GWAII HAANAS

SOUTH MORESBY NATIONAL PARK RESERVE

REVIEW OF VERTEBRATE FISHERY RESOURCES

Prepared for:

CANADIAN **PARKS SERVICE**

R. Hamilton

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GWAII HAANAS - SOUTH MORESBY NATIONAL PARK RESERVE
REVIEW OF INVERTEBRATE FISHERY RESOURCES

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1.0 EXECUTIVE SUMMARY

INTRODUCTION

This review of fisheries resources focuses on the South Moresby/Gwaii Haanas area of Haida Gwaii and was prepared to facilitate a discussion of fisheries management among the Canadian Parks Service, the Council of the Haida Nation and the Department of Fisheries and Oceans (DFO). The vertebrate species occumng in the study area which are reviewed in this report include the six Pacific salmon species (chum, pink, coho, sockeye, chinook, and steelhead trout), hemng, halibut, sablefish, lingcod and three species of inshore rockfish. The invertebrate fisheries are reviewed in a companion report.

THE FISHERIES RESOURCES

Salmon, halibut and hemng are abundant in Haida Gwaii waters. Haida Gwaii has more than 170 salmon producing stream systems, and most support productive chum, pink and coho runs. Small but prized runs of sockeye occur in 17 streams with lakes and steelhead trout occur in about 30 streams. Migrating salmon originating from other Pacific coast streams are regularly found in the inlets and surrounding waters. Hecate Strait, Dixon Entrance and the west coast of Haida Gwaii are also productive feeding and rearing areas for chinook, coho salmon and halibut. Pacific halibut from Haida Gwaii intermingle with stocks from other areas of the Pacific coast. Major halibut spawning grounds occur at Langara Island, Whaleback (Frederick Island) and Cape St. James. Important hemng spawning grounds occur in shallow inshore waters, and are particularly concentrated in the study area. Hecate Strait is a significant feeding and juvenile rearing area for hemng.

Sablefish are found in deep water along the continental shelf. Relatively little is known about the mainly non-migratory lingcod and rockfish stocks on Haida Gwaii.

All the fish species described in this report have been harvested in traditional Haida fisheries and their products have been used for food and sometimes for trade. Haida fishing methods and locations are not well documented, but available ethnographic and archaeological evidence indicates considerable reliance on these and other fisheries resources. Traditional Haida fisheries continue, especially for sockeye, chinook and other salmon, halibut, herring spawn-on-kelp, lingcod and rockfish.

Recreational fisheries on Haida Gwaii target mainly on salmon. Ocean fisheries occur mainly for trophy chinook, coho and halibut. Lingcod and rockfish are often caught incidentally. River fisheries occur for spawning coho and steelhead. The number of recreational anglers on Haida Gwaii has increased tremendously since 1985, to more than 7,800 at the northern end of the archipelago (Area 1) in 1989. In 1990, there were eight major commercial fishing lodges on Haida Gwaii targeting mainly on trophy chinook. Three operated at Langara Island, three at Naden Harbour, and two at west coast locations. Subsistence and local recreational anglers account for only a small proportion of documented fishing effort.

The value of the commercial vertebrate fisheries on Haida Gwaii in 1988 was $72.8 million which was 15% of the value of British Columbia landings. Commercial salmon and halibut fisheries have occurred on Haida Gwaii for the past century. Salmon fisheries include terminal net fisheries for chum and pink salmon, interception net fisheries for sockeye and pinks, and interception troll fisheries for chinook, coho, sockeye and pinks. Salmon landings comprised $37 million or more than half of the total landed value of vertebrate fisheries on Haida Gwaii in 1988. About 60% of British Columbia halibut landings are from Haida Gwaii, and Haida Gwaii landings had a value of $15 million in 1988. The herring fisheries on Haida Gwaii account for about **12%** of British Columbia roe herring and about 40% of herring spawn-on-kelp landings.[1] Haida Gwaii sablefish landings had a value of about $7.2 million in 1988 and account for about 40% of British Columbia sablefish landings. Lingcod and rockfish are caught mainly incidentally in trawl and longline fisheries and Haida Gwaii landings had values of $350,000 and $4.8 million, respectively in 1988.

BASELINE FISHERIES DATA

Considerable baseline information is available for local chum and pink salmon and hemng stocks including historic catch and stock information. In-season estimates of salmon escapement and run size are used to further assess stocks and adjust fishery openings and catches. Information regularly gathered about Haida Gwaii hemng stocks includes abundance by area, age composition and extent of herring spawns. Halibut and sablefish stocks are managed on a coastwide basis and information about age composition, halibut migrations, and fishing effort is regularly gathered to make stock predictions and estimate safe levels of catch for these species. Catch information about local lingcod and rockfish stocks is of

[1] **Based** on 1988 herring spawn-on-kelp landings and average roe hemng **quota,** 1984-1991.

limited use for stock assessments, since catches are mostly incidental to other fisheries.

Catches in **Haida** and recreational fisheries are generally small compared to commercial fisheries. Recreational fisheries catches are estimated by local fisheries officers based on reports by fishing lodges and casual surveys of other **users.** Haida catches are estimated based on Indian Food Fish permits and are incomplete, since these are usually only taken out when commercially licensed vessels are **used.**

RESOURCE MANAGEMENT

Regional catch quotas are outlined in annual management plans for salmon, hemng, halibut and sablefish fisheries. Migrating salmon stocks and intermingling halibut stocks are managed by the Pacific Salmon Commission and the International Pacific Halibut Commission through Canada/United States agreements such as the Pacific Salmon Treaty (1985) and Pacific halibut conventions (beginning in 1923). Fisheries for migrating salmon stocks are managed by **gear,** based on domestic net and troll allocations. Terminal salmon fisheries are managed based on target escapements to key stream systems.

No stock assessments are available for Haida Gwaii lingcod and inshore rockfish. Rockfish quotas have recently been established, however, for longline and directed hook and line fisheries.

Local DFO staff are responsible for monitoring and surveillance of Haida Gwaii fisheries, including fisheries openings and closures. On-island staff includes, the District Supervisor, a habitat biologist, and five Fisheries Officers whose activities focus mainly on the salmon and hemng fisheries. Limited entry licensing presently controls fishing effort in the salmon, roe herring, herring spawn-on-kelp, halibut and sablefish fisheries. The herring spawn-on-kelp, sablefish and halibut fisheries are presently controlled by individual vessel quotas implemented in 1975, 1990 and 1991 respectively.

FISHERIES MANAGEMENT NEEDS

Fisheries management effort in the study area is focused mainly on the actively managed commercial salmon and herring fisheries. Terminal salmon fisheries for chum and pink salmon require frequent estimates of in-season escapement and abundance. The roe hemng fishery requires careful timing to achieve high **roe** quality and avoid overfishing by the large and highly efficient fleet. Fisheries for halibut and sablefish require less monitoring on the fishing grounds since they are currently managed based on coastwide and individual vessel quotas and landings are monitored by observers at landing **ports.**

Salmon quotas for interception troll and net fisheries are readily managed through landing information. Chinook target catch ceilings in interception net fisheries (outside the study area) are more difficult to achieve. Some management shortcomings in terminal fisheries include difficulties in accurately enumerating salmon escapement in the large number of salmon producing streams and limited understanding of optimum escapements. The habitat database for study area salmon streams is incomplete and anecdotal, and should be updated according to approved stream survey methods (e.g. FHIIP). Monitoring of catch and fishing effort in sub-areas and separation of the study area into a new Statistical Area, would assist in regular assessments of the overall status of study area stocks.

Fisheries management concerns in the study area relate to passively managed stocks, such as coho salmon, lingcod and rockfish for which less baseline information is available. Escapement information for local coho stocks is poor but stocks appear to be declining. Accurate monitoring of key coho streams and studies of coho productivity would help to develop conservation strategies for these stocks. Lingcod and inshore rockfish are subject to overfishing, due to their generally non-migratory nature. Commercial harvest of rockfish and lingcod in the study area should be assessed. Fisheries monitoring could be improved by expanding the scope of the Haida Fisheries Program and Haida Gwaii Watchmen Program in the study area.

There is limited information about Haida and recreational fisheries in the study area. Increasing tourism in the area may lead to increasing harvest of bottomfish such as rockfish and lingcod. Regular assessments are needed to detect such trends.

The existing licensing and fleet management system sometimes causes difficulties, particularly in harvesting small, discrete salmon and herring surpluses. Excess fleet capacity results in a risk of overfishing and sometimes caused missed fishing opportunities. Individual vessel quotas (IVQs) in the halibut and sablefish fisheries have reduced these risks and are expected to improve product value and

catching efficiency. IVQs require increased management effort, including careful catch monitoring and more costly, extended surveillance, however.

FISHERIES POLICY

Development of a fisheries policy for local stocks within the study area must involve the Canadian Parks Service, Council of the Haida Nation and DFO and should address Haida, recreational and commercial fisheries issues. These should include conservation issues such as local coho stocks and legal and social issues relating *to* aboriginal rights and claims and licensing.

Haida participation in the commercial fishery needs to be reviewed in the context of aboriginal rights and title. Haida participation in commercial fisheries in Haida Gwaii waters has declined. Recent DFO policy changes such as limited entry licensing, individual vessel quotas and area licensing may contribute to this decline. Hence, the present situation should be carefully reviewed and no changes implemented in the study area, until changes in Haida participation are examined.

The present fleet management system in the salmon and hemng fisheries makes precise catch management difficult in the study area. Alternative management systems should be investigated to prevent overfishing which take Haida interests into account.

2.0 OVERVIEW

INTRODUCTION

This review of vertebrate fisheries on Haida Gwaii/Queen Charlotte Islands, focuses on the Gwaii Haanas/South Moresby Island area and provides a framework for discussion of fisheries management among the Canadian Parks Service, the Council of the Haida Nation and Fisheries and Oceans Canada (DFO). This report concentrates on the important vertebrate fisheries for salmon, halibut, hemng, sablefish, lingcod and rockfish. Invertebrate fisheries for shellfish are reviewed in a companion report.

The study area (Map 1) is referred to as Gwaii Haanas by the Council of the Haida Nation and the South Moresby National Park Reserve by the Government of Canada and for the purposes of this study includes the intertidal zone, the streams and surrounding waters. For consistency, Haida Gwaii will be used throughout the report to refer to the Queen Charlotte Islands, and is used generally to discuss fisheries that occur in DFO statistical Areas 1, 2W and 2E. This first section of the report provides a general overview of the important fisheries on Haida Gwaii, including the history of use and resource management, and outlines the general fisheries management concerns.

THE VERTEBRATE FISHERIES RESOURCES

Six species of Pacific salmon spawn in Haida Gwaii streams; chum, pink and coho salmon are the most abundant and occur in most of the more than 170 documented salmon streams; sockeye occur in about 17 streams with lakes; steelhead occur in about 30 streams; and chinook in only the Yakoun River. The waters of Haida Gwaii are important rearing areas and migration pathways for salmon particularly chinook, sockeye and pinks. Baseline information about salmon stocks is extensive, and includes historical catch and escapement records, anecdotal stream reports and habitat information, results of enhancement projects and other information. Since the data collection methods have varied over the years, caution must be used in interpretation of historical information.

Hemng spawning grounds are found in the study area, and are the focus of significant spawn-on-kelp and roe hemng fisheries. Information about hemng stocks is regularly collected in annual test fisheries and spawn assessments to predict future stocks and estimate allowable catches.

Halibut are abundant in Haida Gwaii waters and are found at feeding, rearing and spawning grounds. Major spawning grounds are found at Cape St. James,

Whaleback (Langara Island) and Frederick Island. The only other major spawning grounds in British Columbia occurs at the Goose Islands, but stocks there have declined seriously over the past decade. Through catch monitoring, tagging and other studies, information about age at catch, migration, etc. are regularly collected to assist in annual stock assessments.

Sablefish are a long-lived fish commonly found the on the west coast of Haida Gwaii and along other parts of the continental slope at depths from 500-1500 m. Regular sablefish stock assessments are made based on information collected from the commercial fishery, including age, catch and catch per unit effort. Juveniles are thought to rear in coastal areas and then migrate to deeper offshore waters. Strong year class variations, slow adult growth and changes in the age structure of the population have been observed as a result of the commercial fishery.

Lingcod and rockfish are territorial and generally do not stray far from their rearing areas. Stocks are difficult to assess, since catches are incidental to other fisheries. Very little local information is available about the three focus rockfish species, yelloweye, quillback and black rockfish. Serious declines in lingcod and rockfish abundance have been observed in the Strait of Georgia, where closures or quotas are now in effect. Both lingcod and rockfish are susceptible to overfishing and recovery of stocks, is expected to be slow, due to local spawning, limited dispersion of eggs and young from spawning areas, and slow growth, especially for rockfish.

All species have been harvested to some degree in Haida, commercial and recreational fisheries as described in the following sections.

THE HAIDA FISHERIES

Fish has always been an important item for food and trade for the Haida. While detailed studies of Haida use of plants (Turner 1971) and marine invertebrates (Ellis and Wilson 1981) have been compiled, comprehensive studies of the other important food sources of the Haida - fish, marine mammals and birds - are not complete. Considerable ethnographic information about Haida use of fish was recorded by Ellis (1972-80) and a few fragmentary studies exist (Blackman 1975; Newcombe and Newcombe 1870-1955).

Halibut and chum were probably the most important fish species to the Haida due to their availability and preservative qualities. Halibut can be harvested year round, in large quantities, and could be preserved by drying as *ts'ilgi*. Chum are available in great numbers during spawning and are a lean fish, with good preservative qualities when dried or smoked. Both species are often referred to

in Haida myth. One well known Haida story (Ellis 1972-80) relates how the "chum salmon people" travelled to this world to spawn, but found no water in the creeks. The chief of the chum salmon then poked the clouds with his staff to make it rain.

Other salmon species - pink, sockeye, coho, chinook and steelhead - were of local importance depending on the size and timing of returning runs. All species could be caught in nets and traps in the rivers, at various times. Chinook spawned only in the Yakoun River, but trolling for ocean-going chinook also took place.

Herring, sablefish, lingcod and rockfish were also utilized by the Haida. Herring spawn-on-kelp is a favourite delicacy still harvested for food and trade. Sablefish oil was a special trade item, which required considerable energy and skill to obtain. Lingcod and rockfish, especially yelloweye, are still caught and utilized fresh in many areas during the winter. Other marine species, including dogfish, sole, greenling, Pacific cod, shiner and pile perch, cabezon, smelt and capelin were also of local importance in some areas of Haida Gwaii (Ellis 1972-80).

Fish is still an important item for food and trade for the Haida. Records about Haida catch of salmon have been reviewed by Argue (1985) and Anon (1988a). The historical information is fragmentary and incomplete and is currently gathered mainly for salmon fisheries using permits. Information about other species is poor although some fisheries such as herring spawn-on-kelp have been regularly monitored in recent years.

THE RECREATIONAL FISHERY

Recreational fisheries are important for chinook, coho and steelhead; halibut; and for lingcod and rockfish to a lesser extent. Chinook are targeted in a mainly commercial recreational fishery which has developed since 1985. There were approximately eight major fishing lodges operating on Haida Gwaii in 1991, expecting to accommodate more than 6000 customers. Most of these customers are seeking trophy chinook which are fish larger than 30 pounds (13.5 kg). The recreational chinook catch on Haida Gwaii in 1989 was 20,600 or almost 60% of the catch on the North Coast. Coho are targeted by recreational anglers and fishing lodges in the fall in some areas such as Skidegate Inlet, Cumshewa Inlet and Selwyn Inlet. Steelhead populations are small and fragile, but support small recreational river fisheries.

THE COMMERCIAL FISHERY

Salmon, Pacific halibut and Pacific herring are the three most valuable fisheries on Haida Gwaii. Sablefish, lingcod and rockfish are also commercially harvested. In 1988 the total value of the commercial fishery (not including shellfish) was $72.8 million' and relative value by species is presented in Figure 1. This represented 15% of B.C. landed value (not including shellfish)', which is shown by species in Figure 2. Relative value by fisheries management area is shown in Figure 3.

Salmon

Salmon is the most valuable commercial fishery on Haida Gwaii with a value of $37.4 million in 1988. Chum, pink and coho salmon are captured in terminal commercial net and troll fisheries in many of the more than 170 salmon producing streams on Haida Gwaii. Interception net and troll fisheries also target on chinook, sockeye and pink salmon bound for other river systems.

Pink.' and chum landings from Haida Gwaii had values of $10.3 and $6.6 million, respectively, in 1988. Local stocks are an important component of the catch, although pinks from other areas such as the Skeena and Fraser River are intercepted in Haida Gwaii net and troll fisheries. Coho are harvested mainly in troll fisheries and had a value of $6.1 million. The 1988 catches were 35% of record landings of 841,000 coho which occurred in 1986 and 1990. Escapements of local coho stocks are depressed according to target and historic levels. Chinook fisheries are on mixed stocks originating from other parts of the Pacific coast and had a value of $12.1 million in 1988. An average of 168,000 chinook were commercially harvested on Haida Gwaii from 1980-89, which represents more than 60% of the chinook harvested on the North Coast. Sockeye from coastal river systems have been increasingly intercepted in net fisheries on Haida Gwaii, and had a value of $2.2 million in 1988. The 1990 sockeye harvest was the highest on record of more than 1 million fish, which was more than ten times the 1988 harvest. Sockeye are harvested mainly in Area 1 and 2W interception troll and seine fisheries.

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1 Value of shellfish was $3.7 million.

2 Value of 1988 B.C. landings was $483.7 million, not including shellfish which was $41.4 million.

3 1988 was a cycle year for pink stocks on the North Coast.

Halibut

The halibut fishery is one of the oldest on this coast and the stocks among the most valuable. Halibut are abundant in the waters surrounding Haida Gwaii and accounted for approximately 60% of B.C. landings in the past decade[4]. In 1988, halibut landings from Haida Gwaii waters were about 3,900 tonnes, valued at $15.4 million. Commercial halibut fishing gear has changed little over the years, and consists of baited hooks set on long groundlines. The 1990 season consisted of 10 fishing days. Introduction of individual vessel quotas in 1991 will extend the season to year-round.

Herring

The study area includes most of the herring spawning grounds on Haida Gwaii, and supports valuable commercial herring roe and spawn-on-kelp fisheries. The 1988 spawn-on-kelp fishery had a value of $5.6 million, and accounted for about 40% of B.C. landings. Herring spawn-on-kelp had a high market value of $55/kg in 1988, which had declined to less than $36/kg in 1990. A total of 12 out of 38 licences' for spawn-on-kelp operated on Haida Gwaii in 1991. The roe herring fishery was closed on Haida Gwaii in 1988, but quotas from 1984-1991 averaged 4,000 tonnes which is 12% of the average B.C. quota over this period. The roe herring fishery on Haida Gwaii is typically less than one day in the year for seines and one to two days for gillnets.

Sablefish

Sablefish are managed through coastwide and individual vessel quotas, and the 1988 fishery had a value of $7.2 million. That year, Haida Gwaii landings averaged 38% of B.C. landings which is close to the ten year average of 36.6%. Sablefish were harvested historically by Haida people for food and trade, particularly for their oil. The Haida were involved in one of the earliest fishing ventures at the turn of the century, but presently do not hold any of the 48 commercial licences issued by D.F.O.

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4 **Average 1981-1990**

5 **There were 10 new licences issued to Native organizations in 1991, although only one operated on Haida Gwaii.**

Lingcod

Lingcod are harvested incidentally in halibut longline and Pacific cod trawl fisheries. The value of lingcod landings from Haida Gwaii in 1988 was $351,000. There is limited information available about Haida Gwaii lingcod stocks and no commercial quota in place. Lingcod stocks in the Strait of Georgia are seriously depleted and those fisheries are regulated by quotas and seasonal closures.

Rockfish

Rockfiish are harvested, incidentally, in trawl and longline fisheries. However, a directed longline fishery for yelloweye has developed on Haida Gwaii with landings of 181 tonnes in 1988. This fishery has been restricted by a quota set in 1991. Other important inshore rockfish species include quillback and black rockfish.

The Fish Processing Industry

The history of the development of the commercial fisheries in the early days is related to development of saltaries, canneries and fish buying stations, as described by Dalzell (1968). Argue (1985) reports commercial salmon landings on Haida Gwaii since 1888. Fish handling and processing has become centralized in recent years with packers or fishing vessels delivering to major ports such as Prince Rupert or Vancouver. Some local deliveries occur at Skidegate Landing and Massett, mostly of salmon. Following is a brief description of fish processing in the early days in Area 1, Area 2W and Area 2E, including the study area. Various fish-buying stations were also located around the Islands.

A cannery handling spring salmon operated in Naden Harbour in 1910, was enlarged in 1912 and moved to Massett Sound in 1919. A two line cannery was operated in Henslung Cove at North Island in 1919. A large cannery was built at Shannon Bay in Masset Inlet in 1926 and operated until 1940, except for a closure from 1931 to 1935. Various canneries were opened in Massett including Langara Fishing and Packing Company in 1924. A crab cannery which was built in Masset in 1950 operated until recently. A cannery at Tow Hill canned clams as well as fish from about 1924 to 1930, and was bought by Nelson Brothers about six years later. Another cannery was build at old Massett in 1926 and operated until the collapse in 1930.

Within the study area, a fish buying camp for dog salmon operated at **Sedgwick** Bay in 1916 and 1917. A cannery was organized at Lockeport in 1918, but the venture failed. A fishing station, saltery and cannery were periodically operated **at** Pacofi in Selwyn Inlet from 1910 up to the end of 1949. Several salteries were in operation during the 1920s **and** 1930s. Two were in Queen Charlotte City, one **was** at Jedway and one was at Huston Inlet, to the east of Jedway. Abalone were canned for short time near Huston Inlet. **A** processing plant for dogfish oil began operation at Skidegate **as** early **as** 1879 and operated to at least 1912 (Ketchen 1986).

Dalzell (1968) reports a small cannery and fishing station operating at Two Mountain Bay at Tasu from 1911 to 1913, and another at Shields Bay in Rennell Sound from 1917 to 1919. Other fishing stations were located at Hippa Island and in Englefield Bay, near Hibben Island.

RESOURCE MANAGEMENT

DFO Organization and Staff

The Department of Fisheries and Oceans (DFO) assumes a responsibility for salmon, herring and groundfish fisheries in the study area which include fisheries management and regulation, licensing, fish inspection, enforcement, statistics, habitat management, enhancement and research.

DFO have a District Office in Queen Charlotte City, and offices in Masset and Sandspit. Resident DFO staff include the District Supervisor, five fisheries officers and a habitat biologist. Year-round patrols are carried out with three vessels (Pillar Rock, Arrow Post, Sooke Post). Seasonal patrols are *carried* out by small charter vessels during the salmon season.

Haida Fisheries Program Organization and Staff

The Council of the Haida Nation directs a Haida Fisheries Program whose goals include increased Haida involvement in fisheries management. The program began in October 1989 and presently employs five full-time staff including a biologist. Activities to date have included operation of the Yakoun River counting fence in 1990, participation in halibut and geoduck observer programs, monitoring of the Haida spawn-on-kelp fishery, and field training in the herring fishery.

Management Areas

In British Columbia, the nearshore coastal zone is divided by DFO into 29 Statistical *Areas* for fishery management and catch monitoring purposes. The "North Coast" consists of Area 1 to 10 north of Cape Caution, the "South Coast" covers *Areas* 11 to 27 south of Cape Caution and the "Fraser River" is Areas 28 and 29 (See Maps in Appendix B). The Queen Charlotte Islands District, consisting of Areas 1, 2W and 2E is managed from the District office in Queen Charlotte City and divided into smaller sub-areas (Map 2). These statistical areas are used for management of salmon and hemng fisheries and monitoring of catches of halibut, sablefish and other groundfish species.

The halibut fishery is managed and quotas are established according to international management areas established by the International Pacific Halibut Commission (IPHC). The British Columbia coast is treated as one management area, Area 2B (Map 3). DFO records for statistical areas are useful to IPHC for cross-checking information from fish buyers and for information about sales to small buyers that might otherwise be missed. However, the IPHC believes that their statistics on catch are more complete and accurate than those based on the DFO statistical areas (Argue 1985).

Quotas for groundfish including sablefish, lingcod and other rockfish are established and catches are monitored based on international statistical areas designated by the Groundfish Technical Sub-committee of the Pacific Maxine Fisheries Commission (PMFC) as shown in Map 4. The boundaries for DFO minor statistical areas are compatible with boundaries for the PMFC.

Policies and Processes

General

DFO fisheries policies are established by the Minister of Fisheries under the authority of the Fisheries Act. Biological advice is reviewed by the Pacific Stock Assessment Review Committee (PSARC) and subcommittees[6]. Advice on economic and social issues and long term policies is provided by a senior industry advisory group, the Pacific Regional Council (PARC), (Terms of Reference are provided in Appendix B). Other industry advisory groups provide advice on specific species and/or gear types. This includes advisory groups on commercial

[6] There are separate PSARC subcommittees for salmon, herring, groundfish, shellfish, and stock assessment data systems.

fishing and separate advisory groups on recreational fishing (Sports Fish Advisory Boards). In addition, DFO may meet with a variety of Native groups, including the B.C. Aboriginal Peoples Fisheries Commission, the B.C. Interior Indians Fisheries Commission, the Native Brotherhood of B.C. and representatives of First Nations, including the Council of the Haida Nation. However, there is presently no formal, mutually agreed, consultative mechanism between First Nations and the Government of Canada.

DFO policy statements are available on fish habitat (Anon. 1986a), and recreational fisheries (Anon. 19886). A discussion document on future DFO fisheries policy, "Vision 2000", was recently released (Anon. 1989b).

Salmon

The Pacific Salmon Treaty between Canada and the United States applies to all five species of salmon in all areas subject to bi-lateral intercepting fisheries along the Pacific Northwest coast of the United States and Canada. It calls for cooperation in all aspects of fishery management, including research, data collection, and enhancement. The main effects of the Treaty on Haida Gwaii fisheries are on management of the chinook fisheries; Fraser River sockeye and pink salmon; and Boundary Area pink, chum and sockeye.

The status of salmon stocks, habitat and enhancement on Haida Gwaii is outlined in the Pacific Region Salmon Stock Management Plan (Anon. 1986b). Management strategies are described including rebuilding of salmon stocks (through reduced interception, reduced management uncertainty and control of fishing effort) and enhancement of salmon stocks.

Annual troll fishing plans (Anon. 1990b) are developed by D.F.O. Pacific Region in consultation with the Outside Troll Advisory Committee[7]. Catches are limited by Pacific Salmon Treaty quotas, domestic allocations, and stock abundance.

Annual net fishing plans (Anon. 1990a) are developed by D.F.O. Pacific Region in consultation with a variety of advisory committees, including the Queen Charlotte Islands Advisory Board[8]. The Terms of Reference and membership

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7 **Includes representatives of the Northern Trollers Association, the Pacific Trollers Association, the United Fishermen and Allied Workers Union, the Native Brotherhood, *Nuu-chah-nulth* Tribal Council, and the processing industry.**

8 **Other advisory committees include the South Coast, Fraser, Skeena and Central Coast.**

of the QCIAB are provided in Appendix B. Catches are limited by Pacific Salmon Treaty quotas, domestic allocations, and stock abundance.

Herring

Herring stocks are managed domestically, and a herring working group is responsible for developing annual herring management plans. The working group also implements policies and identifies policy issues, develops advisory processes and makes recommendations on hemng research, management and enforcement. Hemng biological advice (e.g. Haist and Schweigert 1989) is reviewed by the PSARC hemng subcommittee. Advice on economic and social issues is provided by a hemng industry advisory board.

Hemng quotas are set based on annual stock assessments and catch forecasts. There are presently 38 herring spawn-on-kelp category "J" licences. Ten of these licences were issued in 1991 to Native Indian organizations. The roe herring fishery is managed by quotas set by area and gear type (Anon. 1990d) and there are presently 252 seine and 1,327 gillnet licenses. A small hemng fishery for food and bait takes place each year. Coastwide roe herring fishing effort is distributed each year, through a process where individual licence holders select fishing areas for the coming season.

Halibut

Pacific halibut stocks intermingle and the British Columbia (Area 2B) quota is set by the International Pacific Halibut Commission (IPHC) under a convention between the United States and Canada. The IPHC is made up of 3 Canadian and 3 U.S. Commissioners. Each year, the IPHC recommends any regulatory changes including quotas to the Canadian and United States governments based on scientific investigations and review of the fishery. Regulation, monitoring and enforcement of halibut fisheries in Canadian waters (Area 2B) is carried out by DFO. The Canadian advisory process for Pacific halibut is informal and occurs by way of an annual meeting with industry representatives just prior to the IPHC annual meeting.

Limited entry licensing was introduced in the Canadian commercial halibut fishery in 1979. There are currently 435 halibut category "L" licences.

Groundfish

Groundfish other than halibut are managed domestically. Annual stock assessments are prepared by the staff of the Groundfish Section of the Fisheries Research Branch for review by PSARC and the groundfish subcommittee (e.g. Tyler and Fargo 1990). Separate industry advisory groups are consulted for sablefish, trawl[9] and hook and line fisheries. The annual Groundfish Management Plan is drawn up by the Offshore Division of the Fisheries Branch.

Coastwide quotas were in place in 1990 for sablefish, dogfish and some species of rockfish. No specific quotas are in place on Haida Gwaii for the lingcod, or the three inshore rockfish species discussed later in the report, yelloweye, quillback rockfish or black rockfish. Some gear specific quotas have been recently established however. A quota for hook and line rockfish of 650 tonnes was established on the North Coast in 1990, and a quota of 200 tonnes was established for areas surrounding Haida Gwaii in 1991 (Anon. 1991b). Trawl fisheries in Haida Gwaii waters are regulated by quotas for target species such as Pacific cod, sole and rockfish. Rockfish catches in the halibut longline fishery are limited to 15% of halibut landings.

FISHERIES *MANAGEMENT* NEEDS

General

DFO staff and resources have been reduced in recent years, while fisheries management needs in the Queen Charlotte District have increased. For instance, changes in management of sablefish, geoduck and halibut fisheries to individual vessel quotas have extended the fishing season and increased the need for accurate assessments of landings. Contracted Observer programs have assisted in monitoring and in on-the-grounds surveillance. The recreational fisheries have increased dramatically in the past five years, and are spreading to areas on the east and west coast of Haida Gwaii.

Research programs on Haida Gwaii are presently very limited. Recent research programs have included the Fisheries/Forestry Interaction Program which was an interagency study of the effects of logging on landslides and fish habitat; and baseline studies of enhancement of sockeye populations in coastal lakes. Development of a coordinated research program for Haida Gwaii should be

[9] Groundfish Trawl Advisory Committee.

considered which addresses management issues such as coho conservation, rockfish populations or other issues.

Salmon enhancement programs on Haida Gwaii began in the late 1970s. A variety of stock enhancement opportunities were described in the Salmon Stock Management Plan (**Anon.** 1986b), none of which were within the study area. Enhancement programs at Pallant and Mathers Creeks have been expanded. A long term strategy should be developed for Haida Gwaii stocks, to address stock improvement and conservation issues.

Haida Fishery

Haida fisheries have not been closely monitored, and catches are small compared to the commercial fisheries. An important current issue is the declines in rockfish and groundfish in some areas, such as Skidegate Channel and Cartwright Sound.

Recreational Fishery

Recreational fishing effort on Haida Gwaii has increased tremendously in the past five years. Most of the increase has been a result of the large fishing lodges, but small charter fishing effort, and numbers of non-resident and resident anglers have also been increasing. Aside from an area registration and management program for the commercial recreational fishery by the Council of the Haida Nation, there is presently no planned or orderly system to control these developments. Related issues include increasing harvest pressure on local groundfish and coho stocks.

Commercial Fishery

There are a variety of management needs in the salmon, halibut, herring and groundfish fisheries, discussed in more detail in later sections of this report. One common issue relates to statistical area boundaries. Designation of the study area as a separate management area for the purpose of statistics and data collection would facilitate any strategies for management of stocks.

GENERAL POLICY ISSUES

Some of the general policy issues concerning Pacific fisheries include aboriginal fisheries and land and sea claims issues, allocation by user or gear type, and current licensing policies.

Claims Issues

Recent legal interpretations of aboriginal fishing rights (R. v. Sparrow 1990) have shown them to be constitutionally protected rights that have priority over recreational or commercial users. Hence, continuing Haida access to fishery resources must be addressed in any discussions of fisheries policy and management in the study area. The commercial sale of herring-spawn-on-kelp or other fish is another major outstanding issue.

Allocation

DFO presently has no formal process concerning allocation of benefits from chinook rebuilding as a result of the Pacific Salmon Treaty. Also, although the Haida people have an interest in the fisheries resources of Haida Gwaii, they are not presently involved in DFO international negotiations, domestic management or allocation processes.

Licensing

Haida participation in commercial fisheries has declined from historic levels. Presently, only a few Haida participate in salmon and herring fisheries. Only one Haida presently has a licence for halibut and none for blackcod, despite the significant fisheries occurring in Haida waters. A recent DFO discussion document provides background on licensing issues including limited entry, individual quotas, Indian commercial fishery policies and area licensing (Anon. 1990c).

Limited entry categories and their dates of introduction are as follows: salmon (1969), roe hemng (1974), spawn-on-kelp (1975), groundfish trawl (1976), abalone (1977), shrimp trawl (1977), general species C license (1979), halibut (1979), sablefish (1981) and geoduck and horse clam (1983). Limited entry was recently introduced in the prawn trap, sea urchin and sea cucumber fishery. Many Native people view limited entry as a means by which their historic rights to participate in fisheries has been seriously eroded.

There are currently five individual quota fisheries in the Pacific Region: spawn-on-kelp (1975), abalone (1979), herring food and bait (1985), geoduck (1989), sablefish (1990) and halibut (1991).

Area licensing is currently **used** in management of four Pacific commercial fisheries; **roe** herring, salmon troll, geoduck, crabs and clams.

Indian participation in the commercial salmon fishery has declined from an estimated high of **30-35% of** the fleet before license limitation to the present level of about **20% of** the salmon fleet. The majority of spawn-on-kelp licenses are held by Indian individuals or bands, however. Recent **roe** herring fishery policy changes[10] are expected to maintain current levels of Indian participation. But coastwide Indian participation in fisheries, other than salmon and herring, remains low. Haida participation in commercial fisheries needs to be reviewed, in the context of Haida ownership and jurisdiction of Haida Gwaii fisheries resources.

Recommendations

The Canadian Parks Service and the Council of the Haida Nation have an interest in the management of the fisheries in the study area. The existing policies and processes to deal with important resource management issues are not adequate. Hence, a forum is recommended to establish policy directions and review management options in the study area. An overall guiding policy and strategy for management of Haida, recreational and commercial fisheries in the study area should address the following priority issues:

- Conservation and protection of fisheries resources
- Data collection and stock assessments
- Infrastructure and resources for adequate monitoring and enforcement
- A research and development strategy
- Resource enhancement
- Provision for Haida needs
- Allocation, licensing and other policies which have social and economic effects on the Haida

10 **A person applying for a** roe **herring licence must have** been **issued a** roe **herring licence the previous year.**

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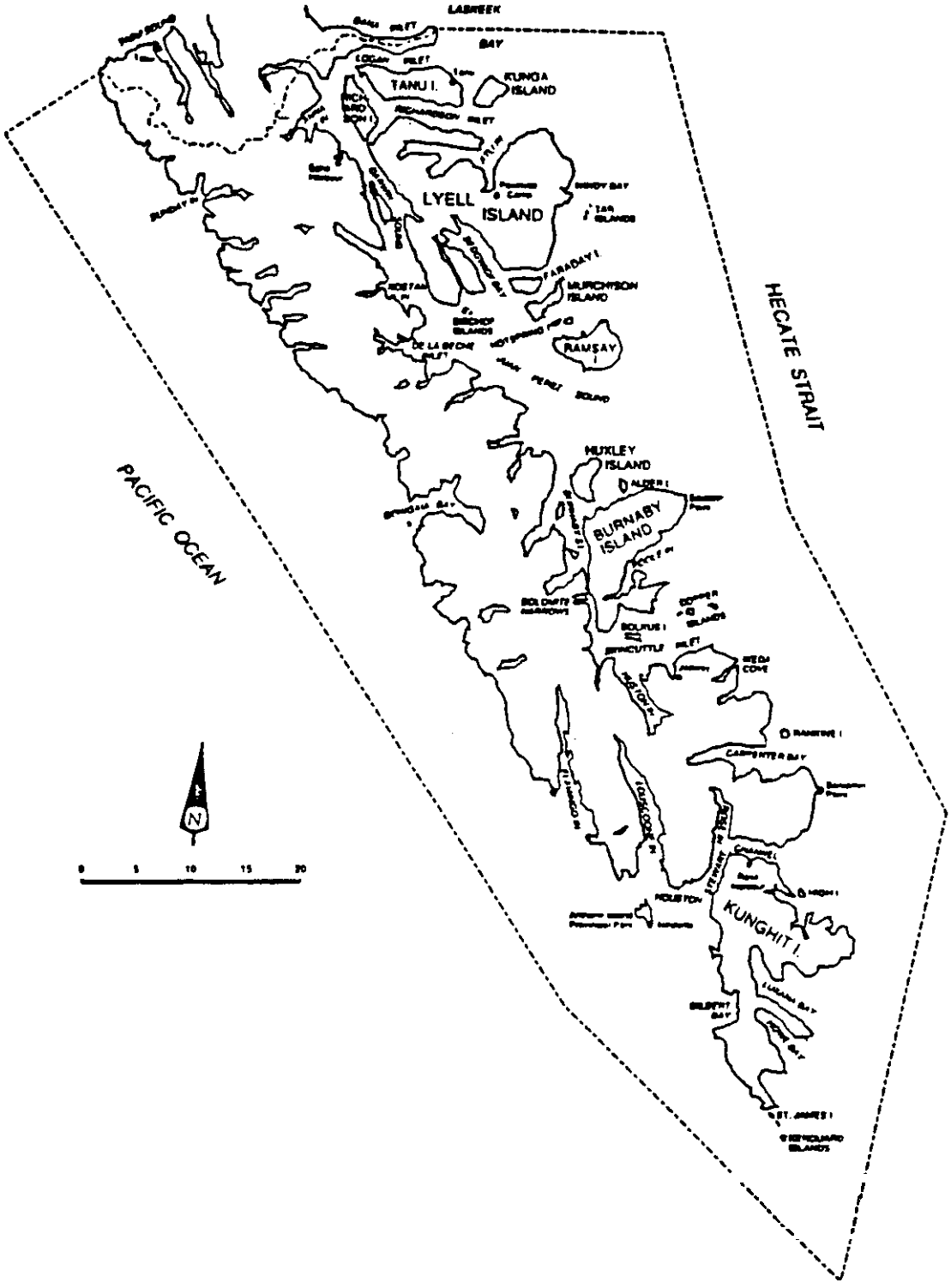


Map 1: **The Gwaii Haanas/South Moresby National Park Reserve Study Area**

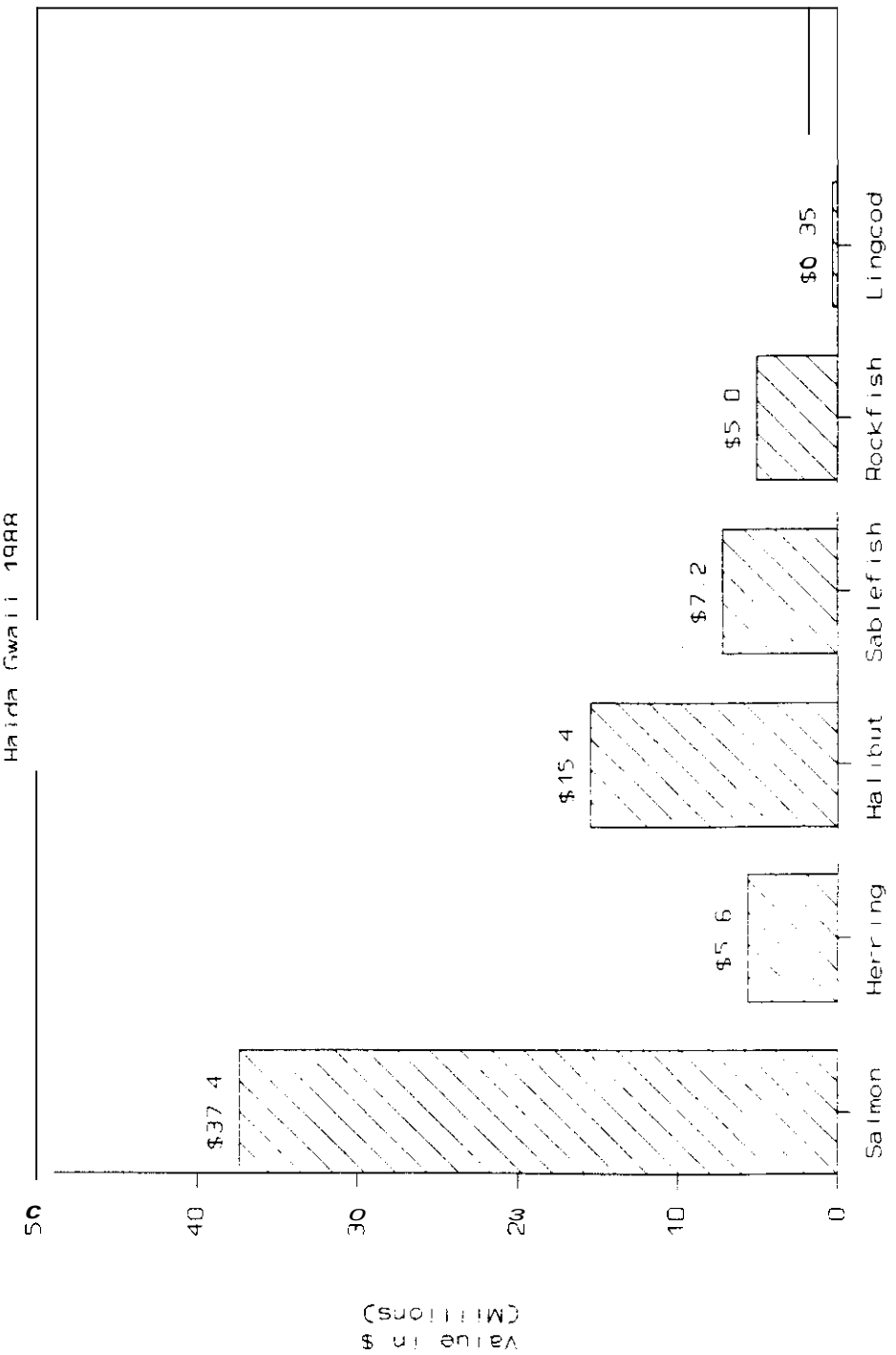


Figure 1: Value of Haida Gwaii vertebrate fishery landings, 1988
Compiled from: British Columbia Commercial Catch Statistics, DFO

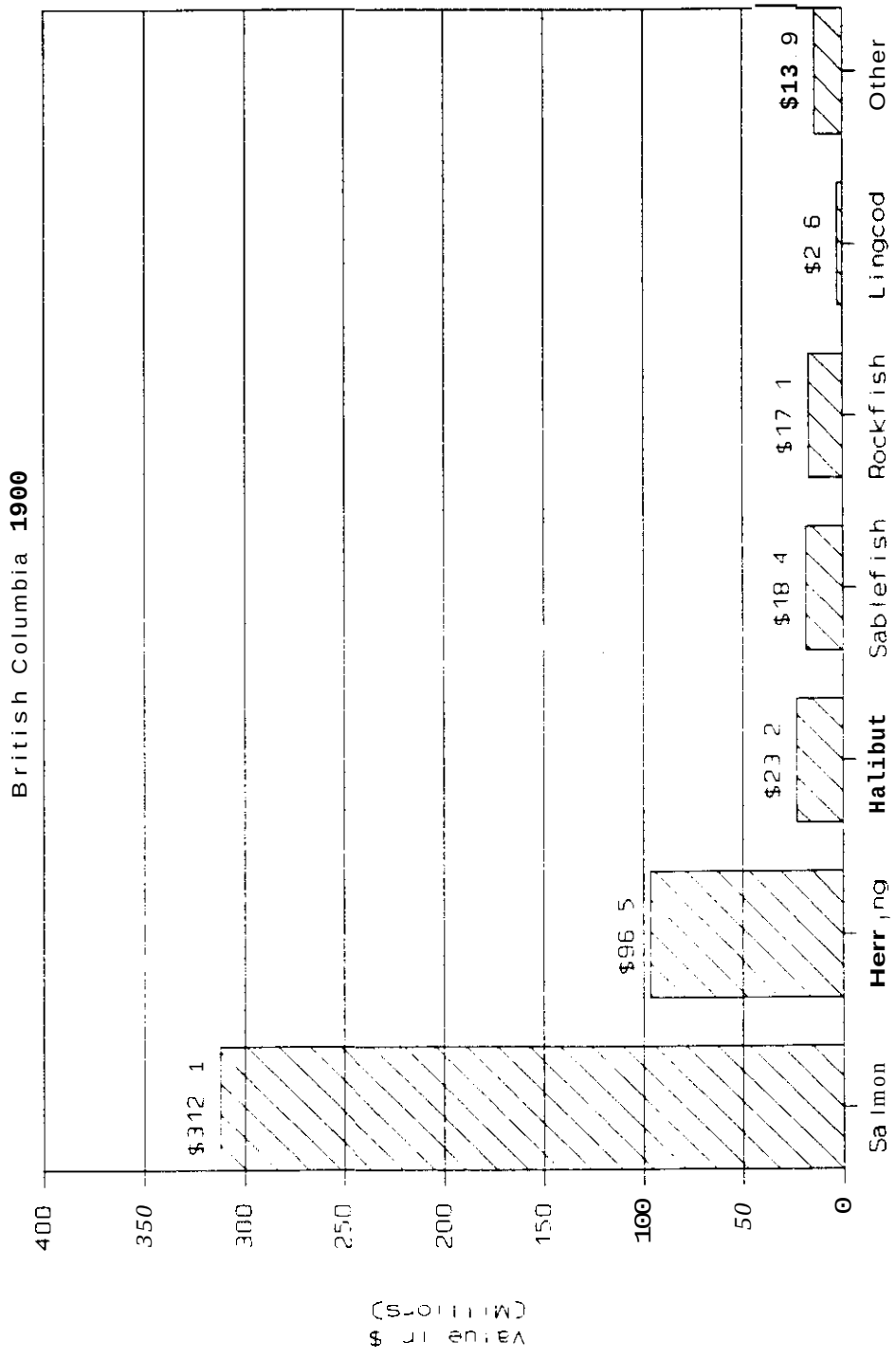


Figure 2: Value of British Columbia vertebrate fishery landings, 1988
Compiled from: Annual Summary of B. C. Commercial Catch Statistics, 1988 (Anon. 1989a)

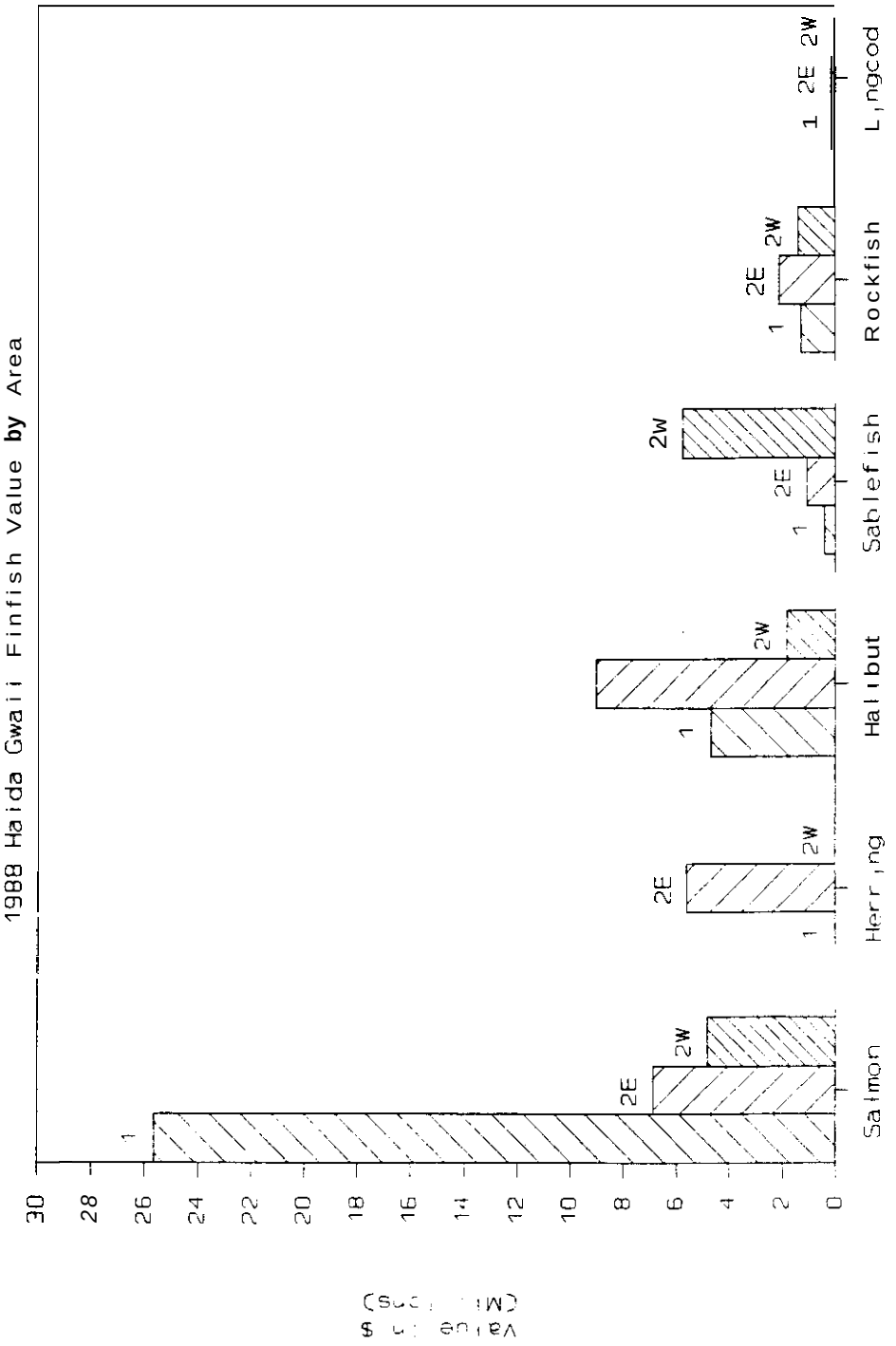
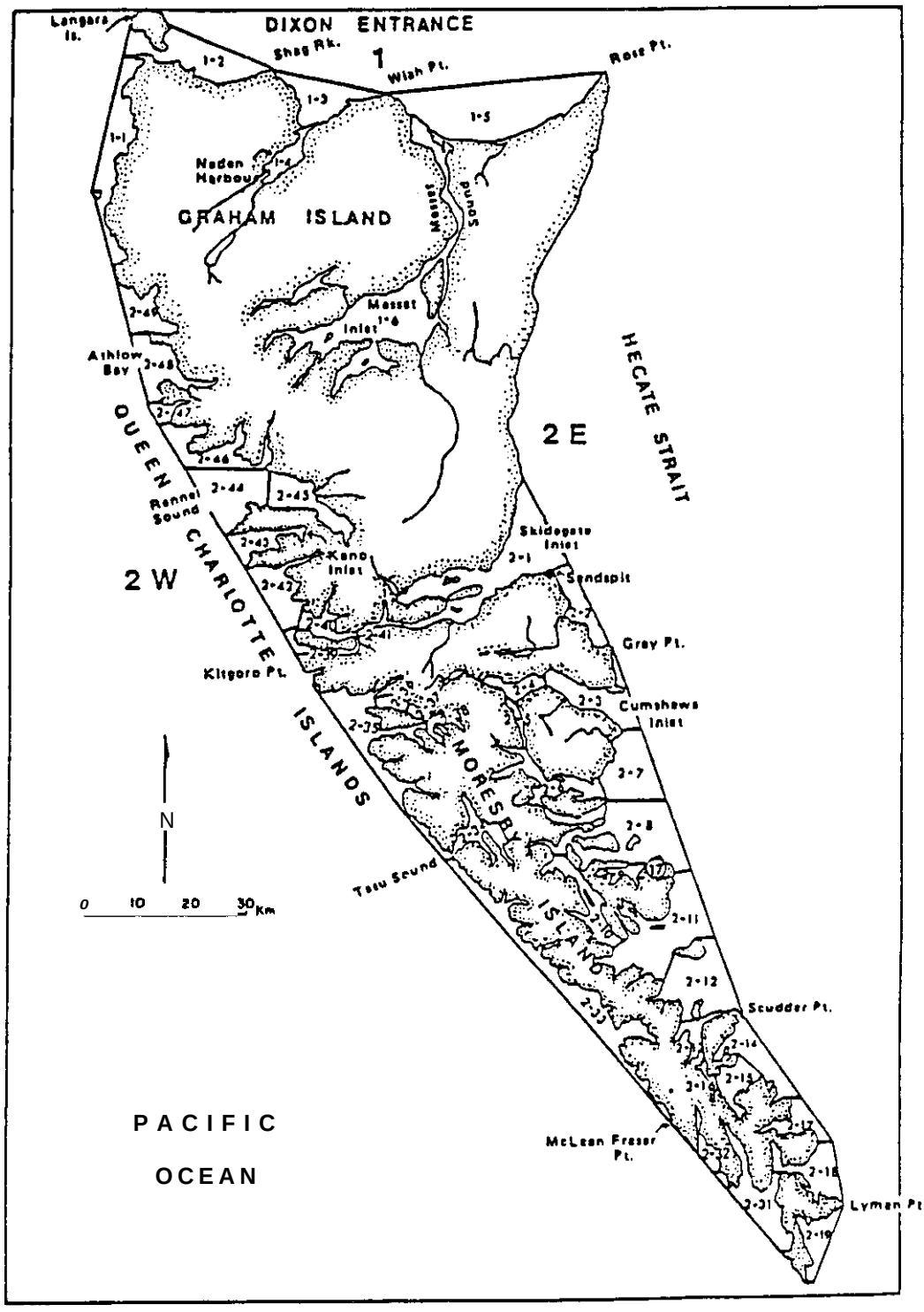
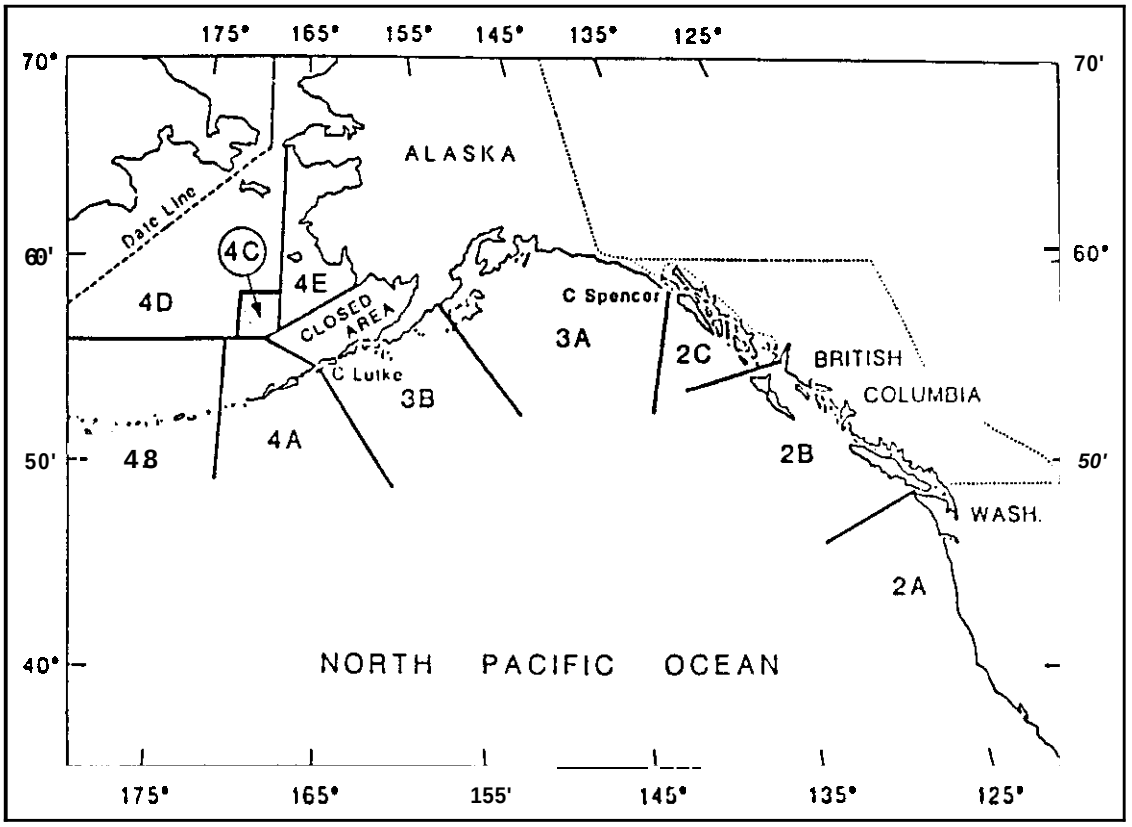


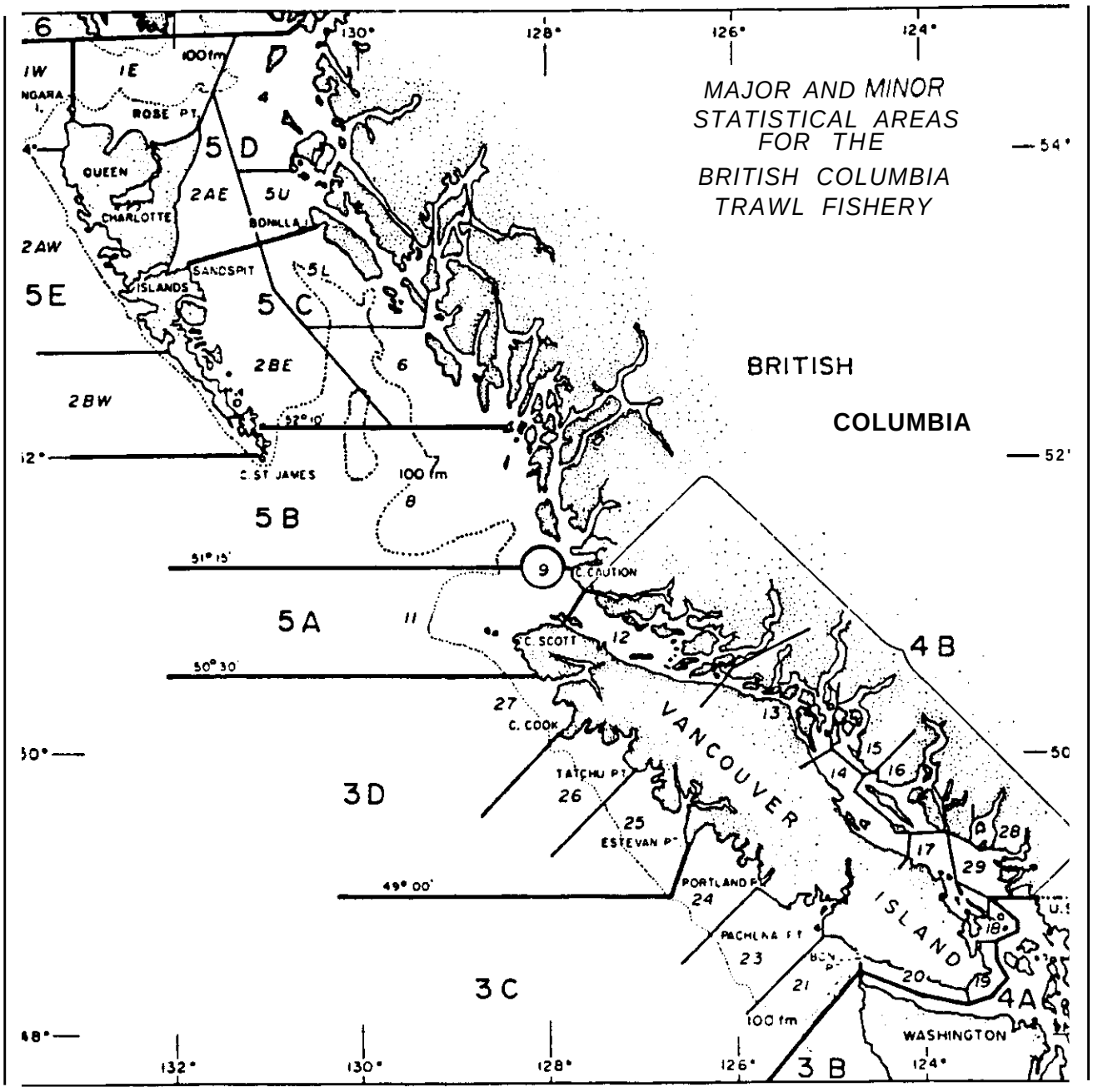
Figure 3: Value of Haida Gwaii vertebrate fishery landings by area, 1988
Compiled from: British Columbia Commercial Catch Statistics, DFO



Map 2: Map showing Sub-areas in Haida Gwaii



Map 3: **Regulatory areas for the Pacific halibut fishery**



Map 4: **International major statistical areas along the British Columbia *coast* designated by the Groundfish Technical Sub-committee of the Pacific Marine Fisheries Commission.**

3.0 SALMONIDS

3.1 GENERAL

INTRODUCTION

The study area has more than 50 streams which provide important spawning and rearing habitat for local salmon populations. Salmon is the most important fisheries resource harvested on Haida Gwaii and had a value of $37.4 million in 1988, accounting for 12% of the British Columbia landed value, consisting of 8.5% of B.C. chum value, 11.0% of the pink (highest during even years), 20.3% of chinook, 10.8% of coho, and 2.2% of sockeye value. Following is a general review of the salmon life cycle, the history of use in Haida, commercial and recreational fisheries and resource management practices on Haida Gwaii. Each species of salmon is reviewed individually in subsequent sections of the report.

SALMON LIFE CYCLE

Haida Gwaii has more than 170 documented salmon producing streams and most support productive chum, pink and coho runs (Table C3 Appendix C). Sockeye occur in only a few systems with lakes, while chinook occur only in the Yakoun River on Graham Island. Sea-run steelhead trout occur in approximately 30 streams. Streams in the study area are typically short and steep and have relatively small drainage areas (less than 20 square kilometres). Spawning and rearing habitat occurs mainly in the low gradient sediment in the lower reaches of the streams.

The Pacific salmon species generally spawn during the fall and the eggs incubate in the stream gravels overwinter. Steelhead may not spawn until the spring, however. Generally early in the spring the eggs hatch, and the alevins mature until they are ready to emerge from the gravels. Chum and pink salmon fry migrate downstream to the ocean and smolt soon after emergence from the gravels, which ends the freshwater phase of their early life cycle. Since their freshwater phase is so short, the smolt productivity of streams producing chum and pink salmon is generally limited by the number of spawners and the area available for spawning. The quality of the environment during egg incubation is important for survival and Haida Gwaii streams are typically rich in clean gravels which provide an ideal spawning and incubation environment. But, mountain streams, particularly on Haida Gwaii, are also unstable and subject to scouring

and occasional landslides during winter storms which can affect survival of fry and result in highly variable productivity.

Coho and steelhead trout fry also emerge from gravels in the spring, but most will live one or more winters in the freshwater system where they grow and feed. Productivity of coho and steelhead trout fry is generally limited by the available stream area for rearing, which is small for Haida Gwaii streams. This explains the relatively low abundance of coho and steelhead relative to chum and pink salmon on Haida Gwaii.

Chinook generally occur in large river systems of which there are few on Haida Gwaii. Chinook fry may spend several months or more rearing in freshwater. Sockeye rear for one or more winters in lake systems and productivity is limited by lake area, the availability of food and water conditions.

All salmon species spend one or more years in the ocean environment. Many salmon migrate thousands of miles to ocean feeding grounds, and less is known of this part of their life cycle than of their life in the stream. Salmon return to spawn in their natal streams after reaching sexual maturity. It is at this time, when they congregate along migration routes, or in holding places or inlets, that they are most susceptible to fishing.

HISTORY OF USE

The migration habits of salmon were well known to the Haida people who located their villages along important migration paths such as Langara Island or near rivers where the salmon could be harvested in great abundance. Even today, Haida fishermen harvest, for food and commercially, these same salmon stocks at many of these same spots. In recent times, two other distinct harvesting sectors have developed to reap the salmon resources which occur in and around Haida Gwaii: the commercial and recreational fisheries. Each of these three fisheries have their own special characteristics.

The present Haida salmon fishery consists of several local river fisheries for sockeye occumng in May, using nets. During the rest of the salmon season, which lasts from May to October, Haida fishermen may harvest salmon using trolling gear or nets from their personal or commercial boats in inlets or offshore waters. The Haida harvest of salmon is believed small compared to the other fishing sectors and the fishery is largely unregulated, except for the river fisheries. A 1990 Supreme Court of Canada judgement (the "Sparrow" case) recognized that the Haida and other aboriginal fisheries have a priority over commercial and recreational fisheries which is recognized in the Canadian

constitution and supersedes the Fisheries Act. Native fishing rights are evolving and will likely involve greater access to fish and may eventually include management and harvesting of fish for sale. Since salmon are such a valuable resource that many people are dependent upon, these matters have led to a great deal of uncertainty concerning fisheries management and aboriginal peoples.

The recreational salmon fishery on Haida Gwaii has expanded greatly in the past few years, due largely to commercial sports fishing development. As well, local anglers fish for chinook and coho salmon in tidal waters near their communities from May to September. Local coho stocks are also fished in the river estuaries and streams during the fall. Recently, floating resorts and luxury cruise ships have conducted commercial sports fishing activities, near chinook feeding grounds such as Langara Island and Naden Harbour. Guests pay $2,000 or more for the opportunity to fish for four or five days for the large chinook salmon (called "tyee") common in these waters. Recreational salmon fishing is regulated primarily by personal catch limits of four salmon per day of which no more than two may be chinook. There are presently no effective limits on commercial sports operations aside from a registration program for commercial recreational operators by the Council of the Haida Nation.

The commercial salmon fisheries on Haida Gwaii began before the turn of the century and presently involve three distinct types of fishery:

Terminal net fisheries harvest the local runs of chum and pink salmon, which are highly variable but provide a bonanza in some years. These net fisheries occur from mid-August to late October and target on stocks which can be discretely fished in the coastal inlets. These stocks have some special characteristics relative to many other British Columbia stocks. Interception of these stocks in other British Columbia and United States fisheries is minimal, which should theoretically improve the potential benefits from enhancement. However, since the fish are caught in terminal fisheries, their value is low relative *to* other fish.

Interception net fisheries occur at two locations during July and August targeting on passing sockeye and pink stocks. Fisheries are in the vicinity of Langara Island (in Area 1) and outside Rennell Sound (in Area **2W).** The main stocks intercepted originate from the Fraser, Skeena and Nass Rivers.

Interception troll fisheries occur in most of the waters surrounding Haida Gwaii. Troll fisheries have traditionally targeted on passing chinook and coho stocks but, in recent years, increasing

> proportions of passing sockeye and pink salmon have also been harvested. The interception troll fishery is carefully regulated by international agreement to control chinook harvest, and usually lasts from July to September.

An important consideration in management of the commercial salmon fishery is the size and mobility of the fishing fleet. The salmon fleet is carefully regulated through limited entry licensing and presently consists of 549 seine boats and 3,937 gillnetters and trollers (Anon. 1990c). This fleet is extremely mobile and may travel the length of the B.C. coast to take part in fishing openings. This causes difficulty in managing the harvest of sometimes small surpluses of relatively discrete stocks such as occur on Haida Gwaii. Relative value of the commercial salmon fishery on Haida Gwaii by species and management area is shown in Figure 4.

RESOURCE MANAGEMENT

Five essential elements of fisheries management are stock assessments, long term goals and strategies, pre-season planning, in-season management, and program evaluation as outlined by Pearse (1982). These are reviewed below for Haida Gwaii salmon fisheries.

Stock Information

Estimates of both stock abundance and spawning escapements for local salmon stocks harvested in terminal fisheries are very poor and optimum escapement is unknown, in most cases (Anon. 1986b). This is still generally true within the study area, although recent improvements have occurred for other areas including counting fences operated at the Yakoun River and Pallant Creek and development of test fishing indices for some chum fishing areas.

Long Term Goals and Strategies

Development of long-term goals and strategies requires a policy framework which takes into account relevant biological, economic and social factors. As presented in the discussion document, Pacific Region Salmon Stock Management Plan for Haida Gwaii (Anon. 1986b), a general objective of management is:

> ...to manage the Pacific salmon fisheries so as to conserve the resource and provide the highest sustainable contribution to the

> economic and social development of the people of Canada, especially residents on the Pacific Coast.

