO THE BOARD OF FISHERIES,

SOUTHEAST SHRIMP OTTER TRAWL FISHERY

by

Gretchen Bishop

Regional Information Report[1] No. 1J02-45

Alaska Department of Fish and Game
Division of Commercial Fisheries
Juneau, Alaska

November 2002

[1] The Regional Information Report Series was established in 1987 to provide an information access system for all unpublished divisional reports. These reports frequently serve diverse ad hoc informational purposes or archive basic uninterpreted data. To accommodate timely reporting of recently collected information, reports in this series undergo only limited internal review and may contain preliminary data, this information may be subsequently finalized and published in the formal literature. Consequently, these reports should not be cited without prior approval of the author or the Division of Commercial Fisheries.

TABLE OF CONTENTS

LIST OF TABLES

INTRODUCTION

The otter trawl fishery targeted primarily northern shrimp *Pandalus borealis,* and secondarily, the larger sidestripe shrimp *Pandalopsis dispar*. Other species captured incidentally and landed in smaller quantities were the coonstripe shrimp *Pandalus hypsinotus;* humpy shrimp *P. goniurus,* and the spot shrimp *P. platyceros*.

Otter trawlers have occasionally entered the fishery throughout its history. In large part because of the operational limitations of otter trawls, high bycatch rates, relatively low catch rates for northern shrimp, lack of markets, and preemption from the most productive grounds by beam trawl fisheries, effort had not been consistent nor significant. The situation changed with the advent of higher priced markets for the larger sidestripe and coonstripe shrimp and the use of catcher-processors to exploit a niche for high-quality, fresh-frozen product. The lack of adequate regulatory controls for this fishery resulted in larger otter trawlers targeting sidestripe shrimp, under-reporting or failing to report discard of fish and shellfish bycatch, and un-quantifiable environmental effects. Guideline harvest levels developed implicitly for northern shrimp management were applied to the much less abundant and slower-growing sidestripe shrimp stocks, with no means to evaluate the effect of these harvest levels on sidestripe shrimp stocks. Consequently, otter trawl gear was prohibited in Southeast Alaska waters as of May 1998 by action of the Alaska Board of Fisheries.

When compared to beam trawls, otter trawls are generally larger, more complex in construction, double-bridled, and fish best on smooth, level substrate. They are dynamic trawls which rely on bridle and “otter” boards" to deploy, position, and maintain the opening dimensions of the net. “Roller gear” can be added, enabling otter trawls to fish on rougher habitat. The design and size allows much greater catching ability than beam trawls, for similar length vessels. Otter trawl vessels are generally larger and more modern, with large hold capacities, and engines with larger horsepower ratings. Otter trawl vessels utilize many shrimp fishing grounds in the North Pacific. Most of the historical harvest in Southeast Alaska occurred in Glacier Bay and other portions of District 14. Smaller harvests occurred near Ketchikan, Juneau, and Petersburg. Major processors and markets were as distant as Kodiak and Seward. Large harvester-processors have expressed interest in fishing both inside and outside waters of Southeast Alaska.

FISHERY DEVELOPMENT AND HISTORY

The first recorded commercial shrimp otter trawl landing from Southeast Alaska waters occurred in 1975 (Table 4.1). Since then, there were eight seasons with no otter trawl harvests reported in Southeast Alaska, and eleven seasons when effort was so low that harvests are confidential. The peak harvest of 145,286 pounds from 11 landings occurred during the 1980-1981 season. Most of this harvest occurred in Glacier Bay from larger vessels transiting through Southeast Alaska to the Westward Region to participate in spring shrimp fisheries. Most of the product was processed in Kodiak. Glacier Bay contributed the most significant portion of this harvest. During only two other seasons, 1993-1994 and 1997-1998 has effort been sufficient to provide significant harvests. With the exception of past fisheries in Glacier Bay by larger vessels, the majority of recent participants were relatively small vessels using small nets.

The 1997-1998 season was the last fishing period when otter trawling was legal. The lack of abundant resource and processing facilities slowed the expansion of the fishery into many geographic locations. Otter trawls were eliminated as a legal gear type because of concerns about: 1) the potential for exceeding GHLs if highly efficient otter trawls were used, 2) the potential for discard of bycatch, and 3) potential negative ecological effects on the sea floor.

REGULATION DEVELOPMENT

Otter trawling was prohibited on some grounds traditionally utilized by beam trawl vessels (District 8, portions of Districts 6 and 10) since the 1959-1960 season, in Lituya Bay by state regulations since the 1980-1981 season, and in Glacier Bay by National Park Service regulations. Until the 1995-1996 season the remainder of Southeast Alaska was open throughout the fishing year with no restriction on mesh size or maximum opening dimensions, or established guideline harvest range. Until the repeal of otter trawls as a legal gear type in Southeast Alaska, otter trawl fishing seasons began on May 1 and closed on February 14. Interest from larger harvester/processors and potential conflicts with other gear users were instrumental in the closure of all districts without a history of consistent and substantial effort or harvest. Open fishing areas and guideline harvest ranges were from 25,000 to 100,000 pounds for Districts 3, 5, and 6 south of a line from Mitchell Point to Point St. John; Districts 7, 9, and 10 west of the longitude of Cape Fanshaw; and District 11. All participants in this fishery had to register prior to fishing and complete logbooks.

LIMITED ENTRY

In late 1996, the Commercial Fisheries Entry Commission published a proposal to limit entry into the shrimp otter trawl fishery with a maximum number of permits of six. To qualify for a permit, an applicant must have fished during at least one of the qualifying years from 1993 to 1996. The consideration to limit entry into the trawl shrimp fishery spawned participation in the fishery during 1996-1997 and 1997-1998 seasons, even though participation in 1997 would not qualify an applicant for more participation credit under a limited entry point system.

The BOF subsequently eliminated shrimp otter trawl gear as a legal gear in Southeast Alaska at the January 1997 meeting. In February, the CFEC decided to postpone its decision on entry limitation in the otter trawl fishery until late June 1997 and allow further public comment. In response to letters and petitions, the BOF considered their regulatory action again during an October 1997 work session but did not rescind their decision. The CFEC moved forward with limited entry, with a one-time only application period of December 1998 through March of 1999. A total of five applications were received. Four applications were denied, one is pending (CFEC website, B6410P-C State of Alaska 2002-10-31 Commercial Fisheries Entry Commission Limited Fisheries Status Report).

FUTURE SEASON OUTLOOK

Current regulations do not provide for a shrimp otter trawl fishery in Southeast Alaska. If the fishery were ever to be allowed at a future date, it would have to be well controlled, have observer requirements, be restricted to limited grounds, use habitat friendly gear specifications, and work under by-catch restrictions of other important commercial species. The potential for a large-scale fishery of this type in Southeast Alaska is very low.

Table 4.1. Registration Area A (Southeast Alaska) shrimp otter trawl fishery harvest, number of landings, and CPUE (pounds-per-landing), 1975-1976 to 1997-1998 seasons.

Year/ Season	Catch in Pounds	Number of Landings	Pounds Per Landing	Number of Permits	Pounds Per Permits
1975-76	*	*	*	*	*
1976-77	*	*	*	*	*
1977-78	0	0	0	0	0
1978-79	0	0	0	0	0
1979-80	*	*	*	*	*
1980-81	145,286	11	13,208	3	48,429
1981-82	*	*	*	*	*
1982-83	*	*	*	*	*
1983-84	*	*	*	*	*
1984-85	0	0	0	0	0
1985-86	0	0	0	0	0
1986-87	*	*	*	*	*
1987-88	*	*	*	*	*
1988-89	0	0	0	0	0
1989-90	0	0	0	0	0
1990-91	0	0	0	0	0
1991-92	*	*	*	*	*
1992-93	*	*	*	*	*
1993-94	17,599	4	4,400	3	5,866
1994-95	*	*	*	*	*
1995-96	0	0	0	0	0
1996-97	3,801	22	173	9	422
1997-98	66,381	34	1,952	9	7,376

* Where number of vessels participating is less than three, information is confidential.

REPORT TO THE BOARD OF FISHERIES,

SOUTHEAST ALASKA POT SHRIMP FISHERY

by

David Love
and
Gretchen Bishop

Regional Information Report[1] No. 1J02-45

Alaska Department of Fish and Game
Division of Commercial Fisheries
Juneau, Alaska

November 2002

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TABLE OF CONTENTS

LIST OF TABLES

INTRODUCTION

This chapter describes the life history of spot shrimp and the commercial pot fishery in Southeast Alaska (Registration Area A). The events characteristic of this fishery are driven by the increasing effort and subsequent limited entry, significant regulatory changes, increasing effort by catcher-processors producing value-added frozen-at-sea products, and the developing program for shrimp management and biological research in the region.

Life History

The spot shrimp *Pandalus platyceros* is the target species for the pot shrimp fishery, with smaller quantities of coonstripe shrimp *P. hypsinotus* also harvested. Life history information concerning these species is limited. Shrimp must shed their exoskeleton to grow; as a result there are no permanent structures to use for age determination, such as the otoliths in fish. Modal analysis of length frequency data as well as laboratory ageing techniques using intracellular pigments may provide some indication of relative age, however, there are considerable differences in age and growth between areas. Canadian reports suggest the maximum age of the spot shrimp is three to five years, while Alaskan tagging data from Prince William Sound suggests eight to ten years (Butler 1964; Kimker et al. 1996). All pandalid shrimp are protandric hermaphrodites, which means they first mature and spawn as males, transition to females, and spawn as females for the remainder of their lives. For the pandalid species *Pandalus jordani*, the age, and thus size, at which transition to female and egg-bearing occurs is variable, and appears to be effected by environmental as well as fishery-related selection pressures (Hannah 1993; Hannah and Jones 1991). Spot shrimp are thought to be functional males for one to three seasons in British Columbia, then change sex and spawn as females for their last year of life (Butler, 1980). Spot shrimp in the colder waters of coastal Alaska may be much older, possibly living 7 or more years (Kimker et al. 1996). While relatively little is known about age or size at sex change for spot shrimp, growth rate appears to be directly related to temperature while size at maturity appears to be indirectly related in another Pandalid shrimp, the northern shrimp, *Pandalus borealis*, from Icelandic waters (Skuladottir et al. 1991). The age of transition from male to female in *P. borealis*, appears to be influenced by near-bottom temperatures in the Gulf of Maine, with a general increase in age at first spawning as temperature decreased (Appollonio et al. 1986). While this may seem contradictory to the work of Skuladottir et al. (1991), slower growing and late maturing shrimp in cold areas have higher longevity and maximum length than faster growing shrimp in warmer waters (Savard and Parsons, 1990). This means that smaller egg-bearing female shrimp may be growing faster in warmer waters and may grow slower but attain a larger maximum size in colder waters. Again using *P. borealis* as example, some researchers report that changes in age and size at maturity could be density dependent (Charnov and Anderson 1989).

The transition from male to female probably occurs during the summer months of the second or third year of life. Shrimp living in colder waters may not become females until later. Females undergo another molt into "breeding dress" in the late summer or fall, after which they extrude their mature eggs from the internal ovaries. Near Petersburg, Hynes (1930) found an average count of 3,900 eggs per female. Eggs are fertilized externally as they are extruded onto the pleopods under the abdomen. Developing embryos are carried on the external pleopods until they are fully developed. In Alaska, eggs may be held until the onset of the spring phytoplankton and zooplankton blooms during late March to mid-May. There appear to be multiple

size classes of female shrimp in several of the fishing districts surveyed by ADF&G. Two sizes of female spot shrimp have been reported during some years in Hood Canal (Chew et al 1974). Following release of the larvae, females appear to undergo a growth and molting period during the summer before extruding the eggs again in the late summer and fall. Females are not thought to survive long after the release of the eggs in British Columbia spot shrimp stocks.

The free-swimming larvae spend up to three months in the plankton at the mercy of the tides and currents. Larvae appear to hatch at night, assisted by the female moving her pleopods, thus expelling the larvae while swimming or clinging to something. Five larval stages are reported, stages I-IV being zoea and stage V being a megalopa (Price and Chew 1972). Five juvenile stages are reported prior to maturation to a functional, adult male (Berkeley 1930; Haynes, 1985). Although larvae may be widely transported by currents, settled juveniles and adults appear to be relatively sedentary. Tagged adults may remain within a mile or two of their release location (Boutillier 1996; Kimker et al. 1996). Spot and coonstripe shrimp appear to utilize shallow water eelgrass and *Laminarium* or *Agarum* spp. kelp habitats as juveniles, before migrating to rocky habitats including reefs, glass sponge reefs and corals (Chew et al. 1974, Marliave and Roth, 1995). They occur from the intertidal to depths of greater than 1,500 feet, from the Korea Strait to the Sea of Japan along the Siberian east coast Unalaska to San Diego, California (Butler 1964). Adults may have a daily (diurnal) migration as well, shallower at night and deeper during the day (Butler 1980). The concept of meta-populations may apply to spot shrimp, with larvae being transported by ocean currents from relatively distant adult populations, thus potentially repopulating depleted waters. Advection into bays and fjords in Southeast Alaska may depend on prevalent wind patterns and resultant currents. Larvae in some inshore waters may experience very small-scale entrainment patterns, with potential effects on adult recruitment to localized fisheries.

Commercial Fishery

Primarily two species of shrimp, *Pandalus platyceros* and *P. hypsinotus,* are harvested using pot gear, with the greatest portion of the harvest taken in Districts 1, 3, and 7. Smaller but significant historical harvests have also occurred in Districts 2, 6, and 10. More recently, harvests from Districts 8, 9, 11, 12, and 13 have also become important. In accordance with the Southeastern Alaska Pot Shrimp Management Plan, these districts are managed for sustained harvest of spot shrimp. The entire guideline harvest for Districts 15, 16 and a portion of the District 11 guideline harvest are managed based on coonstripe shrimp.

Vessels used in the pot shrimp fishery generally range from smaller style gillnet or troll vessels to limit purse seiners. Several “catcher-processors” in the 60-foot keel length range also participate. Fishers use baited pot gear, which is either longlined or fished as single pots. In a longline system each pot is attached to the groundline with a snap or “c-links,” similar to the longline system used in various groundfish fisheries. Pot construction is varied in size, shape, weight, and configuration. The most common pot used during the initial stages of the fishery was a rectangular pot approximately 30-inch x 18-inch x 18-inch with a tunnel at either end. Gear designs have rapidly changed to increase fishing efficiency. Pots that have been legal included those with a large bottom surface area, heavy pots, and pots with three to eight entrance tunnels. Small rectangular "king crab" style pots were also used by a number of fishers.

One of the most commonly used pots today is a “cone style” pot. This pot is constructed using two or three stainless steel rings, the top ring smaller than the bottom, with vertical bars welded between the rings forming six sides, at least three of which contain tunnels. These cone pots are also constructed of either rubber wrapped or “dipped” mild steel. This pot type has webbing tightly drawn in on the top with a

permanent closure. The bottom web is drawn in with a "pucker string" which is opened during baiting operations and to empty the pot of its harvest.

The pot shrimp management plan established by regulation in 2000 for Southeast Alaska stipulates that the department shall manage the spot and coonstripe shrimp stocks in the region for sustained yield according to the following management principles. Current management is based upon a closed season to prevent fishing on major stocks during the egg-hatch or growth and recruitment periods, maintenance of a number of age classes of shrimp, maintenance of adequate brood stock for rebuilding of shrimp stocks, minimum mesh size restrictions intended to only capture and retain the larger size segment of the stock, thus reducing mortality of smaller shrimp, a standardization of two sizes of pots with a maximum number of pots per vessel, restricted daily deployment and hauling times, and a guideline harvest level (GHL) for each fishing district. Regulations have also been adopted for permitting of shrimp floating processors, and reporting requirements for shrimp catcher processor vessels. Harvest is recorded and summarized through the ADF&G fish ticket system. Limited pre-season and post-season surveys and on-board and dockside sampling are conducted. Each year the department provides additional, detailed information on the pot shrimp fishery, management activities and research program for all districts of Southeast Alaska in the form of the Southeastern Alaska Pot Shrimp Management Plan (ADF&G 2001; ADF&G 2002).

FISHERY DEVELOPMENT AND HISTORY

Harvest records dating from 1962 indicate that the pot shrimp fishery began with sporadic effort and low harvests through the mid- 1970s when the pot shrimp fishery served as a supplemental source of income to other fisheries, primarily salmon and halibut. Harvests and effort increased through the 1980s, and culminated in the mid-1990s with harvest of almost 1,140,000 pounds caught during the 1994-1995 season and a maximum number of 351 permits fished during the 1995-1996 season (Tables 5.1 and 5.3).

Through the mid-1980s most of the product was sold over the dock to private individuals, restaurants, or other markets without passing through the traditional system of processors established for other fish and shellfish species. Vessels conducting business in this manner are termed "catcher-sellers." Primarily, picked "tails" were sold, and exvessel prices were dependent upon the size of the tails or count of tails per pound with the larger shrimp commanding the highest price. Because the fishery was supported by relatively low volumes with moderate prices the fishery remained relatively slow paced.

From 1990-1991 through the 1994-1995 fishing seasons the character of the fishery underwent radical changes with the number of permits fished as high as 248 and harvests exceeding 1 million pounds. In October 1994, the first floating processor entered the fishery, and the market product began to change towards unsorted, whole shrimp with a moderate increase in value. This change in market product meant that fishers no longer had to spend time sorting shrimp by size and picking tails on the ground, running to and from markets, or selling their own shrimp, effectively allowing them to spend more time setting and retrieving gear. Many fishers began to rely on this fishery as a significant source of their fishing income. Pot efficiency during this period and the pace of the fishery increased and the first emergency order was issued to close Districts 6 and 8 when the guideline harvest level was reached. The rapid escalation of effort and harvest evoked petitions for limited entry, which was put in place 1995.

Harvests initially decreased following implementation of limited entry, then increased again as shrimp fishers switched to catcher-processing in order to capitalize on high prices for boxed, whole shrimp frozen-

at-sea that are sold overseas, primarily to the Japanese markets. With so many inexperienced catcher-processors delivering inconsistent quality product, the Alaskan frozen-at sea markets have declined in value since the 1999-2000 season, although harvests have regained previous, high levels. Average harvest for the 1996-1997 through 2001-2002 season was about 950,000 pounds, which was caught by an average of 179 permit holders. Harvests during 2000-2001 and 2001-2002 season have equaled approximately 1 million pounds each season.

REGULATION DEVELOPMENT

Throughout most of the development of the pot shrimp fishery, management has generally been passive with only fish ticket data available to assist managers. Seasons have been set to prevent harvesting during the egg hatch period in major districts and mesh restrictions were set to allow the escapement of all shrimp below approximately 30 mm in carapace length. Mesh restrictions have not been totally effective at protecting small shrimp due to current regulations that do not restrict fishers from picking sets twice during the daily 8:00 AM to 4:00 PM fishing period. Longer soak periods would allow the regulatory mesh size more time to passively sort small shrimp. The guideline harvest ranges currently in regulation for each district were established at the Sitka meeting of the Board of Fisheries in 1997 and were based on harvest history data, and not on information describing stock abundance or stock condition. Current research aims to develop a biologically based index of abundance, by which the department will adjust GHLs to provide for sustainable harvest.

