

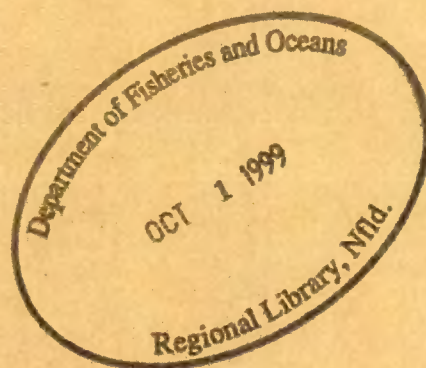


CONSOLIDATION OF FISHERIES RESOURCE INFORMATION WEST COAST VANCOUVER ISLAND

Offshore

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and Aquatic Sciences No. 2120

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ABSTRACT

In 1993, the South Coast Division of the Department of Fisheries and Oceans initiated a program to collect, organize and report information pertinent to oil spill planning from fisheries staff. This report is one of a series which documents fisheries data for the west coast of Vancouver Island. The study area encompasses statistical areas 121 and 123 to 127, the areas seaward of the "surf line". Commercial fisheries which were covered included groundfish trawl, groundfish hook and line or trap, salmon hook troll, and invertebrate fisheries. Recreational and aboriginal fisheries covered include those for lingcod, rockfish, Pacific halibut, sablefish and salmon. Other resources for which data were compiled include marine mammals and euphausiids. The distributions of these fisheries and fisheries resources were mapped and tabulated in a related database.

Key words: west coast Vancouver Island, offshore, fishery resources, oil spill planning

RÉSUMÉ

En 1993, la division de la Côte sud du ministère des Affaires indiennes et du Nord canadien a entrepris un programme de collecte, de classement et de rapport des informations concernant la gestion des déversements de produits pétroliers auprès du personnel de gestion des pêches. Le présent rapport fait partie d'une série d'études visant à formaliser les données sur les pêches de la côte ouest de l'île de Vancouver. La zone étudiée comprenait le secteur 121 et les secteurs 123 à 127 (secteurs au large de la "ligne de ressac"). Les pêches commerciales concernées étaient le chalutage et la pêche aux lignes ou aux trappes des poissons de fond, la pêche du saumon à la ligne traînante, et la pêche aux poissons invertébrés. Les pêches récréatives et autochtones concernées étaient la pêche à la morue-lingue, au sébaste, au flétan du Pacifique, à la morue charbonnière et au saumon. Des données ont également été recueillies sur d'autres espèces, notamment les mammifères marins et les euphausiacés. Le profil de distribution de ces pêches et de ces ressources halieutiques a été cartographié et compilé dans une base de données connexe.

Mots clés: côte ouest de l'île de Vancouver, au large, ressources halieutiques, gestion des déversements de produits pétroliers.

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1. INTRODUCTION

1.1 Objective

Information on fisheries and fish habitat is a fundamental component of oil spill preparedness and response. However, a significant proportion of that information is based on the personal knowledge and experience of Fisheries Officers and other Department of Fisheries and Oceans' (DFO) staff or on unpublished material in field or research offices. Assembling that information at the time that a spill occurs can create critical delays in response.

The purpose of the multi-year Consolidation of Fisheries Resource Information program initiated by the Department of Fisheries and Oceans is to collect, organize and report information from DFO staff and other knowledgeable people regarding fish stocks, fishery activities and fish habitats, based on their personal knowledge and information on file. During year 1, a method and format was developed for collecting, organizing and mapping these data, using statistical area 23 (Alberni Inlet and Barkley Sound) as the pilot area.

This project in year 2 is aimed at adapting the method and format developed in year 1 to the offshore area of west Vancouver Island. The objective is to collect and map fisheries information on hydrographic charts that are referenced to an electronic database.

1.2 Study Area

The study area encompasses statistical areas 121 and 123 to 127, the areas seaward of the "surf line" (Figure 1). Three scales of Canadian Hydrographic Service charts were used in the project:

- chart 3001 (Vancouver Island) covers the entire study area at a scale of 1:525,000;
- charts 3602 to 3605 cover sequential portions at 1:150,000;
- chart 3000 (Juan de Fuca Strait to Dixon Entrance) covers the entire coast at 1:1,250,000.

Chart 3001 was adequate for showing distributions for all fishery resources with the exception of the tuna and salmon troll fisheries. The distribution of the tuna fishery was mapped on chart 3000. Off the south west coast of Vancouver Island where there was detailed distributional information for the salmon troll fisheries, charts 3602 and 3603 were used; further north, polygons were mapped on chart 3001.

Reference is made frequently to offshore areas identified by common geographical names, some of which relate to geographical features identified on the charts (islands, points, sounds, bays, offshore banks and seamounts), but others are known only anecdotally.

1.3 Methods

The tasks developed in year 1 of the program were adapted slightly to accommodate differences in the nature of the fisheries and information sources for offshore west coast Vancouver Island.

Task 1 Definition of fisheries resources

Fisheries resources were defined on the basis of their significance to DFO's mandate in protecting fisheries, fish stocks and habitat in the event of an oil spill, and on their occurrence in the study area. An initial list of resources to be covered in the project was defined in consultation with the scientific authorities. However, the definition of these resources was continuously added to and refined as the project proceeded, as the particular characteristics of the different fisheries and life history stages became evident through the course of interviews and data gathering. The fisheries resources covered are listed in Table 1.