Also, a primary goal is to

> ...manage the harvest of Pacific salmon to achieve target escapement and, recognizing the risks and complexities of harvest management, provide the highest sustainable catches consistent with achieving target escapement.

Natural stock rebuilding, enhancement and habitat restoration are strategies which *can* be followed to achieve these goals. For example, one recent long term strategy has been to rebuild declining chum stocks began in the early 1970s with curtailment of commercial fishing on stocks with low escapements. A major chum hatchery was constructed at Pallant Creek in Cumshewa Inlet in the late 1970s and now contributes significant benefits to the commercial fishery. A major recent research project was the Fisheries Forestry Interaction Program, a joint DFO/MOEP effort, which studied the relationships between logging and landslides and their effects on fisheries. These studies resulted in more stringent requirements for logging, particularly on steep sites. However, clearcut logging has affected many of the watersheds on Haida Gwaii and effects on habitat are not well known. In general, the effects of these various efforts on the resource have been moderate.

Pre-Season Planning

The Operational Planning Cycle is illustrated in Figure 5 and involves pre-season planning, in-season management and documentation, and post-season evaluation. The salmon management biologist prepares pre-season stock expectations for the District, which then prepares net fishing plans. Troll fishing plans are prepared based on stock expectations in many areas outside Haida Gwaii, including the Fraser and Skeena Rivers. The plans are also governed by international agreements such as the Pacific Salmon Treaty and agreements about sharing Fraser River sockeye stocks. Net fishing expectations and fishing plans are reviewed by a local Queen Charlotte Islands Advisory Board (QCIAB) at a meeting in the late fall. The terms of reference and a list of participants are provided in Appendix B. The final stock expectations and fishing plan are published in the early spring and are available to fishermen and the public. A Record of Management Strategies is kept by each of the sub-district supervisors in Areas 1, 2W and 2E, to detail the reasons for decisions or variations from the original fishing plan. Post-season reviews are prepared by fisheries officers and the management biologist for review by the QCIAB.

In-Season Management

The study area net fisheries depend upon the observations of patrolmen and fisheries personnel to assess in-season stock strength and estimate escapement. Scientific methods are not available for most areas of Haida Gwaii. Assessments are affected by the limited number of staff, incomplete knowledge of stocks, lack of historical fishing indices and accurate escapement counts, especially in the study area.

Each stream has a target escapement outlined in management plans which is used to assess the in-season status of stocks. Target escapements for Haida Gwaii streams are determined subjectively based on historically observed spawning densities and estimates of productivity. Target escapement differs from the optimum escapement which is the estimate of the number of spawners which will meet, but not exceed, the actual capacity of the river system.

Haida Gwaii chum stocks are actively managed, and receive priority with regard to management decisions governing the fisheries; that is, they will cause a fishery to be altered if conservation measures are required. On the other hand, the coho stocks caught in the same net fisheries are passively managed, and the fishery will not generally be altered to protect these stocks.

Success of the long-term goals and strategies is dependent on good information and ability *to* monitor effectively.

Program Evaluation

Salmon management is regularly reviewed by District staff, management biologists and by the **QCIAB.**

Salmon Management Issues

The following general salmon management issues relate to the well-being of the salmon resources, and present Haida, recreational and commercial fisheries on Haida Gwaii. Issues apply to other areas of Haida Gwaii, as well as the study area.

1. There are conservation concerns about some Haida Gwaii salmon stocks, such as the coho. Local coho are directly harvested in troll and terminal recreational fisheries and intercepted in terminal

chum net fisheries. As described in Section **3.4,** better information is needed about the status of important coho stocks so that more informed management actions can be initiated.

2. Haida Gwaii supports a wide variety of genetically different salmon races, which may be affected by management actions such as fishing openings and enhancement. A policy should be developed concerning conservation of genetic pools for salmon.

3. The present data collection system monitors escapement **on** a stream-by-stream basis, but aggregates catch statistics for broader Statistical Areas. Terminal fisheries are presently based **on** discrete surpluses in management sub-areas. A system to monitor sub-area catch may improve assessment of. fishery openings and sub-area productivity. To facilitate data processing and implementation of specific management policies within the marine area of Gwaii Haanas/South Moresby, consideration should be given to a new Area **2** South statistical and management area.

4. Haida participation in the commercial salmon fishery has declined from historic levels and should be addressed in any management changes or actions.

5. The present system of commercial fleet management results in short fisheries **on** sometimes small salmon surpluses. Fishing opportunities are sometimes missed and product quality is sometimes affected. Alternative management systems such as sub-area licensing should be considered which may reduce management risk and improve quality and value of catches.

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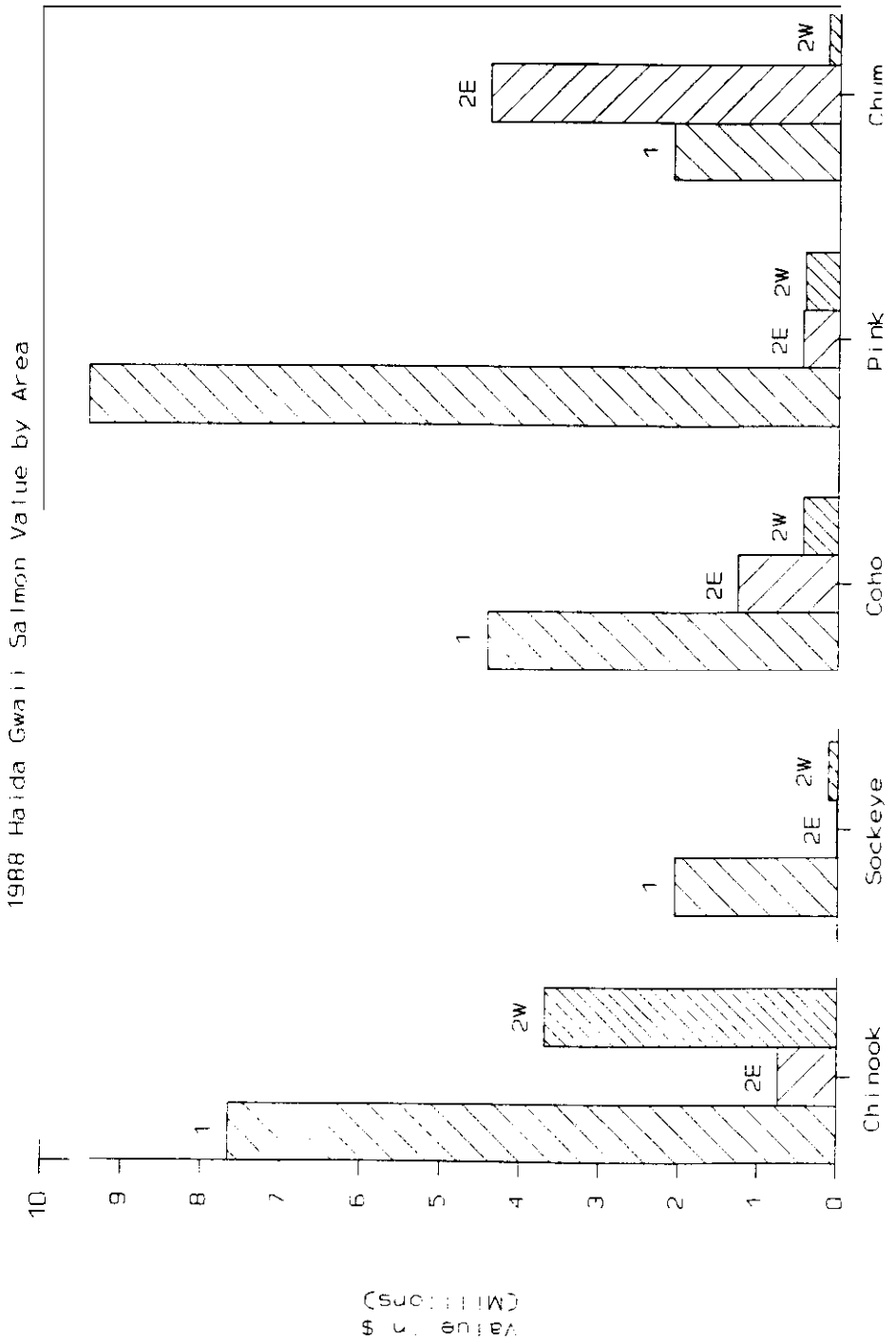

Figure 4: Value of Haida Gwaii Salmon landings by area, 1988
Compiled from: British Columbia Commercial Catch Statistics, DFO

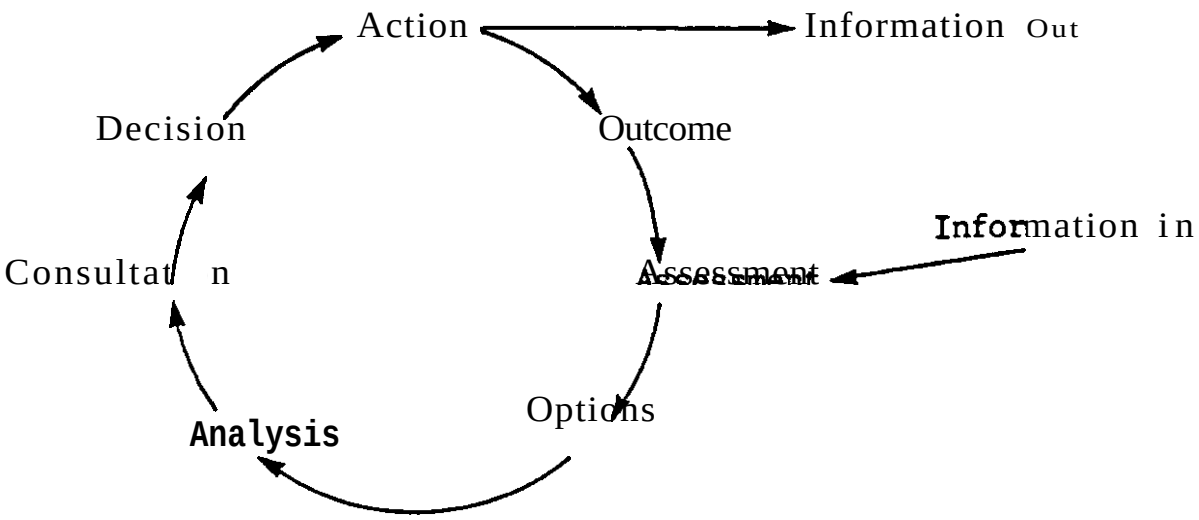

Figure 5: **DFO operational planning cycle**
Source: **Anon. (1986b)**

3.2 CHUMSALMON

INTRODUCTION

Chum salmon are one of the dominant salmon species occurring in Haida Gwaii streams, and the study area is a major chum producing area. The early Haida made great use of chum salmon as a winter food supply, since they could be obtained in large quantities at fall fishing camps and had good keeping qualities once they were dried or smoked. The commercial fishery for chums began before the turn of the century. Stocks were depressed in the 1970s, but escapements have remained relatively stable. Catches averaged 383,000 from 1985 to 1990. The landed value in 1988 was $6.6 million when catches were 530,000 which is 38% above the average over this period.

LIFE HISTORY AND BIOLOGY

Chum salmon, *Oncorhynchus keta* (Walbaum 1792), known as *sk'aagii* in Haida, is a medium-sized salmon which occur in most Haida Gwaii streams (Figure 6). Ocean going chum salmon have dull grey backs with yellow-silver sides, with no distinct spots on the back or tail. The pupil of the eye is nearly the same size as the entire eye. Spawning adults develop olive green coloration of the back and maroon sides covered with irregular dull red bars. Males exhibit many large, canine teeth. Chum have the widest distribution of any of the Pacific salmon species. They are found throughout the North Pacific as far south as the Sacramento River in California in the eastern Pacific and Japan and Korea in the western Pacific (Bakkala 1970).

Chum salmon life history an biology is reviewed by Bakkala (1970), Hart (1973) and Scott and Crossman (1973). Chum return to their rivers of origin in the autumn, enter streams and rivers and spawn late in the year. In most coastal streams, chum spawn the lower reaches, but in larger mainland river systems such as the Yukon River may migrate considerable distances (3200 km) upstream. Mean fecundities of chum from North America and Asia ranged from about 2,000 to over 4,000 eggs; and most were 2,000 to 3,000 eggs (Bakkala 1970). Federenko and Shepherd (1985) measured mean fecundities of samples of Mathers Creek broodstock to be 2,374 eggs. The female digs a redd in loose gravels and deposits her eggs, which the male fertilizes and she buries in a sequence of spawning acts. She may guard the redd from intruding females for several days, before dying. Alevins hatch early in the spring and fry migrate to the ocean soon after emergence from the gravels. Average size of fry migrating from Mathers Creek was 0.4-0.5 g, with a fork length of about 38 mm (Northern Natural Resource Services Ltd. 1979). Young chum may remain near shore for several months, after which they disperse throughout the offshore waters of the North

Pacific Ocean and Bering Sea (Map 5). Chum salmon in the ocean feed mainly on zooplankton. In offshore waters, the main types of food consist of euphasiids, squid, amphipods, and crustacean larvae (LeBrasseur 1965; LeBrasseur and Doidge 1966).

Adult chum average 3.6 kg (eight pounds) in weight but can be found up to 15 kg (33 pounds). They may reach a length of 100 cm (40 inches).

The Salmonid Enhancement Program uses standards to compare natural chum production to various enhancement methods. Average coastwide chum survival from egg to fry is estimated to be 9% and from fry to adult to be 1.4% (Shepherd 1984). Survival of Haida Gwaii chum from egg to fry may be less than the coastal average due to high flows which can scour stream gravels and redds. Predation of chum smolts in coastal inlets is suspected to be a major cause of low productivity for the Pallant Creek hatchery (Mason Pers. Comm.) and is also likely with wild stocks.

The age of return of chum salmon is variable. Chum salmon apparently have a successful survival strategy for environment of Haida Gwaii streams. Stream productivity is determined by egg to fry survival. Variable age of return allows seeding to occur during all years, even if there is a broodyear failure. Egg deposition is limited by spawning area and number of returning adults to a stream.

HISTORY OF USE

Haida Use

Ethnographic material collected by both Ellis (1972-80) and Blackman (1975) indicates that chum salmon or *sk'aagii* were the most important salmon species to the early Haida. Both document ownership of many rivers and streams by the Haida "families," as does Swanton (1905b), and Dawson (1880). The concept of property rights to creeks was as well developed as it was for town sites, beachcombing rights (for dead whales), sea mammal hunting rights and cranberry picking rights. Fishing rights could be owned by people who lived in other places; for example the "Skedans people: were said to "own [the fishing rights in] Tasu." In recent times hereditary access to trapline rights evolved from these early fishing rights, and one of the best records of family ownership is to be found in the B.C. Government trapline files (Province of British Columbia, 1925-1965).

Chums fresh from the sea were not preferred, as they were considered "too bitter." It was better to "leave them in the stream for awhile" until they had become quite discoloured or "dark" and had lost much of their body fat. They were then the focus of what had to be a very well organized campaign to "smoke-dry" them for later use, although they were enjoyed "half-smoked" during the process.

In recent memory, chums were gaffed through the head with sharp iron gaffs mounted on strong saplings, an efficient method in the small streams of the Queen Charlottes. Spears were also used, but this method was apparently more appropriate for taking coho from larger rivers like the Copper River. Older people remembered discussion however, of using various forms of fish traps to take salmon. Archaeological evidence (Acheson and Zacharias 1985) notes the widespread use of fish traps constructed from both stone and wooden stakes. Traps were placed at the mouths of spawning streams and methods are well illustrated in the imaginative work of Hilary Stewart (1977), although with no specific reference to Haida use.

Dawson (1880) noted the use of fish weirs during his visit to the Islands, and Swanton (1905a) describes a salmon trap as well. Material collected by Ellis (1972-80) notes that one of the most effective ways to take salmon had once been to simply build a boulder fence where the fish would be trapped by the receding tide. Once stranded the fish would often die in the shallows, and people would just walk down and pick them up. Another commonly used method had been to build a "throat" or one-way entrance of sharpened cedar boughs that was securely staked and lashed in a strategic place. Fish could be diverted into rock-walled side channels this way, from which they could not escape. Lines of hemlock boughs were often placed in strategic locations to guide the fish.

The male fish were preferred as they were considered larger and less "worn out" than the female fish. The females were taken when the roe, which was made into a wide variety of delicacies, was desired. After clubbing, the fish were bled by breaking the gills with a special stick. The fish were bunched together using a rope passing through their gills and dragged to the smokehouse. Here the fish were cut along the back with a wide, curved knife to yield a single wide fillet still attached at the belly. The fillets were then trimmed by removing thin slices that were dried separately and considered a special delicacy (*ts'ilgi*). *Ts'ilgi* was often sun-dried if the weather was good. Its removal made the skin-on fillets thinner and easier to thoroughly "smoke-dry," a process that was begun after the fish had hung outside for about half a day. The remaining backbones, with some flesh still attached, were tied in pairs at the tail and also smoked. The heads were often saved for a wide variety of delicacies, and the guts quickly thrown back into the creek to avoid attracting flies.

From this time until the fish were consumed, the smokers had to fight a long battle against both moisture and insects, which threatened the shelf-life of the fish at every turn. The first problem was to keep a low fire going with aged, dry, wood, so that the fish were dried and not hot-smoked, for 10 days. During this period, the fish were handled twice per day as they were draped and re-draped over the cedar drying sticks in the smokehouse. This ensured even drying and kept the fillet from assuming a curved shape. When semi-dried, they could be laid flat across the drying sticks, and from this point on they were moved ever higher in the smokehouse. Periodically, they were taken down from the racks and stacked and flattened by applying heavy weights. At the end of the 10 day period, they were finally taken down and tied with string into bundles of 40 fish. On the Deena river in Skidegate Inlet, each family who visited the river for a 3 week period would take home 10 "bundles," or 400 dried fish. The bundles were carefully put away in bent-wood cedar boxes, and stored in a dry place for later, or immediate, use. Under good conditions they could be kept for a whole year this way, although they were rarely kept this long.

Ellis (1972-80) recorded many dishes that were prepared from chum salmon. Most were prepared from the smoke-dried product, and in many cases the same dishes were prepared using other salmon species.

The heads were eaten:

a) fresh boiled, and when eaten "it was fun to see who could make the most noise when eating them." The cartilage just above the eye was considered a special delicacy.

b) after "aging" in pits in the intertidal zone, lined with seaweed and covered with rocks. After about ten days, the special part above the eyes was cut off. *soaked* and eaten.

The smoke-dried double fillets (skin on) were eaten:

a) barbecued by the open fire when half smoke-dried

b) "blistered," by the open fire when smoke-dried, after washing "some of the smoke off." This popular method required little preparation.

The skin was eaten.

a) boiled, after being cut into chunks. This was probably the most common method once open fires were replaced by wood and now electric stoves by

the Haida. The fillets were generally soaked in salt water before being boiled, often together with potatoes, seaweed, eulachon oil, etc.

The dried boneless fillets were eaten:

a) as is, often dipped in eulachon oil, as a "snack" food. They were "chewed for a long time."

The smoked backbones were eaten:

a) boiled, usually with potatoes and eulachon oil, etc., after being soaked in a "sack" in the intertidal zone.

The eggs were eaten:

a) raw, when free-floating in the stream

b) boiled fresh (usually with seaweed)

c) lightly smoked before being roasted over the fire

d) as "stink eggs," when the loose, washed and pre-soaked eggs were put in a bent-wood cedar box lined with skunk cabbage leaves and covered with black mud until they went clear.

e) as "Indian cheese," where the egg skeins are smoked for two days, washed, and then broken up and packed tightly in a "pot," and pounded. In the spring they were opened up and sliced like cheese.

f) as a second "Indian cheese" recipe when the loose eggs were put into a seal stomach, which was "hung near the smoke hole until very dry," and then sliced and eaten.

In later years a number of people had been poisoned and died from eating "stink eggs," usually because they were inexperienced in the methods of preparation. Eggs from unripe fish, and poor choices of materials for containers were said to have been the major problems.

Glue was made by chewing the smoked dog salmon skin and spitting the liquid into a small enamel pot, usually kept covered with a lid for this purpose.

In recent time, salting became an important method of preservation, and today freezing is extremely important. Freezing has led to frequent use of "half-smoked" product since the full ten day smoke-drying process is now no longer needed for preservation.

In 1988, the recorded Indian chum catch in Area 1 was 810 chum and in Area 2 was 1,655 chum (Anon. 1988a, Sec. 2.0). Chum are not utilized for food to the same degree as they were in the early years. DFO statistics are likely underestimates, since they only record catches taken with Indian Food Fish permits.

Recreational Fishery

Chum are a very minor component of the recreational fishery. For instance sockeye and chum made up only 1,500 out of the estimated catch of 42,200 salmon by resident and visiting anglers in Area 1 to 6 in 1988 (Bijsterveld 1989). Chum do not normally strike recreational fishing gear. Chum in terminal areas of Haida Gwaii rapidly become dark and unappealing to local anglers.

Commercial Fisherv

The commercial chum fishery on Haida Gwaii has been significant since the early part of the century (Figure 7). Chum landings have been recorded since 1888 (Tables C4 and C6, Appendix C), and reached an average of 197,000 in the late 1910s, increased to 767,000 in the late 1920s, and remained generally high to the present, except for slight declines during the late 50s and early 60s and the late 70s and early 80s. Catches exceeded one million fish for four years beginning in 1925 and again in 1940 and 1950. The peak catch of 2.0 million chum occurred in 1926.

Buying stations and canneries were once located in many areas of Haida. Gwaii including Pacofi, Sedgewick Bay, Jedway and Huston Inlet in the study area, as discussed in Section 2.0. A cannery at Pacofi in Selwyn Inlet periodically operated from 1910 up to the end of 1949.

Most chum salmon are caught by purse seine, although gillnet catches have increased in the last 40 years. From 1929 to 1941, only 2 gillnetters fished in Area 1 and 2 while the number of seines fishing in Area 2 ranged from 3 to 68 and 2 to 5 seines fished in Area 1 (Anon. DFO Masset records). Gillnet 'catcher increased in the 1950s and in Area 2E averaged 57% of the total catch in the

period 1974 to 1984 (Orman 1985). Seines can get a greater share of the catch during heavy runs.

Purse seines set their nets around schools of fish, which are encircled by drawing the bottom of the net together using a purse line. The net has a small mesh which doesn't allow salmon to escape, and the web is suspended by corks along the top of the net and a weighted "lead line" along the bottom of the net. Once the net is pursed, modern seiners use a drum to pull the net back onto the boat, which draws the fish into an ever smaller "bag" at the side of the boat. Eventually, the captured fish are brailed or scooped out of the net into the hold of the boat or the "bag" of fish may be hauled onto the deck using the drum. In the early days, the nets were pulled by hand and piled onto the deck. Before drums were introduced, seiners used "power blocks" or hydraulically driven blocks to pull the net back on board. Drum seiners are highly efficient and can make a set in 20 to 30 minutes. Drum seiners are not allowed in Alaska, so the seine fleet consists of table seiners which use "power blocks". Seiners generally are more than 40 feet in length and have a crew of five or six persons.

Gillnetters use a monofilament net about 200 fathoms long which is set and allowed to drift in the ocean. Salmon try to swim into the nets and get tangled, usually by their gills. Gillnets are size selective, and fishermen may choose from a variety of nets with various colours and mesh sizes under different fishing conditions. Many gillnetters are combination boats which engage in trolling at other times of the year and have a crew of one or two.

Most chum caught in net fisheries are delivered to packers which transport them to Prince Rupert and other mainland processing plants. Some chum are delivered to the B.C. Packers plants at Skidegate or Masset and transported off island by truck.

Most chum are landed in the round, and a significant portion of their value may be the processed roe which had a value of $9.08/kg in 1989[1]. The roe is exported primarily to Japan. Bright fish may be marketed as fresh product, however, most of the production is frozen or canned. Haida Gwaii chums are generally not suitable for smoking due to their small size and low fat content compared to mainland chum.

In 1988, Haida Gwaii chum catch was 530,231 which had a value of $6.6 million. The catch in 1988 was 38% higher than the average catch from 1986-90 of 382,910. Chum salmon are graded by quality (primarily colour) with three

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[1] DFO **Preliminary** *Statistics*

grades consisting of "bright", "qualla" and "dark". In 1990 prices paid on Haida Gwaii for brights were $1.76/kg ($0.80/lb), for qualla was $1.10/kg ($0.50/lb) and for darks was $0.66/kg ($0.30/lb).

BASELINE FISHERIES DATA

Chum salmon occur in 140 out of 171 documented salmon producing streams on Haida Gwaii (Anon. 1986b). Within the study area, there are 57 chum producing streams including 51 in Area 2E and 6 in Area 2W. A total of 28 of these streams in Area 2E and 3 in Area 2W are classed as significant for chum production.

Chum on Haida Gwaii return to streams to spawn from early September to late October. Generally, stocks from northern British Columbia and south-east Alaska return earlier, from early July to early September.

Stock groupings which have been applied to Area 2E are shown in Map 6 and there are three sub-areas in the study area, namely Darwin Sound/Atli, Juan Perez Sound and Skincuttle.

The Darwin Sound/Atli Inlet sub-area has fifteen chum producing streams with a total target chum escapement of 50,425. The main chum producer is the Salmon river in Darwin Sound with a target escapement of 25,000. Crescent Inlet Creek is another significant creek in Darwin Sound with a target escapement of 6,500. Terminal fisheries in Atli Inlet can be managed separately from Darwin Sound, and import creeks are Moore Creek, Powrivco Creek and Sandy Creek with target escapements of 5000, 3000 and 4500 respectively. These five named streams account for 87% of the target escapement in the sub-area.

Juan Perez Sound has numerous small creeks which together have a total target escapement of 53,800. Sedgewick Creek is one of the dominate streams, which has a target escapement of only 7,000.

Skincuttle has 24 chum stocks which are separated into three geographic groupings consisting of Skincuttle Inlet, Carpenter Bay and Stewart Channel. Target escapement of the sub-area is 94,000 chum.

Area 2W has six chum producing streams in the study area with a total target escapement of 23,000. The three major streams are Goski Bay Creek in Gowgaia Bay, Flamingo Inlet Creek and Louscoone Inlet Creek with a combined target escapement of 17,800. Target escapements are currently under review (Orman Pers. Comm.).

There is considerable uncertainty regarding migration routes for Haida Gwaii chum stocks. These stocks are intercepted in other Area 2E chum fisheries as well as the southeast Alaska fishery (Anon. 1986b). However, interception of Haida Gwaii chum stocks is believed to be low (Anon. 1986b).

A chum tagging program Wried out in 1971 identified Darwin Sound and Atli Inlet-Sedgewick Bay as probable pre-terminal mixing areas for stocks in Area 2E (Anon.). Fish tagged in Darwin Sound were recovered in both the Juan Perez and Skincuttle Inlet sub-areas. Chums tagged in Atli Inlet-Sedgewick Bay were also recovered to the north and south of the tagging sites. This may explain high catch rates within the Darwin Inlet/Atli Inlet sub-area.

Tagging studies in the Northern Boundary area in 1983, 1984 and 1985 provided little information about Haida Gwaii stocks (Hoffman *et al.* 1984; 1985; 1986). Studies were directed at sockeye and pink stocks, and tagging of chum was incidental. Migration routes for Northern Boundary chum appeared to be similar to those of pink salmon. Some chum from Alaskan chum hatcheries are intercepted in Area 1 troll fisheries, based on coded wire tag recoveries.

Haida Gwaii chum escapements by area since 1950 are shown in Figure 8. In the period 1981 to 1990 about 69% of the escapement was to Area 2E streams. Overall chum escapements on Haida Gwaii have been relatively stable in Area 2E and 2W, with a slight decrease occurring in the mid 70s and early 80s.

As shown in Figure 9, the Skincuttle, Juan Perez and Darwin-Atli sub-areas contribute significantly to Area 2E escapements. Average escapements to these sub-areas in 1980 to 1987 was 92,000 or 45% of total Area 2E escapement. Cumshewa Inlet and Skidegate Inlet sub-areas also contribute significantly to Area 2E chum escapements.

Haida Gwaii chum catch by area since 1954 is shown in Figure 10. Overall chum catches on Haida Gwaii averaged about 272,000 over this period but were much lower *over* the period 1975 to 1983. This *is* the result of an overall management strategy to rebuild declining stocks. Catches have exceeded 500,000 seven times over the past 37 years with a peak of 897,000 in 1985. Enhancement has contributed to catches in Area 2E since about 1983. Chum salmon catches in Cumshewa Inlet from 1984 to 1988 averaged 78,900 chum with a range from 28,600 in 1986 to 146,400 in 1988 mainly due to the Pallant and Mathers Creek hatcheries. This represents 16% of the Area 2E average annual catch over this period.

Sub-area catch is not presently available in report form. Hailed catches are presently entered into a hail catch data base, however. A summary report should be available in 1991 (Orman Pers. Comm.).

Most chum catches are by net. However, troll catches in Area 2W in 1985 and 1987 exceeded 25,000 chum which indicates targeting on these stocks by trollers.

The 1988 fall chum fishery lasted for more than 6 weeks. This fishery is important to some local fishermen who require insurable weeks to qualify for Unemployment Insurance benefits during the winter.

Electrophoretic sampling of Haida Gwaii chum stocks in 1983 and 1984 showed considerable genetic diversity between streams but identified four discriminate stock groupings: the north coast of Graham Island, the west coast, north-east Moresby Island and south-east Moresby Island (Orman 1989).

RESOURCE MANAGEMENT

Chum stocks on Haida Gwaii are actively managed which means that the commercial fisheries may be altered for conservation purposes. Each management sub-area is generally managed separately based on assessments of returning fish abundance and escapements. Each stream has a target escapement, and frequent assessments are carried out by charter patrolmen, fisheries officers and fisheries patrols. Aerial reconnaissance is also carried out. Test fisheries generally occur in Skidegate Inlet and Cumshewa Inlet. Test fishery indexes have not yet been developed for study area fisheries.

General management procedures are as follows (Orman 1985). Pre-season stock expectations and fisheries plans are developed by the local fishery officer and area biologist and reviewed with senior managers. Forecasts of returning stock by species and Statistical Area are based on average rates of return and age class contribution of stocks. Surplus stock is identified and a schedule of fishery openings and closures is developed based on the anticipated fishing effort. The usual methods to limit catch are variations of the duration and boundaries of an opening.

The fishing expectations are then reviewed by the Queen Charlotte Islands Advisory Board, to discuss and finalize the fishing expectations. Final fishing plans and stock expectations are published in the Pacific Cnmmercial Fishing Guide.

Rebuilding of depressed chum stocks was a priority for management of chum stocks in the mid-1980s. Improved escapements and increased catches indicate that 2E chum stocks have recovered from depressed levels in the 1970s.

One strategy identified for rebuilding of depressed chum stocks was to reduce interception in mixed stock fisheries (Anon. 1986b). The trade-off associated with later and more terminal fisheries, however, is that fish quality deteriorates with time. This strategy has been applied to pre-terminal mixing areas, such as Darwin Sound and Atli Inlet-Sedgewick Bay. The benefits of reduced interceptions of stocks have been examined in terms of stock rebuilding and the net present value of the fisheries (Anon. 1986b).

Actual escapements are much less than estimates of optimal escapement levels. Target escapements are 72,000 in Area 1; 170,000 in Area 2W; and 430,475 in Area 2E, of which 118,000 is the minimum level for Skidegate Inlet (Spilsted 1988). Overall escapements have seldom reached these levels in Area 2E, and never reached them in Area 2W. Escapements in many streams may be less than optimum in a given year while discrete surpluses in other streams are harvested terminally where they occur. Argue (1985) estimated optimum escapement of Area 2 to be 600,000 based on stock and recruitment data from 1950 to 1976. Target escapements are presently under review (Orman Pers. Comm.).

Escapements are presently estimated during stream walks by fisheries patrolmen, or occasionally by aerial flights in remote areas.

Returns are presently forecast for individual streams and sub-areas on Haida Gwaii. The 1990 stock expectations for study area streams were based on an age distribution of 25% three year-old fish, 69% four year-olds, and 6% five year-olds (Anon. 1990. Record of Management Strategies, Area 2E) and return ratios of adults to spawners ranging from 1.35 to 3.2 (Orman 1990). Argue (1985) assumed a return rate of 2.09 in his analysis of chum stocks based on mean returns from 1960-1984.

An important consideration in management of chum stocks is the quality of harvested chum. Location and timing of net openings can sometimes be manipulated to optimize the catch of bright and qualla (semi-bright) fish. An "aggressive" management policy has been proposed for Cumshewa Inlet chum stocks to harvest a greater portion of brights.

Interception of chum in fisheries outside of Haida Gwaii are believed to be small. There are presently two major chum hatcheries on Haida Gwaii, located at Pallant Creek with a satellite hatchery at Mathers Creek.

Discussion

Chum salmon fisheries in the study area are actively managed, and terminal fishery openings are scheduled based on identifiable surpluses. Management shortcomings relate to limited stream inventory information, poor spawning escapement data and limited ability to manage fishing effort.

Enumeration of spawning escapement is difficult, due to the many salmon producing streams **and** limited staff. Standard methods for enumerating spawning escapement also need to be adopted. Better understanding is also needed about optimum levels of escapement.

The habitat database for study area salmon streams is incomplete and anecdotal, and should be updated according to standard stream survey methods e.g. FHIIP (Anon. 1989h).

Presently, sub-area catch and escapement information is not readily available to assist in management decisions. Separation of the study into a new Statistical Area would assist in management of study area stocks.

BIBLIOGRAPHY

Please refer **to Bibliography in** Section **3.1 Salmonids** - General

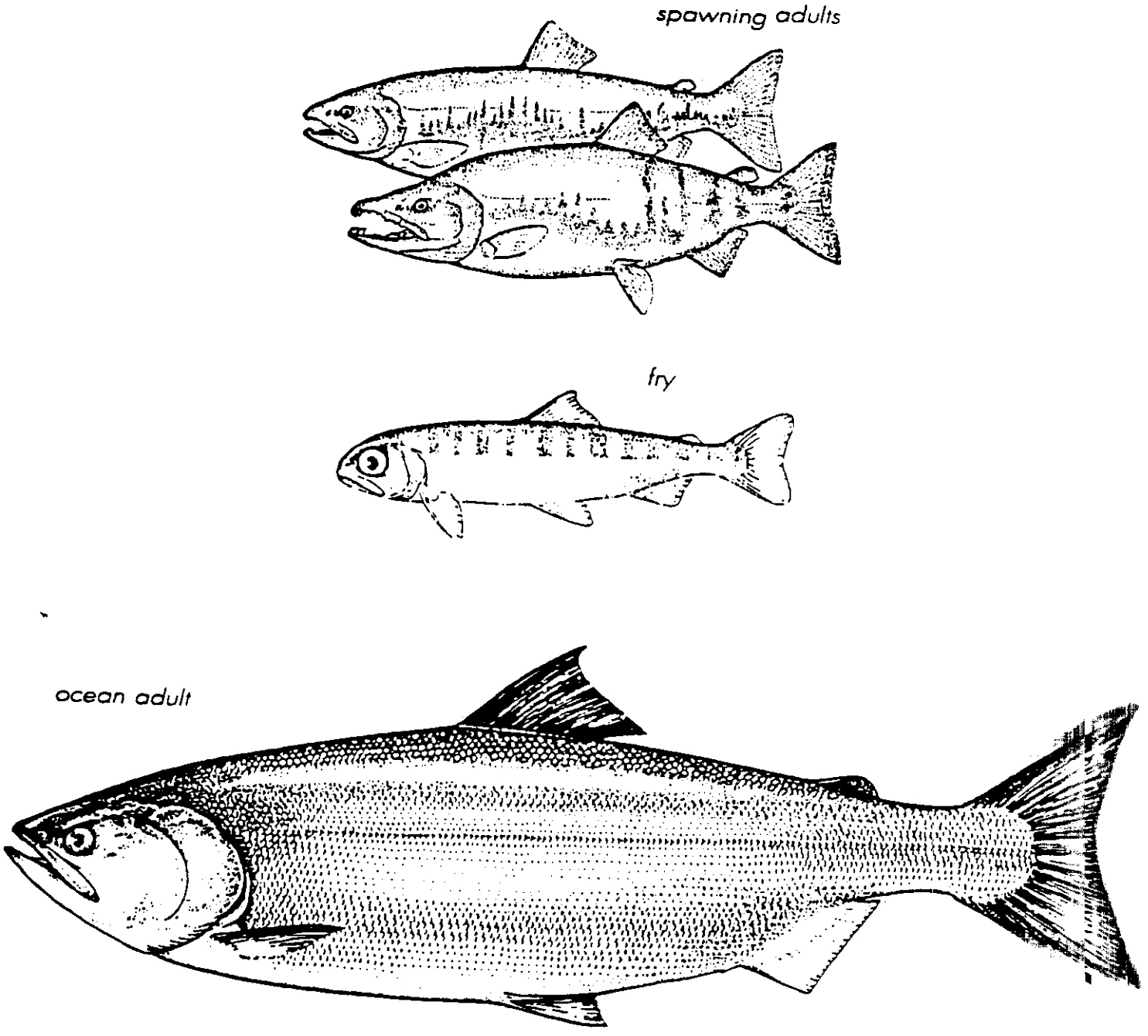
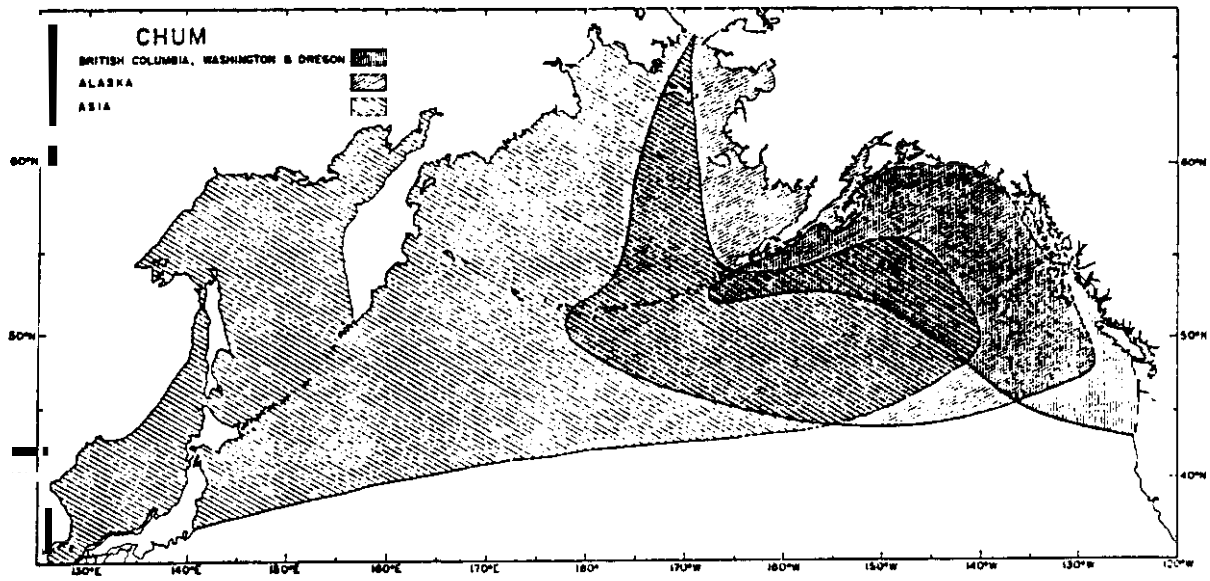


Figure 6 **Chum salmon, *(Oncorhynchus keta)***



Map 5: **Oceanic distribution of chum salmon in the North Pacific**
Source: **Hart (1973)**

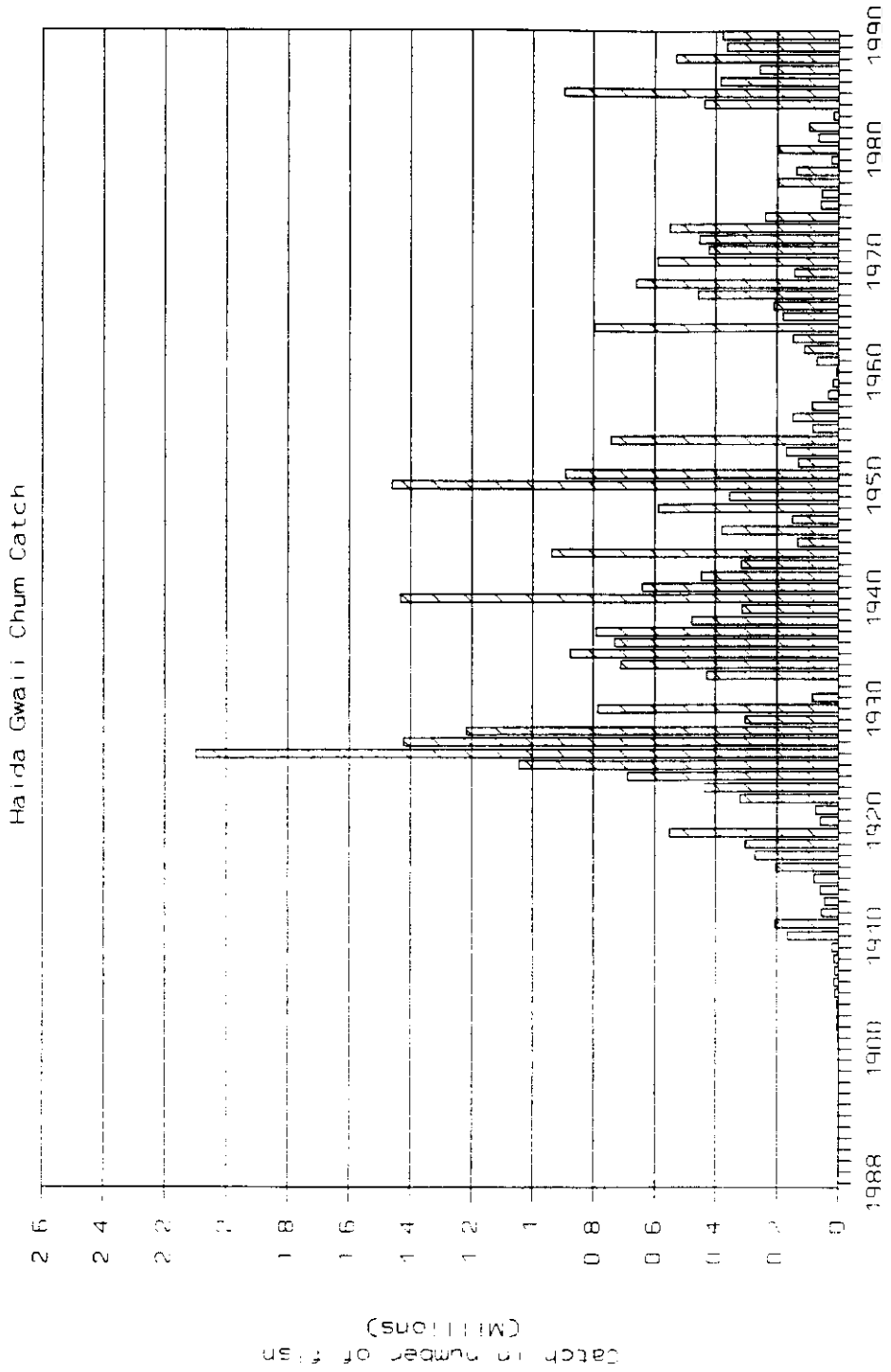
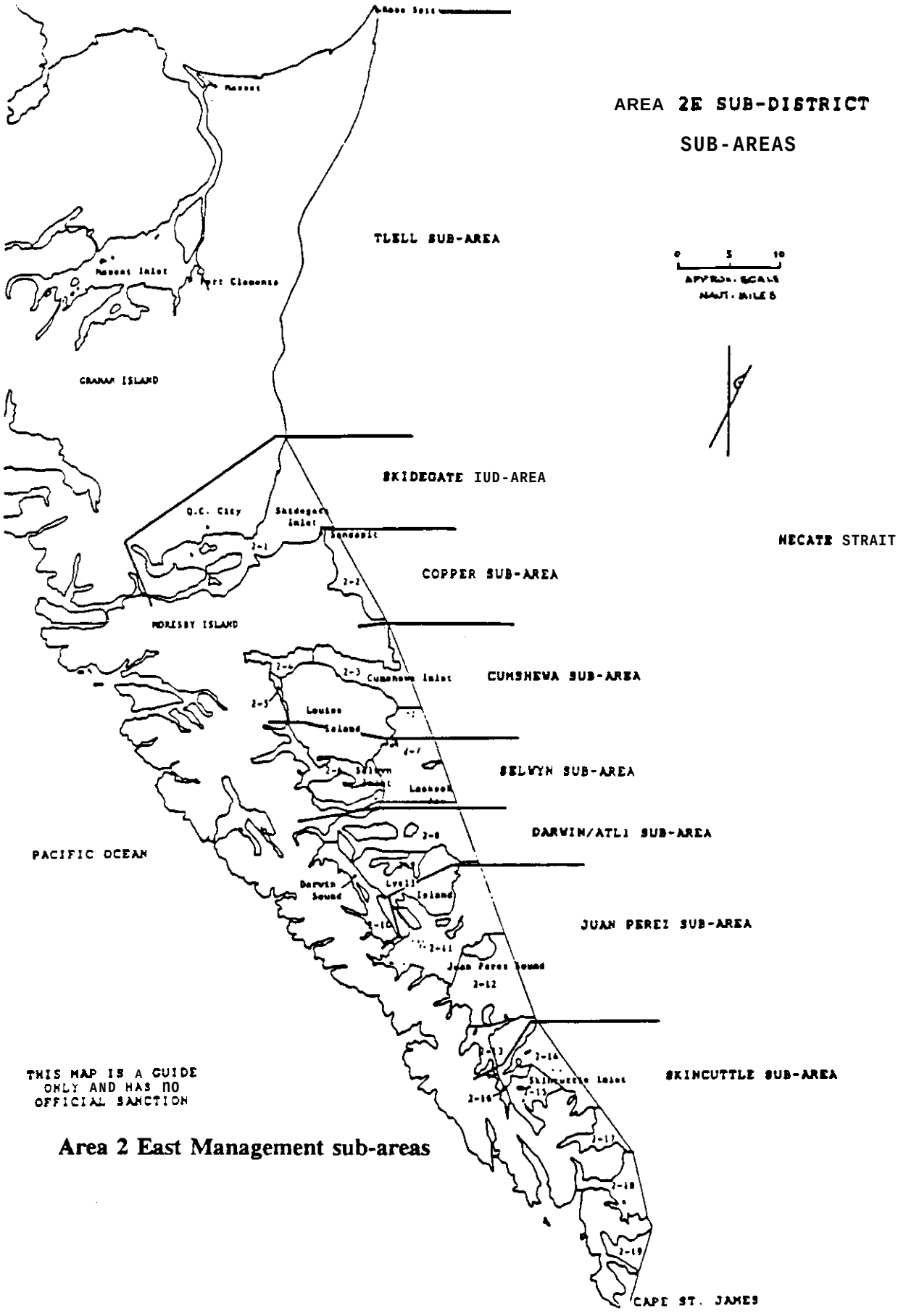


Figure 7: Historical Haida Gwaii chum catch, 1888-1990

Source: See Tables [illegible] and [illegible], Appendix [illegible]



Map 6: **Area 2 East Management sub-areas**

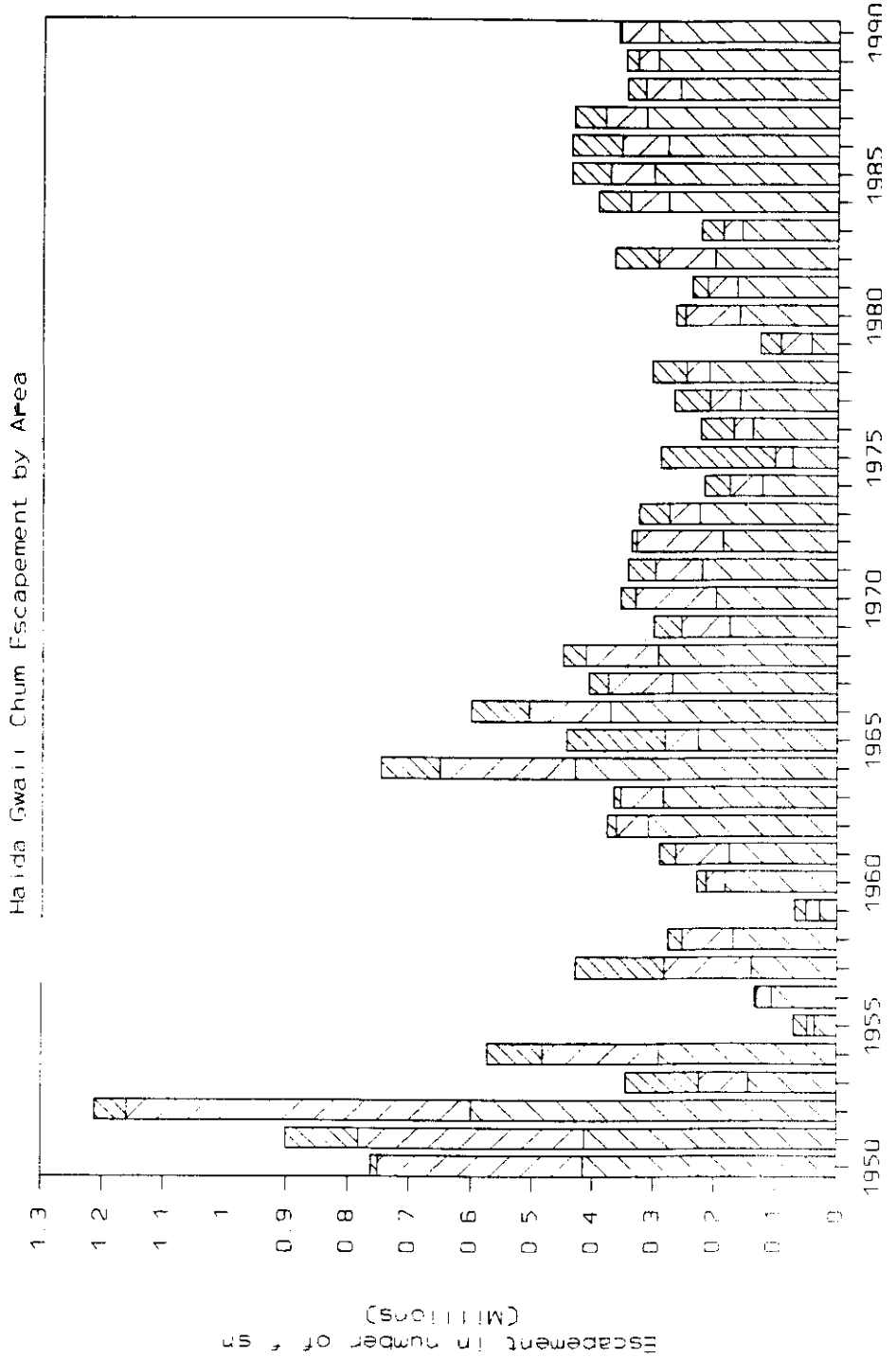


Figure [illegible]: Haida Gwaii chum escapements by area, 1950-1990
Source: [illegible] Appendix [illegible]

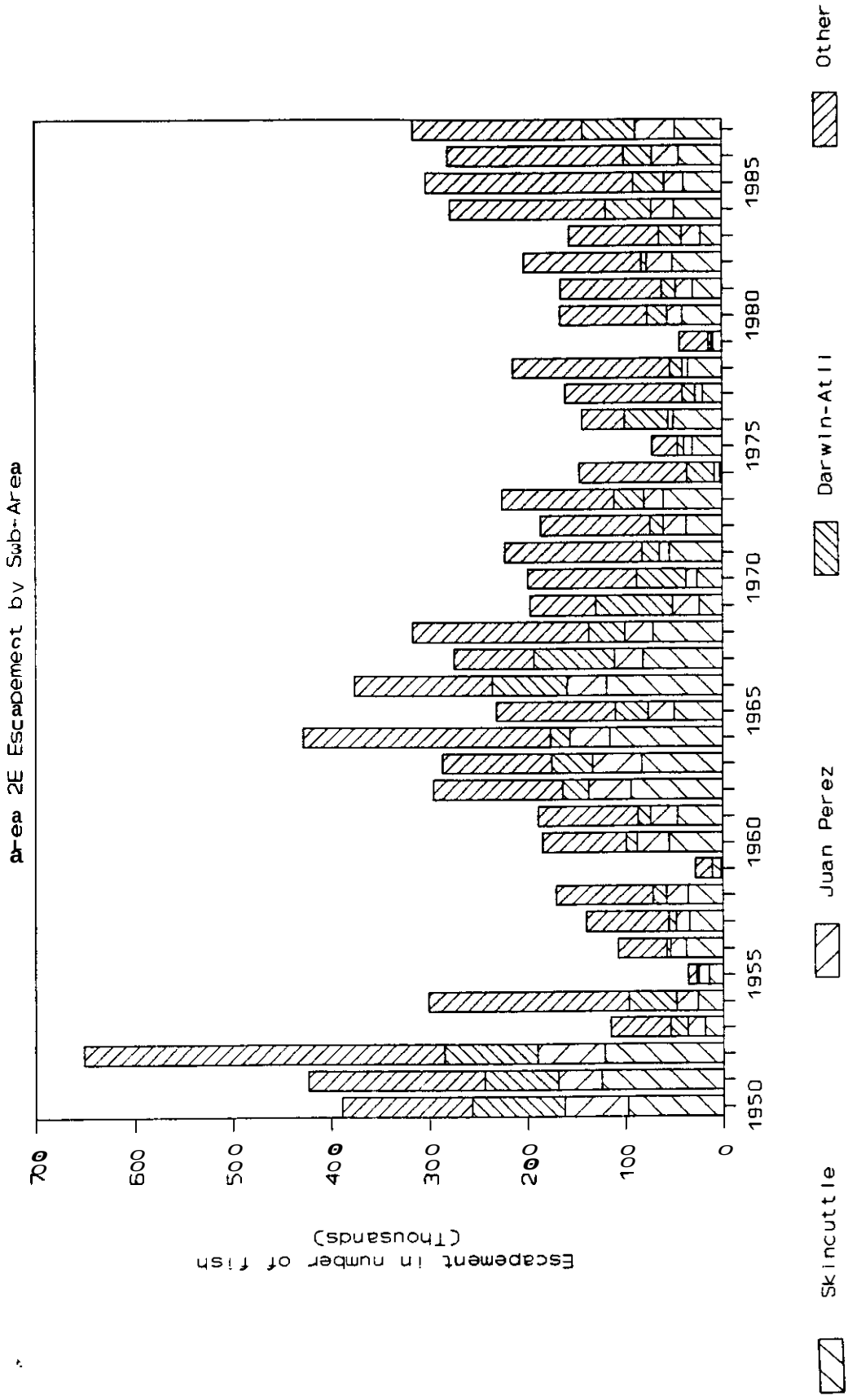


Figure 9: Area 2E chum escapement by Sub-Area, 1950-1985
Source: See Table C7, Appendix C

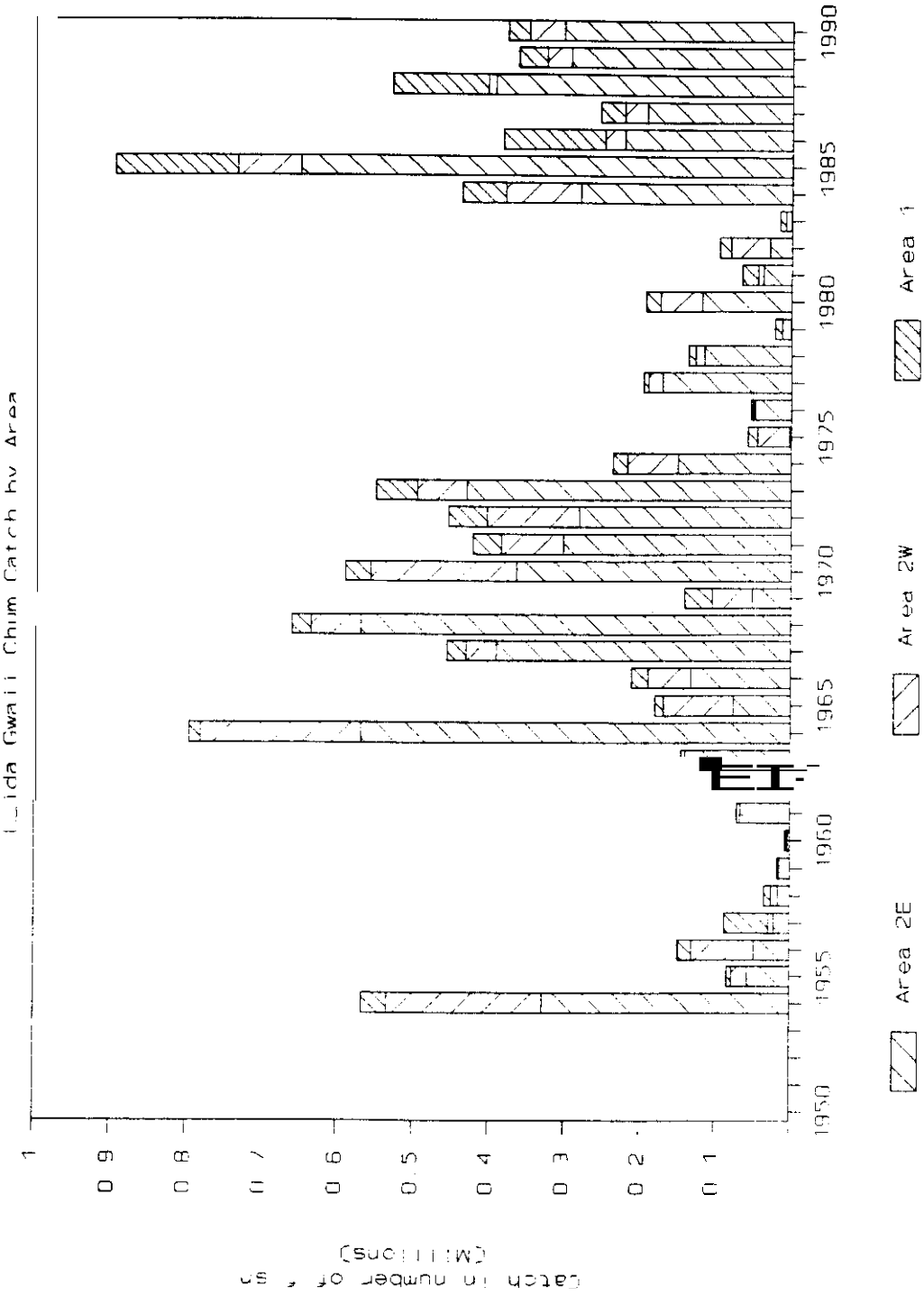


Figure 10: Haida Gwaii chum catch by area, 1950-1990
Source: See Table C6, Appendix C

3.3 PINK SALMON

INTRODUCTION

Pink salmon are the smallest of the Pacific salmon and a dominant run occurs on Haida Gwaii during even years. Pink salmon have historically been harvested in terminal commercial seine fisheries, but interception troll and seine fisheries have developed in recent years which target on passing **stocks. Pinks** were less utilized by the Haida than other salmon species. Pinks are also targeted in terminal recreational fisheries at a few river estuaries such **as** the Yakoun. The study area includes **44** streams with a total target escapement of more than 260,000 pinks which is about 13% of the target escapement to Haida Gwaii streams of 2.0 million pinks in cycle years. About 160,000 of the study area target escapement is in the Juan Perez sub-area. The even year pink salmon run of the Yakoun River is one of the largest in British Columbia, with a target escapement of 650,000. Pink catches in Area 2E in even years have averaged 251,000 since 1984, with **a peak** of 1.6 million in 1976.

LIFE HISTORY AND BIOLOGY

The pink salmon, *Onchorhynchus gorbuscha* (Walbaum 1792), referred to as *ts'iit'an* in Haida, are the smallest **of** the Pacific salmon (Figure 11). There are also referred to as "humpie", humpback salmon and "slimy". Ocean going adults have very large spots on the back with large oval blotches on both lobes of the tail and very small scales. Spawning adults take on a dull grey coloration on the back and upper sides with a creamy-white colour below. Males develop a pronounced hump. Pink salmon are found throughout the northern Pacific Ocean, and range as far south as California in North America and as far south as Japan and Korea in Asia (Hart 1973) and also occur in the Bering Sea as far east as the mouth of the Mackenzie River. The main spawning grounds, however, are between Puget Sound in Washington State and Bristol Bay in Alaska.

Biology and life history are reviewed by Hart (1973) and Scott and Crossman (1973). Haida Gwaii pink salmon generally enter streams between August and late September and spawning takes place during September and October (Marshall *et al.* 1978a,b). Females have a fecundity of 1500 to 1900 eggs (Scott and Crossman 1973) and deposit their eggs in shallow redds where they are fertilized by the males. The female will guard the redd for as long as she is able, but will generally die within a few days of spawning. The eggs hatch in about February and the young may emerge in April and May, depending on uater temperature, after which they make an active migration downstream.

Pink salmon of Canadian origin move offshore in a region extending about 800 km (500 miles) from land between Prince William Sound and the outlet of the Columbia River (Map 7). Food during offshore life consists mainly of euphausiids, copepods, amphipods, fish and squid (LeBrasseur 1966). The return migration takes place during the second summer, with extremely few exceptions The two year life cycle is so invariable that fish running in odd numbered years are genetically isolated from fish in even numbered years and can be considered separate from the point of view of exploitation and conservation (Aro and Shepherd 1967; Larkin and Ricker 1964).

Adult pink salmon may vary between 1.4 to 2.3 kg (three to five pounds) and may reach 76 cm (30 inches) in length. Generally, Haida Gwaii pink salmon are about two to three pounds.

The pink salmon is known to hybridize in nature with the chum salmon, if not with others (Scott and Crossman 1973).

HISTORY OF USE

Haida Use

Pink salmon, or *ts'iit'an*, were utilized more in the northern areas of Haida Gwaii than the south. Blackman (1975) notes that the Massett Haida would move to Alaska and the Alaskan Haida to Haida Gwaii to fish for pinks during the cycle years in each region. Ellis (1972-80) notes that pinks "would only keep until Christmas" after being smoke-dried, likely due to a moderate fat content. Pinks were more work to process than other salmon species, due to their small size. However, the weather was generally good for sun-drying pinks when they returned in the late summer.

Ellis (1972-80) notes that the males were preferred, which are generally larger than the females, and that the roe was only rarely utilized. Fish are usually butchered by splitting them along the backbone to obtain two boneless fillets Pinks were frequently half-smoked. If stored too long, the meat would turn brown next to the skin, and acquire a very distasteful flavour. Fresh, bright pinks are still frequently used in a *jum* or fish stew. The small heads, tails and backbones were generally not utilized.

Recreational Fishery

Pinks are commonly targeted in recreational fisheries at the stream estuaries, when they first arrive as bright fish. Common areas include the Tlell, Copper, Deena, Honna and Yakoun River estuaries.

Between 1970 and 1976, recreational pink salmon catches on Haida Gwaii averaged 1,700 fish (Argue 1985). The recreational pink salmon catch from Areas 1 to 6 of the North Coast in 1988 by resident and visiting anglers was estimated to be 8,500 which represents about 20% of the total estimated salmon catch of 42,200 (Bijsterveld 1988).

Commercial Fiiherv

Catches in the commercial fishery since 1988 are shown in Figure 12 and 13 for the dominant even year and odd year cycles, respectively. Even year catches have fluctuated considerably and have exceeded 2.0 million fish eight times since 1920. Interceptions of passing pink stocks began in the late 1970s, which accounts for the increasing pink catch during odd numbered years.

Pinks have traditionally been caught almost entirely by purse seine in terminal areas on Haida Gwaii. Interception net fisheries have developed in Area 1 and Area 2W which target passing pink stocks bound for mainland rivers such as the Fraser, Skeena and Nass. An interception troll fishery began in about 1980 targeting on passing pink stocks, mainly in Area 1 and 2W.

In 1988, B.C. canned production of pinks was about 16,000 tonnes compared to 4,500 tonnes frozen dressed and 550 tonnes fresh dressed (Anon. 1988). The value of the 1988 chum fishery on Haida Gwaii was about $10.3 million. The average **price** paid for pinks in Area 1 in 1990 was $0.81/kg for net caught and $1.59/kg for troll, based on round weights.[1]

BASELINE FISHERIES DATA

Pink salmon occur in at least 109 streams out of 171 salmon producing streams on Haida Gwaii, and 58 of these are classed as significant (Anon. 1986b). There are 24 streams recorded in the Darwin/Atli and Juan Perez areas of Area 2E which include 10 significant streams (Anon. 1986b). Within the study area, there

[1] , **DFO preliminary statistics**

are more than 40 pink salmon streams recorded with pink salmon populations. Some of the most productive pink salmon creeks in the study area and target escapements (bracketed) are Crescent Inlet Creek (20,000), Echo Harbour Creek (10,000), Salmon River (25,000), Gate Creek (20,000), Windy Bay Creek (70,000) and Scudder Point Creek (20,000).

An International Salmon Tagging Program was carried out in 1982 and 11984 by DFO, the U.S. National Marine Fisheries Service and the Alaska Department of Fish and Game.[2] The purpose of the program was to determine exploitation patterns of sockeye and pink salmon in northern B.C. and southeastern Alaska. Tagging in the Cape Chacon area of northern Dixon Entrance indicated stocks were 74% Southeast Alaska, 15% Skeena, 4% Kwinamass, 3% Haida Gwaii (2% Yakoun and 1% Area 2E), 2.5% Area 6, and 1% Area 3 (outside Dundas 'Island), Orman (1984) indicated that the Canadian contribution to the fishery might be 20-35% greater in the southern Dixon Entrance area where interception net fisheries occurs. Pink returns to the Yakoun River on Haida Gwaii in 1984 were exceptional. The 1990 run was also large. Migration pattern for Area 2 pink salmon, based on recoveries of tagged fish is shown in Map 8.

Electrophoretic analysis of pinks captured in Area 2W interception net fisheries in 1984 indicated [3] that 32% were Haida Gwaii stocks, 62% North and Central Coasts, and 6% South Coast pink stocks. Scale analysis of odd-year pink salmon generally have a high stock component from the Fraser River.[4]

Even year pink escapement by area is shown in Figure 14. Both Area 1 and Area 2E have generally high pink escapements. Escapement to the Yakoun River in 1990 was about 1.1 million pinks.

Even year pink catch by area is shown in Figure 15. Since 1980, Area 2E pink catches have been low and Area 1 accounted for most of the even year pink catch. Pink returns to the Yakoun River in 1984 and 1990 were exceptional. The 1984 stock size was about 2.4 million (Orman 1985), while escapement was 1.1 million (Spilsted *et al.* 1988).

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2 Personal communication with K. English. LGL Ltd. reported in Orman (1985)

3 Personal communication with T. Beachum, DFO (PBS) noted in Orman 1985)

4 Personal communication with J. Wooden. IPSFC noted in Oman (1985)

RESOURCE MANAGEMENT

Pink salmon stocks on Haida Gwaii are actively managed, similar to chum. Management procedures are similar to chum salmon, as described in Section 3.2. Target pink escapements by area are estimated to be 1.15 million pinks in Area 1, about 740,000 in Area 2E and 483,000 in Area 2W (Spilsted 1988). Target escapement to the Yakoun River is 650,000 or 27% of the total for Haida Gwaii of 2.4 million.

Recreational Fishery

Recreational anglers are presently not permitted to retain pink salmon in non-tidal waters. Catches of pinks are regulated by daily bag limits for salmon. These are a daily limit of 4 salmon and a possession limit is 8.

Net Fishery

Pre-stock expectations and fishing plans for pink stocks are developed in a similar manner to chums, as described in Section 3.2. 1990 expectations for Area 2E were calculated based on a return rate of 2.7 adults per spawner. The exceptional stock returns which have occurred in some years, such as 1984 and 1990, are generally not predictable.

A counting fence has been operated on the Yakoun River during even years since 1986. During 1990, the project was jointly funded by DFO and the Haida Fisheries Program. Even with accurate daily counting fence information, it is difficult to manage the terminal commercial fisheries to obtain optimum escapement. Escapement to the Yakoun River in 1990 was 1.0 million which was 350,000 over the target.