Fishing Seasons

Prior to 1970, pot shrimp fishing was allowed only during periods when the trawl shrimp fishery was open, (roughly May 1 through February 14). In 1970, pot fishing was allowed throughout the year; this liberal season existed through the 1981-1982 fishing season. During the 1982-1983 season, fishing was not allowed during May and June in Districts 1 through 8. This closure was intended to provide fecund, female shrimp protection from exploitation during the egg-hatch period in an attempt to maximize stock reproduction potential. The actual range of egg-hatch probably varies by location throughout the region but can safely be defined as from late February through the middle of May.

Prior to the 1983-1984 season the District 1 fishery was restricted by Board of Fisheries actions to a September 1 through April 30 season. This was an allocation for fishers who traditionally used District 1 as a supplemental income source during the fall and winter months. The closure during the late spring and summer provided the important biological benefits of allowing stock recruitment to occur through molting and growth processes.

By the 1986-1987 season, major areas (Districts 1, 2, 3, and 7) were open only from October 1 through February 28 which was established for a combination of egg-hatch closure, growth, and allocation for a fall/winter fishing season. The minor areas (Districts 6 and 8) were open from May 1 through February 28 with only an egg-hatch closure in place. All other areas (Districts 4, 5, and 9 through 16) remained open throughout the year without an egg-hatch closure.

In 1997, the Board of Fisheries adopted a regulatory opening of October 1 and closure of February 28 for all districts. Managers have reopened some districts after the egg-hatch period if the GHRs were not achieved prior to the February 28 closure date. These areas could be reopened by regulation from May 1 until September 30; this allowed a regulatory closure at least one month ahead of the October opening to allow for a fair start the following season.

Size Restrictions

The Alaska Board of Fisheries policy on small shrimp, primarily developed for the trawl fisheries, also applies to the pot shrimp fishery, however, specific regulations concerning a minimum legal shrimp size for the pot shrimp fishery have not been developed. A mesh restriction specifying 1.75-inch stretch mesh was established in 1986 to assist in the escapement of shrimp less than 30 mm in carapace length and to reduce the potential for growth over-fishing. This minimum size is similar to that recommended by Boutillier (1984) for the Canadian west coast shrimp trap fisheries, and should provide for some protection for at least two year-classes of small shrimp. Shrimp pots must be entirely covered with net webbing or rigid mesh. There is no mesh restriction for waters of Lituya Bay in District 16. The fleet testimony at the 1997 Board of Fisheries meeting indicated that significant amounts of small shrimp were being discarded at the floating processors. The requirement for mandatory observer coverage was required, in part, to verify fish ticket information and document possible discard.

Quotas and Guideline Harvest Levels

Prior to the 1983-1984 season, a GHL of 125,000 pounds was established for each of Districts 1, 2, 3, and 7, and a GHL of 55,000 pounds for Districts 6 and 8. By the 1986-1987 season the GHR for Districts 6 and 8 was altered to a range of 75,000 to 100,000 pounds and dropped entirely for all other districts. This situation existed until October 1, 1995 when the department implemented GHRs for each district by news release. This action was taken to maintain the fishery at a stable level and provide for some protection against over-harvesting. For districts with a fairly consistent harvest history, guideline harvest levels were set based on the average harvest for the five fishing seasons, 1990-1991 through 1994-1995. For districts with low and intermittent harvests, guideline harvest levels were arbitrarily set at 20,000 pounds. In January of 1997, the Board of Fisheries adopted regulatory GHRs for each district. Those GHRs were the same as those imposed by emergency order beginning with the 1995-1996 season.

At the 2000 meeting of the Board of Fisheries the Pot Shrimp Management Plan was developed and put into regulation. This plan addressed guideline harvest levels on several different levels. First, it specified that the upper range of the existing GHRs be modified to use a more accurate tail to whole weight conversion factor of 2.0 based on data from pot shrimp collected during the research surveys in Southeast Alaska. The previous conversion factor of 1.67 was developed for sidestripe shrimp, *Pandalopsis dispar*, from Cook Inlet. This higher conversion factor resulted in increased upper limits of the GHR in those districts where historical harvest had been primarily of tails. The new GHRs were implemented beginning with the 2000-2001 season following a major effort by the department to verify, correct, and apply the new conversion to the historic fish ticket databases.

Secondly it specified that for each of Districts 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 12, 13, and 14 GHRs would be for spot shrimp, while for Districts 15 and 16 GHRs would refer to coonstripe shrimp, and District 11 GHRs would be for spot and coonstripe shrimp. This effectively raised the upper level of the GHR for each district by the proportion of historical harvest that was actually the other species. In most districts this is relatively insignificant however in the case of District 7 it amounts to a 20,000 – 30,000 pound increase. Finally, the Pot Shrimp Management Plan specified that District 3 be split into Sections 3-A and 3-B and 3-C and that the GHR for Section 3-A be 0 – 275,000 pounds minus the average harvest from Section 3-B and 3-C from 1990-1991 through 1994-1995 seasons while Sections 3-B and 3-C have a GHR of 0 – 50,000 pounds. This was based upon the perception that shrimp populations in District 3 could support a higher harvest than the historical average. For the spot shrimp districts, no specific GHRs for coonstripe shrimp were set but it was stated that the 'allowable harvest' would be based on the average catch during 1995-1996 through 1999-2000 seasons.

Gear Restrictions

With the exception of the minimum mesh size, no gear restrictions were implemented until the 1976-1977 season when a pot limit of 150 pots per vessel was established for Districts 1 through 15. Until October of 1997, the 150 pot limit applied to all portions of Registration Area A. Minor regulations concerning a maximum tunnel perimeter (15-inch), pot marking requirements, prohibitions against simultaneously fishing shrimp pots and any other type of commercial, sport, or personal use pot, escape mechanisms, and some clarification of mesh requirements had also been developed.

Not only did enforcement problems repeatedly demonstrate the need for clearer definitions of shrimp pot gear, but it was also thought that a reduction in pot sizes would slow the fishery and could provide some CPUE data to the department if gear was standardized, and if a tiered pot system under consideration by CFEC was implemented. Coupled with the implementation of limited entry, the Board of Fisheries in January of 1997, adopted gear regulations allowing for standardization during a number of years. Through September 30, 1998, the number of shrimp pots that could be operated from a registered shrimp fishing vessel was 140 small pots or 100 pots larger than a small pot. If any pot operated from a vessel was larger than a small pot, the total number of pots that could be operated from that vessel was 100 pots.

In October 1998, a "small pot" was defined as having a bottom perimeter of no more than 124 inches and a "large pot" was defined as having a bottom perimeter of more than 124 inches, but not more than 153 inches. Perimeter measurements were selected over diameter measurements to reduce interpretation distortions. Further, all pots on board a vessel or operated from a vessel had to be of the same type and of the same size. Limits of 140 small pots or 100 large pots being operated from a registered shrimp fishing vessel continued.

Pots may not have more than one bottom, a vertical height of more than 24 inches, and more than 4 tunnel eye openings which individually do not exceed 15 inches in perimeter. The sides of the pot may only be at a right angle to the plane of the bottom of the pot or slanted inward toward the center of the pot in a straight line from the bottom to the top.

Other pot shrimp regulations adopted in 1997 include time limitations for deployment and retrieval of gear from 8:00 AM until 4:00 PM each day, restrictions on carrying pot gear owned only by the vessel operator, and unique identification tags for each pot.

No additional gear restrictions were put into regulation at the 2000 meeting of the Board of Fisheries.

Floating Processors

Since 1994 floating processors were increasingly available on the fishing grounds not only for transporting gear for a "mosquito fleet" that moves from one district as it closes to another, but also to purchase live shrimp. As a result, GHRs are achieved more quickly. In order to remain competitive, those fishers that wished to explore other grounds within a district were forced to remain in localized areas and sell to the floating processors. This had implications for localized depletion of shrimp stocks. In an effort to slow the pace of the fishery, the 1997 Board of Fisheries eliminated the ability of floating processors to transport pots for fishing vessels and implemented requirements that includes reporting processor location and any changes in location, reporting projected dates of operation, and daily reporting. The only practical way for the department to have verification of daily reporting was to implement mandatory observer coverage, the cost of which is borne by the processor.

Catcher Processors

Reporting requirements for shrimp catcher-processors were established at the 2000 meeting of the Board of Fisheries in order to allow the department to track harvest from catcher–processors inseason. A catcher processor vessel is defined as a vessel that catches and processes their own product on board [5 AAC 31.143 (d)], observers are not required on catcher processors but they cannot buy or process shrimp from another fishing vessel or act as a tender. The catcher processor owner or operator are required to complete separate fish tickets for every district in which shrimp are caught and processed on board the vessel and to submit fish tickets to an ADF&G office within 7 days of the first delivery of shrimp in the district or section with a unique GHR.

Limited Entry

In April of 1995 the Commercial Fisheries Entry Commission received petitions from more than 70 people from Wrangell, Ketchikan, Craig, and the Tenakee Springs Fish and Game Advisory Committee requesting limitations to the number of participants in the southeast pot shrimp fishery. After the commission obtained and analyzed data concerning the fishery, their proposed regulations were consistent with what the petitioner's had suggested in that 1995 should not be included in the eligibility time frame. This would have capped the number of limited entry permit holders at 186 which was the highest participation level in any of the four years prior to the original qualification date. The commission held numerous public hearings throughout Southeast Alaska and announced in early November 1995, while fishing was in progress, that they had adopted a limited entry program that would include participation during 1995 towards qualification. At the time, the effort level had increased to 234 fishers. And finally, by law, the commission was required to revise upward to the maximum number of permits to 332 that legally participated in

calendar year 1995. In October, 1996 the commissioners adopted a point system for the fishery and by February of 1998 the commission began the process of issuing and denying permits for this fishery. To date, 311 permits have been issued with 57 additional applicants either undergoing hearings or administrative review for additional points or vying for the remaining 21 permits that will be available. Of the 311 permits that were granted, 157 are non-transferable and 154 are transferable (CFEC website, B6410P-C State of Alaska 2002-10-31 Commercial Fisheries Entry Commission Limited Fisheries Status Report)

A total of 315 permits were issued in the Southeast Alaska pot shrimp fishery in 2001. During the 2001-2002 season 181 permits were registered and of those 169 were fished.

STOCK ASSESSMENT

Pot Surveys

Little research had been conducted concerning the distribution and abundance of spot shrimp in Southeast Alaska prior to 1996. Information concerning pot efficiency and limited stock distribution data was collected by various agencies during the 1960s and early 1970s. Pot efficiency studies concerned various pot tunnel configurations in rectangular pots, and a comparison of covered versus uncovered pots.

During the mid 1990s, the department reviewed available CPUE data recorded on fish tickets and found it to be insufficient to provide a basis for management. The pot shrimp fishery for spot and coonstripe shrimp in Southeast Alaska has seen a 10-fold increase in participation since 1960, heightening concern for conservation of stocks and resulting in increasing regulatory restriction and control of the fishery, including limited entry in 1996. Increasing harvest and effort was determined to have the potential to jeopardize the long-term sustainability of the fishery. More information on the status of the shrimp populations was needed in order to establish biologically based, sustainable harvest levels. To this end, the department initiated a pot shrimp stock assessment research program and during September 1996 the department conducted the first pilot survey in Ernest Sound. The initial purpose of this program was to collect and evaluate data required for rational management, to understand the variability of various parameters associated with stock assessment, to investigate factors essential to establishing an appropriate stock assessment program, and to provide information necessary to develop a well-founded management plan.

The preseason survey program was subsequently expanded, first to the Cordova Bay area (Section 3-A) in 1997, followed by Hoonah Sound (Section 13-C) beginning in 1999 and Tenakee Inlet (District 12) in 2000. In order to minimize variability in catch rates and provide more accuracy when conducting analyses, index set locations and standardized methods were established; these began in 1998 for District 3-A, in 1999 for Districts 7 and 13, and in 2000 for District 12. The objectives of these surveys are to obtain information on shrimp abundance, define trap selectivity and associated behavior of shrimp attracted to pot gear, develop a survey-based index of abundance, define the size composition of stocks from a variety of areas, and to determine sex ratios, size at first spawning, and female fecundity for both spot and coonstripe shrimp.

Post-season surveys were initiated following the 1998 fishery for District 3, and in 2001 for District 7. The primary objective of the post-season surveys is to develop a method to estimate harvest rate by comparing the ratio of pre to post-season size specific shrimp abundance. While removals by the fishery are quite evident between pre- and post-season surveys, this method has proved to be somewhat complicated by pot selectivity and shrimp behavior. Specifically, it appears that size-specific gear selectivity for shrimp may be a function of size composition of shrimp available. In other words, abundant, smaller shrimp may saturate the pot, reducing the catch rates of larger shrimp out of proportion to their abundance. Thus, before pre- and post-season survey information can be used to obtain an accurate harvest rate estimate for shrimp, soak time experiments must be conducted and the results analyzed. This work was begun during the 2001 post-season survey in District 3 and will be continued during the 2002 surveys in that district.

Pre-season surveys of Districts 3, 7, 12, and 13 and post-season surveys of Districts 3 and 7 are planned for the fall of 2002. Analysis of data collected since 1997 during the District 3 surveys may prove useful for evaluating trends in catch per pot and mean carapace lengths of shrimp captured during surveys.

Dockside Sampling Program

Also, beginning in 1997, the department began coordinated dockside sampling of the landed catch. The dockside sampling program has been expanded to sample landed catch in all ports throughout the region. In addition, managers now monitor the fishery on the fishing grounds, and collect samples of the landed catch directly from fishers on the grounds. Results of this expanding research and management effort are beginning to yield a better understanding of the effects of commercial fishing on the relative abundance and size of shrimp removed by the commercial fleet, commercial catch rates, as well as that portion of the population of shrimp present that are harvested by commercial gear.

SEASON SUMMARIES

1999-2000 Season Summary

The 1999-2000 fishing season opened on October 1, 1999. Market conditions were strong and available effort was initially high. The number of registered fishers was 167, but the actual number of permits fished was 157. All fish tickets entered for the season totaled 870,061 pounds.

There were no floating-processors buying and processing shrimp on the grounds this season. A number of tender operations registered to get product from the grounds to shore-based processing facilities. An increasing number of catcher-processors participated. The major product is whole, sorted, dipped and frozen shrimp. Some catcher-processors are producing an undipped, frozen tail product. Prices remain high, and are

estimated at $3.44 per pound (whole shrimp and tails combined). By the end of the fishing season, the exvessel value of was about $1.4 million.

The fishery began at a fast pace, with good prices, and fairly poor weather conditions. The department initiated on-the-grounds management teams for the first time this season. Managers boarded vessels, obtained direct information about the fishery, and collected shrimp sex and size-distribution samples, this information increases the department's understanding of the fishery and the resource. Section 13-C was closed by emergency order on October 5 when the GHR was caught. District 12 followed on October 9, and District 3 on October 12. By the end of October, Districts 8 and 10 were also closed. Guideline harvest levels were achieved in Districts 2, 7, and 9 and by November 26 these districts were closed. Approximately 26 percent of the District 7 catch was comprised of coonstripe shrimp. Guideline harvest levels in Districts 1, and 16, and Sections 13-A and 13-B, were all reached by the regulatory closure on February 28. The pot shrimp fishery was closed during March, April, and the first two weeks of May to protect shrimp during the peak egg hatch and release period. Districts 4, 5, 6, 11, 14, and 16 were reopened by emergency order from May 15 to July 31. Only District 15 was closed by emergency order prior to the end of the regulatory period. Districts 15 and 16 are managed based on catches of coonstripe shrimp.

2000-2001 Season Summary

The 2000-2001 fishing season opened on October 1, 2000. Market conditions were strong and fishing effort was high. The number of registered fishers was 184, and the actual number of permits fished was 161. All fish tickets entered for the season totaled 1,056,889 pounds.

This season there were no floating-processors buying and processing shrimp on the grounds. A few tender operations registered to get product from the grounds to shore-based processing facilities. Participation of catcher-processors continued to increase. Product types included whole, sorted, dipped and frozen shrimp and frozen tail product. Prices remain high, and are estimated at $3.71 per pound, whole weight. By the end of the fishing season, the exvessel value of was over $3.3 million. As more fishers began to produce more highly valued whole, frozen-at-sea shrimp the price per pound and exvessel value began to rise.

The fishery began at a fast pace, with good prices, and fairly good weather conditions. These conditions, coupled with problems with call-ins from catcher-processors that were moving around the region made targeting the harvest of the guideline level difficult and resulted in two districts reopening in order to catch the remainder of the GHL. On-the-grounds management census of the fishing fleet was conducted again this year, for the purpose of collecting catch and effort information associated with unsorted catches and shrimp size and sex biological samples. Section 13-C was closed by emergency order on October 4 when the GHR was caught. District 12 followed on October 7, and Section 3-A on October 10. Section 3-A was reopened to harvest remaining guideline harvest from November 1 to 4. The combined Sections 3-B and 3-C closed October 15. By November 3, Districts 2, 8, 9, and 10 were also closed. Districts 1, 6, and 16 were closed by November 20. District 16 harvests are predominantly of coonstripe shrimp. District 6 was reopened to harvest the remainder of the GHL from December 9 to 17. Guideline harvest levels were achieved in Districts 15 by December 12. Guideline harvest levels in Districts 11, and Sections 13-A and 13-B, were reached by the regulatory closure on February 28. District 11 was managed based on combined catches of spot and coonstripe shrimp. The pot shrimp fishery was closed during March, April and the first two weeks of May to protect shrimp during the peak egg hatch and release period. Districts 4, 5, and 14 were reopened by emergency order from May 15 to July 31 and none of these areas closed prior to the end of the regulatory period.

2001-2002 Season Summary

The 2001-2002 fishing season opened on October 1, 2000. Market conditions were not as strong as during previous years due to many inexperienced catcher-processors delivering inconsistent quality product, causing the Alaskan frozen-at sea markets to decline in value. Harvests remained high; as did effort possibly due in part to low value of the salmon fisheries in which many of the boats also participate. The number of registered fishers was 188, and the actual number of permits fished was 172. All fish tickets entered for the season totaled 1,046,717 pounds.

This season there were no floating-processors buying and processing shrimp on the grounds. A few tender operations again registered to get product from the grounds to shore-based processing facilities. Participation of catcher-processors continued to increase. Product types included whole, sorted, dipped and frozen shrimp and frozen tail product. Price per pound and exvessel values are not presently available, but were higher due to additional production of whole, frozen-at sea boxed shrimp.