Figure 1. Study area - statisitcal areas 121, 123-127 and 3C, 3D, and 5A.

TABLE 1: Fisheries and Species Covered in the Project - type of coverage

FISHERY	SPECIES	Report	Map	Data-base
Commercial Groundfish Trawl	Pacific cod, lingcod, rockfish, petrale sole, Dover sole, shallow flatfish species, spiny dogfish, Pacific hake, walleye pollock	x	1 a-d	TRAWL
Commercial Groundfish Hook and Line or Trap	lingcod, rockfish, sablefish, Pacific halibut, spiny dogfish, Pacific hagfish	x	2	HOOKLINE
Commercial Finfish Hook and Line	salmon	x	3 (in 3 parts)	SALMON
	Albacore tuna	x	4	-
Recreational	lingcod, rockfish, Pacific halibut, sablefish, salmon	x	5	RECREATN
Aboriginal	lingcod, rockfish, Pacific halibut, sablefish, salmon	x	5	ABORIGIN
Commercial Invertebrate	shrimp, Tanner crab, dungeness crab	x	6	-
	squid (<i>Loligo</i> sp.), flying squid	x	-	-
Other Resources	fur seals, gray whales, killer whales, other marine mammals	x	-	-
	euphausiid distribution	x	6	-

Task 2 Identification of fisheries staff to be interviewed

The project team initially identified DFO staff to be interviewed in consultation with the scientific authorities. The list was subsequently revised and added to as the project proceeded and interviewees suggested additional staff members. Those who were interviewed consisted of staff from Regional Headquarters, the Pacific Biological Station, the South Coast Divisional Office and patrol vessels. Details as to their positions and experience in offshore fisheries management and research are listed in Appendix A.

Task 3 Collection of information from DFO staff

Initial meetings with DFO staff were conducted in April and May 1994 to gather information about the fishery resources with which each was familiar. Meetings were conducted singularly or with 2-3 staff members together. A project team member took detailed notes on a series of topics (Table 2). Charts of the study area were annotated with distribution information as appropriate; in a few cases, DFO staff were able to provide hard-copy mapped information.

Table 2: Topics covered in interviews

GENERAL:

- Experience of interviewee.
- List of species: applicable to offshore? others?

FOR FISHERIES - BY SPECIES and AREA/POLYGON:

- Fishery type: commercial, foreign, recreational, aboriginal.
- Gear.
- Regulatory regime as it affects distribution; e.g. season open.
- Timing of fishing (peak).
- Depth.
- Effort - number of boats total, year round, peak.
- Relative importance in offshore area; entire coast.
- Anecdotal information about nature of fishery.
 - peculiarities of fishing practice.
 - changes in management regime over time.

FOR HABITATS OR LIFE STAGES:

- Habitat type (physiography).
- Use by species.
- Critical periods or stages.
- Anecdotal information about nature of habitat/population.
- Coastal significance.

The knowledge base of those interviewed overlapped considerably. Therefore, it was useful to compile notes and mapped information between interview sessions, so that each session could build on or refine the information gathered from previous interviews.

While the primary goal of this project was to compile information directly from relevant

DFO staff, considerable background information was gleaned from management plans, tables of catch statistics and published papers that dealt with the biology and distribution of the fishery resources being examined. For the most part, these reports and papers were provided by the interviewees to summarize or augment the information that they provided. They are referenced in the appropriate sections of this report.

Task 4 Generation of maps

The fishing areas identified through interviews were integrated and transferred onto the appropriate scale chart. Annotated maps were produced showing the distribution of fishing areas and, where applicable, the species fished in each area. Colour codes were used to differentiate the type of fishery on maps showing more than one fishery (e.g. maps 5 and 6) or the level of use of each area on maps that cover only one fishery (e.g. maps 1a-d, 2 and 3).

As the groundfish trawl fishery is a complex, multi-species fishery, the grounds were mapped for each of the four quarters of the year (maps 1a-d).

Task 5 Generation of databases

The structure of the databases were adapted as the project proceeded to accommodate the nature of the offshore fishery resources.

As described in sections 2 and 3, the groundfish trawl fishery and hook/line and trap fisheries are multi-species in that the same fishing areas are exploited for a variety of species. Consequently, database files for these fisheries were structured to reflect areas fished rather than particular species. In contrast, the database files for finfish troll fisheries, shellfish fisheries and other resources are structured on a species-specific basis.

The database file structures were reviewed with the scientific authorities to ensure that the databases covered all of the variables pertinent to each of the fishery resources and that data could be efficiently retrieved to meet the needs of DFO. The data gathered from the interviews were entered into the databases as the project proceeded, and draft data tables were generated.

Task 6 Drafting of report

Simultaneous to tasks 6 and 7, a draft report was generated that described each fishery resource in terms of data sources, database files, maps, and general information (see "Report Organization").

Task 7 Review of databases, maps and draft report with project authorities and DFO staff

The draft report, maps and database were reviewed with project authorities at the end of May 1994 to assess how well the project was fulfilling its objectives. These draft components were also reviewed with the DFO staff who were interviewed to clarify, verify and elaborate on the information compiled.

Task 8 Final revisions of report, databases and maps

Based on the results of Task 9, appropriate modifications were made, and the report, databases, and annotated charts were finalized.

1.4 Data Qualifications

While all resources were considered important from an oil spill planning perspective, in several cases, site-specific information was not available from DFO staff in sufficient detail to warrant generating a database and/or a map. Table 1 indicates the fishery resources for which database files and/or maps were generated, and which ones are covered only descriptively in the report.

