SUBSISTENCE HARVEST AND USE OF SEA CUCUMBER IN SOUTHEAST ALASKA

With Specific Reference to Sea Cucumber Harvest and Use by Residents of Craig, Klawock and Hydaburg

Technical Paper No. 190

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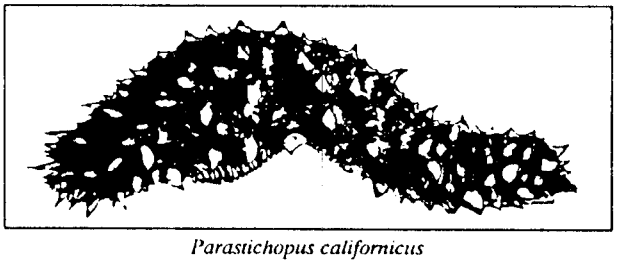

Parastichopus californicus

DIVISION OF SUBSISTENCE
ALASKA DEPARTMENT OF FISH AND GAME
OCTOBER, 1990

ABSTRACT

This report summarizes available information on the subsistence uses of sea cucumbers in Southeast Alaska. The report draws from Division of Subsistence studies from 1984 to the present, and provides sea cucumber harvest and use data, for at least one year, for all communities of the region. Marine invertebrate harvest area maps are also included. In addition, the report provides information about the subsistence use of sea cucumbers by residents of Hydaburg, Klawock, and Craig, on Prince of Wales Island. These details include methods of harvest, preparation, and storage of sea cucumber, and historical and contemporary cultural traditions related to sea cucumber use.

Sea cucumbers have been a regularly harvested food species throughout the historic period, particularly for Alaska Natives living in the southern portion of Southeast Alaska. In 1987, sea cucumbers were taken in the highest quantities by residents of Prince of Wales Island communities, Wrangell, Sitka, and Metlakatla. Klawock's subsistence harvest in that year approximated 9,560 lbs (23,900 gutted sea cucumbers). Current harvest methods vary little from traditional methods. Most subsistence harvesting occurs during minus tides, in calm waters during mild weather, with the use of poles or bare hands for collection.

The principal sea cucumber species harvested for subsistence (*Parastichopus californicus*) is of interest to a rapidly developing commercial fishery, which provides a product to an international market. Subsistence sea cucumber users in Craig, Hydaburg, and Klawock, are becoming concerned with sea cucumber management issues, and the possibility of commercial use affecting subsistence harvest opportunities. Long-term management options that have been suggested for this commercial fishery include identifying subsistence use areas that should be closed to commercial harvesting, and developing conservative commercial harvest quotas. Other management policies may be appropriate that would promote local involvement in the commercial sea cucumber industry, while providing continued protection for subsistence uses.

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INTRODUCTION

This report on subsistence uses of sea cucumber (*Parastichopus californicus*) in Southeast Alaska has been prepared in response to increasing interest in commercial exploitation of this species in the region. Commercial interest stems from the existence of a well developed market for sea cucumber products in several Asian countries, an experienced domestic fishing fleet, primarily located in the Pacific Northwest, and depleted sea cucumber stocks in areas where this fleet has previously been active. Rapid commercialization of the sea cucumber resource in southeast Alaska is occurring in the context of existing uses of sea cucumber by residents of many communities. State law requires that customary and traditional harvests of traditional food species be granted a priority over other uses, when restrictions on harvest are necessary. After July 1, 1990, this priority potentially applies to all Alaska residents, but it is the Board of Fisheries that must decide where customary and traditional uses occur. This report presents available information on sea cucumber harvests and uses by residents of southeast Alaska communities, in order to facilitate the process of providing continued subsistence harvest opportunities.

Data summaries of sea cucumber harvest and use, for selected years in all communities of the region, have been gathered for this report from resource harvest studies conducted by the Division of Subsistence from 1984 to the present. Additionally, some community coastal management plans provided information on use of sea cucumbers. At the time this report was begun no studies were available that provided detailed quantitative and qualitative information on subsistence harvests of sea cucumber. Accordingly, research was conducted specifically for this report that focused on sea cucumber use by residents of Hydaburg, Klawock, and Craig, on Prince of Wales Island (Figure 1).

The recent research addresses the socio-cultural context for sea cucumber use, harvest methods and means, geographic patterns of sea cucumber use, and sharing within and between communities. The Prince of Wales Island communities were chosen as study sites because of the known historical and contemporary significance of sea cucumber harvesting to many local residents, and because of their location in an area of interest to the commercial sea cucumber fishing industry.

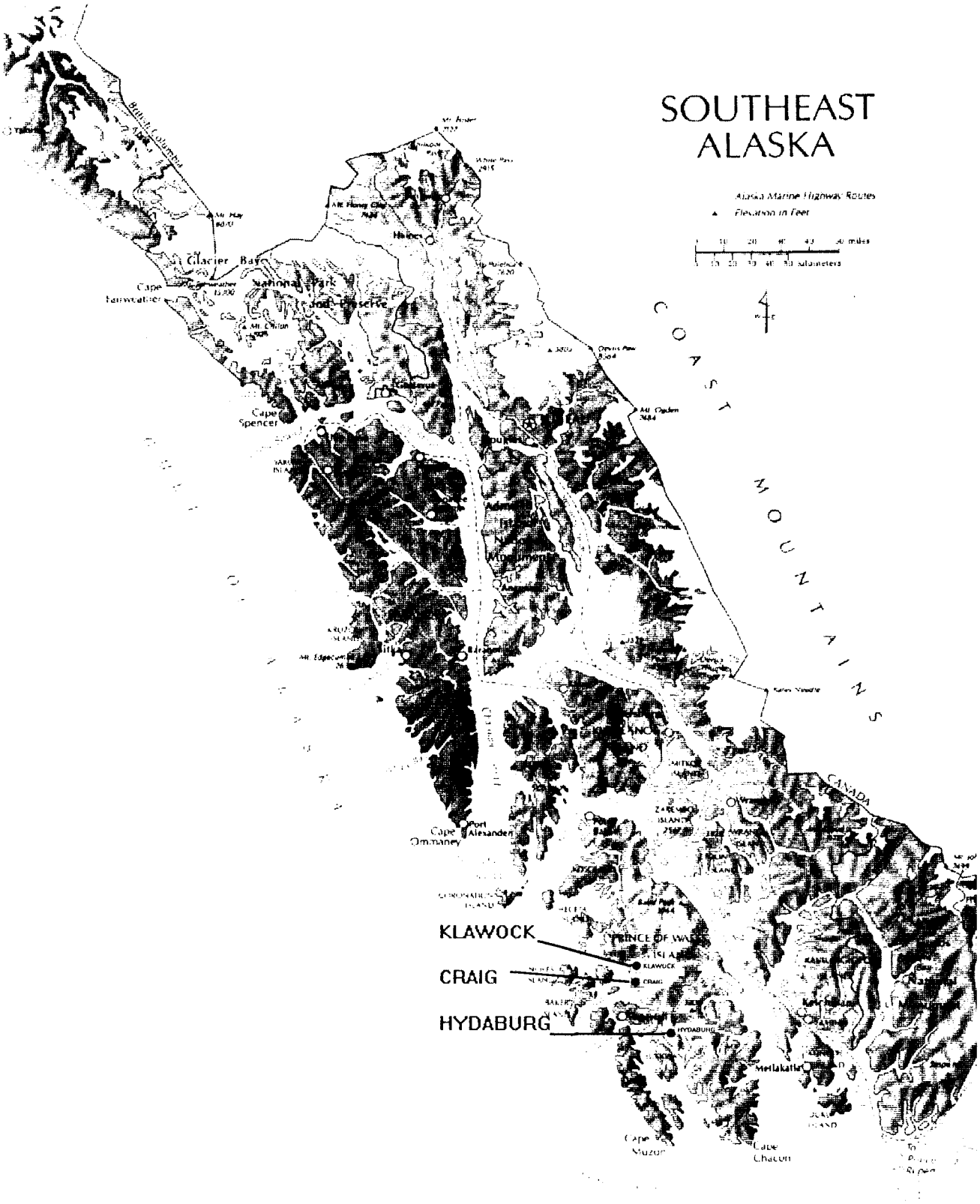

Figure 1. Prince of Wales Island Study Communities

Patterns of use of sea cucumber in these communities do not necessarily typify uses in all communities in the region. Nonetheless, background information on sea cucumber use in the southwest Prince of Wales Island area will aid in understanding the ways that sea cucumbers are used by some communities of the region. The report also briefly summarizes available information on sea cucumber ecology.

METHODOLOGY

This description of subsistence sea cucumber harvest and use derives from Division of Subsistence records and field research. First, Division of Subsistence records on subsistence harvest and use of sea cucumber were compiled. The sources of this information include seven Division of Subsistence field studies, in Haines and Klukwan (Mills 1982), Tenakee Springs (Kookesh and Leghorn 1986), Angoon (George and Bosworth 1988), Kake (Firman and Bosworth 1990), Klawock (Ellanna and Sherrod 1987), Hoonah (Schroeder and Kookesh 1990), and Yakutat (Mills and Firman 1986). Another source of information was a Division of Subsistence field study and survey of 30 southeast Alaska communities, conducted in 1987-88 in cooperation with the U.S. Forest Service and the University of Alaska (ADF&G 1990; Kruse and Frazier 1988). In all of the above studies, interviews on subsistence use of wild resources were conducted with a random sample of households. Sea cucumber was one of the resources included in these subsistence interviews.

Field work conducted in 1990 specifically for this report involved interviews with knowledgeable residents of study communities, individuals who are referred to here as "key respondents", and participant observation, whereby the researcher actively participated in sea cucumber harvest activities in three study communities--Craig, Klawock, and Hydaburg. The following topics were addressed during this study:

1. The history and cultural traditions of subsistence sea cucumber harvest and use in the communities;

2. Traditional and contemporary methods of sea cucumber harvest, preparation, and

preservation;

3. Tlingit and Haida nomenclature for sea cucumbers;

4. Identification of species used for subsistence;

5. Traditional and contemporary seasonality of subsistence use;

6. Change in subsistence harvest and use over time;

7. Traditional stories and beliefs associated with sea cucumber use;

Community reviews of the report's research plan were conducted prior to the interviews, observation, and mapping sessions in the study communities. Reviews sessions took place with the Hydaburg City Council and IRA Council, Klawock's City Council and Alaska Native Brotherhood Camp, and Craig's City Council and IRA Council. The field work for this study was accomplished by the authors in March, April, May, and June, 1990. In all, twenty-five key respondent interviews were conducted, as well as four participant observation trips (see Table 1).