The fishery began at a relatively fast pace, with lower prices and poor weather conditions. On-the-grounds management census of the fishing fleet was conducted this year for the purpose of collecting catch and effort information associated with unsorted pot catches and shrimp size and sex biological samples. Section 13-C was closed by emergency order on October 4 when the GHR was caught. District 12, Tenakee Inlet followed on October 6, and District 10 on October 14. For the first time this season, the upper end of the GHR in District 12 was increased from 20,000 to 35,000 pounds and split between Tenakee Inlet (0-20,000 lbs) and the remainder of District 12 (0-15,000 lb). District 12, not including Tenakee Inlet closed December 29.

By October 28, Districts 2, 6, 9, and Section 3-A were also closed. District 7 and 8 were closed by November 5. District 7 and 8 also reported catches of an additional 24,700 and 2,100 pounds of coonstripe shrimp, respectively, by time of closure. The fishing period for District 8 was subsequently reopened until November 8 to catch the remainder of the GHL for spot shrimp. Combined Sections 3-B and C closed November 15 and District 1 closed November 19. District 16 closed December 5 with all the GHL for coonstripe shrimp taken by that time. District 11 closed on January 24 with 8,400 pounds of coonstripe and 16,000 pounds of spot shrimp taken. All other districts remained open until the regulatory closure on February 28. The fishery was closed during March, April, and the first two weeks of May to protect shrimp during the peak egg hatch and release period. Districts 4, 5, 14, and 15 and combined Sections 13-A and 3-B were reopened by emergency order from May 15 to July 31. The District 15 GHL was taken by May 28 and District 14 was closed on June 27. Districts 4 and 5 remained open until the regulatory closure.

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Table 5.1. Registration Area A (Southeast Alaska) pot shrimp fishery harvest, number of landings, and CPUE, 1968-1969 season to present. Reported catches include coonstripe and spot shrimp caught, both tailed and whole product.

Season[a]	Harvest in Pounds	Number of Permits Fished	Number of Landings	Pounds per Landing	Pounds per Permit
1968-69	32,373	4	47	689	8,093
1969-70	19,928	3	25	797	6,643
1970-71	12,684	5	27	470	2,537
1971-72	26,727	6	49	545	4,455
1972-73	*	*	*	*	*
1973-74	*	*	*	*	*
1974-75	7,640	7	16	478	1,091
1975-76	19,242	5	29	664	3,848
1976-77	15,716	6	16	982	2,619
1977-78	24,631	10	76	324	2,463
1978-79	21,318	9	35	609	2,369
1979-80	57,818	19	123	470	3,043
1980-81	80,948	32	192	422	2,530
1981-82	157,770	49	381	414	3,220
1982-83	268,625	58	373	720	4,631
1983-84	257,242	93	653	394	2,766
1984-85	298,960	117	780	383	2,555
1985-86	209,207	81	498	420	2,583
1986-87	354,145	83	608	582	4,267
1987-88	368,982	96	688	536	3,844
1988-89	440,580	121	836	527	3,641
1989-90	415,828	110	816	510	3,780
1990-91	562,596	138	1,100	511	4,077
1991-92	823,344	177	1,560	528	4,652
1992-93	676,594	150	1,291	524	4,511
1993-94	916,028	182	1,650	555	5,033
1994-95	1,139,900	246	2,687	424	4,634
1995-96	987,461	351	2,843	347	2,813
1996-97	1,022,589	202	1,988	514	5,062
1997-98	868,142	198	1,759	494	4,385
1998-99	861,340	185	1,833	470	4,656
1999-00	870,061	157	1,373	634	5,542
2000-01	1,056,889	161	1,302	812	6,565
2001-02[b]	1,046,717	172	2,440	429	6,086

Note: Harvest based on 2.0 conversion tail to whole weight and corrected fish tickets.
[a] Pot shrimp seasons are October through September.
[b] Most recent year's data should be considered preliminary.
* Where number of vessels participating is less than three, information is confidential.

Table 5.2. Registration Area A (Southeast Alaska) pot shrimp fishery harvest in thousands of pounds by month, 1968-1969 season to present.

Season	Month														
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Total	Landings	Permits
1968-69				2.9	4.8	9.4	5.5	*	*				32,373	47	4
1969-70			*	*	4.6	5.1	*	*	6.5	1.0			19,928	25	3
1970-71	*	*	3.2	*	3.5	*						*	12,684	27	5
1971-72	*	*	*	*	*	4.5	11.3	3.8	1.8		*		26,727	49	6
1972-73	*					*	*		*				*	*	*
1973-74			*		*	*	*		*				*	*	*
1974-75	*	*	*	*	*	*	*			*			7,640	16	7
1975-76		*	*	*	*	*	*	*	*	*	*		19,242	29	5
1976-77		*	*	*		*	*			*		*	15,716	16	6
1977-78	*	*		*	*	*	*	*	*	*	*	*	24,631	76	10
1978-79	*	*	*				*	5.1	*	*	*	*	21,318	35	9
1979-80		*		*	1.5	3.0	2.7	16.5	8.3	7.9	*	9.1	57,818	123	19
1980-81	10.0	3.1	*	*	*	4.2	8.1	6.5	7.2	22.0	9.9	5.9	80,948	192	32
1981-82	11.4	3.8	5.5	2.7	6.3	14.6	11.7	3.4	6.3	34.4	36.2	20.3	157,770	381	49
1982-83	25.3	11.7	22.3	13.9	26.5	11.4	*	7.9	3.4	51.5	51.6	39.6	268,625	373	58
1983-84	44.2	32.4	15.0	13.3	21.3	22.9	24.3	32.5	31.7	8.7	5.9	4.1	257,242	653	93
1984-85	35.3	34.6	26.5	30.3	40.5	9.9	9.7	31.7	21.1	17.0	20.0	22.2	298,960	780	117
1985-86	20.3	30.3	25.2	34.7	33.1	31.1	11.1	2.3	4.3	7.3	6.3	2.6	209,207	498	81
1986-87	54.6	55.6	45.7	55.3	70.1	30.4	12.3	7.0	3.6	7.6	5.0	6.0	354,145	608	83
1987-88	74.1	56.2	48.8	54.0	62.6	19.1	20.9	10.3	7.3	5.8	5.9	3.8	368,982	688	96
1988-89	86.6	97.3	68.9	56.1	62.3	23.4	12.3	2.5	5.8	8.1	9.9	7.1	440,580	836	121
1989-90	87.9	70.7	51.9	53.8	48.6	41.8	11.6	11.1	7.7	10.8	8.8	8.9	415,828	816	110
1990-91	129.4	76.0	65.1	81.3	105.6	28.5	20.9	3.9	12.6	16.6	12.1	10.4	562,596	1,100	138
1991-92	226.2	166.0	110.3	104.9	79.4	54.2	18.4	14.3	12.7	10.8	16.8	8.8	823,344	1,560	177
1992-93	140.5	105.7	91.5	101.8	124.7	34.9	15.4	22.8	8.5	11.3	10.6	8.3	676,594	1,291	150
1993-94	174.3	194.6	99.2	131.1	130.5	44.5	22.4	25.0	23.2	20.4	26.3	24.4	916,028	1,650	182
1994-95	184.8	140.4	104.6	179.1	182.4	61.0	30.6	118.2	63.6	19.3	25.1	29.9	1,139,900	2,687	246
1995-96	463.0	205.3	119.1	73.3	41.4	38.8	8.3	11.3	9.4	6.9	8.4	1.4	987,461	2,843	351
1996-97	795.3	129.7	23.7	18.3	20.7	7.8	4.7	6.0	3.5	3.7	4.5	4.6	1,022,589	1,988	202
1997-98	757.0	57.9	30.9	3.7	6.8	5.6	7.5	9.4	10.1	*	*		868,142	1,759	198
1998-99	618.9	128.6	47.8	19.9	25.6	*		16.3	4.1	2.1	3.8	2.9	861,340	1,833	185
1999-00	639.8	96.9	39.0	33.3	24.5			18.0	8.2	12.2		*	870,061	1,373	157
2000-01	816.3	153.3	39.4	18.1	13.6			11.7	6.2	4.1		*	1,056,889	1,302	161
2001-02[a]	841.2	120.9	26.3	17.9	17.3			11.8	9.4	5.3		*	1,046,717	2,440	172

Note: Harvest based on 2.0 conversion tail to whole weight and corrected fish tickets.

[a] Most recent year's data should be considered preliminary; season in progress.

* Where number of vessels participating is less than three, information is confidential.

Table 5.3. Registration Area A (Southeast Alaska) pot shrimp fishery harvest in thousands of pounds by district, 1968-1969 season to present.[a]

Season	District															
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1968-69	25.1	*					*									
1969-70	11.9		*													
1970-71	3.7	*						*		*						
1971-72	10.6	14.8					*		*	*						
1972-73		*					*									
1973-74	*	*														
1974-75	4.1	*	*													
1975-76	7.2	11.5	*													
1976-77	*	9.6	*				3.3									
1977-78	5.6	14.1			*		*						*			
1978-79	4.2	6.7	*	*			3.6					*	*			
1979-80	19.0	12.8	*				18.3	*					*	*		
1980-81	15.4	14.8	25.0	*		*	16.6	*	*	*		*	*			
1981-82	26.3	17.5	57.1			9.4	15.6	2.0	4.9	*	*	*	14.6	*		4.7
1982-83	31.0	36.5	84.8	*		7.8	73.9	2.7	9.6	3.9		*	14.9	*		*
1983-84	41.1	22.5	36.6	*	*	7.7	87.2	16.5	*	14.2	*	3.3	21.1			*
1984-85	69.1	50.6	18.5	*	*	6.2	85.4	8.7	*	33.5	*	*	17.1	0.5		*
1985-86	36.7	37.5	71.1	*	*	6.0	23.1	2.8	1.7	13.4	*	0.4	11.1	*	*	*
1986-87	60.9	137.3	48.9		*	2.2	40.6	2.0	5.2	33.1	2.3	3.9	11.0	*	*	*
1987-88	118.5	80.0	27.5	*	*	0.6	50.2	2.8	18.8	29.0	2.3	13.9	21.5	2.0	*	*
1988-89	200.8	62.8	19.8	*	*	8.0	61.5	0.9	6.6	36.4	0.6	10.7	26.8	*		*
1989-90	155.3	68.6	27.0	2.7		8.4	44.2	18.7	*	47.9	*	6.6	30.5			*
1990-91	181.3	78.9	61.8	11.4		10.2	97.6	13.6	5.2	42.8	1.5	16.8	39.8		*	0.8
1991-92	168.6	83.5	274.4	*	*	21.2	123.4	15.3	2.9	49.7	*	12.3	61.2		3.3	4.5
1992-93	160.1	70.0	221.9	4.7	*	24.4	64.5	20.1	9.6	30.5	*	26.8	40.4		1.2	*
1993-94	147.0	120.5	288.6	5.4	*	41.2	120.5	25.3	27.0	36.0	2.1	33.5	61.7	*	1.8	*
1994-95	159.9	76.9	232.0	1.0	21.6	130.2	199.6	30.4	12.1	88.5	3.1	58.9	110.8	2.4	8.9	5.9
1995-96	179.4	90.5	245.1	23.3	34.9	76.0	120.2	9.2	25.9	48.8	23.4	28.3	49.2	17.7	10.1	7.7
1996-97	171.9	82.5	280.9	20.8	24.2	79.0	128.2	29.8	19.5	53.0	20.5	28.6	48.8	4.3	22.2	*
1997-98	142.7	83.0	228.0	10.2	5.9	72.6	127.2	20.0	21.0	39.6	18.3	25.5	41.1	12.2	21.9	*
1998-99	163.2	76.5	225.7	6.1	5.5	68.3	101.9	20.5	18.1	31.8	8.9	30.1	66.8	6.6	22.8	17.6
1999-00	158.6	76.1	237.8	16.6	11.8	70.0	100.9	23.5	18.3	37.9	8.6	26.0	48.0	*	24.7	*
2000-01	161.3	122.0	305.6	20.3	14.3	79.4	116.2	23.5	20.8	46.2	19.8	25.6	47.8	16.5	24.2	*
2001-02[b]	174.2	103.7	320.7	10.4	7.9	71.0	128.8	19.6	18.5	38.4	24.1	36.7	42.3	21.9	18.9	*

Note: Harvest based on 2.0 conversion tail to whole weight and corrected fish tickets.

[a] Pot shrimp seasons are October through September.

[b] Most recent year's data should be considered preliminary.

* Where number of vessels participating is less than three, information is confidential.

Table 5.4a.Registration Area A (Southeast Alaska) pot shrimp harvests in thousands of pounds, number of permits, and number of landings by district by month, 1999-2000 season. Regular season: October 1–February 28.

District	Oct	Nov	Dec	Jan	Feb	May	Jun	Jul	Closure date	Harvest	Permits	Landings
1	74,433	51,022	14,203	17,285	*				7-Feb	158,589	35	238
2	72,990	3,101							3-Nov	76,091	17	123
3-A	226,905								12-Oct	226,905	41	146
3-B, 3-C	7,026			*					28-Feb	10,047	5	16
4[b]				*	2,916	6,101	*	*	31-Jul	16,613	6	39
5[b]			*	*	2,499	1,853	*	4,940	31-Jul	11,839	8	13
6	29,600	12,192	7,886	9,005	11,391				14-Feb	70,074	16	101
7	88,580	11,961							24-Nov	100,541	21	229
8	23,503								22-Oct	23,503	9	94
9	16,126	*							26-Nov	18,284	6	14
10	37,921								30-Oct	37,921	15	52
11	*	*	*	*	*	*	1,692	1,598	31-Jul	7,896	6	42
Tenakee	21,854								9-Oct	21,854	11	21
Remainder of Dist. 12	1,589								9-Oct	1,589	4	4
13-A, B	5,598	1,512	5,499	*	*				28-Feb	15,005	10	34
13-C	30,597								5-Oct	30,597	16	30
14[b]		*						*	31-Jul	*	*	*
15[b]	2,306	2,464	2,156	*	3,678	9,139	4,362		10-Jun	24,668	10	153
16		*	*						15-Dec	*	*	*
Harvest	639,127	96,916	39,010	33,277	24,488	17,997	8,259	12,215				
Permits	851	194	96	51	70	62	35	20				
Landings	191	70	38	21	18	14	10	7				

* Where number of vessels participating is less than three, information is confidential.

[a] Reopened by emergency order May 15 to July 31, or until GHL for that area was met.

Table 5.4b. Registration Area A (Southeast Alaska) pot shrimp harvests in thousands of pounds, number of permits, and number of landings by district by month, 2000-2001 season.[a] Regular season: October 1 - February 28.

District	Oct	Nov	Dec	Jan	Feb	May	Jun	Jul	Closure Date	Harvest	Permits	Landings
1	124,491	36,786							10-Nov	161,277	67	185
2	121,963								29-Oct	121,963	23	120
3-A	225,486	41,351							4-Nov	266,837	78	187
3-B, C	36,508								15-Oct	36,508	12	54
4[b]	*	3,168	*	4,235	*	2,533	3,766	*	31-Jul	20,343	18	22
5[b]	*	6,122		*	*	*	*	*	31-Jul	14,331	17	20
6	45,055	16,301	18,086						17-Dec	79,442	35	87
7	106,866	8,783							3-Nov	115,649	36	173
8	23,536								23-Oct	23,536	9	79
9	20,831								1-Nov	20,831	5	15
10	46,244								26-Oct	46,244	15	87
11	927	7,640	1,153	9,295	*				10-Feb	19,843	18	29
12	25,627								7-Oct	25,627	12	31
13-A, B	2,070	6,376	*	*	*				28-Feb	13,928	13	46
13-C	33,001								5-Oct	33,001	16	42
14[b]	*	*		*	4,594	6,935	2,139	*	31-Jul	16,469	20	62
15[b]	1,955	11,934	10,279	*					15-Dec	24,216	19	92
16		*	*						20-Nov	21,832	3	3
Harvest	815,362	153,329	39,413	18,134	13,654	11,711	6,190	4,084				
Permits	230	114	24	12	8	14	10	4				
Landings	929	241	58	24	19	37	19	7				

* Where number of vessels participating is less than three, information is confidential.

[a] Reopened by emergency order May 15 to July 31, or until GHL for that area was met.

Table 5.4c.Registration Area A (Southeast Alaska) pot shrimp harvests in thousands of pounds, number of permits, and number of landings by district by month, 2001-2002 season.[a] Regular season: October 1–February 28.

District	Oct	Nov	Dec	Jan	Feb	May	Jun	Jul	Closure date	Harvest	Permits	Landings
1	116,821	57,377							19-Nov	174,198	79	422
2	103,774								28-Oct	103,774	20	163
3-A	255,370	*							28-Oct	255,370	39	417
3-B, C	42,382	20,569							15-Nov	62,951	25	123
4[b]		*	*	*	*	*	*	*	31-Jul	10,337	10	51
5[b]		*	*	*	*	*	968	1,731	31-Jul	7,857	12	30
6	71,035								27-Oct	71,035	13	166
7	107,309	17,122	3,701						10-Dec	128,132	43	450
8	19,396	*							4-Nov	19,575	12	94
9	18,482								25-Oct	18,482	5	39
10	38,442								14-Oct	38,442	16	69
11	5,233	3,521	3,555	11,602	*				24-Jan	23,351	21	90
Tenakee Inlet	19,677								6-Oct	19,777	9	34
Remainder of Dist. 12	8,945	*	4,266						29-Dec	14,175	15	55
13-A, B	5,660	*	*	*	*				28-Feb	14,328	13	46
13-C	25,876								4-Oct	25,876	17	26
14[b]		*	*	2,006	10,070	2,240	6,796		31-Jul	21,858	22	104
15[b]	2,646	1,718	4,630	899	*	5,514			28-May	18,942	27	79
16		*	*						5-Dec	19,954	4	30
Harvest	843,912	123,282	28,875	19,129	18,042	11,809	9,468	5,389				
Permits	170	82	28	14	12	15	10	4				
Landings	1,762	393	117	68	60	70	62	22				

* Where number of vessels participating is less than three, information is confidential.

[a] Most recent year's data should be considered preliminary.

[b] Reopened by emergency order May 15 to July 31, or until GHL for that area was met.

REPORT TO THE BOARD OF FISHERIES,

YAKUTAT DUNGENESS CRAB FISHERY

by

Jan Rumble
and
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[1] The Regional Information Report Series was established in 1987 to provide an information access system for all unpublished divisional reports. These reports frequently serve diverse ad hoc informational purposes or archive basic uninterpreted data. To accommodate timely reporting of recently collected information, reports in this series undergo only limited internal review and may contain preliminary data, this information may be subsequently finalized and published in the formal literature. Consequently, these reports should not be cited without prior approval of the author or the Division of Commercial Fisheries.

TABLE OF CONTENTS

LIST OF TABLES

Page

INTRODUCTION

Dungeness crabs *Cancer magister* are members of the highly evolved brachyuran (true crab) subgroup of the order Crustacea. They are commercially significant and widely distributed in coastal waters of the eastern Pacific Ocean from Baja California to the Aleutian Islands.

