

INTERIM MANAGEMENT MEASURES FOR THE RED SEA URCHIN
IN SOUTHEAST ALASKA FOR THE 1993 SEASON



By
Bill Davidson
Doug Woodby
and
Bob DeJong

Regional Information Report¹ No. 1J93-01

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

March 1993

¹ The Regional Information Report Series was established in 1987 to provide an information access system for all unpublished divisional reports.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 un-interpreted 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

	<u>Page</u>
LIST OF FIGURES	iii
FISHERY OUTLOOK	1
Stock Assessment	1
Commercial Fishery	1
INTRODUCTION	3
GOAL AND OBJECTIVES	3
Biological Conservation Objective	3
Subsistence Objective	3
Sustainable and Orderly Fishery Objective	4
Research Objective	4
MANAGEMENT MEASURES	5
Permit/Reporting Requirements	5
Size Limits	6
Fishing Seasons	6
Weekly Openings	6
Subsistence Priority	7
Catch Quotas	7
Experimental Fishing Areas	9
Inseason Adjustments	9
LITERATURE CITED	10

LIST OF FIGURES

<u>Figure</u>	<u>Page</u>
1. Red Sea Urchin Fishery Boundaries, 1993: Area A, Northern Section; Area B, Middle Section; Area C, Southern Section; Area D, Peisar Island (closed); Area E, Round Island (closed); and Statistical Area 113-31 & 113-41 Boundary Line (This figure is also on the back page of the logbook)	11
2. Front page of Sea Urchin Harvest Log showing Area A-B Boundary Line Detail; Area D, Peisar Island (closed); Area E, Round Island (closed) (The back page of the logbook is the same as Figure 1 above)	12

FISHERY OUTLOOK

Stock Assessment

Assessment surveys were conducted by Department of Fish and Game divers in southern Sitka Sound from December 1, 1992 to February 24, 1993. Results from these surveys indicate sufficient quantities of red sea urchins to provide for a continuing commercial fishery in 1993. These surveys provided for a stratified population estimate based on areas where urchins were harvested commercially during the 1992 fishery. Comparing the results of the most recent survey with that of the previous year indicates a substantial decline of the urchin population from about 25 million to 9 million over a 15 month survey interval within the area where most harvesting took place in 1992. This decline is over 25 times the amount taken by commercial harvesters in 1992. Based on numerous observations from airplane, skiff, and underwater, this nearly 2/3 decline appears to be mostly attributable to predation by sea otters. If the present rate of decline in the urchin population continues, it is unlikely that urchin fisheries will be held in these waters beyond the current season.

Commercial Fishery

The commercial fishery will open on April 11, 1993 in the Sitka area and will close no later than December 31, 1993. The quota for this fishery is approximately 190,000 urchins (approximately 144,000 lbs).

The area open for commercial fishing in 1993 includes waters of southern Sitka Sound and the Necker Islands from Deep Inlet to West Crawfish Inlet as described on page 5 and shown in Figure 1. These waters have been divided into three areas (Areas A, B, and C shown in Figure 1) which will be managed for separate harvest quotas in order to avoid local overharvesting. The overall fishery quota has been allocated to the areas as follows:

Area A:	84,000 urchins (63,000 lbs)
Area B:	57,000 urchins (43,000 lbs)
Area C:	50,000 urchins (38,000 lbs).
Area D:	Closed
Area E:	Closed
Total :	191,000 urchins (144,000 lbs).

Closed waters in 1993 will include the waters surrounding Round Island, the reef immediately north and west of Round Island, and the waters of Peisar Island out to -60 feet MLLW shown in Figures 1 and 2. These waters will be closed as experimental harvest control sites, and to protect urchins which have been marked as part of a study to determine red sea urchin growth rates.

Once the fishery has been opened by emergency order, openings will continue from 12:01 a.m. Sunday through 11:59 p.m. Thursday each week. When the quota for each area (Areas A, B, and C) is taken, an emergency order will be issued closing that area. Once an area has been closed, fishing will be allowed

to continue in other open areas on the same schedule until the overall quota for the fishery (191,000 urchins) has been taken, and the fishery is closed by emergency order for the season.

The fishery will be managed with the miscellaneous shellfish permitting system (5AAC 38.062). Permits will be issued only from the Sitka Fish and Game office.