An interview schedule was followed with each interview, covering a variety of topics:

1. Background on the respondent, length of residency in the community;

2. Community's cultural background and history;

3. Subsistence sea cucumber harvest and use, contemporary and traditional;

4. Seasons and environmental conditions for sea cucumber subsistence harvest ;

5. Ecological information about sea cucumbers (spawning, recruitment, movements, frequencies)

6. Subsistence information about other intertidal species.

Table 1. Sample Size for Southwest Prince of Wales Island Interviews and Observations, March-June 1990

Study Community	Key Respondent Interviews	Observation Activities	Mapping Interviews
Hydaburg	16	2	9
Klawock	7	2	3
Craig	2	0	0
Total	25	4	12

Participant observation of harvest activities followed an observational outline. For each observation, the researcher recorded the time and date of leaving and returning, the travel distance and travel time, the weather and sea conditions, the names of participants, the gear description, the travel route to a harvest location, the description of the harvest site, the harvesting technique, the quantity of harvest, the process used to prepare the sea cucumbers for preserving or use, and the distribution of harvested sea cucumbers.

During interviews, respondents were asked to map areas used for harvesting sea cucumber for subsistence, on transparent overlays on 1:40,000 NOAA navigational charts. Different color pens were used to represent areas used by individuals, during their lifetimes. All information was subsequently combined to generate a community harvest area map, at a scale of 1:229,000. Mapping of subsistence sea cucumber harvest areas was completed in Hydaburg. Mapping of subsistence sea cucumber harvest areas was planned in Klawock and Craig. However, respondent concerns over the potential disclosure of subsistence harvest sites to commercial fishing entry caused respondents to decline to participate in mapping sessions at this time. Consequently, subsistence sea cucumber use areas currently have not been systematically documented for the Craig and Klawock area.

THE STUDY COMMUNITIES OF HYDABURG, KLAWOCK AND CRAIG

Hydaburg

During the 17th century, Haida Indians began to migrate northward from the Queen Charlotte Islands into Tlingit territory, on the southern tip of Island in the Prince of Wales archipelago. Population pressure and competition for resources in the Queen Charlotte Islands may have been the reason for this migration. Skirmishes between the Haida and Tlingit over territory and resources followed. By the mid-1800s numerous Haida camps were established along the southwest coast of Prince of Wales. By 1910, three of the largest Haida population centers existed in the Prince of Wales area, at Howkan (also spelled Hawkan) on the west side of Long Island, at Klinkwan on the southwest side of Prince of Wales Island near Klakas Inlet, and at Sukkwan across Sukkwan Strait from Hydaburg's present location (Fig 2).

After suggestions from the federal government and the Presbyterian Church, the Prince of Wales Haida consolidated their village sites in 1911 to form the present community of Hydaburg. This site was intended to provide for better schooling and to facilitate making other social and institutional changes (CH2M Hill 1982; Mills 1982; ADF&G 1989). In 1912, 7,800 acres surrounding Hydaburg were reserved from the federal domain for the use of the Haida tribe of Indians (Ch2m Hill 1982; Alaska Department of Community and Regional Affairs 1981). In 1936 Hydaburg became the first Alaska Native village to form an Indian Reorganization Act Council (IRA). The federal government, in 1945, offered Hydaburg a reserve land grant in excess of 77,000 acres, which Hydaburg accepted in 1949, but the courts in 1951 held the reserve was improperly established and it was later nullified (ADF&G 1989).

Hydaburg has an economy that is dependent on subsistence fishing, hunting and gathering, and on commercial fishing and logging. The community's cash economy has been heavily dependent on commercial fishing and cannery industries, and as a result has fluctuated with the economic conditions of the area's fisheries. Hydaburg became a first-class city in 1972, and thus was able to assume

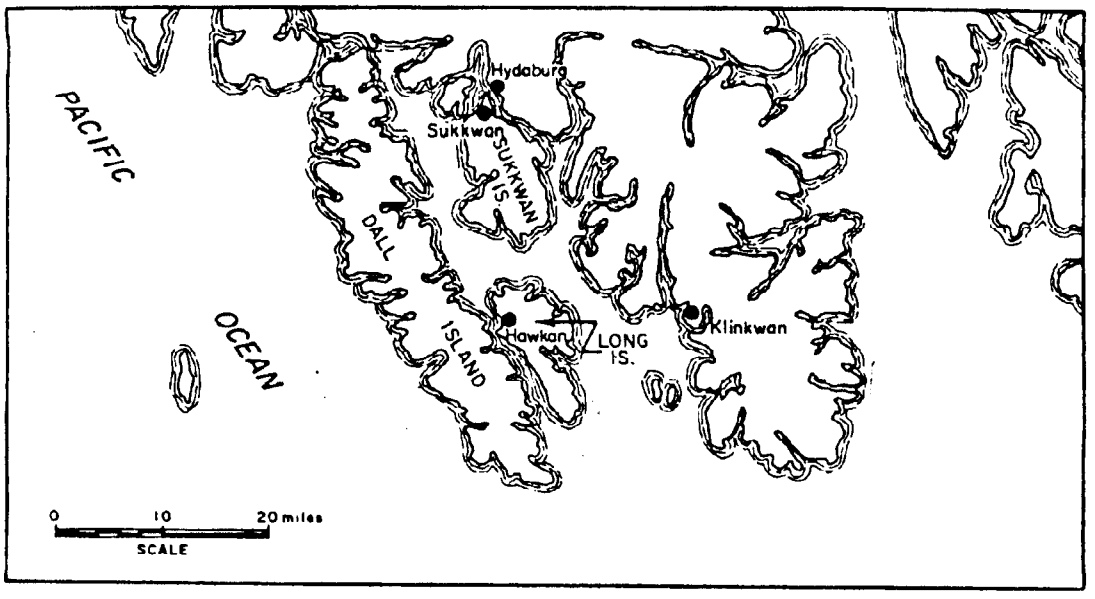

Figure 2. Map of Howkan, Klinkwan, and Sukkwan locations. From U.S. Department of the Interior, Bureau of Indian Affairs 1978; Hydaburg, Alaska, Its History, Population and Economy, page 17.

municipal powers under State law, including taxation (Alaska Department of Community and Regional Affairs 1981). Since Hydaburg's establishment in 1911, the population has fluctuated from 338 in 1930, to a low of 214 in 1970, to a 1988 population of 379 (Fig. 3.) (U.S. Bureau of the Census; ADF&G 1989). Hydaburg's Alaska Native population in 1988 constituted 87 percent of the total village population with 88 percent of the Hydaburg households having an Alaska Native member. According to a 1988 survey 64 percent of Hydaburg's residents over age 16 grew up in Hydaburg and 72 percent of all residents grew up in Hydaburg (Kruse and Frazier 1988). Hydaburg's current monetary employment is highly seasonal in all sectors. Recent unemployment figures from the Alaska Department of Labor () for Hydaburg are included within the Prince of Wales Census Subarea. ADOL's unemployment rates for this subarea were 14.3 percent for 1985, 14.7 percent for 1987, and 11.5 percent for 1989. In 1985, a Tlingit and Haida Central Council survey, 61 percent of the residents over 16 years of age reported having no jobs.

In the subsistence sector, wild food harvests in 1988 by Hydaburg residents ranked in the upper third of communities in the region (Kruse and Frazier 1988). Documented subsistence harvests

in that year averaged 337 pounds per capita, calculated as edible weight. The average for the region was less than 200 pounds per capita. In Hydaburg, 40 percent of this harvest consisted of salmon, 24 percent marine invertebrates, 16 percent other finfish, and 13 percent deer. The regional average for the survey year was 27 percent salmon, 24 percent other finfish, 21 percent deer and 16 percent marine invertebrates. This data illustrates a proportional subsistence harvest and use of marine resources at Hydaburg that is considerably greater than for the region as a whole (Kruse and Frazier 1988).

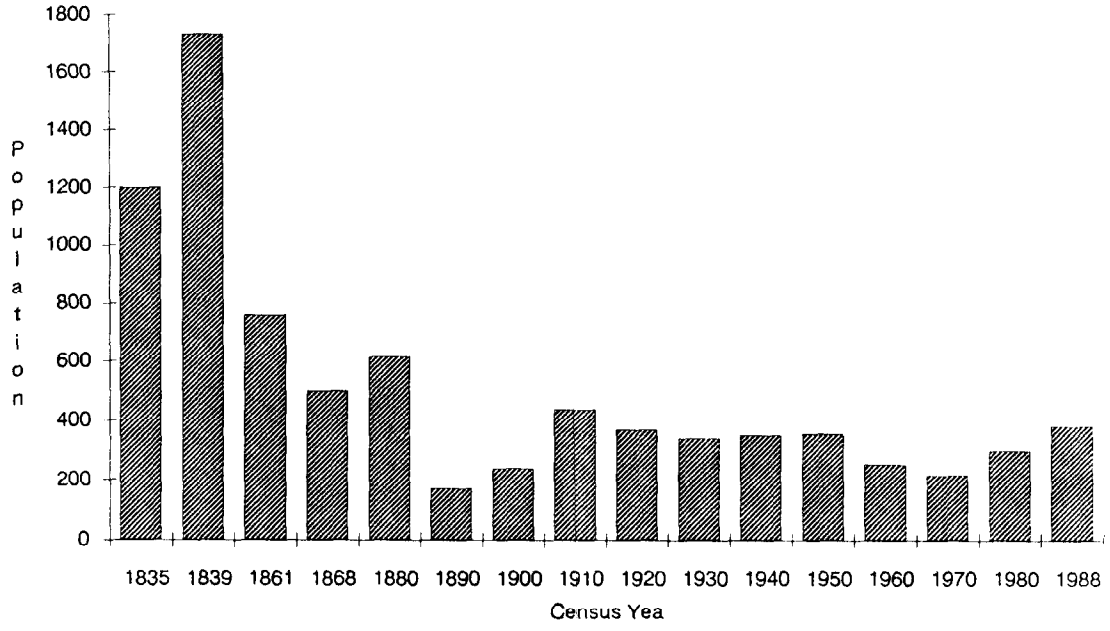

Figure 3. Hydaburg Population 1835 - 1988. Sources: Rollins (1978) for years 1835-1970, U.S. Census Bureau for 1980, Kruse and Frazier (1988) for 1988.

Klawock

The Spanish explorer Ortiga visited Klawock in 1853 and reportedly named it "La Galeria", which means "the Galley," because Klawock was surrounded by water during high tides (Alaska Department of Regional and Community Affairs 1981b; Langdon 1975, 1977). Distant relatives of Klawock residents are believed to have originated from the villages of Tuxekan, a former Tlingit winter

village north of Klawock; Shakan, a former village on Kosciusko Island located on the northeast side of Prince of Wales Island, and clan sites scattered across Prince of Wales Island (cf. Langdon 1977:78 - 100).