The information provided by management staff and research staff differed in nature and perspective. Management staff tended to deal with fisheries as a collective, identifying fishing areas by gear type rather than by species. In contrast, research staff tended to provide information on a species-specific basis, identifying ranges within which populations existed, and by corollary, where fishing occurred. The differences are theoretically subtle, but in several cases, led to divergent conclusions regarding fishing area boundaries and areas significant from an oil spill planning perspective. The project team attempted to integrate the information, and to resolve significant discrepancies by checking with the interviewees for clarification and verification.

In a few cases, DFO staff identified other people who could provide more detailed information on a given fishery resource, or databases and maps that are confidential but would be available in the event of an oil spill emergency. More significantly, DFO staff identified other resources that should be addressed from an oil spill planning perspective, such as major food species for fisheries. Pursuing these other information sources and fishery resources, however, was beyond the mandate and resources of this project.

1.5 Project Products

- **Project report:** A report describing each fishery resource giving the data sources, general (non site-specific) information and sources of additional information. For selected groundfish species, aspects of the life histories that are relevant to oil spill preparedness planning are provided. For those resources with sufficient site-

specific information, the relevant databases, maps and method used to rank the importance of individual sites are also indicated.

- **Databases:** A database for each fishery resource for which site-specific information was available.
- **Maps:** A series of copies of chart 3001 and 3602/3603 showing areas (polygons) indicating the distribution of a fishery with annotations indicating the species fished. Each polygon is tied to the appropriate database file by an identifying number. Only those fishery resources for which sufficient site-specific data were available are mapped. A portion of chart 3000 showing areas where Albacore tuna are fished off the west coast of Vancouver Island, is included in the report.
- **Electronic maps:** Each mapped element/attribute has also been digitized to create electronic map files.

1.6 Report Organization

The remainder of this report details the fishery resource information compiled for offshore west coast Vancouver Island. It is organized on two levels:

- By fishery or resource group - 7 are identified:
 - commercial groundfish trawl (section 2)
 - commercial groundfish hook and line, and trap (section 3)
 - commercial salmon and tuna troll (section 4)
 - aboriginal (section 5)
 - recreational (section 6)
 - commercial shellfish (section 7)
 - other resources (euphausiids, marine mammals; section 8).
- By species - common species or species groups caught in each fishery or included in the resource group.

Since many of the characteristics of the groundfish trawl fisheries are similar across all species, section 2 begins with notes about the trawl fisheries in general. Section 3 begins in the same way with respect to finfish hook and line and trap fisheries. The remaining texts in these sections as well as subsequent sections are then organized by species. Each fishery and species is described using the following headings:

DATA SOURCES: There are three types of data sources:

- DFO staff familiar with the study area. Names and positions are indicated on the report sheet; details regarding experience with the fishery resource are contained in Appendix A.

- annual fisheries management plans, authored in many cases by the DFO staff who were interviewed.
- published papers authored by DFO scientific staff interviewed and/or their associates.

A "#" preceding the data source signifies the major source of information.

DATA COMPILED: This indicates the form in which data are compiled and where they reside (Table 1). Appendix B is a compilation of all database file structures; Appendix C presents tables listing the data contained in the database files. The following are noted under this heading:

- **Database file structure:** the number of the table in Appendix B which gives the structure of the applicable database.
- **Database:** the name of the file that contains the site-specific data, and the applicable table in Appendix C.
- **Map:** the identifying name of the chart on which distribution data are mapped.

For groundfish, databases have been created on the basis of the fishery (trawl or hook-and-line/trap). Therefore, this heading is applied only to the discussion of the fisheries in general and not to species-specific descriptions.

USE-LEVEL RATING: This describes the numeric scheme used in the database to rate the relative importance of specific areas (grounds) to the fishery in question. Most ratings are relevant to the study area only. Relative importance of the particular fishery on a regional (west coast Vancouver Island) or provincial scale (entire British Columbia coast) may be discussed under "Notes", if applicable.

NOTES: This part contains comments on the fishery/species that are relevant to oil spill planning. It is organized under the following subheadings which may vary in order of presentation, as appropriate to the discussion:

- Fishery characteristics
- Regulations
- Depth
- Geographic location and effort
- Seasons
- Bycatch (where applicable)
- Biological notes relevant to oil spill response (where applicable).

FURTHER INFORMATION: (where applicable) sources of further site-specific or general information recommended by District fisheries staff that would assist in oil spill response or serve as future references for updating the files.

1.7 Oil Spill Response Datasets

With respect to further information on fisheries resources: another major initiative has been the compilation of biological resource databases within DFO that are relevant to oil spill response. This compilation is published as:

Wright, M.E. 1994. Nestucca Project: Inventory of Department of Fisheries and Oceans Biological Resource Datasets. Can. Manuscr. Rep. Fish. Aquat. Sci. 2259: 76p.

The inventory covers over 50 resource datasets. Some are regional in scope, but most focus on the west coast of Vancouver Island. The inventory describes the datasets in terms of their data parameters, form of data collection, geographical extent, date, georeferencing, and database characteristics. The reader is directed to this document for additional information on any of the fisheries resources covered in this project.

2. COMMERCIAL GROUND FISH TRAWL FISHERIES

DATA SOURCES

See below under USE LEVEL RATING and in sections for individual species.