Fishing grounds in Yakutat (Registration Area D) are close to the northern limit of Dungeness crab distribution. They are widely distributed in Yakutat waters, but tend to concentrate off ocean beaches in two to 10 fathoms. Some of the most productive summer fishing occurs in the shore break of exposed beaches. Although the fishery extends along the entire coast, much of the total harvest is taken from four or five distinct, localized fishing grounds. Through the past forty open seasons, Yakutat produced a long-term average harvest of about 1,370,000 pounds per season (Table 6.1) but with a downward trend occurring since 1992-1993. Historically, the product was marketed as canned or frozen meat, sections, and whole-cooked, or live crab. More recently, whole cooked or live crab entered the summer tourist markets in Washington, Oregon, and California.

The 1989-1990 and 1999-2000 fishing seasons were closed early because of indications of low stock abundance shown in fish ticket and port sampling information. For the last three seasons, starting with the 2000-2001 season, the department has kept this fishery closed pending rebuilding of the stock and development of a management and research program designed to provide sustained yields.

Yakutat is a superexclusive registration area for Dungeness crab; a vessel registered to fish in this area cannot register or fish in any other area in Alaska during the same calendar year. The fishery is currently under open entry. Anyone with a permit and license can register a vessel to crab in this area. During the past decade, up to 67 permits fished in the Yakutat area. For three seasons preceding the closure of the fishery, an average 23 permits were fished. Most participating vessels are 50 feet or larger, with some vessels up to 90 feet in length. As a rule, the fleet is composed of sturdy vessels designed to be operated in near-shore rollers and capable of open ocean transit. The 400-pot limit, open ocean conditions, and the remote nature of the fishing grounds favors vessels typical of Dungeness crab fisheries in the Pacific Northwest. In fact, most of the vessels fishing the more remote western and eastern grounds have homeports in the Pacific Northwest. Almost all participants use standard, hatbox-shaped pots constructed with steel frames and webbed with stainless steel wire.

Management of this fishery is problematic because collection of biological data is limited to port sampling of the landed harvest for size frequency information, and to harvest data reported through the fish ticket system. The wide range of landing ports, as far away as Cordova, and very sporadic deliveries make it difficult to schedule dockside sampling of deliveries. The remoteness of many of the grounds complicates understanding the effects of the fishery on crab stocks. Determining stock composition and abundance would require a much more extensive research and management program.

The summer fishery overlaps important parts of the male molting period, which extends into mid-summer, and the female molting period that extends through the summer. The major mating period is also during mid to late summer. The relative success of the summer fishery depends on sporadic major recruitment events that support the fishery for up to three years thereafter. Once a large recruit year-class passes through the fishery, the fishery is dependent on annual recruitment and is vulnerable to local depletion until another large year class enters the fishery.

Alaska is the only management jurisdiction on the West Coast of North America that allows major summer fisheries for Dungeness crabs, justifying the risks because of overriding economic considerations. The Yakutat summer fishery is considered a necessary concession to the extreme winter weather conditions on the open ocean fishing grounds.

FISHERY DEVELOPMENT AND HISTORY

Through much of its history, from the mid-1920s to the mid-1960s, Southeast Alaska and Yakutat were managed as a single unit. Prior to the 1960s, harvests from much of the Gulf of Alaska were combined into a single total; Yakutat contributions were significant, but the exact percentages are unavailable.

Since the early 1960s, the fishery in the Yakutat area has evolved through two major periods. Between the early 1960s and the 1981-1982 season, the landings and participants fluctuated widely (Table 6.1). Until the early 1980s, demand for Dungeness crab from Yakutat was generally inversely related to the availability of crab from Washington, Oregon, and California and highly dependent on the willingness of one or two major processors to purchase crab during the summer. The fishery was market driven.

Between the 1981-1982 and 1995-1996 seasons, effort and participation generally increased. As the preferred product form changed from frozen or canned meat to air-freighted live crab, there was increasing interest from processors to handle Dungeness crab. For many crabbers from the Pacific Northwest, the Yakutat summer fishery was attractive because their home waters are closed during the summer. The rising demand in the early 1980s coincided with the entry of a huge recruit class into the fishery and a decline in harvests from Washington, Oregon, and California. The recruit year class supported increasing fishing effort through the next two seasons and set the pattern for development of the fishery, which is driven by stock abundance.

REGULATION DEVELOPMENT

The documented regulatory history of this fishery started in 1924. Most management jurisdictions within the range of this species employ passive management measures such as size limits, restricting harvest to males, and specifying a season that avoids known sensitive molting and mating periods. In Yakutat, this management triad, called 3-S management (size, sex, and season), is actually 2-S management since the summer fishery occurs while males and females are molting and mating. The current May 15 to July 15 opening is a compromise developed over many years to avoid the major molts to the extent possible, while recognizing economic returns. There are few alternatives to a summer season in Yakutat because the most productive grounds are exposed to extreme weather conditions in the winter. Both classical 3-S and modified 2-S management usually does not effectively manage intensive, highly competitive fisheries.

There are more active management alternatives to the 2-S methods currently used. Some of these, such as harvest rates or guideline harvest levels based on stock assessment surveys, could structure harvest to protect weak stock segments or soft-shell crabs while optimizing exploitation rates and product quality. Additional management measures must be in place before re-opening this fishery.

Fishing Seasons and Periods

For most years and seasons before 1975-1976, the fishery was open all year. The accounting period started on January 1 and ended on December 31. In 1975, following eight consecutive years of harvests between one and two million pounds and a rapid rise in the number of fishing vessels; the season was shortened to May 16 through February 28, 1976. It was then closed in the summer by emergency order because large numbers of soft-shelled crab were observed in the landed harvest. It was a season notable only because it marked the advent of short seasons and inseason management of the fishery based on stock conditions.

The 1976-1977 season started on June 1, with a scheduled closure on February 28, 1977. The season opening and closing dates remained the same through the 1981-1982 season, although several intervening seasons were closed by emergency order when large numbers of soft-shells were sampled at the dock. The season changed again in 1982, to May 1 through February 28, 1983. Each season from 1982-1983 through 1984-1985 was closed by emergency order at some point in the summer due to increasing numbers of soft shells in the landed harvest. In 1985, a split season was implemented from May 1 through July 14, and November 1 through February 28, 1986. Management of the summer fishery focused on avoiding major male molts, which frequently start on the western grounds around Icy Bay and move eastward through the summer. The summer season was generally tailored to start after the major molt on the western grounds, and end before the major molt in the Yakutat Bay stocks. By 1986, it was evident that the May 1 opening was too early and the season was shortened to start on May 15. For each season since, the summer segment of the season has started on May 15 and ended on July 14, and the winter segment has started on November 1 and ended on February 28. The timing of the winter segment was intended to provide a fishery for local residents fishing in Yakutat Bay.

Although there were no proposals before the Board of Fisheries at their January 1997 meeting to deal specifically with Yakutat stock status, they directed the department to take action. In the first three weeks of the 1997-1998 season, a large portion of the harvest was recruit size crab coupled with low abundance, together indicative of poor stock condition. An emergency order closure was issued for June 13, 1997 to foster recovery of the stock. By also closing the winter portion of the fishery, it was thought that there would be an accrual of benefits from the summer closure. However, the 1998-1999 fishery indicated further recruitment failure and overall low stock abundance. On June 9, 1998 the fishery was closed for the second consecutive season. And on June 15, 1999, the fishery was closed by emergency order for a third season. At the January 2000 meeting of the Board of Fisheries in Juneau it was designated as a collapsed and recovering fishery and closed indefinitely.

Size Restrictions

From 1924 to 1935, the legal size of male crabs was 6 ½-inches in greatest width of carapace. This changed in 1936 to 7 inches and remained unchanged until 1963, when the measurement was redefined as 6 ½ inches in width, measured immediately anterior to the tenth anterolateral spines. This was essentially the equivalent of a 7-inch total shell width measurement but more consistent since damage to the tips of the tenth anterolateral spines is common, particularly in older shell crabs. This measurement standard, often termed "shoulder width," has been in effect since then.

Gear Restrictions

In 1934, trawls were prohibited. Only pots or ring nets were allowed from 1954 to 1965. A gear limit of 300 pots or ring nets was implemented in 1963. In 1966, diving gear was legalized. The legal limit for pots and ring nets was raised to 600 pots in 1968. In 1995 the legal limit for pots was reduced to 400. This limit continues to the present. Two escape rings with a minimum inside diameter of 4 3/8-inches were first required in 1976. The intent of escape rings is to permit the escape of sublegal males and females, which are usually smaller than legal males. In 1977, a Dungeness pot was defined as a pot with tunnel eye openings, which individually do not exceed 30 inches in perimeter. A biodegradable natural fiber-breaking strap for the pot tiedown has been required since 1978. Originally specified for a maximum of 120-thread, it was reduced in 1990 to 30-thread, then increased in 1991 to 60-thread.

Other Regulations

Registration and hold inspections were required starting in 1974. In midsummer 1983, Yakutat was designated a superexclusive registration area and vessels registering to fish in Yakutat were prohibited from fishing in any other area in Alaska for the calendar year. The hold inspection requirement was rescinded in 1984, although registration was still required. In the same year, the area between Sitkagi Bluffs and Cape Yakataga, the western half of the Yakutat fishing district, was designated a non-exclusive area. The partial non-exclusive area was difficult to enforce and other problems led to redesignation of the entire Yakutat fishing district as a superexclusive registration area in 1985. In 1986, Yakutat was designated as Registration Area D, distinct and separate from Southeast Alaska (Registration Area A).

OUTLOOK

The Yakutat Dungeness crab fishery was designated as a collapsed and recovering fishery at the 2000 meeting of the Board of Fisheries in Juneau. Although the department has not yet established a policy on re-opening of collapsed and recovering fisheries, it is apparent that re-opening must be a stepwise process. The

first step is to demonstrate stock recovery. This could be accomplished either by a very limited scale commercial fishery with onboard observer requirements or by a fairly large-scale pot survey program. Our preference is for a pot survey program, as this would provide us with fishery independent stock assessment information. This would provide baseline information on the status of the Yakutat Dungeness crab stock. Once recovery is demonstrated full re-opening of the fishery must be contingent upon funding of a well-developed management and research program designed to provide sustained yields. This would include a preseason pot survey; inseason port sampling based in Yakutat, and a management program with associated biometric support based out of Juneau and would require significant long-term funding.

Table 6.1. Registration Area D (Yakutat) Dungeness crab harvest, number of participating vessels, number of landings, and average harvest per landing, 1960 to 1999-2000.

Year/ Season	Harvest in Pounds	Number of Permits	Pounds per Permit	Number of Landings	Pounds per Landing
1960	543,762	-			
1961	1,023,545	-			
1962	937,051	-			
1963	1,383,298	-			
1964	637,140	-			
1965	910,278	-			
1966	528,060	-			
1967	2,031,460	-			
1968	2,096,119	-			
1969-70	1,223,240	11	111,204	107	11,432
1970-71	1,508,561	10	150,856	83	18,175
1971-72	1,212,198	7	173,171	88	13,774
1972-73	1,992,574	9	221,397	85	23,442
1973-74	2,347,752	27	86,954	236	9,948
1974-75	1,031,573	22	46,890	154	6,698
1975-76	579,908	17	34,112	113	5,131
1976-77	537,543	7	76,792	28	19,197
1977-78	131,052	3	43,684	11	11,913
1978-79	1,799,403	12	149,950	122	14,749
1979-80	1,436,923	21	68,425	87	16,516
1980-81	895,220	10	89,522	63	14,209
1981-82	3,228,301	28	115,296	169	19,102
1982-83	5,160,135	35	147,432	305	16,918
1983-84	2,666,383	67	39,797	458	5,821
1984-85	774,828	39	19,830	228	3,398
1985-86	371,237	32	11,601	168	2,209
1986-87	755,912	22	34,360	111	6,810
1987-88	2,725,040	28	97,323	191	14,267
1988-89	3,494,368	32	109,199	220	15,883
1989-90	1,701,859	29	58,685	207	8,221
1990-91	2,101,676	36	58,380	320	6,567
1991-92	2,852,074	67	42,568	482	5,917
1992-93	1,392,700	49	28,416	257	5,419
1993-94	815,969	44	18,545	250	3,263
1994-95	915,523	47	19,479	240	3,814
1995-96	557,528	46	12,120	269	2,072
1996-97	244,425	26	9,401	152	1,608
1997-98	156,072	30	5,202	84	1,858
1998-99	121,478	29	4,189	84	1,446
1999-00	65,386	10	6,539	51	1,282
2000-01	----------Closed----------				
2001-02	----------Closed----------				

REPORT TO THE BOARD OF FISHERIES,

YAKUTAT SHRIMP OTTER TRAWL FISHERY

by

Gretchen Bishop
and
Dave Love

Regional Information Report[1] No. 1J02-45

Alaska Department of Fish and Game
Division of Commercial Fisheries
Juneau, Alaska

November 2002

[1] The Regional Information Report Series was established in 1987 to provide an information access system for all unpublished divisional reports. These reports frequently serve diverse ad hoc informational purposes or archive basic uninterpreted data. To accommodate timely reporting of recently collected information, reports in this series undergo only limited internal review and may contain preliminary data, this information may be subsequently finalized and published in the formal literature. Consequently, these reports should not be cited without prior approval of the author or the Division of Commercial Fisheries.

TABLE OF CONTENTS

LIST OF TABLES

INTRODUCTION

This report describes the commercial otter trawl fishery for shrimp in the Yakutat Area (Registration Area D) and reviews the history of the fishery and development of management regulations. The report emphasizes the otter trawl fishery; although beam trawls are also legal gear, their reported use has been insignificant. Many otter trawlers that participated in the Yakutat shrimp fishery also utilized shrimp fisheries in other registration areas. In the Yakutat Area most of the otter trawl harvest has occurred in waters of Yakutat Bay and Icy Bay. Major processors and markets have been in Kodiak, Seward, Valdez, and Astoria, Oregon.

The most significant historic harvests targeted northern shrimp *Pandalus borealis*, with smaller quantities of sidestripe shrimp *Pandalopsis dispar*, also retained. Other species incidentally captured and landed in much smaller quantities are the coonstripe shrimp *Pandalus hypsinotus*, humpy shrimp *P. goniurus*, and the spot shrimp *P. platyceros*. Northern shrimp are harvested in large volumes but with a relatively low exvessel value. Significant quantities of incidentally captured sidestripe shrimp are normally retained because of their relatively high economic value. The adoption of restrictive monthly guideline harvest levels has forced industry to target the more valuable sidestripe shrimp in lower volumes during recent seasons.

Otter trawls are double-bridled and fish best on smooth, level substrate. They are dynamic trawls that rely on bridle and "otter board" arrangements to deploy, position, and maintain the opening dimensions of the net. Their design and size allows much greater fishing power than beam trawls, other vessel characteristics being equal. Otter trawl vessels are generally large and modern, with large holding or processing capacities and they have high horsepower ratings for their size.

FISHERY DEVELOPMENT AND HISTORY

The first recorded shrimp otter trawl landing from the Yakutat area occurred in 1976 (Table 7.1). During the past 23 seasons, there have only been six seasons when harvests exceeded 100,000 pounds and these all occurred between 1977 and 1987. Harvests are confidential for nine seasons when there were a limited number of boats and landings.

The highest harvest on record was in the 1980-1981 season when a harvest exceeding 1,900,000 pounds was reported by 16 vessels making 23 landings (Table 7.1). Most of this volume was harvested in Yakutat Bay during the fall (Table 7.2) by larger vessels that also participated in various shrimp fisheries around Kodiak Island and further westward. Fish ticket data indicate the harvest was comprised of only northern shrimp, but undoubtedly some sidestripe shrimp were also harvested. Northern shrimp were the predominate species harvested through the 1987-1988 season. No harvest was reported from the 1988-1989 and 1989-1990 seasons.

There was a small resurgence in the fishery from the 1990-1991 through the 1993-1994 seasons. Effort and harvests during this period were light, primarily due to restrictive monthly harvest levels, limitation of trawl fisheries to Icy and Yakutat Bays, closures of major portions of Yakutat Bay, and generally more

conservative management. These harvests were almost evenly split between northern shrimp and sidestripe shrimp, but the target species was sidestripe shrimp due to their higher value and the restrictive monthly harvest levels. Fishing occurred within, or immediately adjacent to, these two bays and will be limited by regulation to the bay areas in the future (Table 7.3). There were no harvests reported for the 1994-1995 through 1998-1999 seasons.

The department conducted stock assessment surveys in Yakutat Bay from 1980 through 1984 (Table 7.4). The fall 1980 and spring 1981 surveys were conducted in cooperation with the National Marine Fisheries Service. All subsequent surveys occurred with department vessels, equipment, and personnel. During some years, both spring and fall surveys were completed. Survey results indicated population estimates ranging from 1,840,000 to 6,460,000 pounds of all species of shrimp combined, and an average composition of 70% northern shrimp and 30% sidestripe shrimp. No surveys have been conducted since 1984. The department assumes that harvestable stocks of northern and sidestripe shrimp are present in Icy and Yakutat Bays, but the current abundance of either of these species is unknown.

REGULATION DEVELOPMENT

Initially, the entire Yakutat Area (Registration Area D, between Cape Suckling and Cape Fairweather) was open to trawling and there were no restrictions on season, harvest level, gear, or closed waters. After the intense 1980-1981 season was closed by emergency order, regulations were developed in cooperation with the Yakutat Advisory Committee and brought before the board. The resulting regulations were a mixture of biological needs expressed by the department and desires by the community of Yakutat to continue to utilize the local resources through commercial, personal use, and subsistence fisheries. By the 1982-1983 season, a 30,000 pounds monthly guideline harvest level, closed waters, and season opening and closing dates were implemented by regulation and emergency orders. In 1993, all waters except Icy Bay and specified areas in Yakutat Bay were closed to trawl fisheries, logbooks were made mandatory, and all participating vessels had to be registered prior to fishing. Gear regulations were liberal.

In 1997, the BOF eliminated trawl shrimp fishing in the contiguous waters of Yakutat Bay east of a line from the westernmost tip of Ocean Cape to the westernmost tip of Point Manby, including the waters of Russell and Nunatak Fjords.

Fishing Seasons

In 1981 a fishing season from June 21 through February 14 opened and closed by emergency order, was established for Yakutat Bay. The closed period was presumed to be the peak egg-hatch period based on life history information from other fisheries around the Gulf of Alaska. The closure alleviated gear conflicts during the spring halibut openings. All other waters, including Icy Bay, remained open throughout the year. By 1993, the trawl shrimp fishery was restricted to Icy and Yakutat Bays and since 1997, the fishery has been further restricted to Icy Bay only.

Guideline Harvest Levels

Initial guideline harvest levels were estimated using average abundance per unit surface area from population estimates previously conducted on other Gulf of Alaska shrimp stocks, a preliminary survey conducted in Yakutat Bay by the National Marine Fisheries Service in 1953, and applying a fishing morality of approximately 0.30.