The Klawock river and Klawock Lake provided an abundant supply of red salmon for the residents of the Klawock area. George Hamilton established a trading post and a salmon saltery at Klawock in 1868, which he later sold to the San Francisco based company of Sission, Wallace & Company. This became the first cannery in Alaska, in 1878 (Walsh Planning Consultants 1984; Mills 1982). In 1920 and 1924, two more canneries were built in Klawock, as was a sawmill to meet the demand for construction lumber (Walsh Planning Consultants 1984; ADF&G 1989). With the passage of the Wheeler Howard Act in 1934, federal funding became available to Klawock for cannery operations. The Act required Klawock residents to vote to keep Klawock free of liquor and required the establishment of a nonprofit corporation, the Klawock Cooperative Association, to be the owner/operator of the Klawock Cannery (Alaska Department of Regional and Community Affairs 1981b). In 1971, construction began on the Alaska Timber Corporation's sawmill in Klawock which has since provided intermittent employment to the residents of the area.

Fishing productivity has greatly affected Klawock's population, which has varied from 587 residents in 1880, to a recorded low of 131 in 1900, rebounding to 455 in 1939, with another low in 1970 of 213 (Fig. 4)(Rollins 1978, U.S. Census 1980, Kruse and Frazier 1988). Klawock grew to 795 inhabitants by 1988, reflecting an in-migration of people in response to growth and expansion of the timber industry. Timber harvest has taken place since the late 1970s on Klawock's and Craig's Alaska Native Claims Settlement Act (ANCSA) Village Corporations lands as well as on the National Forest. Alaska Natives represented 66 percent of Klawock's population in 1988, with 51 percent of the households having an Alaska Native member (Kruse and Frazier 1988). In 1988, the percent of residents over the age of 16 who grew up in Klawock was 28 percent, with 31 percent of all residents growing up in Klawock (Kruse and Frazier 1988).

The principle economic sectors of Klawock include subsistence fishing and hunting, timber products, commercial fishing, transportation, government, and retail. Recent unemployment figures

from the Alaska Department of Labor (ADOL) for Klawock alone do not exist. ADOL data are collected by census districts and subdistricts. Klawock belongs to the Prince of Wales Census Subarea. Unemployment rates for the subarea were 14.3 percent for 1985, 14.7 percent for 1987, and 11.5 percent for 1989. According to a Central Council of Tlingit and Haida Indian Tribes of Alaska (THCC) survey, Klawock had a 1985 unemployment rate of 42 percent.

In the subsistence sector, Klawock's per capita subsistence harvests in 1987 were in the middle range for the region as a whole, approximating 250 lbs per capita. Among the subsistence foods harvested, salmon represented 32 percent of the harvest in that year. Other finfish comprised 29 percent of the harvest of wild foods, deer were 19 percent, and marine invertebrates made up 14 percent of the overall harvest (Kruse and Frazier 1988).

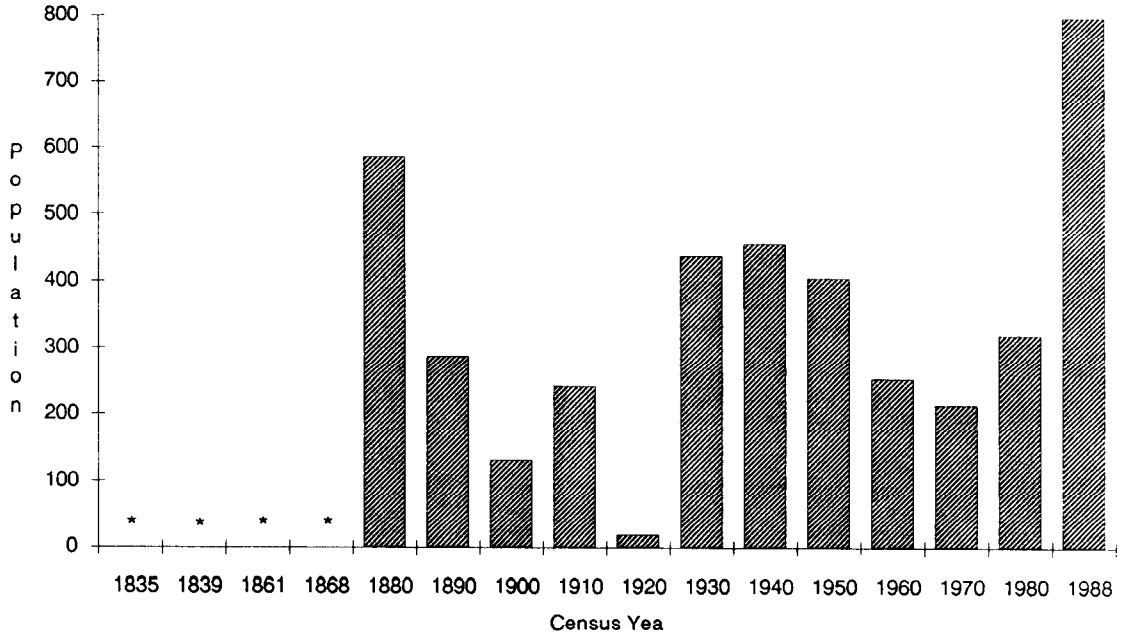

Figure 4. Klawock Population 1880 - 1988. Sources: Rollins (1978) for years 1835-1970, U.S. Census Bureau for 1980, Kruse and Frazier (1988) for 1988.

Craig

Tlingit fish camps and seasonal villages originally occupied the present location of Craig (Langdon 1975; ADF&G 1989). The community of Craig grew in the early 20th century along with the expansion of commercial fishing operations in the region. In 1908 a saltery, initially known as "Fish Egg" (after a nearby island famous for its productive herring spawn) was established at Shaan-Seet, the present Craig location (Langdon 1975). Fish Egg was renamed Craig in 1912 after Craig Millar, superintendent of the cold storage facility there. Millar had started the salmon packing operation in 1907 on Fish Egg Island. He also built a cold storage facility and 20 to 25 houses, at the present site of Craig, between 1908 and 1911 (Alaska Department of Regional Affairs 1981c; Langdon 1975). In 1912 a cannery was built in Craig furthering the growth of the community. The U.S. Forest Service surveyed Craig in 1910, 1913, and 1914, and established a permanent ranger station there around 1919 (Langdon 1977). In 1922, the City of Craig incorporated into a territorial second-class city (Alaska Department of Community and Regional Affairs 1981c).

Craig's population declined since World War II, along with salmon runs and associated industries. Craig had 231 residents in 1930, it increased to 505 residents in 1939, and dropped again in 1970 to 272 (Fig. 5)(Mills 1982; Rollins 1978). By 1988, Craig had a population of 1182. As with Klawock, this recent rise in population mainly reflects an influx of people associated with the expanding timber industry. Alaska Natives, in 1988, represent 28 percent of the population, with 32 percent of the households containing an Alaska Native (Kruse and Frazier 1988). Recent unemployment figures from the Alaska Department of Labor for Craig alone do not exist. ADOL data are collected by census districts and subdistricts; Craig belongs to the Prince of Wales Census Subarea. Unemployment rates for the subarea were 14.3 percent for 1985, 14.7 percent for 1987, and 11.5 percent for 1989. A THCC 1985 survey showed Craig's unemployment rate at 39 percent.

In the subsistence sector of the economy, the harvest of subsistence foods by Craig residents in 1987 was near the mid-range for the region as a whole, at approximately 200 lbs per capita. Equal proportions of salmon (22 percent), finfish (22 percent) and deer (22 percent) were harvested that

year. An additional 26 percent of the harvest was composed of marine invertebrates (Kruse and Frazier 1988).

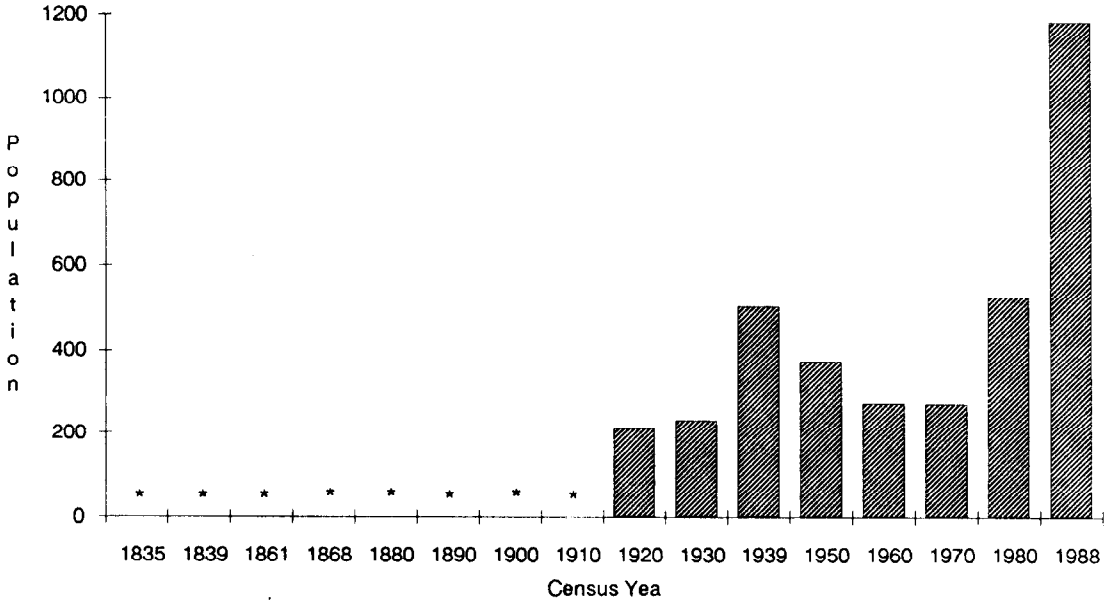

Figure 5. Craig Population 1920 - 1988. Sources: Rollins (1978) for years 1835-1970, U.S. Census Bureau for 1980, Kruse and Frazier (1988) for 1988.

SEA CUCUMBER ECOLOGY AND THE COMMERCIAL FISHERY

Background on Sea Cucumber Ecology

Several species of sea cucumber are known to occur in the waters of Southeast Alaska. All are echinoderms, closely related to sea urchins, brittle stars, and sea stars. Sea cucumbers occur from Baja California to the Gulf of Alaska in intertidal waters to depths of at least 800 feet (Lambert 1984). *Parastichopus californicus* was found to be the principle species harvested for subsistence use in the 1990 study communities. This same species has also been targeted by a commercial fishery that has developed in southeast Alaska in recent years. It is possible that sea cucumber species other than *P. californicus* may be harvested for subsistence use in some portions of the region.