Troll Fishery

The Area 1 pink salmon troll fishery is managed according to an Annex of the Pacific Salmon Treaty. The agreement allows a maximum annual catch of 1.95 million fish with a maximum four year cumulative catch of 5.125 million pinks. Since the 1990 catch was 1.1 million, there is a balance of about 4 million pinks for harvest in 1991-93. In Area 2-10, a troll ceiling of 4% of the total allowable catch is in effect. These troll limits are in response to United States concerns about expansion of the Area 1 troll fishery. Pink returns to the southern part of Southeast Alaska were 63 million in 1989.

Discussion

Haida Gwaii pink stocks are intercepted in Alaskan and Canadian fisheries. Tag recoveries in 1984 indicate that Area 2E stocks are intercepted in Area 3 fisheries near Dundas Island. Pinks bound for Darwin Sound and Juan Perez Sound are assumed to be intercepted at the rate of 10% in Alaskan fisheries and 6% in outside Canadian fisheries (Anon. 1986b). The present management strategy of allowing mainly terminal fisheries once target escapements are reached is conservative.

Factors affecting run strength of Haida Gwaii pink stocks are not well understood. Ocean survival is a major factor affecting run strength, which is outside the control of fisheries managers. Better information about interceptions in Alaska or other Canadian fisheries reduces some of the management uncertainty. Stream productivity may be affected by habitat changes as a result of logging. Some habitat degradation has occurred at Gate Creek (Anon. 1986b).

BIBLIOGRAPHY

Please refer **to Bibliography in** Section **3.1 Salmonids - General**

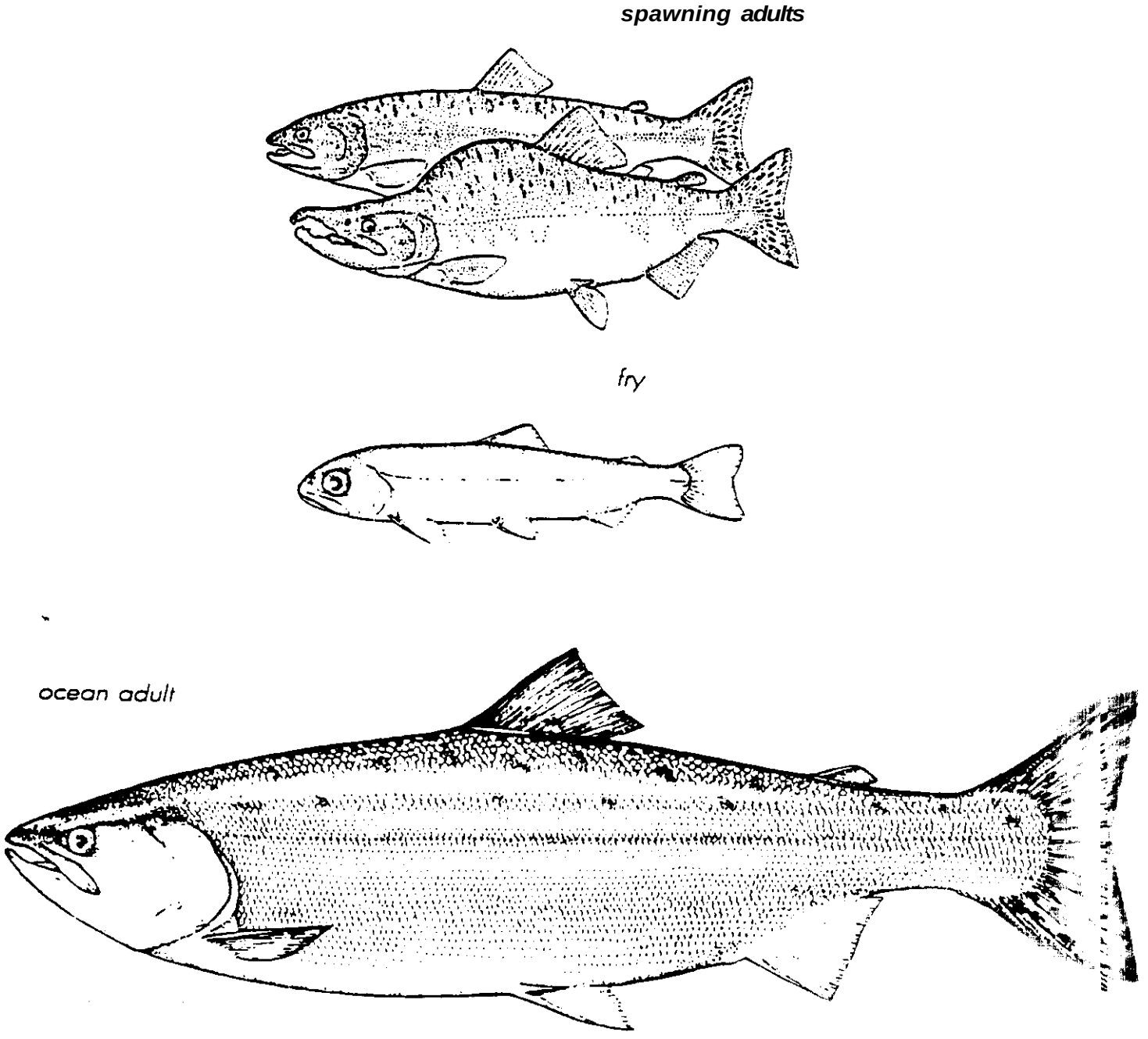
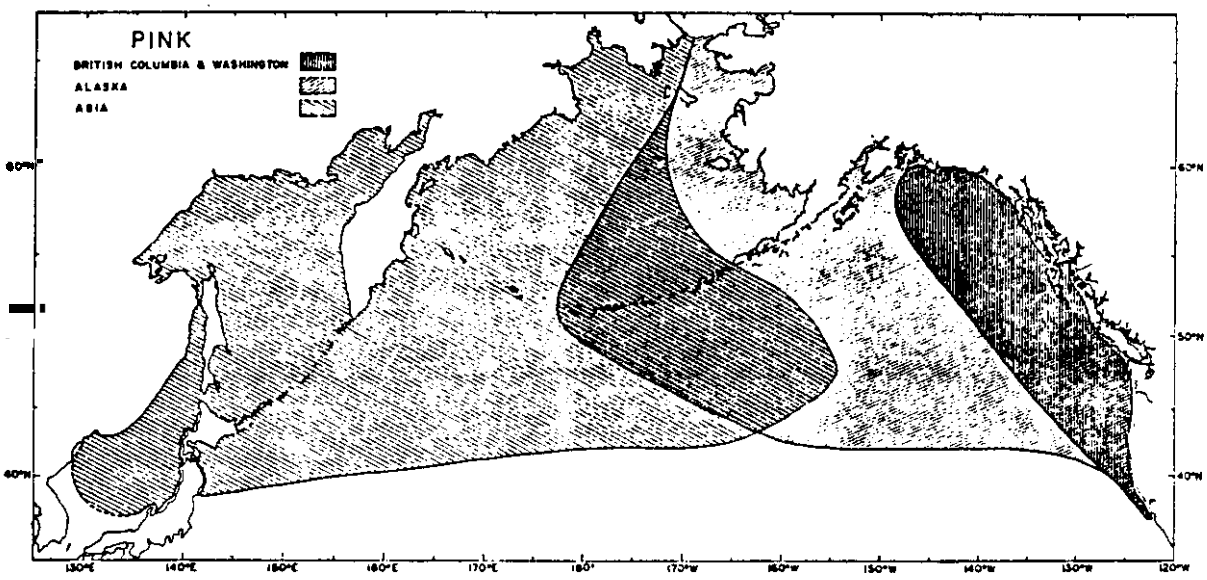


Figure 11: Pink Salmon, *Onchorhynchus gorbuscha*



Map 7: **Oceanic distribution of pink salmon in the north Pacific**
Source: **Hart (1973)**

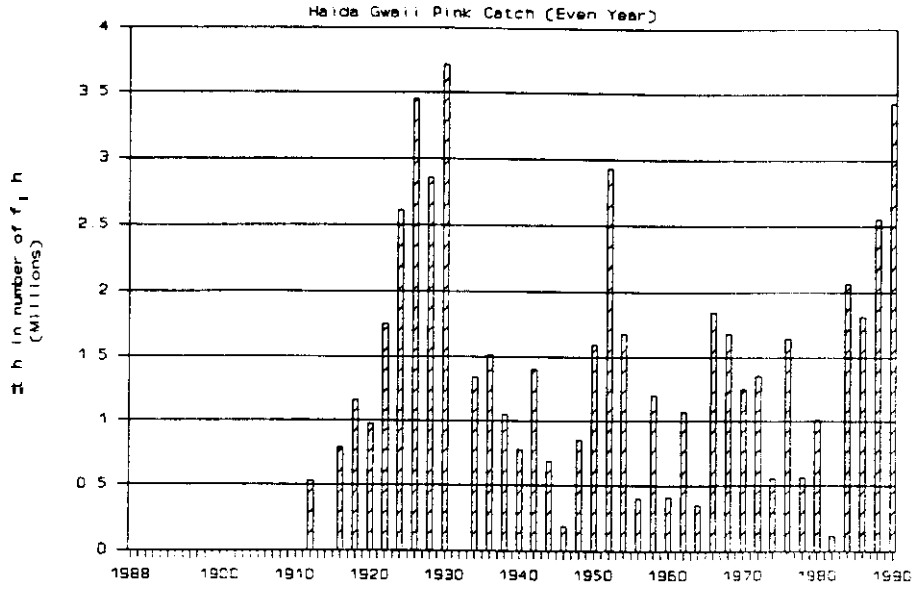


Figure 12: **Even year Haida Gwaii pink salmon catch, 1888-1988**
Source: **See Tables C4 and C9, Appendix C**

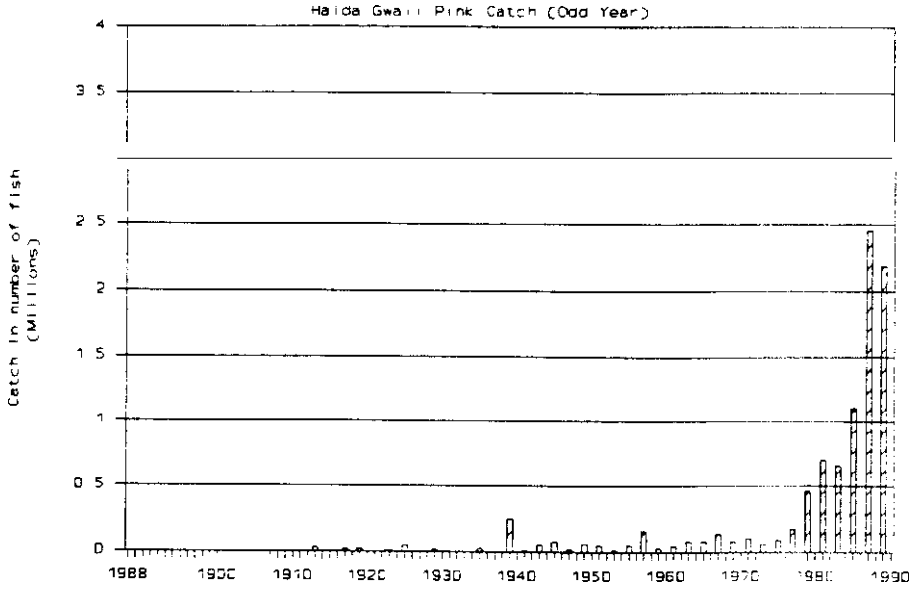
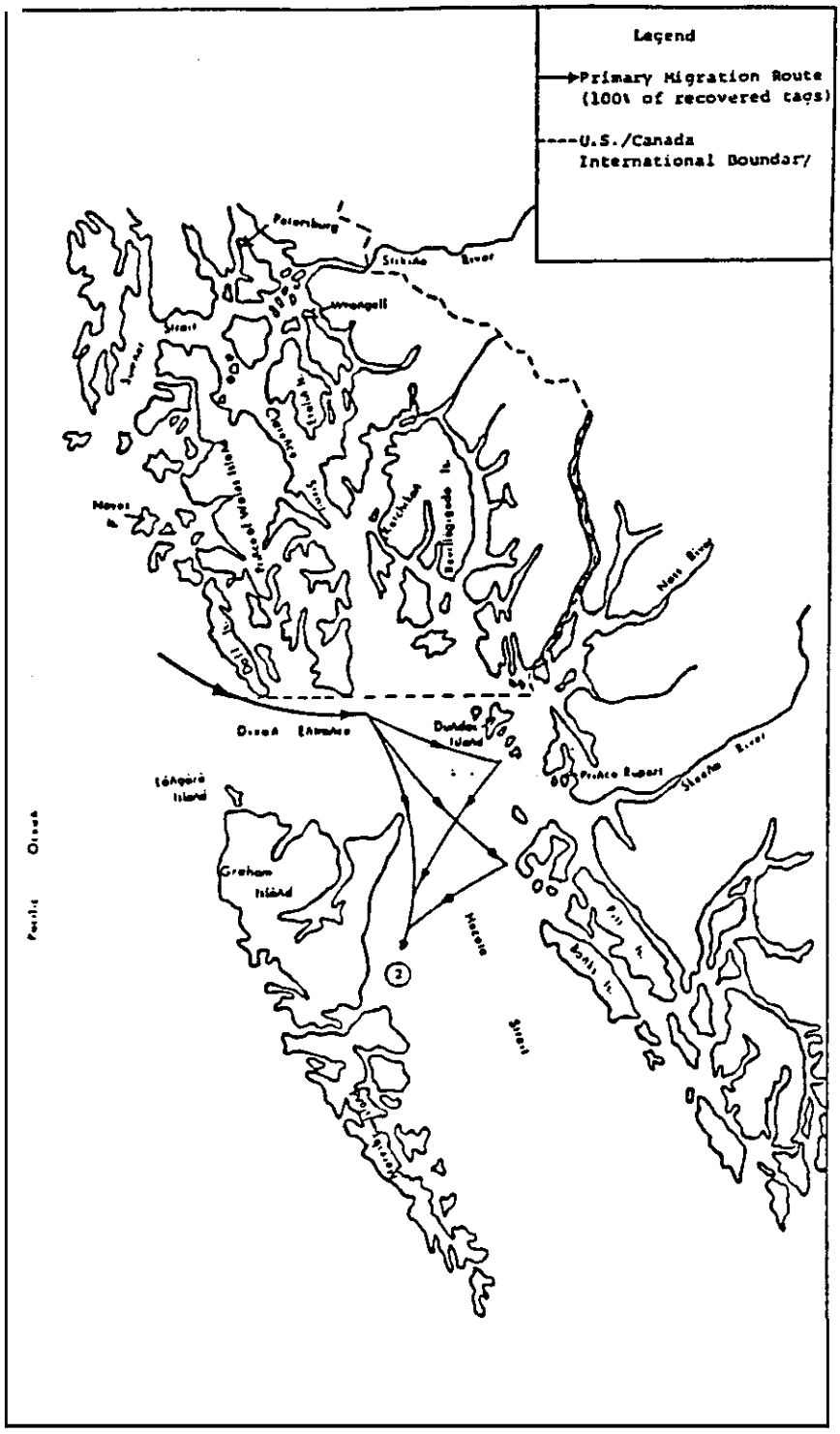


Figure 13: **Odd year Haida Gwaii pink salmon catch, 1889-1989**
Source: **See Tables C4 and C9, Appendix C**



Map 8: **Area 2 pink salmon migration patterns based on recoveries of tagging statistics**

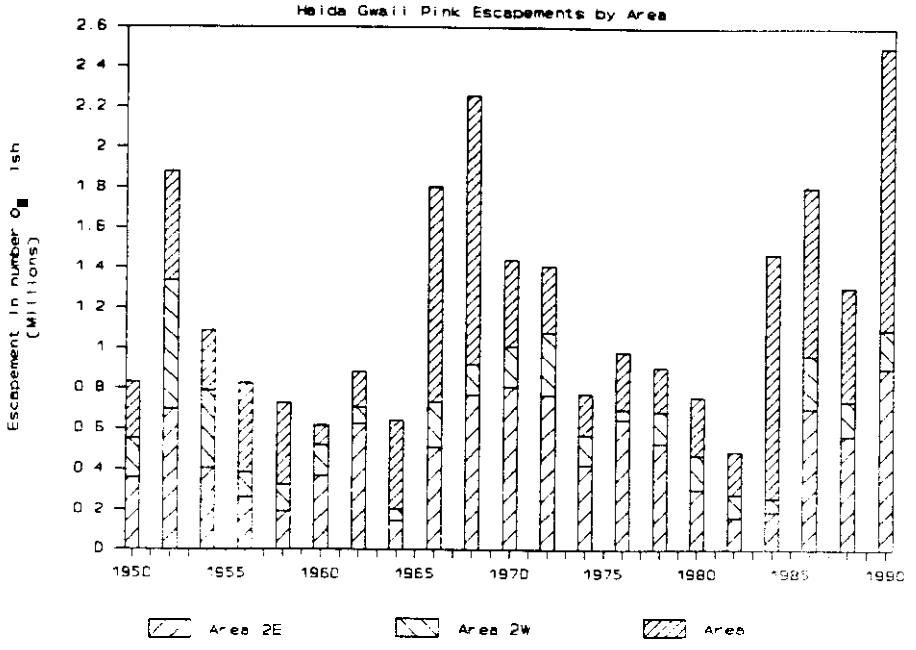


Figure 14: Haida Gwaii even year pink escapement by area, 1950-1990
Source: See Table C8, Appendix C

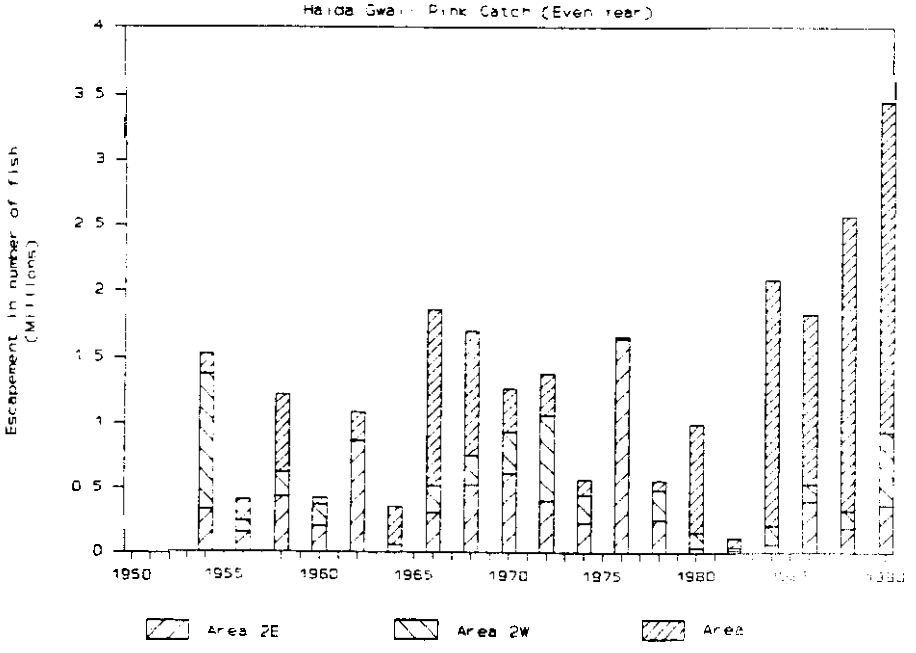


Figure 15: Haida Gwaii even year pink catch, 1954-1990
Source: See Table C9, Appendix C

3.4 COHO SALMON

INTRODUCTION

Coho spawn in more than 109 streams on Haida Gwaii and the surrounding marine waters are important for rearing and migration of these and other stocks. Local coho are important to Haida, commercial and recreational fisheries. Coho are also caught incidentally in sockeye, chum and pink net fisheries and targeted in interception troll fisheries in Haida Gwaii waters. Coho are vulnerable to habitat changes caused by logging and other timber management practices. Commercial coho catches in Haida Gwaii waters averaged 398,000 since 1954 and exceeded this level in seven of the past ten years with peaks of 841,000 in 1986 and 1990. Observed escapements on Haida Gwaii in 1988 were about 16% of target escapements, and average escapements over the past ten years are about 52,000 which is about 50% of escapements over the past two decades. Hence, there are serious concerns about the present status of Haida Gwaii coho stocks.

LIFE HISTORY AND BIOLOGY

The coho salmon, *Oncorhynchus kisutch* (Figure 16), known as *taay* in Haida, is a medium-sized salmon which occurs in most Haida Gwaii streams. Coho are found along the Pacific coast of North America from Monterey Bay in California and possibly as far north as Kotzebue Sound, although the centre of abundance is between Oregon and southeast Alaska (Hart 1973). Coho also occur along the Asian continent as far south as Korea. Ocean going coho can be recognized by their greenish-blue back with silvery sides and the small black spots on the back, the dorsal fin, and usually on the upper lobe of the tail only. The gum line is white to light grey. Spawning adults develop greenish-black heads with dark brown to maroon bodies. Mature coho are generally in the weight range of 2.7-5.4 kg (6-12 pounds) but may reach up to 14 kg (31 pounds) in weight and 98 cm in length (Hart 1973).

Juvenile coho are more dependent on freshwater habitat than chum or pink salmon, because they spend one to two years rearing in freshwater, before migrating to the ocean. Coho spawn in the fall, and will generally utilize upstream areas not accessible to chum and pinks. Fry emerge in the early spring. Fry are commonly found in low velocity glides, pools and backwaters and depend mainly on drifting insects for food. After one or more years, juvenile coho migrate to the ocean and smolt. In the ocean, coho may rear in nearshore areas or migrate far offshore. In nearshore areas such as Chatham Sound or the Strait of Georgia, food is mainly fishes such as sand lance, herring or rockfish; some

insects; and various kinds of crustacea. Food in offshore areas may consist of squid, euphausiids, and fish. On the return migration, coho tend to move south along the coast. They actively feed mainly on fishes and grow rapidly. Most coho return as age 3 or 4 fish, although some 5 year old fish occur in northern areas. Broodstock collection data from Mathers Creek, indicated that out of 9 coho collected in each of 1979 and 1980, that 7 or 8 were age 3_2 (3 years old; 2 years in freshwater) and only 1 or 2 were age 4_3 (4 years old; 3 years in freshwater) (Fedorenko and Shepherd 1985). The average *postorbital-hypural* lengths in 1979 and 1982 returns were 56 to 57 cm. Coho have high rates of return of small precocious males, called jacks.

Survival is highly variable, depending on a variety of freshwater and ocean conditions. The Salmon Enhancement Program assumes a survival rate of 0.18% from egg to adult under natural conditions. Survival during various life stages is estimated to be 15% from egg to fry, 8% from fry to smolt and 15% from smolt to adult.

Overwinter and oversummer habitat are thought to be an important factors affecting coho smolt productivity. Tschaplinski and Hartman (1983) found that coho abundance at Carnation Creek, on the west coast of Vancouver Island decreased more overwinter than oversummer. Coho abundance was found to decrease overwinter in both logged and unlogged watersheds by 80% and 60% from average densities of 5.4 parr/m and 14.5 parr/m stream, respectively, based on studies of 48 streams (Tripp and Poulin 1986b). Seasonal movements of stream-dwelling coho have been observed in winter to back channels, sloughs and cutbanks (Bustard and Narver 1975; Mason 1976).

HISTORY OF USE

Haida Use

According to Ellis (1972-80), coho salmon, or *taay*, keep at most three months when smoked, likely due to the high fat content, and so were not favoured to preserve for winter use. Coho were esteemed as a fresh product (Blackman 1975) and other products such as the eggs were used in a variety of ways.

Coho were generally taken incidentally during the chum salmon harvest (Ellis 1972-80). On the Copper River, they were taken using spears, with a single detachable barb, tied by a line to the middle of the shaft. At Cape Ball, coho were one of the most abundant salmon species and were of special importance to the Haida people who lived there or owned the salmon fishing rights in the areas.

Coho were prepared as fillets or *ts'ilgi*, which were air dried or partially smoked. Coho *ts'ilgi* is richer and softer than *ts'ilgi* prepared from chum salmon.

Coho eggs were prepared in a variety of ways. Usually, the eggs were separated, soaked in fresh water until they turned hard and white, and then pounded to a soft butter-like consistency. The eggs were then eaten raw, with water. Loose coho or chum eggs were also collected from spawning streams, and were eaten raw. Loose eggs from ripe coho were sometimes placed in baskets which were suspended in creek water, and then eaten raw. Intact skeins of eggs were sometimes lightly smoked. Coho eggs were not considered suitable to make "stink eggs". Milt from the male coho was also sometimes added to fish stew or *jum*.

The method of fishing for coho using nets in small streams and the importance of coho were described in the court transcripts in Regina v. Fred Davis (Province of B.C. 1988). This case upheld the rights of Haida people to continue to catch coho in traditional ways.

Recreational Fishery

Coho are a prized recreational fish which are caught using rod and reel in tidal and non-tidal waters. Coho are caught incidentally in fisheries directed at trophy chinook salmon, in the area of Langara Island and Naden Harbour. More than 85% of the Chinook catch in Area 1 in 1986-89 was through fishing lodges and charter vessels. A directed recreational fishery for coho occurs in Area 2E in the fall. The main tidal areas are Skidegate Inlet, Cumshewa Inlet and Selwyn Inlet. Fishing effort in 1990 in Cumshewa Inlet and Selwyn Inlet was primarily from charter vessels located in Cumshewa Inlet. Non-tidal fisheries occur on the Tlell River, Deena River, Copper River and Pallant Creek. Non-tidal fisheries also occur in Area 1 on the Yakoun and Sangan Rivers.

Recreational fishing catch has not been closely monitored in the past and has increased in recent years. The average estimated catch was 1,822 coho from 1970 to 1976, increasing to 6,933 between 1982 and 1983 (Argue 1985). The estimated 1990 catch was 17,000 coho, with the increase occumng mainly in Area 1. This trend in recreational coho catch is caused mainly by increases in fishing effort attributable to floating fishing lodges, charter vessels and freshwater angling guiding.

Commercial Fishery

Coho have been caught in commercial fisheries on Haida Gwaii since at least 1888 (Argue 1985). Most who are caught by trollers, although some coho are caught incidentally by seine and gillnet fishermen. Coho landings were an important part of the troll fishery which developed in Area 1. Catch statistics during the early years of the fishery (Argue 1985) indicate that coho catches, in number of pieces, were consistently higher than chinook. In the early years of the fishery, most coho was either salted, smoked or delivered fresh. Very few fish were canned. Historic coho catches since 1888 are shown in Figure 17.

In modem times, most commercially caught coho are still caught by trollers and fishing methods have changed very little. Coho are generally caught in the upper 20 fathoms of the water column in nearshore areas and generally within 30 miles of shore. Modem trollers either carry ice or are equipped with their own freezers.

In 1990, the B.C. average value of coho' was $2.79/kg for troll[2] and $1.54/kg for seine.

BASELINE FISHERIES DATA

Coho have been documented in 109 Haida Gwaii stream systems, of which 26 occur within the study area (Anon, 1986b). Of the 55 streams classed as significant for coho production, 11 occur within the study area (Anon. 1986b). Recent escapements to some significant coho streams within the study area and on Haida Gwaii are summarized in Table 1. Escapements are depressed compared to target escapements, with the exception of Pallant Creek, which is enhanced.

Figure 18 presents total coho escapements by Area for Haida Gwaii since 1950. Escapement fluctuates considerably, but, on average, has declined in recent years. In Area 2E, the average escapement has declined from 76,000 in the '60s, to 46,000 in the '70s and 26,000 in the '80s (Table C11 Appendix C). Coho stocks in Area 2W, are small compared to Area 2E and Area 1. Escapement data has limited accuracy since methods are not standardized and are affected by monitoring effort which has changed in recent years due to reductions in chartered fisheries patrols.

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1 Preliminary Statistics, Statistics Division, DFO based on round weight

2 Based on average price for ice and freezer boats in the round.

Figure 19 presents commercial coho catches on Haida Gwaii by Area since 1954. Coho catches since 1954 have ranged from a low of 157,000 in 1977 to a high of 841,000 occurring in 1986 and 1990. Average catch over the past four decades is high and has ranged from 332,000 to 463,000 pieces (Table C11, Appendix C). In general, coho catches in Area 2W have increased from historic levels, while catches in Area 1 and 2E have fluctuated but remained high. Average coho catch from Haida Gwaii in the period 1985-89 is 520,000 which is 25-56% higher than average catches in periods since 1953.

The average coho troll catch on Haida Gwaii from 1985-89 was 492,000 pieces and represents 91% of the total catch. About 15% of the coho catch in Area 2E from 1985-89, or 11,900 occurs in net fisheries (Table C12 Appendix C). Argue (1985) estimated that 25% of the 1980 and 1982 Area 1 and 2 coho catch was from Haida Gwaii stocks'.

Figure 20 shows recreational coho catches on Haida Gwaii by Area since 1970. Recreational coho catch increased sharply from less than 10,000 to 17,000 in 1990. Factors affecting catches may include changes in coho abundance (commercial catches also increased sharply in 1990) and changes in fishing effort or patterns. Some transfer of fishing effort may have occurred from chinook to coho. Catch limits for chinook salmon were reduced in 1990 from the daily bag and possession limit of 4 and 8 chinook, respectively, to 2 and 4. The overall catch limits for salmon were unchanged at 4 and 8, respectively. Area 2E coho catches peaked at about 7,000 in 1987 and 1988, and declined in 1989 and 1990. The 1990 recreational coho catch of 17,000 was 2% of the total commercial coho catch of 841,000.

According to recreational mail surveys (Bijsterveld 1989), approximately equal numbers of chinook and coho salmon were caught by anglers in Areas 1-6 in 1988/89. Estimated catches were 16,400 chinook and 15,400 coho. The proportion of chinook in Area 1-6 is high compared to estimates of British Columbia totals, which were 179,200 chinook and 1,367,400 coho.

Migration patterns of Haida Gwaii coho stocks are not well documented. Some information is available from tagging studies on enhanced coho at Pallant Creek, the Yakoun River and Sachs Creek. Coho released from Pallant Creek are caught mainly in Northern troll (44%), net (21%) and sport fisheries (25%) with a small proportion reported in Alaska commercial (5%) and sport fisheries (4%), based on coded wire tag recoveries from 1980 to 1986 (Table C14 Appendix C).

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[3] Based on 1980-83 escapement data and an assumed 55% harvest rate.

Migration routes for coho in Southeast Alaska, are shown in Map 9, from migration studies by the Alaska Department of Fish and Game. During mid-summer, most juvenile coho move northward along the coast. Juveniles move southward as the days shorten and air and sea temperatures begin to decline and move northward again when temperatures again begin to rise.

RESOURCE MANAGEMENT

Haida Gwaii coho stocks are passively managed, which means that harvesting plans will not be altered to account for in-season information. The available information about coho stocks is limited and the status of Haida Gwaii coho stocks is not accurately known. Escapement data is incomplete and catch data provides only limited information about Haida Gwaii stocks, due to mixing with other stocks.

Coho are difficult to enumerate accurately because migration and spawning occurs during freshets when visibility is impaired, the prolonged period of the run and tendency to migrate further upstream than other salmon species.

Haida Fishery

Present Haida fisheries for coho are small, and not well documented. In 1988, DFO estimated that the Indian food fish catch in Area 1 and 2 was 985 coho out of a total of 11,922 salmon. Most commercial fishermen obtain food fish permits, but many others do not, so that catches are underestimates.

Commercial Fishery

Troll Fishery

Area 1 is the most important coho troll area on the North Coast. Significant fisheries also occur in Area 2E, 2W, 3, 4 and 11.

As discussed in Sections 3.3, 3.5 and 3.6, interception troll fisheries are managed primarily by quotas set for chinook, sockeye and pink salmon. One exception on the North Coast are special conservation measures for Skeena River coho stocks, which involve time and area closures for trolling in mainland sub-areas.

Major changes occurred in troll fishing patterns as a result of the implementation of the Pacific Salmon Treaty in 1985. These have included area closures for chinook conservation and a reduced season. Prior to 1985, coho could not be retained during the early part of the troll season until June 15 due to their small size. These measures are no longer required, since trolling commonly does not begin until the end of June or beginning of July.

Net Fisheries

Presently, coho are caught only incidentally in net fisheries for other salmon species. Prior to 1970, net fisheries could be targeted at all species of salmon including coho. Targeted net fisheries for coho have been eliminated, since the 1970s, which has caused a reduction in the catch of coho by gillnets. Interception of coho by seines has increased however, due to developing interception fisheries for pinks and sockeye and terminal fisheries for chum, particularly in Area 2W.

Recreational Fiiherv

Recreational fisheries for coho in tidal waters are regulated by overall limits for salmon, which are a daily bag limit of 4 salmon, a possession limit of 8 salmon and a minimum size limit of 30 cm. There are presently no time or area closures for tidal sports fishing on Haida Gwaii, including the river mouths. There have been no changes in the tidal recreational fishing regulations for the past 20 years.

Recreational fisheries for coho in non-tidal waters are regulated by the Province. Regulations include a daily bag limit of 2 and possession limit of 4 coho over 50 cm, with two additional jacks, or coho between 30 and 50 cm, allowed.

Recreational anglers can presently have the combination of tidal and non-tidal limits in their possession, or up to 14 coho.

Enhancement

Coho are enhanced at most of the small and large hatcheries on Haida Gwaii, but production is generally small compared to chum. For instance, in 1989, the expected adult production from Pallant Creek and Mathers Creek hatcheries combined was 15,500 coho and 215,000 chum and at four small enhancement facilities was 5,641 coho and 3,544 chum (Anon. 1990d). Efforts to enhance coho stocks have been small scale, and productivity is likely limited by the rearing area of Haida Gwaii streams.

Discussion

A major current management concern for coho is the continued decline in observed escapements in streams throughout Haida Gwaii (Argue 1985; Anon 1979-90). Declines in wild coho stocks in the Strait of Georgia caused DFO to initiate a special management planning process to preserve these stocks. Factors contributing to the decline of Haida Gwaii coho stocks are not well understood.

Factors which need to be assessed include possible overfishing and effects of habitat changes as a result of logging.

Recommendations

1. A better understanding is needed about productivity of both wild and enhanced coho stocks on Haida Gwaii, and limiting factors including habitat, optimum escapements and other variables.

2. Indexes are needed to monitor exploitation of coho stocks which would allow managers to evaluate the results of coho management actions.

3. Enhancement strategies should be developed to maintain coho populations, in streams where escapements have declined.

4. Stock size indicators should be developed to assess in-season coho run strength.

BIBLIOGRAPHY

Please refer to Bibliography in Section 3.1 Salmonids - General.

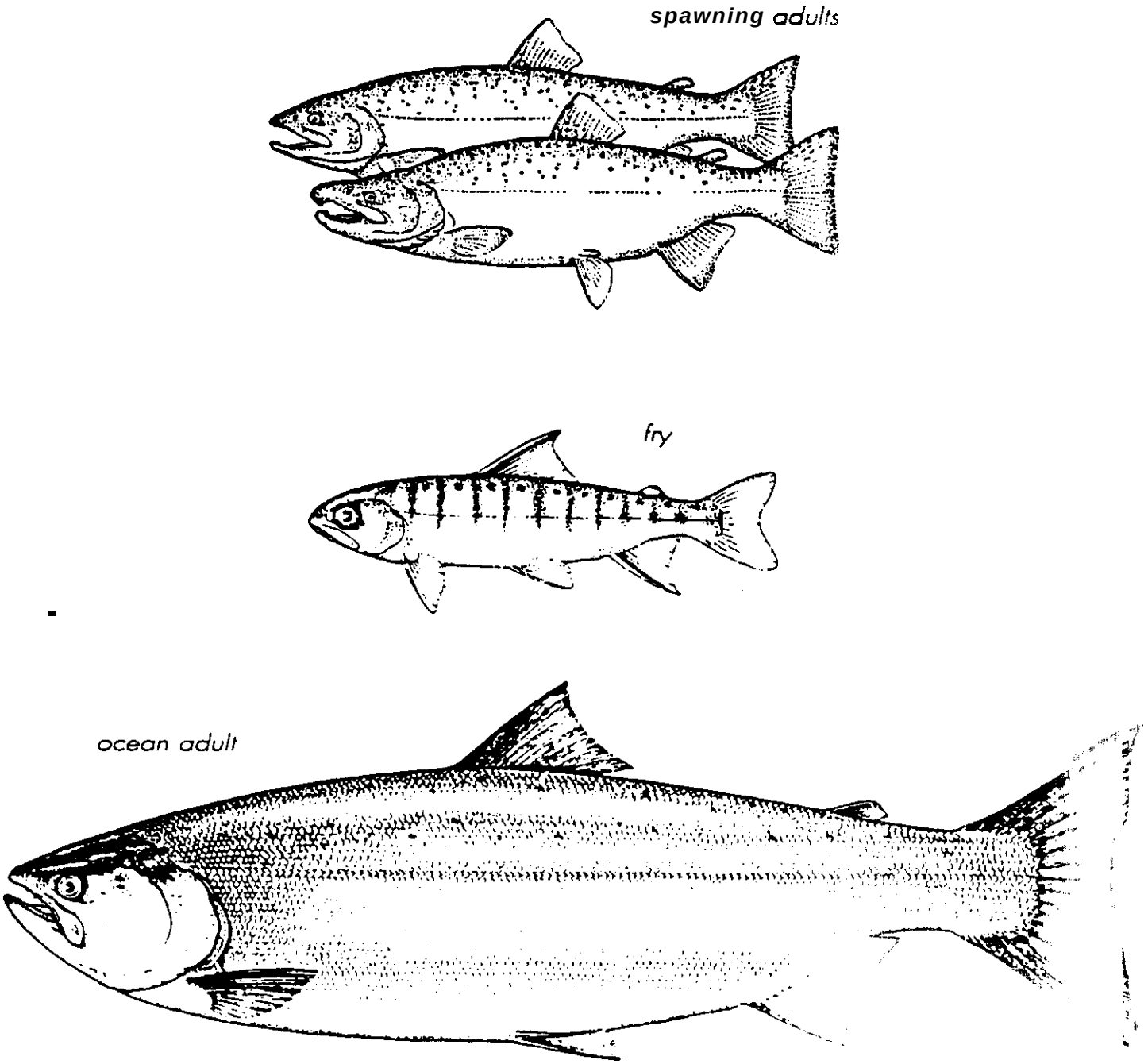


Figure 16: **Coho Salmon, *Oncorhynchus kisutch***

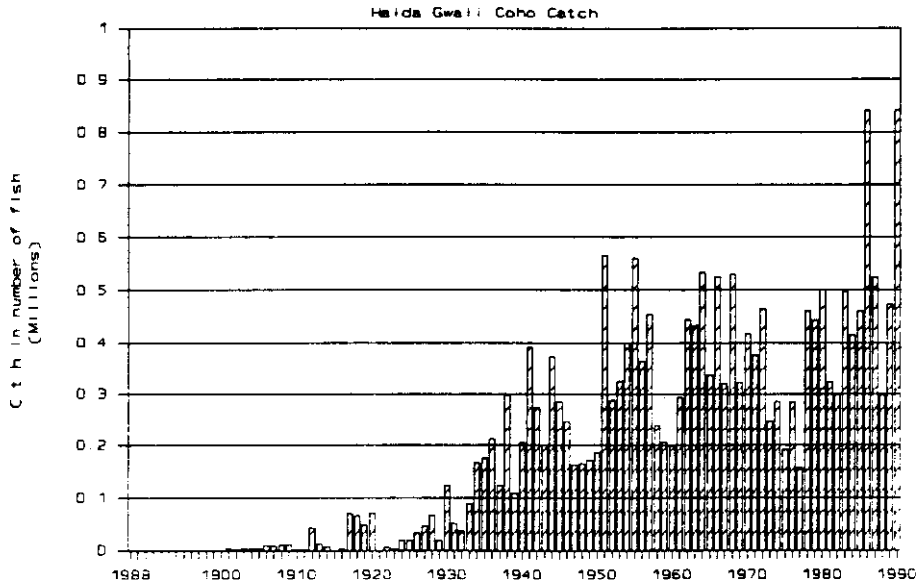


Figure 17: **Haida Gwaii commercial coho catch, 1888-1990**
Source: **See Tables C4 and C11, Appendix C**

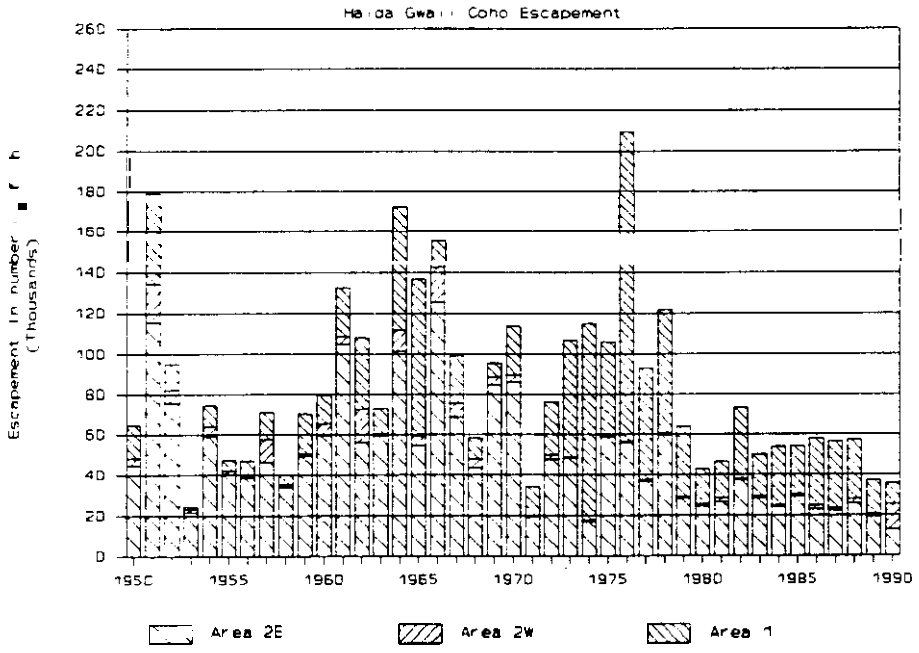


Figure **18:** **Haida Gwaii coho escapements by area, 1950-1990**
Source: **See Table C11, Appendix C**

Stream	Area	Target Escapement	Escapements 1980-89 Average	1990
Yakoun River	1	40,000	8,644	8,000
Mamin River	1	15,000	2,478	500
Jalun River	1	15,000	1,161	unknown
Sangan River	1	15,000	956	800
Tlell River	2E	25,000	5,111	750
Deena River	2E	12,000	2,925	1,000
Copper River	2E	15,000	5,543	2,000
Pallant Creek	2E	3,000	2,839	3.802
Study Area				
Crescent Inlet Creek	2E	1,000	196	30
Bag Harbour Creek	2E	1,000	262	300
Sedmond Creek	2E	1,000	354	50
Salmon River	2E	750	216	50
Flamingo Creek	2 w	1,000	32	--
Total		144,750	30,717	17,282

* Preliminary statistics

Table 1: **Coho escapements of** key **Haida Gwaii stream**

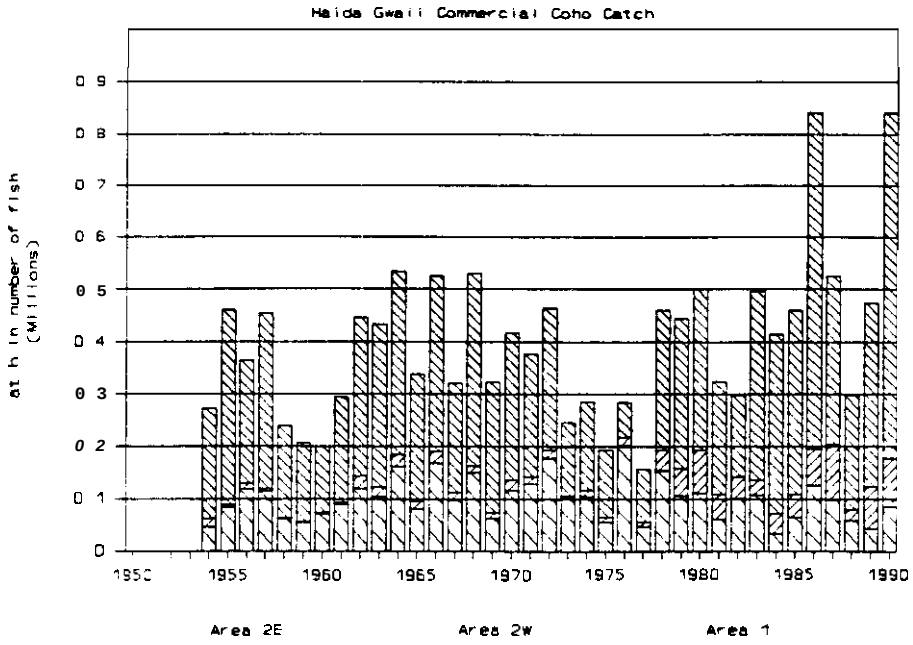


Figure 19: **Haida Gwaii commercial coho catches by area, 1954-1990**
Source: **See Table C11, Appendix C**

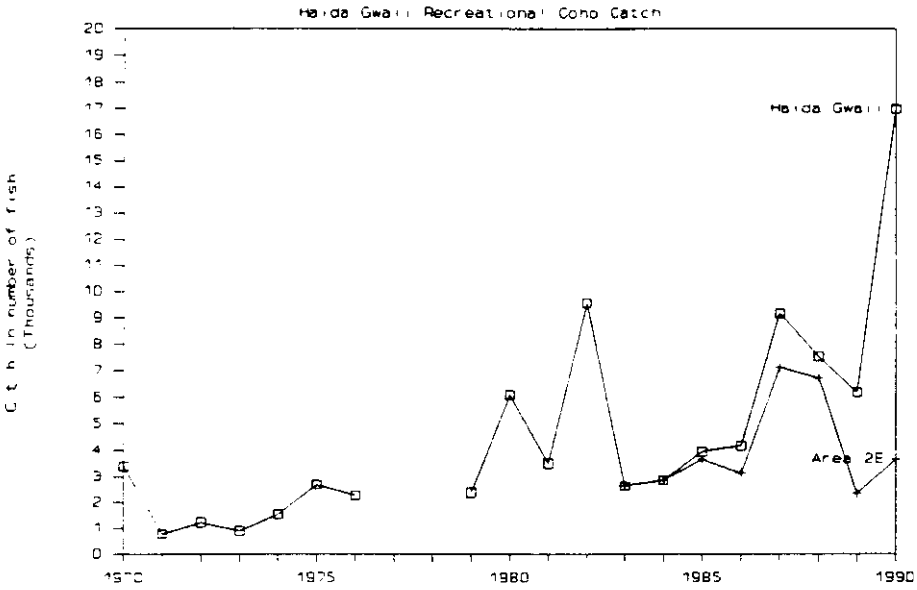
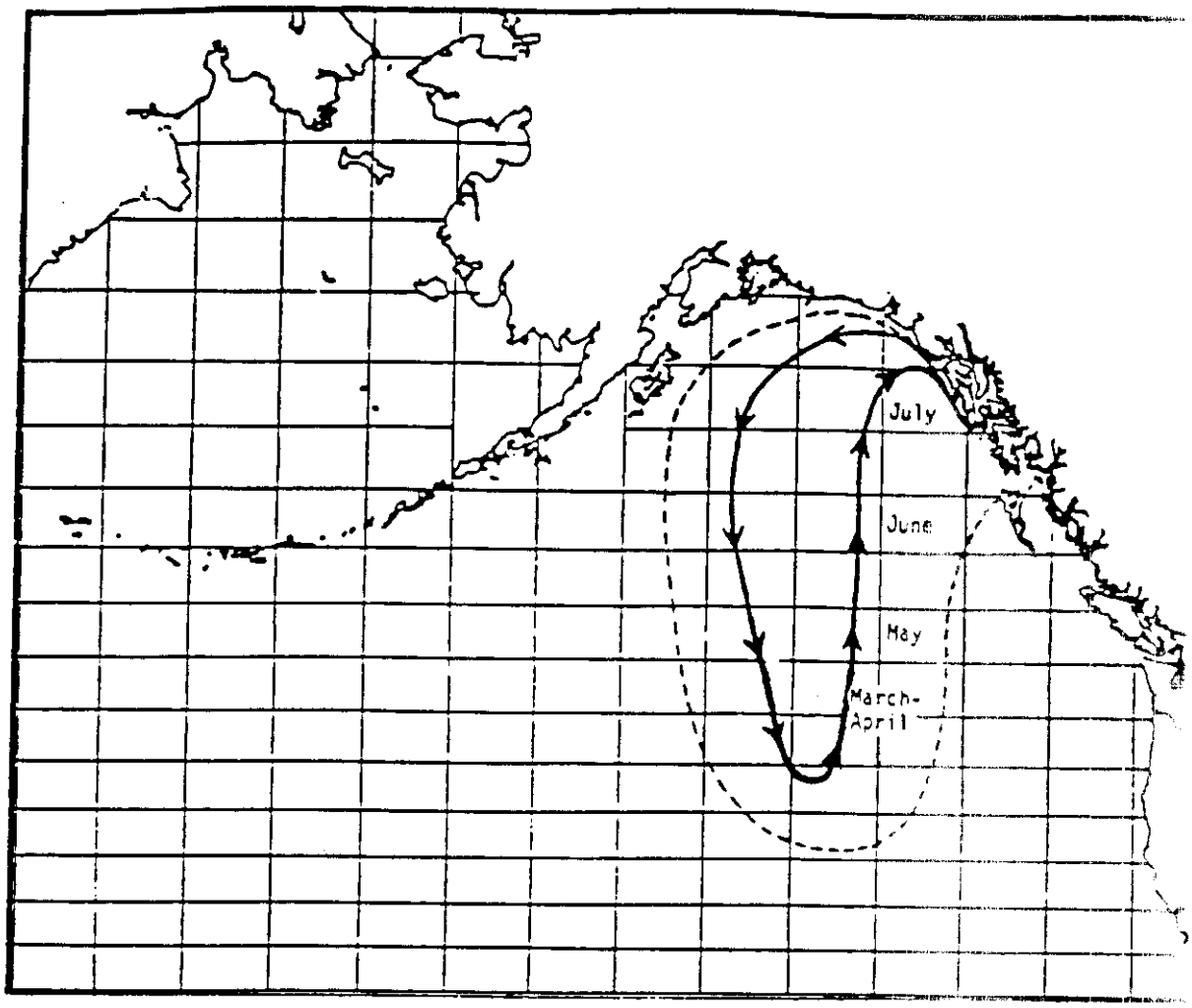


Figure 20: **Haida Gwaii recreational coho catches by area, 1970-1990**
Source: **See Table C13, Appendix C**



Map 9: **Ocean migration patterns of Southeast Alaska coho salmon base[d] on coastal and high seas tagging and test-fishing studies.**
Source: **Alaska Department of Fish and Game**

3.5 CHINOOK SALMON

INTRODUCTION

Chinook salmon are the largest of the Pacific salmon. Haida Gwaii is known for its abundance of mature fish and supports a continuing Haida fishery for chinook, a large commercial troll fishery which began more than 100 years ago and a new, rapidly developing recreational fishery. Haida Gwaii is an important rearing area for juvenile chinook and lies on an important migration pathway for chinook returning to their home streams to spawn. Since 1985, catches of chinook salmon on the North Coast have been limited to 263,000[1] fish by the Pacific Salmon Treaty, a Canada/United States agreement to rebuild chinook stocks. Catches from Haida Gwaii since 1985 averaged about 173,000 chinook. Only one small locally spawning stock of chinook occurs on Haida Gwaii at the Yakoun River.

LIFE HISTORY AND BIOLOGY

Chinook salmon, *Oncorhynchus tshawytscha* (Walbaum 1792), known as *taagwun* in Haida, is known by a variety of local names including king salmon, spring salmon, tyee, quinnat and smilie (Figure 21). Ocean-going chinook salmon have a blue grey back with silvery sides and small irregularly shaped black spots on the back and dorsal fin, and usually on both lobes of the rail. The gum line is black. Spawning adults lose their silvery bright coloration and take on a maroon to olive-brown colour. Chinook may reach up to 147 cm in length and 57.3 kg (126 pounds) in weight (Hart 1973). Chinook salmon are found along the Pacific coast from the Ventura River in California to the Bering Sea and in northeast Asia from the Anadyr River in Kamchatka to Hokkaido Island in northern Japan (Hart 1973).

Biology and life history are reviewed by Hart (1973) and Scott and Crossman (1973). The age and life history of mature adults is variable. Spawning may occur during most times of the year and in relatively few larger rivers. Fecundity depends on stock and size, and 5,000 eggs per female is an average for coastal stocks. Eggs are large, 6-7 mm in diameter and orange-red in colour. Young chinook salmon usually go to sea soon after hatching but may remain in fresh water for up to a year. Diets of chinook fry and smolts collected in the Yakoun River and estuary depended on size and included insects, amphipods, nematodes and crustaceans (Stockner and Levings 1982). Ocean migrations are, for the most part, a feeding migration to the northwest along the coast and then a return to

[1] Except for a one year increase of 38,000 in 1990.

spawning streams. Foods during this phase are mainly fish such as herring, sand lance, pilchard and rockfish but at some times of the year may include crustacea and squid (Pritchard and Tester 1944). Most chinook return to spawn in their fourth or fifth year, but some return as early as their third or as late as their eighth year.

HISTORY OF USE

Haida Use

The Haida utilized both the migrating chinook or *taagwun* stocks which were abundant in tidal waters surrounding Haida Gwaii and the small local stock on the Yakoun River. The fall chinook fishery on the Yakoun River has been discontinued for more than a decade because of the low numbers of returning fish. The Old Massett Village Council began an enhancement program for chinook on the Yakoun River in 1977, but escapements are still below the target level of 5,000 fish.

Haida harvesting of migrating chinook stocks has evolved with development of the commercial fishery over the last 100 years. Haida use of chinook salmon prior to development of the commercial fishery at the turn of the century is not well documented. Trolling at Langara Island may be a Haida practice of considerable antiquity, however. Other northern Indian groups engaged in trolling for chinook salmon, which involved moving a baited hook fashioned out of wood, bone and sinew in the water from a canoe so as to lure salmon to strike. Ethnographic accounts of the gear and methods are available for the Tlingit of south-east Alaska and the Nuu-chah-nulth of the west coast of Vancouver Island (Jewitt 1803-1805). In archaeological excavations at Kiusta village, across from Langara Island, a number of bone barbs for fish hooks and salmon vertebrae up to 18 mm in diameter were unearthed, corresponding with chinook salmon between 30 and 40 pounds, where midden deposits were dated between 4,380 and 10,435 years of age (Gessler Pers. Comm.).

Chinook are mentioned in "the Raven story," a well known Haida myth. When chinook were seen jumping, Haida people would often repeat the saying "Chinook salmon come and hit my heart", a tradition which had its origins in this story (Swanton 1905a; Ellis 1972-1980).

Chinook salmon were eaten both fresh and "half-smoked". The head and eggs were generally boiled and the boneless fillets were either sun-dried or lightly

smoked. Chinook were not smoke dried for winter use, since they do not keep well due to their high fat content.

With the development of commercial markets for salmon, in the late 1800s, the Haida were among the first to become involved in the troll fishery (Forester and Forester 1975). In the early days, most of the trolling for chinook salmon was done by hand from self-built rowboats. The 1912-14 "Fisheries Report" of the Federal government reads as follows:

> Early in the spring it was apparent that there would be a large demand for spring (Chinook) salmon, and the Haidas prepared to make a record catch. They built boats averaging about 16 feet in length and obtained a large number of trolling lines during the winter months. On May 1, all the families from the reservations left for Langara Island.

Rowboats were eventually replaced by gasoline and diesel-fired trollers which were also self-constructed. In the mid-1930s, there were three groups participating in the troll fishery at North Island in about equal numbers: the Haida from Massett, the Haida from Skidegate and "whites". There were about fifty or sixty boats in each group (Hill) Trolling became a traditional way of life for many Haida from Skidegate as well, and a fleet of fifty trollers would spend the entire winter at anchor in front of Skidegate village (Williams Pers. Comm.).

Recreational Fishery

Up to 1985, the recreational chinook fishery on Haida Gwaii was very small. From 1970 to 1976, the average recreational catch was 95 chinook and from 1982 to 1983 was 1,253 chinook.[2] Since 1985, however, Haida Gwaii has become a popular destination for commercial sports fishing or charter operations. In Area 1, the number of charter operators expanded from one in 1985 to 16 in 1989. The number of anglers over this period increased from 170 to 7,814 and the Area 1 recreational chinook catch from 500 to 16.452 chinook.

In 1990, the Council of Haida Nation implemented a management program for commercial recreational fishing in the Duu Guusd area of Haida Gwaii, which includes Langara Island and Naden Harbour. The program was directed at limiting fishing effort in the area to 1989 levels, and included registration of commercial operations, limits on fishing effort and a Haida watchman or sports fishing guardian program. The 1991 program is island-wide, with five out of

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[2] "From DFO statistics and the Tidal Diary Program, respectively. (Argue 1985)

eight major operators participating in the program, representing 70% of the charter fishing effort.

Commercial recreational operators generally offer a package to anglers which includes air costs from Vancouver, meals, accommodation and fishing equipment. The cost of three to four day packages in 1990 was about $2,000.

Commercial Fishery

Commercial chinook landings have occurred on Haida Gwaii since 1888. (Figure 22) Based on ten year averages of historic catch data, Argue (1985) estimated that annual chinook landings were less than 1,000 fish up to 1910, sharply increased from 1910 to 1920 to an average of 25,900 with a peak of 78,000 in 1919, declined during the 1920s, and have been generally high since the 1930s. Significant increases in landings occurred from the mid 1960s to the mid 1980s until catches levelled off in response to catch ceilings established by the Pacific Salmon Treaty between the United States and Canada.

The early fishery consisted largely of row boats which were replaced by power boats by the early 1940s. Early DFO records indicate that in 1933, the trollers at Langara Island numbered 225 power and 90 row boats; in 1934, 2.2 million pounds of chinook salmon and 86,000 coho were landed at Langara Island by 230 power and 50 row boats; the number of power boats fluctuated between 200 and 350 up to the early 1940s, when the use of row boats had declined to only a few boats (Anon). Langara Island and Naden Harbour in Area 1 continue to be areas of high chinook catch by commercial salmon trollers.

Under the Davis Plan, named after the Minister of Fisheries at that time, limited entry licensing was introduced for the salmon fishery in 1969. Indian participation in the commercial salmon fishery declined from an estimated 30-35% of the fleet before license limitation (Anon. 1990c) to the present participation of 21% of the salmon fleet[3]. Following license limitation, at least 23 salmon licenses were lost by Haidas (Scow 1987). At present, there are only about ten trollers owned by Haidas, five from Skidegate and five from Massett. By comparison, there are presently 3,974 vessels with salmon troll and gillnet privileges. A fleet of more than *200* trollers operates on Haida Gwaii each summer.

The harvest prior to 1909 was either salted, smoked or used fresh. Numerous small canneries operated sporadically about this time in many parts of Haida

[3] The latter figure includes A licenses, rentals, and leases (Price Waterhouse 1989)

Gwaii, as described in Section 2.0. Currently, most chinook salmon are dressed and frozen for export markets.

In 1990, the average value of large red chinook[4] was $4.24/kg for troll[5] and $2.92/kg for seine.

BASELINE FISHERIES DATA

Commercial chinook catches by area on Haida Gwaii since 1954 are shown in Figure 23. Catches from Area 1 and Area 2W have generally increased over this period. Catches in Area 2E were high during the 1970s but declined during the 1980s. About 25% of Area 2W troll catch presently comes from the study area (Sjoland Pers. Comm.). Haida Gwaii chinook landings from 1980 to 1989 averaged 168,110 fish which was 61% of the North Coast catch over this period.

Recreational chinook catches on Haida Gwaii since 1977 are shown in Figure 24. The recreational catch in Area 1 increased dramatically from 1985 to 1989, mainly due to commercial sports fishing operations and was largely responsible for increases in North Coast chinook catch over this period. Commercial recreational statistics are provided by fishing lodges. Recreational catches by other anglers are estimated by fisheries officers. The Tidal Diary program provides further estimates of recreational catch.

The average size of dressed troll chinook landed on Haida Gwaii in 1990 was 8.6 kg (19.0 lb). This is high compared to the British Columbia average of 7.2 kg (15.8 Ib).

Chinook escapement to the Yakoun River is shown in Figure 25. Escapements have been below target levels of 5,000 for many years but are improving due to enhancement. The escapement in 1990 was 2,000.

Chinook catch in Area 1 and Area 2W originates from a variety of streams on the north and central British Columbia coast, the Strait of Georgia, west coast Vancouver Island, the Fraser River, Alaska, Washington and Oregon based on recovery of tagged fish (Orman 1985).

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4 Preliminary statistics, Statistics Division, DFO.

5 Based on average price for ice and freezer boats in the round

RESOURCE MANAGEMENT

Management of chinook salmon is complicated by a large number of sequential fisheries affecting many different stocks during various rearing and migration stages. Many factors come into play in harvest management, including age at maturity, productivity, ocean distribution and migration.

Chinook fisheries on Haida Gwaii are interception fisheries on stocks bound for other British Columbia and United States streams and, since 1985, have been managed under the Pacific Salmon Treaty between Canada and the United States. The catch ceiling for the North Coast in 1990 was 264,000 chinook. The harvest of chinook salmon by Native peoples generally occurs in terminal fisheries. On Haida Gwaii, the Haida harvest of chinook is small, variable and is not limited by a specific allocation. The domestic allocation for other harvesting sectors on the North Coast in 1990 was 42,000 for recreational fishing, 35,000 for commercial net fishing and 187,000 for commercial trolling.

Haida Fishery

Haida harvest of chinook salmon is usually by seine or troll gear. Haida fishermen usually obtain food fishing permits from either the Band councils or the DFO District offices.

Recreational Fishery

The recreational fishery of chinook on the North Coast is managed mainly through personal quotas. There is also a minimum size limit of 45 cm, measured from the tip of the nose to the fork of the tail. Since June 1990, on the North Coast, the following catch limits have been in effect for chinook: daily bag limit of 2, possession limit of 4 and annual limit of 30. Recreational fishermen in tidal waters require both a tidal sports fishing license which costs $10 and a chinook stamp, costing $3.

In 1989, the recreational catch allocation for chinook on the North Coast was 20,000 but that catches exceeded 35,000. At that time, the daily bag limit for chinook salmon was 4 and the possession limit was 8. Catch limits were reduced and the recreational catch allocation was increased to 42,000 in 1990 and resulted in reduction in troll and net fishery allocations.

Commercial Fishery

Commercial fisheries are managed according to the domestic catch allocations using a variety of area and gear restrictions.

The 1990 troll fishing plan for the North Coast, including Haida Gwaii, was to implement area closures inside the "Red Line" (Map 10) when in-season chinook catches reached prescribed levels. The 1990 Troll Fishing Plan (Anon. 1990a) outlines the management objectives and states:

> "The management intent of the North Coast troll fishery is to maintain the quality and economic base of the fishery and the opportunity to extend the season to harvest other species while minimizing the shaker fishery and the need for chinook offloading. Specifically, the intent is to extend the chinook fishery to the end of August."

The minimum size limit is 67 cm in length, measured from the tip of the nose to the fork of the tail (or 56 cm head-off).

Interception net fisheries in Area 1 and Area 2W are directed at passing sockeye and pink stocks to the Skeena River and passing sockeye stocks to the Fraser River. According to the 1990 Salmon Net Fishing Plans (Anon. 1990b), net fisheries on Haida Gwaii were to be managed to abundance of these stocks while minimizing the chinook by-catch. The fishing plans note that underhailing of incidentally caught chinook has been a major problem in recent years and that the opportunity for extensions would be limited if incidental chinook catches were significant. Target net chinook catches in 1990 were 4,400 chinook in each of Area 1 and 2W. This was a reduction from 5,000 in previous years.

The Pacific Salmon Treaty - Chinook Rebuilding Program

The Pacific Salmon Treaty between the United States and Canada was signed in 1985 in response to declines in escapements to many naturally spawning chinook stocks originating from the Columbia River northward to Southeastern Alaska. The objectives of the subsequent coordinated chinook management program were (Anon. 1989f):

i. to halt the decline in spawning escapements in depressed chinook stocks: and

ii. to attain by 1998, escapement goals established in order to restore production of naturally spawning chinook stocks, as represented by indicator stocks ... based on a rebuilding program begun in 1984.

The Treaty established catch ceilings in selected mixed-stock fisheries in southeast Alaska, northern and central British Columbia (the "North Coast"), the west coast of Vancouver Island and the Strait of Georgia. The quota established in 1985 for the North Coast war 263,000 chinook for commercial and sport fisheries, excluding terminal sport and Native food fisheries.

Spawning escapements are closely monitored and catch ceilings are reviewed annually. The catch ceiling on the North Coast was unchanged until 1990, when it was increased by 38,000, for that year only. The North Coast chinook quota in 1990 was 264,000 chinook since the increase of 38,000 was nearly balanced by an overharvest of 37,000 chinook in 1989.

Chinook ceilings established in the Pacific Salmon Treaty have had significant impacts on the commercial fishery. Haida Gwaii commercial chinook catches have increased slightly from an average of 163,139 chinook between 1980-1984 to 173,080 chinook between 1985-1989. Also, the troll season has been reduced to an average of 75 days from 170 days prior to 1985, so that off-Island fishermen purchase fewer goods and services in Island communities.

Discussion

Commercial chinook fisheries are valuable present-day fisheries with a long history of use. Haida participation in these fisheries has been seriously eroded in recent years. Commercial sports fishing is a major development issue on Haida Gwaii, although development within the study area has been limited.

Hence, commercial sports fishing development in the study area should be closely monitored and a policy should be developed prior to any major development.