During September 1980, the first population estimate using modern nets and the area swept method was conducted. Another survey was conducted during the spring of 1981 and this information was used to establish a guideline harvest level of 1.28 to 2.0 million pounds for Yakutat Bay for the 1981-1982 season. In 1982, the Alaska Board of Fisheries amended the harvest level to 30,000 pounds/month to prevent taking the entire GHL early in the season. This conservative monthly harvest level was also established to provide opportunities for local Yakutat residents to enter the commercial fishery. In 1997, trawl shrimping was eliminated from Yakutat Bay.

In 1997 a trawl shrimp GHR was established for Icy Bay for a harvest between 50,000 and 350,000 pounds for the entire fishing season. Permit holders must contact the department, obtain logbooks, and attach them to the fish ticket at time of delivery.

Gear Restrictions

Legal trawl gear is still broadly defined as trawls, including beam and otter trawls, with no restriction to the maximum opening dimensions of the trawl mouths. Board members at the 1997 meeting discussed limiting the gear to beam trawl only, as they had done in Southeast Alaska. During periods specified by emergency order when the fishery targets sidestripe shrimp, there are regulations defining the minimum mesh size that may be used to reduce the bycatch of other shrimp species. Incidental shrimp species retention was limited to 10 percent, by weight of target species.

Closed Waters

A considerable portion of Yakutat Bay, including protected waters in the vicinity of Yakutat and extending to Knight Island, and Russell and Nunatak Fjords were closed to commercial trawling through early 1997. At that point, all waters of Yakutat Bay east of a line from the westernmost tip of Ocean Cape to the westernmost tip of Point Manby were closed to shrimp trawling. The commercial closure protects important subsistence fishing grounds and prevents conflict with growing commercial pot shrimp fisheries in these areas.

SEASON SUMMARIES

2001-2002 Season Summary

No shrimp were reported taken with trawl gear in the Yakutat Registration Area during the past season.

2002-2003 Season Outlook

There has been little interest in this fishery during the past nine seasons, but the markets for shrimp in general, and specifically sidestripe shrimp, are improving and this situation could change. If the market supports the operation of a harvester-processor or a floating processor, or if land based processing interest develops in the city of Yakutat, it may be difficult to effectively manage the fishery with existing regulations and programs. If the resurgence of the fishery targets sidestripe shrimp while discarding northern shrimp, accurate accounting for bycatch will be necessary. Trawlable grounds in Yakutat Bay are utilized by other commercially important species that include Dungeness, Tanner, and king crab and halibut and scallops.

Stock assessment surveys have not been conducted since September 1984 (Table 7.4), and the current condition of the shrimp stocks is unknown. Previous survey estimates and current regulations would support a seasonal harvest of up to 270,000 pounds from Yakutat Bay. An additional 350,000 pounds could be harvested from Icy Bay. Sustained harvests at these levels would require stock assessment surveys to verify seasonal abundance and new regulations to assure adequate monitoring and reporting of both the harvest of target species and incidental bycatch. It may be necessary to incorporate bycatch criteria into the management strategy for this fishery.

Table 7.1. Registration Area D (Yakutat) shrimp trawl harvest, number of vessels, number of landings, pounds per vessel, and pounds per landing, 1976-1977 to present.[a]

Year/ Season	Harvest in Pounds	Number of Permits	Landings	Pounds per Permit	Pounds per Landing
1976-1977	*				
1977-1978	0	0	0	0	0
1978-1979	0	0	0	0	0
1979-1980	*				
1980-1981[b]	1,906,680	16	23	119,168	82,899
1981-1982	*				
1982-1983	141,714	3	7	47,238	20,245
1983-1984	426,649	5	10	85,330	42,665
1984-1985	*				
1985-1986	*				
1986-1987	*				
1987-1988	40,448	3	6	13,483	6,741
1988-1989	0	0	0	0	0
1989-1990	0	0	0	0	0
1990-1991	*				
1991-1992	*				
1992-1993	34,875	3	3	11,625	11,625
1993-1994	*				
1994-1995	0	0	0	0	0
1995-1996	0	0	0	0	0
1996-1997	0	0	0	0	0
1997-1998	0	0	0	0	0
1998-1999	0	0	0	0	0
1999-2000	0	0	0	0	0
2000-2001	0	0	0	0	0
2001-2002 [c]	0	0	0	0	0

[a] Almost all landings of trawl shrimp have been made using otter trawl gear.

[b] 1980-1981 season includes 450,000 pounds caught by otter trawl out of Yakutat Bay during the fishery (August 1980), but not reported on fish tickets.

[c] Most recent year's data should be considered preliminary.

* Where number of permits less than three, data is considered confidential.

Table 7.2. Registration Area D (Yakutat) shrimp trawl harvests in thousands of pounds by month and season, 1976-1977 to present.[a]

	Month												
Season	May	June	July	Aug	Sept	Oct	Nov	Dec	Jan	Feb	March	April	Total
1976-1977	0.0	*	0.0	*	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	*
1977-1978	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1978-1979	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1979-1980	0.0	0.0	0.0	0.0	*	0.0	0.0	0.0	0.0	0.0	0.0	*	*
1980-1981[b]	0.0	0.0	*	1,350.0	481.9	0.0	0.0	0.0	0.0	0.0	24.3	0.0	1,906.7
1981-1982	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	*	0.0	0.0	0.0	*
1982-1983	*	*	*	*	*	0.0	0.0	0.0	*	0.0	0.0	0.0	141.7
1983-1984	0.0	0.0	0.0	0.0	*	*	0.0	0.0	0.0	0.0	*	128.0	426.6
1984-1985	0.0	*	0.0	*	*	0.0	0.0	0.0	0.0	0.0	0.0	0.0	*
1985-1986	0.0	0.0	0.0	0.0	0.0	0.0	0.0	*	0.0	0.0	0.0	0.0	*
1986-1987	0.0	0.0	0.0	0.0	0.0	0.0	*	*	0.0	*	154.7	0.0	*
1987-1988	0.0	0.0	0.0	0.0	0.0	0.0	0.0	*	*	0.0	*	0.0	40.5
1988-1989	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1989-1990	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1990-1991	0.0	*	0.0	*	*	0.0	0.0	0.0	0.0	0.0	0.0	*	*
1991-1992	0.0	0.0	*	*	0.0	*	0.0	0.0	0.0	0.0	0.0	0.0	*
1992-1993	0.0	0.0	*	*	*	0.0	0.0	0.0	0.0	0.0	0.0	0.0	34.9
1993-1994	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	*	0.0	0.0	0.0	*
1994-1995	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1995-1996	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1996-1997	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1997-1998	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1998-1999	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1999-2000	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2000-2001	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2001-2002 [c]	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

[a] Almost all landings of trawl shrimp have been made using otter trawl gear.

[b] 1980-1981 season includes 450,000 pounds caught by otter trawl out of Yakutat Bay during the fishery (August 1980), but not reported on fish tickets.

[c] Most recent year's data should be considered preliminary.

* Where number of permits is three or less, data is considered confidential.

Table 7.3. Registration Area D (Yakutat) shrimp trawl fishery harvest in thousands of pounds, by season and district, 1979-1980 to present.[a]

District	Season										
	1976-1977	1977-1978	1978-1979	1979-1980	1980-1981[b]	1981-1982	1982-1983	1983-1984	1984-1985	1985-1986	1986-1987
181	*	0.0	0.0	0.0	556.8	0.0	*	310.4	*	*	*
183	0.0	0.0	0.0	*	1,349.9	*	*	*	*	0.0	0.0
189	*	0.0	0.0	*	0.0	0.0	0.0	0.0	0.0	0.0	0.0
191	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total	*	0	0	*	1,906.7	*	141.7	426.6	*	*	*
Landings		0	0		23		7	10			
Permits		0	0		16		3	5			

District	Season													
	1987-88	1988-89	1989-90	1990-91	1991-92	1992-93	1993-94	1994-95	1995-96	1996-97	1997-98	1998-99	1999-00	2000-01	2001-02[c]
181	40.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0
183	0	0	0	*	*	*	*	0	0	0	0	0	0	0	0
189	0	0	0	*	0	*	0	0	0	0	0	0	0	0	0
191	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	40.5	0	0	*	*	34.9	*	0	0	0	0	0	0	0	0
Landings	6	0	0			3		0	0	0	0	0	0	0	0
Permits	3	0	0			3		0	0	0	0	0	0	0	0

[a] Almost all landings of trawl shrimp have been made using otter trawl gear.
[b] 1980-1981 season includes 450,000 pounds caught by otter trawl out of Yakutat Bay during the fishery (August 1980), but not reported on fish tickets.
[c] Most recent year's data should be considered preliminary.
* Where number of permits is three or less, data is considered confidential.

Table 7.4. Summary of shrimp research cruises in Yakutat Bay, Alaska.

Begin Date	Vessel	Cruise Number	Gear	Strata	Tows	Shrimp per nm (pounds)	Percent Northern Shrimp	Percent Sidestripe Shrimp	Area Surveyed (nm^2)	Point Estimate (pounds x 10^6)	Range of Point Estimate (pounds x 10^6)
3/1953	John N. Cobb	COBB15	20' Beam		26	297.42[a]			Unknown	Unknown	Unknown
9/1980	Resolution	8008	32' NMFS[b]		9	680.56	91	8	50.01	6.46	4.73 to 8.19
3/1981	John N. Cobb	JC81-01	32' NMFS		24	231.00	43	57	105.70	4.38	3.04 to 5.72
8/1981	Pandalus		32' NMFS		22	196.27	72	27	50.01	1.86	1.13 to 2.60
9/1982	Resolution		32' NMFS	2	14	141.53	47	53	50.01	1.43	1.05 to 1.64
9/1982	Resolution		32' NMFS	3	5	206.00	65	35	12.89	0.50	0.30 to 2.13
9/1984	Pandulus		32' NMFS	2	22	181.06	61	38	50.01	1.72	1.31 to 2.13
9/1984	Pandulus		32' NMFS	3	3	230.33	93	7	12.89	0.56	0.24 to 0.89

[a] Figure in pounds of pandalids per trawl hour. Species composition unknown quantitatively. Report suggests a preponderance of sidestripe shrimp.
[b] NMFS gear is an otter trawl.

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TABLE OF CONTENTS

Page

LIST OF TABLES

INTRODUCTION

Life History

The shrimp pot fishery targets spot shrimp *Pandalus platyceros*, and harvests significant quantities of coonstripe shrimp *P. hypsinotus*. Life history information concerning these species is limited. Canadian reports suggest the maximum age of the spot shrimp is three to five years, while Alaskan tagging data suggests eight to ten years (Butler 1964; Kimker et al. 1996). All pandalid shrimp are protandric hermaphrodites, which means they first mature and spawn as males, transition to females, and spawn as females for the remainder of their lives. In British Columbia, spot shrimp are thought to function as males for one to three seasons (into their fourth year), then change sex and spawn as females for their fourth or possibly fifth year, before disappearing from catches (Butler 1980). While size at sex change appears to be variable and may be site specific for pandalid shrimp such as spot shrimp, the age and size of another pandalid shrimp, *Pandalus jordani*, appears to be effected by environmental as well as fishery-related selection pressures (Hannah 1993; Hannah and Jones 1991). The average fecundity of large female spot shrimp sampled near Petersburg, Alaska has been estimated at about 3,900 eggs per female per year (Hynes 1930). Spot shrimp eggs hatch in late winter and early spring, followed by a growth molt for females. The transition from male to female occurs during the summer months. Females undergo another molt into "breeding dress" in the fall, after which they extrude their mature eggs from the internal ovaries. Eggs are fertilized externally when they are extruded. Developing embryos are carried on the external pleopods until they are fully developed. Hatching occurs during late spring through early summer (Price and Chew, 1972). The free-swimming larvae spend up to three months in the plankton at the mercy of the tides and currents. Juveniles enter estuaries in July of their first year, at approximately four mm carapace length, following a larval period of approximately 1–3 months during which they are transported by tides and currents. Spot as well as coonstripe shrimp appear to utilize shallow water eelgrass and *Laminarium* or *Agarum* spp. kelp habitats as juveniles, before migrating to rocky habitats including reefs, glass sponge reefs and corals (Chew et al. 1974; Marliave and Roth 1995). Five juvenile stages are reported prior to maturation to a functional, adult male (Berkeley 1930; Haynes 1985). Although larvae may be widely transported by currents, settled juveniles and adults appear to be relatively sedentary. Tagged adults may remain within a mile or two of their release location (Boutillier 1996; Kimker et al. 1996).

Fishery

Both spots and coonstripe shrimp are primarily harvested from rocky habitat located in Yakutat Bay by fishers using baited pot gear, which is either longlined or fished singly from vessels ranging in length from small skiffs up to about 40 feet. In a longline system each pot is attached to the groundline with a snap, similar to that used on longline snap-on groundfish gear. Pot construction is extremely varied in size, shape, weight, and configuration, so it is difficult to describe a "standard" pot. Gear designs have rapidly changed to increase fishing efficiency. One of the most commonly available pots today is a "cone style." This pot is constructed using two stainless steel rings, the top ring smaller than the bottom, with vertical bars welded between the rings forming six sides, at least three of which contain tunnels. This pot type has webbing

tightly drawn in on the top with a permanent closure. The bottom web is drawn in with a "pucker string" which is opened during baiting operations and to empty the pot of its harvest.

FISHERY DEVELOPMENT AND HISTORY

The first reported landings occurred in the Yakutat Area during the 1969-1970 fishing season. For the next ten seasons, landings occurred during only two seasons. Participation and landings have been fairly consistent since the 1982-1983 fishing season, with a peak landing of 29,872 pounds occurring during that season. The peak effort level of 16 permits occurred during the 1995-1996 season when 15,411 pounds were landed. Average landings have totaled 10,741 pounds by an average of eight vessels per season since 1982-1983. Average landings of 9,427 pounds taken by an average of eight boats per season are reported for the 1987-1988 through 1996-1997 seasons. Average annual catches of 12,711 pounds taken from an average of eight vessels have been taken since the 1997-1998 season. Usually, only the tails are sold by the shrimper to private individuals, restaurants, or other specialty markets without passing through traditional processors. This is a low volume fishery with a relatively high exvessel value. The average price paid for tails has been about $5.00 per pound during recent seasons. Peak effort and harvests normally occur during May and June. However, activity in this fishery can be highly variable. For example, the peak harvest during the 1982-1983 season occurred during the month of September.

REGULATION DEVELOPMENT

Management of the commercial pot shrimp fishery in the Yakutat Area is largely passive, focusing on Yakutat Bay. Regulations specific to Yakutat Bay are limited to a closed season to prevent fishing during the egg-hatch period, a minimum mesh size to retain the larger female segment of the stock, a maximum number of pots per participant to limit effort, and prohibition of trawling in productive areas heavily utilized by the pot fishery. Fish ticket data assists tracking major trends or changes in stock status. The Yakutat Area has had a separate section in the regulatory code since 1985.

A guideline harvest level (GHL) of 10,000 pounds for the May through September period was established for Yakutat Bay in 1996, in response to increasing effort and higher harvest rates. The GHL was based on historical harvest data, and not on information describing stock abundance or stock condition. In 1997, the BOF adopted separate monthly GHLs for two portions of Yakutat Bay for each month the fishery is open. By doing so, the total seasonal harvest potential was effectively doubled to 20,000 pounds.

Fishing Seasons

Prior to 1985, the Yakutat Area was open throughout the year. In 1985, a May 1 through February 28 season was established for Yakutat Bay. The closed period coincided with the major egg-hatch period, which was assumed to be similar to that of Southeast Alaska for the spot shrimp. In 1997, separate fishing periods were adopted for portions of Yakutat Bay. In the waters running east of a line from the northernmost point of Khantaak Island to Logan Bluff and east of a line from the northernmost point of Khantakk Island to the northernmost point of Doggie Island, the season runs from October 1 through February 28. The remaining waters of Yakutat Bay east of a line from the westernmost tip of Ocean Cape to the westernmost tip of Point Manby are open May 1 through February 28. The remainder of the Yakutat Area outside the bay remains open throughout the year.

Size Restriction

The Alaska Board of Fisheries policy on small shrimp discourages harvest of shrimp less than two years of age. A mesh size restriction is used in lieu of specific regulations for a minimum legal size to reduce the harvests of small shrimp. The mesh size assumes passive sorting through minimum mesh webbing minimizing the retention of the smaller male, transitional, and female spot shrimp and coonstripe shrimp.

Gear Restriction

A mesh restriction specifying 1 ½-inch stretch measure was established in 1986 for all pots used in Yakutat Bay to reduce the potential for recruitment over-fishing in this area. This regulation provided some protection to approximately one or two-year classes of small shrimp. Prior to 1997, only a portion of the pot was required to have the minimum mesh panels. Current regulations require that the pot be entirely covered with net webbing or rigid mesh with at least two opposing sides of the pot having a webbed panel of minimum stretch mesh of the 1 ½-inch stretch mesh if a permit holder is fishing inside Yakutat Bay. The 1-½-inch minimum mesh size allows the retention of smaller shrimp, compared to the Southeast Alaska fishery. The potential impacts on future stock condition will not be understood until more samples for size and sex data are collected and analyzed. The use of a smaller minimum mesh size risks unintended harvest of smaller spot shrimp and increased handling mortality. This may constitute a conservation concern.

A pot limit of 75 pots per vessel was established in 1985 for Yakutat Bay. Even with the relative stability with regard to the number of permit holders up until the 1995-1996 season, fleet members considered the number of allowable pots to be more than the fishery could withstand. Current regulations allow for a limit of 30 pots per vessel inside Yakutat Bay. Along with the pot reduction adopted in 1997, trawling is prohibited within all waters of Yakutat Bay.

There are no pot limits, mesh restrictions, or other harvest-limiting gear regulations for all waters in the Yakutat Registration Area outside of Yakutat Bay. Additional regulatory requirements for commercial shrimp pot gear include maximum tunnel perimeters (15-inches), buoy markings, and escape mechanisms.

Quotas and Guideline Harvest Levels

In the mid-1990s, several larger southeast pot shrimp vessels and a floating processor entered the fishery in Yakutat Bay. Although their presence was transitory, it did lead to closure of the commercial fishery in the bay, changing inseason starting and ending dates and resulting in implementation of a GHL for the commercial harvest, for the first time.

During the 1996-1997 season, a GHL of 10,000 pounds was set for Yakutat Bay, north and east of a line from Ocean Cape to Point Manby, for the period from May through September. The 10-year average harvest for the 1987-1988 to 1996-1997 seasons equaled 9,427 pounds, and the 15-year average harvest was 10,204 pounds. The harvest level for the winter fishery from October 1 through February 28 was unrestricted because potential effort was less in winter than in summer. The GHL capped the harvest at a level commensurate with those years historically reported for this fishery and provided some protection against possible localized depletion. The summer GHL represented a higher harvest than the prior seasonal average but was lower than the maximum historical harvests in the early 1980s. The five-year average harvest for the Yakutat registration area for the 1997-1998 through 2001-2002 seasons was 12,711pounds, while the 10-year average for the period 1992-1993 to 2001-2002 was 12,079 pounds. These averages appear somewhat high because they represent all of Registration Area D including harvests from Yakutat Bay as well as Icy Bay. The GHL for Icy Bay was established by emergency order at 10,000 pounds for the 2000-2001 season to allow for a limited fishery on an unknown biomass of spot and coonstripe shrimp.