Urchins of any size may be taken. The only legal gear for urchins is hand picking (5AAC 38.051).

Divers must maintain accurate and complete logbooks (Figure 2) showing catch amounts, and with catch locations marked on the logbook maps (see instructions with the logbook). Logbooks are available from the department office in Sitka. Completed logbooks must be turned in with each sale of product.

All other areas of Southeast Alaska will remain closed to the commercial harvest of sea urchins until stock assessments are conducted, and funding has been set aside to manage the fisheries.

INTRODUCTION

This document specifies how the Alaska Department of Fish and Game (department) will manage the commercial fishery for red sea urchins (*Strongylocentrotus franciscanus*) in Southeast Alaska under the authority of Alaska Statutes (SEC. 16.05.060) and regulations of the Alaska Board of Fisheries (5AAC 38.062) during the 1993 season.

This document specifies management objectives that will guide department actions, identifies specific management measures that will be used to achieve those objectives, and presents the outlook for harvesting during the 1993 season. These management measures will serve as a basis for subsequent years, but are subject to change as the fishery evolves and as our understanding of the red sea urchin resource improves.

GOAL AND OBJECTIVES

The management goal for the Southeast Alaska commercial red sea urchin fishery is to maximize the overall long-term benefit of the red sea urchin resource to the State of Alaska consistent with responsible stewardship for conservation of red sea urchin populations and their habitats. To attain this goal, four objectives are to be met concerning biological conservation, subsistence, sustainable and orderly fisheries, and adaptive management and research. For the purposes of interim management, the fishery will be limited both in area and allowable harvest levels.

Biological Conservation Objective

The biological conservation objective is to ensure the long-term reproductive viability of red sea urchin populations and the quality and availability of their habitats. This objective takes precedence over other objectives that address social, economic, management, and research considerations.

To ensure the long-term reproductive viability of red sea urchin populations, management must prevent recruitment overfishing, in which spawning stocks are reduced by fishing below a level that ensures adequate production of young red sea urchins to provide future recruits to the fishery. To maintain the quality and availability of red sea urchin habitat, harvesting methods that may destroy or damage habitats required by red sea urchins will be prohibited. Similarly, harvesting methods which substantially impact other species will not be permitted.

Subsistence Objective

The subsistence objective is to ensure that red sea urchin harvest requirements by customary and traditional users in coastal communities are met, as required by law.

To meet this objective, management must prevent deleterious effects of commercial fisheries on the availability of red sea urchins to subsistence users. Area closures, reduced catch quotas, or other restrictions on commercial harvest may be used to ensure that traditional subsistence users are not adversely impacted.

Sustainable and Orderly Fishery Objective

The sustainable and orderly fishery objective is to ensure the conduct of manageable, steady-paced red sea urchin fisheries to provide sustainable supplies of a high quality product to seafood markets.

To meet this objective, management measures will be established to maintain sustainable fisheries over the long-term and prevent "boom-and-bust" or "derby-type" fisheries. Reporting systems are specified to provide accurate and timely data on catch for each area. As the need arises, other regulations may be adopted.

Present funding levels do not allow the commitment of staff and other resources of the department to manage region-wide fisheries. For this reason, interim management will provide for exploratory fisheries only on a limited basis.

Research Objective

The research objective is to conduct a fishery research program that contributes information on red sea urchin biology and population dynamics pertinent to management.

This growing information base should include better data on stock abundance and distribution, in order to determine the population available for harvest. In addition, the impact of sea otter predation and their distribution should be monitored, in order to determine areas where future fisheries might occur.

It is also important to develop an understanding of sea urchin population growth as a function of stock size in order to promote long-term sustained yield, and to determine threshold population levels below which stock recovery is uncertain. The department will conduct research to estimate population parameters necessary for sustainable harvest levels, and will also monitor changes in urchin quality over time to establish optimal fishing seasons. This research will first be conducted in Sitka Sound and, depending on the success of this work, the methodology will be transferred to other areas of Southeast Alaska. The department is conducting a four year study of red sea urchins in Sitka Sound that started July 1, 1991. It is funded, in part, by the Pacific States Marine Fisheries Commission (PSMFC).