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Please **refer** to **Bibliography in Section 3.1 Salmonids - General.**

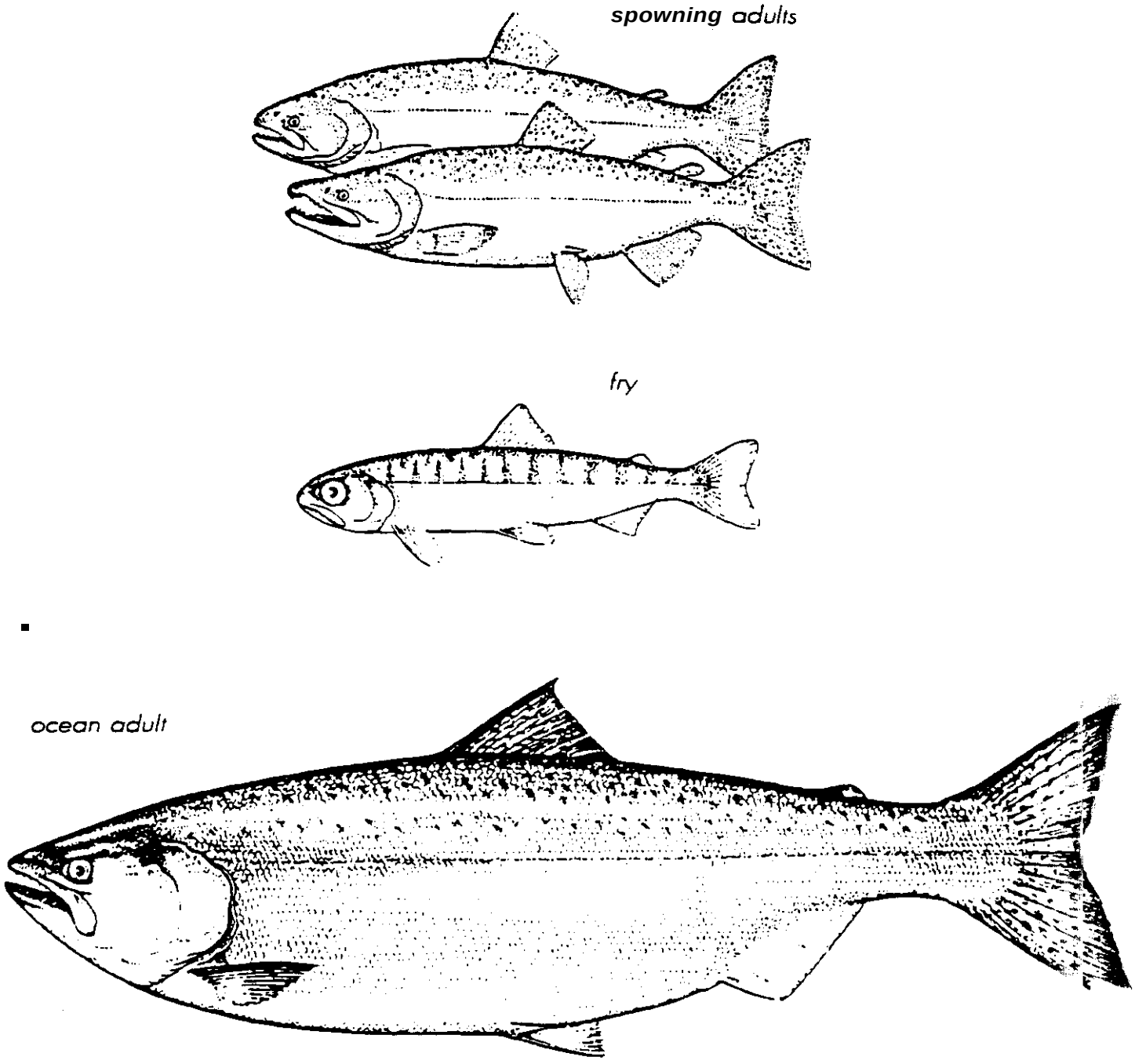


Figure 21: **Chinook Salmon, *Oncorhynchus tshawytscha***

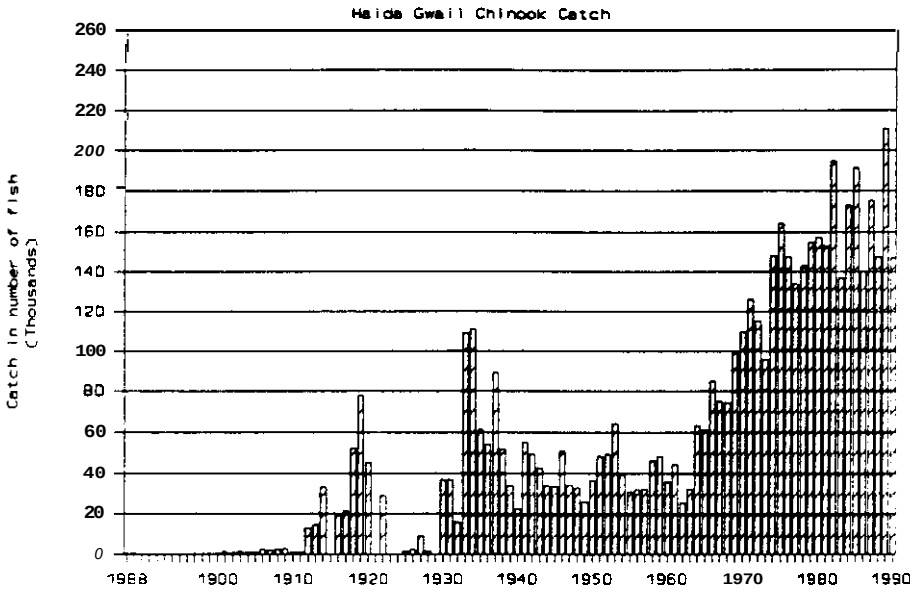


Figure 22: **Haida Gwaii commercial chinook catch, 1888-1988**
Source: **See Table C4 and C15, Appendix C**

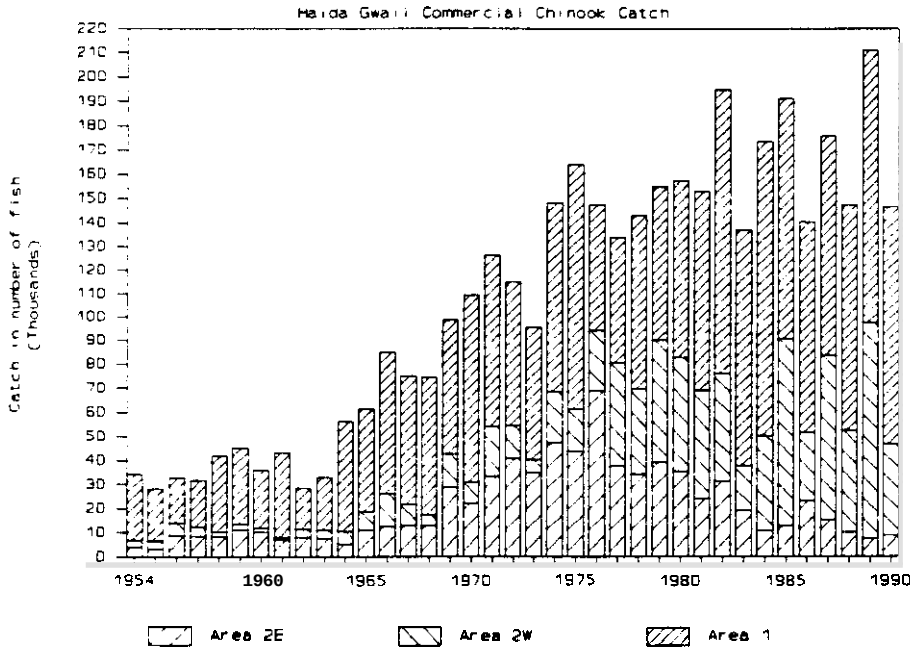


Figure 23: **Haida Gwaii commercial chinook catch by area, 1954-1990**
Source: **See Table C15, Appendix C**

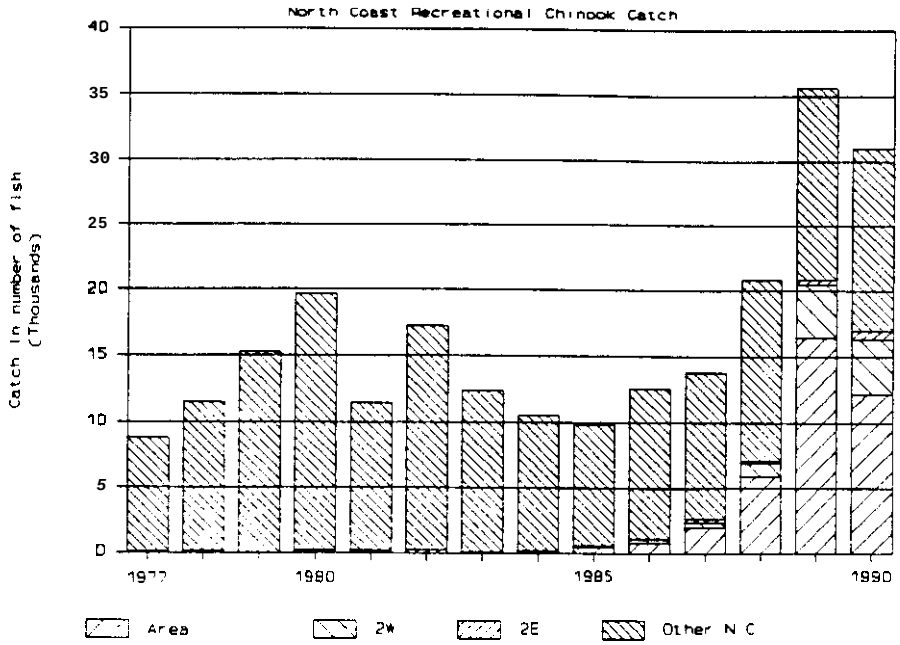


Figure 24: **North Coast recreational chinook catch, 1977-1990**
Source: **See Table C16, Appendix C**

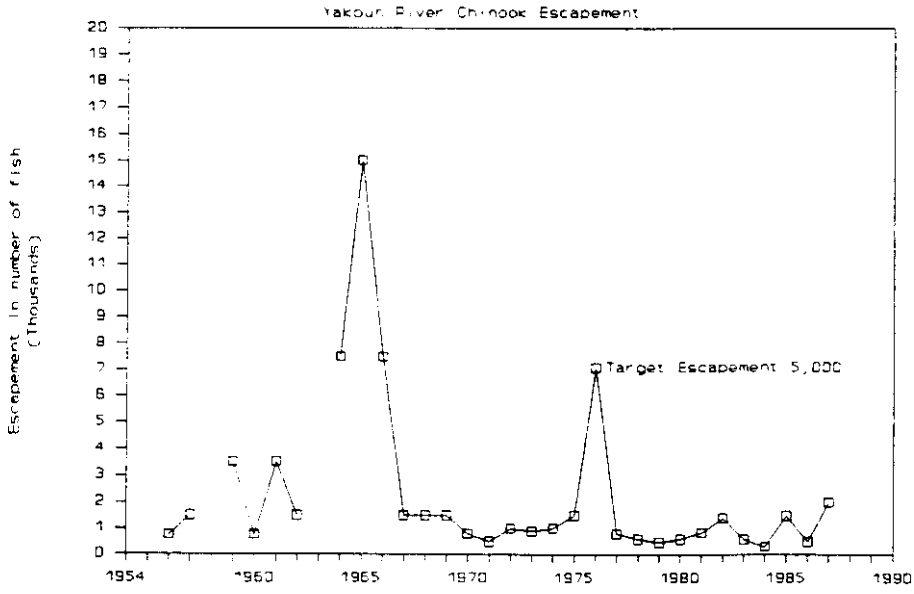
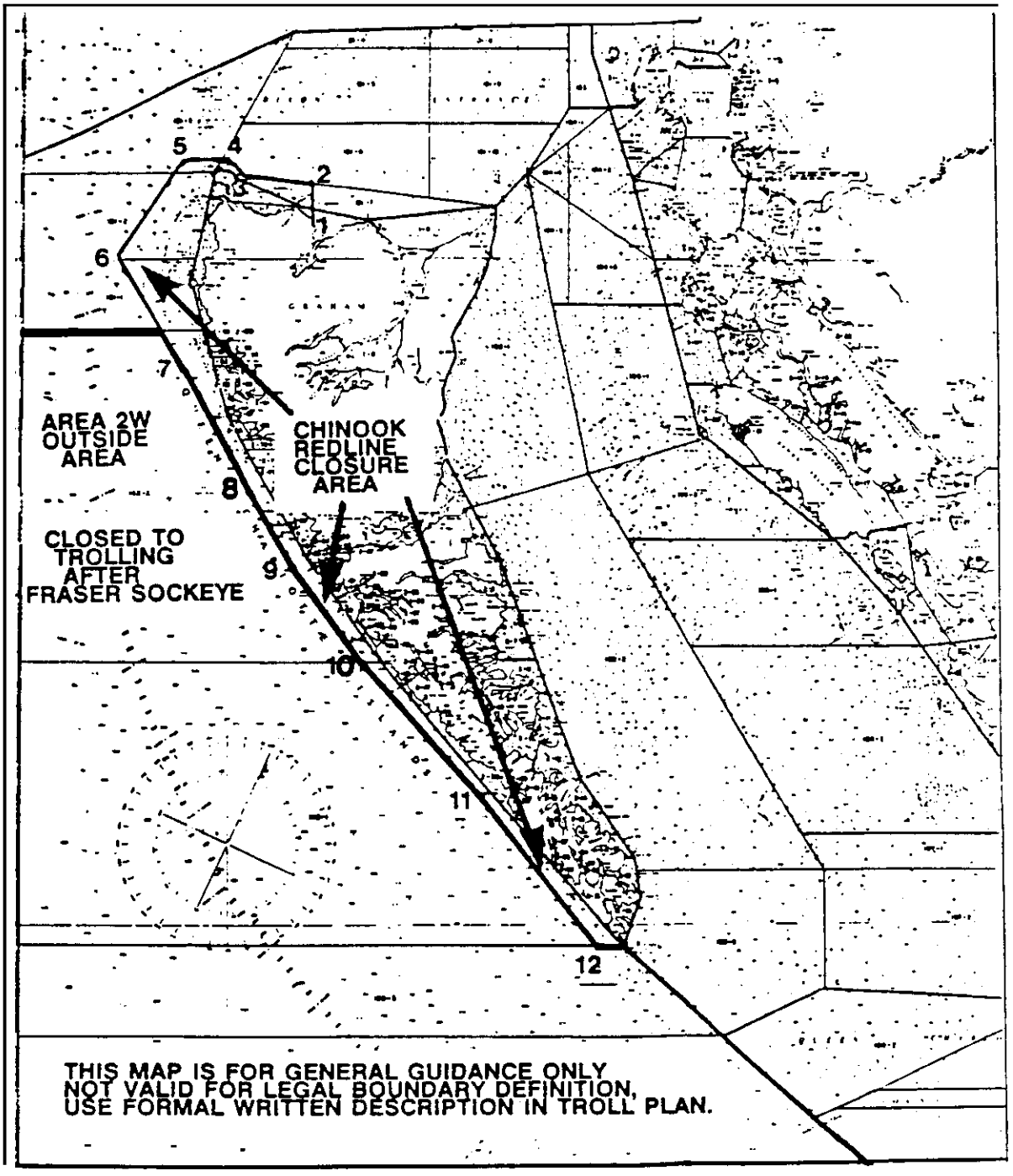


Figure 25: **Yakoun River chinook escapement, 1956-1987**
Source: **See Table C15, Appendix C**



Map 10: **Area 2W outside troll area and red line closure area**
Source: **Anon.** (1990a)

3.6 SOCKEYE SALMON

INTRODUCTION

Sockeye is one of the most important Pacific salmon in the commercial fishery due to its abundance, premium value and market demand. Sockeye bound for the Skeena, Nass and Fraser Rivers are harvested in interception net and troll fisheries in Area 1 and Area 2W during the summer. Increasing numbers of sockeye have been intercepted by troll fisheries in the last few years, producing high quality fresh and frozen products. Local sockeye stocks, referred to as "blueback", are harvested for food by the Haida at a few rivers when they return in the spring in preparation for spawning. Passing sockeye are also harvested for food by Haida fishermen using seines or gillnet in the summer for distribution in the Haida communities.

LIFE HISTORY AND BIOLOGY

The sockeye salmon, Oncorhynchus nerka, are called *taaxit* or *skwaagwun* in Haida, where the first Haida name refers to sockeye from the Copper River or Mathers Creek and the second to sockeye from other areas. Adult sockeye are moderately sized fish weighing between 2.2 and 3.1 kg (5 to 7 Ib), but can reach up to 6.3 kg. Sockeye are slim and streamlined and are almost toothless with prominent glassy eyes (Figure 26). Ocean going sockeye have a dark blue-black back with silvery sides and no distinct spots on the back, dorsal pin or tail. Spawning adults develop dull, green-colored heads with brick-red to scarlet bodies.

Sockeye occur in the northeastern Pacific from the Klamath River in northern California to the Yukon River and Kotzebue Sound in Alaska (Hart 1973). Commercial fisheries occur from the Columbia River to Bristol Bay, Alaska. Sockeye are also common in Asia from the Okhotsk Sea northward to the Kamchatka peninsula. Large sockeye producing systems in British Columbia include the Fraser River, Rivers Inlet, the Skeena River and the Nass River. The Fraser River and its approaches account for about 67% of British Columbia and Washington State landings; Smith and Rivers Inlet account for 16%; the Skeena 8% and the Nass 3% (Hart 1973).

The rivers where sockeye spawn will almost invariably have lakes within their system, where juveniles will rear for one or more years in freshwater. Adult sockeye returning from their ocean feeding grounds to spawn in larger river systems may migrate great distances, and must draw on fat and protein reserves to complete their long upstream migrations. Delays such as high water levels or

obstructions can have deleterious effects on populations. The man-induced slides at Hell's Gate in 1913 and 1914 decimated the Fraser River runs of sockeye salmon, and decades were required to rebuild to historic levels. Adult sockeye may spend varying periods in nursery *lakes* before spawning. Sockeye on Haida Gwaii generally enter rivers in May or June but usually don't spawn until stream levels rise with heavy rains in September and October. The females dig spawning nests or redds in the gravels where their eggs are deposited. Fecundity ranges from 2200 to over 4300 with a general average around 3720 *(Hart* 1973) and relates to a variety of factors including the run, the size of fish and the migration history of the individual fish. Incubation time ranges from 80 to 140 days, and depends on water temperature. Once the eggs hatch, the alevins remain in the gravel for 3 to 5 more weeks before emerging as free-swimming fry. Fry move downstream to nursery *lakes* where they rear for one or more years. They are generally found in the top 10 to 20 meters of the *lake* feeding on insects and their larvae, Cladocera, copepods and amphipods.

Migration to the sea occurs in April or early May at Mathers Creek (Shepherd 1982). Young sockeye salmon near the Fraser River spend the early part of the summer in inshore waters (Manzer 1969), and later become scattered over the northeast Pacific Ocean (Map 11). Food during the ocean stage consists mainly of crustaceans such as euphausiids, amphipods, copepods and occasionally squid and young fishes. Most sockeye from Canadian waters spend two years in the sea, although this may range from one to four years. Sockeye in southern British Columbia generally spend 1+ years in fresh water and 2+ years in the sea so that a four year cycle of run size is prevalent.

Lake fertilization is a successful, low-cost technique used for sockeye enhancement in British Columbia. Techniques were based on studies on Great Central Lake between 1969 and 1975. LeBrasseur *et al.* (1978) reported that during fertilized years, the mean summer primary production increased fivefold, zooplankton standing stock increased 9 times, the percentage survival of sockeye from egg to juvenile increased 2.6 times, and the mean stock size of adult sockeye increased from less than 50,000 to more than 360,000. Results of fertilization on other coastal lakes have been mixed and site specific, however (Stockner 1987).

Sockeye smolt production from *lakes* is related to phytoplankton productivity and rearing area. During surveys of coastal *lakes,* sockeye densities were found to range from 129 to 9,160 fish/ha in fertilized lakes and 310 to 5,658 fish/ha in unfertilized *lakes* (Hyatt and Stockner 1985). Sockeye production from three fertilized Haida Gwaii *lakes* was low relative to other British Columbia lakes

based on two to three surveys in the **period** 1980 to 1982.[1] High smolt densities have also been found to lead to slow growth of **young** sockeye, which leads to in complex interactions **among** the population age structure and smolt size which in turn may affect marine survival and the subsequent age-at-return **of** adult sockeye.

HISTORY OF USE

Haida Use

Sockeye, known locally as "blueback", occur in relatively few rivers and streams on Haida Gwaii. Sockeye are the only salmon species which return in the spring so they were greatly appreciated. Ellis (1982-84) reports that the Copper River run was harvested in the early days by a single salmon trap owned by Chief Skidegate. It was said that there were only ten days out of the year that this trap did not catch one of the salmon species or steelhead. At one time, special gillnets made from fireweed fibre were also used on the Copper River to catch sockeye. Sockeye from Copper Creek and Mathers Creek were preferred to those from Gudal Creek in Cartwright Sound, Fairfax Creek in Tasu Sound and **Port** Athlow. Modem Haida people continue to harvest sockeye using gillnets **on** the Copper River and Yakoun River. The Copper River run is presently managed using modem techniques. Escapement is estimated by counting the fish passing over a counting plate and the fishery is not opened until the target escapement is reached.

Sockeye were once preserved and stored in boxes for the winter, like other salmon, although special care had to be taken to watch that the fish "did not go mouldy" (Ellis 1982-84). Fresh sockeye heads were boiled, as were the backbones and **roe.** Blackman (1975) notes that the **roe** was smoked. The boneless side fillets, *ts'ilgii*, were, and still are, a highly prized delicacy. In recent years, sockeye are preserved by canning and freezing and the fillets are frequently half-smoked first.

Some migrating sockeye and chinook are also harvested in Haida net fisheries and distributed within Haida communities. Harvest rates of sockeye by other Native groups is high. For instance, food fishery harvest of Skeena River sockeye averaged 100,000 fish but has reached 200,000 in some recent years (Kadowaki *et al.* 1984).

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[1] Awun 225-1238 fish/ha; Ian 136-310 fish/ha; Eden 57-232 fishlha

Recreational Fishery

Recreational angling techniques and gear have been recently developed for sockeye in tidal waters, although angling catches are small compared to the commercial fishery. Retention of sockeye caught by sportfishermen in non-tidal waters is not permitted under present regulations.

commercial Fishery

Sockeye are landed in interception net and troll fisheries in Area 1 and Area 2W. Net fisheries occur near Langara Island in Area 1 and outside Rennell Sound in Area 2W. Gillnet and seine landings in the Area 1 fishery have been substantial since the early 1960s. The Area 2W fishery is mainly a seine fishery with significant landings first occumng in 1974.

Most of the commercial harvest of sockeye is presently either frozen or canned, and a smaller proportion is either cured or sold fresh.[2]

Sockeye has a high demand and fetches a premium price because of its deep red flesh colour, rich flavour, high oil and protein content, uniform size and ease of mechanical handling.

In 1990, the average landed price of sockeye' was $4.97/kg for troll caught[4] and $2.87/kg for net caught'.

BASELINE FISHERIES DATA

Sockeye landings on Haida Gwaii (Figure 27) have fluctuated considerably but in general have greatly increased since the 1950s. Returns of Fraser River sockeye were exceptionally high in 1989 and 1990, and catches on Haida Gwaii were correspondingly high. Catches in Area 2W are primarily by seine and troll gear and have fluctuated considerably since the late 1970s when these interception

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2 **Breakdown** of **sockeye products from 1987 B.C. landings** of **15,035** tonnes was **as follows: 494 t - fresh, 4,840 t - frozen. 900 t - salted** or **smoked, 154 t - roe., 6,740 t - canned (Anon. 1988).**

3 **Preliminary statistics, Statistics Division, DFO.**

4 **Based** on **average price for ice and freezer boats in the round.**

5 **Gillnet price was $3.12/kg and seine price was $2.87/kg.**

fisheries commenced (Table C17 Appendix C). In 1990, a fleet of about 350 trollers harvested approximately 600,000 sockeye in an eight day fishery which occurred mostly within the study area. Seine and troll catches have also increased in Area 1 in recent years (Table C18 Appendix C).

Stock composition of the 1984 sockeye catch in Area 1, was reported by Orman (1985), based on three sampling fisheries between July 8 and August 4. The fishery is on mixed stocks which included the following: Skeena, Haida Gwaii and Chilkoot stocks (approximately 55% at the end of July and the beginning of August), Smith Inlet sockeye (approximately 25% during early July), and a mixture of Rivers Inlet, Vancouver Island, North Coast British Columbia and southeast Alaska stocks (approximately 20% throughout mid-July). Approximately 15,000 sockeye were harvested in Area 1 in 1984 between July 15 and August 14.

Stock composition of the 1984 sockeye catch in Area 2W from July 27 to August 6 was 97% or more from the Fraser River (Orman 1985).

Small sockeye populations occur on Haida Gwaii in some of the stream systems with lakes including Yakoun Lake, Ian Lake, Awun Lake, Naden River and Jalun River in Area 1; Fairfax Lake in Tasu Sound and Mercer Lake in Athlow Bay in Area 2W; and the Copper River and Mathers Creek in Area 2E. The only stream system where sockeye have been observed in any numbers in the study area is the Salmon River which has a target escapement of 200 sockeye. Target escapements for the Copper River and the Yakoun River, where Haida fisheries occur are 20,000 and 45,000, respectively.

Migration patterns for Area 2 sockeye salmon are shown in Map 12, based on recoveries of tagged fish released in southern Southeast Alaska and northern British Columbia in 1983.

Recreational fishing catch of salmon other than chinook, coho and pink in Area 1 to 6 in 1988 was estimated to be 400 for B.C. resident anglers and 1,500 for visiting anglers based on recreational mail surveys (Bijsterveld 1989).

RESOURCE MANAGEMENT

Commercial Fishery

Management of Fraser River and Skeena River sockeye fisheries are described in Woodey (1987) and Sprout and Kadowaki (1987). Major regulatory measures

used to manage sockeye fisheries are fishing time, area and gear. Typically, fishing areas are open for a specified gear type and time. For instance, net openings may be for 24 to 96 hours weekly over an 8 week period. However, in offshore areas, trolling may continue 7 days per week until a season ending date or a catch ceiling is reached. Sport fishing regulations are usually developed a year in advance and seldom adjusted. The Indian food fishery was previously regulated by permits which prescribe gear, area and time. In the coastal area they were issued for specified days throughout the fishing season upon request.

United States and Canadian fisheries for Fraser River sockeye are managed according to specific harvest allocations negotiated in the Pacific Salmon Treaty. Catches of Fraser River sockeye in all areas were to be included in the allocation computations including Fraser River Indian food fish harvests in excess of 400,000 sockeye. In 1990, the Fraser River sockeye run was predicted to be 16.5 million and the Canadian commercial total allowable catch (TAC) was 8,435,000 based on run expectations. The outside troll allocation was 22.7% of the Canadian commercial TAC or 1,920,000.

Interception troll fisheries have increased in the past decade (Figure 28) with development of selective fishing gear, and generally produce a better quality and higher valued product than the net fisheries. In 1990, approximately 30% of the outside troll allocation was harvested within the study area.

Recreational Fishery

Sockeye is a tiny proportion of the recreational catch in tidal waters. There is presently a minimum size limit of 30 cm for salmon other than chinook and no annual catch limit. New regulations are presently being considered for non-tidal fisheries which would allow retention of sockeye in the Fraser and Skeena Rivers in 1991.

Discussion

The commercial sockeye fisheries on Haida Gwaii and within the study area are highly valuable and of short duration, with minimal impacts on other fisheries. Local sockeye stocks are small and fragile and have a high intrinsic value due to the nature of the historic Haida fishery.

Recommendations

1. **Recreational angling for sockeye which may target on local stocks should be carefully monitored.**

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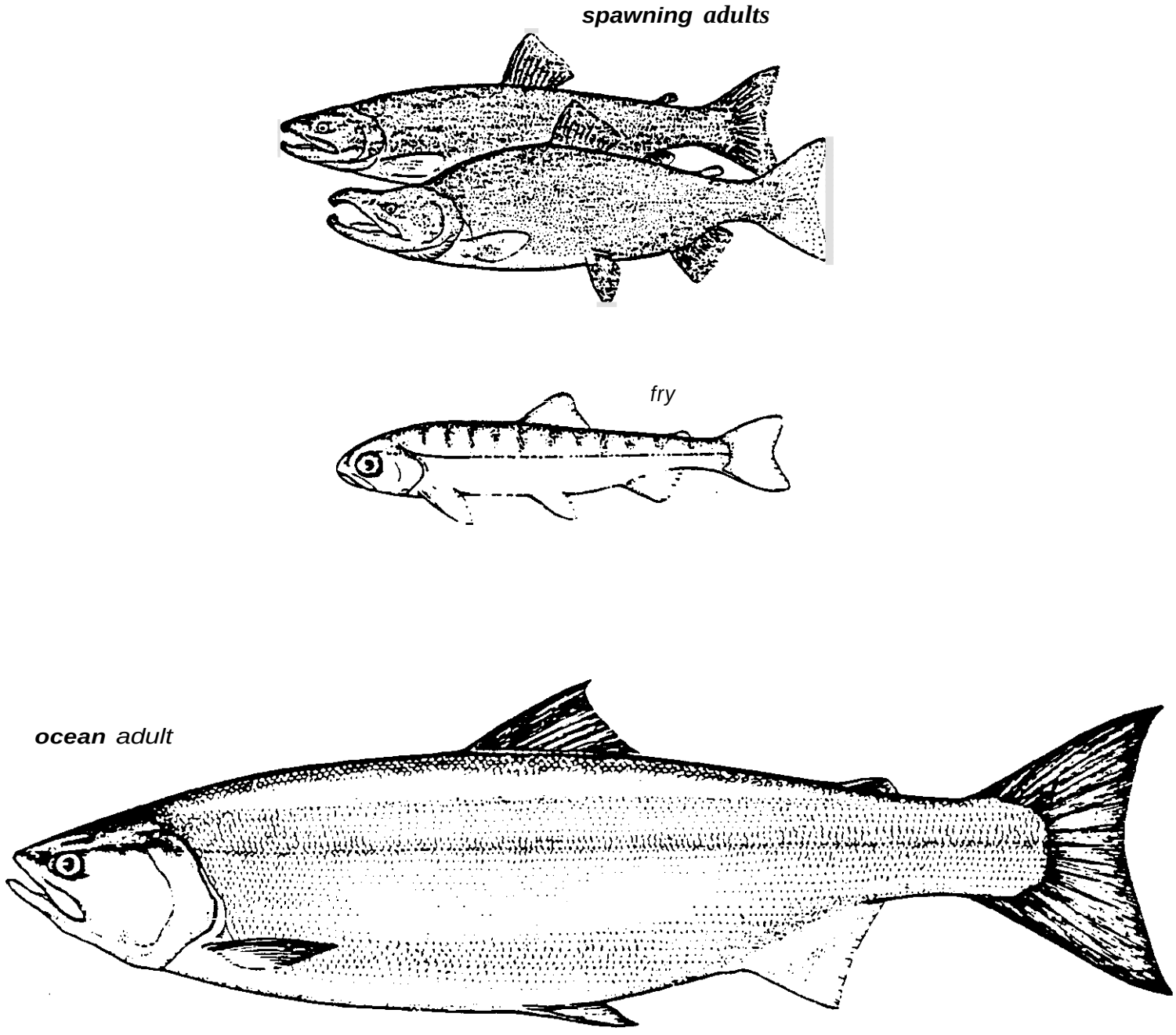
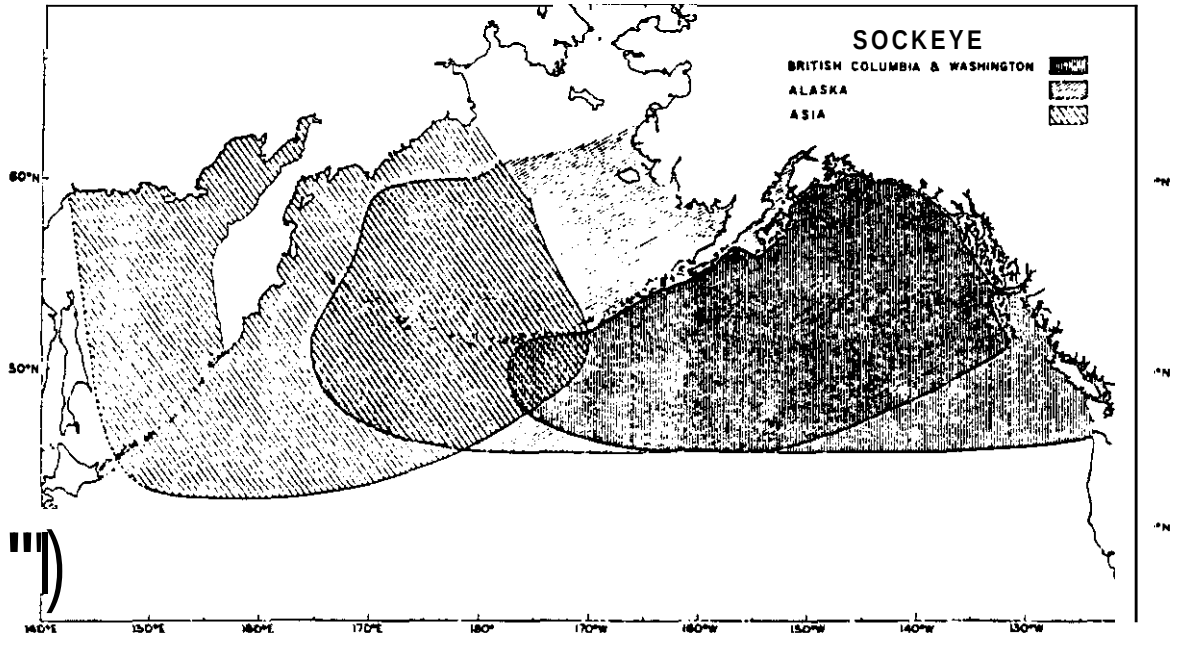


Figure 26: **Sockeye Salmon, *Oncorhynchus nerka***



Map 11: **Oceanic distribution of sockeye salmon in the north Pacific**
Source: **Hart (1973)**

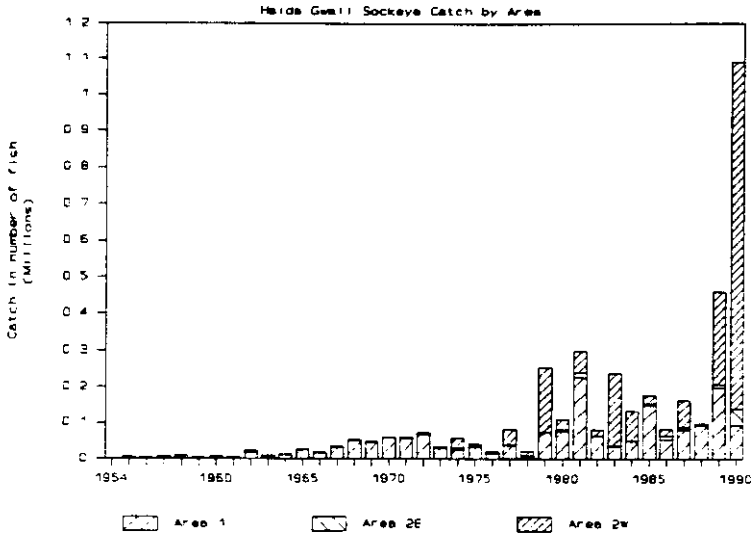


Figure 27: **Haida Gwaii commercial sockeye catch by area, 1954-1990**
Source: **See Tables C17 and C18, Appendix C**

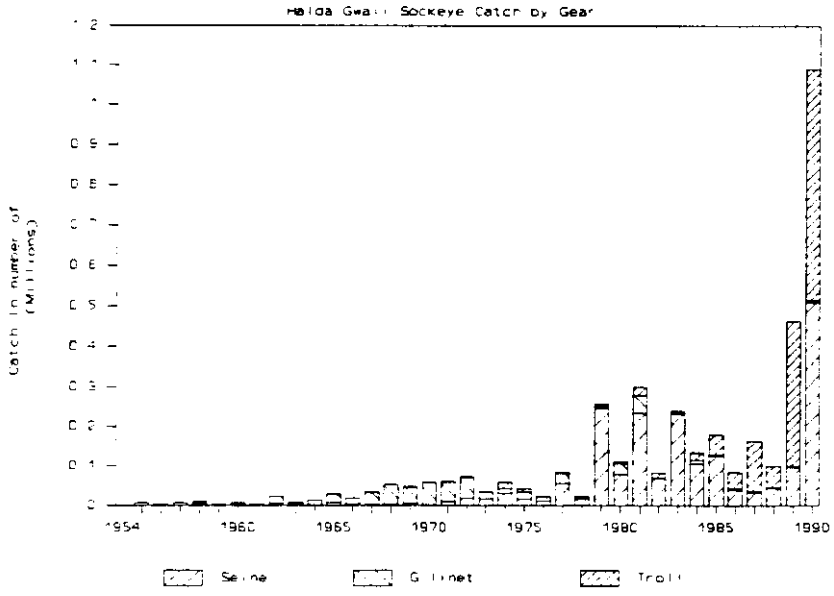
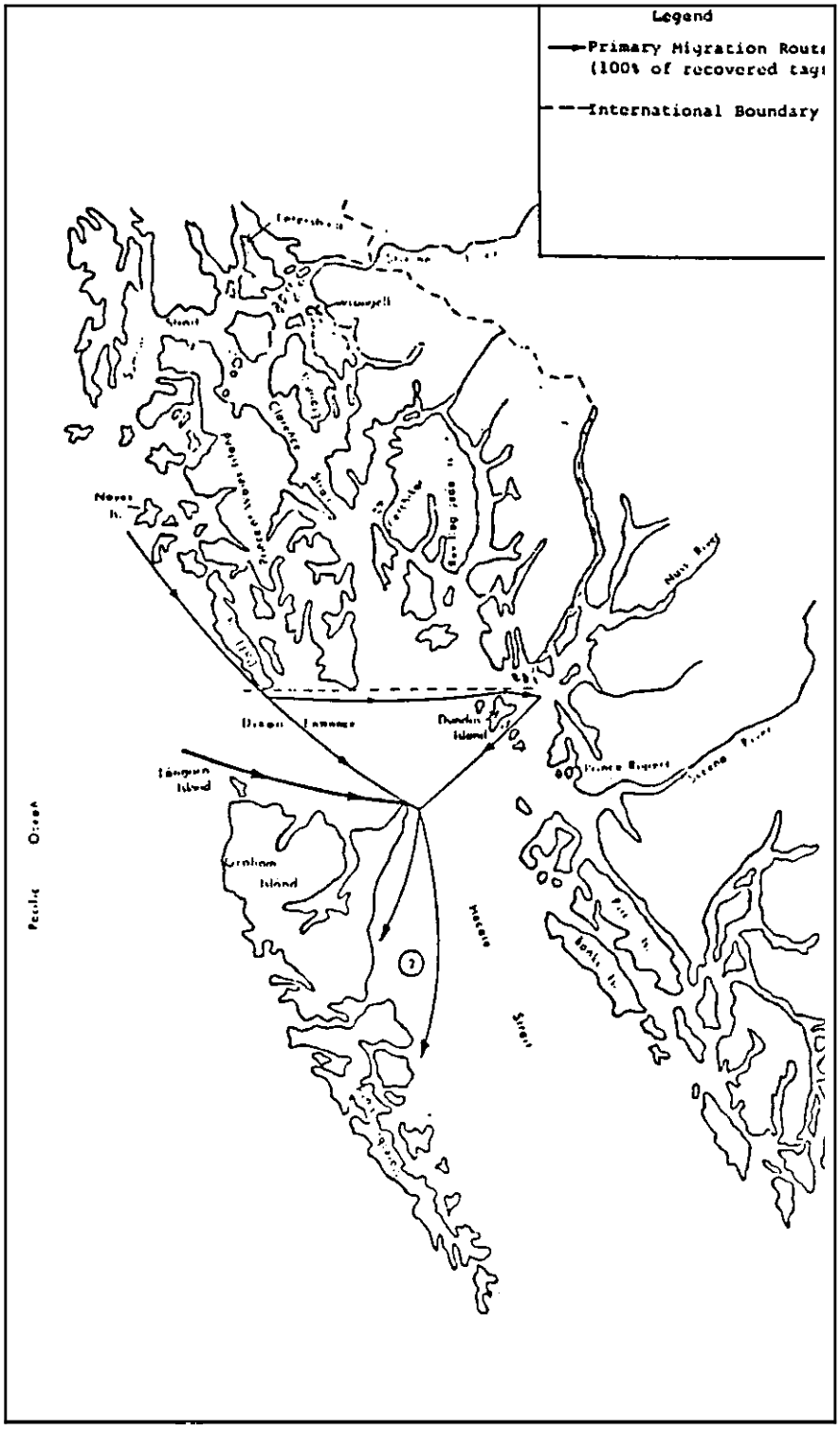


Figure 28: **Haida Gwaii commercial sockeye catch by gear, 1954-1990**
Source: **See Table C17 and C18, Appendix C**



Map 12: **Migration patterns of Area 2 sockeye salmon.**

3.7 STEELHEAD

INTRODUCTION

Steelhead are a prized recreational fish which occur in at least 12 streams within the study area. Steelhead populations on Haida Gwaii are small and fishing effort is considerable on some Haida Gwaii streams outside the study area. Important steelhead streams on Haida Gwaii include the Yakoun, Tlell and Honna Rivers on Graham Island and the Deena River, Pallant Creek, and Copper River on Moresby Island. Concerns about the rapid development of non-tidal commercial guiding resulted in the establishment of guiding limits on these streams during 1990 by the provincial government.

LIFE HISTORY AND BIOLOGY

Steelhead trout, *Oncorhynchus mykiss*, known as *taaynga* in Haida, are an anadromous or sea run rainbow trout, which occur in the northern Pacific from Kamchatka, U.S.S.R. to northern California. Steelhead and rainbow trout (Figure 29) are indistinguishable as juveniles. Ocean going steelhead have a bluish-grey back and bright silvery sides with small black spots on the back, sides and tail and a white mouth inside. Mature fish in spawning condition in fresh water develop a pink to red coloration. The largest steelhead on record weighed 19.5 kg (43 pounds) and was caught by net off Port Simpson, near Prince Rupert (Hart 1973).

Adult steelhead trout migrate to spawn in their rivers of origin and runs are generally prolonged, with peaks showing considerable variability in Haida Gwaii stream systems. Runs occur from September to May on Pallant Creek with slight peaks occurring in December and April (de Leeuw 1984) and from October to March on the Yakoun River with peaks in December and January (de Leeuw and Whately 1983). Thus, spawning may occur throughout the late winter or early spring. Hatching generally occurs 4 to 7 weeks after spawning and emergence from the gravel as fry takes an additional 3 to 7 days (Scott and Crossman 1973), depending on the time of spawning and water temperatures. Juvenile steelhead rear for one to four years in the freshwater and spend two or more years in the ocean, before returning as adults to spawn. From analysis of their scales, de Leeuw (1987) found that 71% of adult steelhead returning to the Yakoun River in 1982/83 were six to seven years of age and had spent three years in freshwater and three or four years in the ocean. Seagoing British Columbia steelhead have been found as far offshore as 150 degrees west latitude (Map 13). Steelhead may spawn more than once, and studies on the Keogh River on Vancouver Island

found that between 3 and 20% of runs were repeat spawners (Ward and Slaney 1988).

HISTORY OF USE

Steelhead, or *taaynga*, were mostly eaten fresh by the Haida. Steelhead was frequently the only catch taken in a special fish trap on the Copper River, where migrating and spawned-out fish were both taken. Blackman (1975) notes that steelhead was "considered closely related to red snapper" because the bones of both fish were so tough. Some Haida harvesting of steelhead may occur in net fisheries on Haida Gwaii on the Yakoun and Copper River. Some Haida also participate in the winter steelhead fishery using rod and reel.

Steelhead are a prized recreational fish and are taken in rivers by fly fishing, and by casting using both artificial lures and natural bait such as clusters of salmon eggs.

Steelhead are also occasionally harvested as an incidental catch in commercial troll and net fisheries, although the usual timing of net fisheries doesn't coincide with returning steelhead migrations.

BASELINE FISHERIES DATA

Steelhead populations are generally small, in the streams where populations have been estimated. The recreational steelhead harvest on Pallant Creek in the 1980/81 season was 59 out of an estimated run size of less than 400 adults (de Leeuw 1984). The estimated run size on the Yakoun River was approximately 850 adults in 1981-82, and 1,500 in 1982-83 (de Leeuw and Whately 1983; de Leeuw 1984).

Presence of juvenile rainbow trout and adult steelhead have been documented in 12 study area streams (Table 2). Juvenile rainbow trout are mainly documented from electroshocking studies (de Leeuw, Pers. Comm.) and adult steelhead from anecdotal reports by DFO fisheries guardians. No recreational harvest was recorded in the study area in the steelhead harvest questionnaire by the Ministry of Environment from 1979-89 (Anon. 1979-89).

In the period 1984-89, the average recreational fishing effort for steelhead was 5,184 angler days with an average catch of 7,456 steelhead. Only 956 or 13% were killed (Anon. 1979-89).

Commercial steelhead catches are insignificant compared to salmon landings. In 1989, a catch of 7,803 steelhead was recorded in British Columbia, and 5,733 (73%) were caught by gillnet. The commercial steelhead catch on Haida Gwaii in 1989 was 362 fish, with 141 caught by seine in Area 1 and 2W, 216 caught by troll and only 5 caught by gillnet.

RESOURCE MANAGEMENT

Haida river fisheries for sockeye occur at the mouths of the Copper River and the Yakoun River which also support recreational steelhead fisheries. Sockeye net fisheries are managed by the Band Councils with some input from DFO. In recent years, the Old Massett Village Council has adjusted the start date of the Yakoun river net fishery to reduce interception of steelhead.

In general, river fisheries for steelhead are managed by the Recreational Fisheries Branch of the British Columbia Ministry of Environment (MOE) under the authority of the Wildlife Act. Haida Gwaii is part of the Skeena Region which has a daily bag limit of 1, a monthly limit of 2, and an annual limit of 10 steelhead. Special restrictions are in effect for some streams such as reduced bag limits, area and seasonal closures, limits on guided fishing effort and bait restrictions. Anglers in non-tidal waters require an annual license which costs $17 for residents and $27 for non-residents. A less expensive six day angling license is also available. Angling guides require licenses.

Over the past few years, MOE has been developing an angling guide policy (Anon. 1989) with the following purpose:

> Maintain a number of uncrowded, quality fishing opportunities in British Columbia;
>
> Ensure that residents of the Province continue to have access to high quality fishing opportunities;
>
> Develop a better management system for angling guides;
>
> Develop and test systems for managing angler use.

Changes to the Wildlife Act were required to allow classification of angling waters to restrict use by angler guides and non-Canadians and with the potential to restrict resident anglers. Two classifications of waters have been introduced. Class I waters involve limitations on guides, restrictions on non-Canadians and eventual limited entry. On these waters, all fishing effort will eventually be

regulated according to a water specific management plan. Class II waters involve limitations on guides and some future restrictions on non-Canadians.

In response to concerns raised about increasing guided pressure on Haida Gwaii steelhead streams, MOE established a Local Angling Advisory Committee to review proposed angling water classifications and advise about guided angler day quotas. Changes implemented by MOE are classification of the Yakoun River, Tlell River, Copper River, Pallant Creek, Datlamen River, Honna River, Mamin River and Deena River as Class II waters (Anon. 1991). Guiding on these rivers is limited from September 1 to March 31 in the 1991 regulations.

Some incidental catch of steelhead occurs in commercial net and troll salmon fisheries. Some interception of steelhead is also likely in squid driftnet fisheries in the North Pacific.

Discussion

Steelhead populations of Haida Gwaii stream systems are generally small and fishing effort is high on some streams. Hence, steelhead are susceptible to overfishing by recreational anglers. Strategies which have been used in other areas to reduce catch include bait restrictions such as a roe ban, closed areas and catch and release.

Steelhead are a valued recreational fish, and are the target of many small enhancement projects in British Columbia. Some larger projects in Washington State, particularly on the Columbia River, are the result of mitigation for loss of habitat due to construction of hydroelectric dams.

Timing of winter steelhead fisheries does not correspond with the peak summer tourism season in the study area.

Recommendations

1. Steelhead catch and fishing effort in study area streams should be monitored and regularly reviewed. Freshwater angling licenses could be issued through the Canadian Parks Service to directly monitor all non-tidal fishing effort in the study area.

2. Potential of study area streams for angling guiding should be assessed and policies established prior to any developments.

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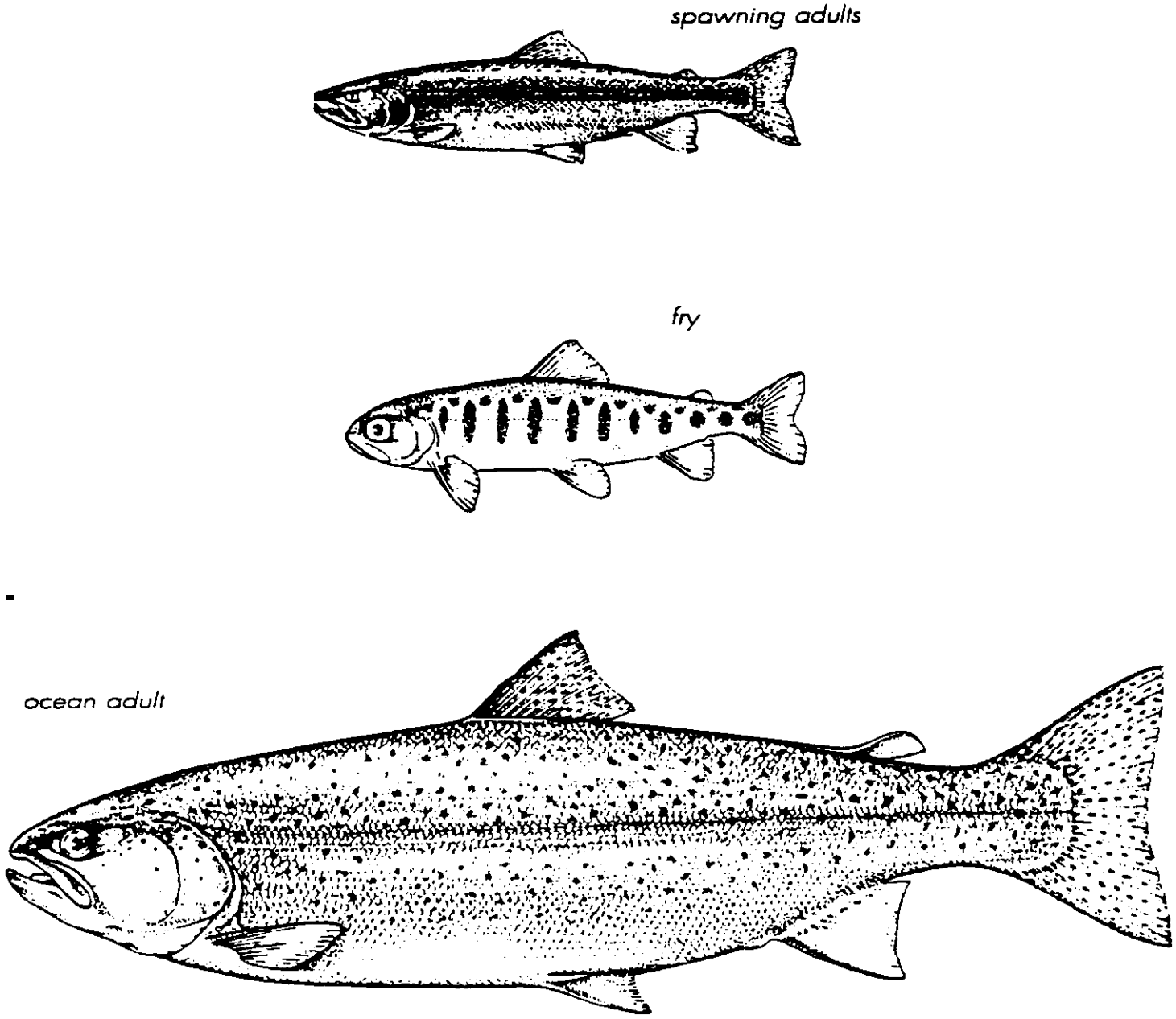
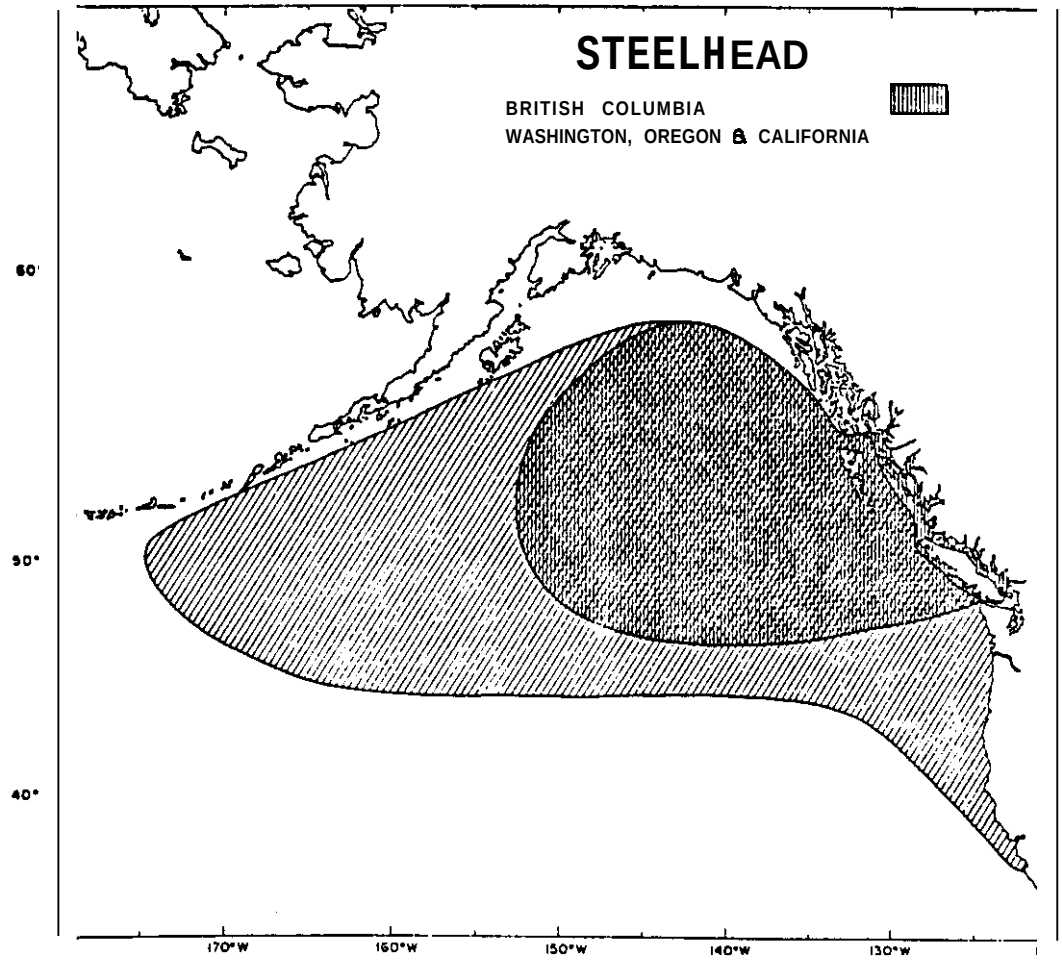


Figure *29:* **Steelhead (Rainbow) trout,** ***Oncorhynchus mykiss***



Map 13: **Offshore distribution of steelhead by geographic area**
Source: **Hart (1973)**

STREAM	Juvenile	Adult
Marshall Inlet	x	
Mathieson Inlet (left and right)	x	
Bag Harbour Creek		x
Slim Inlet Creek	x	
Ikeda Creek	x	
Flamingo Inlet Creek	x	
Windy Bay Creek	x	x
Gate Creek	x	x
Salmon River	x	x
Echo Harbour Creek	x	
Breaker Bay Creek		x

Table 2: **Presence of juvenile rainbow trout and adult steelhead in study area streams.**
Source: DFO/MOE Fish Habitat Inventory and Information Summary

4.0 HERRING

INTRODUCTION

Pacific herring are found throughout Haida Gwaii, and the study area supports significant spawning areas and fisheries. Valuable commercial fisheries occur in the study area for roe herring and herring spawn-on-kelp. The roe herring fishery on Haida Gwaii has an average annual value of $5.1 million' and the spawn-on-kelp fishery has an average annual value of $2.9 million? The Haida continue to utilize both hemng and hemng spawn-on-kelp for food and trade. This fishery is controversial because some salted and dried product is sold on the black market, but recent court cases have upheld the aboriginal rights of Haida harvesters. The roe fishery began in 1972 and supplies the Japanese market with "kazanoko", a salted roe product. The roe hemng fishery is a "gold rush" fishery which sometimes takes place within a few hours. Recent area licensing changes have improved the manageability of the roe hemng fishery, but quotas are often exceeded.' The spawn-on-kelp fishery is managed using individual quotas of 16,000 lb (7.256 tonnes).

LIFE HISTORY AND BIOLOGY

Pacific hemng, (*Clupea harengus pallasi*), known as *iinang* in Haida, are small bony fish with a blue-green back shading into iridescent silver-white on the sides (Figure 30). Herring have a large mouth, slightly jutting lower jaw and deeply forked tail and are almost always encountered in schools. In the eastern Pacific Ocean, Pacific herring range from Baja California to Cape Bathurst in the Beaufort Sea. In waters off British Columbia, between six and nine populations have been recognized and, although some mixing occurs, these populations seem fairly discrete (Hourston 1980a).

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1 Based on average 1984-91 quota of 3,241 tons (3,573 short tons), Table 4, and 1990 *Area* 2E weighted average price of $1.584/kg from preliminary DFO statistics (gillnet $1.1647/kg; seine $1.323/kg)

2 Based on average 1980-90 landings of 80.1 tonnes, Table 9, and 1989 average B.C. price of $35.77/kg.

3 Quota for the 1991 fishery was 32,339 tonnes, catch was 38,881 tonnes or 20% over quota *.(PacificFishing 1991).

Pacific herring deposit their eggs on vegetation in and near the intertidal zone along the coast of British Columbia. Most of the spawn deposition (80%) occurs on marine algae at depths shallower than 1.5 m below datum, so spawning is over a range of about 6 m to high water level (Hourston and Haegele 1980). Egg deposition decreases rapidly below this point but may occur at depths up to 25 m below high water. If spawning is intense, eggs may be deposited in several layers. Experiments have shown that hatching success decreases sharply with the thickness of the egg mass.

Sea birds are the major predators at this stage. Gulls and diving ducks may easily consume two thirds or more of the eggs which are exposed on a beach at low tide (Hourston and Haegele 1980). Another major source of mortality is the loosening of substrate and eggs by wave action during storms. Overall, mortality at the egg stage is estimated to be about 20% (Hourston and Haegele 1980).

Pacific hemng eggs are spherical, transparent, with a diameter of about 1.5 mm, and slightly denser than seawater. The incubation period ranges between 10 and 21 days after fertilization, depending on water temperature. Hatching is virtually simultaneous for all eggs deposited in a single spawning.

The Larval Stage

Thread-like larvae about 9 mm long hatch from the eggs. The larvae bear little resemblance to the adult fish and initially derive their nourishment mainly from the yolk sac. Larvae begin to feed on plankton once the yolk sac is used up, which is typically about 6 days. During the next 5 weeks, the body deepens, taking on an opaque, whitish colour and rudimentary fins form at folds in the body. At a length of about 25 mm (10 weeks after hatching), metamorphosis into the adult form takes place. The body takes on the appearance of a miniature adult. The scales appear at this stage.

During the first few days after hatching, hemng larvae are at the mercy of the water currents. As swimming ability develops, the larvae migrate downwards during the day and back to the surface at night, following their food supply of microscopic plankton. During this period, the larvae become dispersed farther and farther from the spawning grounds by the local water currents. Mortality is extremely high in the larvae stage, probably averaging over 90% (Hourston and Haegele 1980). It is here that year-class strength (the abundance of an age-group at the adult stage) is usually determined.

The Juvenile Stage

The rest of the first year of life (July - March) is known as the juvenile stage. The herring have now assumed their typical form as a bony, soft-rayed fish. At the completion of metamorphosis (June - July) the juveniles are about 35 mm in length and weigh about 5 g. They grow quickly over the summer, achieving a length of close to 100 mm and a weight of about 40 g by fall. There is little growth over the winter. During the summer the juveniles gather into increasingly larger schools in the protected waters of bays and inlets in the general region of the spawning ground. In September, the schools, now consisting of millions of individuals, gradually move seaward to offshore wintering grounds where they are found mainly at depths of 150-200 m. Two major offshore grounds are off the mouth of Juan de Fuca Strait in the south and Hecate Strait in the north.

Before migrating offshore, juveniles are preyed upon by fish, marine mammals and birds. Mortality at this stage is probably about 20% (Hourston and Haegele 1980). Food is no longer limiting as the juvenile herring are able to seek out planktonic organisms of suitable size (copepods, amphipods and euphausiids.)

Herring that have completed their first year of life but have yet to undertake their first spawning migration are considered to be immature. These are mainly fish in their second year that are similar in appearance to juveniles but larger. During their second summer, the hemng increase in both length and weight (to 150 mm and 60 g respectively). Immatures are found in the same offshore feeding grounds as the juveniles but usually at shallower depths (100-150 m). They are more likely to mix with adults than with juveniles. As is the case for the juveniles and adults, immature hemng are fed upon by any fish, birds and mammals capable of catching them.

The Adult Stage

The adult stage includes all fish that will mature and spawn during the next spawning season. Three-year-old fish spawning for the first time will have attained an average length of about 185 mm and a weight of about 90 g. During each of the next 2 years the fish will gain about 30 mm in length and 30 g in weight. In subsequent years the rate of gain will gradually decline. Most of the adult fish taken by the fishery range between 175 and 250 mm in length, from 70 to 200 g in weight, and from 3 to 6 years in age.

Adult hemng return to their offshore feeding grounds in April and May. These feeding grounds, such as Juan de Fuca Strait in the south and in Hecate Straight in the north, are often the same as the juvenile rearing areas. The adult fish are

generally found in shallower depths (100 - 150 m) but are occasionally mixed with immatures and/or juveniles.

Between October and December, the herring gather into larger aggregations and begin their annual migration to their inshore spawning grounds. The fish that have the longest distance to travel tend to leave first. Upon reaching the general vicinity of their spawning ground, the fish stop feeding and remain in the deeper channels and bays during the final stages of maturation.

When maturation is complete, the herring move into the shallows and onto the spawning grounds. There, a variety of environmental or physical stimuli such as storms, crowding, or contact with nets will cause a few of the males to extrude some milt. This initiates ritual spawning behaviour in individual hemng of both sexes in the presence of a suitable spawning substrate such as red algae, sea grasses, rockweed, or kelp. Since a female usually lays less than 100 eggs in a single spawning act, each fish would carry out several hundred such acts before its supply of 20,000 - 40,000 eggs is exhausted. After several such spawning acts, the fish may rejoin a school for several minutes, or even hours, before returning for another spawning act.

While the females generally deposit the eggs on a substrate, the male releases milt into the water column where it is dissipated, forming large milky "clouds" in the water which characterize hemng spawnings. At this stage, both eggs and milt may be released in a midwater spawning frenzy, the eggs sinking to "blanket" the vegetation and rocks on the bottom.

Some spawning may extend over several days, with the spawn deposition stretching out for miles along the shoreline. The width of a band of spawn may vary from a few metres to over 1000 m depending on the slope of the beach and the extent of the vegetation. A larger spawning may involve over 300 million fish.

After spawning is completed, the fish begin feeding voraciously as they migrate back to their offshore feeding grounds.

Mortality from "natural" causes during the adult stage probably averages about 30% per year and appears to increase with age, especially for males. Most of the older fish are females. The adults run a gauntlet of predators on their spawning migration and are most susceptible when massed on the spawning grounds and preoccupied with spawning activities. Large herds of seals and sea lions, pods of killer whales, flocks of gulls, cormorants and puffins, and schools of dogfish gather from miles around during hemng spawns. After spawning, the survivors,

weak from lack of food and from spawning activity, must again run a gauntlet of predators on the return migration to their offshore feeding grounds.

The fishery is another major source of mortality during the adult stage. The current management practice is to allow for the harvest of about 20% of the run. Since many of the fish taken by the fishery would have been subsequently lost to natural predators during the remainder of their spawning migrations, the total annual mortality is somewhat less than the 50% sum of the two parts considered separately (Hourston and Haegele 1980).

HISTORY OF USE

The history of man's utilization of hemng along Canada's Pacific coast is, like other aspects of the early history of this area, not well documented. Hemng and herring spawn have a long history of use as food and for barter by the Haida and other Native groups. The oldest known written record of hemng in these waters appeared in the diary of Archibald Menzies, naturalist aboard H.M.S. Discovery commanded by Captain George Vancouver. While mapping the British Columbia coast in July 1792, herring were purchased for the ship's mess from Natives at Stuart Island. The first commercial catch recorded was 75 tons taken in 1877.

Haida Use

Herring, or *iinang*, "plentiful" in Haida, and hemng eggs have a long tradition of use by the Haida for food and trade. *Gaaw* or herring spawn-on-kelp was likely once harvested in all areas of Haida Gwaii, based on the settlement patterns of historic Haida villages. *Gaaw* is currently harvested mainly in Skidegate Inlet and on the East Coast of Moresby Island (Ellis 1972-80). The Massett Haida had less access to hemng spawns and often traded with the Skidegate Haida (Blackman 1975).

Adult hemng were taken with a "rake" throughout Haida Gwaii, both when they spawned, and at other times. Hemng rakes were made from a light pole 6 to 8 feet in length, and had a number of sharpened nails driven through them which, when swept through a school of hemng, impaled the fish. Herring were boiled, roasted over the fire, and in recent times salted. Hemng were occasionally smoked, but they did not keep for long.

Gaaw may be gathered over a period of about two months in Skidegate Inlet as described in Ellis (1972-80). Telltale signs of a spawn are the white colour in the water from the milt of the males and activity of birds in the area. Picking doesn't

begin until the eggs have lost their sticky, adhesive quality and continues until the "eyes" of the eggs become visible, which is about three days. Gathering is usually done at half tide or lower, and the stems and fronds are lifted up with grapples or long gaffs. Eelgrass with hemng spawn on it was sometimes picked, and eaten on the spot, or hemlock branches were suspended in spawning areas to gather the herring eggs. Spawn collected on hemlock branches acquired a distinctive taste.

Gaaw was traditionally sun dried, but is also preserved by salting. It was once dried on the beach, by lying the fronds on the pebbles or rocks, but is now usually hung on lines under cover. Beach drying took about two to three days and was affected by the weather. If the fronds had to be dried indoors, the drying was slowed and the product was poorer quality. Dried fronds were tied into bundles of about ten and stored in bent-wood cedar boxes (Turner 1971). The dried product was susceptible to insect damage, and had a limited shelf life, since it "turned red" and lost it's flavour. Dried *gaaw* was eaten as is, or soaked in fresh water, to get rid of the salt, and then fried or dipped in boiling water. ***Gaaw*** is often eaten with Eulachon oil or *hum*. Nowadays, freezing is an alternative to drying or salting.

Commercial Fishery

The recorded catch of herring from British Columbia waters remained quite small (between 130 and 650 tons) until the end of the 19th century. Fishing during these early years was carried out mainly with small beach seines.

Dry-Salted Fishery 1904-34

Between 1904 and 1907, a market for dry-salted herring was developed in the Orient and drift netting became the major mode of fishing. The catch increased to about 30,000 tons, where it held until 1919. It was during this period that purse seining was introduced into the fishery (1913). Between 1919 and 1927, the annual catch rose to 85,000 tons and then declined back to 30,000 tons in 1934 with the rise and fall in the dry-salted hemng market.

Reduction Fishery 1935-67

The introduction of a meal and oil (reduction) industry in 1935 almost doubled the catch in each of the following 2 years and catches levelled off at about 100,000 tons for the next 10 seasons (1938-47). By this time the fishery was

conducted almost exclusively by purse seine. The fishing season extended from November to March during the inshore migration of the spawning runs. In 1947-48 the catch jumped to 172,000 tons and hovered around the 200,000 ton mark until 1965-66 (except for 1952-53 and 1957-58 when the catch was held down by industrial disputes).

In 1962-63, a record catch of 264,000 tons was taken, followed by a near record 260,000 tons in the following season. The previous record of 251,000 tons was set in 1955-56 and included a record catch of 92,000 tons.

Up to this point, catches had been limited by the markets available for the products and, in the earlier years, by the processing capacity of the plants and the catching capacity of the fleet. As demand increased, the fleet ranged farther afield and by 1940, virtually the entire coast was being extensively fished. The introduction of echo sounders and radio-telephones in the 1940's, powered hauling blocks in the 1950's, and sonar, drum seining, and mercury arc lights (to attract fish) in the 1960's, increased the catching capacity of the fleet. In addition, larger, faster vessels decreased the amount of time lost for travel and weather.

Concern for conservation of the stocks led to the establishment of catch quotas on the Lower East Coast and West Coast of Vancouver Island in the 1936-37 season, on the Middle East Coast in 1940-41, and on the Northern and Central B.C. coasts in the following season. However, these quotas had a limited effect on the catch as extensions were frequently granted (and not always taken). The quota for the West Coast of Vancouver Island was discontinued in 1946-47 and there never was a quota for the Haida Gwaii. Nevertheless, the quota system succeeded in distributing fishing effort more evenly over the coast and thus provided some protection for the most accessible populations (Lower and Middle East Coast of Vancouver Island).

During most of the 1964-65 season, a good catch (241,000 tons) was taken, but the fishermen had more difficulty in locating quantities of fish. Spawn deposition was down somewhat (especially for the heavily exploited stocks on the Lower East Coast of Vancouver Island). This trend continued for the following two seasons, when the catches were 181,000 and 135,000 tons, respectively. The proportion of small, immature fish in the catch rose noticeably. In spite of these ominous indicators, there was a reluctance to believe that these herring populations could be overfished since they had supported large and almost unrestricted catches for over two decades. A sharp decline in abundance resulting from a series of poor year-classes in the mid-1960's and the highly efficient fleet was unable to maintain catches at their former levels. Finally, when the downward trend continued in 1967-68, the fishery was closed early in the season.

Only the traditional minor fisheries for local food and bait were permitted for the **next 4 years.**

Roe Fishery

Cessation of the intensive reduction fishery resulted in a gradual recovery of **stocks.** Subsequently, a shortage of hemng in other parts of the world created a demand for prime quality herring roe on the Japanese market. Hemng **roe** is considered to be a great delicacy by the Japanese people and commands a high price. Consequently, during the 1971 season, in addition to the small traditional food and bait fishery that continued to operate through the closed period, a new and still lucrative fishery became established for **roe** herring.

To satisfy the Japanese market, herring roe must be at an exact stage of ripeness. This stage occurs just prior to spawning and lasts only for a few days. Consequently, **roe** fisheries are conducted on or adjacent to spawning grounds and must take place within a few days in any one locality. Because the eggs Fake on water and swell up prior to spawning, the weight of the egg sacs increases dramatically, accounting for 20-35% of the body weight. The fish are judged "ready" when test **sets** show ripe **roe** making up 10% or more of a random sample of fish of both sexes. After spawning, the spent fish mix with the remaining ripe fish and the "roe content" gradually drops below 10%. The fishery is then closed.

