ENVIRONMENTAL PROTECTION BRANCH
ENVIRONMENTAL PROTECTION SERVICE
PACIFIC REGION

# PULP MILL ENVIRONMENTAL IMPACT ASSESSMENT
# TAHSIS COMPANY LTD.
# GOLD RIVER, B.C.

Regional Program Report: 79-4

by

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February 1979

## ABSTRACT

In October 1976, the Environmental Protection Service initiated a program to assess the environmental impact of pulp and paper mills in British Columbia. With the co-operation of various other government agencies and the Pulp and Paper industry, EPS compiled relevant resource data and receiving environment monitoring information. After reviewing and evaluating the existing information the environmental quality of each area was assessed and the need for additional monitoring studies determined. This report represents the environmental impact assessment for the Tahsis Company pulp mill at Gold River, B.C.

## RÉSUMÉ

Au mois d'octobre 1976, le Service de la protection de l'environnement a entrepris de'évaluer les répercussions mésologiques des fabriques de pâtes et papiers de la Colombie-Britannique. Aidé de l'industrie et de divers autres organismes gouvernementaux, il a réuni une documentation concernant les ressources ainsi que certains résultats de contrôles portant sur l'environnement affecté. Après avoir étudié ces données, le Service a évalué la qualité environnementale de chacune des régions et déterminé quelles seraient les études supplémentaires qui resteraient a réaliser. Ce rapport fait connaître les résultats ayant trait à l'évaluation des contrecoups imputables à la fabrique de pâte de la Tahsis Company de Gold River, Colombie-Britannique.

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## SUMMARY AND CONCLUSIONS

To date only minimal impact on the flora and fauna of Muchalat Inlet has been attributable to the pulp mill discharge. The depth of effluent discharge and the diffuser system appear to have been effective in dispersing the effluent resulting in no evidence of low dissolved oxygen in surface waters.

Some decreases in intertidal organisms and periphyton have been recorded at the stations nearest the discharge. Of particular interest is the apparent modification in the migrating behaviour of two species of Pacific salmon. Although this subject warrants further research, the noted changes do coincide with the start of operation at the Tahsis Co. Ltd. mill. The inlet supports a substantial commercial fishery and the areas adjacent to the pulp mill, i.e., Gold River mouth and entrance to Matchlee Bay are particularly sensitive.

# 1 INTRODUCTION

The Tahsis Company Ltd. kraft mill at Gold River, B.C., is located on the north shore of Muchalat Inlet on the Gold River delta (Figure 1 and 2). The Gold River is the major contributor of freshwater to the inlet. Muchalat Inlet is a narrow fjord approximately 30 km long, characterized by steep mountainous shores, which flows into Nootka Sound on the west coast of Vancouver Island. The Gold River delta is one of the few areas of level shoreline in the inlet. Thermally induced winds blow seaward for part of the day and reverse direction during the afternoon (T.W. Beak, 1967).

The Tahsis Company Ltd. mill was opened in June 1967, making it the newest pulp mill on the B.C. coast.

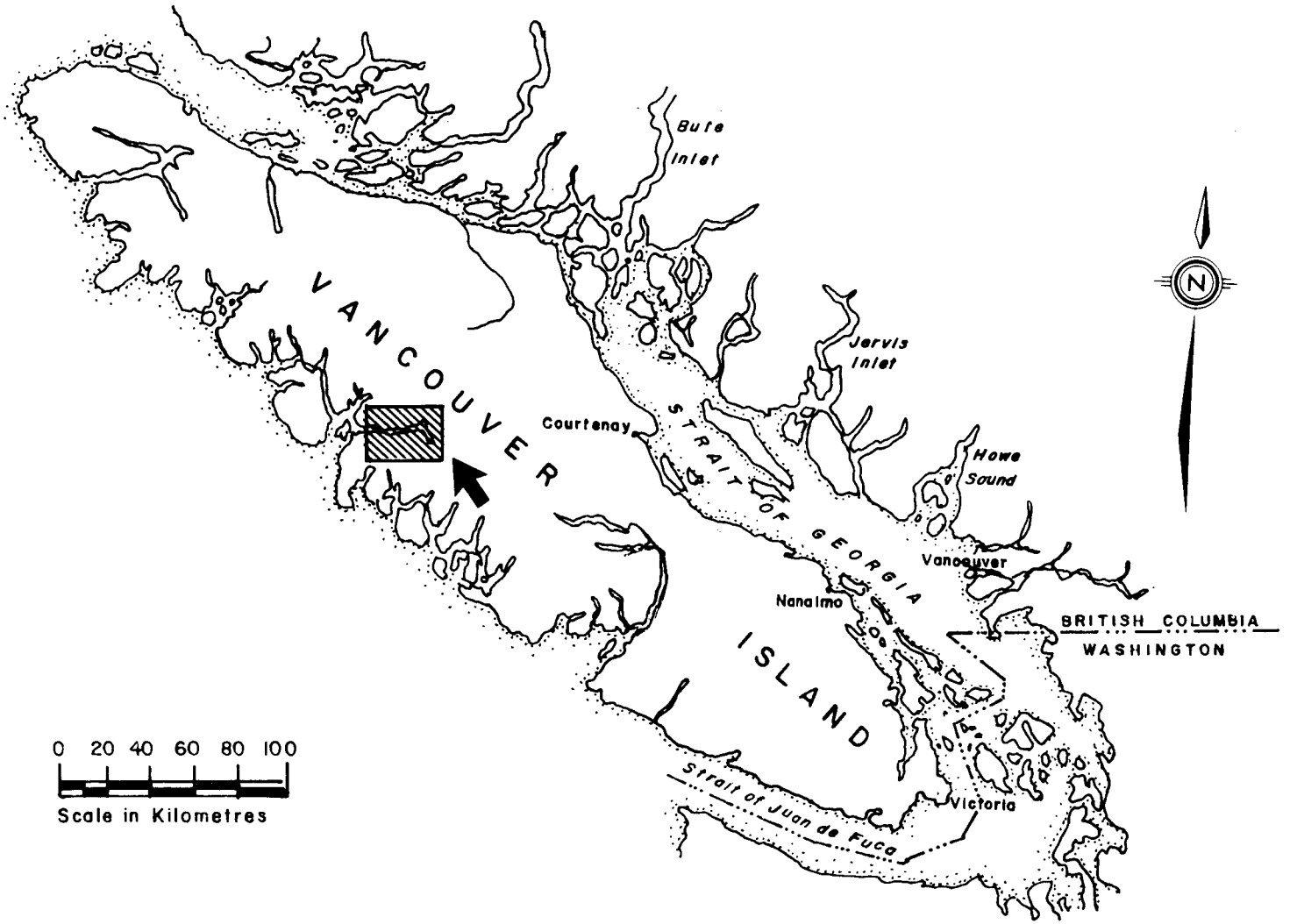
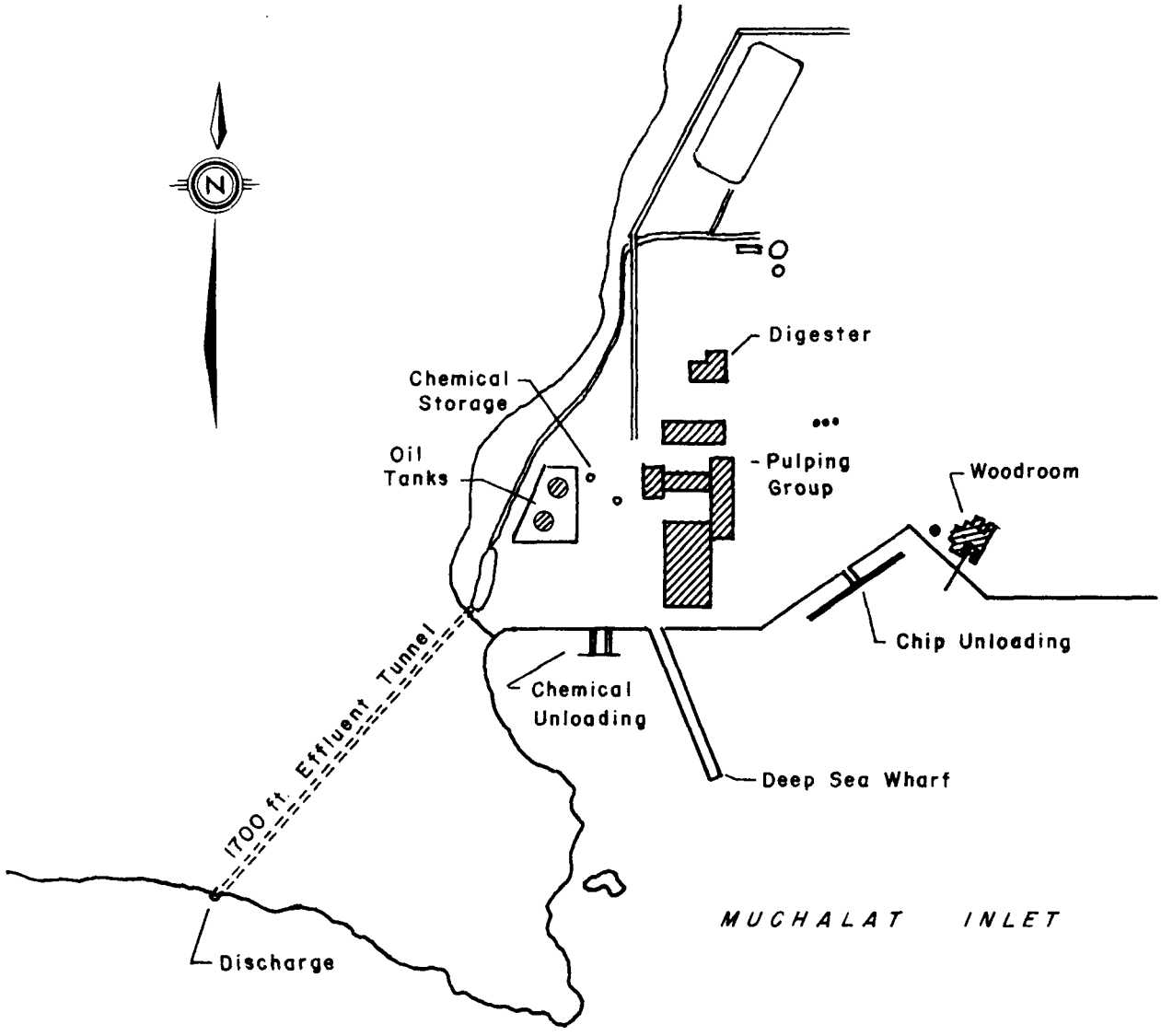