DEFINITION OF FISHERY MANAGEMENT AREAS

There are five separate fishery management areas designated as areas A,B,C,D, and E, shown in Figures 1 and 2, and described as follows:

Area A includes the waters of Sitka Sound south of a line from a point on the northern entrance of Deep Inlet at 56°59'35"N latitude, 135°18'43"W longitude to the easternmost tip of Long Island, to the westernmost tip of Long Island to Shoals Point, and east of the longitude of Shoals Point (135°38'10"W), and north of 56°55'00"N latitude, except not including the waters of Area E described below, and including all waters of the Taigud Islands out to -60 feet MLLW.

Area B includes the waters of Sitka Sound and the Necker Islands south of 56°55'00"N latitude and north of the latitude of the northern tip of Golf Island (56°48'25"N latitude), except not including the waters of Area D and Area E described below, and not including waters of the Taigud Islands out to -60 feet MLLW.

Area C includes waters of the Necker Islands and the Baranof Island Shore south of the latitude of the northern tip of Golf Island (56°48'25"N latitude) and north of 56°45'00"N latitude near the southern entrance to West Crawfish Inlet.

Area D includes waters adjacent to Peisar Island and out to -60 feet MLLW.

Area E includes waters out to -60 feet MLLW, and adjacent to Round Island and the reef immediately north and west of Round Island.

MANAGEMENT MEASURES

Permit/Reporting Requirements

Individuals wishing to commercially harvest red sea urchins must first register their vessels and obtain harvest permits from the Sitka Fish and Game office. Registrations will be valid for each fishing season. These requirements are in addition to the vessel license and interim-use permit which must be obtained from the Commercial Fisheries Entry Commission. These are current requirements for all miscellaneous shellfish fisheries conducted in state waters.

All commercial red sea urchin fishery participants must also maintain logbooks (Figure 2). As with registrations and permits, logbooks may be obtained from the Sitka Fish and Game office. Logbooks will permit the department to collect data on harvest distribution and to monitor stock responses to commercial harvest. Logbooks will require catch statistics to be recorded on a daily basis for each location fished. Other information required includes: the exact location of catch (to be indicated on the logbook chart), weight of catch, and time fished.

Completed logbooks must be returned to the department along with the department's copy of a fish ticket. This means that each time a diver delivers their catch to a processor, they must be sure that the log is

attached to the department's copy of the sales slip. To assure confidentiality of these records, processors will be required to seal the logbooks and sales slips obtained from individual divers in separate envelopes which are signed by the diver. It is the diver's responsibility to assure that this process is followed. Divers should retain a copy of their logbooks as proof of compliance with this requirement. Failure to complete and surrender logbooks is sufficient cause to revoke a diver's harvest permit.

The harvesting of red sea urchins shall be confined to the following gear types:

1. SCUBA;
2. Tethered, umbilical, surface-supplied systems;
3. Skin/Free Diving without the aid of a breathing apparatus, or diving with a snorkel only.

Red sea urchins must be harvested by hand and transported to the surface in bags. A diver may use a rake no longer than 16 inches, possessing no more than six tines, each tine being no more than 5 inches long. Any means other than individually collecting red sea urchins by hand, placing them in bags, and air-lifting or buoying filled bags for surface collection is prohibited. Such lifting devices shall be used in such a manner that no rocks, mineral matter, aquatic plants, fish or other aquatic life except red sea urchins shall be disturbed or removed from the bottom.

Size Limits

No size limits will be imposed for urchins at this time because the conservative catch quotas (below) are considered sufficient to protect the stocks. Also, the current market for urchin roe targets a narrow size range of approximately 76 to 127 millimeters (3 to 5 inches), so that urchins outside this range are likely to receive minimal harvest pressure. However, size limits may be instituted in the future if the need arises. The biological basis for size limits is that large red sea urchins often provide a protective spine canopy for small juveniles (Tegner and Dayton 1977), so it is important to protect large red urchins by imposing a maximum size limit. Small urchins are needed for subsequent recruitment and may also need to be protected. Fishermen are, therefore, encouraged to leave small and large urchins undisturbed.

Fishing Seasons

The general fishing season for red sea urchins will open on April 11, 1993. The fishery will continue until December 31, 1993, unless closed earlier by Emergency Order.