The fishery was originally with purse-seine but gillnets now take a large share of the catch. Gillnets can be set near spawning grounds, intercepting only ripe hemng while the main body of fish farther offshore may be made up of immature or spent fish. Seiners can catch large quantities of fish in a short time in a small area. Consequently, gillnets are most effective when spawning is spread over a longer distance of coastline and continues for several days (e.g. the east coast of Vancouver Island). Seines are most effective where spawning is concentrated and the fishery is over in a few hours (e.g. the southern areas of Haida Gwaii). Some grounds can be fished effectively by either gear (e.g. Barkley Sound on the west coast of Vancouver Island).

The specialized nature of the fishery has led to adaptations to both types of gear. The need for shallower seines and quicker sets has brought drum seiners into prominence, although table seiners with power blocks are **also** quite effective. Seiners usually take between 50 to 150 tons in a set but sets of up to 500 tons are taken occasionally. The catch is pumped from the nets into the hold of the seiner or another vessel for transport to a processing plant where it **is** pumped for **a** second time from the vessel into the plant.

Gillnets are fished using aluminum skiffs developed especially for this fishery. The nets are pulled in over rollers, the fish are shaken out into the skiff, and the net is reset over the other side of the skiff. Improved technology has included larger skiffs with powered pullers and shakers and their own fish finding, radio telephone, and other electronic aids. Such skiffs may take 8 tons over a 24 h period when fishing is good. Gillnet catches are unloaded on the grounds where they are often pumped to large packers or brailed into totes on barges for transport to a processing plant. Frequently, the totes are transported on trucks by road to processing plants.

In the first year of the roe fishery (1971) 11,000 tons was landed. The catch increased to 38,000 tons in 1972 and to 56,000 tons over the next two years and then jumped to 87,000 tons in 1976. In 1977 and 1978, the roe catch declined to 81,000 tons and 70,000 tons, respectively, as catches by other fisheries on these stocks went up. In 1979, the catch dropped to 45,000 tons as a result of several years of low year class survival. However, the landed value of the catch continued to rise over this entire period from $0.6 million in 1971 to $126.6 million in 1979.

Since 1979, the landed weight of B.C. herring catches has varied between 15,600 and 42,000 tonnes with a landed value of $24 - 91 million. (Table 3) Roe herring quotas by area from 1984 to 1991 are presented in Table 2.

The female carcases and the male fish are reduced to meal and oil. The meal is used primarily for salmon hatchery/aquaculture feed and the oil is used mainly for food and industrial products.

Spawn-on-Kelp Fishery

The harvest of hemng spawn-on-kelp for export is a relatively new industry in British Columbia. Most of the spawn-on-kelp is exported to Japan where it is greatly prized as a traditional delicacy, particularly during New Year festivities. Traditionally, this product was harvested from natural spawns but it was found that a better product with more even coverage of eggs on both sides of the kelp frond could be obtained by impounding herring. The current method is to construct floating ponds using webbing suspended from logs, suspend the kelp (*Macrocystis integrifolia*) in the pond and then introduce seine-caught, sexually mature herring. After the eggs are laid and fertilized, the spawn is allowed to remain in the water for 3-4 days, after which the product is removed and heavily salted.

Midway through the 1982 spawn-on-kelp season open-ponds were tried as an alternate fishing technique in spawn-on-kelp production. No fish are impounded using the open pond method and natural spawnings of hemng are utilized. *Macrocystis* is suspended from log frames which are then anchored in areas of naturally spawning hemng.

The spawn-on-kelp fishery is presently conducted throughout the British Columbia coast but is concentrated as the east coast of Haida Gwaii and north coast of the mainland.

The commercial spawn-on-kelp fishery began in 1975, when the first 13 permits were issued. From 1979 to 1990, there were 28 spawn-on-kelp licences (J licence category) issued annually. In 1991 the Minister issued an additional 10 licences to Indian Bands for a total of 38 licences. The licences are non-transferable, are issued to persons or Native Bands and authorizes the holders to harvest a certain quantity of spawn-on-kelp; since 1980 each licence authorizes the harvest of a quota of 8 short tons, except in 1986 when a 6 ton quota was implemented due to an overall low hemng stock size. In 1991 a total of 2,600 tons of hemng were allocated to the 38 licence holders. The distribution of licences and herring allocation for each area is shown in Table 5. A summary of spawn-on-kelp landings and average value per permit is presented in Table 6.

The hemng spawn-on-kelp fishery is a relatively small fishery that provides income to the industry from March through to May.

Spawn-on-kelp operations in northern British Columbia have generally been more successful because of the availability of the giant kelp *Macrocystis*, which does not grow in large quantities in the Strait of Georgia. In the Strait of Georgia, other common seaweeds, such as *Laminaria* have been tried as a substrate, but less successfully. Care also has to be taken to locate ponds in areas that are free from oil pollution as this can render the product unsuitable for human consumption.

Food and Bait Fishery

The hemng food fishery is minor compared to the roe fisheries, in terms of both quantity and price. The landed price for food fish has generally been one-fifth of prices paid for roe fish. The food catch has fluctuated over recent years according to market demand and negotiated prices between fishermen and processors. In 1971-72, 25,000 tons were landed; in 1972-73, 38,000 tons were landed. For 1973-75, catches were small because of contract disputes. In 1975-76, 5,700 tons were landed and sold mostly to companies involved in a Canadian

international food aid program. The product was mostly canned hemng with a small portion of the catch marketed dried to the Oriental food market. In 1976-77, a catch of 6,500 tons with a landed value of $822,000 was sold mostly to Japan as frozen whole fish, with a small portion sold to Europe as butterfly fillets. 20,000 tons of food herring with a landed value of $4 million were caught in 1977-78 and again exported frozen whole, to Japan. In 1978-79, 14,000 tons were taken with a landed value of $3.3 million. Of this, 1837 tons were processed as frozen fillets that were sold to West Germany and 1161 tons were salted whole and exported to the U.K. and Europe. The remainder was frozen whole or processed otherwise. The local food market for fresh, smoked, salted, and pickled hemng is fairly stable and accounts for 1000 tons of fish per year.

The food fishery was dominated by seiners until 1977-78 when trawlers took 16% of the catch. This share increased to 19% in 1978-79.

The food fishery takes place mainly between November and January, as the fish are intercepted on the migration routes to the spawning grounds. Also, most of the fishing takes place close to the processing plants so that the product can be landed fresh. In addition, there is a minimum preferred weight and size of 120 g and 20 cm for food fish by companies, and in 1978-79, bonuses of $120 per ton were paid for catches that had 60% of fish in that category. The major fishing area is the Strait of Georgia, where 86% of the catch was obtained in 1978-79. Comparable percentages for 1977-78, 1976-77, and 1975-76 are 68%, 79%, and 89%. The North Coast contributed 12%, 17%, 12%, and 10% respectively, for the same fishing seasons. In 1977-78, the West Coast of Vancouver Island contributed an appreciable portion of the food catch (13%) for the first time.

Since 1979 the herring food fishery has been reduced considerably. Herring presently caught in the food fishery is intended to provide a small quantity of herring to firms engaging in secondary processing. A small quantity is also needed to satisfy the frozen bait requirements of commercial fishermen. The low quotas (50 tons) in this fishery over the past 9-10 years reflect the low value of herring destined for use as human food or frozen commercial bait.

The herring bait fishery, has had a relatively constant market. The fish are taken during the food fishing season and under special permits. The usual method of capture is by seine although trawls and gillnets have also been used. Bait, usually frozen, is used in commercial long line fisheries for halibut and sablefish, and to a lesser extent for cod. Live bait for cod is usually kept in small quantities (50 kg) in wooden slat boxes or in the holds of the fishing boats.

Sport bait is often sold live from net ponds or barges at major marinas where herring can be fished locally. Otherwise, bait herring are sold whole frozen or

as strips at retail outlets. Most of the sport bait ponds and permits are for Johnstone and Georgia Straits. Most of the bait catch is marketed locally although some bait is exported to the U.S. A high quality bait hemng, comparable to food hemng, is sold to aquariums and zoos.

There are also a number of bait pond operations on the coast which supply fresh hemng to commercial halibut vessels. Some of the spawn-on-kelp operations on the North Coast, including Haida Gwaii, operate bait ponds for sale to the halibut fleet. The future of these bait pond operations is presently unclear, as halibut vessels are now allowed to fish for most of the year.

Commercial bait hemng fishermen usually participate in other fisheries as their main source of income. There are only a few small companies (five or more) that specialize in producing frozen bait hemng.

BASELINE FISHERIES DATA

Hemng spawning areas in the study area are shown in Map 1 and Map 2 in Appendix C for Atli Inlet and Skincuttle Inlet. Only four spawns were recorded between 1956 and 1980 in the Atli Inlet. Spawns occur consistently in the Skincuttle Inlet Area.

The dominant commercial fisheries for herring on Haida Gwaii are the seine and gillnet roe fisheries, as well as the spawn-on-kelp fishery. In recent years, there has been no hemng food fishery on Haida Gwaii, and the bait fishery has been limited to a few spawn-on-kelp operators maintaining herring in their impoundments for sale to commercial halibut vessels.

A summary of dates and locations of roe hemng (seine and gillnet) fisheries on Haida Gwaii between 1980 and 1991 is presented in Table 7. Since 1980 the roe hemng fishery has concentrated along the southeast shore of Moresby Island. Seine fisheries have taken place in lower Juan Perez Sound, Skincuttle Inlet, Atli Inlet, Louscoone Inlet, Rennell Sound and Inskip Channel. The gillnet fishery has taken place in those same areas, as well as in Naden Harbour and Poole Inlet.

Hailed roe catches on Haida Gwaii between 1984 and 1991 are presented in Table 8. Roe hemng catches (gillnet and seine) have varied between 0 (19813) and 8,792 (1990) tons, with an average of 4,401 tons. There was no roe fishery in 1988 due to poor stocks. At present, DFO fishery managers feel that the herring stocks are in good shape on Haida Gwaii.

The spawn-on-kelp fishery on Haida Gwaii also concentrates in the area of southeast Moresby Island. Typically, the fishery occurs during the months of March and April, and takes place in any of the following locations: Carpenter Bay, Poole Inlet, Juan Perez Sound, Darwin Inlet, Selwyn Inlet, Sewell Inlet, Cumshewa Inlet, Atli Inlet and Skidegate Inlet. Spawn-on-kelp landings on Haida Gwaii 1980 and 1990 have varied between 63 and 105 tonnes (Table 9).

Licence holders have used both closed-ponds and open-ponds since 1982. Currently most operators are using closed-ponds as there is less risk and because operators feel they can get a higher percentage of top grade product. Hemng have a tendency to deposit more eggs on the kelp within enclosures than when spawning naturally, as is the case with kelp suspended from open-ponds.

There are total of 12 spawn-on-kelp licences operating on Haida Gwaii. Seven seine licences are held by Skidegate Haida, one is held by each of the Masset and Skidegate Band Councils. The remaining three are held by non-natives.

RESOURCE MANAGEMENT

British Columbia hemng are currently managed by a fixed rate policy in conjunction with a cut off level of 25% of the long-term average biomass. To ensure conservation of the stocks, 20% of the forecast biomass of each of seven recognized district stocks is harvested commercially unless the run falls below the cut off level. If this occurs, the decision may be made to close the fishery to rebuild the stock (Anon. 1989). This management policy has been in place since 1983. Prior to 1983 the fishery was managed through a fixed escapement policy. Forecasting the potential catch that can be removed from hemng stocks required an assessment of current stock status and the determination of factors which affect stock dynamics, in particular recruitment. Traditionally, equilibrium based methods such as yield models have been favoured. They assume constancy in age structure, growth and mortality. However, hemng are strongly affected by changes in environmental conditions, thus making equilibrium models more attractive (Haist and Schweigert 1989).

Department of Fisheries and Oceans research scientists currently use two methods to assess present hemng stock status (1) An escapement model (Schweigert and Stockner 1988) and (2) an age-structured model (Foumier and Archibald 1982). Both methods use a 38-year time series of catch and spawn deposition information, and age structure and size-at-age data obtained from biological samples.

The primary data sources for the stock assessments are spawn surveys, commercial catch landings, age composition from biological samples of the commercial fishery, and pre-fishery research catches. These data are available on computer files for the period 1957 to 1988.

The escapement model was developed for the 1984 hemng stock assessment (Haist *et al.* 1985) Subsequently it was modified to incorporate age structure information which allows separation of the growth and recruitment components of stock productivity. This also facilitates comparison of estimates with those from age-structured model. When diver spawn survey information is available it is used in preference to surface survey data; where dive survey data are not available surface survey data are adjusted.

In the escapement model, estimates of the potential catch in each stock assessment region are calculated as 20% of the forecast run size. The forecast run size is the product of the estimated escapement in the previous year and an average annual survival rate (0.64) plus an estimate of anticipated recruitment to each stock. Recruitment is estimated for poor, average and good levels by calculating the mean of the poorest third, middle third and top third recruitments observed during the historical time series from 1951 - 1988. The estimates of total catch (tonnes) and spawning escapement (billions of eggs) are converted to fish at age based on the sampling data for each area. The age structure and average weight at age are calculated for all samples available for the region. Estimates of repeat spawners and recruiting fish are converted back to tonnages using average weight at age for the current year.

A modified version of the age-structured model described by Fournier and Archibald (1982) has been used to assess B.C. hemng stocks since 1982. The model has undergone numerous revisions to make it more consistent with the life history of the hemng and the commercial fisheries being analyzed. The current version incorporates additional information in the form of spawn survey data, separate catch at age data by gear type, and includes an availability term to model partial recruitment to the spawning stock (Haist and Schweigert 1989).

Of the two types of commercial fishing gear, seine nets are assumed to be non-selective, while gillnets are selective for larger, older fish. Seine and gillnet fisheries are temporally separate so catch-at-age data is partitioned into fishing periods, separating data for the different gear types. Three fishing periods are modelled. The first period encompasses all catch data prior to the spring roe-hemng and spawn-on-kelp fisheries. Most of this catch will taken by seine gear. The second fishing period includes all seine caught roe-herring fishery data (and spawn-on-kelp). The third period includes all gillnet caught roe-herring data.

Forecasts of stock abundance for a given year are calculated by assuming all natural mortality for the first fishing period occurs prior to the fishery. The number of fish at age prior to the fishery, the number estimated at the beginning of the fishing season multiplied by survival and the estimated availability at age. Recruitment is calculated for three scenarios based on estimated number at age 3. Poor, average, and good recruitment are calculated at the mean of the lowest third, the mid third, and the highest third of historic age 3 recruitments. Biomass is calculated using the average weight at age for roe seine fisheries in the final season.

DFO research scientists have recently examined the status of hemng stocks in the region of the Haida Gwaii (Anon 1989). Spawning stocks on Haida Gwaii increased substantially in 1989; the estimated biomass of 25,500 tonnes represents a 55% increase over the 1988 spawn levels. Four year olds comprised 50% of the stock and 3 year olds 28% of the stock. The 1985 year class was estimated to be double the 1951 - 1989 average and the 1986 year class was estimated as average.

Hemng stocks on the west coast of Haida Gwaii have been building over the past few years, and potential was identified for fisheries in these areas (Anon. 1990). The 1989 stock estimate was 9,300 tonnes from spawn surveys and 12,000 tonnes from charter vessel sounding surveys. A quota of 1,000 tonnes or 10% of the biomass was recommended for the area, and that no more than 50% of the biomass be taken by the fishery. The hailed catch in Area 2W seine fisheries were 2,745 and 2,210 tons in each of 1990 and 1991 respectively. Total roe herring catches on Haida Gwaii were 8,792 and 6,965 tons in each of 1990 and 1991 (Table 8), which were 2,690 tons (44%) and 1,795 tons (35%) over the quota (Table 4).

This highlights the difficulties in managing current roe herring fisheries, particularly small pocket fisheries, to a prescribed catch limit under the present fleet management system.

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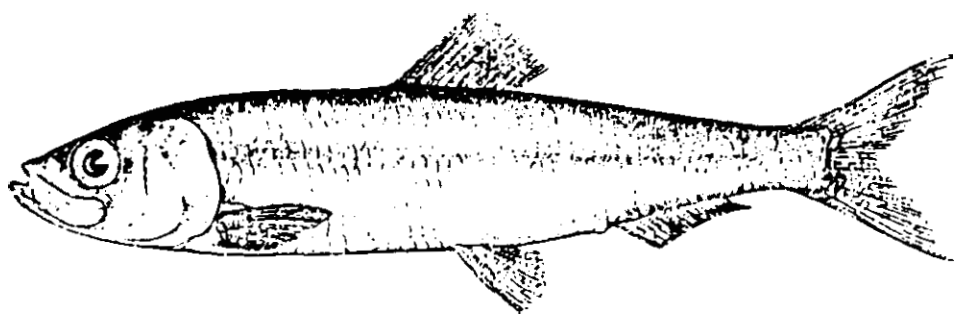

Figure *30:* **Pacific herring, *Clupea harengus pallasi***

Year	Landed Weight (tons)	Landed Value ($ million..'
1980	19,330	23.91
1981	32,087	32.62
1982	29,593	31.58
1983	39,058	46.46
1984	33,379	39.14
1985	25,691	36.35
1986	15,681	39.24
1987	38,790	91.33
1988	30,786	81.00
1989	42,016	64.07
1990	39.709	NIA

* Estimated value based on average price paid for seine and gillnet fish.

Table 3. Landed weight and value of British Columbia Roe herring catches, 198[illegible] 1990 (Sales Slip Data - does not include Roe Herring Charter payment seized fish)
Source: Anon. (1990)

Area	1984	1985	1986	1987	1988	1989	1990	1991
Haida Gwaii	5070	5512	4150	1555	closed	1000	6102	5200
Prince Rupert	4409	5512	7000	6000	8092	8092	3837	2902
Central	7275	4519	2516	3661	4127	8566	8218	6824
Gulf	12786	5181	closed	8870	7100	8151	7800	10000
W.C.V.I.	4960	closed	closed	10363	8940	11360	7889	7413
All Coast	**34501**	**20724**	**13666**	**30449**	**28486**	**37169**	**33846**	**32339**

Table 4. **Roe herring quotas (tons) by area, 1984 - 1991.**
Source: **Anon. (1990)**

Area	Number of Licences (New Licences in 1991)	Herring Allocations - Tons (From Minor Stock)
Haida Gwaii (Statistical Areas 1-2)	12 (1)	1100
Prince Rupert (Statistical Area 3-5)	9 (1)	800
Central Coast (Statistical Area 6-10)	7 (2)	300 (200)
Strait of Georgia (Statistical Area 11, 18, 28)	2 (2)	*0*
West Coast Vancouver Island Statistical Areas 19, 27)	8 (4)	*0* (400)
TOTAL	38 (10)	2200 (600)

Table 5. Distribution of herring spawn-on-kelp licences and herring allocations ' area, 1991.
Source: DFO

YEAR	QUANTITY (lbs.)	VALUE ($)	AVERAGE PRICE ($/lb.)	NO. OF PERMITS	TOTAL QUOTA (lbs.)	PERCENT OF QUOTA (lbs.)	AVERAGE VALUE PER PERMITS ($)
1975	32,503	102,810	3.16	13	156,000	21	7,908
1976	123,846	567,833	4.58	21	252,000	49	27,040
1977	256,086	1,407,074	5.49	24	480,000	53	58,628
1978	336,930	1,911,115	5.67	29	464,000	73	65,901
1979	431.801	4,582,262	10.61	28	448,000	96	163,652
1980	370,453	2,231,748	6.02	28	448,000	83	79,705
1981	411,920	2,985,852	7.52	28	448,000	92	106,638
1982	390,733	3,900,390	9.98	28	448,000	87	139,300
1983	423,111	5,435,296	12.85	28	448,000	94	194,118
1984	379,562	4,507,254	11.87	28	448,000	85	160,973
1985	415.424	5,698,989	13.72	28	448,000	93	203,535
1986	314.431	6,066,432	19.29	28	336,000	94	216,658
1987	426,847	10,539,877	24.46	28	448,000	95	372,853
1988	467,361	12,421,369	26.58	28	448,000	104	443,620
1989	469,583	8,711,185	18.55	28	448,000	105	311,114
1990	493,534	8,005,474	16.22	28	448,000	110	285,910

Table 6. **Herring spawn-on-kelp landings summary, 1975-1990. [Includes overages.]**
Source: **DFO**

YEAR	SEINE		GILLNET	
1980	March 23	Skincuttle Inlet	Feb. 12-14, 17-20	Naden Harbour
	March 19-21	Louscoone Inlet		Louscoone Inlet
			March 19-21	Skincuttle Inlet
			March 24-27	
1981	March 17	Skincuttle Inlet	March 18-20	Skincuttle Inlet
	March 21	Inskip Inlet	March 24-30	Atli Inlet
	March 24	Atli Inlet		
	March 25	Rennell Sound		
1982	March 14	Lower Juan Perez Sd.	March 20-30	Inner Skincuttle Inlet
	March 20			
	March 22	Inskip Channel		
	March 22	Atli Inlet		
1983	March 09	Lower Juan Perez Sd.	March 15	Outside Poole Inlet
	March 21	Inskip Channel		
1984	March 2	Lower Juan Perez Sd.	March 14	Poole Inlet
1985	March 11	Skincuttle Inlet	March 25-26	Inner Skincuttle Inlet
1986	March 23	Skincuttle Inlet	April 7	Juan Perez Sd.
1987	March 20	Juan Perez Sound	No fishery	
1988	No fishery		No fishery	
1989	March 28	Louscoone Inlet	No fishery	
1990	March 26	Louscoone Inlet	April 8	Bumaby Straits
1991	March 31	Lower Juan Perez Sd.	April 8	Lower Juan Perez Sd.
	March 23	Rennell Sound		

Table 7. Dates and locations of roe herring fisheries on Haida Gwaii, 1980 - 1990
Source: Anon. (1990)

YEAR	GEAR	2E	2w	SUB TOTAL	TOTAL
1984	SN	5100	--	5100	5691
	GN	591	--	591	
1985	SN	4825	--	4825	6383
	GN	1558	--	1558	
1986	SN	3143	--	3143	4067
	GN	924	--	924	
1987	SN	2061	--	2061	2061
	GN	--	--	0	
1988	SN	NO FISHERY		0	0
	GN				
1989	GN	--	1245	1245	1245
	GN	--	--	0	
1990	SN	5800	1745	7545	8792
	GN	1247	--	1247	
1991'	SN	4157	2210	6367	6965
	GN	598		598	
				Average	4401

* Preliminary results

Table 8. **Hailed roe herring catch (tons) on Haida Gwaii by statistical area and gear type,** 1984 - 1990 [No fishery **in Area 1.]**
Source: **Anon.** (1990) **DFO.**

YEAR	LANDINGS (tonnes)
1980	79.0
1981	80.2
1982	78.1
1983	**104.7**
1984	71.9
1985	75.9
1986	63.5
1987	83.9
1988	88.0
1989	65.2
1990	90.2'
Average	80.1

* Preliminary Figure

Table 9. Haida Gwaii spawn-on-kelp landings from sales slips, 1980-1989. Source: DFO.

5.0 HALIBUT

INTRODUCTION

The halibut fishery is one of the oldest on this coast, and the stocks among the most valuable. Halibut are abundant in the waters of Haida Gwaii, and approximately 60% of recent British Columbia landings are from fishing grounds on Haida Gwaii'. In the early days, halibut was a staple food of the Haida which was dried and used for trade. License limitation was introduced to the commercial fishery in 1979 and there are presently 435 vessels licensed to fish halibut. Although many Haida participated in the early years of the commercial fishery, only one Haida presently owns an "L" licence and has the privilege to fish halibut commercially. The Canadian halibut fishery is presently managed by area quotas set by the International Pacific Halibut Commission; a catch sharing arrangement with the United States which accounts for intermingling of halibut stocks; and an individual vessel quota system established in 1991. In 1988, halibut landings from Haida Gwaii waters were about 3,900 tonnes which had a value of $15.4 million.

LIFE HISTORY AND BIOLOGY

The Pacific halibut, *Hippoglotus stenolepis*, known as *xaagu* in Haida, is the largest of all flatfish and is shown in Figure 31. The body of the halibut is compressed laterally, with both eyes on one side of the head. The eyed side is pigmented and the underside is white. Pigmentation ranges from olive to dark brown or black with light irregular blotches which makes the fish less conspicuous to predators or prey on the ocean bottom. The distribution of Pacific halibut on the continental shelf of the North Pacific Ocean is shown in Map 14. Halibut have been recorded on the North American coast from Santa Barbara, California to Nome, Alaska. On the Asiatic coast, they occur from the Gulf of Andyr, U.S.S.R. to Hokkaido, Japan.

Halibut life history and biology are reviewed by Anon. (1987) and Hart (1973). Halibut are demersal which means they are found living on or near the bottom. Most halibut are caught in the summer at depths from 30 to 300 m, although some have been caught at depths up to 1,200 m. Movements have been documented by tagging studies carried out by the International Pacific Halibut Commission (IPHC) since 1925. Seasonal movements have been recorded from

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1 Average 1981-90 from DFO statistics, see Appendix C.

deep water to shallow banks and coastal water in the summer; and back to deep water in the winter. These movements are thought to be associated with winter spawning and summer feeding. Coastwide migrations for distances of hundreds of miles have been recorded, although most tagged fish have been recovered within 100 km (60 miles) of the release area. Tagging studies have shown that the patterns of movement are complex and indicate that intermingling is extensive and halibut stocks are interrelated.

The life cycle of halibut is shown in Figure **32.** Halibut spawn in the winter, mostly from November to March. Mature halibut Concentrate on spawning grounds along the edge of the continental shelf at depths from 200 to 500 m. Major spawning grounds are shown in Map 15 and include Cape St. James, Langara Island (Whaleback) and Frederick Island on Haida Gwaii. Major spawning grounds in Alaska are Cape Suckley-Yakataga ("W" grounds), Portlock Bank and Chirikof Islands. Other spawning grounds include the Goose Islands, Hecate Strait and **Rose** Spit. Based on the wide distribution of mature halibut during winter, spawning is widespread and occurs in many areas.

Mature individuals spawn annually. Males reach sexual maturity at about 8 years of age and females at **12** years of age. Fecundity depends on size and is about 50,000 eggs for a 50 Ib. female and **4** million eggs for a 250 Ib. female. Eggs are about 3 mm in diameter and are fertilized externally. Developing ova are found at depths from 100 to 200 m but may occur as deep as 500 m and hatch after about 15 days, depending on water temperature. Larvae gradually move towards the surface, as their specific gravity decreases. They generally drift passively with currents both northward and westward. Larvae begin life in an upright position with a yolk sac and eyes on each side of the head. In the early post-larval stage, the yolk sac is absorbed and the larvae begin to feed on plankton. In the late post-larval stage, a transformation or metamorphosis occurs where the left eye moves over the snout to the right side. The pigmentation on the left side also fades. At the age of about *6* months, the young fish settle to the bottom and have the characteristic adult form.

From an age of about 1 to **3** years, juveniles generally remain in relatively shallow inshore water. Many juveniles move to deeper waters and migrate in an easterly and southerly direction, reciprocal to the passive movement of eggs and larvae.

Halibut are strong swimmers and carnivorous feeders and fish become increasingly important to their diet with increasing size. Larval halibut feed on plankton while juveniles less than about 30 cm in length (1 to **3** years of age) feed on shrimp-like organisms and small fish. Larger halibut feed on bottomfish such as cod, sablefish, pollock, rockfish, sculpins, turbot and other flatfish. They also

feed on pelagic fish such as sandlance and hemng. Octopus, crabs, clams and occasionally, smaller halibut, are also consumed.

Halibut have been reported to reach a length of over 2.7 m (9 ft.) with an undocumented weight over 320 kg (700 lb). Individuals with a weight of 227 kg (500 lb) have been recorded in British Columbia waters. However the size of commercially caught halibut commonly ranges from 5-45 kg (10-100 lb.) with an average from 14-18 kg (30-40 lb). Female halibut grow faster and live longer than male halibut. Few males reach 175 kg (80 lb.) and nearly all halibut over 45 kg (100 lb.) are females.

Age of halibut can be determined by examining the otolith, which is a stone like body in each internal ear. The oldest age recorded for halibut is 42 years for females and 27 years for males. Catch, age and size information is regularly gathered by IPHC biologists to assess halibut stocks. In general, there has been an increase in growth rate since the 1920s. For instance, the size of 10 year old males and females has increased from 29 to 32 inches and 8 to 10 pounds, respectively, in the 1920s to 38 to 46 inches and 20 to 37 pounds from 1971 to 1980 (Anon. 1987).

HISTORY OF USE

Haida Use

Halibut, or *xaagu*, was particularly important as a staple food and trade item to the Haida. This was due to their year-round availability, large size and good preservative qualities. Many Haida villages were located at exposed, seaward locations which gave ready access to halibut fishing grounds, during the winter when the weather permitted (Ellis 1972-80).

Halibut are available year round in most areas of Haida Gwaii, but were most plentiful in shallow waters during the spring and summer months. An old Haida saying was "When the salmonberries are ripe, the halibut are in the kelp". Even during the winter, halibut were fished and frequently dried (Ellis 1972-80). Blackman (1975) also notes that halibut were available year round, but "were fished most intensively March through September". In the Skidegate and Cumshewa Inlet areas, halibut were fished less frequently in the summer, from May to September, due to the presence of dogfish (Ellis 1972-80).

According to Ellis (1972-80), halibut were once so abundant along the east coast of Graham Island that people regularly hiked up the coast north of Skidegate to

"beachcomb" halibut that were washed ashore. It was believed that these fish were trapped in the shallows during storms and died from "getting sand in their gills". Halibut were also commonly taken by setting a baited, anchored hook in a tide pool at low tide. After the tide had risen, all one had to do was walk down and get one's halibut!

Halibut were caught using special fishing gear as illustrated by Stewart (1977). The wooden halibut hooks, used on the northwest coast, were remarkably similar in design to the efficient "circle" hooks adopted by the commercial longline fishery in the early 1980s. Fishing lines used in shallow water were made of cedar bark and spruce root; while kelp lines were used in deeper water, since they were easier to make. Great care had to be taken in handling and fishing with kelp lines. They would easily part if they rubbed against the edge of the canoe. They could last many years, if they were properly cured, coiled and stored. Prior to use, they were always soaked in seawater. Two hooks were often suspended from the same float. When a fish had been caught, the float would "stand up", which would alert the fisherman who would leave his other chores to go and retrieve the fish. For extra buoyancy, in case a large fish was hooked. an inflated seal stomach was often attached.

Most halibut were taken on well known fishing spots, called "halibut houses" or *gyu*. These were located by "ranges" or imaginary intersecting lines formed by landmarks such as distant points, islands, or other geographic markers. These locations were learned by experience, and when they could be reached during periods of good weather, halibut catches were usually good. Swanton (1905) indicated that "the halibut bands were all named and were owned by certain families" which provides some evidence of ownership of marine fishing areas.

Landing of large halibut, which sometimes could exceed 100 pounds, required considerable skill on the part of the fishermen since they are strong fish and could easily capsize a canoe. Blackman (1975) noted that one or two men would generally go out in a "medium-sized canoe" to take halibut. Larger halibut were generally considered to be better eating than smaller fish.

After being landed, halibut were bled by cutting and breaking the vertebrae at the tail. Almost every part of the fish was utilized and savoured by the Haida. The head was highly prized and was generally chopped into pieces and boiled fresh in *jum*, or fish stew. The fish was filleted, and fillets were carefully sliced into wide, thin sections which were usually sun-dried as *ts'ilgi* or sometimes partly-smoked. Dried halibut was stored in bent-wood cedar boxes and was one of the staples of early Haida life. When eaten, it was often dipped in eulachon or sea mammal oil. The butchering and drying process are described by Ellis (1972-80) in consultation with the late Becky Pearson of Skidegate. The

backbone was either boiled fresh, sun-dried or smoked and was cut into chunks and cooked by roasting or boiling. Only the bones would be discarded, and even these would often be eaten if the backbone was boiled long enough. The skin was usually lightly smoked and dried before being "blistered" over the fire. The gills and stomach were also boiled in a fish stew, called *jum*. The flesh just behind the eyes, called *xang*, was often smoked and was said to be a special food of chiefs. Halibut eggs were added to *jum* or barbecued over the fire. A good glue could be prepared by chewing the skin around the tail, and storing the resulting liquid in a container. Even the trimmings from butchering would be cooked and eaten.

The large size of halibut enabled Haida food gatherers to efficiently store large quantities of protein for subsequent use or trade. This made halibut one of the most important food supplies of the early Haida, next to chum salmon. Both Ellis (1972-80) and Blackman (1975) note that halibut was often traded with mainland Native peoples. Trade of halibut was also recorded in early records by explorers and traders, including the Spanish in 1754 (Crespi 1974) and the Americans in 1791 (Bartlett 1925).

Recreational Fishery

The sportfishery for halibut has historically been small, and, until 1973, was governed under the commercial fishery regulations. As shown in Figure 33, the halibut sports catch has grown in all regulatory areas and is greatest in Alaska (Areas 2C and 3). The taking of halibut by sportfishermen was usually incidental to saltwater fishing for salmon. However, directed fishing for halibut now occurs from Oregon to Alaska. Large halibut are often taken as trophy fish.

Most halibut are taken using either a rod and reel or handline. Metal lures or jigs weighing from 17 to 28 ounces are commonly used.

Commercial Fiihery

The history of halibut fishery is described by Bell (1981). The first major landing of Pacific halibut occurred in 1888, by an east coast sailing vessel, the ***Oscar and Hattie.*** After an unsuccessful trip to northern British Columbia, she fished grounds off Cape Flattery and landed 50,000 pounds of fresh iced halibut which was shipped from Tacoma to the east coast. The directed halibut fishery has been almost exclusively by hook and line. Set-line gear was common in the early days, when dories fished from a mothership. By the late 1920s, however, most vessels had converted to longline gear and fished directly from larger

vessels. Sailing vessels were soon replaced by company owned steamers which, in turn, were eventually replaced by smaller wooden schooners which first began to appear in the 1910s. A variety of combination vessels began to participate in the halibut fishery, with the onset of restricted seasons by the IPHC. These have included seine vessels and a small-boat fleet which participated in a variety of other fisheries, especially salmon.

Halibut are caught on set-lines or groundlines, which are referred to individually as a "skate". Set-lines are generally laid out on relatively shallow bank areas, at depths ranging from 10 to 150 fathoms. Individual hooks may be baited with frozen herring, cod or octopus. Since the early days, there have been relatively few changes to the fishing gear. Some changes have affected CPUE information, however. These include a switch from fixed hook gear to snap gear (Hoag *et al.* 1984). Circle hooks became the dominant hook type used by Area 2B fishermen in 1984. A study by IPHC staff found circle hooks were about 2.2 times as effective as J hooks in catching halibut.

In 1990, United States and Canadian fishermen received an average price of approximately $1.82 and $2.24 (U.S.) per pound respectively for halibut, and the coastwide average price was $1.88 per pound (Gilroy 1991). The average price in 1990 for landings from Area 2E was $5.60/kg for large halibut and $5.75/kg for medium halibut[2].

BASELINE FISHERIES DATA

Aboriginal Fisheries

No directed aboriginal commercial fisheries for halibut occur in Haida Gwaii or British Columbia waters. In Washington, the 1990 Treaty Indian catch of halibut was 122,000 pounds which was caught in 26 fishing days (Gilroy 1991). This represented 39% of the Area 2A catch. In Alaska during 1990, the Metlakatla Indian Band conducted a test fishery authorized by the United States Secretary of the Interior within the 3,000 foot Annette Island Reserve boundaries. The total catch was 33,000 pounds during eight fishing days.

[2] Preliminary British Columbia Catch Statistics in Canadian dollars

Recreational Fishery

As shown in Figure 33, recreational fishing catch of halibut has increased in the past decade. In 1990, the total recreational halibut catch of 6.2 million pounds represented 10% of total Canadian and U.S. commercial landings of 61.2 million pounds. The Canadian recreational halibut catch of 0.66 million pounds represented 7.8% of Canadian commercial landings of 8.5 million pounds.

In 1990, the estimated Alaskan catch was 5.3 million pounds and represented approximately 85% of all sport caught halibut. The British Columbia sport fishery has increased at a slower rate than the Alaskan fishery, with a 1990 expected catch of 0.66 million pounds. In Washington, Oregon and California (Area 2A), the 1990 sport fishing allocation by the Pacific Fishery Management Council was 195,000 pounds while the preliminary catch estimate for this area was 209,000 pounds (Gilroy 1991).

The decrease in recreational halibut catch in Area 2B from the 1988 peak of 0.8 million pounds to 0.6 million pounds in 1989 may be the result of new methods of estimation (Anon. 1989a). However, harvest levels have increased considerably above the level of the early 1980s, particularly off Barkley Sound on the west coast of Vancouver Island and near Langara Island in Dixon Entrance (Anon. 1989b). The estimated British Columbia halibut catch by B.C. resident and visiting anglers in 1988/89 was 33,700, with 8,700 caught in DFO statistical areas 1-6 (Bijsterveld 1989).

In 1990, the IPHC issued 517 sport licenses for charter vessels in the United States and 105 in Canada. This was an increase of 36 U.S. and 45 Canadian licenses over the number issued in 1989. These totals do not include vessels that obtain both sport and commercial licenses.

Recreationally caught halibut tend to be smaller than those caught in the commercial fishery. Size varies with area, but averages less than 20 pounds (Anon. 1989a).

Commercial Fishery

Commercial halibut landings from Area 2B, and Haida Gwaii are shown in Figure 34. Since 1981, landings from Haida Gwaii averaged 3,273 t (round weight) which is 60% of Area 2B landings (Table C19 Appendix C).

The 1990 Area 2B commercial catch of 8.5 million pounds represented 13.9% of the total Pacific halibut fishery catch of 61.186 million pounds based on

preliminary statistics (Table C20, Appendix C). The 1990 fishery in Area 2B consisted of three openings with a total of ten fishing days.

IPHC issued more than 6,900 commercial licenses in 1990. Most of the 435 Canadian licensed vessels were active. Over 6,500 licenses were issued to United States vessels. In 1989, only 53% of the licensed U.S. boats reported halibut landings (Gilroy 1991).

The 1990 population assessment (Sullivan 1991) is based on information about catch, catch per unit effort (CPUE), age composition and average weight data. Results for Area 2B and coastwide stocks are shown in Figures C3 and C4 Appendix C. Recruitment to the fishery was low in all areas including Area 2B. In 1990, the thirteen-year-old class, which recruited strongly as eight-year-olds in 1985 is contributing less and less to the current fishery in terms of yield. The overall CPUE declined from 1989 levels but increased in Area 2B and other southern Areas 2A and 2C.

Bycatch Mortality

Pacific halibut are often caught incidentally in fisheries directed at other species, Regulations require that incidentally caught halibut must be returned to the sea in as good a condition as possible. However, survival of discarded halibut varies from zero to 90 percent, depending on the type of fishery and the handling by fishermen (Trumble 1991).

The 1990 halibut bycatch mortality and impact on the directed fishery by regulatory area is shown in Figure 35. The 1990 bycatch mortality has increased since 1985 as shown in Figure 36. The increase in 1990 resulted mainly from attainment of several bycatch limits in the Bering Sea trawl fisheries during 1990 that were not reached in 1989 and a tripling of the estimated bycatch mortality in the gulf of Alaska longline fishery from 1989 to 1990.

The total loss in yield to the longline halibut fishery is estimated to be 1.6 times the bycatch mortality, or 27.84 million pounds in 1990. Because young halibut migrate to the south and east, the yield losses are lower than bycatch mortality in regulatory areas from which migration occurs, and greater in areas to which migration occurs. Trumble (1991) estimated the yield loss of the 1990 bycatch on Area 2B to be 5.39 million pounds which is more than 60% of the 1990 catch in Area 2B of 8.5 million pounds.

RESOURCE MANAGEMENT

The IPHC makes regular population assessments for Pacific halibut (Anon. 1988; 1989a). There are four principle sources of information: (1) landing tickets obtained from fish processors, which provide information on the total catch by area; (2) logbook data, supplied by fishermen, which provide information on the fishing effort associated with a given catch by area; (3) otoliths, obtained by port sampling, which provide information on the average weight at age of the individuals in the catch as well as providing the age composition of the catch; and (4) tags, recovered by fishermen and fish processors, which provide information on fish migration. The basic principles of the stock assessment are that the age composition of the catch represents the age composition of the stock, after adjusting for gear selectivity, differences in catchability among areas, seasonal and regional changes in fishing effort, and fish migration. Also, that the population changes over time in a consistent manner, which can be calculated based on abundance of previous year classes after accounting for factors such as selectivity, survival and migration. Due to regional and temporal changes, catch per unit effort can only be used as one indicator of population change in a given area. The procedure for estimating the 1990 commercial catch is illustrated in Figure 37.

Canada

In Canada, the Department of Fisheries and Oceans handles the management and enforcement of the halibut fishery. Domestic consultation is by means of an annual meeting with the industry just prior to the IPHC annual meeting. The meeting is initiated by contacting a number of key user groups. The meeting includes industry representatives, Canadian halibut commissioners and DFO staff. A representative of IPHC staff makes a presentation on stock status and expectations and answers questions from the industry. There is no other formal consultation mechanism. Some concerns have been raised about representation and accountability through this process (Anon. 1989b).

Recreational Fishery

In Canada, the halibut season for the recreational fishery extends from February 1 to December 31. There is a daily bag limit of two fish, and a possession limit of two fish.

Commercial Fishery

A size limit of 81 cm has been in effect for the commercial fishery since 1973. The size limit had a significant effect on Canadian halibut fisheries since subarea 2B has a higher relative abundance of juveniles than other subareas such as 2C. The changes resulted in increased discards as well as larger average size of fish landed.

In general, halibut seasons have become greatly reduced in recent years. For instance, the halibut season in subarea 2C was only two days and in subarea 2C was only 10 days (Table C20 Appendix C). As the catch per day has increased, it becomes more difficult to stay under the catch limits. This problem has been alleviated in Canadian waters with the introduction of individual vessel quotas in 1991.

The International Pacific Halibut Commission

The International Pacific Halibut Commission has the authority to regulate Pacific halibut fisheries in Canada and the United States. This authority was granted in 1923, when Canada and the United States signed the Convention for the Preservation of the Halibut Fishery. This was in response to declines in halibut stocks off northern British Columbia and Alaska in the early 1920s and because of the transboundary nature of the stocks. The International Fisheries Commission was created under the Convention, which was renamed the International Pacific Halibut Commission in 1953. The Halibut Convention has had periodic revisions since the original treaty.

The Commission itself has no power of enforcement in either country, but under the Convention, Canada and the United States signed a declaration of intent to comply with the regulations recommended by the commission.

Initially, the commission imposed a three month closure for conservation. When this proved inadequate, the commission was granted greater powers in 1930 to set catch quotas by area, regulate gear and close nursery areas. The catches and apparent size of the halibut stocks declined dramatically in the late 1960s and early 1970s - due partly to environmental changes but mainly to incidental catches of halibut by foreign high seas trawl fleets.

Both Canada and the United States declared a 200-mile fishing limit towards the end of the 1970s. Canada excluded U.S. fishermen from fishing in Canadian waters in 1979. Canadian fishermen were phased out of the Alaskan fishery by

1980. The impact on Canadian fishermen was substantial since two thirds of the Canadian halibut catch had been taken in U.S. waters off Alaska.

In 1979, the division of the catch from the remaining international halibut stocks was specified. Canada introduced limited entry licensing in the halibut fishery in 1979. Halibut ("L") licenses were issued to vessels that had reported halibut landings of at least 3,000 pounds (dressed, head off) in either of the preceding two years.

The Pacific United States

In the United States, halibut management regulations are handled through the Management Council process established under the Magnuson Act. There are both a Pacific and North Pacific management councils involved with halibut regulation. Enforcement responsibilities are handled by both the National Marine Fisheries Service and the respective State Agencies plus the **U.S.** Coast Guard. Domestic consultation takes place through a formal management council process.

The catch sharing plan for Area 2A was developed by the Pacific Fishery Management Council (PFMC) to allocate the 520,000 pound catch limit among commercial, sport and treaty Indian fisheries. The non-Indian commercial catch allocation was 194,000. Washington state Treaty Indians were allocated 130,000 pounds which included 10,000 pounds for ceremonial and subsistence fishing.

Sportfishing regulations for Pacific halibut (Table 10) changed significantly for most areas in 1988. **In** Alaskan waters (Area 2C, 3 and 4), the possession limit was increased from one to two daily bag limits at the request of charter boat operators operating in remote areas on extended trips. **In** Area 2A, a variety of controls were used to reduce the recreational harvest and allocate the recreational portion of the harvestable biomass among recreational fishermen. These included shorter seasons, reduced bag limits, size limits, catch limits, and the creation of sub-areas (Anon. 1989a).

Discussion

Generally, the management system for Pacific halibut has proven highly successful. As discussed, a major current management issue is halibut bycatch mortality. The main bycatch occurs in Alaskan trawl fisheries, but all fisheries including Area **2B** are affected due to the general southward migration of juveniles and adults.

The halibut longline fishery is highly selective with generally limited impact on other species. Biological concerns in the halibut fishery relate to incidental catches of lingcod and rockfish, discussed in Section 7.0 and 8.0.

Fleet licensing and the new Individual Vessel Quota system for the halibut fishery has been a major concern for the Haida and other aboriginal groups. Limited entry licensing excluded Haida people from participation in the halibut fishery in 1979, although about 60% of halibut in British Columbia are currently harvested in Haida Gwaii waters. The new system, which gives a share of the resource to relative newcomers in the fishery, is seen as further alienation of the halibut resource from them.

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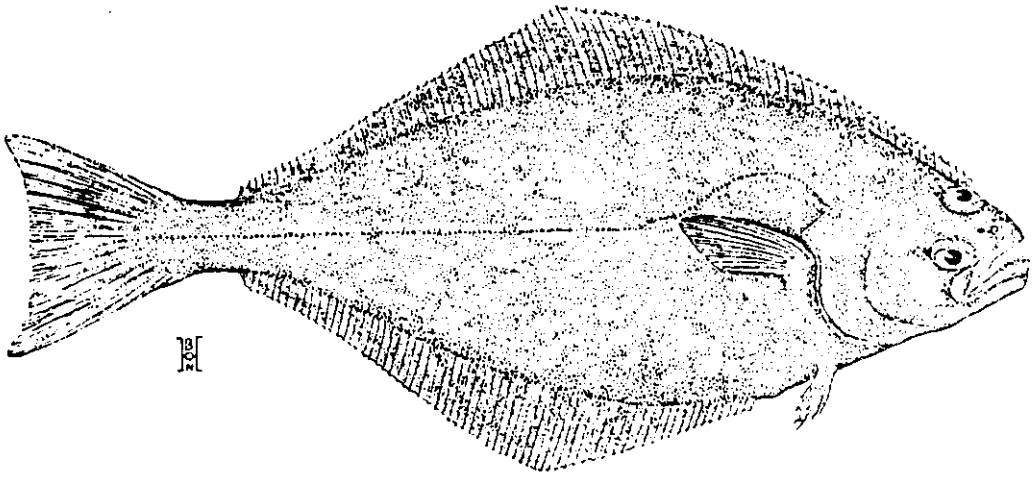
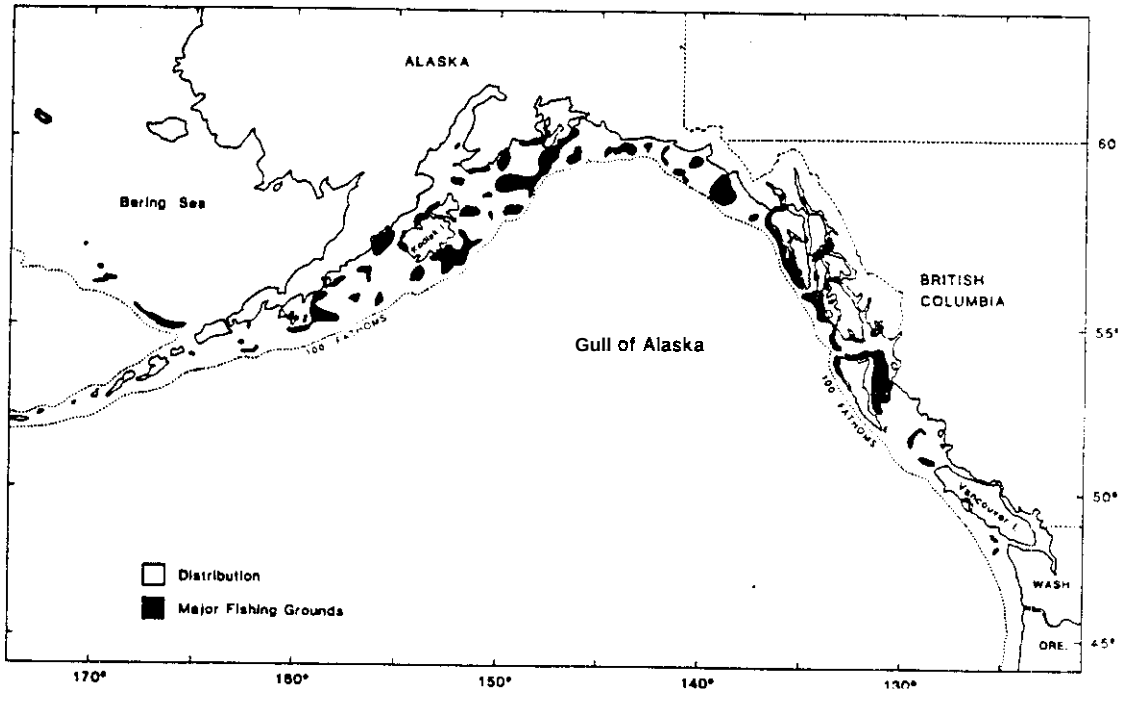


Figure 31: **Pacific halibut, *Hippoglossus stenolepis***



Map 14: **North American distribution of Pacific halibut and major fishing grounds.**
Source: **Anon. (1987)**

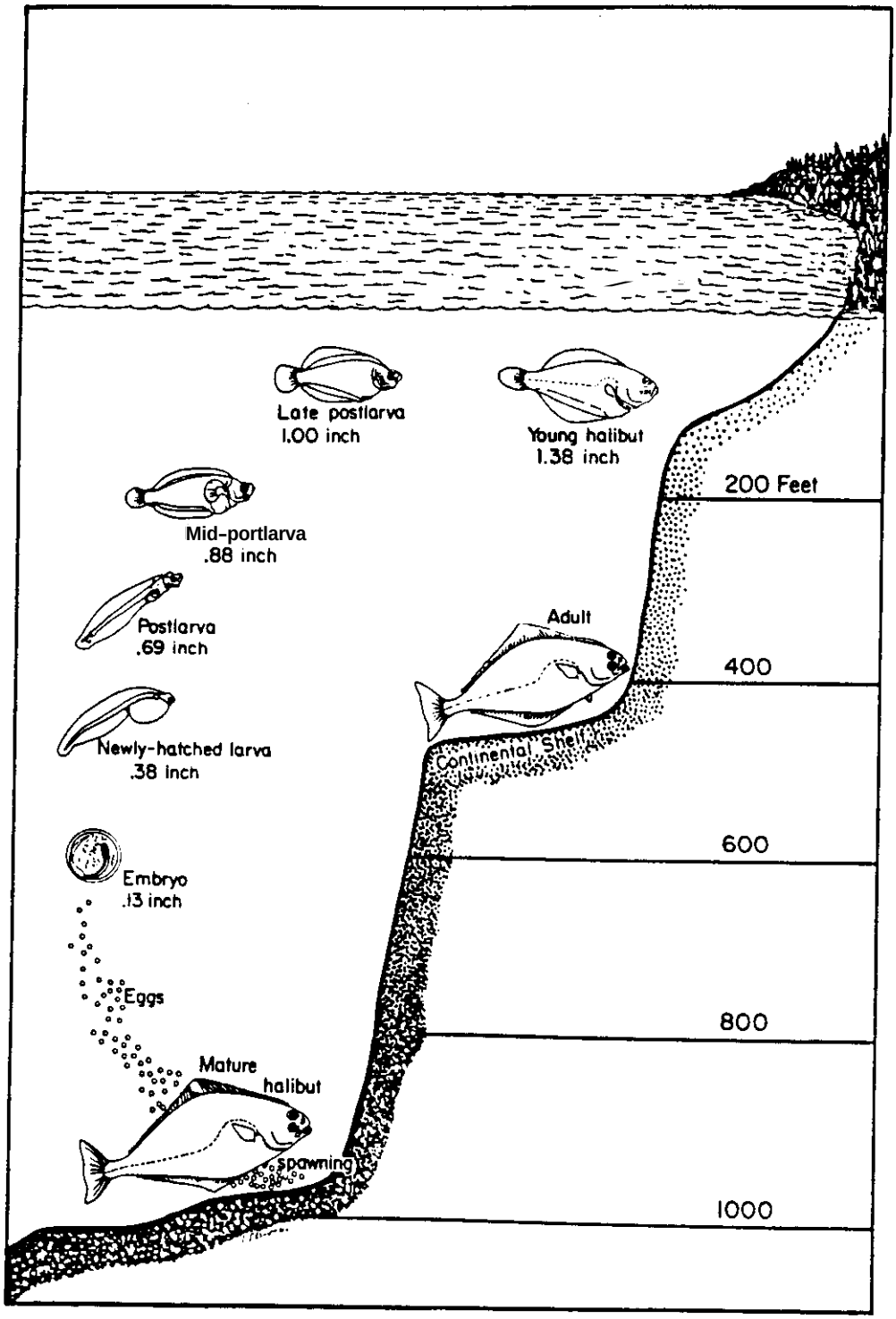
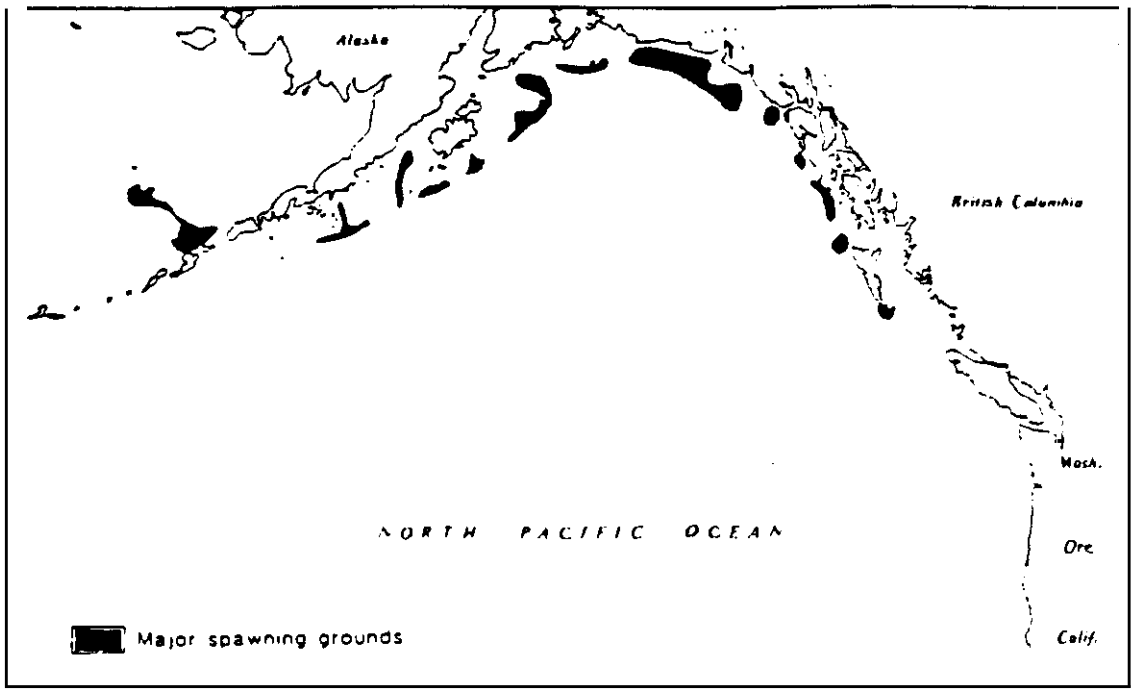


Figure 32: **Life cycle of the Pacific halibut**
Source: Anon. (1987)



Map 15: **Major spawning grounds of Pacific Halibut in the northeast Pacific Ocean**
Source: **St. -Pierre (1984)**

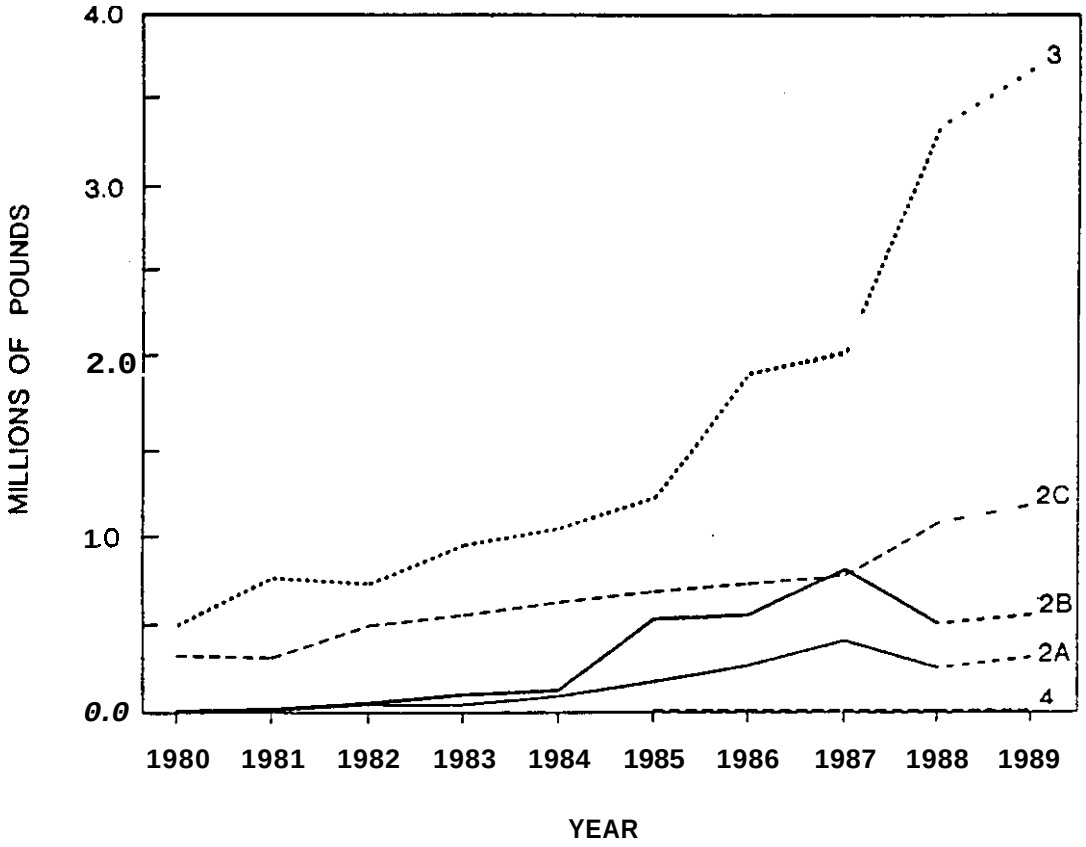


Figure 33: **Pacific halibut recreational landings**
Source: **Anon. (1990)**

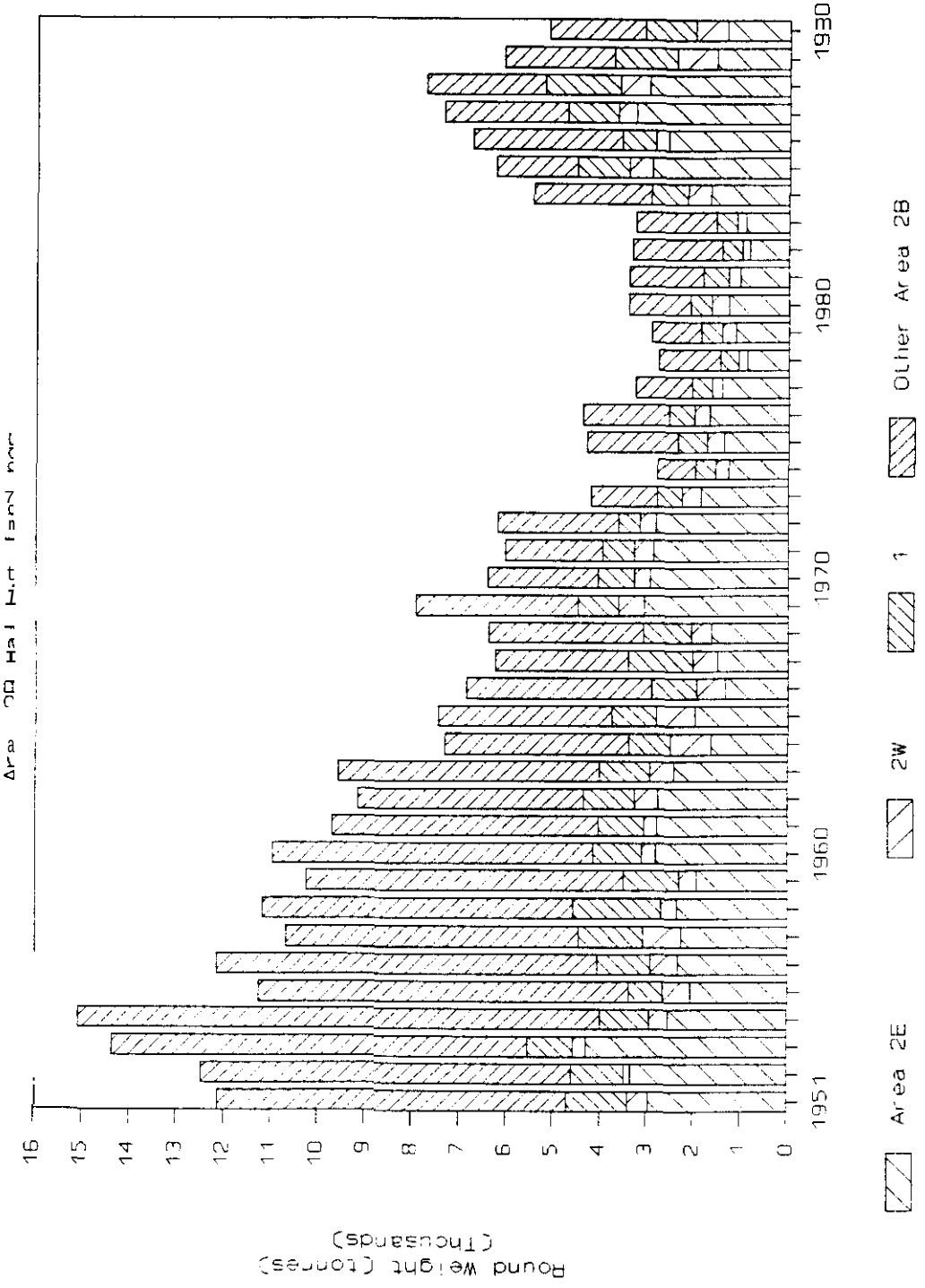


Figure 34: Haida Gwaii and other Area 2B halibut landings, 1951-1990

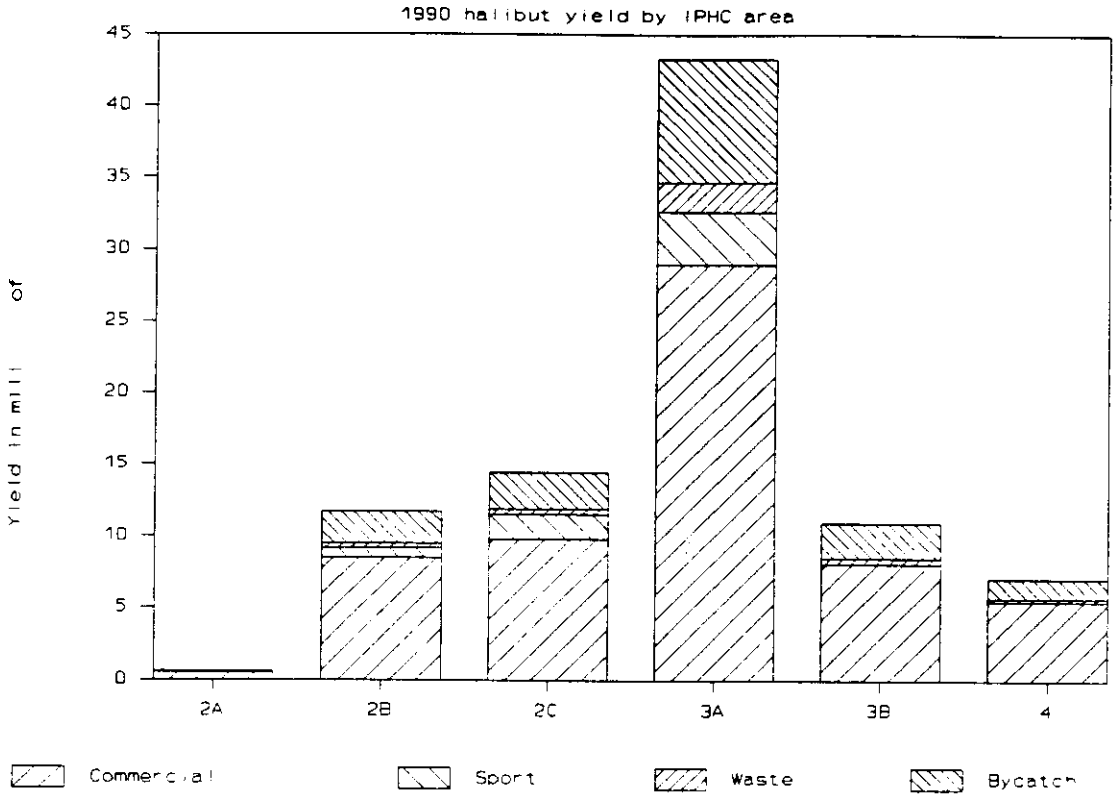


Figure 35: Halibut yield by IPHC management area, 1990

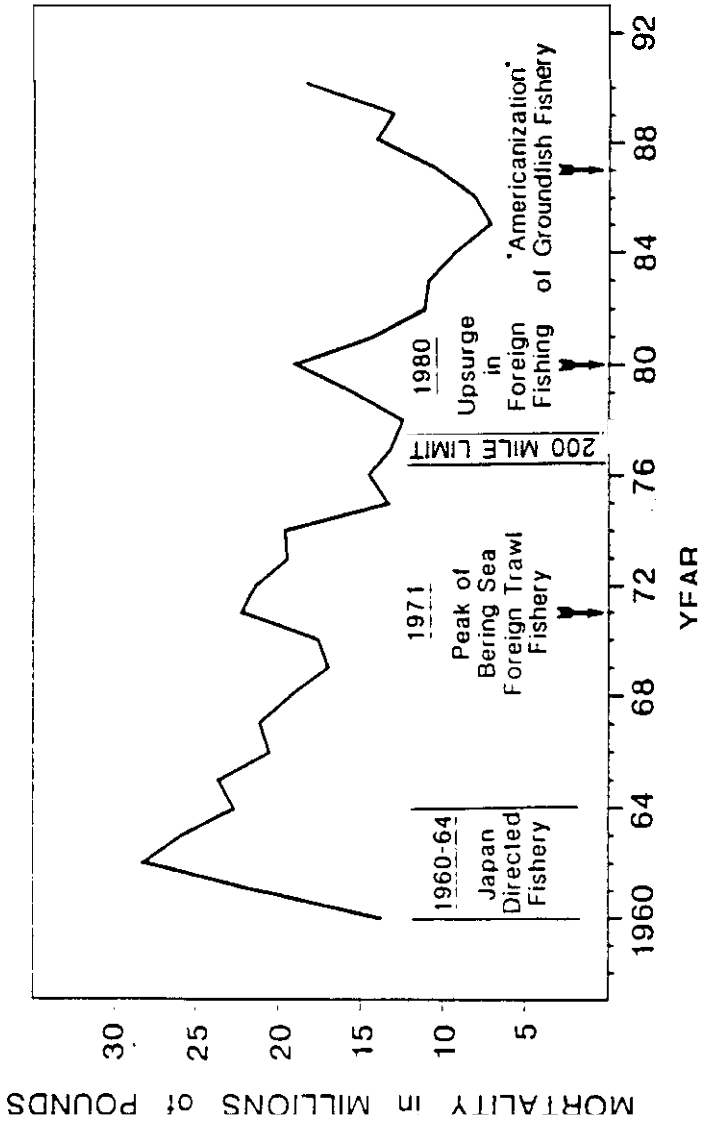


Figure 36: **Mortality of Pacific halibut by non-target fisheries since 1960**
Source: **Trumble (1991)**

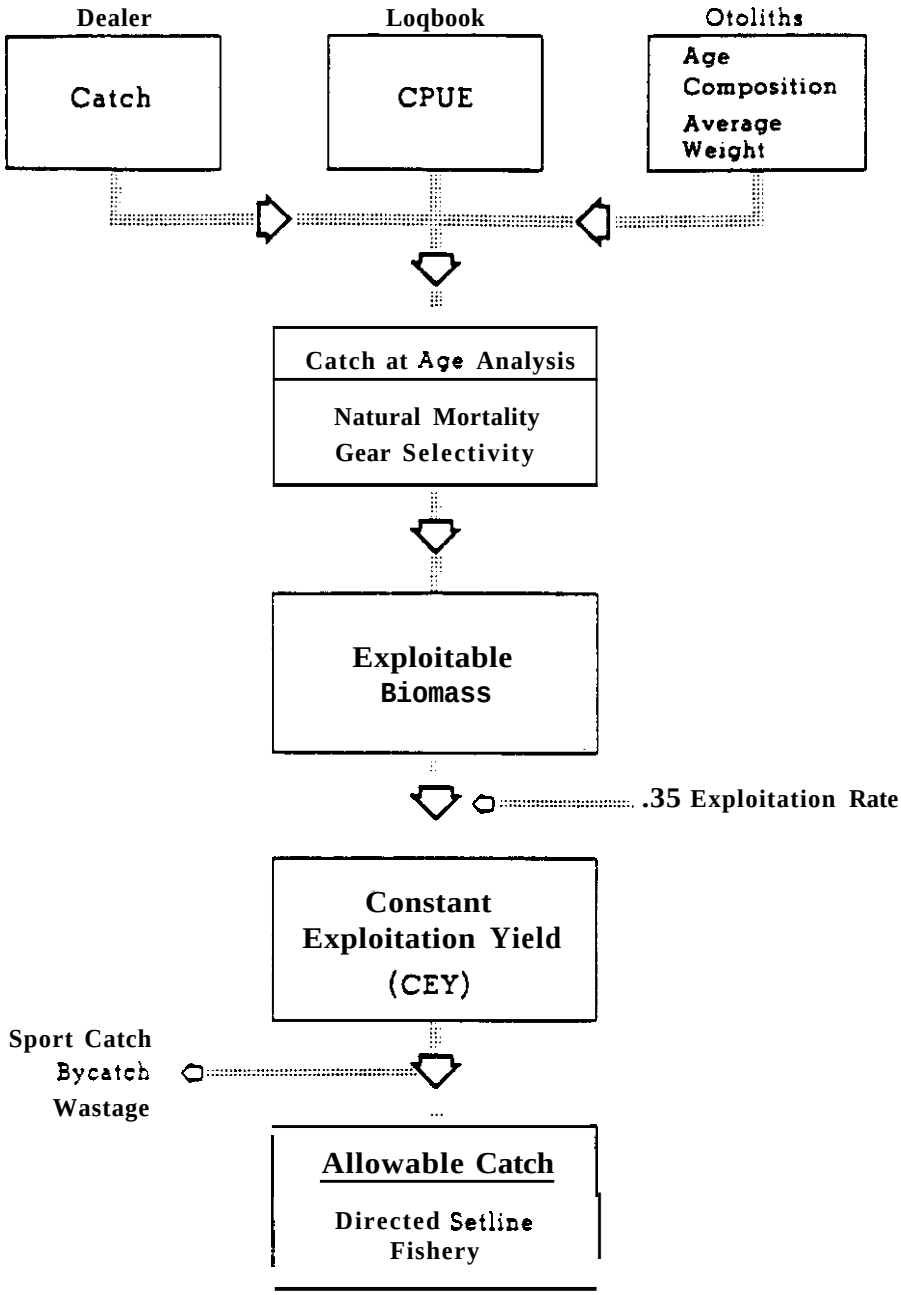


Figure 37: Procedure for estimating the 1990 allowable halibut catch. Source: Anon. (1990)

6.0 SABLEFISH

INTRODUCTION

Sablefish are a long-lived fish that occur along the continental slope from California to Alaska. In the Canadian fishery, they are captured using baited traps or hooks set on the bottom at an average depth of 500-1500 m. Sablefish is currently the second most important groundfish fishery on Canada's west coast. The landed value of sablefish increased from less than $1 million in 1977 to approximately $14 million in 1985. The sablefish fishery is currently managed by individual vessel quotas in order to maintain a sustainable annual yield. License limitation presently constrains the fleet to approximately 30 vessels fishing 48 'K' licenses.