Adult sea cucumbers range in length from 1 to 1.5 feet, 2 to 4 inches in width. They weigh an average of one pound (Furlong and Pill 1975; Barrs 1983). They have vestigial plates of lime within their thick skins, rows of tube feet on the underside, and large conical-shaped soft spines on the upper surfaces. They range in color from red to brown to black, with a yellowish background showing in the spines and underside tubed feet and skin. A mouth with tentacles and an anus are the predominate external features. Sea cucumbers have a primitive digestive tract and a network of respiratory trees that branch out from the colon for oxygen exchange. The body wall, consisting of external skin and five white longitudinal muscles, surrounds internal organs (Pacific Fishing 1982; Mottet 1976).

Sea cucumbers are slow-moving detritus feeders that extract microscopic algae and other organic matter from ingested muds, sand, and silt. They excrete the mineral particles in tubules on the sea bottom. Sea cucumbers rework benthic sediment, ultimately turning over 90 percent of the sea bottom, down to depth of a few millimeters. The role of sea cucumbers in the ecology of the sea bottom is largely unknown (Fishing Pacific 1982).

Sexes are separate in sea cucumbers with little sexual dimorphism (Cameron and Fankboner 1986). Males trigger spawning with both sexes being broadcast spawners. Spawning occurs in spring and summer during bright, sunny days in warm, shallow waters. Fully mature females release up to several million eggs during a protracted spawning period beginning in Alaska waters as early as April

and continuing possibly until the end of August (Cameron and Fankboner 1986; Draft ADF&G Sea Cucumber Management Plan April 1990). Larvae move to the open ocean for 50 - 90 days, or longer in Alaskan waters, before returning to intertidal areas (ADF&G Draft Sea Cucumber Management Plan 1990). Little is known about population size and recruitment rates for sea cucumbers in Alaska waters.

Alaskan sea cucumbers appear to move or migrate to deeper waters in autumn and return to shallower waters with warming temperatures in March through May. Greatest growth in length of juveniles and weight of adults occurs in spring and summer. During fall and winter the sea cucumber's digestive, respiratory, circulatory, and reproductive systems atrophy and are expelled, with regeneration starting in January and February. During this time sea cucumbers lose approximately 25 percent of body wall thickness, with respiration occurring directly through the body wall during that time (Cameron and Fankboner 1985).

Commercial Exploitation

Developed commercial sea cucumber dive fisheries occur in California, Washington, and British Columbia. Commercial markets for sea cucumber exist in cities such as New York, San Francisco, and Vancouver, British Columbia and world Asian markets (eg. Taiwan). Sea cucumber muscles strips are frozen; skins are boiled and dried to produce an Oriental cuisine known as *trepang* or *beche de mer.*

A commercial sea cucumber fishery began in 1971 in Washington. Until 1987, sea cucumbers were commercially harvested by divers without seasonal or area restrictions. In 1987, following signs of depleted sea cucumber populations, Washington established harvest districts and a restricted harvest season (Alaska Department of Fish and Game 1990). The British Columbia commercial sea cucumber fishery began in 1980 and in 1989 harvest quotas were reduced due to concern that stocks were being depleted (Ibid). The restrictive regulations in Washington and British Columbia have encouraged commercial divers to expand into southeast Alaska waters (Simpson 1990).

HARVEST AND USE OF SEA CUCUMBERS

Traditional Use of Sea Cucumbers

Sea cucumbers were traditionally used as a food in the Northwest Coast culture area, of which southeast Alaska communities are a part. The earliest reference comes from the 1804 voyage of Urey Lisiansky into Southeast Alaska waters. In October of 1804, Lisiansky recorded an exchange with a Tlingit informant. According to Federica de Laguna (1960), Lisiansky's account referred to contempt between Tlingit groups (Angoon and Sitka) and was an example of a story of a rival clan proving the worthlessness of another clan (Stikans) because they broke a taboo:

> He told us, that in a small bay near our old settlement, there formerly live two youths, who were brothers: that it was not known from whence they sprung, and yet they had everything they wanted in abundance: that one day walking together along the shore, the younger brother, whose name was Chat, found a sea vegetable, resembling a prickly cucumber, which he tasted: that the elder, on seeing this, told him he had eaten of a forbidden fruit, the consequences of which would be, that the present abundance they enjoyed would cease, and they would be obliged thenceforward to labour for their subsistence. (Lisiansky 1814, pg.166)

The Manhousat tribe on the west coast of Vancouver Island according to Ellis and Swan (1981) traditionally ate sea cucumbers and compared the stubbornness of sea cucumbers when harvesting to that of misbehaving children.

> At these places (deeper waters), sea cucumbers were brought to the surface with a special implement made by lashing a short stick at right angels to the end of a long pole. The animals were draped over the small stick and pulled to the surface. They had to be drawn up quickly, as they tended to swell and become wi7akshitl, `round like a ball', or `stubborn', and so firm that they would roll off the small stick. The Manhousat people have an expression for children that become particularly stubborn when they are scolded: "You are like Taa7inwamit (the name given to the sea cucumber in legends); you are wi7akshitl (`stubborn')". (Ellis and Swan 1981, pg.58)

These two references attest to traditions associated with the subsistence use of sea cucumbers in the northwest coast area noting legends and taboos associated with sea cucumbers.

Sea cucumbers have traditionally played a part in the subsistence harvest of Southeast Prince of Wales Island Native residents, making a contribution to a traditional subsistence diet that varied among communities. Both the Haida and Tlingit made use of sea cucumbers as a subsistence food

resource. One respondent explained the traditional importance of sea cucumbers this way, "It was taken for granted, like the berries". Often, sea cucumbers were among the survival foods used when stranded away from the village, when camping, and when other more desired foods were not available.

Harvest Methods

The harvest of sea cucumbers in the early historic period took place when the sea cucumbers were found in shallow waters within easy harvesting reach. This generally occurred in the spring, summer, and early fall. Sea cucumbers were harvested at minus tides, either from a boat or from shore. The cucumbers on shore would be collected by hand or with the use of a pole. Boat harvest required the use of poles for reaching sea cucumbers on the sea bottom.

The poles were called a *yein* or *yaanuu* stick. *Yein*, is the Tlingit word for sea cucumber and *yaanuu* is the Haida name for sea cucumber (Lawrence 1977). Also, one respondent said, you could simply use "a good sensible stick". A *yein* or *yaanuu* stick were be eight to ten feet long with a cross stick attached at one end. The cross stick was eight to nine inches wide, tied to the long pole with string. The "sensible stick" or spear would be the same length, and either sharpened or forked at one end. When metal became available, through trade with Europeans, spikes were flattened and attached to the stick. *Yein* or *yaanuu* sticks were used to lift the sea cucumber from the sea bottom and bring them to within hands' reach. Care was taken not to pierce the body wall of the sea cucumber, which might damage the meat or internal organs.

The *yein or yaanuu* stick design allowed the harvester to reach behind rocks and into eel grass beds to lift out the sea cucumbers. The cross stick attachment angle allowed the sea cucumbers to be either raked toward or lifted to the harvester. Baskets were used to carry sea cucumbers from the shore or from the boat.

In order to gut and clean sea cucumbers, first, the head of the cucumber was cut off, which was followed by a squeezing out of the guts or viscera. Next, the other end of the cucumber was cut off. For skinning, the cucumber body wall was slit lengthwise and the meat along the body wall was pulled from

the skin either by hand or with the use of a knife. Skinning began by working the fingers between the skin and muscles or meat and carefully working the meat away from the skin, until enough of the meat could be firmly grasped with the other hand that it could be pulled away from the skin. A knife was used to assist with the beginning process of separating the meat and skin and to strip the meat away from the skin in a filleting action. Several study respondents mentioned that the traditional skinning process differed from that used today because community elders would skin the cucumbers under water along the shore. They thought they did this because it might be easier to do underwater.

Preservation and Utilization

Frequently, sea cucumbers were eaten fresh, the same day they were harvested. However, both drying and smoking were described as traditional methods of preserving sea cucumbers for storage. Drying, according to one of the study respondents, was done in a fashion similar to that of herring eggs and octopus: "they used to pull the skin off and hang them in the trees to dry for winter."

Preservation methods for sea cucumbers changed with the development of canning using glass jars and metal cans to preserve food. With this technology, sea cucumber meat could be easily preserved for winter use. Families in all three study communities reportedly canned sea cucumbers for the lean times of late winter when food supplies might be in short supply. In particular, during the depression years of the 1930s, canned sea cucumbers were among the wild foods used to make ends meet. Many of the elders contacted in the study remember those financially tough years as a time when they collected, canned, and ate large quantities of sea cucumbers. With the arrival of affordable home freezers in the late 1940s and early 1950s preservation methods of drying and canning decreased in favor of freezing. Freezing sea cucumbers eliminated some of the work involved with other preservation methods.

Boiling and roasting cucumbers were the traditional ways of preparing sea cucumbers for the table. After being gutted, sea cucumbers were boiled, skin and all, until the meat turned chalky white.

Some people reportedly rubbed off the warts or flexible spines on the sea cucumber's skin by rubbing the cucumbers against barnacles. While the cucumbers were boiling, a hemlock branch was used to stir the boiling cucumbers. A hemlock branch was used to cut down on the slime created when boiling sea cucumbers. Boiling sea cucumbers, skin and meat together, makes them tough in texture to eat. One study respondent commented about the toughness of boiled sea cucumbers by saying "the old ladies used to chew on it and it would last a long time, sometimes all day". Boiled sea cucumber meat was added to other food items in stews and chowders.

Roasting sea cucumbers was a cooking method that was used when harvesters were out camping or stranded away from the village. There were several different ways of roasting sea cucumbers around the campfire. One method roasted them the same way as black chitons (*Katherina tunicata*, locally known as "gumboots"), by ringing the campfire with gutted cucumbers, turning them when the skin blackened. A variation of campfire roasting was to place gutted sea cucumbers on the hot ground from which a campfire had been moved, allowing the residual heat in the ground roast the cucumbers. Another method was to simply throw the gutted sea cucumber into the fire to be fished out later when the skin charred. Others roasted gutted sea cucumbers over the fire on devil's club (*Oplopanax horridum*) sticks to add a unique taste to the cucumber meat. Some people believed devil's club sticks were used because of the medicinal value of the plant. Before the devil's club could be used, the spines or needles, along with the bark, had to be stripped off.

With all campfire roasting methods, the cooked cucumber was be eaten whole or cut up into pieces and eaten. Most respondents, especially the men, described roasting as their favorite way of cooking and eating sea cucumbers. One respondent said, of campfire roasting, "It tastes so good. It has its own salt and it cooks in its own juices [over the campfire]". Many of the respondents pointed out that when roasting gutted sea cucumbers, the cut ends close, thereby sealing it and allowing it to make its own broth during cooking. One warned, "if you did not know better, you would think it [cooked cucumber] is still alive, the way it squirts".