While there had not been a consistent trawl shrimp fishery in Yakutat Bay, surveys in the early 1980s demonstrated harvestable stocks capable of supporting a fishery with a monthly quota of 30,000 pounds. In 1997, the BOF prohibited continuation of trawl shrimping inside Yakutat Bay. This prohibition to trawl gear may maximize availability of coonstripe shrimp to pot gear, but does eliminate harvest of northern and sidestripe shrimp. Coupled with this trawl prohibition, separate monthly GHLs were established for two portions of Yakutat Bay. In waters of Yakutat Bay east of a line running from the northernmost point of Khantaak Island to Logan Bluff and the waters east of line running from the northernmost point of Khantaak Island to the northernmost point of Doggie Island, the monthly GHL is 2,000 pounds for each month the fishery is open. This provides a potential season total of about 10,000 pounds. For the remaining waters of Yakutat Bay that are east of a line running from the westernmost tip of Ocean Cape to the westernmost tip of Point Manby, the monthly GHL is 1,000 pounds for a potential seasonal total of an additional 10,000 pounds.

SEASON SUMMARIES

1999-2000 Season Summary

A harvest of 7,007 pounds was reported in 1999-2000 by four permit holders making 86 landings (Table 8.1). Most of the harvest occurred during the months of May through September, although landings were also reported through the entire winter open season (Table 8.2). The majority of the harvest reported was taken in Yakutat Bay, District 183 (Table 8.2). The harvest level, number of participants, and the number of landings were lower than the 1997-1998 through 2001-2002 average (Table 8.1).

2000-2001 Season Summary

A harvest of 28,487 pounds was reported for all of Registration Area D in 2000-2001 by 11 permit holders making 140 landings (Table 8.1). Most of the harvest in 183-11, Doggie Island area of Yakutat Bay, occurred during the months of October through February, while harvests in the remaining waters of Yakutat Bay were fished during the May through September period (Table 8.2). Fewer than three boats made landings from Icy Bay during the 2000-2001 season, therefore, information is confidential. The majority of the harvest was reported taken in the Doggie Island area, Statistical Area 183-11, and from Icy Bay, District 181 during the 2000-2001 season (Table 8.2). Area-wide harvest, number of participants, and the number of landings were much higher than 5-year and 10-year averages and the highest since the record setting seasons in the early 1980s, due to the additional effort in Icy Bay (Table 8.1).

2001-2002 Season Summary

A harvest of 9,740 pounds was reported in 2000-2001 by seven permit holders making 81 landings (Table 8.1). Landings were more sporadic than in recent years with most of the harvest occurred during the months of October through January in the Doggie Island area, with fewer permit holders fishing during the summer months in the open waters of Yakutat Bay (Table 8.2). No vessels fished in Icy Bay, during this season. The majority of the harvest was reported taken from the Doggie Island area of Yakutat Bay, District 183-11 (Table 8.2). The harvest level, monthly harvests, and number of participants were lower than the five-year average (Table 8.1).

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Table 8.1. Registration Area D (Yakutat) shrimp pot fishery harvest, number of landings, and CPUE, 1968-1969 to present.

Season[a]	Harvest in Pounds	Number of Permits Fished	Number of Landings	Pounds per Landing	Pounds per Permit
1968-69	0	0	0		
1969-70	*				
1970-71	0	0	0		
1971-72	0	0	0		
1972-73	0	0	0		
1973-74	0	0	0		
1974-75	*				
1975-76	0	0	0		
1976-77	0	0	0		
1977-78	0	0	0		
1978-79	0	0	0		
1979-80	*				
1980-81	*				
1981-82	*				
1982-83	29,872	4	63	474	7,468
1983-84	14,249	8	33	432	1,781
1984-85	2,796	6	35	80	466
1985-86	7,441	5	33	225	1,488
1986-87	2,643	5	10	264	529
1987-88	4,403	8	45	98	550
1988-89	2,714	6	15	181	452
1989-90	8,352	5	72	116	1,670
1990-91	12,791	7	70	183	1,827
1991-92	8,773	12	79	111	731
1992-93	3,844	4	41	94	961
1993-94	7,093	6	55	129	1,182
1994-95	6,358	6	64	99	1,060
1995-96	15,411	16	106	145	963
1996-97	24,532	14	218	113	1,752
1997-98	11,999	10	135	89	1,200
1998-99	6,324	10	113	56	632
1999-00	7,007	4	86	81	1,752
2000-01	28,487	11	140	203	2,590
2001-02	9,740	7	81	120	1,391

* Where number of vessels participating is less than three, information is confidential.

Table 8.2. Registration Area D (Yakutat) shrimp pot harvests in pounds (landings) by district and month, 1998-1999 – 2001-2002 seasons.[a]

Season	Month									
	Oct	Nov	Dec	Jan	Feb	May	June	July	Aug	Sept
District 181										
1997-98										
1998-99										
1999-00										
2000-01	*									
2001-02										
District 183										
1997-98	390	113		1,180	764	*	1,416	1,752	1,468	*
1998-99	666	539	*			785	*	*	*	*
1999-00		*	*	*	*	*	*	*	687	*
2000-01				602	2,445	1,392	656	*	288	*
2001-02	280	*			*		*	*		
District 183-11 Doggie Island										
1997-98	884	*	825	278	464					
1998-99	2,135	544	*	454	*					*
1999-00	*	*		*	*	*		*	*	
2000-01	*	1,599	1201	3,108	3,483	572	*			*
2001-02	2,424	2,340	2550	*	*					

* Where number of vessels participating is less than three, information is confidential.

REPORT TO THE BOARD OF FISHERIES,

YAKUTAT SCALLOP FISHERY

by

Gretchen Bishop

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Division of Commercial Fisheries
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[1] The Regional Information Report Series was established in 1987 to provide an information access system for all unpublished divisional reports. These reports frequently serve diverse ad hoc informational purposes or archive basic uninterpreted data. To accommodate timely reporting of recently collected information, reports in this series undergo only limited internal review and may contain preliminary data, this information may be subsequently finalized and published in the formal literature. Consequently, these reports should not be cited without prior approval of the author or the Division of Commercial Fisheries.

TABLE OF CONTENTS

LIST OF TABLES

INTRODUCTION

Life History

The weathervane scallop *Patinopecten caurinus* is widely distributed over sandy substrates at depths of 15 – 110 fathoms (Barnhart and Rosenkranz 2000), primarily in areas with relatively high bottom currents. A filter feeder on near bottom plankton, this species becomes sexually mature in Alaska at a diameter of three inches at which time they are approximately three-years of age (Hennick 1970). However, the oldest scallop aged in Alaska was estimated to be 28-years of age; it measured 10-inches across the shell (Hennick 1970). Although there is no minimum legal size, harvest is limited to scallops of four-inches in shell width or greater by the minimum inside diameter of the dredge ring. This allows the escapement of mature scallops. Weathervanes are dioecious and in Alaska release gametes into the water column for fertilization from mid May to early July. Fertilized eggs settle to the bottom where they hatch into larvae within several days (U.S.B.L.M. 1980) and settle after two to three weeks. Other commercially exploited species that are captured during scallop dredging include juvenile Dungeness crab *Cancer magister* and Tanner crab *Chionoecetes bairdi* that are found over similar substrates.

Fishery

Commercial scallop harvest in Region I occurs in Registration Area D (Yakutat area) and District 16 of Southeast Alaska. Commercial dredging for the weathervane scallop in the Yakutat area occurs in open coastal waters between Cape Fairweather and Cape Suckling. Known offshore beds are extensive and overlap state and federal Exclusive Economic Zone (EEZ) waters. Harvestable populations also occur in Yakutat Bay, but scallop dredging in the bay is prohibited by regulation.

Scallop dredging in Registration Area A (Southeast Alaska) is limited by regulation to District 16, with the exception of Lituya Bay in District 16, which is closed. The known offshore beds in District 16 are small in comparison to those historically fished elsewhere in Alaska and overlap state and EEZ waters. Many of the productive beds are discontinuous or dispersed between foul grounds.

The fishery is managed by the State of Alaska according to guidelines in the Alaska Scallop Fishery Management Plan (ASFMP), adopted in 1993. The major features of the plan are required registration, minimum ring sizes of 3 or 4 inches depending on the scallop species targeted (the Life History section implies that only weathervanes are harvested), prohibition on chafing gear and shucking machines, maximum opening of 15 feet for a scallop dredge, maximum of 12 crew members, guideline harvests ranges by registration area, and a requirement for complete observer coverage on all participating vessels.

The determination of the number of vessels allowed to participate in the statewide fishery is under the jurisdiction of the North Pacific Fishery Management Council, which set the maximum number of vessels at nine in 1999, and identified the permitted vessels at that time. Most vessels working in this fishery are very seaworthy, in excess of 70 feet, and based in Kodiak, Seward, and in other states. The fleet is highly

mobile. Most vessels fish New Bedford-type dredges, approximately 12 to 15 feet in width, with one set off each side of the vessel. These dredges have heavy, rectangular steel frames supporting a mesh bag made from heavy steel rings. Ideally, the dredge skims the bottom just deeply enough to flip scallops into the mesh bag without plowing into the substrate.

Scallop fishing, processing, and marketing operations are more vertically integrated than most other fisheries in Alaska. The same company that owns or operates the vessel also warehouses, transships, brokers, and sells the product to consumers.

The primary product is the major adductor muscle, with most processing, and freezing or icing, conducted aboard the harvester vessel on the fishing grounds. The current guideline harvest range (GHR) is 0 to 250,000 pounds in Registration Area D and 0 to 35,000 pounds in District 16. Landed product weight is reported in pounds of frozen or iced meat, which comprises 6 to 11% of the live whole weight.

FISHERY DEVELOPMENT AND HISTORY

Registration Area D

The first reports of scallop harvests in the Yakutat area were in 1968. Since then, harvests have varied widely (Table 9.1). The roller coaster highs and lows in the harvest reflect a largely unregulated fishery, driven by economics and market forces before adoption of the ASFMP in 1993. Since scallops live for many years after reaching harvestable size and worldwide demand has generally outstripped supply, the recurring crashes in the historical harvest record were strong circumstantial evidence that exploitation rates during some years had been too high. There was little consideration for long-term reproductive viability. Combined with sporadic recruitment, heavy harvests did not leave enough scallops on the grounds to carry the fishery over poor years.

The earliest years of the fishery were very productive. Virgin biomass supported harvests of over 900,000 pounds in 1968 (Yakutat Annual Report, 1968) and 800,000 pounds in 1969, by up to 14 vessels (Table 9.1). These years were followed by two decades of reduced effort and harvests. A statewide trend of increasing interest and participation in scallop fisheries in the early 1990s culminated in a peak harvest of over one million pounds in Area D in 1992. In response, the department developed an interim management plan in 1993 under the High Impact Emerging Fishery regulation (5 AAC 39.210). The Alaska Board of Fisheries subsequently adopted a management plan (the ASFMP) into regulation. Annual harvests in Yakutat have been constrained to a maximum of 250,000 pounds under the ASFMP.

District 16

The fishery in Southeast Alaska started in the early 1980s as stocks in the Yakutat Area to the north and west were fished down. Interest and harvests have been generally low and intermittent. District 16 stocks have been spared much of the roller coaster highs and lows prior to implementation of the Alaska Scallop Fishery Management Plan in 1993. Only a few vessels fished in most seasons, with a maximum of nine vessels in 1994, and one to nine vessels in each of the other 16 years of record. The peak harvest of 148,624 pounds occurred in 1990, with an overall historical average of about 46,000 pounds (Table 9.2). Most of the effort in Southeast Alaska has occurred in District 16, although a few landings were reported during the 1982 season from three other districts around the outer coasts of Southeast Alaska before limitation of the fishery to District 16 in 1993. Due to the low numbers of participants and landings, historical data for much of this fishery is confidential.

In recent seasons the harvest has usually been after the Yakutat fishery closed. The general pattern has been for vessels displaced by competition or closure from the more productive grounds in Alaska to prospect for product in Southeast Alaska.

REGULATION DEVELOPMENT

The weathervane scallop fishery evolved from a wide-open, almost unregulated fishery through the 1992 season into one of the most stringently controlled and managed fisheries in the state in little more than a single season. The speed of emergency order implementation of the statewide ASFMP, and the scope of the regulations were unprecedented.

Guideline Harvest Ranges

A guideline harvest range (GHR) of 0 to 250,000 pounds for Registration Area D and 0 to 35,000 pounds for District 16 was established by the ASFMP in 1993. The ceilings are the approximate long-term average annual harvests for each area up to 1992.

Gear Restrictions

As weathervane scallops become sexually mature at approximately three inches (Hennick 1970) a four-inch minimum ring inside diameter for scallop dredges was established in order to permit the escape of juvenile

and smaller sexually mature scallops. This was the primary passive management tool from 1969 through 1992, and continues to be used as a conservation measure to the present time. Since 1993, the width or horizontal front opening of scallop dredge gear has been limited to 15 feet and the use of any chafing gear or device that would tend to restrict the size of the rings has been prohibited.

To further discourage the entry of ever-larger vessels into the fishery, regulations adopted as part of the ASFMP in 1993 restricted the number of dredges that may be deployed at any time from a scallop vessel to two. Prohibiting mechanical or automated shuckers and restricting the crew size to 12, excluding the observer, limited daily production per vessel. With the exception of experimental dredges operating under stringent permit conditions, only dredges as defined and restricted by regulation may be used.

Fishing Seasons and Periods

Registration Area D

For much of its history, this fishery has been open all year, with no closures during sensitive spawning periods. In late spring of 1991, Yakutat Bay was closed to commercial scallop dredging by the Board of Fisheries. Closure of the bay alleviated conflicts with commercial and subsistence salmon fishers, Dungeness crab and shrimp pot fishers, and other miscellaneous interests. Season closures went into effect in 1993, with the winter fishery managed for a harvest of about 125,000 pounds. The fishery lasted from January 1 through February 28. The ASFMP, with its observer requirement and new regulations, went into effect before the summer fishery, which opened on July 1 and closed on July 11, 1993. The next season opened on January 10, 1994. The delay was due to problems in scheduling training and certification for observers. The season lasted eight days, closing on January 18, 1994. The summer season opened on July 1 and closed on July 12, 1994. The Board of Fisheries formally changed the opening date for the winter fishery in late 1994 from January 1 to January 10, and from a split season to a single winter season. The single winter season lasted through 1997.

In 1995, the season opened January 10 and closed on February 2. The season was shorter in 1996, opening on January 10 and closing on January 25. The last year for the winter fishery was in 1997 when the season opened on January 10 and closed on February 24. At the Board of Fisheries meeting in 1997 regulations changed so that the season was opened on July 1 and extended to February 15. In 1998, the season opened on July 1 and closed on July 29. In 1999 the season was July 1 to September 1.

District 16

Prior to 1993, this fishery was open all year, with an accounting period of January 1 through December 31. Starting in 1993, the statewide management plan was implemented. For Southeast Alaska, it specified a split season, with a winter fishery starting on January 1 and a summer fishery starting on July 1. In 1994, because of high anticipated effort and catch levels, the winter season opened and closed after a one-day fishery on January 20. The following summer season, which opened by regulation on July 1 and closed by

emergency order on October 31, was not as intense because productive areas in other parts of the state were open concurrently.

In 1995, there was only a winter fishery, which opened January 10 and closed on February 13. There were two seasons in 1996. The first one opened in state waters only on January 10 and closed on January 20. The summer fishery opened in federal waters on August 1 and continued through the fall to close on November 29. In 1997, there was a winter fishery lasting from January 10 to February 24. At the Board of Fisheries meeting in 1997 regulations changed so that the season was opened on July 1 and extended to February 15. There was not a summer fishery in 1997, as the annual allocation had been taken in the winter. The next season began in 1998, opening July 1 and closing on October 6. In 1999, the season was shorter, opening July 1 and extending to September 1.

Size Restrictions

There are no size restrictions on scallops. Any scallop that is retained by 4-inch minimum-diameter, legal gear may be possessed and processed. In the past, a high percentage of the smaller scallops retained by this gear could not be economically hand-processed and were returned to the sea. These smaller scallops can now be processed and profitably marketed. Management assumes that adherence to the current GHR will be sufficient to insure overall stock viability despite retention of a larger percentage of smaller scallops.

Observer Program

Mandatory observers are required on each vessel fishing for scallops. The observer program has two main goals: to monitor bycatch and to collect biological and commercial fishing information about the weathervane scallop. There has been concern about the bycatch of crab and other important commercial species. The results from observer sampling from 1993 through 2001 (Table 9.3) show that there is minimal bycatch of crab in Yakutat Registration Area D and District 16, especially when compared with other registration areas.

Observer sampling of the scallop catch and discarded scallops allows determination of the stock size composition. In addition, shells are collected for ageing in order to determine the age structure and population dynamics of Yakutat weathervane scallop populations.

Crab Bycatch Limits

Dungeness and Tanner crab are captured incidentally in scallop dredges in the Yakutat fishery. The estimated bycatch for District 16 and Yakutat combined from 1993 through 1998 averaged 4,561 Tanner crab with a modal carapace width of approximately 28 mm and 966 juvenile Dungeness crab annually

(Barnhart and Rosenkranz 2000). At its peak from 1980-1981 through the 1990-1991 seasons the Yakutat Dungeness crab fishery averaged an annual harvest of 2.2 million pounds or approximately 1.1 million crabs. During it's peak from 1972-1973 – 1981-1982 seasons the Yakutat Tanner crab fishery averaged an annual harvest of 1.3 million pounds or approximately 0.6 million crabs (ADF&G 2000, 2002).

Tanner crab bycatch caps are established for each management area or district except the Bering Sea and Scallop Registration Area D. These bycatch caps are based on the most recent Tanner crab trawl survey population estimate in each area. They are calculated as 1% of the surveyed population in areas where a commercial crab fishery has opened in the most recent season and .5% if it has not opened. Although the SFMP states that bycatch limits may be required for scallop fisheries opened by permit, no bycatch limits have been established to date for the regular fishery in Scallop Registration Area D. This is both because there is no annual survey to use to estimate populations of Tanner and Dungeness crab in Scallop Registration Area D and because the observed bycatch of crab in the scallop fishery in this area is low in comparison to that of other areas (Barnhart and Rosenkranz 2000) and relative to the historic commercial harvest of Dungeness and Tanner crab in the area (ADF&G 2000, 2002).

Permits and Registration

Regulations specific to the Yakutat area date back to 1960. Between 1960 and 1969, the definition of legal gear was very broad; any device capable of being dragged on the ocean floor and taking scallops was legal, including longlines, trawls, and dredges. Declining harvest during the mid-1970s led to the deletion of longlines as legal gear in 1976, and of trawls in 1981. Permits were required of scallop dredgers from 1979 to 1985. The first closure of Yakutat Bay by regulation occurred in 1992.