LIFE HISTORY AND BIOLOGY

The sablefish, *Anoplopoma fimbria* (Pallas 1811), or blackcod is called *skil* in Haida. Sablefish are recognized by two medium-sized, almost equal and well separated dorsal fins, fine teeth and more than 15 spines in the first dorsal fin (Figure 38). Sablefish are found along the Pacific coast of North America, from northern Mexico to the Gulf of Alaska and the Aleutian Islands and along the continental shelf in the Bering Sea to the coasts of Siberia, Kamchatka and northern Japan.

Along the Pacific west coast sablefish spawn from January to March at depths up to 300 m (McFarlane and Beamish 1983). The fertilized eggs incubate at depths between 300 and 400 m. Upon hatching, the larvae sink to depths of 1,000 m or more, then gradually rise to the surface. After hatching, it takes approximately 56 days for sablefish larvae to develop into juveniles 8-9 in length. Juvenile sablefish move to inside coastal waters until where they remain until the age of three or four, at which time they migrate back offshore. Adult sablefish spawn annually and do not display a spawning migration (McFarlane and Beamish 1983).

McFarlane and Beamish (1983) examined stomach contents of sablefish captured in sunken gillnets and bottom trawls. Most of the of sablefish caught in gillnets off Haida Gwaii (Beamish *et al.* 1980) contained fish remains (76%) with 61% (by volume) rockfish. More than half of the sablefish captured in the trawl nets were found to have empty stomachs. The absence of food in the stomachs of sablefish is a common observation in the commercial fishery, and may explain why they are so easily caught. The dominant food items in the trawl survey were Pacific herring (24%) and squid (30%).

Age of sablefish caught in the commercial fishery commonly ranges from 4 to 35 years (McFarlane and Beamish 1983) and the oldest age determined to date is 55 years. The average age of sablefish caught in the commercial trap fishery off British Columbia was 20.2, 12.7 and 16.5 years in 1979, 1980 and 1981 respectively. McFarlane and Beamish (1983) attributed the decrease in average age for 1980 and 1981 to the presence of a strong 1977 year class in the fishery.

Growth and size of sablefish was described by McFarlane and Beamish (1983). Juvenile sablefish show tremendous growth in length during the first year, after which growth is very slow. Males and females are similar in length up to 4 years of age, after which females are significantly larger. The size of sablefish in the commercial catch from 1971 to 1982 ranged from 30 to 104 cm on Haida Gwaii, 38 to 104 cm off Queen Charlotte Sound and 38 to 114 cm off the West Coast of Vancouver Island. During late 1977, a large number of young-of-the-year sablefish appeared in Hecate Strait, Queen Charlotte Sound and the mainland inlets, and evidence of this strong year-class has continued to the present (Saunders Pers. Comm.). This strong year-class has also been reported from other areas throughout the northeast Pacific Ocean (Balsiger 1982).

Anecdotal information from fishermen and a study of the relative abundance of juvenile sablefish in the diet of Pacific cod captured in inside waters indicates that juvenile sablefish were also abundant during the late 1960s and the late 1950s or early 1960s (McFarlane and Beamish 1983). These reports corroborate the Occurrence of strong year classes within sablefish populations. The mechanisms causing strong year-classes are poorly understood and likely complex. There is little doubt, however, that oceanographic conditions contribute to the success of some year-classes.

The importance of the present age structure in sablefish is uncertain. McFarlane and Beamish (1983) suggest that the presence of older ages allows the sablefish population to survive in an environment where food may be scarce and where recruitment is limited for extended periods. Unlike adults, actively growing juveniles are commonly found in shallow inshore waters, where food is more available. Growth in deeper waters is slower and it is likely that most energy, surplus to maintenance requirements, is used for reproduction.

HISTORY OF USE

Haida Use

Ellis (1972-80) describes Haida use and fishing methods for sablefish. Since sablefish, or *skil* live at great depth, their capture by the early Haida required a great deal of technological skill as well as physical effort. The manufacture and preparation of the special fishing gear needed for blackcod fishing, the strenuous fishing operation and the very labour intensive processing needed to extract the oil are a reflection of the high cultural value of this product.

The 150 to 200 fathom long kelp lines used for blackcod fishing were carefully stored on the racks suspended from the ceiling of the old Haida houses. The kelp lines were hard and brittle when they were dry, so on the morning before the expedition was to set out, they were thrown into the sea. Winter was a preferred time to go for blackcod. The west coast of Haida Gwaii, where most of the fishing took place, is often calm in the dead of winter when the northeast winds prevail.

Once the well-known fishing spot known as *gyu* or blackcod house was reached, the heavy rock anchor was dropped and the kelp line carefully let out. The wooden hooks, made from carefully steamed hemlock knots, were tied individually to the main kelp line, and propped open with a small stick which floated free when the bait was taken by a fish. The anchor could be released with a special slip knot so that it would not have to be hauled back.

Great caution had to be taken in handling these lines as they often broke and could withstand very little chafe or friction on the gunwale of the *canoe*. The lines parted so often, in fact, that the Haida in the Englefield Bay area adopted the following gear-sharing arrangement: of the four men who went fishing, two would own the lines, which would be tied together. These men would be stationed in the bow and stem of the *canoe*, with the job of keeping the *canoe* positioned so that the line would not twist. The hooks were time consuming to make, and were individually marked by their owner. As the line was retrieved and each hook appeared with a fish, it was unhooked and a specific fin bitten to identify the owner of the fish. Upon landing, extra fish were distributed to the owner of the *canoe* and those who owned the lines.

Immediately upon landing, the Haida women gutted the fish without using a knife. The stomach and gills were often saved and boiled with seaweed. The fish were split or sliced along the backbone which was removed. After soaking overnight, the fish were boiled in bent-cedar boxes with hot rocks, and the oil

skimmed off. Oil was also extracted by wrapping the boiled meat in spruce root sacks and squeezing them between two boards. What could be eaten of the boiled meat was consumed and the rest discarded. In the Englefield Bay area, blackcod were taken mainly for their oil, which was a valuable trade item not only with the mainland Indian tribes but also with Haida from other areas of Haida Gwaii who did not have access to sablefish. The eggs were used in a dish that was said to resemble "cream of wheat" and were also preserved by drying.

Blackman (1975) notes that sablefish were taken in several areas in northern Haida Gwaii and even in Massett Inlet. She notes that sablefish were a "preferred food which was sliced and smoked for winter use," and also highly valued for its oil.

Swan (1885) obtained samples of sablefish which had been brought to Skidegate Village by Haida people. A short lived saltery was established in 1890 in the Englefield Bay area after sablefish was favourably received in the east.

Commercial Fishery

Harvesting of sablefish is presently influenced by market demand as well as seasonal openings for other commercially fished species. In the past, sablefish harvesting usually occurred during the spring and fall. The two different gear types used for harvesting are longlines and traps. The main market for sablefish is in Japan where processed J-cut sablefish (cut behind pectoral fin, belly left unslit) are popular. The fish are graded and sold both overseas and domestically according to size classes by dressed weight which are 2-3 lbs, 3-4 Ibs, 4-5 lbs, 5-7 lbs and +7 lbs. A small percentage (approximately 5%) of the total product is smoked and marketed. A small amount of smoked product is also marketed in the United States. Sablefish have a high oil content, and are rich in Vitamins A and D. As a result, they are considered a luxury fish product in Japan and remain in steady demand especially during the fall and winter months.

The first fishery for sablefish in British Columbia was implemented on a very small scale by Haida fishermen (McFarlane and Beamish 1983). Fishing on a commercial scale in Canadian waters commenced only after appropriate longlining gear was made available during the latter part of the nineteenth century. The popularity of the salmon and halibut fishery overshadowed interest in sablefish until the demand for an oil and Vitamin A source, coupled with fish shortages during the second World War, helped reestablish the sablefish industry up until 1950. Between 1951 and 1971, the Canadian fishery for sablefish remained fairly constant with catches of 400 tonnes/year (McFarlane and Beamish 1983).

Before Canada instituted the 200 mile fishery conservation zone in 1977, the Japanese fishing fleet harvested 5142 tonnes of sablefish in 1969 and 1970 and between 2900 tonnes and 4700 tonnes a year during 1971-1975 (McFarlane and Beamish 1983). The USSR and the Republic of Korea also fished off the British Columbian coast but to a lesser extent than Japan. The establishment of a total allowable catch (TAC) of 5000 tonnes in 1977 resulted in surplus sablefish stocks of 3500 tonnes which were made available to the foreign fishing countries of Japan and the Republic of Korea. A reduction in the TAC in 1978 and subsequent years resulted in the eventual phasing out of Japan's fishing interests within Canadian waters by 1980.

A shift in fishing techniques from trawling to longlining and, around 1980, to trapping, was influenced by the reduction in the minimum size limit for sablefish as well as fluctuations in the halibut fishery. Introduction of a minimum size limit in 1972 rendered trawling ineffective as the majority of sablefish caught were then much smaller than allowed. The popularity of longlining for sablefish during the slower periods of the halibut fishery rapidly decreased. It was not until the U.S. imposed area restrictions on halibut fishing in 1980 that the transition to trapping became the overall preferred fishing method.

Limited entry was introduced in the sablefish fishery in 1981 to control the increasing directed fishing effort and 48 licenses were issued to 26 vessels. Fifteen vessels utilized trap gear and 11 fished with longlines. As a result, 7.9 million pounds (3601 metric tonnes) of sablefish were landed at a value of $5.5 million during a 245 day fishery.

Sablefish landings in 1988 totalled 11.2 million pounds (5076 metric tonnes) with a value of $17 million. Fishing time was greatly reduced as 46 vessels comprised of 27 trappers and 19 longliners, fished only 20 days. Total fishing days per season steadily declined from 1981 to an extreme low in 1989. Although the 1989 sablefish fishery lasted only 14 days, the catch was 10.4 million pounds (4720 metric tonnes) valued at $19 million when all 48 licensed vessels fished.

The limited entry system without individual quotas or allocations resulted in intense competition for sablefish stocks at the onset of every fishing season. Poor product quality, increased fishing costs and increased safety risks ensued as fishing pressures to land the most sablefish per vessel continued.

BASELINE FISHERIES DATA

Sablefish landings from 1973 to 1988 for British Columbia and the north coast (Areas 5A, 5B, 5C, 5D and 5E) are shown in Figure 39. Catches are presently limited by a coastwide quota of 5,000 tonnes. From 1979 to 1988, about 37% of British Columbia sablefish landings were from Haida Gwaii (Area 1, 2E and 2W). As shown in Figure 40 for Areas 5A, 5B, 5C, 5D and 5E, most landings are by traps (87% from 1979 to 1988), and landings by longline and trawl have increased slightly over the past 15 years.

The largest concentrations of adult sablefish are found in the Gulf of Alaska between Queen Charlotte Sound and the Shumagin Islands (Low *et al.* 1976). Juvenile sablefish are generally located in shallow inshore waters at depths < 200 m. Adult sablefish are abundant along the entire west coast of British Columbia at depths exceeding 200 m. Sablefish are also present at seamounts. Commercial catches by Japanese longline vessels fishing in 1973 and 1977 on Bowie seamount indicated that catch per unit effort (CPUE) in 1973 was similar to CPUE values obtained by Japanese longliners fishing the more traditional grounds (McFarlane and Beamish 1983).

Sablefish have been reported at depths of 1900 m (Kodolov 1976), and 2740 m (Beamish *et al.* 1979). Trawl surveys along the Pacific coast of North America indicate that 93% of the exploitable sablefish biomass is confined to the continental slope from 200-1000 m (Low *et al.* 1976).

Studies of commercial trap catches off the west coast of British Columbia from 1979-1981 (McFarlane and Beamish 1983) indicate sablefish were abundant between 400 and 1830 m. There was no apparent trend between catch and depth. Catches were consistently high between 600 and 800 m. Catches increased in deeper waters (> 800 m) during summer and fall, probably related to cessation of spawning. Other studies have reported an increase in the size of sablefish with depth, especially between the surface and 200 m (Phillips 1954; Hegamoto and Alton 1965; Kennedy and Pletcher 1968).

Standardized catch per unit effort data is presented in Figure C6 Appendix C.

RESOURCE MANAGEMENT

The sablefish industry is presently managed by a coastwide quota, limited entry licensing restricting the fleet to 48 vessels and individual vessel quotas (IVQ's) introduced on a trial basis from 1990 to 1991.

IVQ's were determined from historical fishing performance (70%) and vessel length (30%). Each fisherman makes decisions about the current fishing season based on a known amount of sablefish they are able to catch. These decisions may be based on appropriate fishing times, safety measurements, market fluctuations and/or the commencement of other fisheries. This system should provide the fishermen with an opportunity to devise methods of preparing, handling and distributing product with a goal to maximize landing price and profits while keeping costs at a minimum.

Fishermen can choose when to fish which may extend the fishery to twelve months and should improve product quality. IVQ's reduce time pressures on fishermen, decrease product gluts for processors, distributors and consumers. IVQ's provide economic stability to license holders who have the security of knowing the quota provides them with an opportunity to catch a fixed share of the TAC.

One disadvantage of IVQ's is the requirement for year-round monitoring and enforcement. Sablefish landings are monitored by a validation system designed to provide immediate updates on individual quotas and coastwide catches which enable enforcement personnel to verify industry compliance.

Monitoring of the 1990 and 1991 sablefish industry is being carried out by the Department of Fisheries and Oceans (DFO) and Archipelago Marine Research Ltd. (AMR) through an agreement with the Pacific Coast Blackcod Fishermen's Association. The cost of the program is paid by the 48 licensees.

Archipelago maintains trained and certified observers to verify dockside landings at five ports: Vancouver, Ucluelet/Tofino, Port Hardy/Coal Harbour, Port Alberni, and Prince Rupert. Three additional landing ports have been included for the 1991 fishery: Winter Harbour, Bella Bella/Shearwater, and Massett. Information collected by the observers is faxed to the AMR office within 12 hours of validation. Data is checked for accuracy and entered into DFO's mainframe (VAX) computer within 12 hours of the landing. Following the verification of each sablefish landing, the calculation fishing status information on every license holder throughout the duration of the sablefish fishing season. This system allows

the status of each license holder to be updated or checked at any time throughout the fishing season.

Discussion

There are few resource management concerns in the sablefish fishery. There are presently no Haida licenses for sablefish, although Haida were among the first in the commercial fishery. As with the halibut, the main concern from the point of view of the Haida is that a significant fishery occurs within Haida waters with no Haida benefits.

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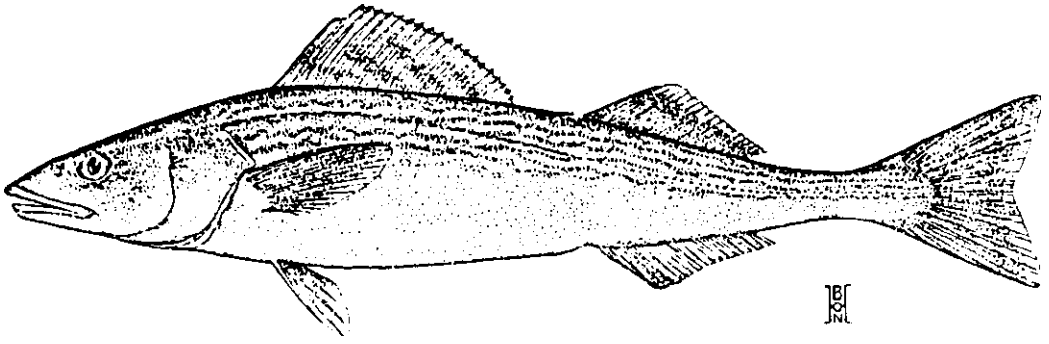

Figure 38 **Sablefish, *Anoplopoma fimbria* (Pallas 1811)**

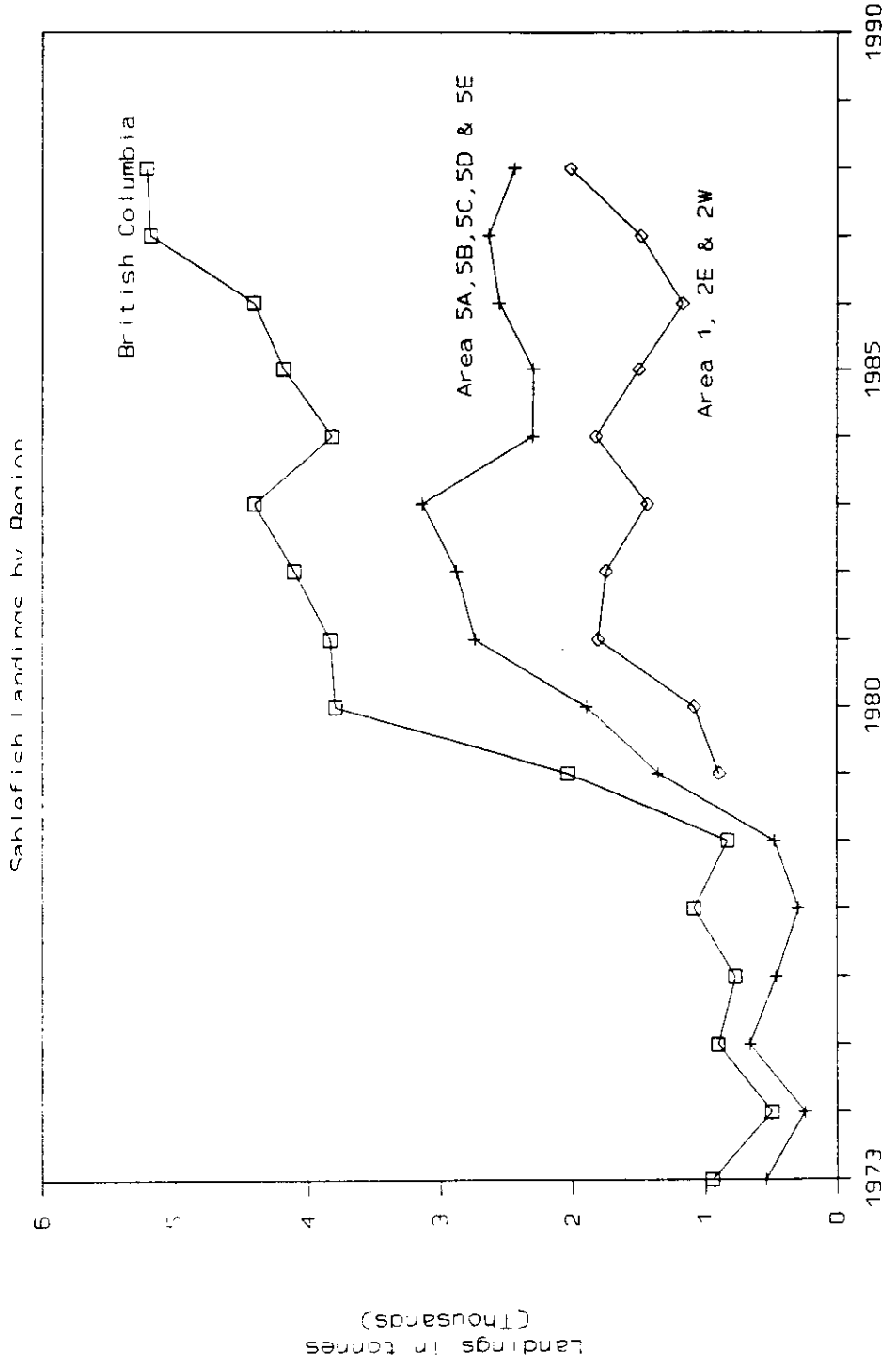

Figure 39: British Columbia sablefish landings by region, 1978-1988.

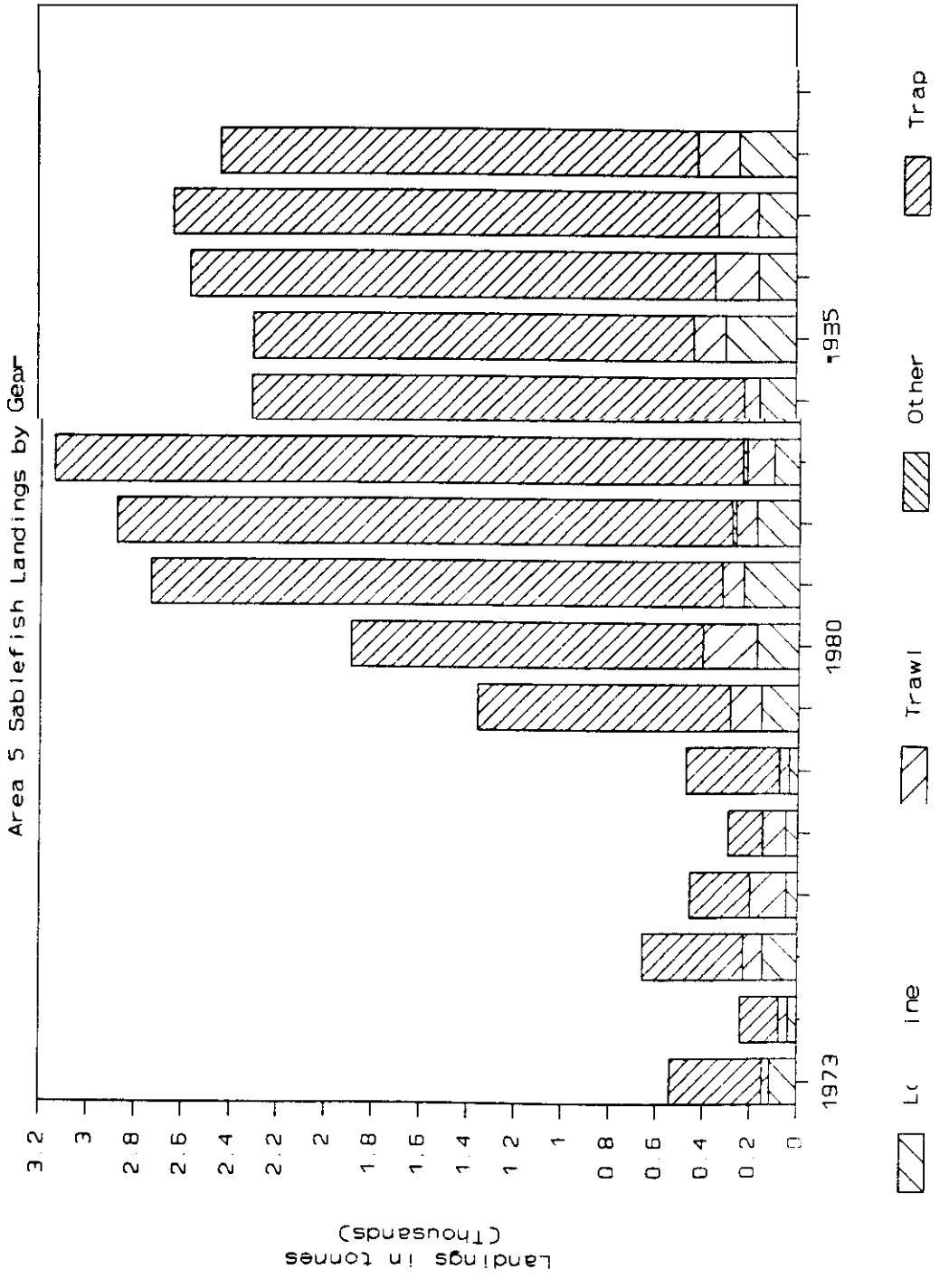

Figure 40: Northern B.C. sablefish landings by gear. 1973-1988.

7.0 LINGCOD

INTRODUCTION

Lingcod are a popular fresh fish harvested by Haida and recreational anglers throughout Haida Gwaii. Most lingcod caught by the commercial fishery are a by-catch in trawl fisheries for Pacific cod in Hecate Strait and Dixon Entrance and longline fisheries, mainly for halibut. A few boats engage in a small part-time directed commercial hook and line fishery for lingcod on Haida Gwaii. Lingcod are often sedentary and overfishing of lingcod stocks is a concern, especially since the recent collapse of Georgia Strait lingcod stocks. Existing information is not sufficient to assess the status of lingcod stocks on Haida Gwaii.

BIOLOGY

Lingcod, *Ophioden elongatus,* known in Haida as *skaaynang*, are commonly harvested on Haida Gwaii in Haida, recreational and commercial fisheries. Relevant knowledge about lingcod in British Columbia was recently reviewed by Cass *et al.* (1990). No specific research has been conducted on Haida Gwaii, however. Lingcod are found from the surface to depths of 421 m (230 fathoms) but are most common in the upper 92 m (50 fathoms) (Hart 1973).

Lingcod (Figure 41) are recognizable by their single dorsal fin which has one moderate notch; their large mouth and teeth; the thoracic pelvic fins; and the small smooth scales on the head and body. Their colour is very variable and mottled in shades of brown, grey and green.

Unlike most ocean species, which release large numbers of eggs into the ocean, lingcod deposit eggs in "nests" in rock crevices, usually in shallow water. After fertilizing the eggs, the male fish alone guard them until they hatch, usually by mid-March or April. Spawning takes place from December to March (Hart 1973). The young remain in the surface waters for only a few weeks or months before taking up local residence in nearshore kelp or eelgrass beds (Cass *et al.* 1990).

Lingcod have rapid growth rates compared to rockfish (Cass *et al.* 1990). Later growth in males is at a rate of about 7 cm or 0.7 kg/year, and for females 8 cm or 1.1 kg/year (Hart 1973). Chilton and Beamish (1982) report a maximum age of 21 years. Lingcod are aged through a recently developed method involving analysis of thin sections of fin-rays (Beamish and Chilton 1977). Tagging studies indicate that adult lingcod stay close, mostly within 34 km, of the areas where they were tagged (Smith *et al.* 1990), and that adult fish remain close to the area

where they spawn (Cass *et al.* 1990). They are voracious feeders that utilize many species, but primarily herring and hake. Seals and sealions prey upon lingcod, especially during their "egg guarding" period (Cass *et al.* 1990).

Cass *et al.* (1990) conclude that lingcod in different regions can be considered to be separate stocks which have differing rates of growth, with individuals from the Queen Charlotte Sound area growing larger than in the southern areas.

HISTORY OF USE

Haida Use

The Haida name for lingcod is *skaaynang*, with the nickname of *skaagi*, "doctor", often applied, apparently in reference to the way they shake their head "like a (Indian) doctor (dancing)." Ethnographic material indicates that the Haida historically utilized lingcod as a fresh product. Data collected by Ellis (1972-1980) indicates that lingcod and inshore rockfish were harvested with special types of spears and lines and that the people of Tanu village often speared lingcod and rockfish close to the local kelpbeds. It was also noted that lingcod eggs were eaten. Ellis also describes cooking methods. Today, lingcod are taken by Haida people and other Island residents with jigs attached to handlines and are commonly prepared as "fish and chips."

Recreational Fishery

Sportfishermen tend to target lingcod and other groundfish on Haida Gwaii when salmon are not abundant. Handlines or "jigs" are perhaps the most popular method used to take lingcod. Lingcod are commonly caught by sportfishermen using rod and reel and targeting upon chinook salmon. Lingcod often provide a thrill as they bite onto rockfish or salmon already hooked, and hold on until they are gaffed aboard by the more skilled fishermen. Lingcod are part of a large recreational fishery for groundfish in Washington State (Jagiello Pers. Comm.) and have long been a prized quarry of sportfishermen in California (Miller and Geibel 1973).

Commercial Fishery

Lingcod are taken incidentally in trawl, halibut longline and salmon troll fisheries on the North Coast. As well there is a small directed handline/troll fishery by

a few vessels on Haida Gwaii. Trawlers are generally large vessels which tow large nets along the seabed and target on groundfish.

The trawl fishery accounts for the largest catches of lingcod on Haida Gwaii. The trawl fishery in Hecate Strait (5C) and Dixon Entrance (5D) targets mainly on grey cod (also called Pacific cod), and lingcod, ranked as the fifth most important species in 1988. The trawl fishery on the west mast of Haida Gwaii targets on rockfish, and lingcod is only a minor amount of the landings.

A significant by-catch of lingcod occurs in longline fisheries in which a groundline with many baited hooks attached is laid along the seabed. In the past, much of the longline lingcod catch was not landed but with the introduction of the Individual Vessel Quota (IVQ) system for the halibut fishery in 1991, more incidentally caught lingcod is likely to be retained. Small lingcod by-catches are taken in other longlining activities for yelloweye rockfish, blackcod and dogfish.

Commercial salmon trollers frequently take lingcod as a by-catch, although the fish are frequently released during peak fishing periods.

During some times of the year, a few vessels use troll or handline to target on lingcod on Haida Gwaii. Both freezer and ice boats are involved in this activity, but the west coast of Vancouver Island and the Prince Rupert areas are generally preferred because they are closer to market. A few vessels have shipped lingcod and rockfish by air freight out of Sandspit when demand is high enough to offset freight costs (Lauga Pers. Comm.) and one vessel focuses upon supplying local restaurants (Lambert Pers. Comm.).

Lingcod are a moderately valuable groundfish, with an average landed price' of $0.61/kg ($0.28/lb) for trawl caught, $1.01/kg ($.46/lb) for longline and $0.83/kg ($0.83/lb) for troll caught fish in 1990. Line-caught fish are gutted at sea, whereas trawl-caught fish generally are not. Since the 1900s, the handline fisheries of the Gulf of Georgia produced a "live" quality product similar to modem farmed fish (Wilby 1937).

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1 DFO preliminary statistics.

BASELINE FISHERIES DATA

British Columbia lingcod landings in 1988 were 3,472 tonnes (Rutherford 1990) which is significantly higher than any of the Pacific United States (Figure 42). Landings from Hecate Strait, Dixon Entrance and the west coast of Haida Gwaii (Areas 5C, 5D and 5E shown in Map 4) were 738 tonnes or 21% of total British Columbia landings.

Commercial lingcod landings from Haida Gwaii have increased since 1980 (Figure 43) and most landings occur as a by-catch in trawl, longline, troll and handline fisheries (Figure 44). Trawl landings were most significant in Area 2E. The trawling grounds for Pacific cod in Hecate Strait are shown in Map 16. Hecate Strait (Areas 5C and 5D) is historically the highest production area for Pacific cod in British Columbia and trawl landings in 1988 were 6,198 tonnes which was 56% of total B.C. landings of 11,080 tonnes. The breakdown of trawl landings by species in Area 5A, 5B and 5C is shown in Figure 45. Significant by-catches of sole (English, rock, petrale, Dover and Rex sole), lingcod, Pacific ocean perch, and other rockfish and groundfish species occurs. The trawl fishery on the west coast of Haida Gwaii targets mainly on Pacific ocean perch and other rockfish species and lingcod landings were a small proportion of the total catch in 1988.

The lingcod sports fishing catch in northern British Columbia in 1988 was estimated to be 33,600 fish (Bijsterveld 1989) which amounts to 54 tonnes[2]. By comparison, commercial landings for the North Coast were 1,436 tonnes in 1988 (B.C. Commercial Catch Statistics). Lingcod are also the target of a growing underwater spear fishery. The lingcod spearfishing catch was very roughly estimated to be 80 t for 1983, or 60% of the annual sport angling catch (McElderry and Richards 1984). Recreational catch information for the North Coast is estimated from tidal sports fishing diary and survey information.

Lingcod stocks in the Strait of Georgia have continued to decline since the early 1960s (Figure 46), and the cause of the decline is not clear, according to Richards and Hand (1990). Overfishing is suspect because of the large catches in the commercial fishery up until recent years and the present large catch of immature fish by the sport fishery. The decline could also be related to changes in lingcod predator abundance, food abundance, other aspects of habitat quality, poor recruitment associated with small spawning stocks, or any combination of these factors. Commercial catch information is provided from sales slips. Logbooks

[2] Based on 1.6 kg/fish used by Richards and Hand (1990) to convert Strait of Georgia tidal diary data to landings.

are mandatory for in "ZN" rockfish fisheries, but inclusion of lingcod catch is optional.

RESOURCE MANAGEMENT

B.C. Commercial Fishery

Richards and Hand (1990) assessed British Columbia lingcod stocks and outlined management options. Strait of Georgia stocks were low and options included total closure of sport and commercial fisheries, experimental sub-area closures and introduction of a minimum size limit of 65 cm for both commercial and sport-caught lingcod. No analysis was carried out for Areas 5C/D/E and no options were outlined. Argue (1985) states that since lingcod are a minor species in the Hecate Strait fishery, insufficient data are available for quantitative stock assessment.

During 1991, a size limit of 58 cm overall length is in effect coastwide for lingcod caught in the commercial fishery. The size limit is presently under review (Anon. 1991). Richards and Hand (1990) recommended an increase in the overall size limit to 65 cm based on the size of maturity.

Trawl Fishery

Groundfish management areas are shown in Map 4. The category T groundfish trawl license has been issued as a limited entry category license since 1976. Coastwide and area quotas are in effect for many groundfish species. In Hecate Strait and Dixon Entrance (Area 5C and 5D), a quota of 3,800 tonnes was introduced for Pacific cod in 1990. An additional 2,000 tonnes could be allocated after April 1, 1990, following assessment of age-2 fish recruitment. Quotas of 800 tonnes and 700 tonnes were in effect for Dover sole and English (lemon) sole, respectively.

Trawl fishing effort is concentrated in Hecate Strait and not in the inshore waters of the study area. Important issues in the trawl fisheries include dumping of catch and habitat effects. Approximately 40% of the catch in B.C. trawl fisheries is dumped (Stanley 1985). In discussing the decline of lingcod stocks in the Strait of Georgia, Ketchen (1983) speculated that "over a more protracted term, destruction ofjuveniles by trawl nets may have had a greater impact than earlier believed." The Groundfish Trawl Advisory Committee recommended a minimum mesh size of 127 mm (5 inches) in waters less than 80 fathoms, and fishermen

were advised that the recommendation may be implemented in the future (Anon. 1990).

Dumping and the possible habitat damage caused by trawlers is the subject of a DFO inquiry on the east coast of Canada and is a major concern of environmental groups such as the World Wildlife Fund, Greenpeace and the Canadian Wildlife Federation.

Longline Fisheries

Lingcod have been dumped or released in the past in longline fisheries, particularly the halibut fishery, because of past haste and onboard storage problems. This situation is likely to change with introduction of Individual Vessel Quotas (IVQ) for the halibut fishery in 1991. The dumping or release of lingcod in longline or troll fisheries is an undocumented source of fishing mortality.

Troll/Handline Fisheries

Extensive closures are in place on hook and line fisheries in the Strait of Georgia and areas in Queen Charlotte Strait. In 1990, quotas were in effect in some areas of the South Coast, but not on the North Coast.

Seasonal closures are in effect to all commercial fishing from November 15, 1989 to April 30, 1990 in most areas including the West Coast of Vancouver Island and Queen Charlotte Sound, but not in Hecate Strait, Dixon Entrance and the west coast of Haida Gwaii. Winter closures are to protect spawning fish and, later, guarding fish.

B.C. Recreational Fishery

The combined daily limit for lingcod and greenling is 3. No size limit was in effect for the recreational fishery in British Columbia from April 1, 1990 to March 31, 1991.

Pacific United States

The State of Alaska has a minimum commercial size limit of 69 cm and no winter closures, but has recommended a by-catch allowance for lingcod during winter

fisheries. Southeast Alaska has an arbitrary quota for directed lingcod fisheries of 150 to 200 tonnes (Bracken Pers. Comm.).

Washington State has a minimum size of 56 cm and no winter closures (Jagiello Pers. Comm.). Winter weather is a factor in limiting fishing effort by recreational charters and the 50 boat Neah Bay troll/handline fleet.

Oregon has no size limit and winter weather is thought to provide sufficient deterrent to reduce fishing effort during the winter (Bracken Pers. Comm.).

Discussion

On Haida Gwaii, lingcod are mainly caught as a by-catch in trawl, longline and troll/handline fisheries. There are no lingcod by-catch quotas in place for these fisheries and the directed hook and line and recreational catches are believed to be small in comparison to them.

Recreational fishing pressure is already high in some areas of Haida Gwaii. Lingcod are sometimes caught during winter "jigging" trips for fresh fish. Small lingcod are often the only catch of sportfishermen in the winter and spring months in the Skidegate Channel area (Lambert, Pers. Comm.) and commercial sports fishing in this area during the summer could increase fishing effort considerably.

Recommendations

1. Recreational catch and effort for lingcod should be monitored in the study area.

2. Directed hook and line fisheries for lingcod or rockfish should also be carefully monitored.

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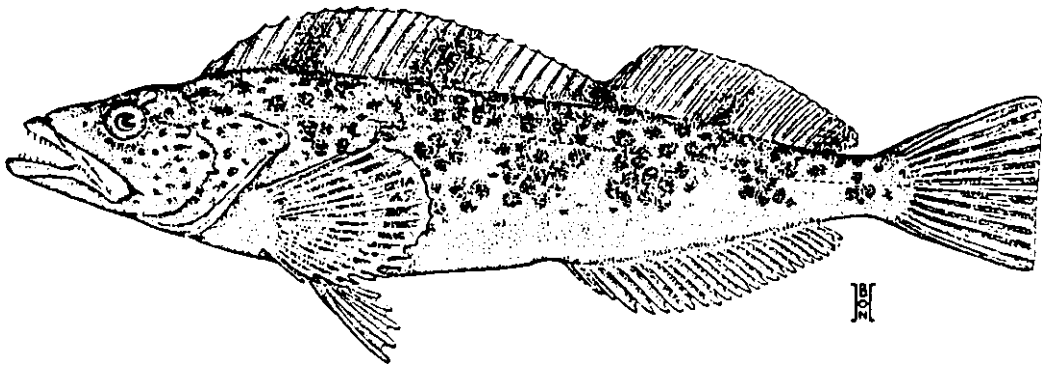


Figure 41: **Lingcod** ***Ophiodon elongatus***

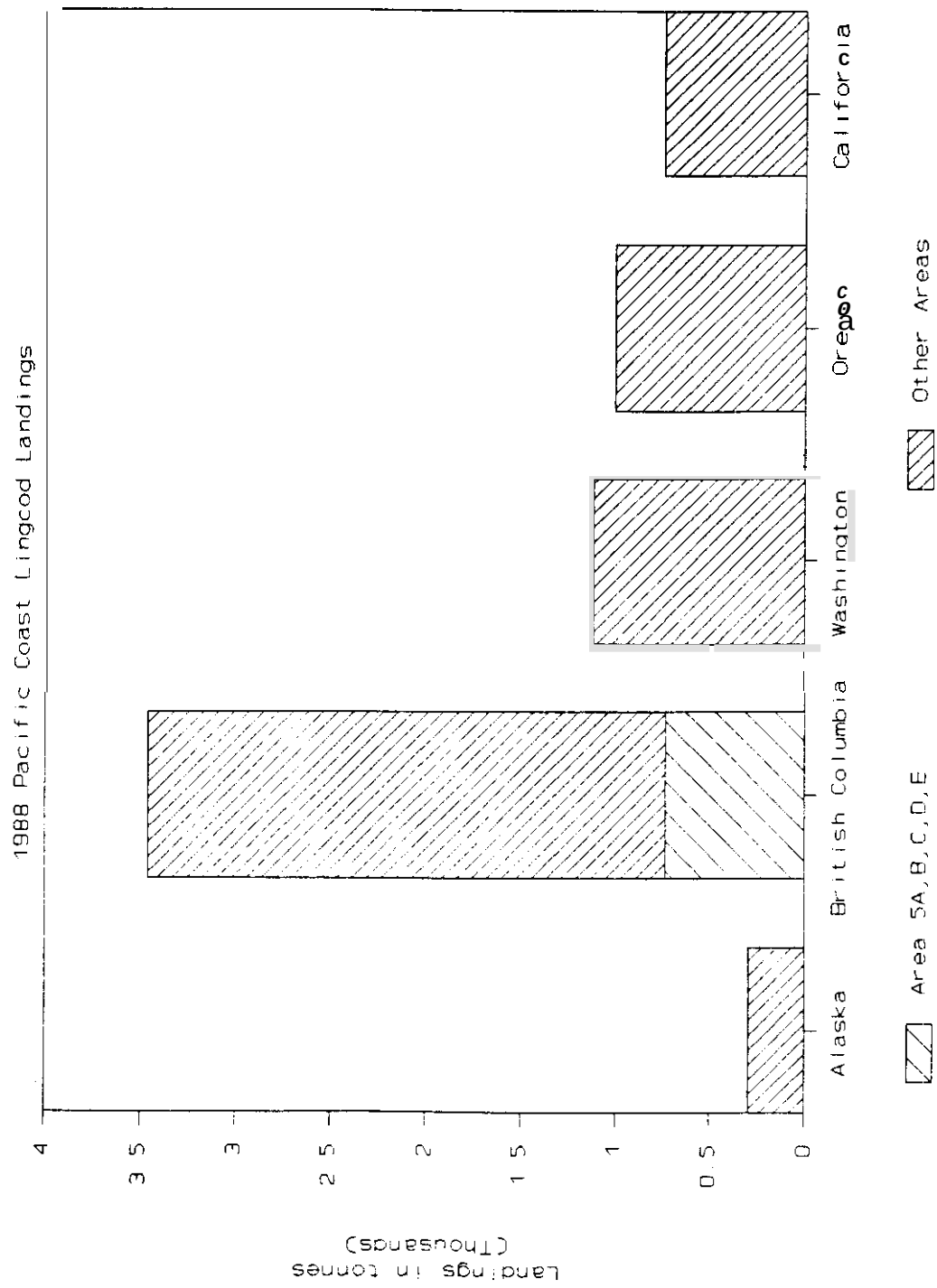


Figure 42: Lingcod landings on the Pacific coast, 1988.

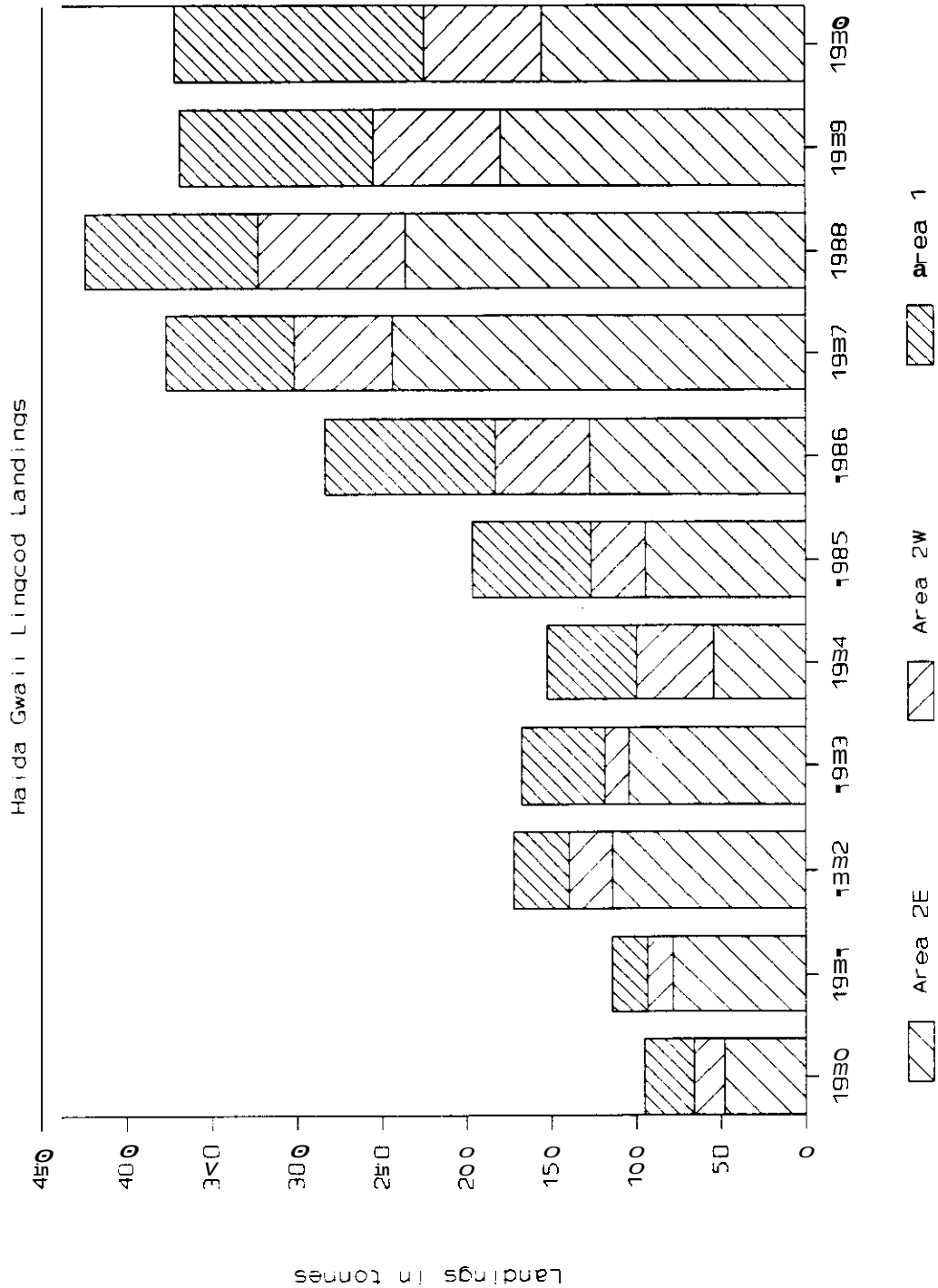


Figure 43: Haida Gwaii lingcod landings by area, 1980-1990.

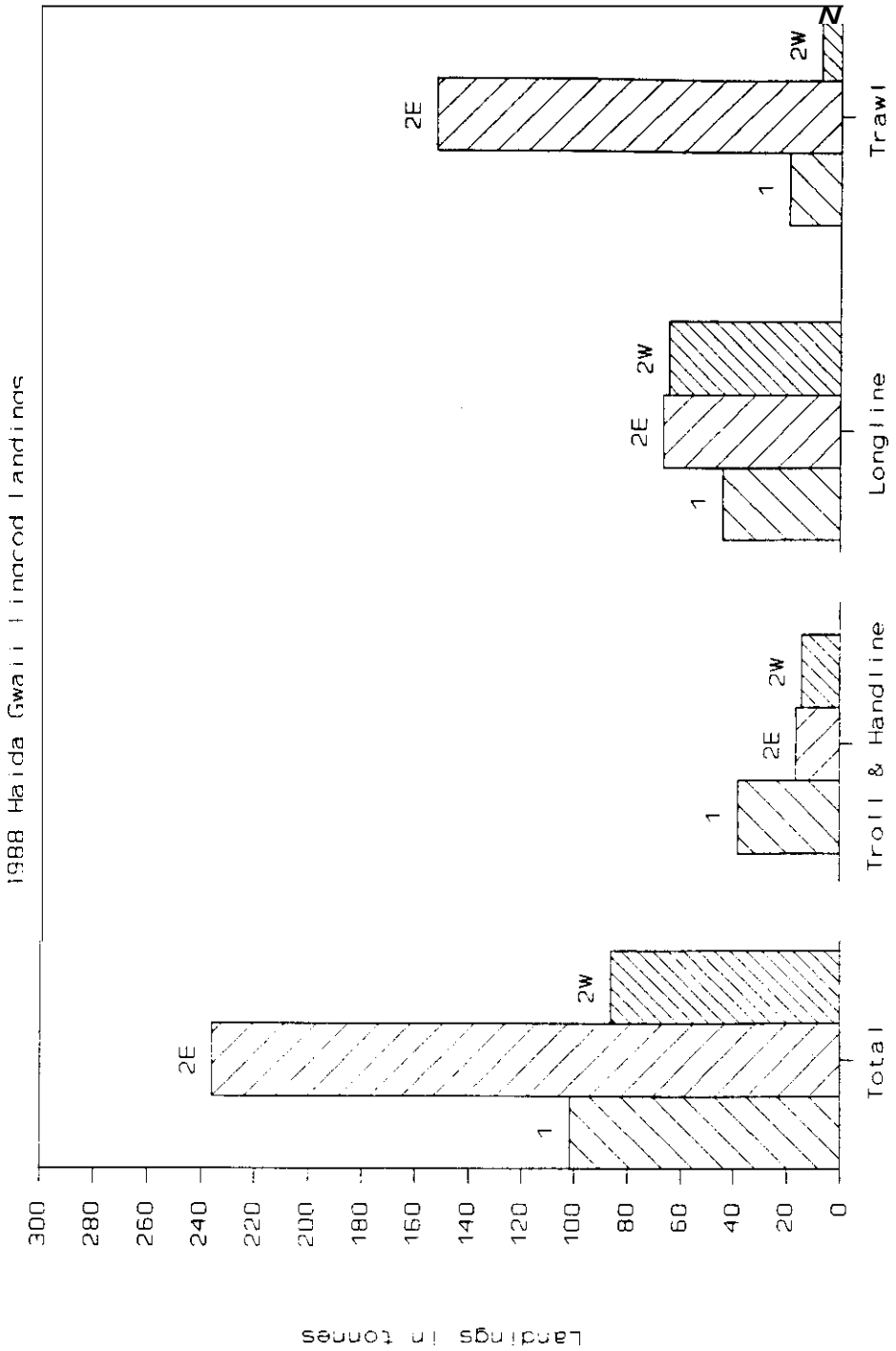
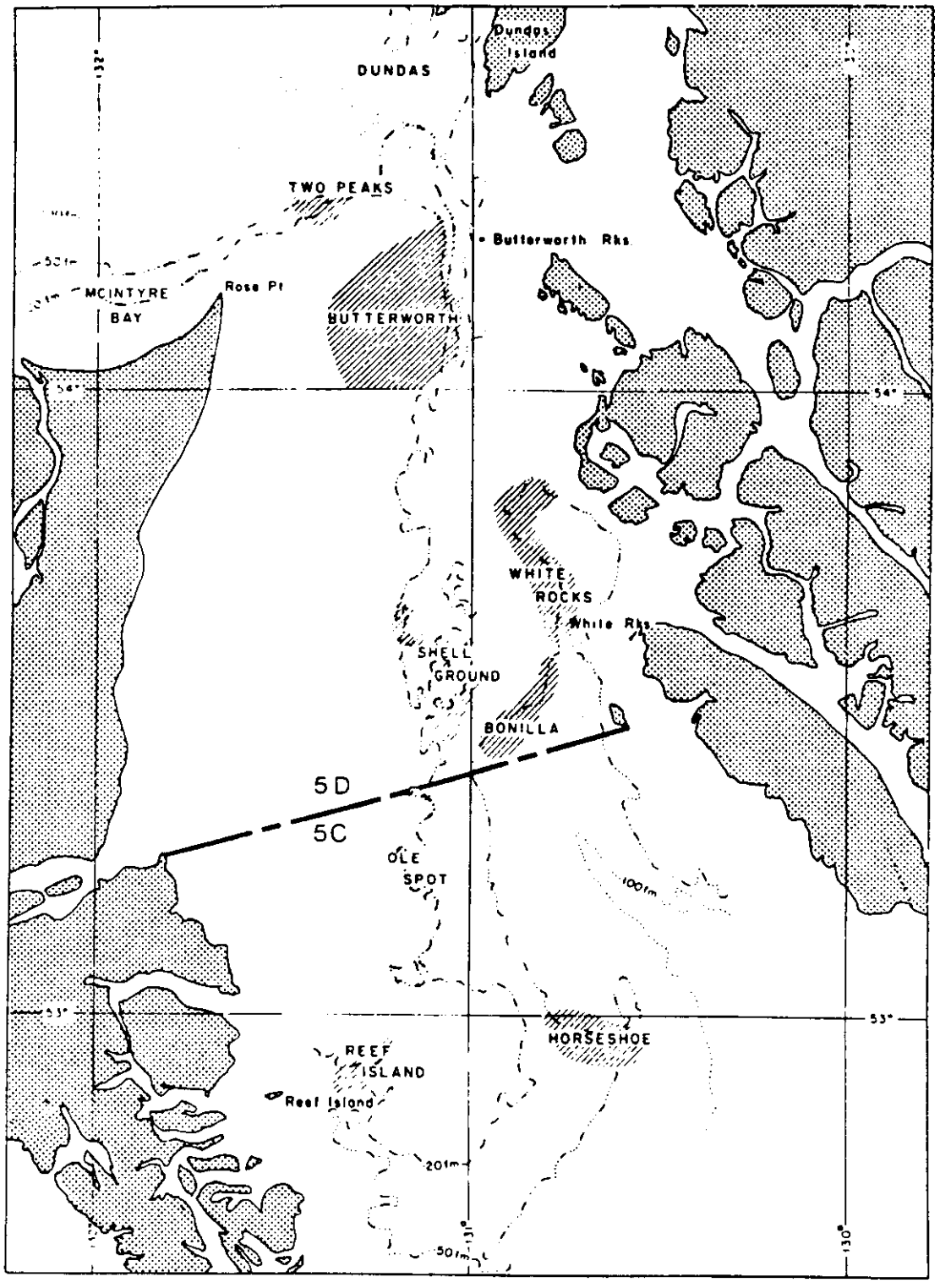


Figure 44: Haida Gwaii lingcod landings by area and gear type, 1988.



Map 16: Important trawling grounds for Pacific cod in Hecate Strait.

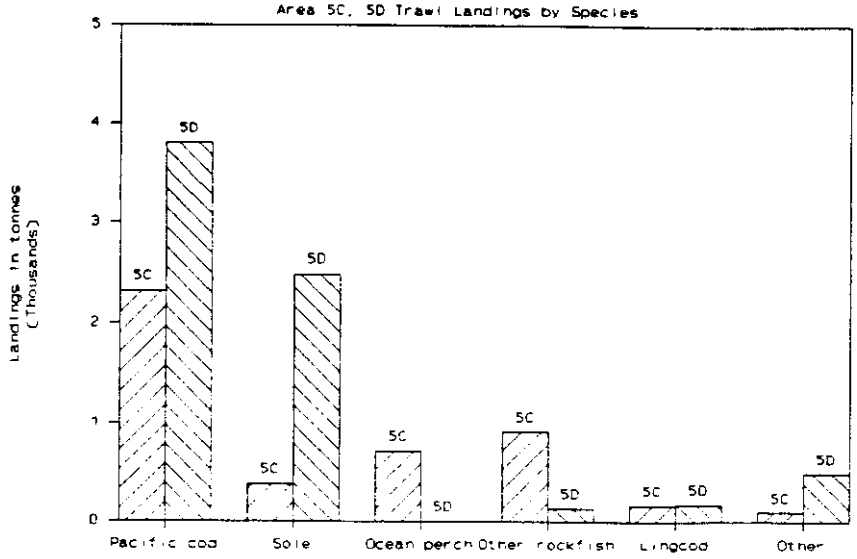


Figure 45a: Trawl landings in Areas 5C and 5D, 1988.

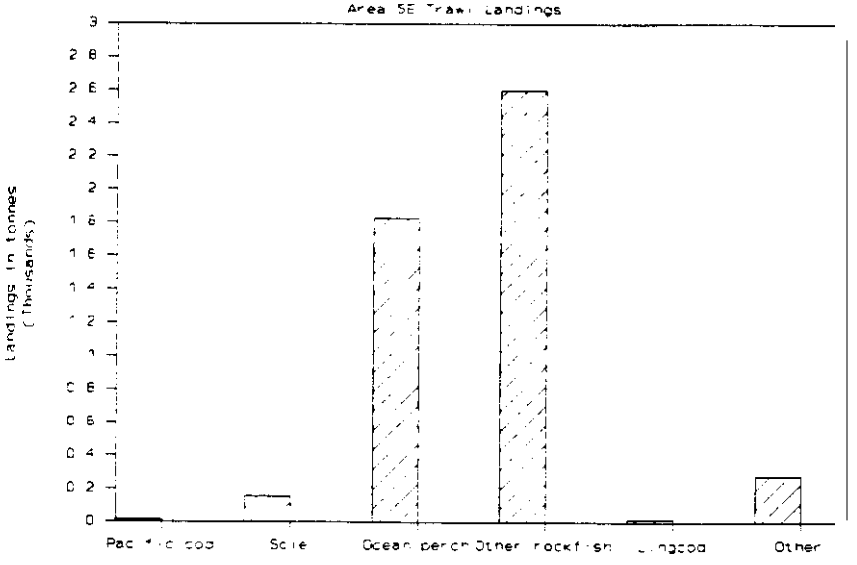


Figure 45b: Trawl landings in Area 5E, 1988.

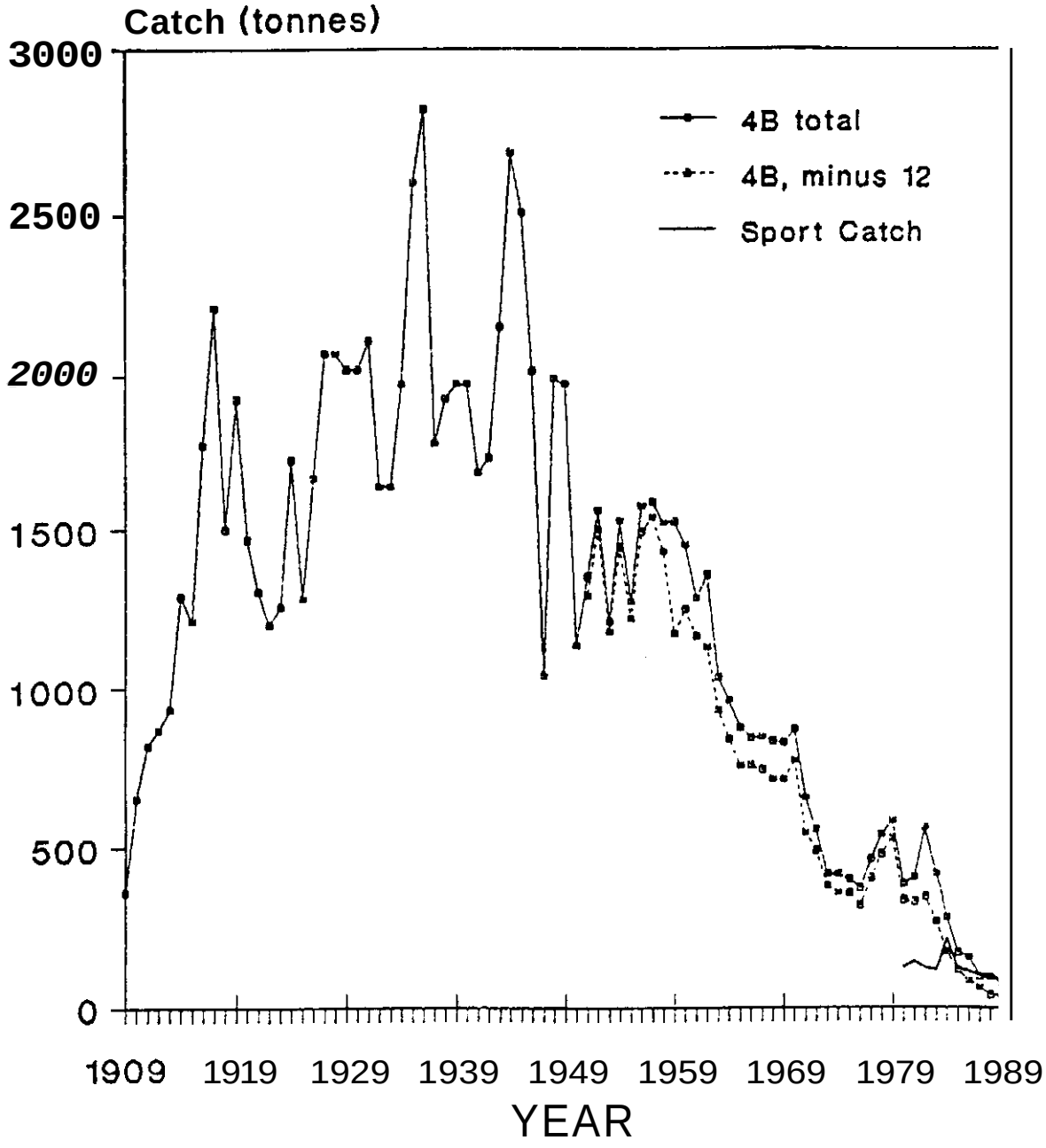


Figure *46:* **Lingcod landings in Strait of Georgia, 1909-1989.**

8.0 ROCKFISH

INTRODUCTION

Rockfish are present along most rocky shores on Haida Gwaii and 34 species are found in British Columbia. There are 21 other rockfish species that are taken by Native, commercial and sportfishermen on Haida Gwaii. Trawlers take approximately 85% of the rockfish caught on the North Coast although only small quantities of the three focus species are taken.

BIOLOGY

This discussion focuses on 3 species of inshore rockfish, the yelloweye rockfish, or "red snapper," the quillback rockfish or "brownbomber" and the black rockfish, or "Black bass" (Figure 47a,b,c). Rockfish (*Sebastes sp.*) are well known for their many spines, which are slightly venomous (Roche and Halstead 1972) and hence often cause painful wounds to commercial and sportfishermen. Their early life history is best summarized by Kendall and Lenarz (1986) who note that while most marine fishes lay free floating planktonic eggs that are fertilized and undergo embryonic development as independent organisms in the open sea, in rockfish, fertilization occurs internally and the eggs develop and hatch inside the ovary of the female (called parturition). This reproductive strategy improves survival at the larval stage and reduces the dispersion by ocean currents. Embryonic development within the female takes about 40-50 days with many rockfish. In Alaska, the season for the extrusion of larvae peaks from April to June for yelloweye rockfish and from April to early May for quillback rockfish (O'Connell 1987).

Rockfish are generally considered to be a non-migratory species (Anon. 1985). They are opportunistic feeders. In one Alaskan study, quillback rockfish were found to consume a wide variety of crustacea and small fishes, such as hemng, sandlance, juvenile rockfish, crabs, sea urchins, and even lingcod eggs, while the larger yelloweye rockfish feed primarily on fish (Rosenthal *et al.* 1988).

Rockfish are long-lived and grow very slowly. Yelloweye from Alaska have been aged up to 114 years, with growth becoming very slow after about 30 years of age (O'Connell and Fritz 1986). Richard and Hand (1990) note that the mean age of quillback rockfish was 25 years in two samples taken in the Gulf of Georgia.

HISTORY OF USE

Haida Use

Ethnographic material relating to the Haida use of rockfish indicates considerable use, particularly of yelloweye rockfish (Ellis 1972-1980). The Haida name for Anthony Island, *Sgun Gwaii,* means "Yelloweye Island," and this area is well known for the abundance of these fish. Following are the Haida names for some of the more common rockfish species.

Yelloweye	*Sgun*
Quillback rockfish	*Sgun quiits xwuuldung*
Black Rockfish	***K'iitsga lung'*** or ***Haasaa***
All deep water red rockfishes	***Kaah***

Rockfish were taken with special "light" kelp lines as well as with spears. They were also taken during halibut and blackcod fishing operations. It was said that during the winter, yelloweye could be taken by the Skedans people in the lee of the Skedans Island "in any weather." The eggs were boiled and eaten, and made a kind of "porridge." All rockfish were apparently allowed to "age" for 4 or 5 days before they were scaled, cut into chunks, and boiled. Rockfish were eaten fresh rather than preserved for later use (Blackman 1975).

The head was also boiled and eaten. Letting the fish "age" was said to aid the digestion (Martin Pers. Comm.) Today, yelloweye rockfish, together with lingcod, are the target of Haida subsistence fishermen who use handlines and jigs to obtain these fish off rocky shores (H. Williams, Pers. Comm.). Yelloweye are filleted and commonly prepared as "fish and chips" (Percy Williams, Pers. Comm.).

[1] The Haida meaning is "they flip their tails" [on the surface]

Recreational Fishery

Sportfishermen catch rockfish using either rod and reel or handlines with jigs. Techniques used with rod and reel may include trolling or mooching, often with buzz bombs.

Commercial Fishery

The inshore rockfish fishery began in its present form in the Strait of Georgia and vicinity (Area 4B) in 1977. The fishery developed at that time to supply live rockfish to restaurants and retail outlets, primarily in Vancouver's Chinatown.

In the Strait of Georgia, 91% of the line rockfish catch is a result of directed fishing effort, where directed effort is defined as more than 50% of landings consisting of rockfish (Richards and Hand 1990). Quillback rockfish accounts for about 85% of the total catch by number in the Strait of Georgia fishery, based on commercial samples and the logbook program (Hand and Richards 1988). A winter closure was first implemented in 1987 from January 1 to April 15, and was extended to April 30 in 1988.