DATA COMPILED

Database file structure: Table B1, Appendix B

Database: TRAWL.dbf

Maps: Maps 1a - 1d: Groundfish trawl grounds identified by polygon number which links the ground to the database and colour coded by average use level for the:
a: first quarter (January - March), b: second quarter (April - June)
c: third quarter (July - September), d: fourth quarter (October - December).

Note: these data compilations apply to all species discussed in the remainder of section 2.

GENERAL NOTES REGARDING GROUND FISH TRAWL FISHERIES

Species Characteristics: The groundfish trawl fishery is a multi-species fishery with trawlers switching their target species based on availability, market demands and regulations. Of the roughly 40 species of groundfish that are caught by the trawl fishery, there are 8 species or species groups which are targeted commercially and the remainder are caught incidentally. The core group of species which make up the groundfish trawl fishery off the west coast of Vancouver Island include:

- Pacific cod
- Lingcod
- Sablefish
- Pacific hake
- Spiny dogfish
- Rockfish species (see species listing in rockfish section)
- Deep-water flatfish (Dover sole, petrale sole)
- Shallow-water flatfish (English sole, rock sole, rex sole, starry flounder).

Fleet Characteristics: There are 142 trawl licences; about 120 are active coastwide (west Vancouver Island and north coast). Vessels fall into three size categories:

- less than 60 ft. (small)
- 60 - 80 ft. (medium)
- greater than 80 ft. (large)

Most of the vessels are medium to large size. Smaller vessels tend to fish seasonally using only one type of trawl gear, and fish close to home ports (Tofino, Ucluelet, Winter Harbour). The remaining larger vessels range coastwide. As such, the British Columbia trawl fleet is highly mobile and when more boats move into north coast trawl grounds there are fewer boats off the west coast of Vancouver Island.

While smaller vessels are generally limited to shallow bottom trawling, most large vessels carry out all three types of trawling: shallow bottom (<200 m), deep bottom (>200 m), and mid-water. However, changing from bottom to midwater gear is not trivial and mid-water trawling requires more power, and therefore usually larger boats, to maintain speed.

Regulations: To a large extent, the nature of the fishery is determined by the regulations which are designed to meet several goals:

- conserve groundfish stocks;
- spread the fishery out over the calendar year where possible;
- minimize bycatch of other species.

A "T" licence is required to trawl groundfish in British Columbia waters. Trawlers which also wish to fish hake must apply for special permission. The table below lists the 1994 trawl fleet regulatory measures and the species to which they apply off the west coast of Vancouver Island. Species which occur in numbers too low to manage (e.g. rex sole) or in large quantities combined with a low demand (e.g. walleye pollock, turbot), are not currently managed in the study area .

Regulation		Lingcod	Rockfish	Pacific cod	Sole	Dogfish	Hake	Sablefish
TAC	Coastwide (excluding 4B)		quarterly			annual	annual	annual
TAC	Area specific	annual		annual	annual			
Limited # trips and catch/trip		Q1	all quarters	Q1	Q1			Q1
Size limits		yes			yes			yes
Localized seasonal closures		yes					yes	

TAC = total allowable catch Q1=first quarter of the year (January through March)

Fishery Characteristics: The trawl fishery off the west coast of Vancouver Island is dominated both in tonnage and value by the joint venture mid-water fishery for Pacific hake (Figures 1 and 3, Appendix D). Rockfish are the second most important groundfish species group with average landings of about one tenth and value of approximately two-thirds that of Pacific hake. The following sub-sections deal with each of these species or species groups individually.

The entire continental shelf off the west coast of Vancouver Island is fished to some extent by the groundfish trawl fleet. Bottom trawlers mainly fish on soft (gravel to mud) substrates, although, with heavier gear they may fish on rocky bottoms. Mid-water trawlers can fish any bottom type. There are, however, some grounds which are fished more heavily than others; most fishing occurs at the edge of the continental shelf on either side of the 100 fathom (200 m) depth contour and on the edges of banks and canyons (see Maps 1a-d). The characteristics of the fishery differ significantly in the areas north and south of Estevan Point.

North of Estevan Point:

The continental shelf north of Estevan Point is much narrower than off southwest Vancouver Island. Most of the trawl grounds in this area are deep (>200 m) bottom. Target species tend to be almost exclusively rockfish species with turbot as a common incidental catch. There are minor catches of Dover sole on the deeper trawl grounds and of Pacific cod on Top Knot grounds. There are some shallow water trawl grounds (<200 m); for instance off the entrances to Quatsino and Nootka Sounds trawlers target canary and silvergray rockfish, English and rock soles and lingcod. Although some Pacific hake may be found in this area, its fishery is usually closed north of Estevan Point.

South of Estevan Point:

South of Estevan Point there are extensive deep and shallow trawl grounds. The Pacific hake fishery in British Columbia takes place almost exclusively in the area south of Estevan Point primarily in depths of 80-120 m. All the groundfish species caught in the trawl fishery off the west coast of Vancouver Island (with the exception of rockfish species and turbot) have higher landings south of Estevan Point. On the shallow trawl grounds (<200 m) target species tend to be lingcod, Pacific cod, spiny dogfish, English, rock and rex sole and starry flounder. On the deep bottom trawl grounds (>200 m) target species tend to be sablefish, Dover and petrale sole, and slope rockfish.