Traditional Stories

Two stories were shared during the field research. The first story is a Haida story, told by a member of the Yada Clan[1].

> A group of Haidas were going some place and set up camp. They collected some *yaanuu* (sea cucumbers) from along the beach and began to cook them around the fire. They felt very strange about the area and could feel their enemies all around them. They knew they were out numbered and could not fight them and win. They continued cooking the *yaanuu*. Then they decided to play with the cooking cucumbers, squirting each others with the cucumbers. The surrounding enemies seeing this were frightened away because they must have thought the Haida were much stronger. This is how the cucumber saved the Haida from superior [enemy] forces.

A Tlingit story associated with sea cucumbers came from a Klawock respondent.

> During tribal warfare, the Natives from the north, from Hoonah, Angoon, and Juneau area, what we call northern Natives, came down here because of some misunderstanding. They were not familiar with the area and with sea cucumbers. We can go along the beach and collect cucumbers. The northern Natives watched us collect the cucumbers and they were in need of food. The northern Native braves went out and collected cucumbers to fill their stomachs. They collected something lying on the shore which they thought was what their enemies had collected. Anemones are found along the shoreline, some are orange, some brown. They picked these and roasted and ate them making all of them very sick. These northern Natives were causing a lot of battle with us and that is why we did not show them how to collect sea cucumbers.
>
> So that is why the people up north did not eat them.

Contemporary Use of Sea Cucumbers

Quantities Harvested

The subsistence harvest and use of sea cucumber varied substantially among southeast communities in 1987 (Table 2). Table 2 indicates the total number of five gallon buckets of gutted sea cucumbers harvested per Southeast community, including estimated total weight in pounds harvested, and meat return. Klawock residents, for example, harvested 239 five gallon buckets of gutted sea cucumbers in 1987, or an estimated 9560 pounds (239 buckets x 40 lbs of gutted sea cucumbers per five

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1 The Yada clan was one of the first Haida clans from around Graham Island to migrate to Prince of Wales Island during the late 17th or early 18th century (Vaughan 1985, 20 - 25).

gallon bucket = 9560 lbs). The total amount of edible meat for Klawock of 2390 lbs was determined by taking 25 percent (estimated return of meat from gutted sea cucumbers) of the total pounds harvested or ten pounds of meat per five gallon bucket.

The largest total sea cucumbers harvests documented in the region are at Klawock (1987) 9,560 lbs; Wrangell 8,320 lbs; Klawock (1984) 4,940 lbs; Thorne Bay 4,880 lbs; Sitka 4,560 lbs; Craig 2,160 lbs, Hollis 2,040 lbs; Metlakatla 1,560 lbs; and Edna Bay 1,160 lbs. The largest harvests per household were at Klawock (1984) 3.43 buckets/household, Meyers Chuck 1.70 buckets/household, Hollis 1.53 buckets/household, Edna Bay 1.40 buckets/household, Klawock (1987) 1.06 buckets/household, and Thorne Bay .75 buckets/household.

The 1990 study in Craig, Klawock and Hydaburg showed variation in harvest patterns among individuals. Some individuals in each study community placed sea cucumbers high on their list of important subsistence resources and harvested sea cucumbers in substantial numbers. Others harvested sea cucumbers only if they were readily available and if other more desired subsistence species were not available or were limited in quantity. Klawock was considered by respondents in the 1990 study to be the "sea cucumber capital" of Southeast Alaska, as supported by Table 2.

In the 1990 study communities, it was found that a range of three to six sea cucumbers were consumed per person per meal when the item was served. Yearly harvests for a family varied according to the household's consideration of the sea cucumber's dietary importance. On a successful gathering trip, about 300 - 400 cucumbers are harvested per trip. In 1990 yearly harvests ranged from 150 to 700 sea cucumbers per household in the study communities.

Participation in sea cucumber harvesting is also summarized in Table 2. This information shows that, for many communities, sea cucumber harvesting is an activity of a significant proportion of households in the region. For instance, in 1987, over half of the households in Hollis reported gathering sea cucumbers, and nearly 58 percent reportedly used them. This difference in harvest and use reflects the fact that some sea cucumbers are given away by harvesting households to others, who eat them and, in turn, may pass some proportion of them on again to others. Fifty percent of all households in Edna Bay reported harvesting sea cucumbers in 1987, in amounts averaging 1.4 buckets

Table 2. Non-Commercial Sea Cucumber Harvest and Use by Community, 1987

COMMUNITY	Total No. of Buckets Harvested*	Total No. of Pounds Harvested**	Total Pounds of Meat***	Mean Household Harvest*	PERCENT OF HOUSEHOLDS Harvesting	Using	Giving	Receiving
ANGOON	NA	NA	NA	NA	0	1.5	0.7	1.5
COFFMAN COVE	2	80	20	0.04	3.3	3.3	1.6	0
CRAIG	54	2160	540	0.15	9.6	12.7	6.4	5.1
EDNA BAY	29	1160	290	1.40	50	50	15	0
ELFIN COVE	0	0	0	0	0	0	0	0
GUSTAVUS	0	0	0	0	0	0	0	0
HAINES	0	0	0	0	0	0	0	0
HOLLIS	51	2040	510	1.53	51.5	57.6	13.1	16.1
HOONAH	8	320	80	0.04	3	3	0	0
HOONAH, 1985	3	120	30	0.02	2.8	5.6	NA	NA
HYDABURG	34	1360	340	0.32	16.4	19.4	6.	8.9
HYDER	0	0	0	0	0	0	0	0
KAKE	0	0	0	0	0	0	0	0
KAKE, 1985	0.7	28	7	0.01	2.9	4.3	NA	NA
KASAAN	3	120	30	0.22	21.4	21.4	7.1	0
KLAWOCK	239	9560	2390	1.06	18.3	34.1	8.6	20.2
KLAWOCK, 1984	123.5	4940	1235	3.43	25.5	44.4	13.9	25.0
KLUKWAN	0	0	0	0	0	0	0	0
METLAKATLA	39	1560	390	0.06	9.4	12.2	3.1	3.4
MEYERS CHUCK	17	680	170	1.70	20	20	10	0
PELICAN	2	80	20	0.03	2.4	5.2	0	2.8
PETERSBURG	7	680	70	0.01	0.3	3.7	0.3	3.4
P.BAKER/P.PROTECT.	20	800	200	0.44	17.7	19.9	6.9	4.5
PORT ALEXANDER	4	160	40	0.12	11.7	11.7	0	0
SAXMAN	21	840	210	0.28	10.8	18.8	8	8
SITKA	114	4560	1140	0.04	3	0	0	0
SKAGWAY	0	0	0	0	0	0	0	0
TENAKEE	0	0	0	0	0	0	0	0
THORNE BAY	122	4880	1220	0.75	22.4	22.4	3.2	2.2
WHALE PASS	2	80	20	0.11	11.1	16.7	5.6	11.1
WRANGELL	208	8320	2080	0.21	6.1	7.6	3.3	2.4
YAKUTAT	12	480	120	0.08	3.6	3.6	0	0

(* = 5 gal. buckets)

(** = based on the conversion factor of 40 lbs of gutted cucumbers per 5 gallon bucket. Approximately 100 gutted sea cucumbers will fill one bucket.)

(*** = Based on the conversion factor of 25 percent return of meat from gutted cucumber or 10 lbs of meat per 5 gal. bucket of gutted sea cucumber).

or 56 pounds of gutted sea cucumbers per household. In Klawock, in 1987, 18.3 percent of the households harvested sea cucumber, and 34.1 percent reported using sea cucumbers. In 1984, 25.5 percent of Klawock households harvested sea cucumbers and 44.4 percent used sea cucumbers, in amounts averaging 3.43 buckets or 137 pounds (gutted) per household. In 1987 participation in Craig was by 9.6 percent of the households, with 12.7 percent using sea cucumbers. In Hydaburg, 16.4 percent harvested and 19.4 percent used sea cucumbers. Other communities showing harvest participation rates of 20 percent or more included Meyers Chuck (20 percent), Kasaan (21.4 percent), and Thorne Bay (22.4 percent).

As described in the methodology, the information in Table 2 is derived from interviews of randomly selected households, conducted by the Division of Subsistence. In 1987 these studies were conducted in cooperation with the University of Alaska and the U.S. Forest Service. It is important to note that a single year's data does not indicate trends or variation in patterns over time. More harvest information, over a longer time period, would provide a much better description of the patterns of subsistence use and harvest of sea cucumbers in individual communities and in the region as a whole.

Harvest Methods

Technology

Current harvest methods, while incorporating new technology, vary little from traditional methods. Harvests are confined to minus tides, calm waters and weather, and the use of poles or bare hands for collection.

Most harvesters use motorized skiffs to travel to sea cucumber harvest areas. Skiffs range in size from 14 to 18 feet. They are generally made from metal or fiberglass and usually have relatively small outboards motors of 45 horsepower or less. One to two individuals per skiff make up a typical sea cucumber harvest crew.

In 1990, several different types of poles were used to harvest sea cucumbers from skiffs or from shore. Most harvesters were found to use a wooden pole, either a long sapling, a milled pole, or a

2 x 2 board, varying from eight to fifteen feet in length. Fish hooks of various types and lengths were often tied to end of the pole to lift the sea cucumbers closer to shore. The hooks observed were long shank halibut hooks approximately three to four inches long. Some harvesters straightened or bent the hooks out to a wider angle to allow for better raking action of sea cucumbers, occasionally attaching two or three hooks per pole.

Another type of pole used consisted of a bamboo pole eight to ten feet long with sixteen penny nails driven through, and used to rake the cucumbers in. The sixteen penny nails were driven into one end of pole about one to one and half inches apart, resulting in the nails and pole resembling a "barber's comb". This nail arrangement was also used with the 2 x 2 poles, except holes were drilled into the pole for the nails. Other harvesters used cockle rakes, small dip nets, and brailers to harvest cucumbers. Some continue to use the earlier described *yein - yaanuu* sticks or a forked end stick or branch.

The actual harvest of sea cucumbers differs little between shore or skiff harvest. Both methods are subject to same limitations of the tide and calm weather and seas. The equipment used to perform the lifting has to slice through the water with little effort and be light enough so as to allow retrieval of cucumbers from the water. The sea cucumbers are lifted from the sea bottom, around rocks, and through marine vegetation to within arm's reach. After this they are thrown into the skiff or onto the shore.

With all harvest techniques, once the sea cucumber is lifted off the sea bottom the harvester then must gently guide the floating cucumber to the skiff's side or on shore. Guiding the sea cucumber is similar to moving a floating balloon without grabbing it. Each lifting action of the sea cucumber sends the animal floating upward, then slowly descending. Care is taken not to pierce the sea cucumber with the rake or hooks.