FIGURE 1 LOCATION MAP - MUCHALAT INLET




LOCATION MAP

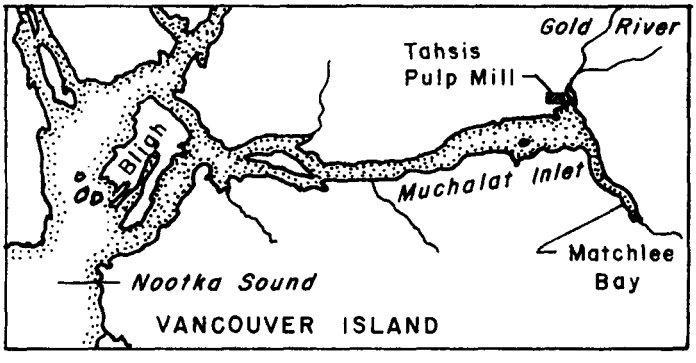



FIGURE 2. TAHSIS CO. LTD., GOLD RIVER PULP MILL

## 2 MILL OPERATIONS

The Tahsis pulp mill has a production potential of 750 air dried tons/day (ADT/D) of bleached kraft pulp. The mill manufactures various grades of pulp. Mill process water is drawn from approximately 5 km up the Gold River but no effluent is discharged into the river. Because of the considerable depth of the inlet, a decision was made to disperse the effluent through a submarine diffuser at a depth 20 meters below the low tide level. A tunnel was drilled through the rock adjacent to the mill to accommodate the effluent pipeline to the diffuser (Figure 2). Shortly after the mill was opened a dye study using Rhodamine B, was conducted to test the efficiency of the diffuser system. The result of the study showed clearly that the diffuser system performed as expected (J. Watkins, E.P.S., on-file). Mill operations including sewer system and effluent characteristics and pollution abatement facilities are discussed in McLean and Tanner (1974).

# 3 EFFLUENT QUALITY

## 3.1 Government Regulations

Tahsis Company Ltd. currently discharges bleached kraft mill effluent (BKME) under a permit issued by the Pollution Control Board (P.C.B.) of the British Columbia Provincial Government. The permit, PE-318, was issued December 17, 1969 and amended February 2, 1976. Effluent characteristics stipulated in the permit are shown in Table 1 and outlined in a report on Pollution Control Objectives for the Forest Products Industry of British Columbia (1974). As an existing mill, Tahsis Company Ltd. will be required by Federal Government Pulp and Paper Effluent Regulations (Environment Canada, 1971) to meet certain standards of biological oxygen demand ($B.O.D._5$), suspended solids (S.S.), and toxicity (Table 2).

The P.C.B. permit applies to a combined effluent from a bleached kraft pulp mill and woodmill hyraulic barkers. Effluent is discharged at depth into Muchalat Inlet through a submarine diffuser, with an estimated flow of 29 million imperial gallons/day.

## 3.2 Effluent Characteristics

3.2.1 B.O.D. and S.S. Tables 3 and 4 show levels of B.O.D. and S.S. based on full-bleached effluent from the Tahsis Company Ltd. mill for 1976 and 1977 respectively. These measurements are taken routinely by Tahsis personnel and the results sent to Provincial and Federal regulatory agencies.

3.2.2 Toxicity. In December 1975, an effluent monitoring program was initiated by Environment Canada to determine the range of toxicity associated with Tahsis mill effluent. Tahsis Co. Ltd. participated in the program by sending composite effluent samples on a regular basis to the E.P.S. bioassay laboratory in Vancouver for static toxicity testing. The results of these tests appear in Table 5. The program of toxicity testing was terminated by E.P.S. in December 1977 possibly to be resumed in two years time.

TABLE 1 P.C.B. PERMIT REQUIREMENTS FOR INDUSTRIAL EFFLUENT FROM TAHSIS COMPANY, GOLD RIVER PULP MILL

| Effluent Characteristics | Value |
|---|---|
| pH Range | 6.5 - 8.5 |
| Temperature | 95°F |
| Floatable Solids | negligible |
| Total Suspended Solids | 31 480 lbs/day (≃15.7 ton/day) |
| Settleable Solids | 2.5 ml/l |
| $B.O.D._5$ | 57 760 lbs/day (≃28.8 ton/day) |
| Toxicity ($LC_{50}$) | 12.5% |
| Mercaptans | < 2.0 mg/l |
| Sulphides | < 2.0 mg/l |
| Residual Chlorine | < 0.1 mg/l |

TABLE 2 FEDERAL EFFLUENT REGULATIONS FOR TAHSIS COMPANY, GOLD RIVER PULP MILL

| | S.S. | $B.O.D._5$ |
|---|---|---|
| Kraft Pulping | 7 lb/ADT | 64 lb/ADT |
| Kraft Bleaching | 6 lb/ADT | 27 lb/ADT |
| Pulp Sheet Formation | 2 lb/ADT | |
| Hydraulic Debarking | 5 lb/ODT of wood | |

Toxicity - 80% survival at 65% effluent concentration (v/v) over 96 hours, continuous flow testing.

TABLE 3 1976 EFFLUENT QUALITY RESULTS FOR TAHSIS COMPANY LIMITED, GOLD RIVER PULP MILL

| Month | Flow x10 IG/D | $BOD_5$ LB/ADT | $BOD_5$ Tons/Day | Suspended Solids LB/ADT | Suspended Solids Tons/Day |
|---|---|---|---|---|---|
| January | 29.2 | 38.9 | 14.89 | 76.3 | 29.20 |
| February | 29.9 | 49.0 | 16.74 | 65.7 | 22.43 |
| March | 29.1 | 46.4 | 18.19 | 56.4 | 22.12 |
| 1st Quarter | 29.4 | 44.8 | 16.61 | 66.1 | 24.58 |
| April | 27.3 | 50.0 | 20.07 | 46.6 | 18.70 |
| May | 27.2 | 45.8 | 17.00 | 41.7 | 15.50 |
| June | 27.7 | 91.6 | 23.27 | 73.6 | 18.70 |
| 2nd Quarter | 27.4 | 62.5 | 20.11 | 54.0 | 17.63 |
| July | 27.5 | 48.7 | 18.15 | 57.9 | 21.59 |
| August | 26.7 | 68.4 | 23.70 | 57.6 | 19.96 |
| September | 27.8 | 55.1 | 19.54 | 40.2 | 14.27 |
| 3rd Quarter | 27.3 | 57.4 | 20.46 | 51.9 | 18.61 |
| October | 30.5 | 62.8 | 24.29 | 43.7 | 16.90 |
| November | 26.4 | 74.3 | 23.63 | 53.4 | 16.98 |
| December | 30.0 | 70.5 | 25.90 | 53.1 | 19.51 |
| 4th Quarter | 29.0 | 69.2 | 24.61 | 50.1 | 18.80 |
| Yearly Average | 28.3 | 58.5 | 20.45 | 55.5 | 19.91 |