Those shallow bottom trawl grounds close to communities in Ucluelet, Tofino, Bamfield and Alberni Inlet are fished year round. Because of the regulations limiting the catch per trip these banks tend to have large concentrations of boats. The proximity to port allows boats to off load daily. From the last week of January to mid April up to 50 trawlers can be concentrated on any one ground; 80-90 vessels may be active throughout.

Seasonal Movements: The fleet moves seasonally to take advantage of concentrations of different species. The most significant movement of the fleet is to the banks off southwest Vancouver Island in May through September for the joint venture fishery for Pacific hake.

1st Quarter (January - March)	Almost 60% of the landings off west Vancouver Island are south of Estevan Point on the deeper trawl grounds targeting on slope rockfish, Dover and petrale sole, Pacific cod and spiny dogfish.
2nd Quarter (April - June)	Effort south of Estevan Point falls to about 50% of west Vancouver Island fleet as Pacific cod concentrations drop off and more opportunities open up in areas north of the Point. Petrale and Dover sole spawning concentrations also break up by May, and these species become incidental catches.

3rd Quarter (July - September)	The majority of the fleet targets Pacific hake from June to September or October on trawl grounds south of Estevan Point. Smaller vessels unable to trawl midwater remain with the bottom trawl fishery.
4th Quarter (October - December)	Weather becomes a determining factor and many smaller vessels retire. Fishers have reached or come close to their annual quotas for many species. Effort is concentrated on yellowtail and widow rockfish (if quota is still available) from Estevan Point to Cape Cook and deep sole species on their spawning grounds. There is little fishing by December.

USE LEVEL RATING

Note: the following use-level rating scheme applies to all species covered in the remainder of this section.

The "Use Level" rating or importance of a polygon to the groundfish trawl fishery was calculated for each month based on three factors:

Factor 1 The catch by the offshore trawl fishery in each polygon relative to that in all other polygons for each species (or species group).

The rating was a subjective assessment based on the source which identified the polygon as being an important trawling area for a species and the importance placed on that polygon by the source. Each polygon was assigned a value from 0 to 3. The specific criteria used were:

- 0 = no source indicated that the species was fished in that polygon.
- 1 = general area identified as having landings of that species and/or a general or detailed trawl grounds with low catches for that species.
- 2 = general trawl ground identified as having landings of that species.
- 3 = detailed trawl ground identified as having landings of that species.

The sources of these data and the nature of the information they provided are shown in the table below. The actual values assigned to each polygon for each species can be found in the database.

Source	Pacific hake	Lingcod	Pacific cod	rockfish	deep soles	shallow soles	Sablefish	Spiny dogfish
1 F. Crabbe	detailed trawl grounds	detailed trawl grounds	detailed trawl grounds	detailed trawl grounds	detailed trawl grounds	detailed trawl grounds	detailed trawl grounds	detailed trawl grounds
2 Capt. Nilssen	general area	detailed trawl grounds	general trawl grounds	general area	general trawl grounds	general trawl grounds	-	-
3 G. Buechler	general area	general trawl grounds	general trawl grounds	general area	general trawl grounds	-	general trawl grounds	-
4 DFO - PBS groundfish unit	general trawl grounds	-	detailed trawl grounds	general area	general trawl grounds	-	-	detailed trawl grounds
DFO - PBS individual	Sandy McFarlane	none	Claudia Hand	Rick Stanley	Jeff Fargo	Jeff Fargo	Sandy McFarlane	Mark Saunders

Information on sources	
Frank Crabbe	Information is based on an interview and a map Mr. Crabbe generated in 1986/87 while working as a port sampler and on the fisheries patrol boat TANU. His mapped information was based on analysis of log book data and interviews with trawl captains. Trawl grounds were located from Loran C coordinates and areas indicated by trawl captains. The map indicates major species caught at those locations. There was no ranking of one ground over another.
A.B.O. (Ozzie) Nilssen	Information is based on an interview in which Captain Nilssen indicated general areas of use based on his experience as Captain of the fisheries patrol vessel TANU. He was more specific for some species than he was for others. This is indicated by the ratings.
Gary Buechler	Mr. Buechler provided a map of the major trawl grounds which he believes was generated by PBS staff in about 1986. For Pacific hake and rockfish trawl fisheries, he indicated the general areas of the coast where the fleet caught these species. For lingcod, Pacific cod, deep soles and sablefish, he indicated the trawl grounds on which these species were primarily caught.
DFO - PBS individual	The specificity of the information on where a species or species group is caught by the trawl fishery depended on the nature of the research and past experience of an individual.

Factor 2 The relative importance of each species (or species group) to the trawl fishery on the west coast of Vancouver Island.

This factor was derived objectively from the average landings of a species in the trawl fishery during the period 1989-93 (Figure 1, Appendix D). The species landings were converted to landed values for each species using the average price in 1992-93 for trawl caught fish (Figure 2, Appendix D). It should be noted that the price used was the wholesale price and not that received by the trawlers. The final rating factors assigned to each species (or species group) are shown in the table below.

	Pacific hake	Lingcod	Pacific cod	rockfish	deep soles	shallow soles	Sable fish	Spiny dogfish
Species relative importance factor	8.3	1.1	1.2	5.3	1.8	0.2	0.9	0.2

Factor 3 The landings by the trawl fishery on the west coast of Vancouver Island of a species (or species group) in each month relative to that of other months.