Tides limit the time for both skiff and shoreline harvesting to at least one hour and no more than two hours at a time. On occasion, heavy wave action carries sea cucumbers up beyond the mean high tide line, where they are easily collected at any time before they deteriorate.

Locating sea cucumbers requires local knowledge. Those who purposefully harvest cucumbers

have favorite harvesting sites and know where sea cucumbers can be found, based on information from their personal experience and from that transmitted by others. Respondents remarked that sea cucumbers were found in both rocky and sandy bottom areas but always near sand deposits. Also, they noted higher sea cucumber concentrations were found in eelgrass beds (*Zostera marina*) and flanking freshwater inlets and fans.

One harvester contacted during the study has used scuba diving gear to gather sea cucumbers. Because of the high cost of equipment and training, diving is not a commonly used method for sea cucumber subsistence harvest. One other harvest method mentioned was incidental catch of sea cucumbers by commercial seining. Seine nets used in shallow waters sometimes become fouled with sea cucumbers, which then have to be removed manually from the nets. Individuals working on the seine boats may retain the cucumbers for family use.

Gutting

Sea cucumbers usually are gutted at the harvest site on the boat or on the shore to reduce the weight and volume of the product transported home. One study respondent who was widely known for her skill in gathering sea cucumbers preferred to transport the sea cucumbers whole, back to the harbor floats, to gut and skin them there.

Sea cucumber gutting methods did not vary between communities. The gutting process, if conducted at the harvest site, did not vary between skiff and shore harvest except that on the skiff an oar or board would be used as a cutting surface. Shore harvest would use any flat, firm surface as a cutting board, usually a rock or firm area of sand. In a skiff, the oar or board would be laid across the skiff's gunwales or seat. The gutting process began with cutting off the sea cucumber's head (the mouth). The head was determined by feeling for the harder or more dense end of the sea cucumber or looking for the mouth tentacles. Most respondents determined the location of the head end more by touch than by sight. Once the knife entered the internal sea cucumber cavity, water and internal organs would begin to squirt out. With the head removed completely, or enough to allow the internal organs

an exit, the cucumber was grasped tightly across the cut end to hold the viscera in and held over the water. With the uncut end in one hand, the other hand would begin squeezing the sea cucumber in a sliding motion toward the cut end, thus removing the viscera. Sometimes a second cut off the end of the sea cucumber was necessary to allow the viscera to pass. After the guts were expelled, the remaining sea cucumber body wall was thrown into a bucket. Gutting a sea cucumber took about 15 - 30 seconds depending on the cutting surface and success in cutting an opening large enough to pass the viscera.

Skinning

Most respondents preferred skinned sea cucumbers. Skinning took place at the harvest site (shore or skiff) or back at the community. Respondents noted that, years ago, if there were two experienced sea cucumber harvesters on the skiff, one would collect the sea cucumbers while the other gutted and skinned them. There were several techniques of skinning observed during this study, but all performed the basic action of pulling the five white longitudinal muscles lining the sea cucumber body wall away from the skin. All techniques were designed to accommodate the slimy sea cucumber conditions, varying muscle thickness, and the contracting action of the muscles.

Most harvesters used the following skinning technique. The gutted sea cucumber was placed on a table or similar surface and the anus was cut off. Then a knife was inserted into the sea cucumber body wall to cut the body cavity open, along the sea cucumber bottom side for the length of body. The bottom was identified by the lighter color and the tiny tubed feet. This cutting sometimes caused the cucumber to curl up. Next, the opened sea cucumber end was held against the table with one hand while the other hand either worked the fingers or thumb between the meat and skin. If a knife was used, a shallow cut was made into the meat across the width of the sea cucumber, approximately 1/4 inch deep but not deep enough to cut the skin near the held end. The cut allowed for more of the sea cucumber to be held firmly against the table and allowed easier working of fingers between the meat and skin. Either method allowed the muscle to be grabbed firmly, after which they were pulled away

from the skin. This was not easy to do given the slimy condition of the sea cucumbers. Strong hands and a firm grip were needed to hold the cucumber skin and pull the meat. The skins were discarded, and the cucumber meat was thrown into a bucket or bowl. The meat was then cleaned by rinsing them with cold water and drained for cooking or preserving. Some respondents soaked the meat in salt or fresh water before cooking or preserving. If the meat was to be frozen, not all the slime would be rinsed off the sea cucumbers because the slime is thought to prevent freezer burn.

Another skinning technique that was observed incorporated a commercial slanted cutting board and a "deer skin knife" or finger knife[2] . The cutting board was 1 x 6 board, approximately four feet long which was propped against a wall or similar structure. In the middle of the board's width, toward one end, were three or four nails, longer than the thickness of the board, driven through with their pointed ends protruding. The board was placed against the wall lengthwise with the end with the nails upward and the other end away from the wall toward the skinner. The protruding nail ends allowed the cucumber to be held to the board during the skinning process.

This technique did not involve cutting the other end of the cucumber off because the uncut end allowed the cucumber body wall to be held to the cutting board. The uncut cucumber end was pushed on to the protruding nails. Then the pointed end of the knife was inserted into the sea cucumber's anus, and with a downward motion the cucumber body wall was cut open. The opened cucumber body wall was laid flat, and either a cross cut was made across the top of the cucumber below the protruding nails, or the knife blade's long edge was held against the cucumber below the protruding nails. With the knife's blade edge firmly in the cut or against the cucumber at a 45 degree angle to the cutting board, with both ends firmly held, the knife was carefully drawn down the entire length of the cucumber, separating the meat from the skin. Care was taken to strip the meat as one whole unit, by using a scraping motion back and forth across the cucumber's width, during the downward draw.

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2 The deer skin knife or finger knife is a smaller, plastic version of the Wyoming knife. The knife has a finger hole for the index finger. The knife is designed in a `J' or hooked shape. The `J' shape allows the pointed end of the knife to be inserted into or under the skin of a animal carcass. The `J' shape allows the skin to drawn against the cutting blade of the knife in the curved part of the `J' design providing a uniformly shallow cut avoiding cutting into the animal's viscera.

The skinning technique using the board was faster than the hand held method because it freed up one hand formerly to hold the cucumber's skin against the table. Many study respondents were interested in this new technique because it was faster and took less energy to complete the skinning task.

Preservation and Utilization

Contemporary users preserved sea cucumbers in two ways, by canning (usually in jars) and freezing. The canning process consisted of par-boiling the meat, sterilizing the jars and lids, inserting meats, and sealing. Cucumber meat was par-boiled long enough for the meat to straighten out and was rolled into the jars standing straight up. Meat from six to eight sea cucumbers fit into a quart jar.

Preserving by freezing required a less than thorough cleaning because the slime protected the meat from freezer burn. After draining the sea cucumber meats, meat from 25 - 35 sea cucumbers would be placed into quart size plastic freezer bags and frozen. Smaller plastic freezer bags could also be used. Some respondents reported freezing sea cucumbers in salt water. Most families contacted in 1990 reported freezing sea cucumbers.

Fresh or frozen skinned sea cucumber meats were prepared by frying, boiling, and roasting. Frying consisted of pan as well as deep fat frying. Residents of all study communities often added the pan fried or boiled sea cucumber meat to fried rice recipes. Many enjoyed eating the pan fried sea cucumber, fried in butter or in butter with garlic, or fried bacon, as the meal's main dish. One respondent's favorite recipe was to roll them in cornmeal before frying. With deep fat frying, the cucumber meats were fried battered or unbattered, and served as a main dish.

Sea cucumber meat was boiled for chowder, stews, and for camp meals. The boiled meat would be cut into small pieces and added to the chowder or stew ingredients. One respondent boiled the cucumbers with seaweed, saying this was how it was done years ago. For camp meals, a small metal can was placed on the campfire with water. Cucumber meat was added when the water boiled and cooked until the meat changed to an opaque white.

Sea cucumber meat was roasted in the oven or over the campfire. With oven roasting, the cucumber meat was laid on top of a stuffing mix and roasted in the oven until done. Campfire roasting continued the traditional methods of roasting, using a devil's club stick, throwing sea cucumber into the fire, and ringing the fire's edge with sea cucumbers. Some respondents mentioned that before throwing the gutted sea cucumber into the fire they would hit it with a stick until it became very hard and dense from muscle contraction. This would make it easier to cut into small round rings after roasting.

Seasonal Cycle of Harvest Activity

Residents of all three 1990 study communities concentrated their sea cucumber harvest around the spring sea cucumber movement from deeper waters to shallow, warmer waters. It was noted by several Hydaburg respondents that sea cucumbers were collected year-round if in they were found in shallow waters. Most of Hydaburg's reported harvest did occur during spring and summer. The fact that sea cucumbers were taken year-round suggests the occasional presence of these animals in relatively shallow water, throughout the year. As is the case with other subsistence harvests, sea cucumber often are taken incidentally to other species, while on harvesting or fishing trips, or while gathering other marine invertebrate species such as abalone (*Haliotis kamtschatkana*). Harvesting sea cucumbers typically begins in early March, continuing through September, with most effort taking place in April, May, and June. Respondents reported they prevent over harvesting of sea cucumbers by rotating harvest sites, leaving some sea cucumbers alone in harvest areas.

Several reasons were given for the reduced harvest activity during late summer and early fall. Reasons for some respondents were their increased involvement with commercial fishing at this time, switching to subsistence harvest of finfish, avoiding interference with sea cucumber spawning, the seasonal reduction in sea cucumber size and weight, and the increased difficulty in seeing the sea cucumbers due to algae blooms. Harvest of sea cucumbers in late fall was generally avoided because of the sea cucumber's viscera atrophy, which results in a noticeable reduction in size and weight of the

animal. Visceral atrophy occurred in late summer (July - August) in the Hydaburg area and early fall (September - October) in the Klawock - Craig area, according to study respondents.

With the use of freezers and associated long term preservation, spring and early summer sea cucumber harvests provided enough sea cucumbers for year-round utilization for those who prized sea cucumbers. Those who enjoyed eating sea cucumbers fresh collected only what they needed for a meal and did not preserve for future meals.

Harvest Sites

Marine invertebrate harvest areas for communities in the region are known from previous Division of Subsistence studies (see methodology). Most sea cucumber harvest sites probably fall within these areas. Harvest areas are necessarily generalized on these maps; standard Division of Subsistence mapping procedures result in harvest area maps that are drawn at a scale of 1:250,000 or less, a scale that is too small to allow precision in disclosing community harvest sites. Also, for each study community, household harvest areas are generalized to create a community harvest map.

Marine invertebrate harvest areas for communities of the region are illustrated on Figures 6 through 9. These are areas that have been identified by community residents as areas they have used for harvest of marine invertebrates during the time they have lived in the community. This information is based on Division of Subsistence records, supplemented with information from Coastal Management plans for many communities. In the case of Hydaburg's harvest areas, sea cucumber harvest data from the 1990 study also contributed to the map.