TABLE 4 1977 EFFLUENT QUALITY RESULTS FOR TAHSIS COMPANY LIMITED, GOLD RIVER PULP MILL

| Month | Flow x10 IG/D | $BOD_5$ LB/ADT | $BOD_5$ Tons/Day | Suspended Solids LB/ADT | Suspended Solids Tons/Day |
|---|---|---|---|---|---|
| January | 27.8 | 77.3 | 28.45 | 41.2 | 15.15 |
| February | 29.7 | 61.9 | 23.54 | 58.8 | 22.37 |
| March | 29.1 | 57.1 | 20.73 | 49.0 | 17.78 |
| 1st Quarter | 28.9 | 65.4 | 24.24 | 49.7 | 18.43 |
| April | 30.6 | 49.8 | 17.44 | 47.2 | 16.52 |
| May | 30.0 | 57.5 | 21.95 | 45.2 | 17.26 |
| June | 29.9 | 64.0 | 24.04 | 39.0 | 14.64 |
| 2nd Quarter | 30.2 | 57.1 | 21.14 | 43.8 | 16.14 |
| July | 31.4 | 66.1 | 21.68 | 58.6 | 19.21 |
| August | 28.2 | - | - | 28.6 | 12.38 |
| September | 27.6 | - | - | 90.3 | 22.79 |
| 3rd Quarter | 29.1 | 66.1 | 21.68 | 59.2 | 18.13 |
| October | 28.6 | 70.1 | 20.45 | 64.2 | 18.71 |
| November | 29.7 | 44.6 | 15.77 | 45.4 | 16.07 |
| December | 25.0 | 70.4 | 25.63 | 44.4 | 16.16 |
| 4th Quarter | 27.8 | 61.7 | 20.62 | 51.3 | 16.98 |
| Yearly Average | 29.0 | 62.6 | 21.92 | 51.0 | 17.42 |

TABLE 5 TAHSIS COMPANY LIMITED, GOLD RIVER PULP MILL
BIOASSAY RESULTS

| Sample Date | % Survival Over 96 Hours, Static Testing<br>Concentration (% V/V) Effluent | | | | | | Sample pH |
|---|---|---|---|---|---|---|---|
| | 100 | 65 | 45 | 32 | 12.5 | 5.6 | |
| December 2, 1975 | 0 | 0 | 0 | 0 | 0 | 0 | 2.7 |
| February 1, 1976 | 0 | 0 | 0 | 0 | 100 | 100 | 6.1 |
| April 25, 1976 | 0 | 0 | 100 | 100 | 100 | 100 | 6.6 |
| June 7, 1976 | 0 | 0 | 50 | 100 | 100 | 100 | 6.6 |
| August 10, 1976 | - | 0 | 66 | 100 | 100 | 100 | 6.8 |
| October 5, 1976 | - | 40 | 80 | 100 | 100 | - | 6.6 |

| | Concentration (% V/V) Effluent | | | | | | Sample pH |
|---|---|---|---|---|---|---|---|
| | 65 | 56 | 49 | 42 | 37 | 30 | |
| February 8, 1977 | 0 | 0 | 0 | 0 | 0 | 0 | 7.0 |
| April 6, 1977 | 0 | 0 | 0 | 0 | 0 | 0 | 7.3 |
| June 8, 1977 | 0 | 90 | 90 | 80 | 100 | 80 | 6.6 |
| August 31, 1977 | 0 | 0 | 0 | 20 | 20 | 60 | 6.4 |
| October 5, 1977 | 0 | 80 | 100 | 100 | 100 | 100 | 6.9 |
| December 20, 1977 | 0 | 0 | 0 | 0 | 0 | 0 | 7.0 |

Federal Bioassay Requirement - 80% survival in 65% (V/V) effluent concentration over 96 hours, continous flow testing.

PCB Bioassay Requirement -50% survival in 12.5% (V/V) effluent concentration over 96 hours, static testing.

3.2.3 Pollution Abatement Program. Although the company has completed several water pollution abatement projects in order to improve effluent quality, additional in-plant facilities are necessary. Improvements to the cleaner reject system are planned to reduce the suspended solids levels. The company has not scheduled plans for primary out-plant treatment as they feel the requirements for toxicity and suspended solids can be met without these facilities. As well, considerable effort is being placed on air emission control. The company has stated it is prepared to provide additional water pollution control if the receiving water quality indicates a need. An extension of the program of improvements as outlined in the amended P.C.B. permit requires the mill to be in compliance with Provincial effluent requirements by December 31, 1978.

# 4 RECEIVING ENVIRONMENT

## 4.1 Oceanography

Oceanographic investigations of Muchalat Inlet were carried out by Waldichuk, et al, in 1959, 1961, 1962, and 1966 (Waldichuk, 1968). Water quality surveys are currently conducted by the company on a quarterly basis.

As previously mentioned, Muchalat Inlet is a true fjord, approximately 30 km long, which empties into Nootka Sound. The main basin reaches a maximum depth of 400 metres; however, water exchange due to tidal action and the outflow of freshwater is restricted to the level of the sill at Gore Island (120 metres). The sill prevents regular flushing of the deep water of the main basin and has resulted in extremely low dissolved oxygen levels near the bottom. This condition was recorded during the oceanographic surveys of Waldichuk in 1959 (Waldichuk, 1968) and appears to still persist.

The Gold River is the major contributor of freshwater to the inlet with a low flow of 5 C.M.S. and a maximum of 420 C.M.S. Turbid surface water conditions at the head of the inlet are observed after periods of heavy rainfall which temporarily increases the flow and silt content of the Gold River. Changes in salinity, temperature and currents also occur during seasonal fluctuations in the river.

## 4.2 Impact Studies

Beak Consultants Ltd. and the environmental control department staff of Tahsis Company Ltd. have conducted pre and post-operational studies of chemical and biological parameters in Muchalat Inlet from 1966 to the present. This constitutes the major portion of the work conducted in Muchalat Inlet to date. Biological surveys have concentrated on investigations of zooplankton, periphyton, intertidal communities, and bioassays. The benthic segment of the program has been discontinued.

The results of the 1976 biological monitoring program indicated a slight reduction in numbers of intertidal organisms and periphyton biomass only at the station located near the effluent discharge (30 m

seaward of effluent pipe casing). Receiving water bioassays conducted by the company close to the point of discharge showed no toxic effect on juvenile Salmo gairdneri (rainbow trout). Zooplankton populations were similar to those recorded in previous years.

A receiving environment monitoring study initiated by the Environmental Protection Service (E.P.S.) in 1976 examined a variety of parameters (Sullivan, 1979 in press). The results of a phytoplankton productivity study indicated there was no serious impact on the phytoplankton community resulting from the pulp mill effluent discharge. The benthic fauna of the area were examined using the Pisces IV submersible and by conducting benthic trawls. The communities at the head of the inlet were greatly reduced when compared to communities further down the inlet, however this effect does not appear to be directly attributable to pulp mill operations. The extremely low dissolved oxygen levels which persist near the bottom in Muchalat Inlet have undoubtedly contributed to reduced benthos. The problem is compounded near the head of the inlet by the build up of fibre beds on the bottom habitat.

The findings of a qualitative intertidal study done by E.P.S. were similar to those of the company study. Analysis of intertidal shellfish and algae indicated there was no heavy metal contamination in Muchalat Inlet.

# 5 NATURAL RESOURCES

## 5.1 Fisheries Resource

A detailed discussion of the fishery resources in Fisheries and Marine Service (F.M.S.) Statistical Area 25, which includes Muchalat Inlet, has been prepared by F.M.S. and is presented in Appendix I. The following will be a brief summary of this information.

Muchalat Inlet supports all five species of Pacific salmon, i.e., pink, coho, chum, sockeye and chinook. The Gold and Burman rivers entering near the head of Muchalat Inlet produce the majority of the stock migrating to the inlet's spawning streams, therefore pollution in this area could seriously effect Muchalat Inlet runs. The commercial fishery off the west coast of Vancouver Island is primarily an offshore troll operation. Pink and chum are taken with nets in Nootka Sound and Esperanza Inlet.

Herring and groundfish fisheries are concentrated mainly in Nootka Sound and in offshore waters. A commercial prawn fishery is active in Tahsis and Tlupana inlets, as well as near the Gold River. The sport fishery consists mainly of chinook and a special permit area created in 1976 protects the chinook escapements from the Gold and Burman rivers.

Since the mill went into operation, changes in the migratory behaviour of the pink salmon have been observed. The pink salmon may selectively avoid pulp mill effluent by remaining in the deeper waters of the upper inlet. Typical migratory behaviour of the chinook has also been affected. Before moving up Muchalat Inlet to their native streams, they hold at the mouth of the inlet. This can result in reduced populations because of delayed spawning and overfishing. Although the altered behaviour has created a management problem for the F.M.S., it appears to be the only recorded effect of the pulp mill operation on the fisheries resource.