A species specific monthly co-efficient was also derived from statistics based on the period 1989-93 (see Figures 4-11, Appendix D). The average proportion (0-1) of a species landings that were landed in each month was calculated and assigned to that species monthly coefficient (Factor 3). The monthly ratings assigned to each species were:

Month	Pacific hake	Lingcod	Pacific cod	rockfish	Deep soles	shallow soles	Sablefish	Spiny dogfish
January	0	0	.030	.107	.081	.018	.025	.149
February	0	.001	.433	.103	.153	.078	.069	.117
March	0	.008	.106	.058	.264	.085	.084	.126
April	0	.002	.049	.091	.195	.098	.077	.348
May	.1	.155	.106	.101	.061	.119	.113	.216
June	.2	.183	.085	.063	.041	.105	.112	.026
July	.2	.205	.055	.078	.031	.105	.250	0
August	.2	.131	.039	.034	.028	.082	.076	0
September	.2	.148	.053	.054	.037	.110	.053	.002
October	.1	.116	.030	.222	.032	.073	.108	.010
November	0	.049	.010	.070	.032	.049	.028	.005
December	0	0	.003	.020	.045	.079	.006	0

USE LEVEL FORMULA

The final groundfish trawl "use level" rating for each polygon was then derived from a formula which combined the three factors to produce a month by month "Use Level" rating for the groundfish trawl fishery for each polygon relative to all other polygons in the study area. This formula combined all species into a single score. The formula that was used to calculate this score was:

For each polygon by month, over all species $\Sigma [A \times B \times C]$

Where:

- A = The concentration of fishing in that specific polygon relative to that in all other polygons for that species (or species group). This factor varied from 0-3.
- B = The relative importance of that species (or species group) to the trawl fishery on the west coast of Vancouver Island. This factor varied from .2 to 8.2 depending on the species.
- C = The relative landings by the trawl fishery on the west coast of Vancouver Island of that species (or species group) in that month relative to that of all other months. This factor varied from 0 to 0.433.

The resulting ratings ranged from 0 to 7. To create maps of average use level by quarter, the ratings for the three months in each quarter were averaged and rounded to the nearest whole number except when this resulted in a value being rounded to 0; in this case it was rounded up to a value of 1. These average ratings were ranked according to the following table:

Final "Use Level" rating		Range of average score for quarter
4	very high	6 - 7
3	high	4 - 5
2	moderate	2 - 3
1	low	>0 - 1
0	none	0

FURTHER INFORMATION

Kathy Rutherford is responsible for groundfish statistics in the Marine Fish Population Dynamics Section at the Pacific Biological Station. She maintains a confidential databases which contains all of the west coast groundfish log book data. This database links groundfish sets to positions (latitude/longitude or Loran C) and trawl grounds. In this report we have tried to maintain a consistency in the naming of trawl grounds with those used in the log book database, however the boundaries do not always coincide. While the log book data requires that all areas of the coast be classified into one trawl ground or another, this project is only aimed at identifying where significant trawling occurs and so only certain portions of the logbook database trawl grounds are mapped.

Note: the following subsections cover "Data Sources" and "Notes" only; "Data Compiled" and "Use-level Rating" described in this subsection apply.

FISHERY: Commercial trawl

SPECIES: Pacific cod (*Gadus macrocephalus*)

DATA SOURCES

Personal Communication:

Claudia Hand # Gary Buechler • Susan Hahn • Barry Ackerman

References:

- Foucher, R.P. and A.V. Tyler. 1991. Pacific Cod. p. 43-70. *In*: J. Fargo and B.M. Leaman [eds.] Groundfish stock assessments for the west coast of Canada in 1990 and recommended yield options for 1991. Can. Tech. Rep. Fish. Aquat. Sci. 1778. 320 p.
- Foucher, R.P. and S.J. Westrheim. 1990. The spawning season of Pacific cod on the west coast of Canada. Can. Tech. Rep. Fish. Aquat. Sci. 2072: 25 p.

NOTES

Fishery Characteristics: Pacific cod are a major component of the domestic, on-bottom trawl fishery off the west coast of Vancouver Island. The average landings from 1989-93 (2,480 t.) are exceeded only by Pacific hake and rockfish. Year class strength varies considerably resulting in wide variation in annual landings.

Regulations: Regulated by annual and first quarter quotas by major groundfish area (3C and 5C/D).

Depth: Most fishing occurs between 75 and 110 m.

Geographic Location and Effort: Area 3C landings typically account for 90% and area 3D 10% of the landings for the two areas combined (in 1993 it was 67% in 3C and 33% in 3D). Within area 3C, 53% of the landings are from Amphitrite Bank, 28% from Big Bank, and 14% from Swiftsure and Clo-ose Banks. Cod production in area 3D is negligible presumably due to habitat limitations. The landings that do occur in area 3D are primarily from the "Top Knot" trawl grounds.

Seasons: Before 1989, most of the catch occurred in April and September (79% & 89% respectively), but since then, over 50% of landings have been in the first quarter, mostly in February. In the fourth quarter (October-December), Pacific cod move further offshore and effort switches to other species.

Biological notes relevant to oil spill response: The main habitat for adult Pacific cod is a gravelly-mud bottom. In Canadian waters, Pacific cod is near its southern limit of its commercial abundance and exhibits rapid growth and a short life span. Recruitment begins at age 2+, while most are recruited and mature by age 3+; few Pacific cod survive to age 7.