Weekly Openings

The red sea urchin fishery will be initially opened on Sunday, April 11, 1993 at 12:01 a.m., and will continue until Thursday, April 15, 1993 at 11:59 p.m. During subsequent weeks, and until closed, the fishery will open for 120 hours each week beginning at 12:01 a.m. on Sunday and ending at 11:59 p.m. on Thursday. The weekly closure is important for orderly fishery management.

Subsistence Priority

Under this plan, a commercial fishery is expected to harvest no more than 2% of the red sea urchins in an area annually (see Catch Quotas, below). This interim fishery is confined to one area south of Sitka where no conflict with the subsistence harvest of urchins is expected. In addition, no commercial harvest of urchins is planned in the area immediately surrounding Sitka. To prevent local depletion of urchins, the department will monitor fish ticket and logbook information, and may close parts of harvest areas to ensure even distribution of the catch.

Expansion of the geographic scope of the fishery may require a decision by the Board of Fisheries to determine if regulations are required to protect the subsistence priority. At that time, the department believes that two options will exist. The first option would be closure of areas, and the second, reduced quotas.

Catch Quotas

Annual catch quotas for red sea urchins in **Areas A, B, and C** (Figure 1) will be set to achieve the biological conservation objective by preventing over fishing. Due to limitations in our understanding of sea urchin population dynamics in Southeast Alaska, yield assessments are based on a conservative application of surplus production models (Garcia et al. 1989). Application of surplus production models over several years carries the risk of fishery collapse if the assumptions upon which the model are based are grossly inaccurate (Koonce and Shuter 1987). For example, these models assume that recruitment will increase as virgin stocks are reduced to levels which are approximately one-half of the original biomass. This assumption is potentially overly simplistic. Evidence from southern California suggests that small urchins are more likely to survive if there are large numbers of adult urchins present to provide a protective spine canopy from predators (Tegner and Dayton 1977). There is also evidence that young of the year occur mostly under the spine canopy of adults in the test fishery area near Sitka (Woodby 1991). Due to this concern and additional uncertainties, the status of urchin stocks will be monitored on a regular basis, and intensively studied over the four-year study period.

A detailed description of the method used to apply surplus production models to estimate quotas for mostly unexploited populations is available in ADF&G Regional Information Report 1J90-31 (Imamura and Kruse 1990). In summary, the allowable harvest, or quota, is measured in numbers of urchins, and is calculated as:

$$\text{Quota} = \text{CF} \times \text{GF} \times \text{M} \times \text{P}_0$$

where

CF = 0.4	scaling factor relating maximum sustainable fishing mortality to unexploited population size (e.g. Caddy 1986);
GF = 0.5	correction factor due to Garcia et. al (1989) to allow for errors in assumptions upon which the surplus production model is based;
M = 0.144	estimated instantaneous mortality rate for red sea urchins using method of Van Sickle (1977) as described by Woodby (1991) for the Sitka area; and

$P_0 = 6,655,000$ "virgin" population size, taken as the lower bound of the one-sided 90% confidence interval.

The point estimate of the mean population size (9,005,000) is about 1/3 of the population (25,000,000) estimated in 1992 for the same area. The apparent reduction of about 16,000,000 urchins from 1992 to 1993 is over 25 times the amount (600,000) taken by commercial harvesters in 1992. Based on numerous observations from airplanes and skiffs and from underwater diving, this decline appears to be mostly attributable to predation by sea otters. Therefore, the population of red sea urchins of southern Sitka Sound can no longer be considered a virgin population. However, treating the remaining sea urchin population as "virgin" will insure that the commercial fishery harvest rate remains at 2%, and therefore the fishery will not significantly decrease the population size.

Population size was estimated as:

$$P_0 = \text{Density} \times \text{Shoreline length (in meters)},$$

where "Density" is the lower bound of the 90% confidence interval for the average number of sea urchins per linear meter of shoreline of available urchin habitat. Density was estimated by divers observing urchin populations on one meter wide strip transects extending perpendicularly from the shore at previously marked locations to the 10 meter (32 foot below MLLW) depth contour, corrected for the height of the tide at the time that the dive was made. Dive locations were marked on shore and transect compass headings were recorded to reduce variability on future transect replications. Only urchins larger than 60 millimeters in diameter were counted. A total of 44 transects were completed for this area in December 1992, and February 1993. These surveys were systematically distributed along shorelines in areas where over 95% of the commercial harvest took place during the 1992 fishery. No allowance is made in the quota for populations below 10 meters depth because scientifically valid assessments of populations below this depth are not available.