Rockfish landings on the west coast of Vancouver Island (Areas 11, 21-17) and the North Coast (Areas 1-10) have lagged the Strait of Georgia fishery (Areas 12-20, 28, 29), but had increased to similar levels by 1988 as shown in Figure 48.

On the west coast of Vancouver Island, the rockfish line catch started to increase dramatically in 1985. Much of the rockfish line catch off the west coast of Vancouver Island has been incidental to other line fisheries such as halibut, dogfish and lingcod fisheries. Longline landings increased dramatically in 1986 and then levelled off, ranging from 363 to 420 tonnes between 1986 and 1988. Handline/troll landings have also increased but have been more variable, reaching a peak of 224 tonnes in 1987, and falling off to 100 t in 1988.

The rockfish line catch on the North Coast has also increased dramatically since 1984. The handline/troll fishery has traditionally been small on the North Coast, but doubled from 1987 to 1988, primarily due to expansion of the fishery into the Bella Bella region (Area 7). This was thought to be a shift in effort due to winter closures in the Strait of Georgia (Richards and Hand 1990). The longline catch from Haida Gwaii has generally increased since about 1984 and accounts for more than two thirds of the North Coast longline catch. Some of this catch occurs during the halibut fishery but a few longliners are off-season freezer salmon trollers who freeze or individually ice their catch.

Rockfish landings in trawl fisheries on Haida Gwaii are significant (Figure 45), but mainly target on offshore rockfish species including the "slope" species which are most abundant and available for fishing on the continental slope and "shelf" species which are found on the continental shelf. Trawl catches of the three focus inshore species are small in comparison to the offshore species.

Commercial Fishery

On average, rockfish are a moderately valuable groundfish, averaging 31 cents/lb. for trawl caught, $0.26/lb. ($0.58/kg) for longline caught, and $0.42/lb. ($0.92/kg) for troll and handline caught rockfish in round weight in 1987 (Turris 1988). Live quillback rockfish are the most valuable species, currently bringing prices as high as $4.00/lb because they are highly prized by the Chinese community. In part because of their yellow skin colour, yelloweye rockfish, if very fresh, are in demand by "sushi" bars as well as fish stores (Hayashi Pers. Comm.). Black rockfish have little commercial value in B.C. as yet, although a commercial "jig" fishery has begun for them in Washington State (Culver 1986). Trawled rockfish are generally landed both in the round and filleted, while longlined fish are often landed both round and frozen at sea in "j-cut" form where the head and belly flaps are removed.

BASELINE FISHERIES DATA

North Coast rockfish landings in Area 1, Area 2 and the rest of the North Coast (Area 3-10) are shown in Figures 49 and 50. In 1988, rockfish landings by line from Area 1 and 2 totalled 286.2 t and accounted for 68% of the North Coast longline catch and 5% of the North Coast handline/troll catch.

Catch and CPUE in the longline fishery for red snapper, primarily yelloweye rockfish, have generally been increasing on Haida Gwaii since about 1985 (Table C25 Appendix C). Yelloweye landings from Haida Gwaii were 181 t in 1988 or about 63% of total rockfish landings, which is similar to other areas of the North Coast and the west coast of Vancouver Island. CPUE and fishing effort have generally increased on Haida Gwaii since 1983. Fishing effort on Haida Gwaii is still less than the Strait of Georgia and vicinity (Area 12-20, 28, 29) and the west coast of Vancouver Island.

Approximately 91% of rockfish catch in the Strait of Georgia is due to directed effort compared to 57% on the West Coast of Vancouver Island and 54% on the

North Coast (Richards and Hand 1990). Directed effort was defined as more than 50% of landings consisting of rockfish.

Based on the tidal diary program, the sports catch of rockfish on the North Coast was approximately 35 tonnes in 1988 or 5% of the commercial line fishery landings of 527 t.[2] The rockfiish sports catch in the Strait of Georgia was estimated to be 120 t annually between 1982 and 1988 and the 1988 catch of 136 tonnes[3] was 49% of the total commercial line catch from areas monitored by the creel survey. The estimate of sport catch by the tidal diary program was 229 t, or 82% of the total commercial line catch over this period. Quillback rockfish, copper rockfish and yelloweye rockfish accounted for 54%, 23% and 15%, respectively of the rockfish sport catch, based on the 1985 creel census[4].

Rockfish are believed to account for 1.1% of the harbour seal diet which amounts to approximately 102 tonnes eaten annually in the Strait of Georgia (Richards and Hand 1990).

RESOURCE MANAGEMENT

The sports fishery has been restricted coastwide by a daily bag limit of eight rockfish since 1986.

The hook and line fisheries for inshore rockfish on Haida Gwaii were unrestricted until 1991, when quotas were established in most areas (Anon 1990; 1991). The 1991 quotas for Haida Gwaii area (Area 1, 2, 101, 102, 130, 142), are 100 t for Rockfish[5] and 200 t for Yelloweye Rockfish. The fishery opens January 1 and may continue until quotas are reached. Incidental catch of rockfish[6] by vessels fishing halibut is restricted to 15% of the catch of halibut, based on round weights.

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2 Based on the sport catch of rockfish in 1988/89 of 41,400 in *Area* 1-6 and 8,700 in *Area* 7-11 (Bijsterveld 1989), and assuming a weight of 0.7 kglfish (Richards and Hand 1990).

3 Based on creel survey results and assuming 0.7 kglfish (Richards and Hand 1990).

4 Unpublished data attributed to T. Shardlow and T. Hoyt (Richards and Hand 1990)

5 Includes quillback, copper, China and tiger rockfish.

6 Includes yelloweye, quillback, copper, China and tiger rockfish

Sustainable yield estimates for the North Coast (Richards and Hand 1990) were based on the experience in Southeast Alaska, assuming that 940 t was a high-risk sustainable yield option for the directed fishery, and that stocks on the North Coast are about two-thirds of those in Southeast Alaska, based on coastal area.

Winter closures are in effect from January 1 through May 14, 1991 in the Strait of Georgia and vicinity and from January 1 to April 30, 1991 on the west coast of Vancouver Island (Area 3C/3D), but not on the North Coast. Winter closures are intended to reduce overall levels of effort, coincided with a lingcod closure and cover the major period of parturition for the most common rockfish species (Richards and Hand 1990).

Rotational area closures have been implemented near Bella Bella (Area 7).

Although sales slips and logbooks are required as a condition of the ZN license, only 36% of the handline/troll and 34% of the longline vessels actually submitted both forms (Hand *et al.* 1990). One problem with the logbook program is that many fishermen are unable *to* correctly identify rockfish by species.

Sports fisheries are developing for other rockfish species in the United States. Black rockfish, which are found in the study area, are important in Oregon (Demory Pers. Comm.) and are taken by a sportfishing charterboats in Oregon (Jagiello Pers. Comm.)

Alaska

A community-based yelloweye fishery began in Southeast Alaska in 1979, which shipped high quality product by air to markets in the United States (Domico 1983). Yelloweye made up 78% of the hook and line landings followed by 18% quillback. Landings peaked in 1987 at 1,225 t, and a preliminary harvest objective of 940 t was set for the directed fishery in 1987-88 which Alaska biologists now consider to be non-sustainable. The harvest limit was reduced to 530 t in 1989/90 and 370+ (Richards and Hand 1990) in 1990/91. 1990/91 harvest objective includes a by-catch for halibut longliners (North Pacific Management Council 1990).

Discussion

Rockfish are subject *to* overfishing due *to* their slow growth and local residency. Area quotas implemented in British Columbia in 1991 are based on quotas in Southeast Alaska and very limited site specific information.

A rockfish species guide would be useful for sportfishermen and commercial fishermen who complete logbooks.

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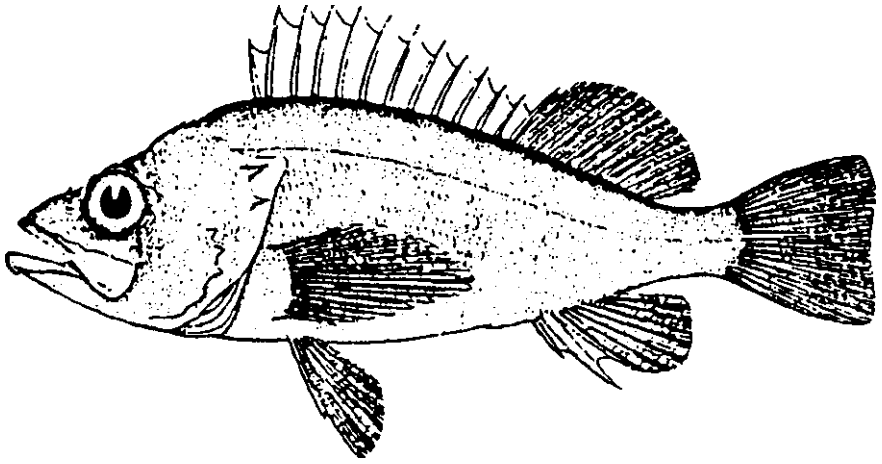


Figure 47a: Yelloweye rockfish *Sebastes ruberrimus.*

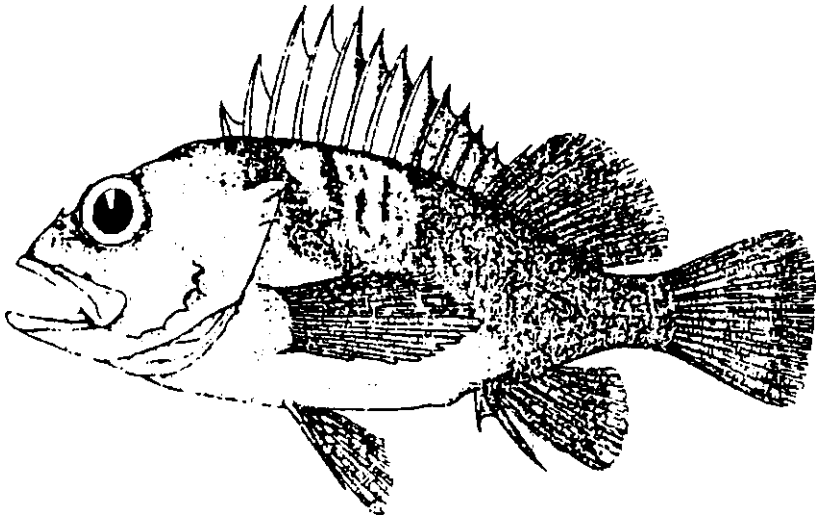


Figure 47b: Quillback rockfish *Sebastes maliger.*

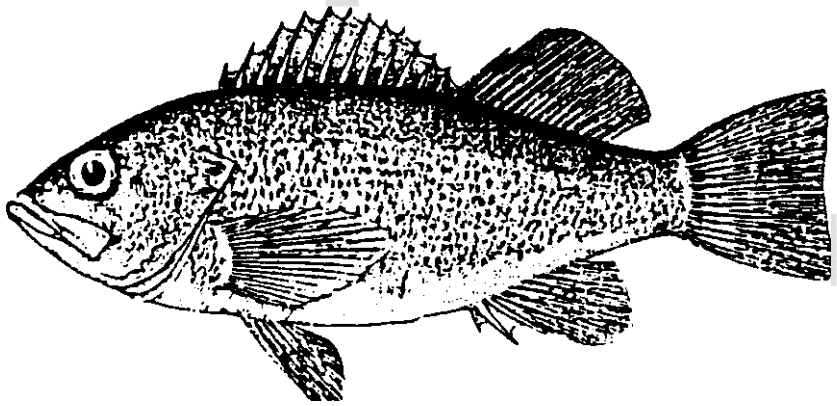


Figure 47c: Black rockfish *Sebastes melanops*.

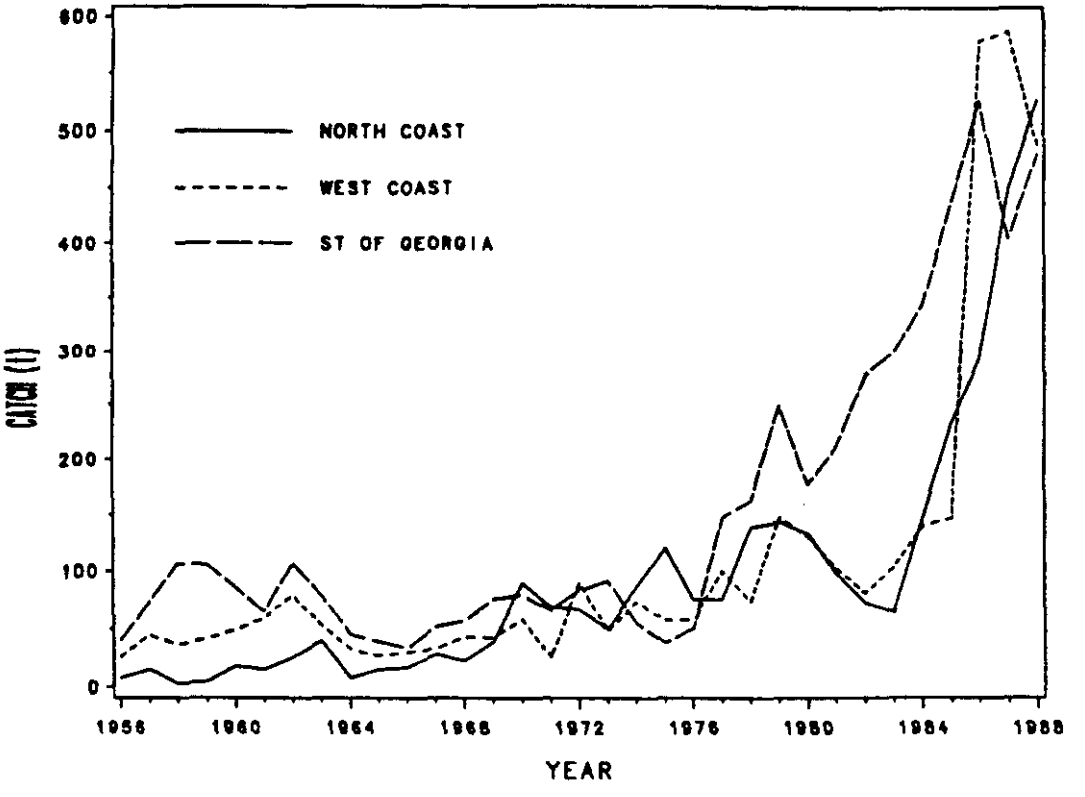


Figure *48:* Rockfish handline/troll and longline catch by area, 1956-1988.

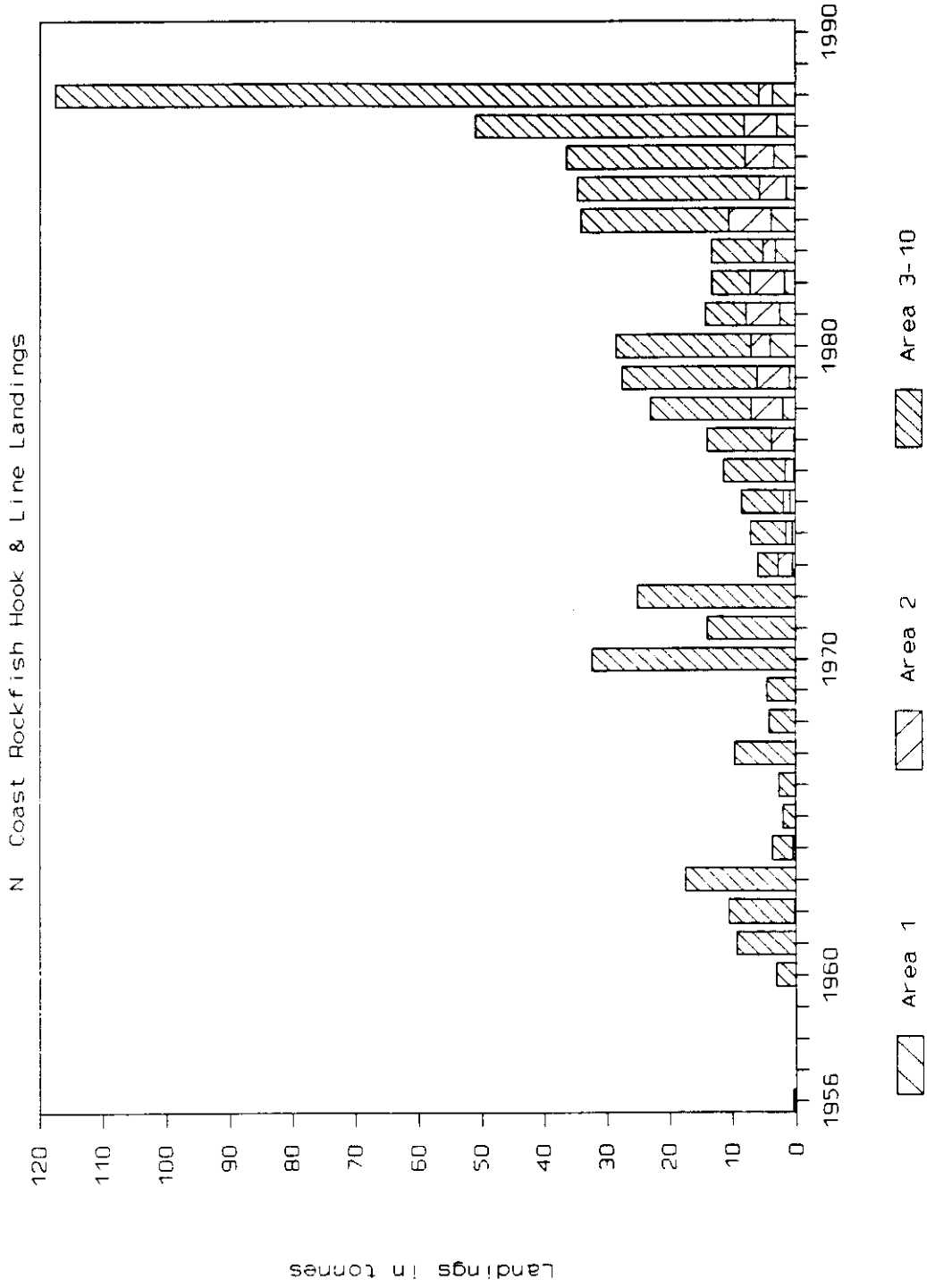


Figure 49: North Coast and Haida Gwaii rockfish landings on hook and line gear, 1958-1988.

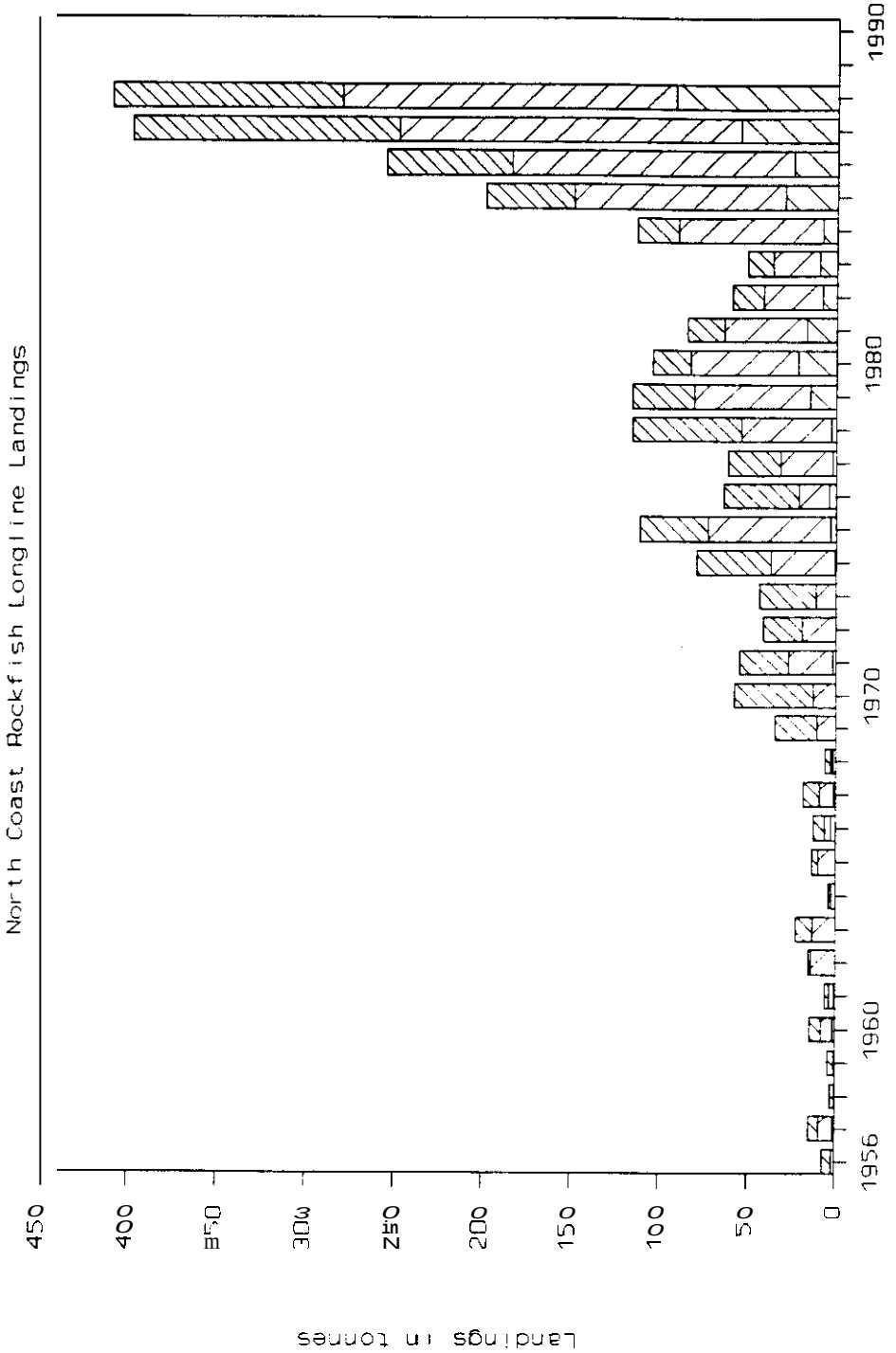


Figure 50: North Coast and Haida Gwaii rockfish landings on longline gear, 1958-1988.

APPENDIX A

Terms of Reference

SOUTH MORESBY
FISHERY BASELINE DATA **July 18, 1990**

Terms of Reference

The contractor shall review the biological data base and present management practices for the following selected marine species on the Queen Charlotte Islands with the greatest emphasis being placed on the South Moresby area.

- squid
- octopus
- goose neck barnacles
- sea urchins (3 species)
- abalone
- sea cucumber
- purple hinged rock scallops
- prawns (commercial)
- shrimp (commercial)
- dungeness crab
- butter clams
- geoducks
- littleneck clams
- manila clams
- blue mussels

A synopsis of the sport, commercial sport, commercial and native food fishery must be done for the following species:

- all salmonids
- herring including roe on kelp
- steelhead
- halibut
- sablefish
- hook and line fishery including ling cod and 3 species of rock fish.

The review for each species shall consist of but not be limited to the following where applicable:

(1) A history of the use including native, recreational and commercial fisheries and possible future trends.

(2) The traditional uses and values (recognising that noncommercial values probably cannot be measured ie. how does one place a value on a sunset?) of the above species by/to the Haida.

(3) The socio-economic values of the species in question to those involved in commercial and noncommercial harvesting of the species.

(4) The present management practices, for example, how quotas are determined, opening and closure procedures, inspections etc.

(5) A description of the present harvesting methods and trends and the potential adverse environmental impacts of these methods.

(6) The harvest statistics for each species, by the various harvesting methods should be included in the form of a line graph.

(7) The catch per unit effort (CPU) should also be graphed if the data are available.

(8) The biological data should include known life cycles, habitat requirements, distributions, population dynamics, annual growth rates and other relevant biological information that could be used to assist in making management decisions.

(9) Biological and management information gaps for each species should be identified.

(10) Any problems or concerns noted throughout the term of the contract with the specific fisheries should be listed.

(11) The environmental impacts of a bottom drag fishery should be discussed and recommendations made with respect to this specific fishery.

(12) The international implications of present salmonid and halibut management practices.

(13) A review of management practices by foreign agencies and the reasons for these practices.

(14) Optional management practices that may be of value in these circumstances.

(15) The interrelationship of the species under consideration and the management practices associated with them.

(16) It will be incumbent upon the contractor to organise the data for each species in an appropriate order.

(17) A list of major recent research projects for each species.

(18) A colour photograph or diagram of each species that can be used for identification purposes.

(19) A bibliography for each species.

(20) Management areas or zones for each species in the South Moresby area.

(21) All information gathered will be considered to be part of this report.

(22) Where requested by a source, the source for specific information will remain confidential.

Appropriate literature will be found at a number of sites including but not limited to:

- DFO Prince Rupert
- Pacific Biological Station, Nanaimo
- University of B.C.

Prior to commencement of the work the contractor must meet with representatives of the Department of Fisheries and Oceans (DFO) the Haida Nation and the Canadian Parks Service (CPS) as a group to discuss any concerns.

REVIEW STAGES

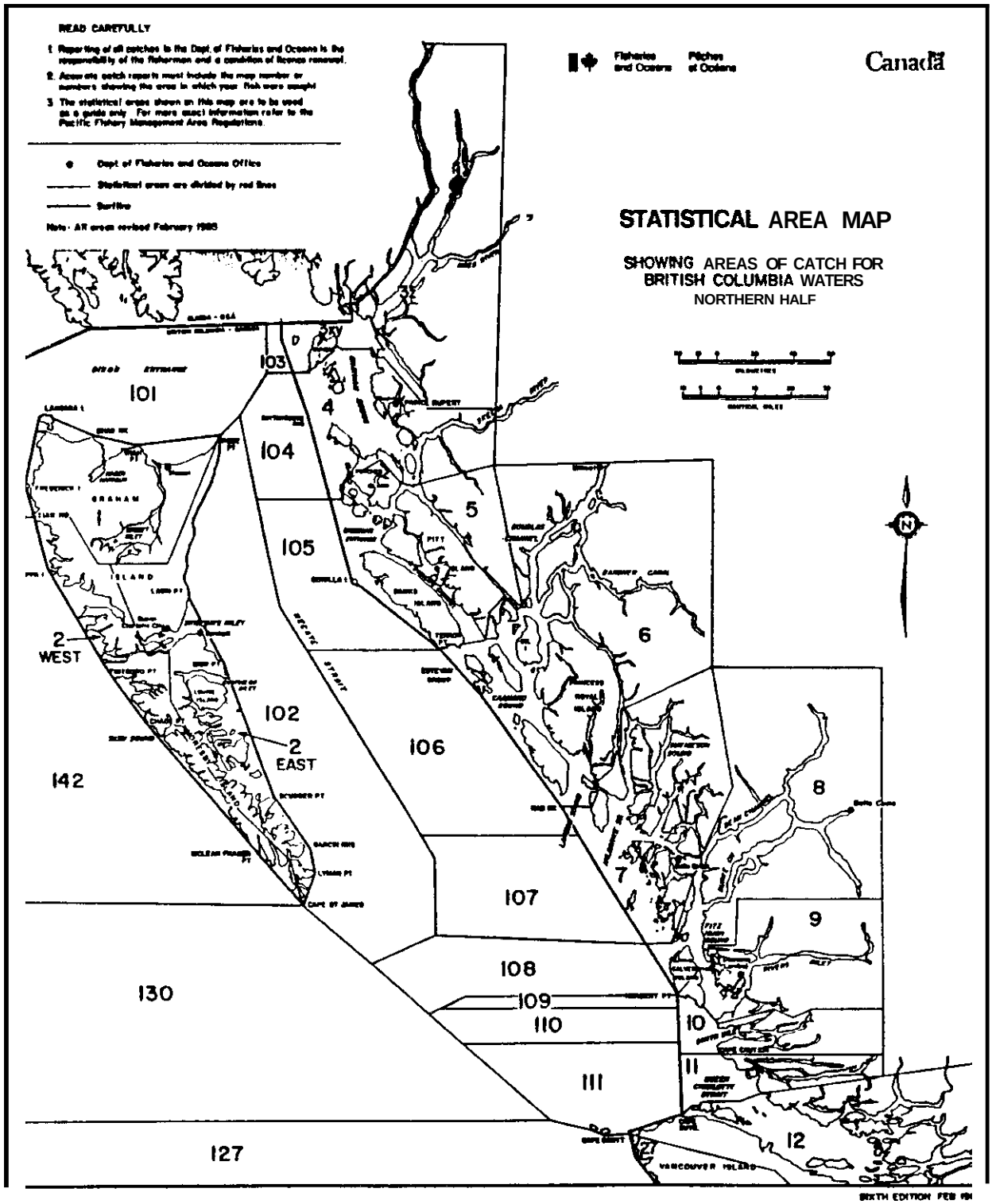
The above information shall be produced in two reports:

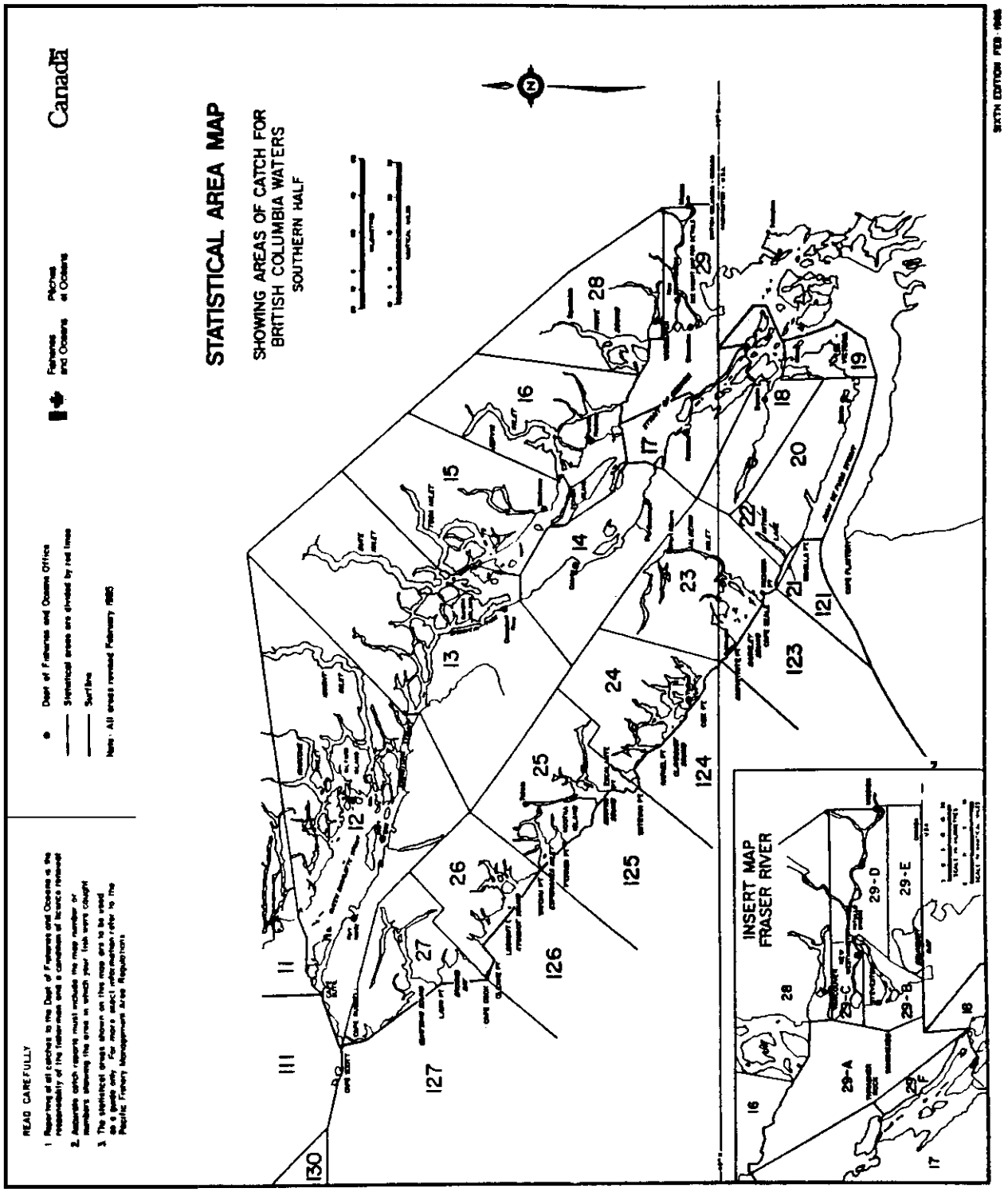
(a) at the completion of the Table of Contents
(b) after the literature review and progress report are completed
(c) upon receipt and review of the first draft
(d) upon receipt and acceptance of the final report.

The contractor will provide six copies of each document. One will be a word processed letter quality original. There will be 5 high quality reproductions of each of the two original reports.

APPENDIX B

DFO Managment Areas, Regulations and Committees


READ CAREFULLY
1. Reporting of all catches to the Dept. of Fisheries and Oceans is the responsibility of the fisherman and a condition of licence renewal.
2. Accurate catch reports must include the map number or numbers showing the area in which your fish were caught.
3. The statistical areas shown on this map are to be used as a guide only. For more exact information refer to the Pacific Fishery Management Area Regulations.
Dept. of Fisheries and Oceans Office
Statistical areas are divided by red lines
Shoreline
Note - All areas revised February 1985
Fisheries and Oceans
Pêches et Océans
Canada
STATISTICAL AREA MAP
SHOWING AREAS OF CATCH FOR BRITISH COLUMBIA WATERS
NORTHERN HALF
101
103
104
105
106
107
108
109
110
111
127
130
142
2 WEST
2 EAST
102
4
5
6
7
8
9
10
11
12
GRAHAM ISLAND
VANCOUVER ISLAND
SIXTH EDITION FEB 19


STATISTICAL AREA MAP
SHOWING AREAS OF CATCH FOR
BRITISH COLUMBIA WATERS
SOUTHERN HALF
Canada
Fisheries and Oceans
Pêches et Océans
READ CAREFULLY
Dept of Fisheries and Oceans Office
Statistical areas are divided by red lines
Sardine
Note: All areas revised February 1985
SIXTH EDITION FEB. 1985
INSERT MAP
FRASER RIVER
29-A
29-B
29-C
29-D
29-E
29-F
111
127
126
125
124
123
121
130

Terms of Reference
Pacific Stock Assessment Review Committee
(PSARC)

Organizational Structure

PSARC is a Departmental Committee that reviews biological advice on the status and management of Pacific fisheries resources. The Committee reviews methodologies and criteria employed in the stock assessment process, presents advice to management in the form of harvestable biomass and/or management guidelines and identifies resource assessment related research needs. In terms of a broad definition, PSARC encompasses the stock assessment community of D.F.O in the Pacific Region responsible for providing biological advice to senior management in the Region. PSARC is controlled, organized and administered by a steering committee, which reports to the Fisheries Management Executive Committee - Pacific. The chairman reports to the Director-General, and will serve for a 2-year term.

The technical work of the organization is performed by sub-committees, organized on a species or a subject basis. Subcommittees are established and disbanded by decision of the Steering Committee and report it.

Terms of Reference

1. PSARC is responsible for (1) reviewing and evaluating biological advice and technical advice on the status and management of Pacific fisheries resources, and (2) evaluating estimation and assessment methods and criteria used in the Region.

2. PSARC will formulate and evaluate methodologies for assessment and decision making for Pacific fisheries, and will advise the fisheries Management Executive Committee of sound and appropriate methods for fisheries management in the Region.

3. PSARC shall provide scientific and technical advice to the Fisheries Management Executive Committee - Pacific on matters relating to fishing statistics, sampling of catches, information needs for stock assessment and coordination of resource assessment and related projects between Branches in the Pacific Region.

4. PSARC will identify resource assessment-related research priorities, and by doing, will provide input into the regional planning process.

5. PSARC will endeavour to ensure liaison with other regional committees. Such liaison will include mutual referral and joint meetings with other fora as required so as to ensure consistency of biological advice with long-term Pacific fisheries management objectives.

The Steering Committee

Composition

The **Steering** Committee includes 9 members as follows:

1 Chairman
1 F.R.B. Section Head from Salmon, or delegate
3 F.R.B. Section Heads from Marine Fish (Groundfish, Hemng and Shellfish), or delegate
5 Subcommittee Chairmen
1 Past-Chairman
1 Director from Regional Planning and Economics Branch
1 Director from **S.E.P.**
1 Director from F.B.
1 Director from Science
1 Director from N.A.B.
1 Delegate from Ottawa
3 **Area** Managers

The immediate past Chairman and appointed members will serve on the Steering committee for a 2 year term. (Note: the addition of **Area** managers, and membership of 5 directors rather than delegates in 1989.)

Responsibility of the Committee

The Steering Committee is established to provide a framework for reviewing Subcommittee biological advice that **goes** forward to senior management and *to take* the responsibility for advice from individuals of the **stock** assessment community and place it in the hands of the corporate structure.

The Steering Committee reviews the Subcommittee reports to ensure all relevant information has been evaluated and thoroughly analyzed, and to formulate appropriate biological advice on management questions in the broader context of departmental policy. It is also vested with the responsibility for identifying **weak areas** in the scientific database ad methodology used by the Subcommittee to reach conclusions and to recommend corrective actions. Items may be referred back to the Subcommittees for further consideration or be accepted as a basis for advising senior management in the form of Advisory Documents or memoranda.

PSARC has the responsibility of generating and providing biological advice to the Fisheries Management Executive Committee.

Responsibility of Members

It is the responsibility of members of the Steering Committee to attend ***all*** regular meetings if possible regardless of whether items being discussed are in their area of **expertise** in order to provide a broad-based evaluation of biological advice generated from PSARC. If the members cannot attend meetings they should appoint an alternate for meeting at which they are unable to be present.

The definition of a quorum will be left to the discretion of the Chairman.

Members are required to send copies of all correspondence and reports pertaining to PSARC business to the Chairman so up-to-date files can be maintained.

Members are required to forward editorial modifications to proceedings to the Committee Chairman; they will not be discussed at the meeting. Corrections of a substantive nature will, however, continue to be brought to the Committee.

Each Steering Committee member, when asked for **a** scientific opinion on matters contained in approved Committee reports, should give the collective judgement of the Committee even if it differs from his/her personal opinion.

Schedule of Meetings

The Steering Committee has at least **3** regular annual meetings. Generally speaking, these meetings occur in the fall for reviewing subcommittee biological advice, and in early spring and late fall for salmon and other marine species advisory documents. Other meetings may be called as required at the discretion of the chairman, or by request of members of the Steering Committee.

Communication with Line Management

Advisory Documents are to be submitted to the fisheries Management Executive Committee.

After Advisory Documents are approved for release by the fisheries Management Executive Committee, they are distributed to the managment working groups, area managers, the ADM - Pacific and Freshwater, ADM - Science, and other regional staff interested in receiving a copy. Notification to the chairman of PSARC for approval of release **of** all Advisory Documents is coordinated through the office of the Director-General.

A listing of PSARC documentation will be forwarded to Area Managers and Section Heads with the request that they indicate what information they would like to receive on a routine basis. This includes PSARC Proceedings and subcommittee Reports. this is intended to keep key managerial staff informed of PSARC activities. They are expected to respect the citation guidelines of documents so received.

Items relating to program implementation and requests for assistance are to be referred through the Steering Committee to Directors for approval prior.

Subcommittees

1. The following five Subcommittees deal with the specialized areas indicated:

   PSARC Salmon Subcommittee
   PSARC Herring Subcommittee
   PSARC Groundfish Subcommittee
   PSARC Shellfish Subcommittee
   PSARC Stock Assessment Data System Subcommittee

2. Participating branches shall nominate Chairmen for each Subcommittee in whose work it is involved. Chairmen are responsible for communicating proposed agendas to members, participants, and reviewers and coordinating their preparations for and participation at Subcommittee meetings. Chairmanship should rotate between branches every 2 years.

3. Participation at subcommittee meetings shall include departmental stock assessment staff (Scient, Fisheries Branch and SEP as appropriate), and at the discretion of the Subcommittee Chairman, D.F.O. scientists from other Regions, and non-D.F.O. scientists, for discussion of specific topics.

4. PSARC will appoint internal reviewers from the stock assessment community to participate in Subcommittee meetings in other than their own discipline. The Steering Committee will select and approve external reviewers nominated by Subcommittee Chairmen.

The PSARC Subcommittees are to provide biological advice consistent with (1) sound conservation principles, and (2) optimization of production, through PSARC on the management of all salmon, hemng, shellfish and groundfish stocks presently exploited, or with potential to be explored, by:

- reviewing all pertinent information and analyses, or by conducting such analyses as may be required, to establish the status of salmon, hemng, shellfish and groundfish stocks in to predict the effects of alternative management measures on potential yields;

- preparing biological advisory reports on salmon, herring, shellfish and groundfish management as may be required by PSARC;

- maintaining a written record of the Proceedings of the subcommittee documenting the recommendations of the Subcommittee, the scientific basis of such recommendations, and resultant management actions;

- critically reviewing externally published reports of scientific research and commenting on matters relevant to the Subcommittees mandate;

- reviewing stock assessment-related research programs on salmon, hemng, shellfish and groundfish, and commenting on their relevance and effectiveness in relation to management of these resources;

- providing a forum for coordination of stock assessment related research programs on salmon, herring, shellfish and groundfish;

- reviewing research requirements for salmon, herring, shellfish and groundfish resource management, and recommending initiation of such programs as may be required by PSARC;

PSARC Stock Assessment Data System Subcommittee

It is the responsibility of the Stock Assessment Data System Subcommittee to provide the scientific and technical basis for PSARC advice on catch statistics, catch sampling, and biological surveys to D.F.O. Pacific, by:

- defining the stock assessment information needs of the stock assessment community and evaluating the adequacy of information provided to meet these needs;

- reviewing Regional data managment priorities, and recommending work priorities to the Information Technology and systems Division and review polities, procedures, and schedules to ensure they meet regional priorities and integrate with PSARC;

- developing an integrated stock assessment data system, and reviewing stock assessment related E.D.P. work plans and assign priorities;

- maintaining a written record of the Proceedings of the Subcommittee documenting all conclusions of the Subcommittee, the scientific basis for such conclusions, and of actions taken by other Regional groups based on the Subcommittee's conclusion.

PACIFIC REGIONAL COUNCIL (PARC)

TERMS OF REFERENCE

MANDATE:

The Pacific Regional Council is an autonomous group whose mandate is to advise the Minister and DFO Senior officials on recommended policy to address long term issues and achieve objectives for optimizing the economic and social value of Pacific fisheries resources for the people of Canada. PARC will be charged with discussing and debating broad policy issues that it deems important or which are referred to it by the Minister or Department of Fisheries and Oceans. Based on discussion, it will draw up, and report on, a range of viable policy options and frameworks to address these issues and advise on strengths and weaknesses of the options. PARC will alto solicit and report on "user" views of options; and where there is agreement, recommend actions. PARC will not address short term allocation Issues. These matters will continue to be the responsIbllity of sector advisory groups.

ROLE:

PARC will be an advisory body drawing on the wisdom, knowledge, and exoertise of members to advise the Minister. It will not serve as a representative forum for expressing fisheries user groups interests.

MEMBERSHIP:

The founding membership will be:

W.B. McDonald (Chair); C. Atleo; R. Fowler; J. Gosnell Snr.; M. Hunter: F. Husoy; L. Johnstone; J. Lornie; F. Penland; T. Protheroe; D. Sewell; B. Williams; R. Wright.

Official Observers: Regional Director General, Fisheries and Oceans [Pacific); B.C. Ministry of Environment and Parks; B.C. Ministry of Agriculture.

The members are appointed by the Minister. Members, who may serve any number of terms, are accountable to the Minister and may be removed by him/her at any time.

CHAIR:

The chair will be appointed by the Minister.

ISSUES/AGENDA:

The priority policy issues for PARC to address include those that:

1) involve or affect all user groups (e.g. conservation. habitat

policy, surplus fish policy, consultative process. fleet rationalization, coartwlde policy and program development initiatives);

2) are long term or involve long term implications (e.g. co-management) and do not involve short term allocation.

3) involve only one or two user groups or gears, but have important non-allocative implications (e.g. herring licensing policy. sport fishery policy, export of unprocessed fish); and

4) specific issues which may be considered in a broader policy context (e.g. freer trade).

A list of prospective issues which need to be addressed by PARC are listed in the attachment.

REPORTING RELATIONSHIPS:

PARC. through its chair, will provide written reports of its findings, policy options, and recommendations, to the Minister, with a copy to the DG, Pacific Region.

Species Committees and Sector Advisory Committees will report directly to the Minister, and need not report their recommendations through PARC.

YORKING RELATIONSHIPS:

PARC is expected to Solicit the representatlve industry vlews on the options it develops through reference to relevant affiliation based sector and species advlsory committees and will include a summary of these views in its reports. Departmental staff will provide technical background information and technical input upon request to assist the Committee in developing advice for the Minister. These requests will be addressed to the Department through the Regional Director General.

ADMINISTRATIVE ARRANGEMENTS:

PARC will meet at the Minister's request, or the call of the chair. PARC will set its own work agenda, in consultation with the Minister, to meet identified priorities.

EXPENSES AND HONORARIA:

In accordance with current policy, DFO will pay meetlng expenses, including travel, lodging and meals, and honoraria (currently $100 per diem), for PARC members. A budget of $80,000 will be provided to cover these costs.

SECRETARIAT SERVICES:

Pacific Region staff will provide services for organizing and expediting meetings and related travel, (and note taking) as well as technical support, as required (to be drawn primarily from the regional Program Planning and Economics Branch).

xii Terms of Reference - Queen Charlotte Islands Advisory Board

1) The Queen Charlotte Islands Advisory Board (QCIAB) will be concerned with all issues related to fisheries on the Queen Charlotte Islands.

2) The board will be responsible for the development and evaluation of salmon net fishing plans for the Queen Charlotte Islands.

3) The board will be chaired by the District Supervisor (District 9), and co-chaired by the Area Manager, North Coast Division.

4) There will be two formal meetings per year. The first meeting will be in late November or early December. The purpose of this meeting will be to review the management of the previous salmon season, and to develop net fishing plans for the upcoming salmon season. The second meeting vill be held in late April or early May, and the purpose vill be to finalize the salmon net fishing plan for the upcoming season and to discuss other Issues, Including, but not limited to, herring and invertebrate fisheries. At least six weeks prior to each meeting, the District Supervisor (Dlst. 9) vill send out a call letter reminding each organization of the upcoming meeting, and soliciting input of agenda Items. Responses vill be expected at least one month prior to the meeting. Each board member will be provided with a Copy of the Operational Framevork for each Subdlstrlct, and, in addition will be provided with a copy of the Summary Record of Management Strategies for District 9 before the fall meeting each year.

5) Nembershlp vill be reviewed annually. Each position on the board will consist of one designated advisor and one alternate. Prior to the fall meeting, accompanying the call for agenda items, there will be a reminder from the District Supervisor for each organization/community to review its representation on the board and make formal recommendations regarding their representatives and alternates. Government (DFO) representation will be flexible, on an as required basis. Any new organizations or individuals sollcitlng representation on the QCIAB will have their formal request for membership revleved by the board at the fall meeting.

6) The agenda vill provide an opportunity for a formal presentation from each group. Each group should provide a written summary of their formal presentation for all in attendance.

7) The DFO representatives vlll provide lnformation and feedback to board members at the meetings or in writing as a follov up, as requested by board members.

8) Any discussion or input vill normally be restricted to official QCIAB members.

9) There vill be flexlblllty for industry representatives to caucus as required.

10) If an official advisor cannot attend a meeting, he/she will be responsible to ensure an alternate attends in their place, and is fully briefed on all issues prior to the meeting.

APPENDIX C

Supporting Tables

Table C1: Value of Haida Guaii Vertebrate Fisheries in 1988

Species	Landings..(kg) ..... Area 1	Area 2E	Area 2W	4. Haida Guaii	Value $	Average Price $/kg
SALMON 1.						
Chinook	941,798	93,171	449,213	1,481,182	$12,077,746	$8.14
Sockeye	227,222	1,988	13,918	243,128	2,197,429	$9.04
Coho	737,808	210,452	75,053	1,023,313	6,134,081	15.99
Pink	3,299,333	263,400	204,410	3,767,143	10,318,169	12.74
Chum	472,048	1,685,870	36,902	2,194,820	6,643,762	$3.03
Steelhead	1,445	81	89	1,615	5,321	13.29
Total	5,679,654	2,254,962	779,585	8,714,201	37,376,508	32
HERRING:						
Roe		280,915		280,915	$665,135	$2.37
F.B.P.	5.761	78.925		84,686	87.658	11.04
Roe an Kelp		87.967		87.967	4,840,878	$55.03
Total	5,761	447,807	0	453.568	$5,586,399	
Halibut	1,190,962	2,253,644	487,719	3,932,325	$15,429,292	$3.92
Lingcod	101,679	235.986	86,471	421.136	350,714	10.83
Sablefish	141,936	312,050	1,560,417	2,014,403	7,193,138	$3.57
2.Rockfish	2,115,500	4,037,440	2,261,098	8,414,038	4,772,251	10.57
Red Snapper	67,762	70.286	50,939	188.987	264.474	$1.40
Sole	103,995	250,345	68,610	422,950	460.728	11.09
Pacific Cod	95,517	1,893,555	6.298	1,995,370	983,729	$0.49
Salmon Roe					7.414	
Wink feed					6,982	
Flounder					523	
Skate					6,783	
Idiot Fish					181,475	
3.Other fish					19,902	
Turbot					6.680	
Walleye P.					125	
Dogfish					141,505	
Shark					194	
Total					129,825,909	
GRAND TOTAL					$72,788,816	

NOTES:

1. Salmon roe not included.
2. Total rockfish includes Pacific Ocean perch, reedi, greenies and other rockfish.
3. Other fish includes tuna and other fish not listed.
4. Halibut - Dressed wt., head off. Gillnet and seine salmon - Round wt Troll salmon - Dressed weight, head on. All other+ - Round weight.

Source: Maureen Kostner. DFO, Statistics

Table C2: Value of British Columbia Vertebrate Fisheries in 1988

Species	Landings tons	Value $,000	Average Price $/kg
SALMON 1.			
Chinook	5.138	$43,795	$8.52
sockeye	11,843	96.408	$8.14
Coho	6.155	37,688	$6.12
Pink	31.467	49,303	$1.57
Chum	30,127	84,621	12.81
Steelhead	93	250	$2.69
Total	**84,823**	**$312,065**	**$3.68**
HERRING:			
Roe & F.B.P.	31,383	$83,523	$2.66
Roe on Kelp	218	12,934	$59.33
Total	**31,601**	**$96,457**	
Halibut	5w	123,217	$3.96
Lingcod	3,444	2.622	M.76
Sablefish	5,291	18,444	$3.49
Pacific Ocean Perch	6.787	3,535	$0.52
2.Rockfirh	20,016	13,521	$0.68
Sole	5,139	4,079	$0.79
Pscific Cod	11.024	5.766	$0.52
Salmon Roe	7	22	13.14
Flounder	141	62	$0.44
Skate	589	92	M.16
Turbot	340	88	$0.26
Walleye P.	460	89	$0.19
Dogfish	5.314	2.182	$0.41
3.Other Fish	6.485	1,481	$0.23
Total	70,903	In,203	
TOTAL	187,327	$483,725	

NOTES:

1. Salmon roe not included.
2. Rockfish includes red, rock, bass, reedi, greenies, other rockfish red snappers and silver perch.
3. Other fish includes hake, idiot fish, shark, eulachon, run-food fish smelts, sturgeon, tuna, anchovies, fresh water fish, hagfish and unspecified species.

Swrce: Annual summary of E.C. commercial catch statistics 1988

Table C3: Summary of streams historically supporting salmon populations in Haida Gwaii.

source: **Anon. (1986)**

Habitat Sub-Area	Sockeye			Coho			Pink			Chum			All
	Total Streams[a]	Significant Streams[b]	% of MRE[c]	Total Streams	Significant Streams	% of MRE	Total Streams	Significant Streams	% of MRE	Total Streams	Significant Streams	% of MRE	Total Streams[•]
Area 1													
Masset Inlet	5	3	96	D	4	82	D	7	99	5	3	W	D
Naden Harbour	1	1	100	4	4	100	4	3	99	4	4	100	4
Coastal Streams	1	1	100	3	3	100	3	3	100	0	0		3
Total Area 1[d]	7	5		15	11		15	13		9	1		15
Area 2E													
Skidegate	1	1	100	15	7	97	14	8	98	14	10	96	21
Cumshewa/Selwyn	5	1	99	15	7	90	13	6	96	12	10	93	20
Darwin/Atli	0	0		9	3	87	10	5	98	15	10	93	16
Juan Perez	0	0		0	0		14	5	81	17	9	89	18
Skincuttle	0	0		15	6	89	0	0		19	9	94	21
Total Area 2E	6	2		54	23		51	24		77	48		96
Area 2W													
Athlow-Otard	1	1	100	2	2	100	3	3	100	10	4	89	9
Rennel Sound	0	0		11	4	91	16	8	91	15	9	87	15
West Skidegate	1	1	100	8	4	94	8	2	98	9	6	97	8
Inskip	1	1	100	9	5	90	11	7	95	14	12	93	14
Louscoone	0	0		2	2	100				6	3	94	6
Tasu	1	1	100	8	4	90	5	1	98	0	0		8
Total Area 2W	4	4		40	21		43	21		54	34		60

[a] = Total number of streams that have historically supported species indicated.
[b] = Significant number of streams which have historically contributed most to production of species indicated.
[c] = Percentage of Maximum Recorded Escapement (MRE) is the percentage contribution of the significant streams to the total maximum recorded escapement.
[d] = Area 1 also has the only stream that produced chinook salmon on the Charlottes. It is the Yakoun River in Masset Inlet.
[•] = Total number of streams in the area reported to support salmon.

Table C5: Estimated average commercial catch of salmon (numbers), standard deviation of catch. and coefficient of variation (standard deviation/average) for Haida Gwaii commercial catches, by decade, 1888-1984.

Source: Argue (1985)

Decade	Estimated Number of Salmon						
	Sockeye	Pink	Chum	Coho	Chinook	Stlhd	Total
1888 - 1889 Average	5203	229	174	1322	294	80	7303
Standard Deviation	2153	119	54	457	104	0	3187
Coefficient of Variation	0.4711	0.5182	0.3083	0.3457	0.3543		0.4365
1890 - 1899 Average	2723	118	188	771	201	91	4082
Standard Deviation	1534	66	113	438	116	50	2305
Coefficient of Variation	0.5631	0.5583	0.6009	0.5684	0.5757	0.6165	0.5617
1900 - 1910 Average	14391	533	23456	5906	1331	861	46478
Standard Deviation	8561	282	47593	3746	742	616	43738
Coefficient of Variation	0.5950	0.5291	2.0291	0.6345	0.5577	0.7506	0.9410
1911 - 1919 Average	139	282958	197320	28155	25851	5731	540152
Standard Deviation	417	437194	165256	28625	25228	6166	511952
Coefficient of Variation	3.0000	1.5151	0.8375	1.0168	0.9759	1.0760	0.9178
1920 - 1929 Average	1805	1172052	766890	28742	8818	1615	1979922
Standard Deviation	3414	1382786	666535	25456	15559	5108	1824298
Coefficient of Variation	1.8921	1.1798	0.8691	0.8857	1.7611	3.1623	0.9214
1930 - 1939 Average	156	790432	519988	138308	59951	NA	1509276
Standard Deviation	661	1191303	310232	77966	32786	NA	1394302
Coefficient of Variation	1.4558	1.5108	0.5966	0.5634	0.5169		0.9238
1910 - 1949 Average	617	112716	537570	247033	38025	NA	1236041
Standard Deviation	1020	185046	195208	83064	10920	NA	769334
Coefficient of Variation	1.5290	1.1752	0.7353	0.3362	0.2872		0.6224
1950 - 1959 Average	4803	810132	576712	558656	42858	66	1593036
Standard Deviation	3503	998981	188639	136197	10573	15	1167018
Coefficient of Variation	0.7292	1.2331	1.2970	0.3806	0.2179	0.5003	0.7326
1960 - 1969 Average	23951	577155	278185	191719	59606	105	1333251
Standard Deviation	16955	695951	267115	116247	21527	255	909166
Coefficient of Variation	0.7079	1.2054	0.9613	0.2952	0.4115	0.6301	0.6821
1970 - 1979 Average	71171	627007	272070	332511	133544	113	1137625
Standard Deviation	68009	587613	215215	115910	21592	267	885181
Coefficient of Variation	0.9555	0.9358	1.7910	0.3486	0.1617	0.6174	0.4768
1980 - 1981 Average	173268	111200	115055	430766	163155	537	1825080
Standard Deviation	85480	220478	132773	101357	19707	201	907579
Coefficient of Variation	0.4933	0.7907	0.9103	0.2353	0.1206	0.3792	0.1973

Table C6: Haida Gwii Chum Catch and Escapement In Number of Fish

YEAR	ESCAPEMENT BY AREA				CATCH BY AREA			TOTAL
	Area 1	Area 2E	Area 2W	Total	Area 1	Area 2E	Area 2W	CATCH
1950	11,000	416.500	335.200	762,700				
1951	119,200	414.350	369.075	902,625				
1952	50,800	600,550	560,575	1,211,925				
1953	121,475	142,900	81.575	345,950				
1954	90,750	291,400	191,350	573,500	33,940	329,009	204,262	567,211
1955	22,650	35.925	11,425	70,000	5,989	55,406	21,241	82.636
1956	3.700	105,700	24,125	133,525	18,216	47,369	83,076	148,661
1957	146,775	138,375	144,550	429,700	57,225	21,412	7,172	85,809
1958	23,500	168,975	85,000	277,475	9,730	15,786	8,278	33.794
1959	18.525	27.743	21.629	67.897	2.241	21	14,601	16,863
1960	15,125	181,543	31,762	228,430	2,122	3,196	1,243	6.561
1961	26,025	175,975	88.625	290,625	1.112	66,300	3,356	70,768
1962	14,575	309,725	52,350	376,650	3,301	106,690	1,372	111,363
1963	10,700	284,808	70.375	365,883	5,142	140,106	124	145,372
1964	95,025	429,980	221,775	746,780	14,570	569,871	212,771	797,212
1965	161,600	227,900	54,725	444,225	11,225	76,170	92,853	180,248
1966	93,950	372,137	134,475	600,562	21,687	132,713	56,509	210,909
1967	31,575	270,675	104,806	407,056	25,107	391,769	39,695	456,571
1968	37,500	294,410	119,191	451.101	25.036	570,141	65,591	660.768
1969	45,000	176,275	79,500	300,775	36.478	50,963	53.624	141,065
1970	24,800	198,975	132.725	356,500	33,544	365,006	192,010	590,560
1971	44,500	221,400	78,476	344,376	37,050	303,244	82.226	422,520
1972	8.600	187,205	142,500	338.305	51,086	281,871	121.857	454.814
1973	50,000	225,725	49,950	325.675	54,341	430,813	65,032	550,186
1974	41,800	121,905	53,823	217,528	20,504	150,443	66,629	237.576
1975	188,050	73,732	28.751	290,533	12,096	2,226	42,494	56.816
1976	53,500	139,000	31,579	224,079	2,762	47.m	2,875	53,412
1977	59,300	159,825	49,721	268.846	6.175	171,392	18.931	196,498
1978	56,200	210,152	38,145	304,497	8.827	116,159	11,617	136,603
1979	33,450	43,158	49,609	126,217	8.896	1,059	11,822	21,777
1980	14,458	160,580	89,705	264.743	19,800	118,825	55,780	194,405
1981	26,100	164,924	47,928	238,952	21,103	37,845	7.232	66,180
1982	70,800	201,556	93,465	365,821	14,777	29,419	51,475	95,671
1983	35,225	156,080	32,169	223,474	7,959	885	6,910	15,754
1984	52,775	277.961	63.570	394,306	56.809	281,750	99,665	438,224
1985	63.800	302.505	72,070	438,375	161.987	651.722	83.432	897,141
1986	82,500	279,928	76.282	438,710	134,128	223,856	26.542	384,526
1987	51.100	315.766	67,710	434,576	32,776	194,030	29,586	256.392
1988	29.950	259,583	57.670	347,203	126,039	394,844	9,348	530,231
1989	18.975	295,627	33.472	348,074	37,617	295.627	31.764	365,008
*1990	3,700	296.923	60.827	361,450	27.457	304,388	66.549	378.394
Average								
to 59	60.838	234,242	182.450	477,530	21.224	78.167	56,438	155,829
60-69	53,108	272,343	95.758	421.209	14,578	210.792	52,714	278,084
70-79	56,020	158,108	65.528	279.656	23.528	186,999	61.549	272,076
80-89	55.710	301,814	79,255	436.779	61,300	222,880	40,173	324.353

Sources: Orman (1988) for catch and escapement to 1984
British Columbia Commercial Catch statistics
* Preliminary Statistics

Table C7: Area 2E Chum Escapement by Sub-Area

YEAR	Total	Juan Perez	Skincuttle	Darwin-Atli	Other
1950	389,900	64,000	98,000	95,200	132,700
	423,300	44,500	124,500	74,550	179,750
	651,250	68,500	121,000	95.050	366,700
	115,375	17.650	18.900	17,400	61,425
	300.925	21.550	26,000	48,700	204,675
1955	35.800	10.100	14.700	2,250	8.750
	107,400	15,600	38,050	4,025	49,725
	140,150	13,250	34,400	7,925	84,575
	170,325	21,850	35,725	13,900	98,850
	27.743	275	1.700	9,000	16.768
1960	184.118	32,100	55.250	11.550	85,218
	188.325	27,350	46,000	13.425	101,550
	295.625	*43.375*	93,850	26,850	131,550
	286,533	50.448	82,975	41,600	111,510
	428,380	40,800	115,650	19,100	252,830
1965	231,300	26,750	49,550	33,300	121,700
	376,350	39,850	119.000	76,600	140.900
	274.550	29.650	81,500	81,675	81,725
	316,700	28,500	71,450	37,050	179.700
	196,900	27.525	23,775	78,600	67.000
1970	198,975	11,500	25,900	50,300	111,275
	222,350	9,300	54,575	18,200	140,275
	185,780	23,700	36,825	13,185	112,070
	225.350	20,185	60,125	30.525	111.515
	146,440	6,390	2,220	27.600	110,230
1975	72,562	8.805	30.860	6.472	26.425
	143,420	5,475	49,885	44,500	43,560
	161,075	7,525	20.200	12,900	120,450
	213.567	5.872	3L.625	12,470	160,600
	43,541	2,210	8,950	2,500	29,881
1980	165,416	14,956	40,995	20,330	89,135
	164,924	17,550	29,628	14,690	103,056
	202,713	26.478	50,838	5,212	120,185
	156,082	19,410	22,071	23.073	91,528
	277,596	23,175	48,607	47.050	158.764
1985	302,505	19,530	39,245	31.621	212,109
	279.928	27.081	44,013	29,502	179,332
	315,766	40,302	47,826	54,746	172.892
1990					
Average					
50-59	236.217	27,728	51,298	36,800	120.392
61-69	277,878	34,635	73,900	41,975	127,368
70-79	161,306	10,096	32.417	21,865	96.928
80-87	233,116	23,560	*40,403*	28,278	140,875

Sources: Spilsted, Savard and Cardinal (1988)

Table C8: Pink salmon escapement on Haida Gwaii in number of fish

YEAR EVEN YEAR	ESCAPEMENT BY AREA			COD YEAR	ESCAPEMENT BY AREA			
	Area 1	Area 2E	Area 2W		Area 1	Area 2E	Area 2W	Total
1950	277,500	359,725	192,800					830,025
1951					3,500	29,775	5.050	38,325
1952	541.400	696,550	639,500					1,877,450
1953					3,500	25,775	1,625	30,900
1954	301,200	406,725	381,000					1,088,925
1955					NA	23,275	800	24.075
1956	440,500	262,600	119,625					822,725
1957					18,500	46,275	1.625	66.400
1958	402.000	192,750	131,525					726,275
1959					18,000	25,275	8.270	51,545
1960	98,575	370,645	148,230					617,450
1961					20,000	42.325	8,050	70.375
1962	175,675	626.800	80,075					882.550
1963					18.575	115,400	3,700	137,675
1964	441.625	146,595	56,325					644,545
1965					33,550	45,550	35.475	114,575
1966	1,068,825	509,400	225,375					1,803,600
1967					150	71,950	6,000	78,100
1968	1,335,900	769.343	148,770					2,254,013
1969					200	120,425	6.025	126,650
1970	432,650	808.360	199,625					1,440,635
1971					6,050	26,700	NA	32,750
1972	329,900	766,950	310,800					1,407,650
1973					4,000	34,225	YA	38.225
1974	201,400	422,271	147,875					771.546
1975					3,950	20.365	352	26.667
1976	285,050	649,900	47,971					982.921
1977					4,900	8,580	125	13,605
1978	217,500	531.000	155,413					903,913
1979					3,125	17,788	601	21,514
1980	290,795	305.112	164,976					760.883
1981					3.650	P.417	457	13,524
1982	211,250	166,796	112,492					490,538
1983					2.130	13.245	516	15,891
1984	1,213,900	191,895	67,426					1,473,221
1985					1,875	19,985	921	22,781
1986	838,500	703,761	264,502					1,806,763
1987					4,500	35.565	42	40,107
1988	566,100	572.303	168,053					1,306,456
• 1989					1,300	23.264	77	24,641
• 1990	1,403,550	906.177	192,703					2,502,430
Average								**Even year**
50-59	392,520	383.670	292,890		8,700	30,075	3,474	1,069,080
60-69	624,120	484,557	131,755		14,495	79,130	11,850	1,240,432
70-79	293,300	635,696	172,337		4,405	21,532	216	1.101.333
80-89	624,109	387.973	155.490		2.691	20,295	403	1,167,572

Swrces: Orman (1988) for catch and escapement to 1984
Spilsted (1988) far escapement data to 1988
• OFO, District records

Table C9: Pink salmon catch on Haida Gwaii In number of fish

YEAR	EVEN YEAR CATCH BY AREA			ODD YEAR CATCH BY AREA			
	Area 1	Area 2E	Area 2W	Area 1	Area 2E	Area 2W	Total
1950							
1951							
1952							
1953							
1954	155,938	325.827	1,036,580				1,518,345
1955				16,730	26,564	72	*L3.366*
1956	163.766	155,799	84.011				403.576
1957				25,268	129601	2.516	157,385
1958	596.535	L25.623	186.925				1,209,083
1959				23,912	7.703	55	31,670
1960	50,771	197,020	164,886				412.677
1961				26,312	18,383	34	44,729
1962	215,689	851,725	5.622				1,073,036
1963				71.037	5,646	1,557	78,240
1964	292,423	52,207	2.997				347.627
1965				75.975	2,919	7	78,901
1966	1,336,551	305,602	200.404				1,842,557
1967				87,203	14.222	13,672	115,097
1968	936.857	517,681	229.824				1,684,362
1969				48,799	28,251	1,369	78,419
1970	332,127	607,105	319,551				1,258,783
1971				99.689	4,108	1.675	105,472
1972	316,386	400,641	653,192				1,370,219
1973				52,730	3.974	818	57.522
1974	121,317	226,133	212,444				559.894
1975				63.784	8.542	16.250	88,576
1976	6,467	1,628,259	12.714				1,647,440
1977				109,706	9.677	53.965	173.348
1978	75,292	250,178	229,284				554,754
1979				240,051	26,041	196,583	462.675
1980	827.382	34,264	120,640				982.286
1981				542,157	35,944	108,727	686,828
1982	74,483	18.635	23,044				116,162
1983				327,792	32,368	299,119	659.279
1984	1,858,570	62,229	145,331				2,066,130
1985				925,240	46,921	127,845	1,100,006
1986	1,282,284	392.478	137,523				1,812,285
1987				1,643,391	70,101	742.574	2,456,066
1988	2,231,401	185,526	135,310				2,552,237
1989				1,527,885	*50,543*	610,983	2,189,411
1990	2,501,095	362.433	566.761				3,430,289
Average							Even year
51-59	305,413	302,416	435.839	21,970	54,623	881	1,043,668
60-69	*566,458*	384,847	120.747	61,865	13,884	3.328	1,072,052
70-79	170.318	622,463	285.437	113,192	10,468	53,858	1,078,218
80-89	1,254,824	138,626	112,370	1,241,616	47.175	472.312	1,505,820

Sources: Orman (1988) for catch and escapement to 1984
British Columbia Commercial Catch Statistics

Table C10: Escapement to key coho Haida Gwaii coho streams

Yew	Yakoun	Mamim	Jalun	Sangan
1980	4,000	2,100	450	600
1981	6,300	3,200	500	1,000
1982	14,000	2.500	1,500	2,000
1963	6,000	1,600	1.500	1,000
1984	1,000	2,500	2,000	1,000
1985	8,000	2,700	1,000	1,000
1986	13.000	2,400	1.500	1,400
1987	N.A.	Y.A.	N.A.	N.A.
1988	18,000	2,800	1,000	300
1989	7.500	2,500	1,000	300
1990	8.000	500	UNK	800
# years	9	9	9	9
Average 80-89	8.644	2.478	1,161	956

Year	Tlell	D e e ~	Copper	Pallant
1980	6,000	3,000	3.000	2,500
1981	5,000	6,000	3.300	1,647
1982	5.000	4.000	12.000	2,100
1983	4,500	2,500	5,000	4,100
1984	3,500	2.800	4.000	3,742
1985	8,000	1,000	8,000	5,300
1986	N/I	2,150	N.A.	2,600
1987	2.500	3,300	Y.A.	Y.A.
1988	5,500	3,500	Y.A.	2,560
1989	6,000	1.000	3.500	1,000
1990	750	1,000	2,000	3,802
# years	9	10	7	9
Average 80-89	5,111	2.925	5.543	2,639

Table C11: Coho salmon commercial catch and escapement on Haida Gwaii, in number of fish 1950-1989

YEAR	ESCAPEMENT BY AREA				CATCH BY AREA			
	Area 1	Area 2E	Area 2W	Total	Area 1	Area 2E	Area 2W	Total
1950	16,500	44.894	3.445	64,839				
1951	44,900	115.628	18.650	179.178				
1952	12,950	75,900	6,255	95,105				
1953	1,200	21,650	1,779	24,629				
1954	10,400	58.850	5,300	74.550	209.632	46,788	16,076	272,496
1955	5,050	40.460	1,775	47.285	372.532	83,253	4.854	460,639
1956	7.675	38.600	600	46.875	233.068	119,186	10,645	362.899
1957	13,550	46.375	11,150	71.075	334.426	115,346	4,538	454,310
1958	5,150	33,950	1,375	40,475	175,395	61,718	1,581	238,694
1959	20,200	49.275	810	70.285	149.461	54.373	2,285	206,119
1960	14,150	59,522	6,000	79,672	124.472	71.396	2,812	198,680
1961	23,650	105,175	3,650	132.475	200.129	90,533	3,283	293,945
1962	35.800	56,100	16.350	108,250	302.080	119,387	23,514	444,981
1963	12.575	59,179	1,215	72,969	311,270	104,244	17,371	432,885
1964	60,300	101,350	10,500	172,150	350.052	160,956	22.492	533,500
1965	77.850	54,380	4.475	136,705	240,955	81,435	14,193	336,583
1966	13,025	125,475	17,275	155,775	336,067	166,917	22,230	525,214
1967	23.625	68.700	6,682	99,007	207.367	97.762	14.265	319.394
1968	10,250	43.480	4.430	58,160	368.848	149,360	12,433	530,641
1969	6.825	84,650	4.110	95,585	248.069	62,864	10,980	321,913
1970	24,050	86,250	3.650	113,950	280,663	116,534	20,154	417.351
1971	14.335	19,304	696	34,335	233,605	128,499	13,205	375.309
1972	26,150	47.475	2.550	76,175	271.979	177.787	14,912	464.678
1973	58,350	48.350	271	106,971	139,055	101,082	5,268	245.405
1974	97,100	16,890	835	114,825	167,393	104,618	12,558	284.569
1975	47,000	58,570	350	105,920	128,140	56,371	8.452	192,963
1976	153,500	55.625	648	209,773	67.061	201.057	15,868	283.986
1977	55,400	37,025	635	93,060	99.630	47.869	9,065	156,564
1978	61,250	59,585	1,054	121,889	267,312	153.438	39,465	460.215
1979	34,750	28.387	851	63,988	285,832	105.944	51,590	443,366
1980	17,140	24,656	965	42,761	307,520	111,353	81,299	500,172
1981	18,000	26,544	1,952	46,496	214,396	61,048	47.842	323.286
1982	35,250	37,059	856	73,165	156,035	101,411	40,687	298.133
1983	20,600	28,660	795	50,055	361,148	107,003	29,165	497,316
1984	28,850	24,230	793	53,873	342,176	33,666	38.542	414.384
1985	23,700	29,604	845	54,149	351,612	65.347	43.255	460.214
1986	32,900	22,891	1,841	57,632	645,987	126.552	68,355	840,894
1987	32.650	22,350	1,197	56,197	322,202	99,076	104,739	526,017
1988	28.900	26,073	2.075	57,048	216.692	58,167	22.110	296.969
1989	16,550	19,298	1,262	37,110	350,389	43.298	80.480	474.167
• 1990	10,270	12,795	12,795	35,860	663,689	84,213	93.063	840.965
Average								
50-59	13.758	52,558	5,114	71,430	245,752	80,111	6,663	332.526
60-69	27,805	75,801	7,469	111,075	268,931	110,485	14,357	393,774
70-79	57,189	45,746	1,154	104,089	194,067	119,320	19,054	332.441
80-89	25.454	26,137	1,258	52,849	326.816	80,692	55,647	463,155

Sources: Orman (1988) for catch and escapement to 1984
British Columbia Commercial Catch Statistics
Spilsted (1988) for escapement data to 1988

• Preliminary statistics

Table C12: Haida Gwaii (Areas 1, 2E & 2W) Annual Coho Catch by Gillnet, seine, and Troll.