Mapped marine invertebrate harvest areas represent near-shore shallow intertidal areas surrounding the communities, which are accessible at low tides. Mapped areas cover approximately one third of Southeast's shoreline. These same areas would probably be attractive to participants in a commercial dive fishery because of their location relative to communities, easy access, shallow water, and generally abundant sea cucumber populations.

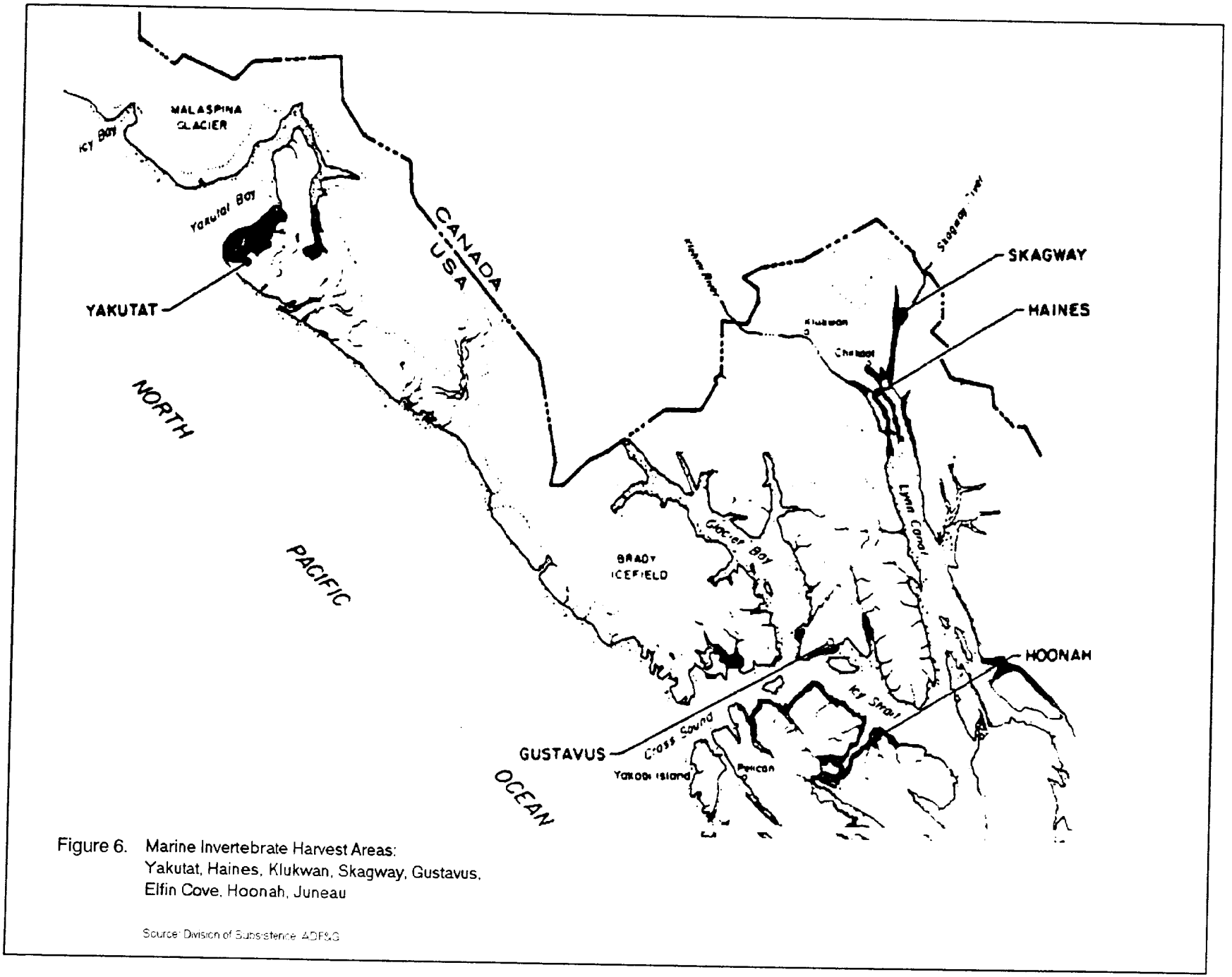

Figure 6. Marine Invertebrate Harvest Areas: Yakutat, Haines, Klukwan, Skagway, Gustavus, Elfin Cove, Hoonah, Juneau

Source: Division of Subsistence, ADF&G

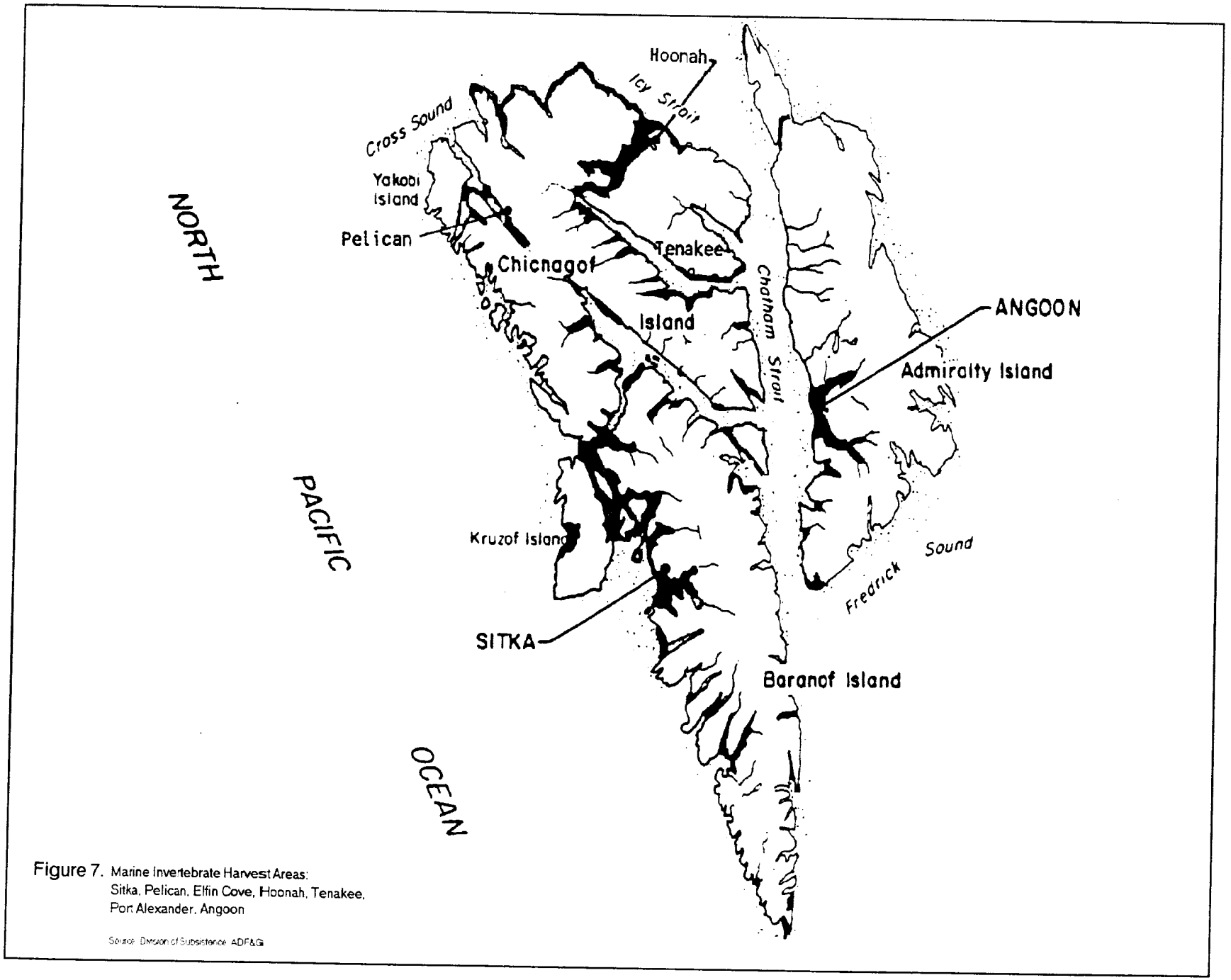

Figure 7. Marine Invertebrate Harvest Areas: Sitka, Pelican, Elfin Cove, Hoonah, Tenakee, Port Alexander, Angoon