For **Areas A, B, & C** the mean density, stratified by shoreline length, was 72.7 urchins per meter. The lower confidence bound on this estimate is 53.7 urchins per meter (73.9% of the mean). The shoreline length is estimated as 123.9 km (66.92 nautical miles). The product of these terms (53.7 urchins per meter x 123,936 meters), P_0 , is 6,654,810 urchins. The product of the first three terms in the quota equation is 2.88%. This percentage harvest multiplied by the lower bound of the population size estimate, results in a quota of about 192,000 urchins on an annual basis. This quota is 2.1% of the mean value of the population size estimate (9,005,000).

The shoreline length of 123.9 km used to calculate this year's quota is 57.7% of the 214.8 km of shore used to calculate the quota for 1992. This year's estimate was based on areas where divers actually harvested the majority of urchins during the 1992 fishery. By concentrating survey effort on these areas, the intent was to increase the precision of the population estimate by eliminating areas from the survey not shown to have commercial quality beds of urchins. The areas (strata) were selected together accounted for 95% of the commercial harvest for 1992. Transects were allocated to these areas based on the proportion of urchins landed from each area. This approach leads to a conservative estimate of total population, and therefore a conservative harvest which will help to guard against local depletions in those areas where diving is feasible and where urchins are abundant.

Experimental Fishing Areas

The two areas set aside during the 1992 season to monitor the effects of increased harvest rates have been impacted by sea otters; hence, this aspect of the sea urchin fishery research program is being eliminated.

Area D (Peisar Island) will be managed as a sea otter predation study site and will remain closed indefinitely for research purposes. On March 5, 1992 department divers noted that a recent colonization of this area by sea otters had occurred. Previous dive surveys in September, 1991 found no evidence of sea otters around Peisar Island. The department now has a unique opportunity to observe and monitor the effects of otter predation on sea urchins. Considering the currently expanding sea otter population in Southeast Alaska, information from this study may be of critical importance for establishing locations of future red sea urchin fisheries in Southeast Alaska. In addition, Peisar Island has been used as a sea urchin growth study site. In August of 1992, department divers participated in a joint project with researchers from Ecometrics, Inc. to directly measure sea urchin growth over a one-year period.

Area E (Round Island), and the reef immediately north and west of Round Island will remain closed indefinitely as harvest control sites for research purposes. Urchins at Round Island have also been marked as part of the sea urchin growth rate study.

Inseason Adjustments

Many factors might affect the department's ability to meet the goals and objectives of this interim fishery management plan. As a result, the department may make inseason adjustments not described in this plan, to insure that the stated goals and objectives are achieved.

The department is planning intensive management of this fishery, as well as research that may impact future urchin fisheries in Southeast Alaska. Inseason management measures for this fishery might include area closures to prevent local depletion of urchins, and delivery of poor quality product to processors. Portions of an area might also be closed in order to re-distribute fishing effort more evenly throughout the area. The department will monitor deliveries for product quality and encourages fishermen to check the beds for the quality of product before proceeding with their harvests.

LITERATURE CITED

- Caddy, J.F. 1986. Stock assessment in data-limited situations the experience in tropical fisheries and its possible relevance to evaluation of invertebrate resources. P. 379-392. In G.J. Jamieson and N. Bourne, editors. North Pacific Workshop on Stock Assessment and Management of Invertebrates. Canadian Special Publication of Fisheries and Aquatic Sciences 92.
- Garcia, S., P. Sparre, and J. Csirke. 1989. Estimating surplus production and maximum sustainable yield from biomass data when catch and effort time series are not available. Fisheries Research 8:13-23.
- Imamura, K., and G. Kruse. 1990. Management of the red sea cucumber in Southeast Alaska: Biology, Historical Significance in Pacific coast fisheries, and regional harvest rate determinations. ADF&G Regional Information Rep. 1J90-31, Juneau.
- Koonce, J.F., and B.J. Shuter. 1987. Influence of various sources of error and community interactions on quota management of fish stocks. Canadian Journal of Fisheries and Aquatic Sciences 44(Supplement 2):61-67.
- Tegner, M.J. and Dayton, P.A. 1977. Sea urchin recruitment patterns and implications of commercial fishing. Science 196:324-326.
- Van Sickle, J. 1977. Mortality rates from size distributions: the application of a conservation law. Oecologia 27:311-318.
- Woodby, D. 1991. The red sea urchin test fishery of south Sitka Sound, 1990. ADF&G Regional Information Rep. 1J91-03, Juneau.