## 5.2 Migratory Bird Resource

The data for Muchalat Inlet is extremely limited and probably not representative of the actual importance of the area to the water

fowl. Diving ducks and gulls are known to winter in the estuary of the Gold River. The estuary of the Burman River is known to support dabbling and diving ducks and at least 12 trumpeter swans. Although more studies are required in the area, the estuaries of the other streams entering Muchalat Inlet may well provide good waterfowl habitat (Trethewey, 1977 pers. comm.).

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# APPENDIX I

TAHSIS PULP MILL, GOLD RIVER, B.C.
FISHERIES RESOURCE OF FISHERIES AND MARINE SERVICE
STATISTICAL AREA 25
(Knapp and Cairns, 1978, F.M.S. Internal Report)

The information presented in this document was collated solely for use within the Pacific Region (DFE) "Pulp Mill Review Process": a process designed to determine effluent characteristics, degree of treatment, and effects upon the receiving environment. This task was carried out to identify current and potential conflicts between aquatic resources and effluent disposal in order to priorize pollution abatement efforts.

Opinions expressed in the text reflect the judgement of the authors and contributing personnel.

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DEPARTMENT OF FISHERIES AND THE ENVIRONMENT
FISHERIES AND MARINE SERVICE

# Tahsis Pulp Mill - Gold River, B.C. Fisheries Resources of Fisheries and Marine Service Statistical Area 25

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# TAHSIS PULP MILL - GOLD RIVER, B.C.
# FISHERIES RESOURCES OF
# FISHERIES AND MARINE SERVICE STATISTICAL AREA 25

## I INTRODUCTION

Fisheries Statistical Area 25 (Figure 1), in which the Gold River pulp mill is situated, is located on the west coast of Vancouver Island and extends from Estevan Point in the south to Tatchu Point in the north. The area consists of 300 miles of rocky coastline including Nootka Sound, numerous inlets and 130 miles of salmon spawning grounds.(1)

## II SALMON

### A. Stocks

Area 25 contains all 5 species of Pacific salmon. Local stocks of sockeye are not harvested commercially. The only pressure on the local sockeye stocks is the Indian Food Fishery, which appears to be declining.(1)

Chum salmon produce the most consistently high year-to-year stocks, although the four year average (1968 to 1974) of even-year pink salmon is slightly higher (Table I).(2,3) Chum salmon were over-exploited in earlier years and closures were required to protect their stocks. (1) Even more critical to the decline of chum salmon was improper logging practices which resulted in the flooding of spawning streams and subsequent loss of eggs from stream beds. Enhancement of chum salmon is to take place over the next two years (1977-1979) in four Tlupana Inlet streams; Canton Creek, Conuma River, Sucwoa River and Tlupana River (Figure 2). Incubation boxes will be used to hatch chum fry which will either be held for 30 days or released into rivers as they emerge from the gravel.(4)

Even-year pink salmon stocks originate mainly from the Burman River and have provided a valuable fishery in the past. Stocks, however, are not as heavily exploited now. The odd-year harvest in Area 25 appears to be on non-local stocks as there has not been a major run of odd-year pink salmon in Area 25 since 1963.

Coho and chinook stocks provide an important sport fishery to the area as well as a commercial harvest. Enhancement plans for chinook in the Gold River area are 10 to 15 years in the future.(4)

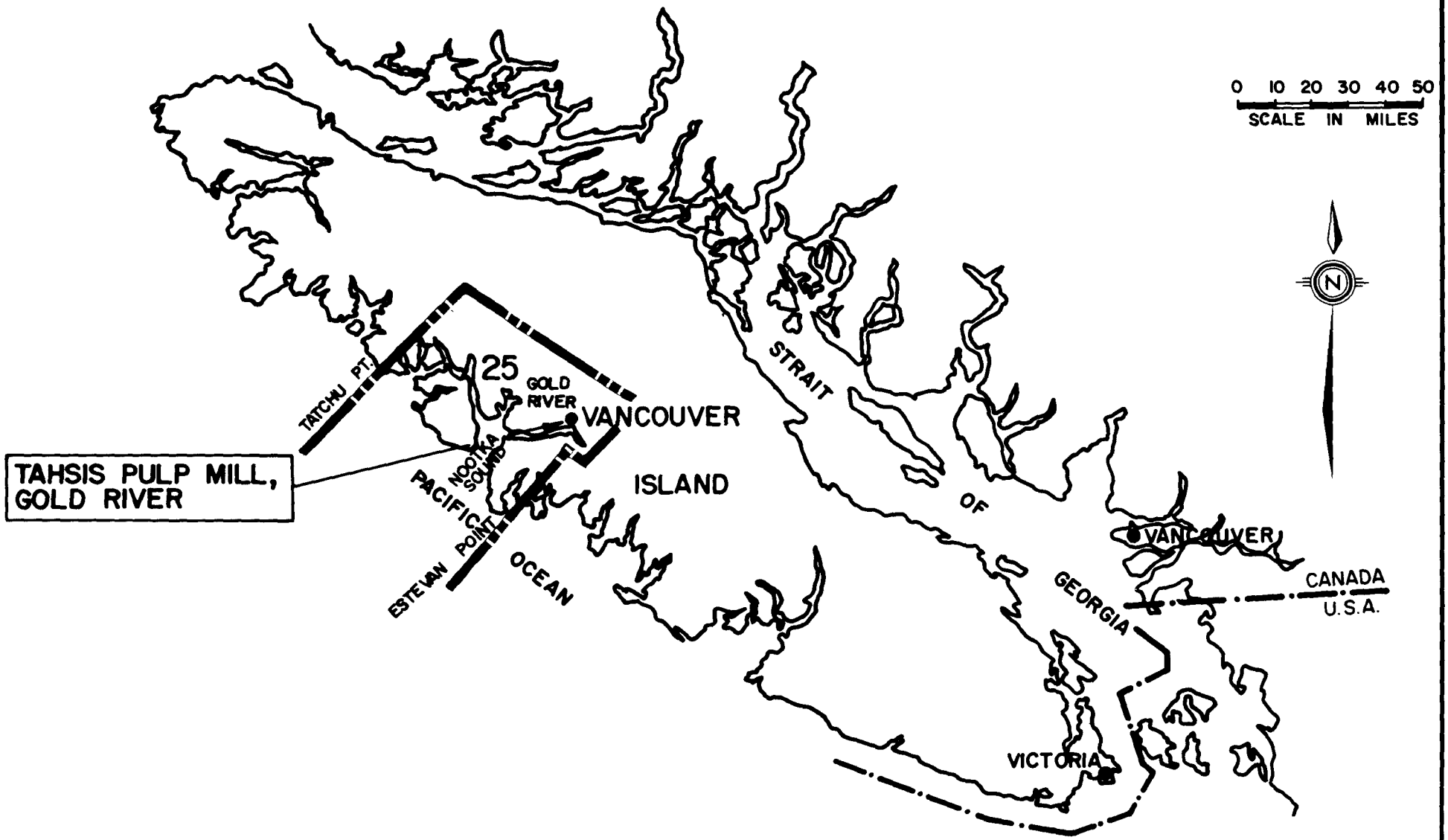


FIGURE 1—LOCATION OF TAHSIS PULP MILL (GOLD RIVER) IN STATISTICAL AREA 25

TABLE I

Salmon Stocks* of Area 25(2,3)

| YEAR | SOCKEYE | CHINOOK | COHO | CHUM | PINK Even/Odd | STEELHEAD** |
|---|---|---|---|---|---|---|
| 1956-60 | 4,000 | 2,400 | 9,250 | 207,400 | 14,700/17,500 | 1,400 |
| 1960-65 | 5,475 | 11,850 | 24,900 | 134,400 | 79,400/14,800 | 1,150 |
| 1966-70 | 3,875 | 8,200 | 18,150 | 97,800 | 191,250/75 | 1,200 |
| 1971-75 | 7,625 | 9,450 | 25,400 | 219,000 | 138,000/4,725 | 450 |
| 1971 | 1,475 | 7,900 | 27,700 | 134,100 | 50 | 5 |
| 1972 | 11,900 | 8,050 | 30,900 | 240,400 | 277,600 | 5 |
| 1973 | 12,400 | 13,450 | 31,000 | 329,500 | 13,100 | 2,200 |
| 1974 | 2,650 | 11,400 | 22,300 | 263,100 | 48,600 | 5 |
| 1975 | 9,700 | 5,900 | 15,000 | 127,800 | 1,000 | 75 |

* Stock=commercial net catch + sport catch + Indian food fishery catch + escapements