	Area 1				Area 2E				Area 2W				Total OCI			
Year	Gillnet	Seine	Troll	Total	Gillnet	Seine	Troll	Total	Gillnet	Seine	Troll	Total	Gillnet	Seine	Troll	Total
53	364	492	266505	267361	428	4508	42523	47455	241	5920	3678	9937	1131	10918	312704	324753
54	243	18359	295289	313871	3279	24653	33422	61354	60	23000	1640	24906	3582	66012	330537	400131
55	38	9452	439403	448891	2512	12199	90743	105454	146	4386	1473	6005	2694	26037	531619	560350
56	8283	2216	222589	233068	1988	13252	103948	119186	1	8451	2193	10645	10270	23919	328710	362899
57	5478	3036	325914	334428	137	3239	111925	115301	0	800	3732	4538	5613	7081	441571	454265
58	4704	349	170342	175395	2184	3805	55729	61718	248	118	1215	1581	7136	4272	227286	238694
59	1526	0	147935	149481	4	788	53583	54373	20	0	2265	2285	1550	788	203783	206119
60	3169	102	121201	124472	562	2508	68328	71398	0	168	2648	2812	3731	2776	192173	198680
61	2600	248	197281	200129	2690	10567	77278	90533	25	68	3190	3283	5315	10883	277747	293945
62	15463	1386	285231	302080	4709	8969	105679	119387	118	0	23398	23514	20320	10355	414308	444981
63	13324	2200	295746	311270	5105	9308	89801	104244	0	0	17371	17371	18429	11538	402918	432885
64	39688	6830	303534	350052	10229	16119	134608	160956	249	3532	18711	22492	50186	26481	456853	533500
65	37320	5393	198242	240955	5859	7688	67888	81435	1073	3242	9878	14193	44252	16323	276008	336583
66	41819	3532	290716	336067	2862	6994	157061	166917	630	4288	17112	22290	45311	14814	465149	525274
67	36489	1005	1691177	207371	11548	10977	75261	97784	241	1849	12111	14221	48278	13831	257269	319378
68	88607	1418	278811	368894	14434	7151	12747	149072	786	1459	10145	12100	103887	10028	416443	530358
69	39952	541	201578	248069	5074	966	56824	62864	176	992	9811	10979	45202	2499	274211	321912
70	70182	1290	209191	280663	16825	5501	94126	116534	644	10024	9486	20154	87851	16697	312800	417351
71	52308	2386	178913	233605	13800	5344	109355	128499	107	3098	10002	13205	66213	10826	298270	375309
72	54025	7731	210223	271979	8427	4662	166698	177787	963	11101	107117	23451	61415	24094	387708	413211
73	7463	986	130549	138998	7132	1940	91813	101075	207	810	4191	5268	15052	3736	226553	245341
74	9803	1494	155956	167311	3918	1062	99036	104016	500	1446	10612	12558	14251	4002	265718	284509
75	15504	3099	109217	128140	183	274	55914	56371	1102	2749	3911	8452	17539	6302	168042	192960
76	2693	1409	62959	67061	2582	6987	183695	193264	100	4518	11244	15868	5381	12914	257898	276193
77	1127	2668	95858	99651	5161	5701	37007	47869	3x)	3091	4852	9065	6606	12260	131117	156585
78	410	2751	264151	267312	8202	1705	143531	153438	68	6441	32958	3945	8680	10897	440638	460215
70	1184	14710	269956	2115032	0	0	105944	105944	177	25214	20199	51500	1341	39924	402101	443366
80	16614	11886	291182	319682		1145	103229	112406	000	10050	00072	83781	22017	20081	404213	515911
81	5953	10959	191571	214306	3161	488	00520	70171	257	7430	52001	59688	0373	10787	310095	344255
82	90	9734	147153	156977	678	91	100192	100965	187	3050	00082	40719	953	13681	284027	298081
83	642	4763	357218	362623	0	0	100998	106998	15	4577	24566	39158	057	9340	488780	498777
84	221	7233	334722	342176	2160	2284	29212	33656	58	7459	31025	38552	2439	16966	394959	414384
85	114	20789	330709	351612	12981	11428	40930	65337	71	2871	39522	43264	13166	35688	411181	460213
86	914	19702	625371	1145117	6943	10278	109125	120544	41	2402	65910	68353	1898	32300	800006	840004
07	304	13205	308693	322202	2685	1511	94890	99089	0	470	104314	104784	2989	15186	507900	526075
	536	3163	212991	216692	27711	3859	51549	58184	2	141	21370	22119	3316	7769	285910	296995
89	310	7731	342288	350389	2732	4259	36307	43298	28	5254	75200	80480	3120	17244	451795	474187
53-59 AVG	2947	4843	266848	274639	1504	8920	70268	80692	117	6097	2343	8557	4568	19861	339459	363887
60-69 AVG	31849	2265	234822	268936	6310	8128	96021	110459	330	1560	12465	14355	38489	11953	343308	393749
70-79 AVG	21117	3878	166709	194063	6442	3300	100712	110540	494	6909	12424	19906	20413	14253	298045	332511
80-84 AVG	4704	a397	265568	279167	2219	803	61630	64851	205	1875	42219	50380	7206	17575	000015	414398
8589 AVG	448	12918	364010	177378	5623	6268	60601	78490	28	2509	81263	63900		21693	491874	519567

Table C13: coho salmon recreational catch on Haida Gwaii, in number of fish 1954-1989

YEAR	CATCH BY AREA (number of fish)– Area 1 Total	Area 2E Tidal	Area 2E Non-Tidal	Area 2E Total	Area 2W Total	Total
1970						*3,400*
1971						775
1972						1,216
1973						900
1974						1.531
1975						2.676
1976						2.254
1977						
1978						
1979						2.375
1980						6,086
1981						3,516
1982						9.565
1983		1,670	955	2.625		2.625
1984		1,855	1,000	2.855		2.855
1985	280	3,100	575	3,675		3.955
1986	1.031	2,708	441	3,119		4,180
1987	2,010	5,752	1,372	7.124		9,164
1988	796	5.978	7b6	6,744		7,540
1989	3,856	1.995	*340*	2,335		6.189
1990	11.437	3,255	420	3.675	1,888	17,000
Average						
1985-1990		3,289	731	4,023		6,689
1970-1990						4.621

Sources: Argue (1985) for catch from 1970-83
D.F.O. Record of Management Strategies, Area 1, 2E & 2W

Table C14: Pallant Creek coho interceptions and broodyear survival

Recoveries of tagged coho by area and gear:

YEAR	WCVI	North/Central			Insid	WA	AK	U.S.	Total	Escape-	U.S.	Release
		Troll	Yet	Sport		/OR		Sport		ment	Total	
1980	8	597	15	21	4	0	99	0	744	1204	99	71230
1981	21	196	36	89	0	0	23	5	370	535	28	31282
1982	5	147	238	213	9	0	14	67	693	618	81	111569
1985	0	87	179	16	0	0	14	6	302	110	20	49542
1984	0	1202	710	1131	2	0	64	83	3192	360	147	97137
1985	0	1587	308	2867	0	0	19	174	4955	677	1V3	187886
1986	0	1176	352	443	0	0	88	158	2217	22	246	186244

Proportion of recoveries by area and gear:

YEAR	%	%	%	%	%	%	%	%	%	%
	WCVI	North/Central			Insid	WA	AK	U.S.	U.S.	Surv
		Troll	Net	Sport		/OR		Sport	Total	
1980		80%	2%	3%			13%	0%	13.3%	2.n
1981		53%	10%	24%			6%	1%	7.6%	2.9%
1982		21%	34%	31%			2%	10%	11.n	1.2%
1983		29%	59%	5%			5%	2%	6.6%	0.8%
1984		38%	22%	35%			2%	3%	4.6%	5.n
1985		32%	6%	58%			0%	4%	3.9%	3.0%
1986		53%	16%	20%			4%	7%	11.1%	1.2%
		43.7%	21.4%	25.2%			4.6%	3.7%	8.4%	2.2%

Source: Orman (1990)

Table C15: Haida Gwaii chinook salmon catch and escapement, 1954-1989

YEAR	CATCH BY AREA (number of fish)					ESCAPEMENT
	Area 1	Area 2E	Area 2W	Total North Coast		Yakoun R.
1954	27.459	4,102	2,884	34,445		
1955	21,871	3,301	3,071	28,246		
1956	18,876	0.642	5,305	32,823		750
1957	19.534	0.467	3,713	31,714		1.500
1958	31,812	8,332	1.900	42.014		
1959	31,989	10,952	2,312	45.253		3,500
1960	23,940	10,145	1.761	35,846		750
1961	35,256	6,890	1,162	43,308		3,500
1962	17,230	7.739	3.417	28.386		1.500
1963	21,920	7.340	3,669	32.929		
1964	45.929	5.115	5,192	56.236		7,500
1965	42.807	10.938	7,670	61,415		15.000
1966	59.134	12.382	13.625	85.141		7,500
1967	53.457	12,673	9,050	75,180		1.500
1968	57.519	12.839	4,272	74,630		1.500
1969	56,117	28,683	13,938	98,738		1,500
1970	78,541	22,230	8,743	109,514		800
1971	72,455	33,458	20.487	126,400		500
1972	60,550	40,850	13,758	115,158		1,000
1973	55,649	34,792	5.396	95,837		900
1974	79.998	47.424	20.991	148,413		1,000
1975	102,589	43.937	17,707	164,233		1.500
1976	53,264	68,824	25,504	147,592		7,090
1977	53.263	37.494	43,242	133.999	317,664	800
1978	73.586	34,219	35,424	143,229	322.489	600
1979	64,889	39,327	50,813	155,029	359,029	475
1980	74,702	35,424	47.386	157,512	312,173	600
1981	84,204	24,185	44,760	153,149	283,678	a50
1982	118,596	31,517	44,635	194,748	352.650	1,400
1983	99.369	19,300	18.387	137,056	273.601	600
19%	122,876	10,693	39.662	173,231	179,777	300
1985	100,316	12,925	77,749	190.990	300,403	1.500
1986	88,559	23,284	28,528	140,371	278,720	500
1987	91,829	15,273	68,569	175,671	269,334	2.000
1988	94,971	10,127	42,359	147,457	226,212	
1989	113,313	7,467	90,132	210,912	273.560	
• 1990	99,921	8.820	38,195	146,936	237.112	
Average						
1954-1959	25,257	7,300	3,198	35.754		
1960-1969	41,331	11,474	6.376	59,181		
1970-1979	69,478	40,256	24,207	133,940		
1980-1989	98,874	19,020	50,217	168,110	275,011	
1985-1989	97,798	13,815	61,467	173,080	269,646	

Sources: Orman (1988) for catch and escapement to 1984
British Columbia Commercial Catch statistics
Spilsted (1988) for escapement data to 1988

• Preliminary statistics

Table C16: Haida Gwaii recreational chinook catch by area

Year	Area 1	Area 2E	Area 2W	Haida Gwaii	North Coast
1977		106		106	8,795
1978		125		125	11,457
1979				0	15,302
1980	50	150		200	19,669
1981	50	134		184	11,425
1982		215		215	17,274
1983		90		90	12.353
1984		171		171	10,525
1985	500	100		600	9,867
1986	800	53	300	1,153	12,619
1987	2,000	244	400	2.644	13,827
1988	5,889	170	1.000	7,059	20.807
1989	16,452	360	4,000	20,812	35,650
• 1990	12.209	665	4.108	16,982	31,000

Sources: DFO North Coast Division

• Preliminary statistics

Table C17: Area 2E and 2W Sockeye Salmon Catch by Gear on Haida Gwaii, 1954-1989

YEAR	AREA 2E CATCH (no. of fish)				AREA 2W CATCH (no. of fish)			
	Seine	Gillnet	Troll	Total	Seine	Gillnet	Troll	Total
1954	33	21	1	55	40	21	0	40
1955	2665	0	3	2,668	4,381	0	0	4,381
1956	9	1	1	11	565	1	0	565
1957	3	0	12	15	6,483	0	3	6,486
1958	5	1	28	34	2.973	1	1	2.974
1959	0	454	64	518	831	454	0	831
1960	11	6	1	18	2,088	6	1	2,089
1961	2	0	1	3	1,026	0	0	1,026
1962	38	86	9	133	4,564	86	8	4.572
1963	1	141	22	164	3,203	141	7	3,210
1964	63	527	11	601	1,072	527	8	1.080
1965	16	794	35	845	517	794	8	525
1966	7	160	91	258	2,036	160	4	2,040
1967	8	878	282	1.168	509	878	13	522
1968	10	31	78	119	1,935	31	5	1,940
1969	0	132	50	182	1,283	132	18	1,301
1970	26	185	763	974	308	185	125	433
1971	8	558	235	801	2,332	558	32	2.364
1972	104	29	504	637	4,569	29	102	4,671
1973	524	130	78	732	2,029	130	9	2.038
1974	3070	473	2390	5,933	23,228	473	4.069	27,297
1975	942	311	60	1,313	6.825	311	14	6.839
1976	1209	930	203	2.342	5.175	930	27	5,202
1977	15	835	418	1,268	43,265	835	86	43,351
1978	60	85	3289	3.434	12,942	85	141	13,083
1979	0	0	645	645	180,691	0	289	180.980
1980	4580	143	273	4,996	28.067	143	771	28.838
1981	175	719	10906	11.800	56.804	719	1,550	*58.354*
1982	3	1	1348	1,352	10.069	1	6.707	16,776
1983	0	0	725	725	200.597	0	408	201,005
1984	22	4	286	312	82.654	4	968	83.622
1985	203	15	3717	3,935	10,301	0	13,939	24,240
1986	616	2	9060	9.678	8.167	736	10,651	19.554
1987	12	89	7925	8,026	94	0	75.657	75,751
1988	179	2	616	797	2,971	4	1.879	4.854
1989	47	1013	9285	10.345	11,505	0	240,907	252.412
• 1990	23255	725	21983	45,963	420.218	1,020	528,139	949,377
Average								
1954-1960	389	69	16	474	2.480	69	1	2.481
1961-1970	17	293	134	445	1,645	293	20	1,665
1971-1980	1,051	349	810	2,210	30,912	349	554	31,466
1981-1990	2,451	257	6,585	9,293	80,338	248	88,081	168,595

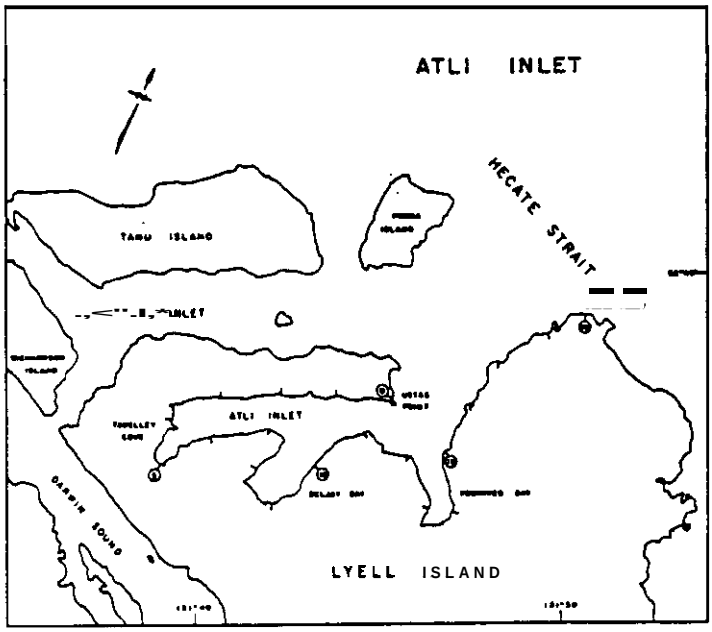
Sources: Orman (1988) for catch and escapement to 1984
British Columbia Commercial Catch Statistics
• Preliminary statistics

Table C18: Area 1 Sockeye Salmon Cmtch by Gear on Haida Gwaii, 1954-1989

YEAR	AREA 1 CATCH (number of fish)				HAIDA GWAII
	Seine	Gillnet	Troll	Total	Total
1954	52	42	31	125	220
1955	0	4	123	127	7.176
1956	1,297	1,398	74	2.769	3,345
1957	0	421	252	673	7,174
1958	1,375	4,173	1.240	6.788	9.796
1959	2	1,020	751	1,773	3.122
1960	196	5,152	295	5,643	7,750
1961	41	2,583	256	2,880	3,909
1962	306	18,661	182	19,149	23.854
1963	276	5,338	265	5.879	9,253
1964	298	10,632	262	11,192	12,873
1965	7,135	19,005	343	26.483	27.853
1966	1,740	14,265	150	16,155	18.453
1967	1.799	30,263	902	32,964	34.654
1968	1.948	48.324	610	50,882	52.941
1969	3,784	40,639	972	45,395	46,878
1970	1,288	56.462	727	58,477	59,884
1971	7,308	48,481	1,135	56,924	60,089
1972	14,045	51,993	702	66,740	72.048
1973	14,770	16,290	463	31.523	34,293
1974	5,015	11,398	9,403	25,816	59,046
1975	9.756	16,844	8.103	34,703	42.855
1976	5,418	7.417	1,151	13,986	21,530
1977	13.294	23.230	2,107	30.639	83,258
1978	4,797	894	799	6,490	23,007
1979	65.288	4.220	4,813	74.321	255.946
1980	46.027	27,026	4,751	77,804	111,638
1981	177,831	42,065	8,837	228,733	298,887
1982	58,665	800	3,840	63.305	81,433
1983	31,315	1,113	3.947	36,375	238,105
1984	21,675	10,034	17,900	49.609	133,543
1985	116,447	1,499	32,969	150,915	179,090
1986	31,200	2,465	21,423	55,088	84,320
1987	33,433	1,904	45,451	80,788	164,565
1988	41,244	402	51,929	93,575	99,226
1989	85,329	1,620	113,512	200,461	463.21 8
• 1990	66,794	2,367	25.943	95,104	1,090,444
Average					
1954-19	417	1,744	395	2.557	5,512
1961-19	1,862	24.617	467	26.946	29.055
1971-19	18,572	20,780	3,343	42,695	76,371
1981-19	66,393	6.427	32.575	105,395	283,283

Sources: Orman (1988) for catch and escapement to 1984
British Columbia Commercial Catch statistics
• Preliminary statistics

Figure C1: Distribution of Atli Inlet herring spawns, 1956-1981.
Source: Haegle and Fitzpatrick (1983)



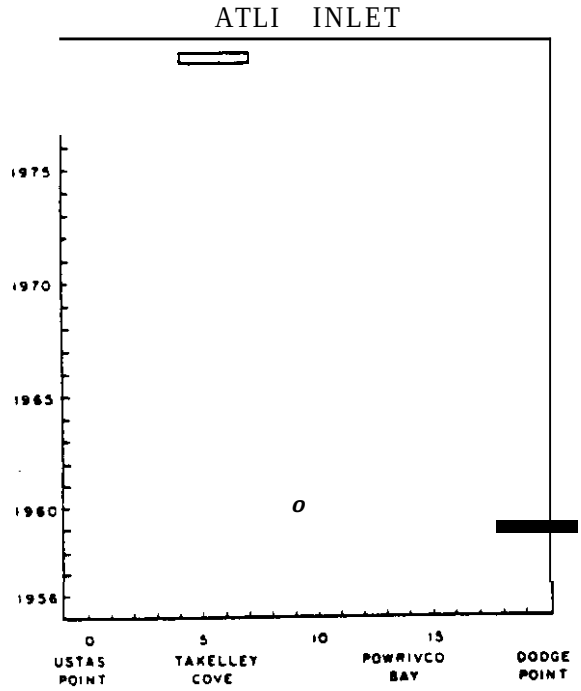
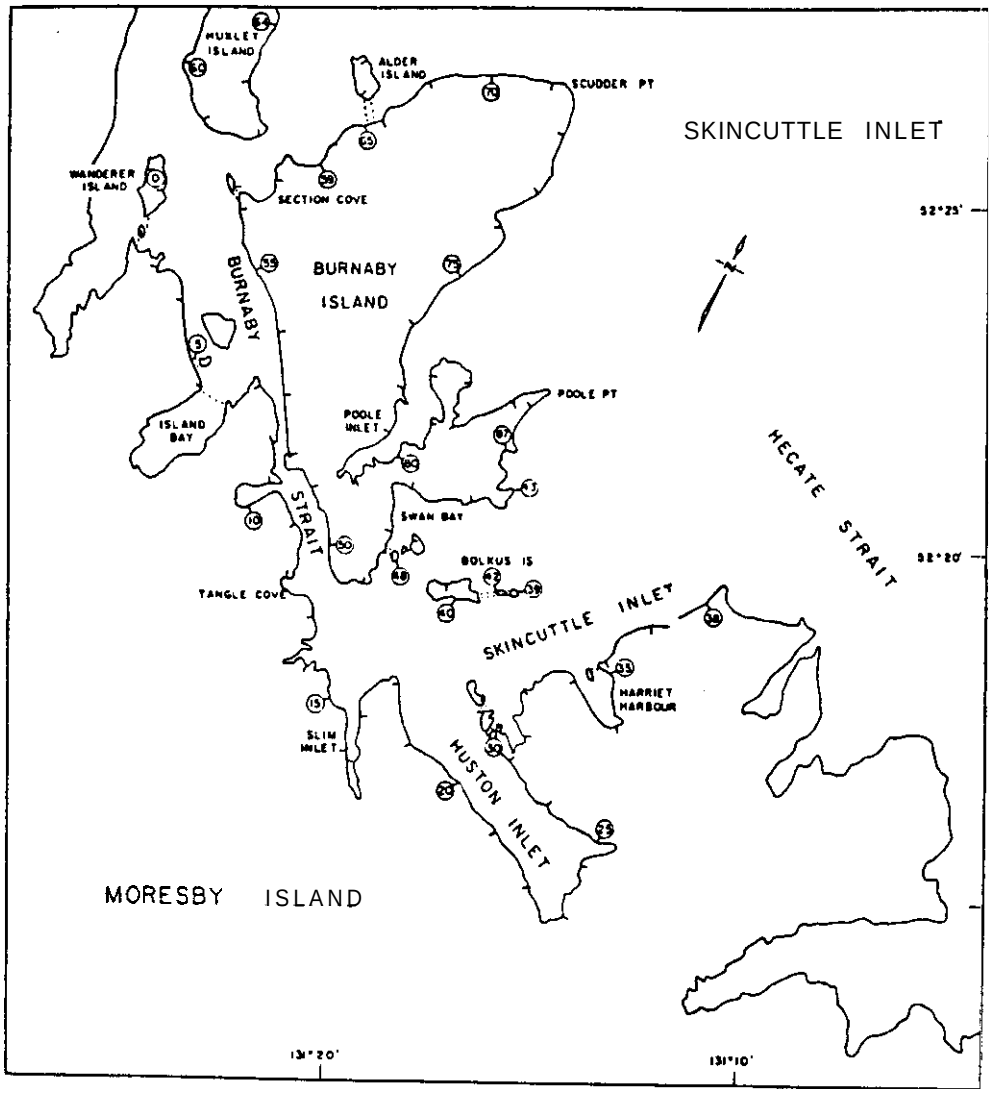


Figure C2: Distribution of Skincuttle Inlet herring spawns, 1956-1981.
Source: Haegle and Fitzpatrick (1983)



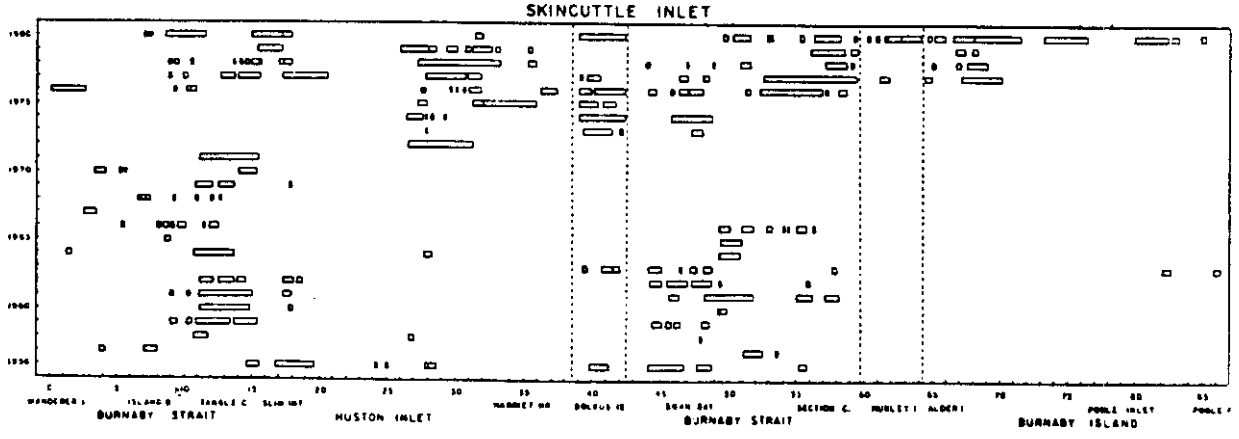


Table C19: Haida Gwaii and Area 2B halibut landings in round weight (tonnes), 1951-1990. *

	Year	Area 1	Area 2E	Area 2W	Haida Gwaii	Area 2B Catch	% H.G.
	1951	1,300.1	2,958.4	436.9	4,695.4	12,119	38.7%
	1952	1,133.2	3,332.7	138.4	4,604.3	12,468	36.9%
	1953	952.4	4,286.1	281.0	5,519.5	14,360	38.4%
	1954	1,051.3	2,531.7	396.9	3,979.9	15,073	26.4%
	1955	732.2	2,063.8	593.1	3,389.1	11,252	30.1%
	1956	1.145.6	2,339.7	584.3	4.069.6	12,168	33.4%
	1957	1,371.5	2,272.9	805.4	4,449.8	10,670	41.7%
	1958	1,878.3	2,357.5	337.7	4,573.5	11,179	40.9%
	1959	1,189.1	1,932.4	376.2	3,497.1	10,253	34.1%
	1960	1,038.1	2,805.3	306.9	4,150.3	10,969	37.8%
	1961	980.4	2,782.3	269.5	4,032.2	9.708	41.5%
	1962	1,082.7	2,762.9	503.9	4,349.5	9,157	47.5%
	1963	1,065.8	2,417.0	521.8	4,004.6	9,570	41.8%
	1964	879.5	1,630.6	868.8	3,378.9	7,315	46.2%
	1965	940.8	1,974.5	835.9	3,751.2	7,459	50.3%
	1966	955.2	1,348.6	605.4	2,909.2	6,867	42.4%
	1967	1,375.6	1,509.4	517.6	3,402.6	6,245	54.5%
	1968	1,024.7	1,627.6	427.4	3,079.7	6,382	48.3%
	1969	865.0	3,067.5	557.8	4,490.3	7,940	56.6%
	1970	770.0	2,952.4	335.6	4,058.0	6,418	63.2%
	1971	670.9	2,869.9	419.5	3,960.3	6,034	65.6%
	1972	466.1	2,826.3	329.2	3,621.6	6,201	58.4%
	1973	526.1	1,872.6	398.2	2,796.9	4,207	66.5%
	1974	424.1	1,277.8	274.5	1,976.4	2,790	70.8%
	1975	616.6	1,380.9	362.0	2,359.5	4,300	54.9%
	1976	537.5	1,689.2	322.8	2,549.5	4,394	58.0%
	1977	425.3	1,426.8	219.0	2,071.1	3,214	63.3%
	1978	392.4	895.1	180.9	1,468.4	2,779	52.8%
	1979	445.6	1,138.5	284.6	1,868.7	2,930	63.8%
	1980	456.2	1,296.8	355.1	2,108.1	3,409	61.8%
	1981	540.1	1,047.0	251.8	1,838.9	3,411	53.9%
	1982	421.9	845.5	158.9	1,426.3	3,341	42.7'1;
	1983	433.8	928.9	199.4	1,562.1	3.279	47.6%
	1984	777.0	1,682.5	492.0	2,951.4	5,461	54.0%
	1985	1,09.7.3	2,948.9	488.6	4,534.8	6,266	72.4%
	1986	717.1	2,599.9	271.3	3,588.3	6,771	53.0%
	1987	1,070.5	3,292.0	386.9	4,749.4	7,386	64.3%
	1988	1,584.2	2,997.2	648.6	5,230.0	7,756	67.4%
**	1989	1,342.6	1,573.5	848.0	3,764.1	6,098	61.7%
**	1990	1,075.9	1,336.7	673.2	3,085.9	5,127	60.2%
	Average						
	1951-60	1,179.2	2,688.1	475.7	4,292.9	17,051.1	35.6%
	1961-70	994.0	2,207.3	544.4	3,745.6	7,706.1	48.6%
	1971-80	496.1	1,667.4	314.6	2,478.1	4,031.8	61.5%
	1981-90	906.0	1,925.2	441.9	3,273.1	5,489.6	59.6%

Source: Argue (1985) for catch statistics up to 1981
British Columbia Commercial Catch Statistics
IPHC (Annual Reports, 1991 Annual Meeting Documents)

* Conversion used was Round wt = 1.33 x (Head-off Dressed wt)

** Preliminary statistics

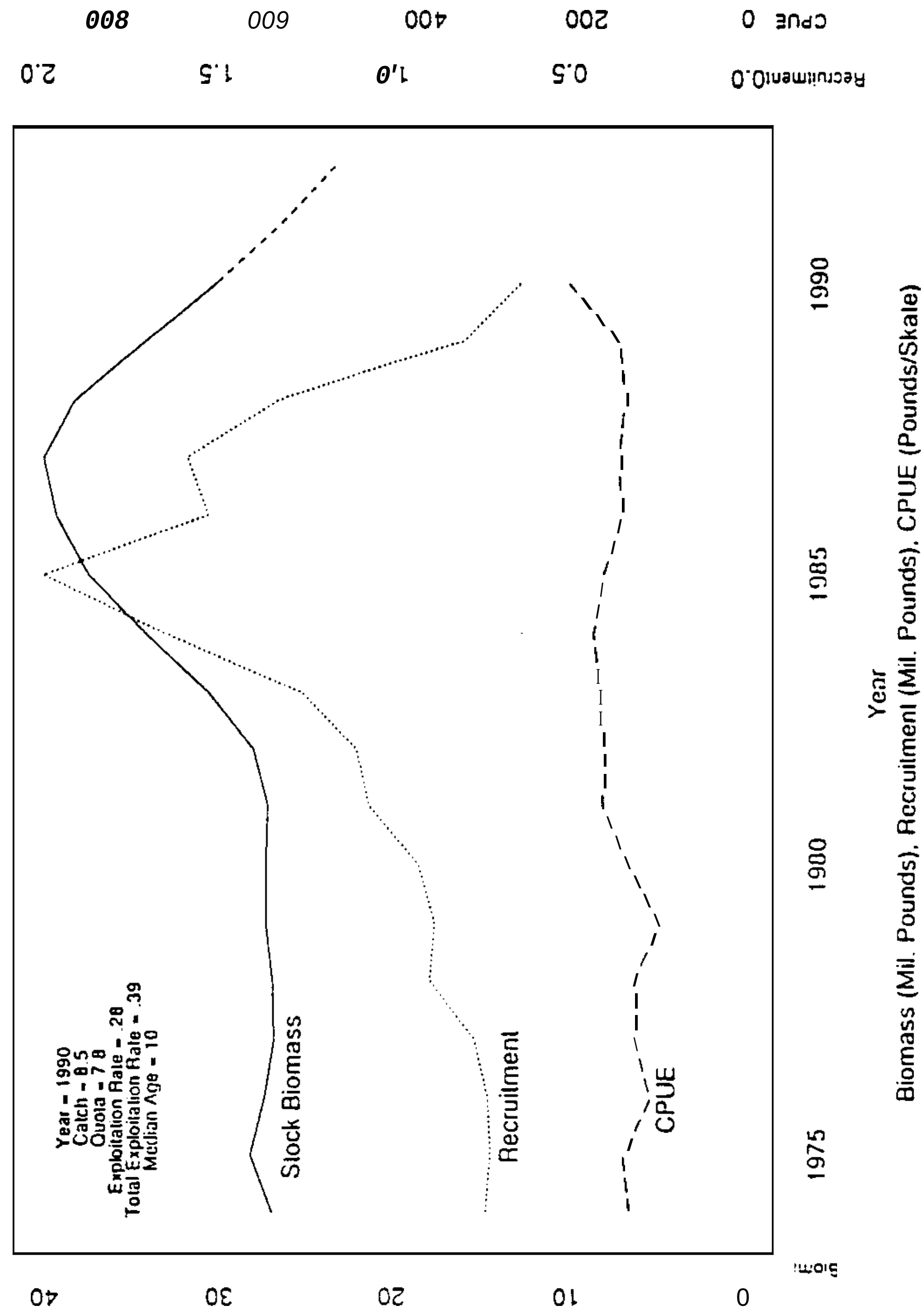
Table C20: Summary of the 1990 commercial Pacific halibut fishery by regulatory area and fishing period (Preliminary)

Source: Gilroy (1991)

Area	Catch Limit (millions lbs)	Opening Date		Closing Date		Fishing Days	Catch (millions lbs)
2A	.195	Jul	10	Jul	10	.5	.175
		Jul	30	Jul	30	.5	.004
		Aug	27	Aug	21	.5	.008
		Sep	11	scp	11	.5	.007
	*.120	My	01	Mar	27	26	.122
* Treaty Indian Catch							.316
2B	7.8	Apr	16	Apr	20	4	1.1
		Jun	14	Jun	18	4	2.9
		Sep	13	scp	15	2	2.9
						10	8.5
2C	8.0	May	01	May	02	1	4.0
		Jun	05	Jun	06	1	5.8
						2	9.8
3A	31.0	May	01	May	02	1	10.7
		Jun	05	Jun	06	1	14.1
		Aug	30	Aug	31	1	4.2
						3	29.0
3B	7.2	May	01	May	02	1	2.8
		Jun	05	Jun	06	1	5.3
						1	8.1
4A	13	May	01	May	02	1	0.050
		lun	05	Jun	06	1	0.325
		Aug	14	Aug	15	1	2.035
						3	2.410
4B	1.5	May	19	May	21	2	.550
		May	26	May	28	2	.375
		Jun	05	Jun	07	2	.000
		Jun	11	Jun	12	1	.100
		Jun	16	Jun	17	1	.130
		Jun	23	Jun	24	1	.010
		Jun	30	Jul	01	1	.075
		Jul	07	Jul	07	.5	.075
		Jul	14	Jul	14	.5	.115
						11	1.430
4C	03	Jun	25	Jul	04	**5	0.53
** 5 1-day fishing							
4D	05	Aug	13	Aug	16	3	1.04
4E(NW)	.07	Jun	01	Jun	01	2	<.001
		Jun	07	Aug	11	***44	.020
		Aug	12	Oct	31	80	.015
*** 22 24-y fishing periods						126	.035
4E(SE)	.03	Jun	01	Jun	03	1	.020
		Jun	07	Jun	08	1	.005
		Jul	31	Aug	01	1	.000
		Aug	07	Aug	08	1	.000
		Aug	21	Aug	22	1	.000
		Aug	28	Aug	29	1	.000
						7	.025
Total	58.415						61.186

Figure C3: Area 2B Stock Biomass, Recruitment, and CPUE

Source: Sullivan (1991)



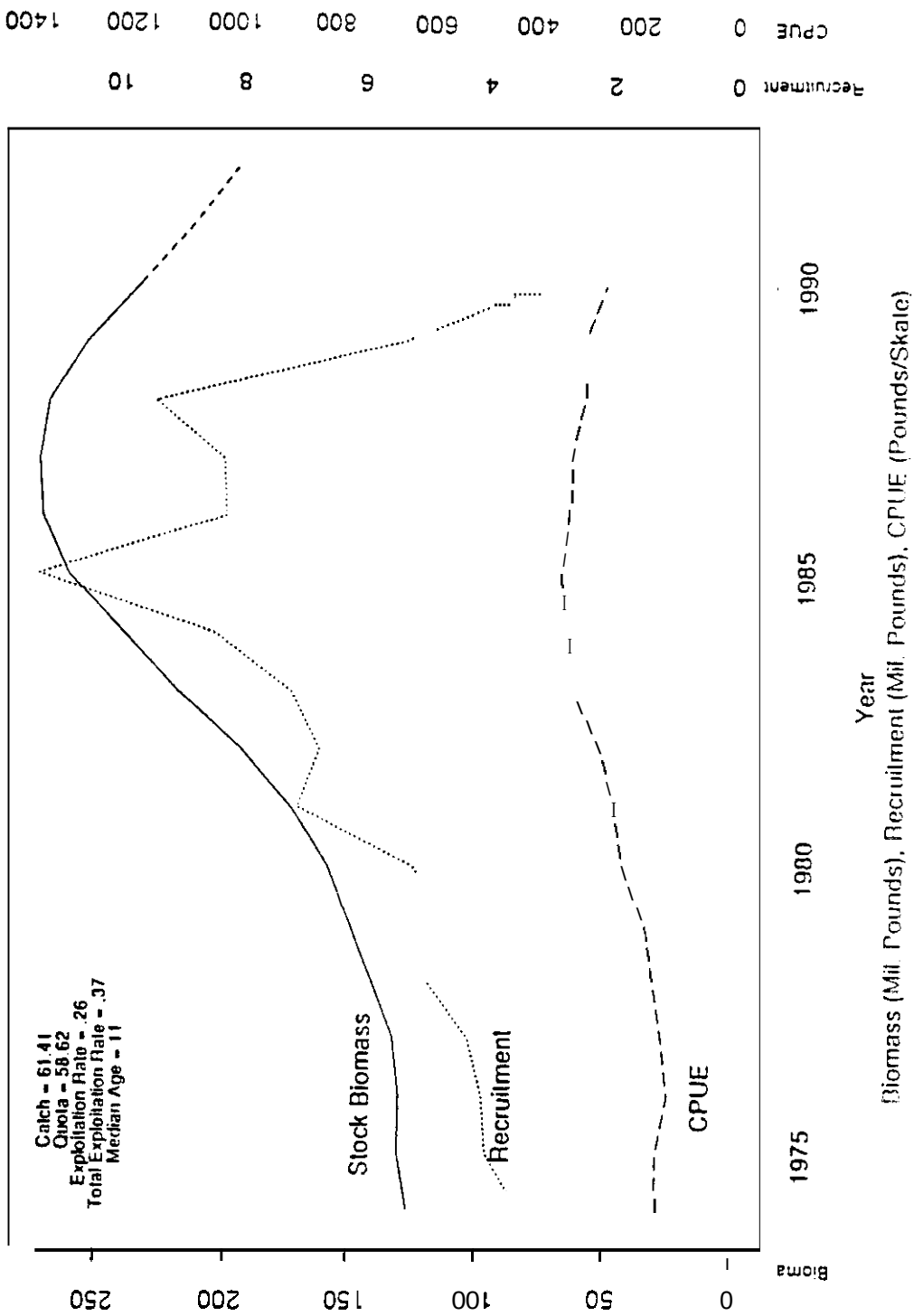


Figure C4: Coast Wide Stock Biomass, Recruitment, and CPUE

Source: Sullivan (1991)

Figure C5: Halibut landings by B.C. fishermen at Canadian and U.S. Ports. 1951-1989.

Source: 1989 Annual Summary of B.C. Commercial Catch Statistics. DFO

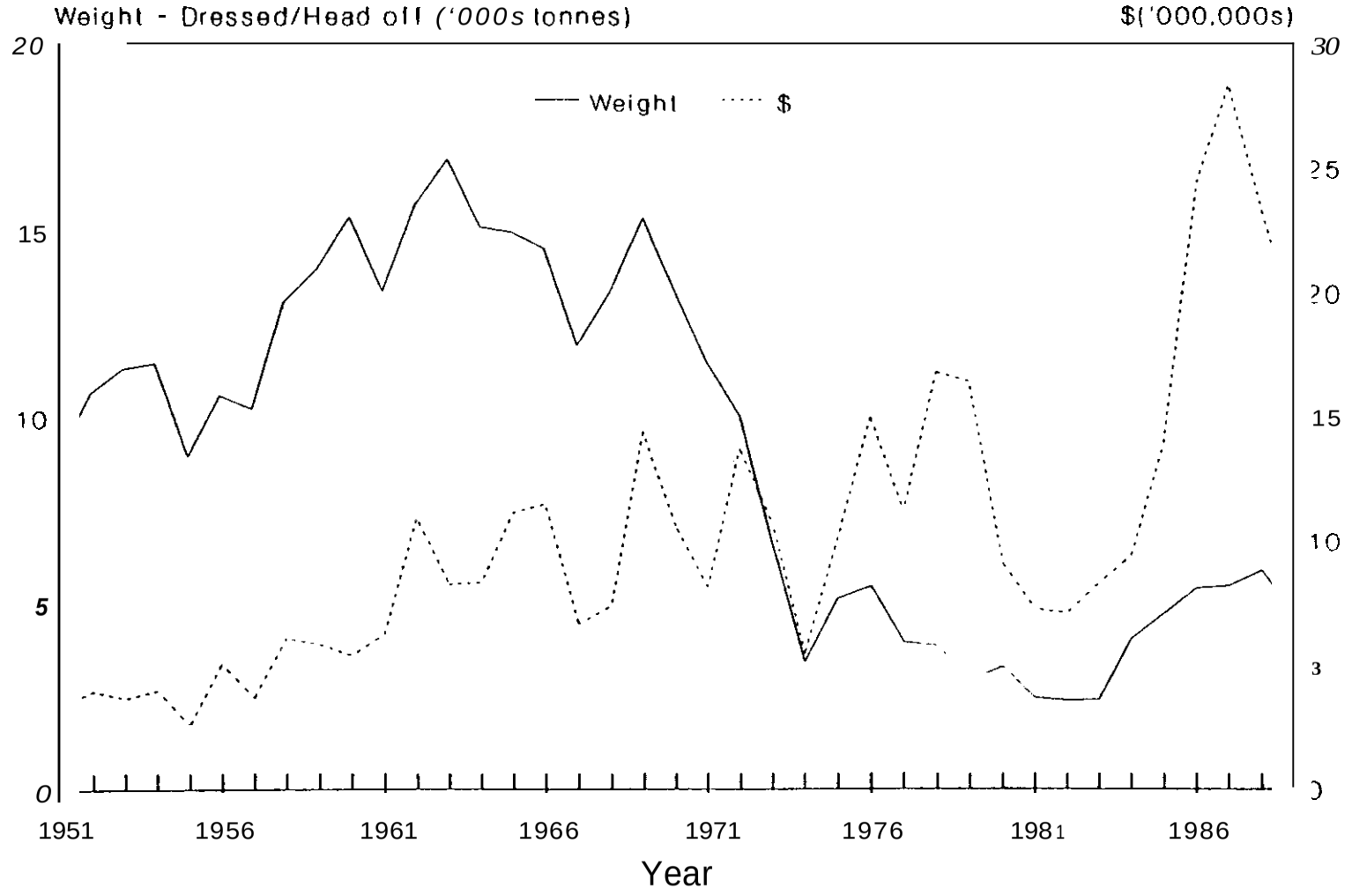


Table C21: IPHC estimates of catch per unit effort (CPUE) for 1976-1988. Data are standardized to circle hook equivalence. Areas 2A and southern 2B CPUE based in part on conversion of "snap-on" gear to conventronal gear

Source: IPHC Annual Report 1988. Anon. (1909)

		IPHC Regulatory Area					
Year	Areas Combined	2A	2B	2C	3A	3B	4
1976	124.8	71.7	116.7	116.0	131.4	142.2	184.2
1977	138.5	182.2	135.3	124.3	134.6	161.3	176.2
1978	155.1	85.5	138.0	155.1	171.9	116.4	166.7
1979	159.7	110.0	105.8	220.8	189.0	80.8	146.1
1980	204.0	82.0	143.7	218.4	260.6	249.5	124.2
1981	232.3	134.4	175.7	273.6	250.8	294.6	236.8
1982	253.8	127.0	176.7	355.9	274.1	300.7	172.5
1983	275.1	127.6	180.5	342.9	349.6	335.5	112.1
1984	300.1	127.2	188.8	328.5	412.8	353.1	193.6
1985	311.5	109.4	176.5	354.1	401.2	420.1	296.4
1986	292.9	132.4	154.7	296.4	411.9	322.4	304.6
1987	278.4	62.9	157.1)	244.5	437.0	329.9	276.4
1988	261.2	111.6	151.1	229.6	357.0	478.9	191.3

Table C22: Canadian Sablefish Landings (tonnes)by Gear and Area

Year	Major Areas 5A, 5B, 5C, 5D and 5E **					B.C.	Haida Gwaii	% of B.C.
	Longline	Trawl	Trap	Other	Total		#	
* 1973	116.6	31.7	392.4		540.7	948.2		
* 1974	39.0	38.1	165.6		242.7	492.0		
* 1975	149.9	82.0	427.9		659.8	904.8		
* 1976	47.7	154.2	255.8		457.7	771.9		
* 1977	49.8	98.3	145.7	0.9	294.7	1,085.2		
* 1978	39.0	40.4	395.1	1.4	475.9	829.9		
1979	158.7	132.7	1,067.6		1,359.0	2,036.5	892.9	43.8%
1980	179.7	228.6	1,488.3		1,896.6	3,798.0	1,085.7	28.6%
1981	238.1	90.4	2,412.6		2,741.1	3,838.5	1,808.5	47.1%
1982	181.8	88.3	2,595.2	16.5	2,881.8	4,112.1	1,748.8	42.5%
1983	108.4	116.5	2,901.2	15.6	3,141.7	4,408.5	1,438.3	32.6%
1984	153.9	64.8	2,082.2		2,300.9	3,821.0	1,823.7	47.7%
1985	298.9	135.1	1,864.1		2,298.1	4,188.6	1,503.5	35.9%
1986	159.3	184.8	2,215.9		2,560.0	4,411.2	1,168.1	26.5%
1987	164.4	167.9	2,302.5	0.3	2,635.1	5,189.3	1,487.1	28.7%
1988	243.4	176.7	2,016.7	2.1	2,438.9	5,217.0	2,014.5	38.6%
1989								
1990								
Average								
73-78	73.7	74.1	297.1	0.4	445.3	838.7		
79-88	188.7	138.6	2,094.6	3.5	2,425.3	4,102.1	1,497.1	36.5%

Source: Saunders ud McFarlane (1990)
B.C. Commercial Catch Statistics

* Foreign landings not included

** Includes Queen Charlotte Sound, Hecate Strait and west coast of Haida Gwaii

\# Statistical Areas 1, 2E and 2W

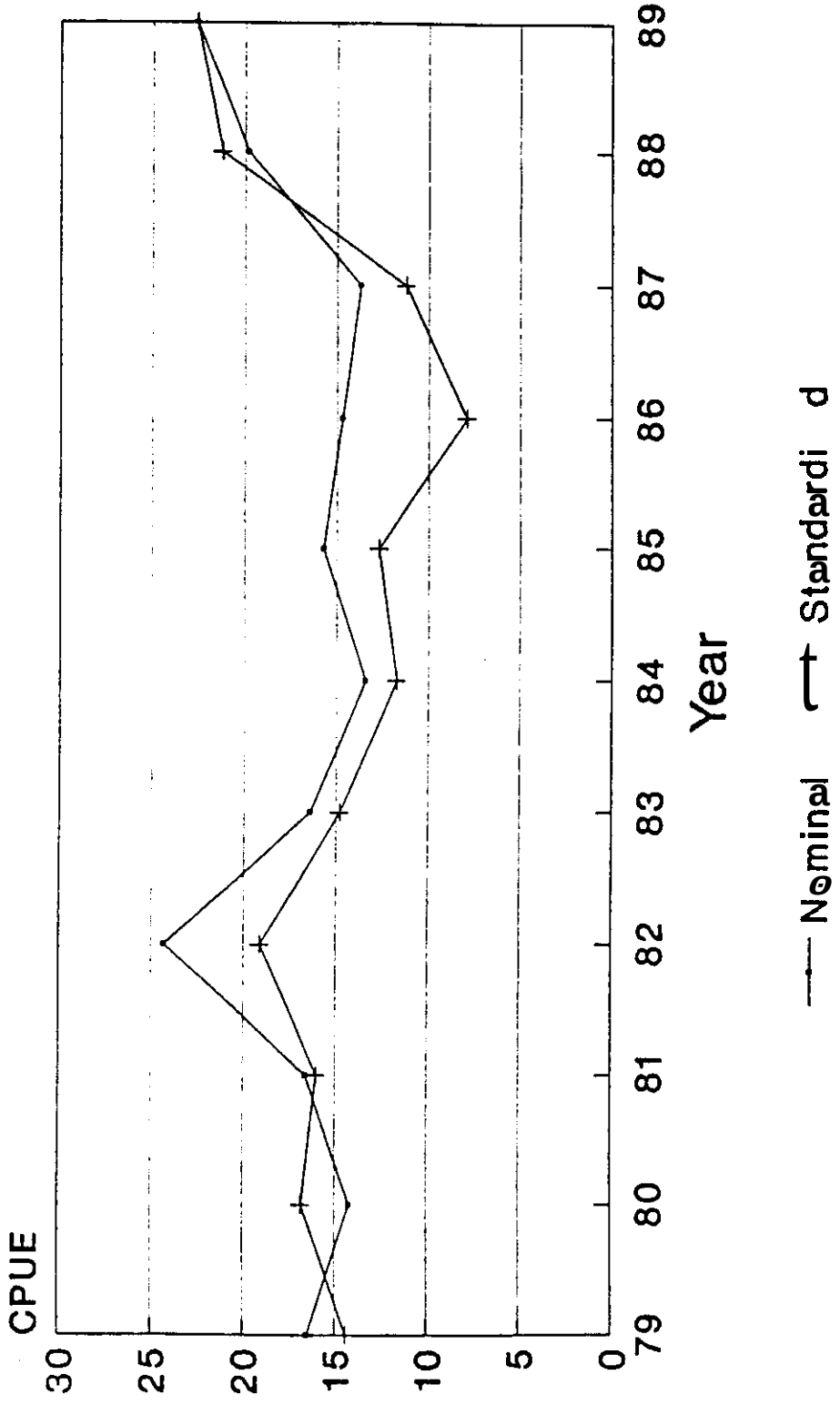


Figure C6: Nominal and standardized CPUE (kg/trap) values for sablefish, 1979-1989.

Source: Saunders and McFarlane (1990)

Table C23: Haida Gwaii Lingcod Catch by Area, 1980-1990

Yew	Area 1	Area 2E	Area 2W	Haida Gwaii	north Coast	B.C.
1980	29.0	48.0	18.0	95.0		
1981	20.8	78.2	15.1	114.1	648.0	1,832.0
1982	32.9	113.8	25.9	172.6	925.0	4,040.0
1983	49.1	104.1	14.4	167.6	1,163.0	3,765.0
1984	52.8	54.3	15.6	152.7	781.0	3,707.0
1985	70.2	94.4	32.1	196.7	965.0	5,688.0
1986	100.5	127.2	55.7	283.4	1,508.0	3,860.0
1987	75.4	243.7	57.9	377.0	1,549.0	3,540.0
1988	101.7	236.0	86.5	424.2	1,506.0	3,444.0
1989	114.0	179.7	75.1	368.9	1,436.2	3,980.4
1990	146.6	155.2	70.0	371.8	1,430.9	3,737.1

Source: British Columbia Commercial Catch Statistics

Table C24: Rockfish Handline/Troll and Longline Landings

YEAR	Handline/Troll Catch				Longline Catch			
	Area 1	Area 2	Haida Gwaii	North Coast	Area 1	Area 2	Haida Gwaii	North Coast
1956	0.0	0.0	0.0	0.4	0.2	1.5	1.7	7.0
1957	0.0	0.0	0.0	0.0	1.2	7.9	9.1	14.9
1958	0.0	0.0	0.0	0.1	0.1	0.5	0.6	3.1
1959	0.0	0.0	0.0	0.0	0.1	0.7	0.8	4.4
1960	0.0	0.0	0.0	3.2	1.6	6.9	8.5	14.8
1961	0.0	0.0	0.0	9.4	0.8	2.9	3.7	6.3
1962	0.2	0.0	0.2	10.5	0.0	13.8	13.8	15.4
1963	0.1	0.0	0.1	17.4	0.0	13.2	13.2	22.9
1964	0.0	0.4	0.4	3.7	0.0	2.5	2.5	4.0
1965	0.0	0.0	0.0	2.0	0.0	10.1	10.1	13.6
1966	0.0	0.0	0.0	2.7	2.7	3.7	6.4	12.6
1967	0.1	0.0	0.1	9.6	0.9	8.4	9.3	18.4
1968	0.0	0.0	0.0	4.2	1.5	1.3	2.8	6.0
1969	0.0	0.0	0.0	4.5	0.0	10.5	10.5	34.4
1970	0.0	0.1	0.1	32.3	0.0	12.7	12.7	57.6
1971	0.0	0.1	0.1	13.9	2.0	25.1	27.1	54.9
1972	0.0	0.0	0.0	25.1	0.0	19.0'	19.0	41.2
1973	0.5	2.3	2.8	6.0	0.0	11.5	11.5	43.6
1974	0.5	1.1	1.6	7.1	0.7	36.3	37.0	79.0
1975	0.9	1.0	1.9	8.5	3.4	69.4	72.8	111.6
1976	0.2	1.4	1.6	11.3	4.1	17.3	21.4	64.0
1977	0.2	3.6	3.8	13.9	2.3	29.5	31.8	61.3
1978	2.0	5.0	7.0	23.0	3.0	51.0	54.0	115.5
1979	1.0	5.0	6.0	27.5	15.0	66.0	81.0	116.0
1980	4.0	3.0	7.0	28.5	22.0	61.0	83.0	104.5
1981	2.4	5.3	7.7	14.2	17.1	46.4	63.5	84.2
1982	1.7	5.4	7.1	13.2	8.2	33.5	41.7	59.3
1983	3.1	2.0	5.1	13.2	10.1	26.3	36.4	50.8
1984	3.8	6.7	10.5	34.0	8.3	81.6	89.9	113.5
1985	1.5	4.2	5.7	34.6	29.5	119.9	149.4	199.2
1986	3.4	4.6	8.0	36.4	24.9	159.8	184.7	255.7
1987	2.9	5.2	8.1	50.9	55.1	193.5	248.6	398.7
1988	3.6	2.2	5.8	117.6	91.4	189.0	280.4	409.8
1989								
1990								
Average								
1969-78	0.4	1.5	1.9	14.6	1.6	28.2	29.8	66.3
1979-88	2.7	4.4	7.1	37.0	28.2	97.7	125.9	179.2

Source: Richards and Hard (1990) from B.C. Catch statistics

Table C25: 'Red snapper' (primarily yelloweye rockfish) handline/troll and longline catch (t) CPUE (kg/d) and effort (d) and other rockfish catch (t), CPUE (kg/d) and effort (d) by geographic region.

Source: Richards and Hand (1990) from B.C. catch statistics data files, 1983-1988.

	'Red Snapper'			Other Rockfish		
Year	Catch	CPUE	Effort	Catch	CPUE	Effort
A) East Coast Vancouver Island, Statistical Areas 12-20, 28, 29						
1983	26.8	44.0	609	270.9	49.3	5495
1984	46.3	37.9	1222	300.8	44.8	6714
1985	83.2	35.2	2364	354.8	50.2	7068
1986	93.6	57.9	1616	433.3	59.5	7282
1987	91.5	56.5	1619	312.1	53.1	5878
1988	124.2	48.8	2545	355.9	55.5	6413
B) West Coast Vancouver Inland, Statintical Area6 11, 21-27						
1983	33.4	69.5	480	65.9	40.2	1639
1984	66.7	121.2	550	71.0	51.0	1392
1985	111.2	152.4	730	90.2	69.2	1303
1986	362.4	202.3	1791	216.9	111.5	1945
1987	301.2	138.3	2178	293.7	88.9	3304
1988	272.2	215.2	1265	216.5	103.5	2092
C) Queen Charlotte Islands, Statistical Areas 1-2						
1983	17.6	63.0	279	22.0	40.1	549
1984	26.5	51.7	513	72.1	137.2	526
1985	76.2	136.9	557	74.4	106.6	698
1986	110.6	185.0	598	82.3	131.4	626
1987	105.2	160.2	657	150.9	128.2	1177
1988	181.2	224.0	809	107.9	137.5	705
D) North Coast, Statistical Areas 3-5						
1983	9.0	56.5	159	4.9	23.2	211
1984	19.9	131.7	151	6.2	28.3	219
1985	22.9	75.5	303	16.4	40.4	406
1986	17.2	70.3	245	22.3	70.9	315
1987	45.7	103.2	443	24.9	57.4	434
1988	47.1	105.7	446	16.0	55.2	290
E) Central Coast, Statistical Areas 6-10						
1983	4.3	45.0	96	10.2	51.4	198
1984	6.9	72.4	95	10.5	40.7	258
1985	14.7	56.0	263	24.6	62.3	395
1986	19.8	74.5	266	42.5	85.9	495
1987	45.7	93.8	488	76.5	77.8	983
1988	68.8	101.1	681	106.3	80.0	1329

APPENDIX D

Glossary

actively-managed **stocks:** salmon **stocks** that receive priority with regard to management decisions governing the fisheries: that is, they will cause a fishery to be altered if conservation measures are required. Actively managed stocks are usually abundant, economically valuable stocks.

by–catch: catch of non-target species

catch ceiling: a regulatory **constraint on** the maximum number of fish which ***can*** be caught by a particular fishery.

CEDP: Community Economic Development Program

closures: termination of a fishery in a specified area during a specified time.

counting weir: device, usually a fence, used to temporarily stop migrating adult salmonids to permit enumeration.

cyclic dominance: the tendency for each sockeye spawning area to produce large numbers of fish in some years and not in others. The dominant cycle years are repeated every four years in the Fraser River. Others have **5** years cycles.

directed fishery: commercial fishery directed at a specific stock by time or space.

diversion rate: the proportion of returning salmon (generally referring to sockeye salmon) that returns, for example, to the Fraser via Johnstone Strait.

emergence: stage in salmonid's life when incubation is complete and young fish emerge from the gravel and begin to swim actively in search of food.

enhancement: techniques used to increase the production of salmonid stocks through intervention by man. May pertain to fish culture techniques, stream improvements, etc.

escapement: number of fish which survive all fisheries and are estimated to be on the spawning grounds.

exploitation rate: the probability that a fish will die from fishing during a specified period. Also, the proportion of a group of fish (usually total stock) that are removed by fishing during period.

exploratory opening: see Test Dip Fishery.

Fishery: a fish harvesting activity that is defined by some combination of gear, area, time and/or target species.

Fixed catch approach: management strategy used in a mixed-stock fishery where the catch is held to an absolute number (catch ceiling). The underlying assumption is that stock abundance is increasing or stable, otherwise the ceiling has to be adjusted. (The latter strategy then resembles the fixed harvest rate approach).

Fiied harvest rate approach: management strategy used in mixed-stock fishery. It is assumed that harvest rate *can* be fixed at a constant level (proportion of the available stocks) by constraining time spent fishing or the amount of fishing gear used in a given area for a given time.

foregone catch: fish in excess of those expected to return to spawn in a given stock, and therefore not caught, resulting in escapement higher than target.

fry: a stage in the life of a fish from the time it starts actively swimming and feeding to age 14 days.

hails on the grounds: counts made by fishery officers on patrol vessels or charter patrolmen hailing commercial fishermen while on fishing grounds.

harvest rate: the harvest proportion of a particular group of fish in a specified area over a specified period of time (also defined by species, sex, cohort, harvesting fishery, etc.).

incidental catch: catch of fish other than the target species.

indicator stock: salmon stocks deemed to be representative of adjacent salmon stocks. High quality data are usually gathered for this stock.

interception fishery: a fishery which captures (intercepts) fish from a number of stocks (i.e. is not stock specific). This term is often used to refer to international interceptions, but in this report it is often defined synonymously with mixed-stock fishery. Although mixed-stock problems may result from interception fisheries the two are not really synonymous. The intentive understanding of interception fishery is that it differs from terminal fisheries in that stocks are intercepted before reaching their natal streams. It could be possible to have an interception fishery on a single stock.

IPSFC: International Pacific Salmon Fisheries Commission.

key stock: a large or otherwise important salmon stock for which better quality data are available or will be obtained in the future, equivalent to an indicator or index stock.

management to escapement: management of fisheries in a manner that ensures (within technical limits) that the target escapement reaches the spawning area.

objective: a statement of intent about resource use that is specified with respect to species, area, fishery, or resource use.

odd/even: refers to discrete pink runs which occur in either odd or even years.

optimum escapement: an estimate of the numbers of spawners that will meet (but not exceed) the capacity of the river system.

passively-managed stocks: salmon stocks not directly managed but affected incidentally as a result of active management of other stocks. The fishery will not be altered to protect these stocks, by definition.

pieces: individual fish (in a commercial catch).

policy: a statement of intent about resource use that has a national or regional scale.

production: the number of fish produced, often used in a stock-specific sense or for a particular enhancement project.

productivity: the rate of production, usually in terms of returning adults per spawner (stock specific).

qualla: refers to external chum colour (and therefore quality). Falls between brights (high quality) and darks (low quality). Also known as semi-brights.

raceway: rectangular fish-rearing containers with high exchange rates of water and vertical walls.

satelliting: an enhancement strategy whereby eggs and milt from a particular salmonid stock are incubated and reared in a central facility or different stream, then returned to donor stream.

scale pattern analysis: analysis of the patterns on scales of fish to distinguish between stocks and to identify age composition.

sea pen: net closures suspended in sheltered saltwater bays containing salmon for rearing purpose.

semi-bright: see "qualla".

SEP biostandard: criteria used to estimate production of salmonid reproduction in the wild or in various types of enhancement facilities. Includes estimates of fecundity and survival during each life stage for each species.

shaker abundance: numbers of undersized salmon available for capture by sport and commercial fishermen.

shaker catch: numbers of undersized salmon caught and released by sports and commercial fishermen.

shaker mortality: shakers which do not survive the catch and release program.

silver bright: type of mature salmon (chum) which has a silvery appearance, and is classified as top quality in the fishing industry.

smolts: a juvenile salmon that has undergone or is undergoing physiological and behavioral changes in preparation for migration from fresh to salt water.

stock: fish of a single species that spawn in a particular geographical area at the same time.

strategy: a collection of management actions for meeting an objective.

straying: returning adults which stray from normal migration route and spawn in an area different from the one in which they originated.

stream boundaries: boundaries of an area around the mouth of a river within which fishing is not permitted, to protect pre-spawning adult fish. *See* also "box boundaries".

surplus to escapement: the number of returning salmon beyond estimated optimum or target escapement. These fish are available for harvest and therefore constitute the allowable catch.

target: refers to the level of escapement at which management plans are aimed. It is the best estimate of "optimum" currently available.

terminal fisheries: fishery conducted near the head of inlets or mouths of rivers where discrete stocks can be fished.

test dip fishery: one-day opening of commercial fishery to assess stock strength.

total stock: catch plus escapement

transplanting: releasing hatchery-raised juveniles in a stream other than the one in which the parent stock originated.

window: a period of time during which an activity occurs.

yearling:: a stage in a salmonid's life reached when a new calendar year begins during juvenile rearing period (a subyearling becomes a yearling on January 1st).