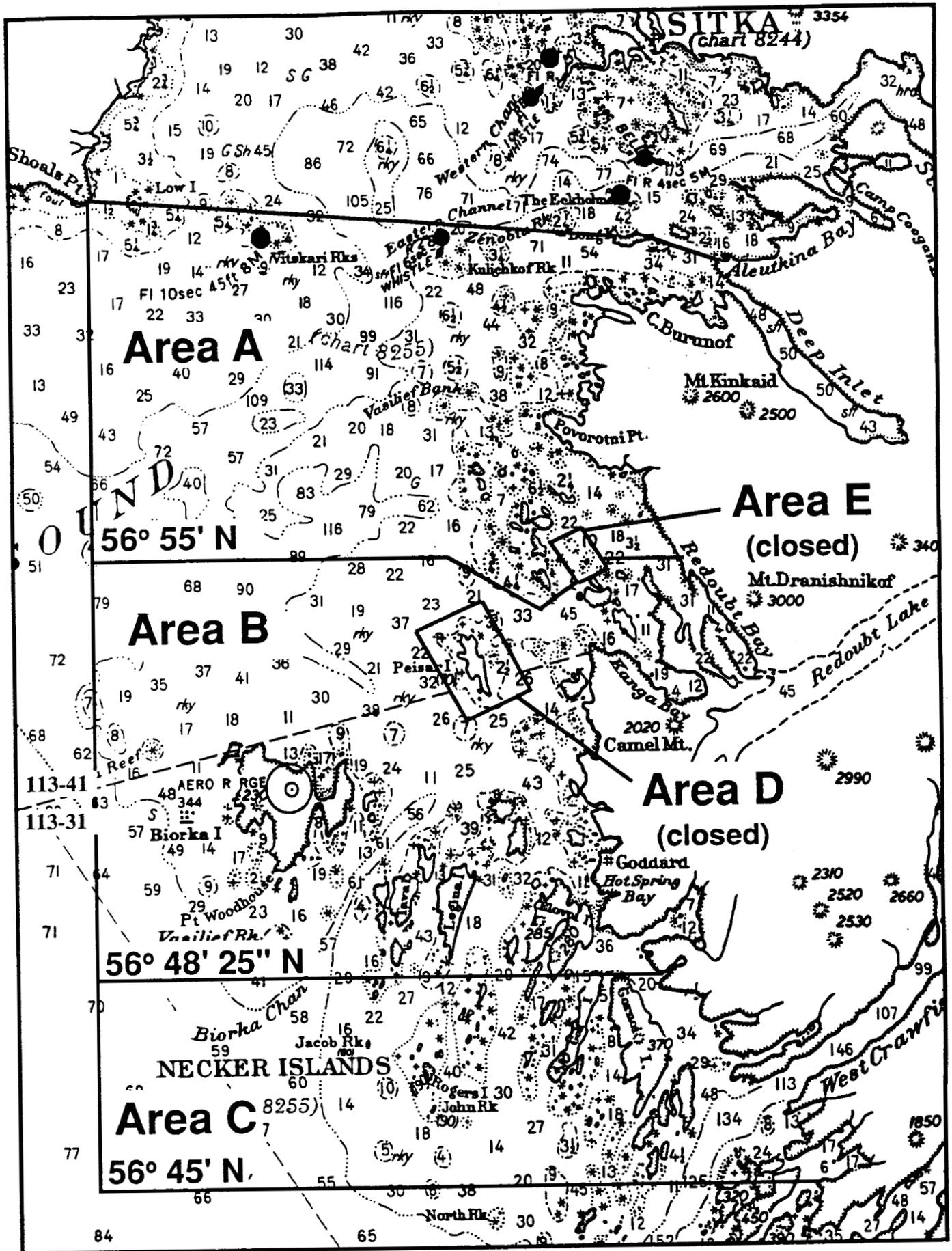


Figure 1. Red Sea Urchin Fishery Boundaries.