** Steelhead populations are only noted incidentally to salmon escapements and are therefore often underestimated.

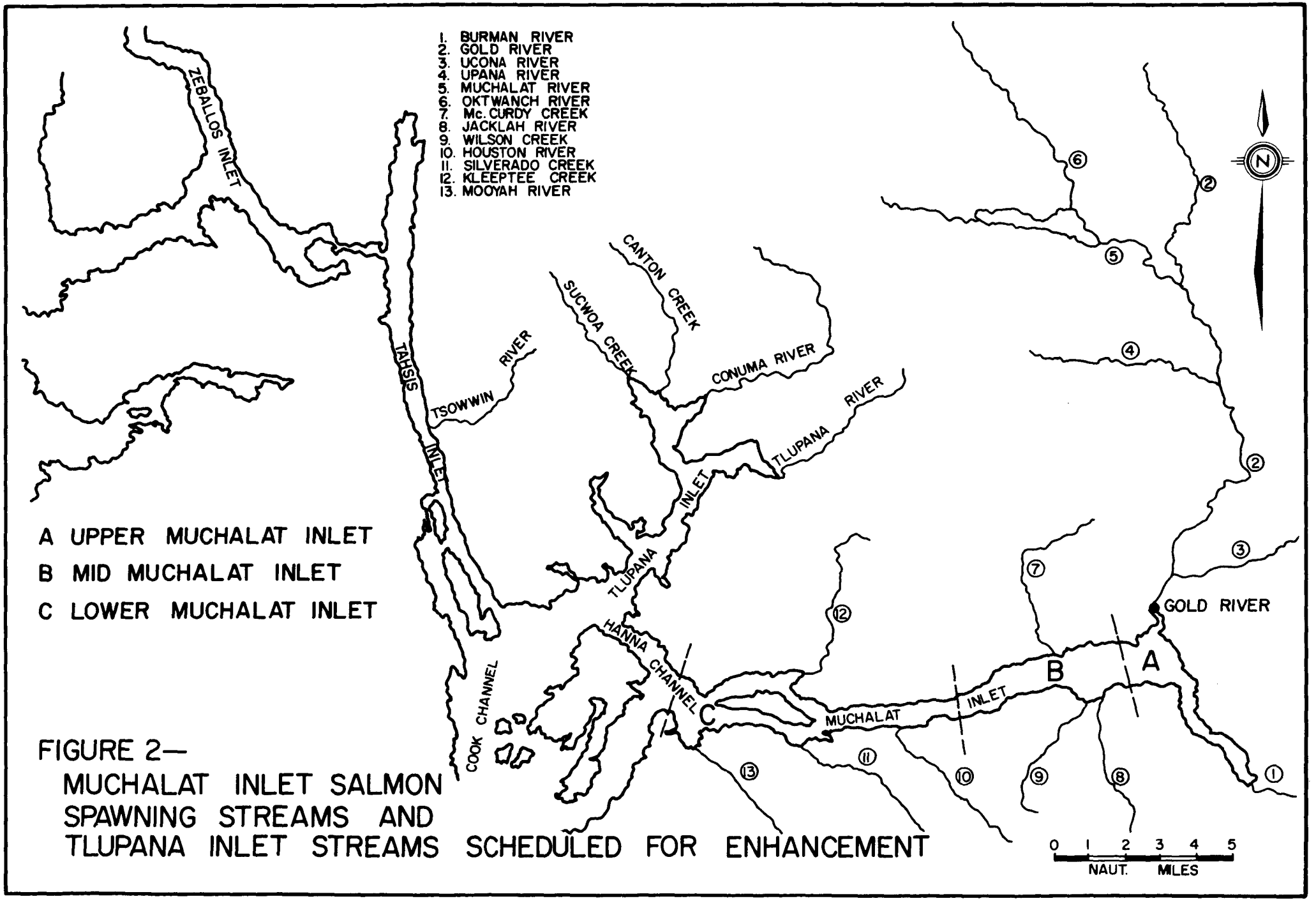


FIGURE 2—
MUCHALAT INLET SALMON SPAWNING STREAMS AND TLUPANA INLET STREAMS SCHEDULED FOR ENHANCEMENT

TABLE II

Commercial Harvest of Area 25 Local* Stocks(2)

(numbers of fish)

| YEAR | SOCKEYE | CHINOOK | COHO | CHUM | PINK Even/Odd | STEELHEAD |
|---|---|---|---|---|---|---|
| 1956-60 | 5 | 650 | 2,850 | 92,400 | 2,400/0 | 2 |
| 1961-65 | 85 | 200 | 3,000 | 44,300 | 25/20 | 6 |
| 1966-70 | 85 | 225 | 2,750 | 21,300 | 43,650/0 | 1 |
| 1971-75 | 175 | 3,000 | 10,500 | 107,200 | 975/675 | 5 |
| 1971 | 5 | 500 | 8,200 | 64,800 | 50 | 1 |
| 1972 | 200 | 600 | 8,800 | 103,600 | 550 | 5 |
| 1973 | 350 | 5,400 | 11,400 | 141,400 | 13,000 | 0 |
| 1974 | 100 | 5,200 | 10,650 | 162,900 | 1,400 | 5 |
| 1975 | 225 | 3,300 | 6,000 | 63,400 | 950 | 10 |

* Commercial troll catches are not included as they are mainly offshore catches of fish migrating past Area 25.(7)

B. Commercial Fishery

The commercial fishery off the west coast of Vancouver Island is primarily an offshore troll operation. However, a small inshore fishery takes mainly chum and pink salmon with nets. This fishery concentrates in Nootka Sound up through Cook Channel and in Esperanza Inlet from Steamer Point to Centre Island (Figure 3).(5) Local stocks of steelhead and sockeye are not harvested commercially, but are taken incidental to other salmon fisheries. The only intentional exploitation of local sockeye occurred in 1963 and provided only 340 pieces.(6)

As mentioned previously, the odd-year pink salmon in the commercial catch are not from local stocks because there has not been a major run of odd-year pink salmon in the area since 1963.

Even-year pink salmon do not provide a larger harvest because they are generally unavailable to the net fishery. Since the Gold River pulp mill opened in 1967 pink salmon have migrated through Muchalat Inlet at great depths, probably to avoid pulp mill effluent. In addition commercial fishermen are prevented from carrying on an August pink fishery at the head of Muchalat Inlet because it would expose chinook and summer steelhead to fishing pressure which might deplete their runs.(5) A special net fishery to harvest excess pink salmon occurred in August, 1968 (1) and was concentrated in Muchalat, Tahsis and Esperanza Inlets with the bulk of the net catch of 81,700 pieces (2) coming from the mouth of the Burman River (34,000 pieces).(1) A second special net fishery, in August 1974, was not as productive (1) and the total season's net catch was only 1,400 fish.(2) Care was taken during these harvests to release the chinooks taken incidentally to the pink fishery.(1) A pink salmon fishery in Area 25 is no longer economically feasible because there has not been a fish processing station in Area 25 since 1974 (when one was operating at Esperanza). Therefore, fishermen must use their boats for at least three days a week to deliver fish to market. Pink salmon stocks of Burman River (a major producer) are apparently in water too deep to fish at the entrance of Muchalat Inlet. Those taken at the head of Muchalat Inlet are over-ripe thus reducing their commercial value.(5)

Coho provide a significant fishery to net fishermen (Table II) and also constitute the major income for offshore trollers.

Chinook provide a minor fishery, primarily because their escapements are low. Measures have been implemented since 1956 to protect chinook stocks. Since 1971, large mesh (>8½") gill-net sizes have been used in the early (February-June) fishery to protect juvenile chinook.(8) Strategic closures to net fishing from 1968 to 1974 were employed to protect the chinook in most inlets, but mainly the Muchalat Inlet-Hanna Channel-Tlupana Inlet area where chinook apparently hold to avoid the pulp mill effluent from the Gold River mill.(1)

Chum salmon form the major net fishery of Area 25. Light escapements to the spawning areas led to declining stocks and a closure of the net fishery from 1964 to 1969. Exploitation of chum stocks was allowed only early in the season, before mid-August, or late in the year depending on whether sufficient spawning escapements were achieved. Since 1970, escapements have increased to the point where the net fishery has been re-opened, allowing 2 or 3 weeks of exploitation each year.

c. Escapement

There are 36 known salmon spawning streams in Area 25, with approximately 130 linear miles of spawning grounds.(1) Escapement data for Area 25 (Table III) indicate large fluctuations for all species. In addition, records for some species, pink salmon in particular, are probably underestimates of actual numbers because, unless small streams are enumerated at the time of migration, a large but short-lived escapement can go unreported.(5) Except for chum, the Muchalat Inlet streams contribute the greatest part (43% to 85%) of Area 25 salmon escapement (Table IV).

The timing of adult escapements, especially those of pink and sockeye, depends on adequate rainfall to provide sufficiently high river water levels to allow fish passage.(1) When fish are forced to delay upstream migrations, spawning occurs later in the year, and prespawn mortalities can occur. In addition, dry summers combined with extreme high water conditions in October, often result in damaged redds.(1) Timing of salmon spawning migrations at the head of Muchalat Inlet are presented in the following table.