In 1995, all of Registration Area D and District 16 in Registration Area A were combined into Scallop Registration Area D to expedite scallop management. Before the areas were combined, vessel operators had to return to Yakutat, deliver scallops caught in an area, void their registration, and register for the new area before they could fish in it. Under the current definition, vessels can fish in either area after reporting their intentions by radio to the management office in Yakutat.

SEASON SUMMARIES

2000 Season Summary

Registration Area D

The 2000 commercial scallop season started on July 1 and closed by regulation on February 15, 2000. There were three vessels participating and 27 total landings. The total catch for the season was 165,846 pounds, well short of the 250,000-pound GHL. There were an average of 6,142 pounds per landing.

District 16

The District 16 fishery began on July 1 and closed by regulation on February 15, 2000. The GHL of 35,000 pounds was not reached. The fleet of four vessels reported a catch of 28,594 pounds of shucked meat and landings averaged 3,177 pounds.

2001 Season Summary

Registration Area D

In 2001, the commercial scallop fishery was opened July 1 and closed by regulation on February 15, 2001. Harvest was confidential as only one vessel was fishing. The guideline harvest level for Registration Area D was reduced from the upper range of the GHR which is 250,000 pounds to 200,000 pounds this season in response to low catch rates during the 2000 season.

District 16

The District 16 fishery opened on July 1 and was closed by regulation on February 15, 2001. Harvest was confidential as only two vessels were fishing. The guideline harvest level was set at the upper end of the GHR or 35,000 pounds.

2002 Season Outlook

Registration Area D

The 2002 fishery in Registration Area D opened by regulation on July 1. Only one vessel is fishing, to date, so information on catch and number of landings is confidential. The GHL was again set below the upper end of the GHR at 200,000 pounds in response to the low catch rates of the previous two seasons.

District 16

The 2002 fishery in District 16 opened by regulation on July 1. Because only one vessel is fishing to date the information on catch and number of landings is confidential. The GHL was set at 35,000 pounds.

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Table 9.1. Registration Area D (Yakutat) historic commercial harvest and effort for weathervane scallops.

Season	Harvest (Pounds shucked meat)	Number of Permits	Number of Landings	Average Pounds Per landing
1969	837,087	14	59	14,187
1970	*	2	*	*
1971	84,948	3	10	8,494
1972	128,241	4	6	21,373
1973	173,700	4	4	43,425
1974	*	2	15	*
1975	139,022	6	11	12,638
1976	189,543	6	15	12,636
1977	*	2	3	*
1979	*	1	1	*
1980	255,667	8	22	11,621
1981	455,858	12	36	12,662
1982	168,353	7	24	7,014
1984	74,010	3	15	4,934
1985	*	2	14	*
1986	98,513	3	19	5,255
1987	*	1	14	*
1988	*	2	10	*
1989	*	2	7	*
1990	442,310	9	49	9,026
1991	402,571	5	55	7,319
1992	1,020,968	8	67	15,238
1993	264,193	10	16	16,512
1994	253,060	12	18	14,058
1995	242,491	10	18	13,471
1996	238,736	5	15	15,916
1997	243,810	4	8	30,476
1998	241,337	7	51	4,732
1999	249,681	3	22	11,349
2000	165,846	3	27	6,142
2001[a]	*	1	7	*

* Asterisks indicate confidential information where fewer than three permits were fished.

[a] Most recent year's data should be considered preliminary.

Table 9.2. Southeast Alaska (District 16 only), historic commercial catch and effort for weathervane scallops.

Season	Harvest (Pounds shucked meat)	Number of Permits	Number of Landings	Average Pounds Per landing
1980	*	2	2	*
1981	*	1	1	*
1982	*	2	3	*
1983	*	1	1	*
1984				
1985				
1986				
1987				
1988				
1989				
1990	148,624	5	8	18,578
1991	39,817	3	9	4,424
1992	*	*	1	*
1993	*	*	9	*
1994	27,613	9	10	2,761
1995	33,302	7	8	4,162
1996	*	*	4	*
1997	22,020	4	4	5,505
1998	34,090	3	6	5,682
1999	34,624	3	5	6,925
2000	28,594	4	9	3,177
2001[a]	*	2	2	*

* Asterisks indicate confidential information where fewer than three permits were fished.

[a] Most recent year's data should be considered preliminary.

Table 9.3. Scallop Registration Area D (Yakutat) annual bycatch of Tanner and Dungeness crab (Barnhart and Rosenkranz 1999; Barnhart and Rosenkranz 2000).

Year	Estimated Tanner Crab Bycatch			Estimated Dungeness Crab Bycatch		
	District 16	Yakutat	Total	District 16	Yakutat	Total
1993	na	1,700	1,700	na	351	351
1994	10	2,370	2,380	15	179	194
1995	469	3,751	4,220	93	2,379	2472
1996	708	4,963	5,671	141	2,358	2499
1997	129	5,884	6,013	0	277	277
1998	273	7,110	7,383	0	0	0
Average			4,561			966

REPORT TO THE BOARD OF FISHERIES,

MISCELLANEOUS DIVE FISHERIES

by

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[1] The Regional Information Report Series was established in 1987 to provide an information access system for all unpublished divisional reports. These reports frequently serve diverse ad hoc informational purposes or archive basic uninterpreted data. To accommodate timely reporting of recently collected information, reports in this series undergo only limited internal review and may contain preliminary data, this information may be subsequently finalized and published in the formal literature. Consequently, these reports should not be cited without prior approval of the author or the Division of Commercial Fisheries.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURE

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. Currently, each fishery is a competitive limited entry fishery. Fish ticket information indicates a total of 304 permits reported landings during the 2001-2002 season including 235 sea cucumber, 37 geoduck, and 32 red sea urchin permits.

The exvessel value of the 2001-2002 Southeast Alaska dive fisheries was estimated at approximately $3,646,223. 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 were 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 $2,517,289 (69% of total 2001-2002 dive fishery value), followed by red sea urchins at $924,882 (25%), and geoduck clams at $204,052 (6%).

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 if 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 statue as AS 16.43.228. The moratorium specified a cap on the total number of interim-use permits in the Southeast Alaska abalone, geoduck, sea cucumber, and sea urchin fisheries. This legislation temporarily halted growth in the number of participants in these fisheries and provided specific eligibility criteria to be used in each fishery.

The effective date of the moratorium was July 1, 1996 and expired automatically on June 30, 2000. During the moratorium, the legislation directed 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 directed the CFEC to determine the type of limited entry program that would be most appropriate for these fisheries. These fisheries would have returned to open access on the expiration date unless the CFEC limited 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 then current moratorium. Following a series of public comment periods and meetings, and after obtaining staff developed options for limiting entry, current dive fisheries became limited entry fisheries as of July 1, 2000. The maximum number of limited entry permits authorized for each fishery is 104 for geoduck, 436 for sea cucumber, and 95 for red sea urchins.

Southeast Alaska Regional Dive Fisheries Association[2]

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.

SARDFA is a non-profit, economic development corporation, whose voting members are all permitted Southeast 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,

[2] Excerpted and summarized from the SARDFA mission statement.

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. On the outer coast of Southeast Alaska 412 otters were successfully released (O'Clair and O'Clair 1998). The number of sea otters occupying Glacier Bay is increasing rapidly, from a count of 5 in 1995 to an estimated 1590 in 2001, which was an increase of 187% above the 2000 estimate. Predation by sea otters on a variety of invertebrates, including several species of crab, clams, mussels, and urchins will likely have profound effects on the benthic community structure and function of the Glacier Bay ecosystem (Bodkin et al. 2001). Similar increases are likely occurring elsewhere in Southeast. Sea otters continue 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 crab, king crab, Tanner crab, 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 an estimated 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 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 concerned 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 10.11). 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 1978-1979 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 1981-1982 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 1984-1985 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 1990-1991 through 1995-1996 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 1990-1991 season was the beginning of a second downward trend that was to continue through the most recent seasons.

As the 1994-1995 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 1995-1996 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 last 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 1996-1997 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 would jeopardize the health of a shellfish species described in this chapter in a registration area or portion of a registration area, the commissioner, by emergency order, shall close fishing for that shellfish species in the registration area or portion of the registration area." 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 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 1985-1986 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 1995-1996 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 protected bays and inlets.

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. 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 1995-1996 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 ended July 1, 2000 with a maximum of 436 limited entry permits authorized for the sea cucumber fishery. The GHL has been approximately 1 to 1.5 million pounds (drained weight) for more than a decade (Table 10.2).

During the 2000, 2001, and 2002 survey seasons, and with SARDFA input, the department surveyed nine and added seven new areas to the sea cucumber commercial harvest. For the 2000-2001 fishing season one new area added 101,900 pounds to the commercial harvest with three new areas adding 463,800 pounds in 2001-2002, and three new areas adding 127,800 pounds in 2002-2003.

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 6.4% of the total sea cucumber biomass taken on a three-year rotational basis (i.e. 19.2% 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 Sea Cucumber Management Plan was amended by the board for the 1997 season and provided 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. During the January 2000 board session the open weekly fishing period was amended providing for a Monday, 8:00 a.m. to 3:00 p.m. and Tuesday 8:00 a.m. to 12:00 p.m. opening in October (i.e. opening an additional half-day in October. The board also allowed the use of enhanced air nitrox of =40% oxygen with the balance consisting of nitrogen.

The time series of stock assessment data was used to evaluate sea cucumber population response to harvest under the current management plan. Preliminary analysis reveals highly diverse response among management units. Although changes in mean density, mean weight, and biomass are apparent in many areas, variability makes detection of statistically significant differences difficult. In general, more areas open to commercial harvest have decreased in mean density, increased in mean weight, and decreased in biomass. In several surveyed areas which are closed to commercial harvest, decreases have been observed in density, weight, and biomass, indicating that populations respond to environmental variables in addition to exploitation. Overall, based on trends observed in stock assessment data, the department does not have serious concerns about conservation for this species. A more complete review and analysis of stock assessment data will be presented in a separate report.

2001-2002 Season Summary

The 2001-2002 season opened by regulation on October 1, 2001. A combined total of 1,425,200 pounds of sea cucumbers were available for harvest this season. A total of 1,438,451 pounds were harvested by 235 divers for an estimated ex-vessel value of $2,517,289. Average exvessel value per pound was $1.75. The number of divers and the average number of pounds harvested per diver increased from the 2000-2001 season’s fishery (Table 10.2).

2002-2003 Season

Biomass estimates made during the summer of 2002 indicate a harvestable surplus of 1,576,700 pounds of sea cucumbers is available for the 2002-2003 season. This is the second highest GHL on record and is partly due to the inclusion of three new areas and the expansion of one previous fishing area. The three new areas collectively added an additional 127,800 pounds to the GHL. The fishery opened by regulation 8:00 a.m., October 7, 2002.

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 1985-1986 season almost 144,000 pounds of the 300,000 pound, five-year quota (Table 10.3) were harvested by eight divers in the Noyes Island area. During the 1986-1987 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 1987-1988 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 1989-1990 season, Kah Shakes was included in the 1990-1991 season, and the Goddard area entered the fishery during the 1998-1999 season. As of the 2002 department survey season, a total of 20 distinct commercial fisheries have been identified and surveyed in Southeast Alaska. It is anticipated that additional new areas will be surveyed over the next several years.

The 1991-1992 geoduck fishery saw an increased interest in participation and harvest by divers from Washington State. Prior to the 1991-1992 season non-resident participation was minimal. Exvessel value and the number of divers began to increase with the 1992-1993 season. Recent participation has been decreasing due to decreasing exvessel value with sales of processed product.

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 meeting 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 1997-1998 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 SARDFA, 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 1998-1999 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 1998-1999 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 know 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 SARDFA 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 biomass assessment surveys. The department has also received Federal Nearshore Funds[3] that have been used through industry contracts to complete reconnaissance surveys for potential commercial beds in a substantial portion of Southeast Alaska during the spring of 2001 and 2002. Limited funds are available for additional reconnaissance surveys during spring 2003. As of the 2002 survey season, a total of 20 commercial geoduck fisheries have been defined in Southeast Alaska. Since 1998, ten of these areas are newly created fisheries that were defined by industry reconnaissance and subsequently surveyed by the department (Figure 10.2; Table 10.4).

Prior to the January 2000 Board of Fisheries meeting, regulations (5 AAC 38.110.) referred to the general harvest of clams; requiring a permit that specifies the species, method of fishing, area of operation, and harvest levels. There were no regulations that specifically addressed the Southeast geoduck clam fishery. The department, in cooperation with the SARDFA Geoduck Committee, developed regulations and a management plan for the Southeast Alaska commercial fishery. The Alaska Board of Fisheries formally

[3] The reconnaissance and biomass surveys were funded, in part, by grants NA06FN0385 and NA16FN1560 from the National Oceanic and Atmospheric Administration (NOAA). The views expressed are those of the authors and do not necessarily reflect the views of NOAA or any of its sub-agencies.

adopted the geoduck management plan (5 AAC 38.142), during their regular meeting in January 2000, which was in place beginning with the 2000-2001 commercial fishery. The core elements are:

1. There are no size limits for geoducks and all geoducks harvested must be retained.

2. Annual guideline harvest levels must be established for an area before it is open to commercial harvest. The GHL must be based on biomass estimates where biomass surveys have been conducted within the previous 12 years.

3. Commercial harvest gear is limited to dive gear while using a hand-held, manually operated, water jet device.

2002-2003 Season

The Southeast Alaska geoduck fishery does not currently realize its potential full value due to PSP issues. Previous to the 2002-2003 season, the department opened commercial geoduck fisheries in Southeast Alaska with little or no preliminary knowledge of current PSP levels. Also, previous to the 2002-2003 season, the Alaska Department of Environmental Conservation (ADEC) did not have a live shipment program in place for geoducks that was based on preliminary fishery testing. A total of 382,100 pounds of whole geoduck clams will be available for harvest during the 2002-2003 season. Fish ticket exvessel value from the 2001-2002 geoduck fishery indicates an average value of $0.72 per pounds (Table 10.3). Most of the product that season was delivered to the processed market due to PSP levels. Anecdotal values from processors and divers indicate a potential of approximately $4.00 per pound may be realized by harvesters delivering to the live market. Assuming the above exvessel values represent the extremes, the 2002-2003 may be worth between $275,000 (processed) and $1,528,400 (live). Due to recent requests by SARDFA for changes to ADEC's program, ADEC held a geoduck conference in Anchorage on August 5 and 6, 2002. A result of this conference was implementation of an enhanced live shipment program for geoducks. This required ADF&G fishery management considerations and changes in order to target live geoduck sales.

In cooperation with SARDFA and ADEC, the commercial geoduck fishery openings during the 2002-2003 season will be based on preliminary Paralytic Shellfish Poisoning (PSP) testing conducted by the ADEC, to increase the likelihood of live product shipment. Prefishery testing of each area was scheduled to begin in November. Beginning in January 2003, those areas that pass PSP monthly testing will automatically begin weekly testing (i.e. in 2003, the first monthly test that passes becomes synonymous with the first weekly test). Once areas pass two consecutive weeks of PSP testing, and the day after the department receives the results of the second week of testing, the department will issue a news release opening that area in seven days. This will allow for a third week of PSP testing just prior to the fishery and offer seven-day notice of intent to open the fishery. Once an announcement has been made to open an area, that area will open regardless of subsequent PSP testing and will remain open until the Guideline Harvest Level (GHL) has been taken. An area will begin weekly testing after the first successful monthly PSP test regardless of the results of previous monthly testing. The above management scenario effectively puts all Southeast Alaska commercial geoduck fisheries on seven-day notice, dependent on PSP testing, approximately after the second week of January 2003.

Daily open periods will initially be from 9:00 a.m. to 3:00 p.m. but may change and individual diver trip limits may be needed, depending on the number of divers registering for individual areas. If an area does not pass PSP testing by approximately mid-April the department may open all remaining areas for commercial harvest. Divers were encouraged to monitor PSP testing results through both ADEC's and SARDFA's web sites.

The fluid opening (i.e. openings based on geoduck passing ADEC PSP testing) necessitate relatively short notice for announcing openings. As openings for specific areas may be delayed, then opened on short notice, permit holders will be required to closely monitor PSP test results which will be posted on ADEC's and SARDFA's web site. Divers may not be 'in position' to take advantage of a short-noticed opening (i.e. divers may be involved in other fisheries/activities and not be able to participate given short notice). This may prohibit a diver from harvesting lower valued product for the processed market, but may leave the product for a higher valued live market. There is no guarantee that an area will ever pass PSP testing before the end of a season which means the product may eventually be harvested for the processed market. By managing the fishery based on PSP results, the fishery may be extended over a longer time period. This may benefit local, year-round divers, but hinder non-resident divers, or local divers who participate in other fisheries. Though the objective of this season's experimental management plan is to realized a higher valued fishery, allocative issues may occur that may need to be addressed by the board. Consequently SARDFA submitted an Agenda Change Request for the board's consideration during the January 2003 meeting.

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.

Red Sea Urchin 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 10.5), expanding to include Districts 1, 2, 3, and 4. Harvests peaked at 890,092 pounds in 1986-1987 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 before it was closed 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 in the spring 1995 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 2,965,607 pounds of red sea urchins (Table 10.5). 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 approximately $1,402,837 paid to dive harvesters.

Since the test fishery, regular population assessment surveys have been completed in portions 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 occurred ever since the 1996-1997 fishing season. The overall quota has remained stable between 4.4 and 6.8 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 during recent years (Table 10.5), 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%.

Red Sea Urchin 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 three-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, three-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 1996-1997 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. Since the management plan became effective, no major regulatory changes have been made to the red urchin fishery. The core elements are:

1. Annual guideline harvest levels are 6% of the biomass estimate. 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.

Red Sea Urchin 2002-2003 Season Outlook

Department biomass estimates indicate a harvestable surplus of 5,309,900 pounds of red sea urchins are available for the 2002-2003 season. The fishery opened by regulation October 1, 2002 with daily open periods from 8:00 a.m. to 6:00 p.m., seven days per week. Daily open periods may be adjusted during the season as warranted.

Green Sea Urchin Fishery Development and Outlook

The red sea urchin fishery was developed in response to an original request by the urchin industry to develop a green sea urchin fishery. The request was set aside because the department lacked several key elements required to formalize a harvest rate management plan for green urchins: information on the

distribution of commercially viable populations, a statistically valid and reasonably precise survey method, and life history information useful in setting a harvest rate.

The department obtained Federal monies[4] to initiate a stock assessment and research program for green sea urchins similar to the department's program for red sea urchins. Specific objectives were to 1) determine the distribution of commercially viable green urchin populations in 10 or more statistical harvest areas in internal waters of Southeast Alaska, 2) investigate potential stock assessment methods that would provide reasonably precise estimates of abundance, 3) develop preliminary estimates of appropriate harvest rates, and 4) establish a baseline of stock assessment data for monitoring effects of future harvests.