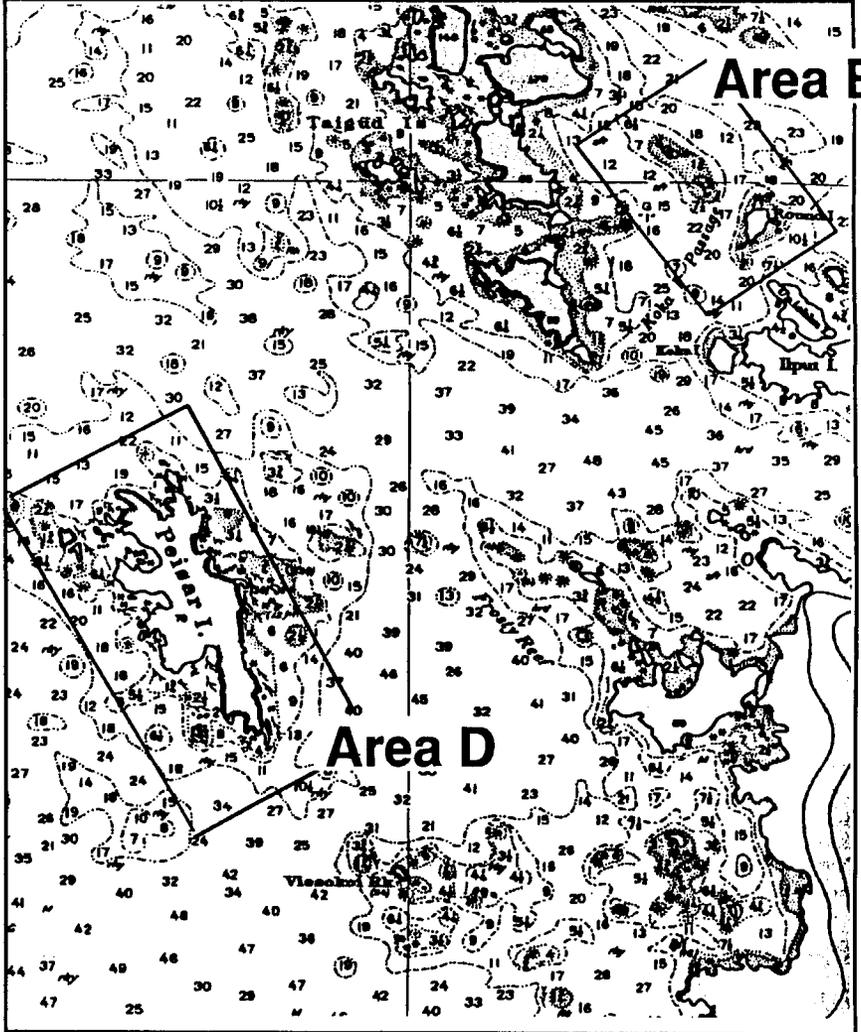
Figure 2. Front page of Sea Urchin Harvest Log showing Area A-B Boundary Line detail.

STATE OF ALASKA DEPARTMENT OF FISH AND GAME

SEA URCHIN HARVEST LOG

Permit Holder Permit Number	Vessel Name ADF&G No.	Fish Ticket Number FOR OFFICE USE ONLY
--------------------------------	--------------------------	--

Line #	Month/Day/Year	Harvest Location (Bay, Distance to Landmark, Etc.)	Percent of Landing by Location	Bottom Time in Minutes
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				



Closed Areas D (Peisar Island) and E (Round Island and reefs to northwest).

INSTRUCTIONS: Mark each harvest location on the map with an x. If there is more than one location, label each location with the corresponding line number (left hand column.)

X _____ Signature of Permit/License Holder	FOR OFFICE USE ONLY	Percent Roe Recovery	Subdistrict	Total Pounds From Fish Ticket	Number of Urchins	STATE COPY
---	----------------------------	----------------------	-------------	-------------------------------	-------------------	------------

The Alaska Department of Fish and Game operates all of its public programs and activities free from discrimination on the basis of race, religion, color, national origin, sex, or handicap. Because the Alaska Department of Fish and Game receives federal funding, any person who believes he or she has been discriminated against should write to:

O.E.O.
U.S. Department of the Interior
Washington, D.C. 20240