Timing of Salmon Spawning Migrations in the Gold River Area(1,3)

| SPECIES | START | PEAK | END |
|---|---|---|---|
| Sockeye | May | Late June - late Sept. | Mid-Oct. - early Nov. |
| Pink | mid-Aug. | mid-Sept. - late Sept. | early Oct. - late Oct. |
| Chinook | Aug. | mid-Oct. - late Oct. | mid-Nov. - late Nov. |
| Coho | late July - early Aug. | late Oct. - early Nov. | Dec. - Jan. |

Timing of Salmon Spawning Migrations in the Gold River Area(1,3)

| SPECIES | START | PEAK | END |
|---|---|---|---|
| Chum | late Sept. - early Oct. | late Oct. - early Nov. | Jan. |

Muchalat Inlet, as well as being the major salmon-producing area, is also the receiving water for the effluent from the Gold River pulp mill located at the mouth of the Gold River. Since the pulp mill opened in July of 1967, average pink and sockeye escapements are twice those recorded prior to the opening of the mill.(1) This can probably be attributed to better fishery management and reduced fishing pressure on stocks which apparently move up Muchalat Inlet in deep water.

For disucssion of fisheries resources in relation to the pulp mill, Muchalat Inlet can be divided into 3 arbitrary areas (Figure 2), (Tables V, VI, VII). Upper Muchalat Inlet would probably contain the highest concentration of effluent and fish would be subjected to the severest pollution conditions. The streams in this area, Burman and Gold rivers, produce 100, 99, 87, 75, and 99 (even-year) percent of the sockeye, chinook, coho, chum and pink salmon (1971-1975) respectively, migrating to Muchalat Inlet spawning streams (Table V). Thus, pollution at the head of the Inlet sufficient to cause mortalities or resulting in sublethal responses could severely affect the Muchalat Inlet runs. Mid-Muchalat Inlet streams (McCurdy Creek and Jacklah River) produce only few salmon, mainly chum and coho (Table VI), which would have to pass through lower concentrations of effluent to reach their native streams. Lower-Muchalat Inlet streams (Houston River, Silverado, Kleeptee and Mooyah Creeks) produce a significant number of chum and even-year pink as well as some coho and chinook salmon (Table VII). These fish would probably be exposed to little or no effluent. Other Inlets would probably not be affected by the pulp mill effluent.

Since the mill opened in 1967 the behavior of salmon in Muchalat Inlet has changed.(1) Pink salmon, which were once evident throughout Muchalat Inlet during spawning season in pre-mill years, were not observed jumping or schooling anywhere in the Inlet, after the mill began operation, except at the mouths of the Gold and Burman Rivers.(1) Test fishing in 1974 and 1975 (2) indicated that pinks were not found in the upper layers of Muchalat Inlet waters, but were located in the deeper waters of the inlet.(5) This suggests that pink stocks may selectively avoid the greatest concentration of pulp mill effluent in the Inlet surface waters.(1,5) It is also apparent that because of effluent, chinook hold in Hanna Channel (Figure 2) for up to a month before moving up Muchalat Inlet to the mouths of the rivers.(1) This can lead to reduced populations because of overfishing and delayed spawning dates.

TABLE III

Escapements to All Area 25 Streams(3)

| YEAR | SOCKEYE | CHINOOK | COHO | CHUM | PINK Even/Odd | STEELHEAD* |
|---|---|---|---|---|---|---|
| 1956-60 | 3,750 | 1,350 | 6,100 | 113,300 | 12,000/17,525 | 1,400 |
| 1961-65 | 4,850 | 10,000 | 22,900 | 88,400 | 79,225/14,750 | - |
| 1966-70 | 3,350 | 6,600 | 14,650 | 81,100 | 145,375/75 | 1,200 |
| 1971-75 | 6,900 | 4,900 | 15,900 | 111,400 | 137,000/50 | - |
| 1971 | 1,175 | 5,400 | 19,025 | 68,275 | - | - |
| 1972 | 11,000 | 6,625 | 21,625 | 136,000 | 226,900 | |
| 1973 | 11,350 | 6,425 | 18,800 | 188,100 | - | 2,200 |
| 1974 | 1,925 | 4,300 | 11,075 | 100,200 | 46,975 | - |
| 1975 | 9,025 | 1,900 | 8,900 | 64,475 | 100 | 50 |

TABLE IV

Salmon Escapements to All Muchalat Inlet Streams(3)

| | | | | | | |
|---|---|---|---|---|---|---|
| 1956-60 | 2,700 | 1,000 | 3,175 | 25,350 | 8,200/25 | 700 |
| 1961-65 | 2,925 | 4,500 | 8,195 | 17,150 | 55,350/50 | - |
| 1966-70 | 2,870 | 3,125 | 6,285 | 16,475 | 103,900/0 | - |
| 1971-75 | 5,875 | 2,950 | 6,785 | 16,875 | 91,700/0 | |
| 1971 | 750 | 3,150 | 8,275 | 9,800 | - | - |
| 1972 | 10,000 | 4,800 | 13,775 | 23,600 | 168,000 | - |
| 1973 | 10,025 | 4,400 | 5,350 | 23,300 | - | 1,500 |
| 1974 | 825 | 1,625 | 3,300 | 11,525 | 15,425 | - |
| 1975 | 7,775 | 725 | 3,225 | 16,150 | - | 25 |
| % of Total Area 25 Escapement 1971-75 | 85 | 60 | 43 | 15 | 67/70 | - |

TABLE V

Salmon Escapements to Upper Muchalat Inlet Streams(3)

(Gold R., Burman R. Tributaries)

| | | | | | | |
|---|---|---|---|---|---|---|
| 1956-60 | 2,600 | 875 | 1,540 | 10,200 | 7,900/25 | 575 |
| 1961-65 | 3,450 | 4,200 | 7,300 | 7,800 | 62,350/25 | - |
| 1966-70 | 2,875 | 2,800 | 6,575 | 10,300 | 101,000/0 | - |
| 1971-75 | 5,875 | 2,900 | 5,900 | 12,700 | 91,100/0 | - |
| 1971 | 750 | 3,000 | 7,750 | 8,000 | - | - |
| 1972 | 10,000 | 4,600 | 13,500 | 14,000 | 167,000 | - |
| 1973 | 10,025 | 4,750 | 5,150 | 17,500 | - | 1,500 |
| 1974 | 7,525 | 1,500 | 3,000 | 9,000 | 15,200 | - |
| 1975 | 1,025 | 650 | 3,075 | 15,000 | - | 25 |
| % of Total Muchalat Inlet Escapement 1971-75 | 100 | 99 | 87 | 75 | 99/- | |

* only incidentally noted during salmon enumeration

TABLE VI

Salmon Escapements to Mid-Muchalat Inlet(3)

(McCurdy Creek, Jacklah R.)

| YEAR | CHINOOK | COHO | CHUM | PINK | STEELHEAD |
|---|---|---|---|---|---|
| 1956-60 | 10 | 25 | 275 | - | 111 |
| 1961-65 | 100 | 150 | 175 | - | - |
| 1966-70 | 25 | 150 | 250 | - | - |
| 1971-75 | 35 | 50 | 400 | - | - |
| 1971 | 25 | 75 | 75 | - | - |
| 1972 | 25 | 75 | 800 | - | - |
| 1973 | 25 | 50 | 300 | - | - |
| 1974 | 75 | 25 | 200 | 200 | - |
| 1975 | 25 | 75 | 750 | - | - |

TABLE VII

Salmon Escapements to Lower Muchalat Inlet(3)

(Houston R., Silverado Cr., Kleeptee Cr., Mooyah Cr.)

| YEAR | SOCKEYE | CHINOOK | COHO | CHUM | PINK Even/Odd | Steelhead |
|---|---|---|---|---|---|---|
| 1956-60 | - | 75 | 350 | 14,950 | 300/0 | - |
| 1961-65 | - | 200 | 750 | 9,175 | 900/25 | - |
| 1966-70 | - | 325 | 575 | 5,925 | 2,825/0 | - |
| 1971-75 | - | 100 | 200 | 3,350 | 512/0 | - |
| 1971 | - | 125 | 450 | 1,725 | - | - |
| 1972 | - | 175 | 200 | 8,800 | 1,000 | - |
| 1973 | - | 125 | 150 | 5,600 | - | - |
| 1974 | 50 | 50 | 275 | 2,325 | 25 | - |
| 1975 | - | 50 | 75 | 400 | - | - |

D. Sport Fishery

i) Tidal

The sport catch of Area 25 consists mainly of chinook (Table VIII) with coho a secondary catch. A few pink salmon are taken, and in 1966 and 1970, exceeded even the chinook catch.