Amphitrite Bank is the only spawning grounds for Pacific cod in British Columbia waters. Spawning occurs on sand-gravel bottom at depths of 60-80 m. The eggs incubate on the bottom and the larvae rest on the bottom for some time. Most of the egg production (77%) occurs in January through March.

FISHERY: Commercial trawl
SPECIES: Lingcod (*Ophiodon elongatus*)

DATA SOURCES

Personal Communication:

Mark Saunders # G.A. (Sandy) McFarlane # Gary Buechler
• Susan Hahn • Barry Ackerman

References:

Richards, L.J. and C. M. Hand. 1991. Lingcod. p. 19-42. *In*: J. Fargo and B.M. Leaman [eds.] Groundfish stock assessments for the west coast of Canada in 1990 and recommended yield options for 1991. Can. Tech. Rep. Fish. Aquat. Sci. 1778. 320 p.
Cass, A.J. R.J. Beamish and G.A. McFarlane. 1990. Lingcod (*Ophiodon elongatus*). Can. Spec. Publ. Fish. Aquat. Sci. 109: 40 p.

NOTES

Fishery Characteristics: The majority of the commercial lingcod catch off the west coast of Vancouver Island is landed by the trawl fishery. Trawl-caught lingcod have a wider market than the hook and line fishery and is not dependent on the fresh fish market.

Regulations: The trawl fishery is closed for lingcod from January 1 through April 14 on the west coast of Vancouver Island to protect spawning stocks. In addition, a size limit of 58 cm (head on) exists coastwide. For 1994, the trawl fleet annual TAC is set at 2,100 tonnes for area 3C and 600 tonnes for area 3D. The regulations also include limits on both the number of trips per quarter and the catch per trip in the first quarter.

Depth: Adult lingcod are found as deep as 400 m, but most occur in rocky areas between 10-100 m. Most of the trawling occurs in depths of <180 m.

Geographic Location and Effort: The main trawling grounds for lingcod are off southwest Vancouver Island and in Queen Charlotte Sound. Catches for these areas accounted for about 80% of the total British Columbia catch during 1956-80. Off the west coast of Vancouver Island most of the effort is south of Estevan Point on Firing Range, Cabbage Patch, Clo-ose and Swiftsure trawl grounds (see Map 1a). Large numbers (≈ 50) of both big and small boats may be spread over these trawl grounds at one time. Trawling is primarily over gravel-mud bottoms. North of Estevan where there are fewer good shallow trawl grounds, more lingcod are caught by the hook and line fishery than by trawl.

Seasons: The fishery takes place primarily between May 1 and mid-November. Adult male and female lingcod appear on shallow nearshore trawl grounds from May to September and are almost entirely absent from these grounds during the winter, when they are assumed to have moved into shallow rocky bottom areas.

Biological notes relevant to oil spill response: Lingcod off the west coast of Vancouver Island are assumed to exist as 2 distinct stocks or groups of stocks; one off southwest Vancouver Island (area 3C) and one off northwest Vancouver Island (area 3D). There is no mixing of stocks in the Strait of Georgia with the offshore stocks.

Spawning begins in early December and continues through March. Most spawning occurs between mid-January and mid-February. Preferred nest sites are located in crevices in shallow (5-40 m), rocky areas where surface wave and tidal changes create circulating water currents (high oxygen content). On the west coast of Vancouver Island the most important nesting sites are on the exposed coastal reefs located within 1-2 km of the coast.

Lingcod appear to migrate prior to spawning. The males begin to segregate from the females during October when they search for nest sites. They remain territorial around the nest site guarding it until about April. Females leave the nest after spawning.

The incubation period for eggs is 5-11 weeks (average 7 weeks) and the majority of the eggs hatch by mid-March to April. Juvenile lingcod disperse from the inshore spawning grounds to a wider range of flat bottom areas by September. Lingcod remain at shallower depths until maturity (2 years for males; 3-5 years for females), when they begin to move into habitats of similar relief and substrate as older lingcod.

FISHERY: Commercial trawl

SPECIES: Rockfish (*Sebastes spp.*, *Sebastolobus spp.*)

DATA SOURCES

Personal Communication:

Bruce Leaman # Rick Stanley # Gary Buechler
• Laura Richards • Susan Hahn • Barry Ackerman

References:

- Gillespie, G.E. and B.M. Leaman. Rockfish sampling cruise: F/V Ocean Selector, July 12 to 30, 1989. Can. MS Rep. Fish. Aquat. Sci. 2061: 89 p.
- Leaman, B.M., G.E. Gillespie, D.A. Nagtegaal, and R.D. Stanley. 1988. Biomass survey of rockfish stocks off the southwest coast of Vancouver Island, September 8-22, 1985 (M/V) Howe Bay. Can. Tech. Rep. Fish. Aquat. Sci. No. 1611: 99 p.
- Leaman, B.M. and D.A. Nagtegaal. 1986. Identification of species assemblages and results of management applications for shelf and slope rockfishes off British Columbia. p. 309-328. *In: Proc. Int. Rockfish Symp. Oct 1986. Anchorage Alaska.*
- Richards, L.J. 1991. Slope Rockfish. p. 201-224. *In: J. Fargo and B.M. Leaman [eds.] Groundfish stock assessments for the west coast of Canada in 1990 and recommended yield options for 1991. Can. Tech. Rep. Fish. Aquat. Sci. 1778. 320 p.*
- Stanley, R.D. 1991. Shelf Rockfish. p. 225-276. *In: J. Fargo and B.M. Leaman [eds.] Groundfish stock assessments for the west coast of Canada in 1990 and recommended yield options for 1991. Can. Tech. Rep. Fish. Aquat. Sci. 1778. 320 p.*