Initially, the primary focus of the green urchin fishery research was to contract with industry to conduct reconnaissance surveys delineating specific areas or beds with commercial potential. In general, green urchins occur in more sheltered waters than do red sea urchins. Fourteen sections of shoreline were chosen, encompassing many statistical harvest areas, where reconnaissance surveys were completed. Survey products submitted to the department included: 1) charts delineating areas surveyed and boundaries of green urchin beds with commercial potential, 2) a list of dive sites, identified on the charts, with coordinates and descriptions, and 3) an overall summary with impressions of the area as having commercial harvest potential.

The department, in consultation with SARDFA and the reconnaissance surveyors, selected areas having potential for a green sea urchin commercial fishery, and conducted biomass surveys. Reconnaissance results indicated that, though green urchins are ubiquitous throughout Southeast Alaska, they generally exist in densities too low and of a size too small to support a commercial fishery. The department conducted biomass surveys in several areas and concluded that the green sea urchin population in Southeast Alaska was not sufficient to support a commercial fishery. The department currently has no plans to pursue a commercial green urchin fishery in Southeast Alaska.

[4] Reconnaissance and biomass surveys were funded, in part, by grant NA96FN0195 from the National Oceanic and Atmospheric Administration (NOAA). The views expressed are those of the authors and do not necessarily reflect the views of NOAA or any of its sub-agencies.

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Table 10.1. Registration Area A (Southeast Alaska) commercial abalone harvests, effort, value, and season length, 1970-1971 through 1996-1997.

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 1986-1987 season is confidential.									
86-87		34,043	$0.21	$7,149	7	44	N/A	4,863	$1,021
87-88		65,056	$0.21	$13,662	11	143	N/A	5,914	$1,242
88-89		801,405	$0.21	$169,096	57	922	N/A	14,060	$2,967
89-90		2,318,305	$0.42	$969,142	205	2,263	N/A	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	11.5	3,095	$3,978
97-98	892,410	894,739	$1.63	$1,458,425	226	976	8	3,959	$6,453
98-99	1,026,345	1,055,572	$1.55	$1,636,137	219	971	8	4,820	$7,471
99-00	1,580,000	1,569,626	$1.95	$3,060,771	200	1,378	18.5	7,848	$15,304
00-01	1,122,500	1,158,385	$2.23	$2,583,199	220	913	7.5	5,265	$11,742
01-02	1,425,200	1,438,451	$1.75	$2,517,289	235	1,201	10.5	6,121	$10,712
02-03	1,576,700								

[a] Season = October 1 thru September 30. Experimental fishing program prior to 1990-1991 season.

[b] Based on CFEC (annual) data prior to the 1998-1999 season, then based on ADF&G 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
1999-00	250,400	202,260	$1.60	$400,640	61	240	50	4,105	$6,568
2000-01	391,100	438,334	$1.06	$414,566	74	544	148	5,285	$5,602
2001-02	285,322	283,405	$0.72	$204,052	37	324	78	7,711	$5,515
2002-03	382,100								

[a] Season = October 1 thru September 30.

[b] Only Noyes Island open (Subdistrict 103-70). Five-year GHL established of 300,000 pounds for all three areas. Separate GHLs first established for 1988-1989 season. Therefore, 1987-1988 GHL does not include remaining GHL from Noyes Island (e.g. 125,000 for Gravina Island only).

[c] Based on CFEC (annual) data prior to the 1998-1999 season, then based on ADF&G fish ticket data.

Table 10.4. Commercial geoduck clam harvest areas, current guideline harvest levels, original open season, and recent (1998-2002) reconnaissance/survey funding sources.

Harvest Area	Current Annual GHL (lb)	First Open Season	Funding Source (recent areas only)
Goddard	14,442	1998-99	SHD[a]
Symonds Bay	3,438	1989-90	
Sea Otter Sound	14,365	1998-99	SARDFA[b]
Steamboat Bay	24,731	1985-86	
Little Steamboat Bay	6,055	1985-86	
Ulitka Bay	5,202	1985-86	
Cone Island	61,565	2002-03	SARDFA
Vallenar Bay	18,943	1987-88	
South Vallenar Point	0	1988-89	
Middle Gravina	8,077	1989-90	
Nehenta Bay	6,001	1990-91	
Foggy Bay	31,434	1990-91	
Kah Shakes	17,701	1991-92	
Nakat Bay	17,193	1999-2000	SARDFA
San Christoval	20,239	2002-03	SARDFA
Port Santa Cruz	25,137	2000-01	SARDFA
Percy / Hotspur	29,639	2001-02	NSII[c]
103 - 50	44,459	2001-02	NSII
East San Fernando Island	6,169	2002-03	NSII
Kelp Island	18,900	2003-04	NSIII[d]

[a] SHD = Sitka Harvest Divers.
[b] SARDFA = Southeast Alaska Regional Dive Fisheries Association.
[c] NSII = Nearshore II federal funding.
[d] NSIII = Nearshore III federal funding.

Table 10.5. Southeast Alaska historic seasonal red sea urchin harvests, effort, and value.

Season	Guideline Harvest Level (lb)	Total Pounds Landed	Average Price Per Pound[c]	Estimated Exvessel Value[c]	Number of Divers	Number of Landings	Average Pounds per Diver	Average Earnings per Diver[c]
1980-81[a]				Confidential				
1981-82[a]				Confidential				
1982-83[a]				Confidential				
1983-84		23,303	$0.12	$2,796	4	9	5,826	$699
1984-85		188,023	$0.17	$31,906	16	84	11,751	$1,994
1985-86		58,303	$0.13	$7,288	8	32	7,288	$911
1986-87		890,092	$0.14	$125,335	26	459	34,234	$4,821
1987-88[a]				Confidential				
1988-89		223,883	$0.41	$91,106	11	128	20,353	$8,282
1989-90		23,617	$0.25	$5,833	9	33	2,624	$648
1990-91		174,233	$0.26	$45,823	6	91	29,039	$7,637
1991-92		428,220	$0.30	$128,894	37	256	11,574	$3,484
1992-93		143,485	$0.29	$41,467	17	108	8,440	$2,439
1993-94		0		0	0	0		
1994-95[b]	3,000,000	2,088,395	$0.45	$944,329	1	1,391	2,088,395	$944,329
1995-96[b]		877,212	$0.52	$458,508	1	705	877,212	$458,508
1996-97	6,093,579	4,929,280	$0.38	$1,878,056	150	3,483	32,862	$12,520
1997-98	4,425,364	4,083,877	$0.34	$1,408,397	129	2,465	31,658	$10,918
1998-99	4,843,610	3,075,095	$0.40	$1,230,038	62	1,524	49,598	$19,839
1999-00	5,780,813	2,676,456	$0.38	$1,017,053	47	1,094	56,946	$21,639
2000-01	6,822,393	2,373,993	$0.36	$854,637	56	842	42,393	$15,261
2001-02	5,689,900	2,720,241	$0.34	$924,882	32	995	85,008	$28,903
2002-03	5,309,900							

[a] Confidential information, = 3 permits participating.
[b] Department test fishery. GHL is the agreed test fishery maximum poundage taken during spring 1995–spring 1996, in exchange for research funds.
[c] Based on CFEC (annual) data prior to the 1998-1999 season, then based on ADF&G seasonal fish ticket data.

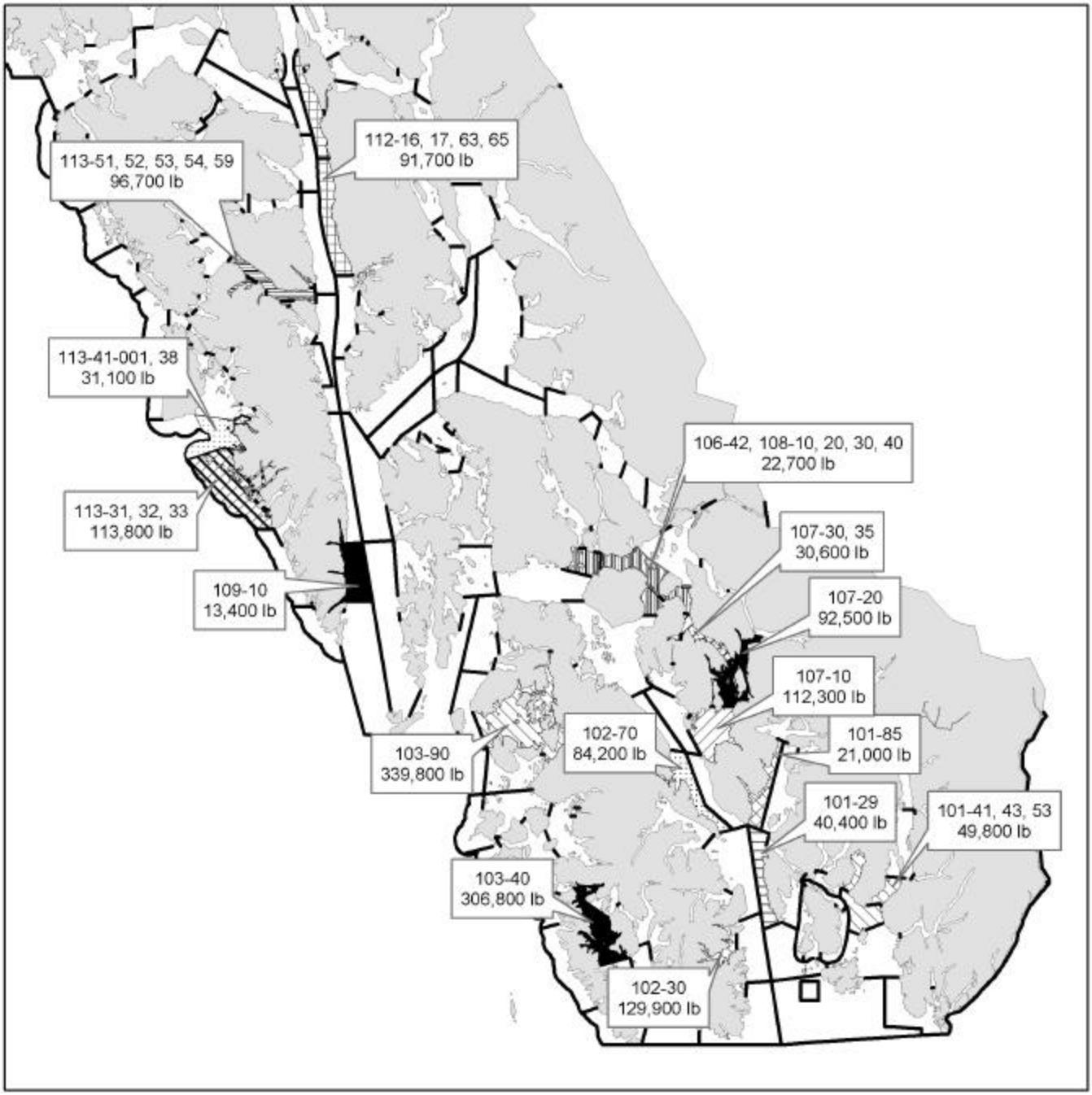

Figure 10.1.Sea cucumber open fishing areas and guideline harvest levels for the 2002-2003 season.

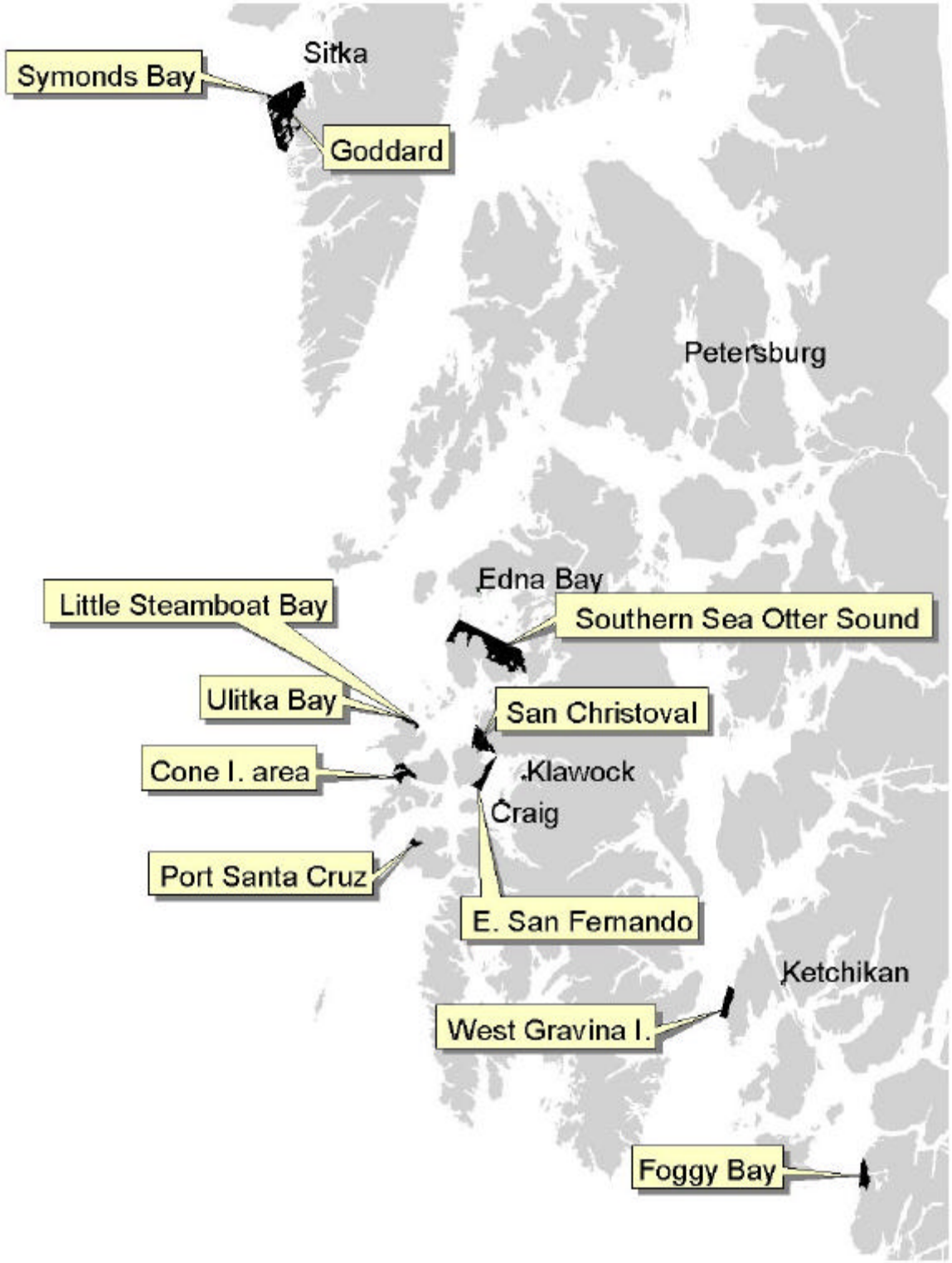

Figure 10.2.Geoduck clam open fishing areas for the 2002-2003 season.

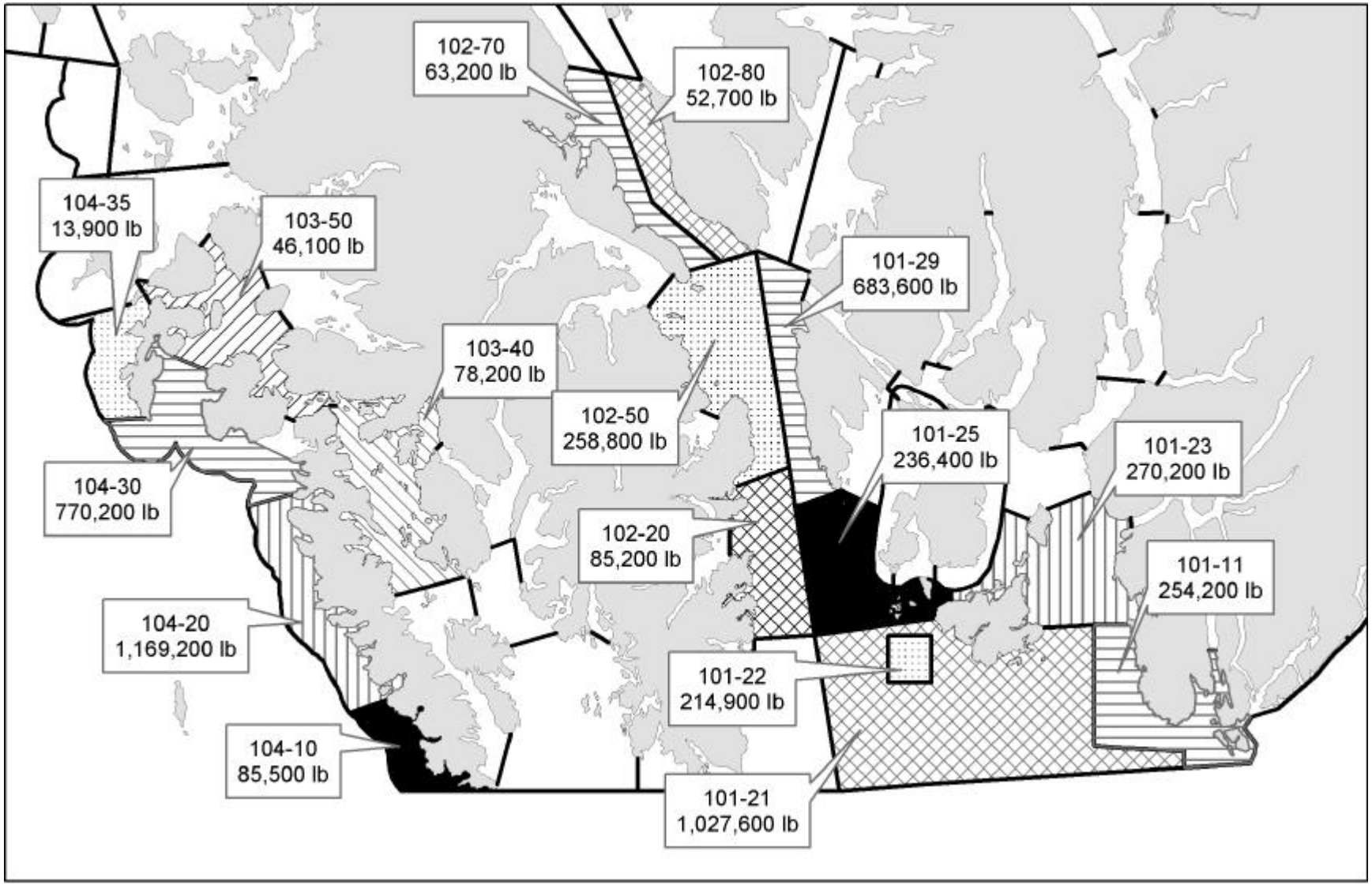

Figure 10.3. Red sea urchin open fishing areas and guideline harvest levels for the 2002-2003 season.

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