A special permit sport-fishing area was created in 1956 at the head of Muchalat Inlet east of the mouth of McCurdy Creek. Free licences were given to sport fishermen in return for records of catches. The special permit area was closed to sport fishing each year for at least one month from August to December, in order to protect the Gold and Burman Rivers' escapements of chinook salmon.(6) In the ten years prior to 1967, 38% of the Area 25 chinook sport catch (Table VIII) was taken from the special permit area.(8) After the Gold River pulp mill opened in July of 1967, the permit area provided only 24% of the sport catch. The number of chinook over 30 pounds caught in the special permit area fell from 46% to 21% in the same period. A drop was also noted in the number of chinook taken per licence after mill operations began. This seems to support the observation that chinook hold at the mouth of Muchalat Inlet and that larger chinook may be more sensitive to the effluent than smaller fish.

Sport fishing effort outside the special permit area concentrates in Hanna Channel, the head of Tlupana Inlet, and Tahsis Narrows.(1) In previous years, the heads of Tlupana Inlet (1964, 1968, 1970-1972) and Tahsis Inlet (1971) were closed to sport fishing for the month of September (September to January in 1964) in order to protect chinook stocks.(6)

ii) Non-Tidal

Steelhead runs to Area 25 are difficult to estimate although it is one of the better producing steelhead areas in British Columbia.(1) The main steelhead fishing streams are the Gold, Burman, Tahsis, Zeballos, and Tsowwin Rivers(1) (Figure 2). Steelhead catch statistics for the more productive streams in Area 25 are given in Table IX. Gold River has been declared a "trophy" river for steelhead by the Provincial, Fish and Wildlife Branch.(2)

E. Indian Food Fishery

The Area 25 Indian Food Fishery is conducted by four reserves with a total population of just over 100 people.(1) For this reason, harvests are low (Table X) and have been decreasing in recent years. Chum and sockeye are the major salmon species taken in the Indian Food Fishery. The sockeye harvested are from local stocks which are not taken by the commercial fishery.

TABLE VIII

Area 25 Sport Catches(8)

| YEAR | TOTAL AREA 25 CHINOOK | CHINOOK* | COHO | PINK Even/Odd |
|---|---|---|---|---|
| 1956-60 | 436 | 242 | 213 | - |
| 1961-65 | 1,558 | 550 | 970 | 112/25 |
| 1966-70 | 1,327 | 222 | 696 | 1,962/12 |
| 1971-75 | 1,492 | 411 | 49 | 142/22 |
| 1966 | 799 | 378 | 850 | 1,525 |
| 1967 | 850 | 295 | 400 | - |
| 1968 | 1,175 | 75 | 730 | 810 |
| 1969 | 2,414 | 189 | 675 | 25 |
| 1970 | 1,398 | 173 | 825 | 3,550 |
| 1971 | 1,997 | 736 | 462 | 1 |
| 1972 | 796 | 294 | 510 | 101 |
| 1973 | 2,140 | 579 | 793 | 60 |
| 1974 | 1,873 | 191 | 590 | 188 |
| 1975 | 653 | 257 | 95 | 4 |

* From special permit area at the head of Muchalat Inlet.

TABLE IX

Area 25 Steelhead Sport Catch (Estimated)*(9)

A. Gold River

| YEARS | EFFORT (DAYS FISHED) | NUMBER OF ANGLERS | CATCH (PIECES) |
|---|---|---|---|
| 1975-76 | 5,740 | 838 | 2,349 |
| 1974-75 | 3,860 | 715 | 2,776 |
| 1973-74 | 6,582 | 979 | 3,412 |
| 1972-73 | 4,278 | 755 | 2,373 |

B. Muchalat River (Tributary to Gold River)

| | | | |
|---|---|---|---|
| 1975-76 | 50 | 18 | 17 |
| 1974-75 | 129 | 30 | 94 |
| 1973-74 | 98 | 31 | 70 |
| 1972-73 | 80 | 23 | 62 |

C. Burman River

| | | | |
|---|---|---|---|
| 1975-76 | - | - | - |
| 1974-75 | 27 | 13 | 14 |
| 1973-74 | 37 | 8 | 12 |
| 1972-73 | 65 | 16 | 414 |

D. Jacklah River

| | | | |
|---|---|---|---|
| 1975-76 | 4 | 4 | 4 |
| 1974-75 | 9 | 3 | 4 |
| 1973-74 | 8 | 8 | 0 |
| 1972-73 | 17 | 10 | 28 |

E. Tahsis River

| | | | |
|---|---|---|---|
| 1975-76 | 27 | 19 | 17 |
| 1974-75 | 234 | 42 | 72 |
| 1973-74 | 166 | 15 | 106 |
| 1972-73 | 113 | 35 | 58 |

F. Zeballos River

| | | | |
|---|---|---|---|
| 1975-76 | | | 421 |
| 1974-75 | | | 349 |
| 1973-74 | | | 219 |
| 1972-73 | | | 73 |

... 2

TABLE IX (Cont'd)

Area 25 Steelhead Sport Catch (Estimated)*(9)

G. Tsowwin River

| YEARS | EFFORT (DAYS FISHED) | NUMBER OF ANGLERS | CATCH (PIECES) |
|---|---|---|---|
| 1975-76 | NO DATA AVAILABLE | | 50 |
| 1974-75 | | | 57 |
| 1973-74 | | | - |
| 1972-73 | | | - |

(Some effort is also made on McCurdy and Kleepee Creeks.)

* Steelhead figures are obtained by a postcard survey system and estimates made from reported figures.

TABLE X

Indian Food Fishery (Salmon)(1,6)

| YEAR | CHINOOK | COHO | CHUM | PINK Even/Odd | SOCKEYE |
|---|---|---|---|---|---|
| 1956-60 | - | - | 1,760 | - | 240 |
| 1961-65 | 129 | 80 | 1,644 | - | 522 |
| 1966-70 | 32 | 34 | 1,327 | 236/0 | 437 |
| 1971-75 | 31 | - | 350 | - | 696 |
| 1966 | 75 | - | 1,975 | 675 | 600 |
| 1967 | 25 | 110 | 865 | - | 1,200 |
| 1968 | - | 27 | 1,220 | 60 | 18 |
| 1969* | 30 | 16 | 1,328 | - | 190 |
| 1970* | 28 | 15 | 1,245 | 34 | 178 |
| 1971 | 50 | - | 1,000 | - | 300 |
| 1972 | 40 | - | 750 | - | 700 |
| 1973 | 3 | - | - | - | 700 |
| 1974 | - | - | - | - | 630 |
| 1975 | 60 | - | - | - | 1,150 |
| 1966-75 | 31 | 17 | 838 | 154/0 | 497 |

Food fisheries occur at Hanna Channel, the entrance to Muchalat Inlet (300-400 sockeye and a few chinook), Esperanza-Tahsis Inlets, Parks River and Ososssitsa Creek.(1) (Figure 3).

## III HERRING

The commercial herring fishery of Area 25 is concentrated in three main areas; Esperanza Inlet, (mainly seines), Nuchatlitz inlet (mainly gill-nets) and Zuciarte Channel.(10) Roe fisheries occur in Esperanza and Nuchatlitz Inlets only, while the Zuciarte Channel fishery is a food fishery. The mean annual (1966-1975) total herring stock (catch + spawners) was 186.4 million fish (13,14,15) of which an average of 24% was taken by the commercial fishery (Table XI).

The major herring spawning grounds are near Nuchatlitz Village, Port Langford and Rosa Harbour to the north, and Friendly Cove and McKay Passage to the south (Figure 3).(11,12) In the 1950's, spawning concentration shifted away from the Nuchatlitz area to the Nootka area and the trend continued into the 1970's. Amounts of herring spawn in these areas is given in Table XII.

No spawnings, or resident populations have been recorded in Muchalat Inlet since 1967.(5,11,12) However, juvenile populations probably utilize Muchalat Inlet to some extent.(7) The timing of spawning in the three general areas; Nuchatlitz is the earliest, with spawning occurring from the beginning of February to the end of March, followed by Esperanza, from the beginning of March to the first week of April. The Nootka area spawning occurs from the second week of March to the beginning of April. However, in 1963, the Nootka area showed May and June spawning, an event that normally occurs only in northern B.C., generally in the Queen Charlotte Islands. A late spawning in April also occurred in Nootka in 1971.(12)

## IV GROUNDFISH

The groundfish fishery of Area 25 is conducted outside of Area 25, in offshore waters, and is probably unaffected by the pulp mill.(5) Commercial catch statistics are given in Table XIII.