Source: Division of Subsistence, ADF&G

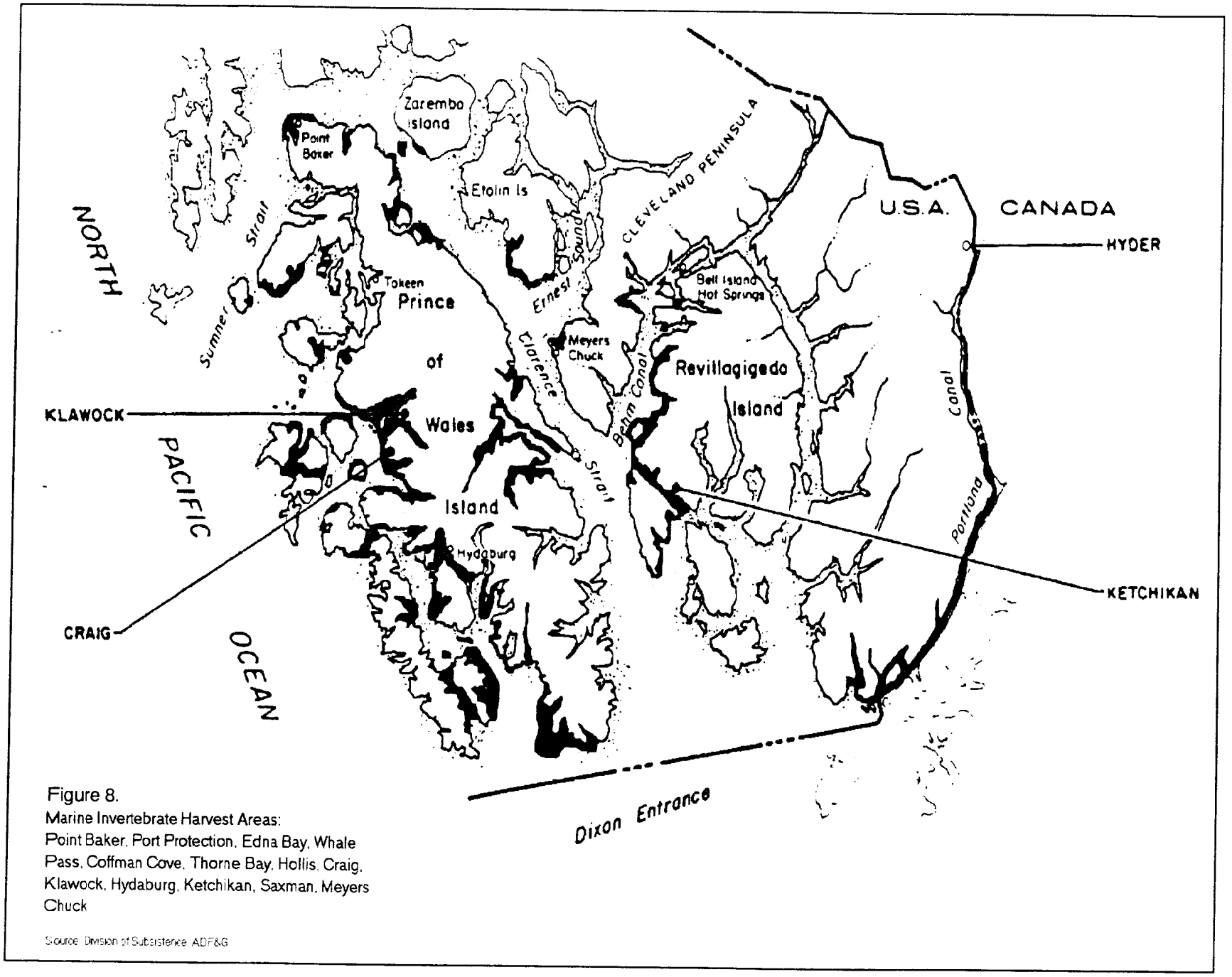

Figure 8.
Marine Invertebrate Harvest Areas:
Point Baker, Port Protection, Edna Bay, Whale Pass, Coffman Cove, Thorne Bay, Hollis, Craig, Klawock, Hydaburg, Ketchikan, Saxman, Meyers Chuck

Source: Division of Subsistence, ADF&G

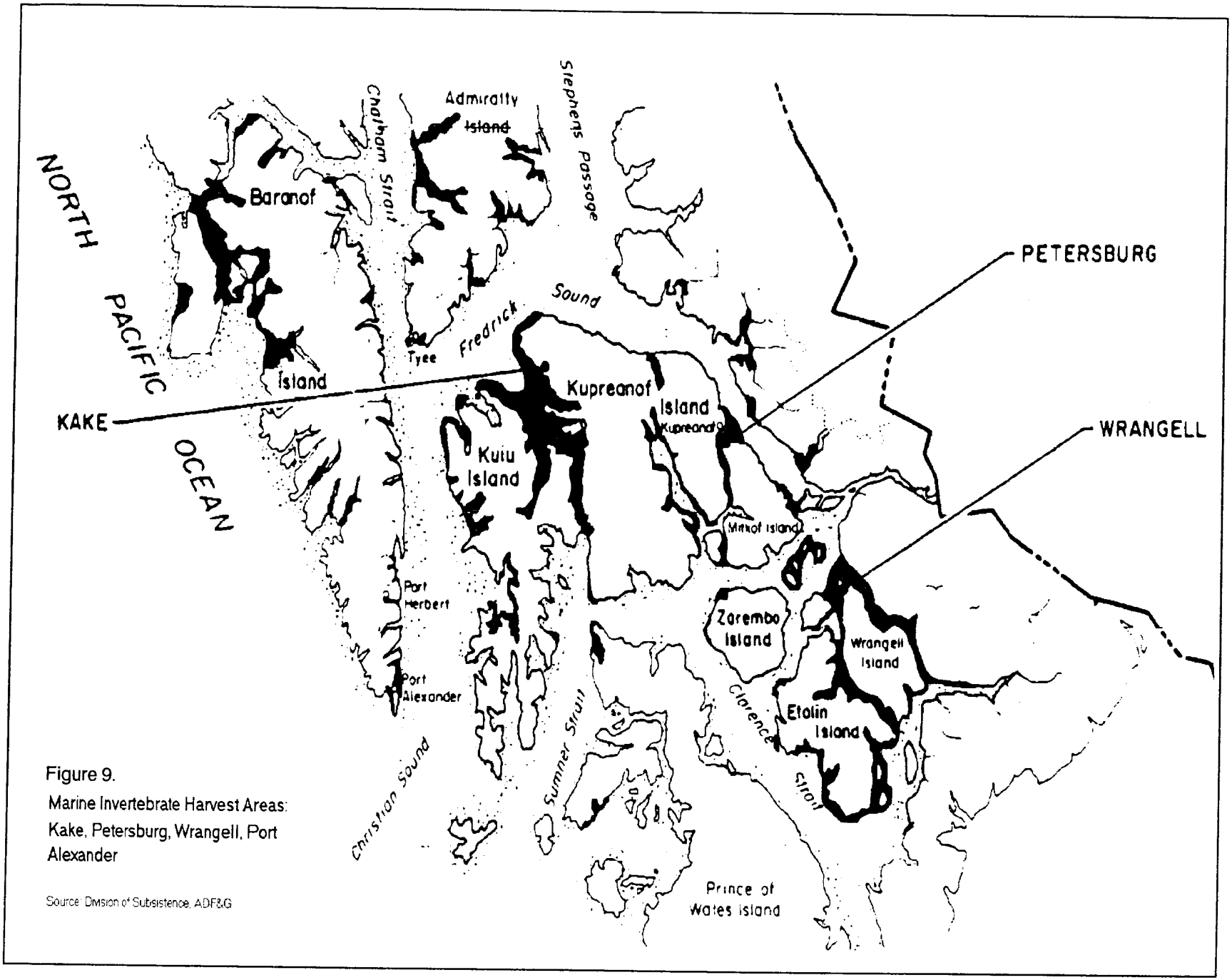

Figure 9.
Marine Invertebrate Harvest Areas: Kake, Petersburg, Wrangell, Port Alexander

Source: Division of Subsistence, ADF&G

DISCUSSION

Sea cucumbers have been a regularly harvested food species throughout the historic period, particularly for Alaska Natives living in the southern portion of the Alexander Archipelago. In the course of this study, *Parastichopus californicus* was found to be the species most commonly harvested for subsistence. This is the same species of sea cucumber that is of interest to a rapidly developing commercial fishery. Contemporary means of subsistence harvest and methods of preparation have changed little from those used in an earlier era. Although sea cucumber use originated with the Tlingit and Haida of the region, and sea cucumbers continue to be used as a traditional Native food, participation in harvest and use of sea cucumbers in some predominantly non-Native communities was also significant. This species is one of numerous intertidal species that are important components of subsistence harvests in the region.

In the study communities of Southwest Prince of Wales Island, many harvesters use specific areas for sea cucumber gathering, and make special trips annually to harvest this resource. Sea cucumbers may occasionally be taken on generalized intertidal harvesting trips or incidental to other activities. Subsistence harvest areas may change over time due to changes in resource abundance and distribution or to other factors; therefore the areas that are most important at the present time may not be the only areas where subsistence harvests may take place in the future. Subsistence sea cucumber harvest takes place in the intertidal zone. Most harvest takes place in spring and early summer, which are times when many other intertidal species are not used, due in part to the possibility of paralytic shellfish poisoning.

Residents of study communities understood sea cucumber life cycles, particularly those features that had the potential to affect subsistence harvest. They noted the type of intertidal areas where sea cucumbers were found, the seasonal migrations of sea cucumbers, and some of the annual anatomical changes that take place in this species. Interview respondents also said they had observed association of immature sea cucumbers with adult animals, with young sometimes clinging to the adult bodies. This has not been reported in the literature. Further discussion of the sea cucumber life cycle

with subsistence harvesters might assist in filling out our biological understanding of this little-studied species, and identify localized changes in population distribution or abundance over time.

In the course of field work in study communities, researchers found that sea cucumber management was of serious concern to subsistence harvesters in Craig, Hydaburg, and Klawock. They believed that unrestricted commercial harvest of sea cucumbers had the potential to severely reduce or eliminate sea cucumbers from traditional harvest areas. They suggested that these areas be closed to commercial harvests and that other management actions be taken as needed to maintain the subsistence harvest. The continued dietary and cultural importance of subsistence harvest of this species and active community interest shown in its management suggests the need for close involvement of local residents in regional sea cucumber management plans and programs.

A broad issue that is represented in the case of sea cucumber management in the region has to do with the effects of commercialization of a resource previously used solely for subsistence purposes. One aspect of this issue relates to the possibility of over harvesting the resource to the point where it is no longer available for subsistence harvest. In the case of sea cucumbers, it is possible that sea cucumbers might be harvested in subtidal areas, in a commercial dive fishery, to a degree that is commercially sustainable but with the effect of decreasing the availability of sea cucumber in intertidal areas, where they are gathered for subsistence food. As mentioned above, identifying "refuge" or "community use" areas, off-limits to commercial harvesting, is one management tool that has been suggested as a means to protect important subsistence harvest areas. This approach requires better definition of subsistence use areas than has been possible in the context of this report. Another management approach would be to set harvest quotas in particular areas that would harvest a sufficiently small proportion of the available sea cucumber biomass that their abundance in intertidal harvest areas would not be disrupted. This approach requires knowledge of the size of the sea cucumber stock abundance in an area, prior to any harvesting. These and other management options are being considered as a part of the sea cucumber management planning effort in the ADF&G, Division of Commercial Fisheries.

Another important aspect of the commercialization issue relates to community involvement in

commercial development of the sea cucumber resource, to a degree that provides local economic benefits and also provides a degree of local management control. Management policies that would favor local participation in the fishery might include weekly fishery closures, or requirements for local, shore-based sea cucumber processing.

This latter point is one that appears not to have been thoroughly addressed at the community level. At present, commercial sea cucumber exploitation is viewed in many communities primarily as a phenomenon whereby large, well-financed, out-of-state vessels and crews would compete with local harvesters, subsistence and commercial, for a limited resource. Recent experiences in the commercialization of sea cucumber have seemed to reinforce these concerns. In some areas, informal local agreements have been used to avoid conflicts among user groups. But other research in Alaska suggests that mechanisms and policies can be developed whereby new fish resources are exploited in a manner that benefits small-scale, local economic development efforts, while still protecting subsistence stocks and harvest areas (cf. Wolfe 1984). Such an economic development model promotes local autonomy and control of harvesting and factors of production (resources, labor, capital). The potential exists for enhancing subsistence harvesting, by providing households with the capital that is needed to finance their subsistence harvest efforts.

In the case of commercial fisheries that are still undeveloped in the region (clams or sea urchins, for example), compatibility with prior uses is very likely to be an ongoing concern. Accordingly, establishing the basis for compatibility should be a primary management goal. It is the hope of the authors that this report will contribute to this effort.

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