## V CRUSTACEANS

The only crabs harvested commercially are taken from Mary Basin in Nuchatlitz Inlet.(1,5) Only a small number have been taken recently (Table XIV). Recreational crab fisheries occur in Esperanza and Nuchatlitz Inlets, however, numbers taken are unknown.(5)

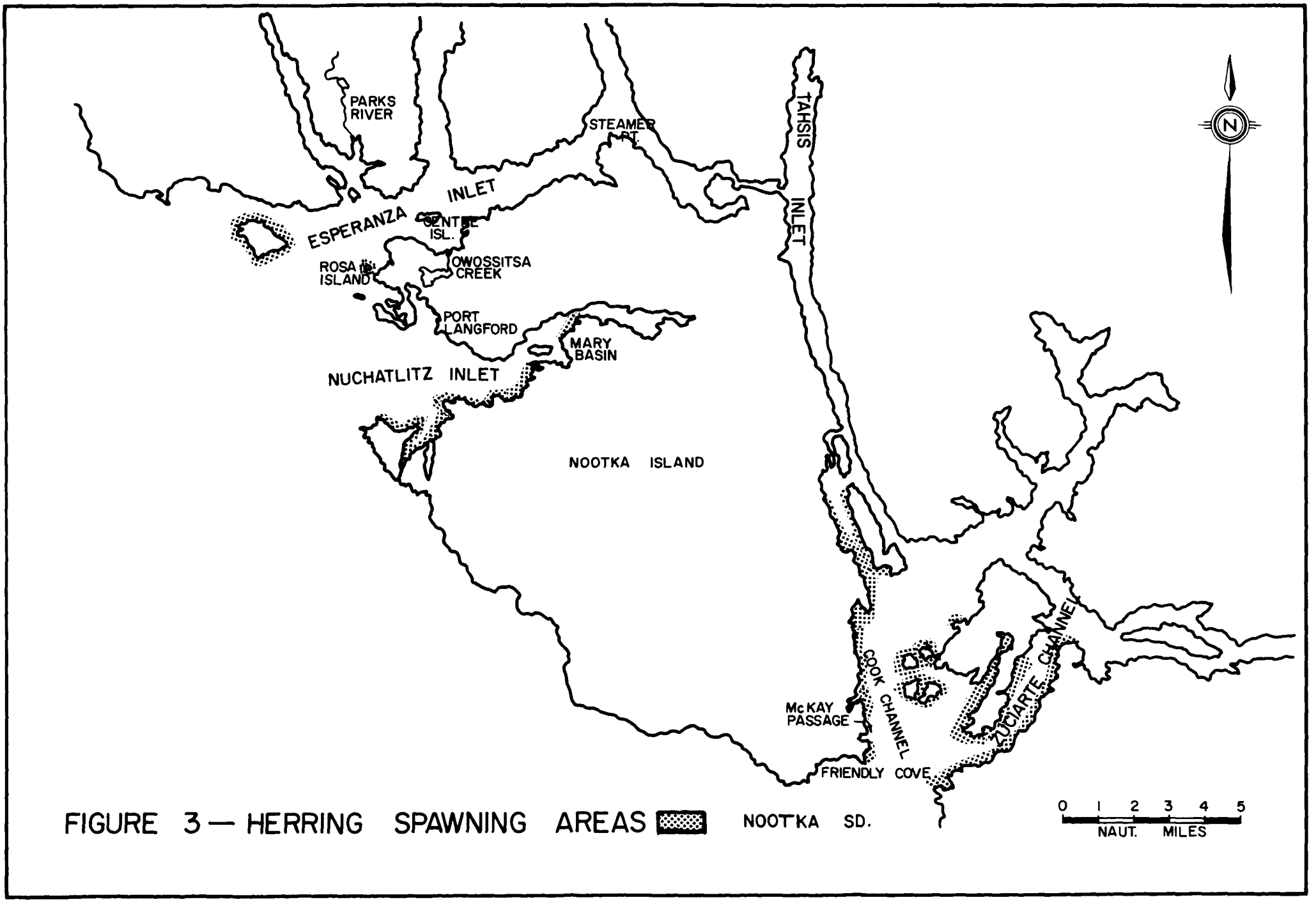


FIGURE 3 — HERRING SPAWNING AREAS NOOTKA SD.

TABLE XI

Area 25 Herring Stocks(13,14,15)

| YEAR | COMMERCIAL HARVEST | SPAWNERS | TOTAL STOCK |
|---|---|---|---|
| | (MILLIONS OF FISH) | | |
| 1956-60 | 138.5 | 280.6 | 419.10 |
| 1961-65 | 78.5 | 72.3 | 150.8 |
| 1966-70 | 15.9 | 166.8 | 182.7 |
| 1971-75 | 38.0 | 152.1 | 190.1 |
| 1971 | 0 | 85.7 | 85.7 |
| 1972 | 19.1 | 267.1 | 476.3 |
| 1973 | 55.2 | 130.6 | 185.8 |
| 1974 | 65.9* | 105.4** | 171.3 |
| 1975 | 49.7* | 171.7** | 221.4 |
| 1956-75 | 67.7 | 167.9 | 235.6 |

* Estimated from catch statistics, assuming 6000 fish/ton.(14)

** Estimated from table XII., assuming 10.6 million spawners/mile of spawn.(14)

TABLE XII

Area 25 Herring Spawn

STATUTE MILES OF HERRING SPAWN(11,12)

| YEAR | NUCHATLITZ | ESPERANZA | NOOTKA | TOTAL AREA 25 |
|---|---|---|---|---|
| 1956-60 | 12.0 | 2.9 | 1.5 | 14.2 |
| 1961-65 | - | - | 6.0 | 9.4 |
| 1966-70 | 3.4 | 1.1 | 9.6 | 7.2 |
| 1971-75 | 4.3 | 2.4 | 6.8 | 13.4 |
| 1971 | 3.1 | .6 | 8.1 | 11.8 |
| 1972 | 9.3 | 7.7 | 2.9 | 20.0 |
| 1973 | 1.7 | 2.2 | 5.3 | 9.2 |
| 1974 | 1.8 | .1 | 8.0 | 9.9 |
| 1975 | 5.2 | 1.4 | 9.5 | 16.1 |

TABLE XIII

Commercial Groundfish Harvest for Area 25(2)

(000's LB.)

| YEAR | CODS | HALIBUT | FLOUNDER & SOLE | NON-FOOD & OTHER FISH |
|---|---|---|---|---|
| 1956-60 | 103 | 49 | 8 | 24 |
| 1961-65 | 162 | 13 | 28 | 45 |
| 1966-70 | 216 | 22 | 52 | 90 |
| 1971-75 | 141 | 16 | 43 | 118 |
| 1971 | 240 | 9 | 85 | 141 |
| 1972 | 141 | 24 | 16 | 199 |
| 1973 | 61 | 15 | 12 | 196 |
| 1974 | 195 | 13 | - | 56 |
| 1975 | 65 | 19 | 19 | 2 |

Thre is a large and active prawn fishery in Area 25, concentrating in Tahsis and Tlupana Inlets and near Gold River.(5) Prior to 1975, as much as 90% of the catch was unreported. However, since 1975, only 25% of the catch has not been recorded in commercial statistics.(5) It is felt that recently, catches have been decreasing,(5) although this is not indicated by the commercial statistics because of the higher percentage of reported catches.

## VI MOLLUSCS

A small commercial clam fishery exists in Mary Basin.(1,5) (Figure3). The fishery began only recently (1971) but the beds are already heavily exploited. Other beds of commercial quality exist throughout Esperanza Inlet, but a closure has been imposed for many years because of paralytic shellfish poisoning.(5) Recreational clam fishing occurs in Esperanza and Nuchatlitz Inlets.

Abalone are heavily exploited by commerical operations in Nuchatlitz Inlet; less heavy exploitation occurs in Esperanza Inlet.(5) There are many abalone along the outer coast of Nootka Island but due to heavy surf they are not utilized by the commercial fishery.(5) Recreational fishing is done mainly by Indians in Nuchatlitz and Esperanza Inlets, with local diving enthusiasts also contributing to the harvest.

TABLE XIV

Area 25 Commercial Shellfish Harvests (Pounds)(2)

| YEAR | CRAB | CLAMS ABALONE | CLAMS BUTTER | CLAMS JAPANESE LITTLENECK | CLAMS NATIVE LITTLENECK | SHRIMP & PRAWNS |
|---|---|---|---|---|---|---|
| 1956-60 | No Record of Commercial Shellfish Harvest | | | | | |
| 1962 | 22,300 | - | - | - | - | - |
| 1963 | 12,100 | - | 22,500 | - | - | - |
| 1964 | 3,000 | - | - | - | - | - |
| 1965 | - | - | 13,600 | - | - | - |
| 1966 | - | - | - | - | - | - |
| 1967 | 64,900 | - | - | - | - | - |
| 1968 | 9,200 | - | - | - | - | 9,200 |
| 1969 | - | - | - | - | - | 22,000 |
| 1970 | - | - | - | - | - | 13,900 |
| 1971 | 1,200 | - | 11,800 | 19,500 | 8,100 | 14,800 |
| 1972 | - | 11,200 | 5,600 | 20,900 | 81,900 | 20,300 |
| 1973 | - | - | 500 | 7,000 | 18,000 | 17,000 |
| 1974 | - | 1,000 | - | - | 8,000 | 7,000 |
| 1975 | 1,000 | 500 | 7,000 | 70,000 | 30,000 | 22,000 |

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