NOTES

Fishery Characteristics: Rockfish are the mainstay of the British Columbia domestic trawl fishery with a coastwide quota for rockfish trawl landings in 1994 set at 17,774 tonnes. Off the west coast of Vancouver Island, in major statistical areas 3C and 3D, the average landings between 1989-93 were 7,976 tonnes. The trawlers targeting rockfish are typically in the size range of 60'-150'. The fleet is very mobile and almost all of the boats fish coastwide. There is little specialization on an individual species. The price per kg for trawl caught rockfish ranges from \$0.50-0.70 depending on markets and species; significantly less than the price paid for rockfish caught by hook and line.

Rockfish (genus *Sebastes*) is the most specious demersal fish genera in the northeast Pacific with over seventy known species. Landings from rockfish fisheries in British Columbia are typically composed of a mixture of species in variable proportions. Fishery landings do not reflect the "true" community or assemblage, rather, they present a variable subset of that community reflecting the influences of differential species abundance, the distribution of fishing effort and market constraints. Seventeen species are caught in significant numbers in the trawl fishery off the west coast of Vancouver Island (major areas 3C, 3D and part of 5A). Rockfish species caught in the

trawl fishery off the west coast of Vancouver Island are listed in the table at the end of this section.

Regulations: The rockfish trawl fishery is managed using quarterly total allowable catches (TAC) and limits on the number of trips and catch per trip in the first quarter. In 1994, the fishery is being managed by species "aggregates" which are based on a variety of factors.

Depth: Each species of rockfish occupies a slightly different depth niche. All species move somewhat deeper in winter. The research community divides rockfish into "slope" species which occur in the deeper water over the continental slope and "shelf" rockfish which are primarily found in the shallower waters up on the continental shelf. The trawl fishery fishes primarily in 3 depth strata:

1. by midwater trawl, primarily for widow and yellowtail.
2. by deep depth bottom trawl (165 - 275 m) primarily for Pacific ocean perch, shortraker and yellowmouth rockfish and shortspine thornyheads.
3. by medium depth bottom trawl (90 - 185 m) for widow, yellowtail, silvergray and canary rockfish.

The prime depth strata for each species of rockfish caught off the west coast of Vancouver Island is shown below (based on research cruise results).

Depth Strata	Species
Mid-water	Widow and yellowtail rockfish.
150 - 275 m	Silvergray, greenstripe, rosethorn, bocaccio, canary, redstripe, yellowmouth, and sharpchinned rockfish.
200 - 400 m	Darkblotched, spiltnose, redbanded, and rougheye rockfish, and Pacific ocean perch.
300 - 500 m	Rougheye and shortraker rockfish, and shortspine thornyhead.

Geographic Location and Effort: There is very little species distributional change within the area along the west coast of Vancouver Island. Species changes are primarily by depth as indicated above. In the last five years, about 75% of the rockfish landings off the west coast of Vancouver Island have been from area 3D.

Deep bottom trawlers fish along the edges of the slope and offshore canyons. Medium-deep bottom trawlers fish on the upper side of the slope and canyon edges just inshore of where the deeper rockfish are concentrated. Significant trawl areas for canary and silvergray rockfish are found just outside the surfline off the entrances to Nootka and Quatsino Sounds.

The midwater trawl fishery is predominantly from Estevan Point north. Estevan and Cape Cook are major grounds. There are two stocks of yellowtail rockfish off the coast

of Vancouver Island; the "Nootka" fishery and a southwest coast fishery. The latter is fished by both Canada and the U.S. on the southern edge of Big Bank (La Perouse) within 30 km of the border.

Seasons: The midwater trawl fishery for widow and yellowtail rockfish tends to occur from April to June and October to December due to the movements of the fish. The remainder of the rockfish fishery takes place year round; not because of the species biology but because of the current way the fishery is managed with trip and quarter quotas. There is very little trawling for any rockfish species in the last two weeks of December and to compensate for this the highest monthly landings are in October.

Bycatch: Yellowtail rockfish are taken incidentally by the Pacific hake fishery; turbot are taken by bottom trawlers targeting on rockfish. Turbot are much lower priced than rockfish (\approx \$0.25/kg) and are currently not managed by DFO as stocks are healthy and demand is low. Most turbot is caught in area 3D during the second quarter. Turbot are not a target species on the trawl grounds off the west coast of Vancouver Island.

Biological notes relevant to oil spill response: Midwater and shallower water (150-275 m) rockfish tend to spawn in the same areas as where they are fished, although the adults move into slightly deeper water to spawn. Deeper water rockfish (200 - 500 m) may go into much deeper water to spawn. For example, the fishery for Pacific ocean perch is at 200 - 400 m depth while spawning is at a depth of 500 - 700 m. The broader the shelf, the greater the separation between fishing and spawning grounds which can range from 20 - 100 km. Larvae are born live from February to April with a north - south gradient. The timing of spawning can be highly variable and in some years can be as late as June. Silvergray rockfish are later spawners than the other species; they typically spawn in July.

The larvae stay deep for about 3-4 months and then move further inshore, probably using deep onshore currents caused by seasonal upwelling. It is thought that juvenile rockfish probably occupy a slightly shallower depth niche to the adults of the same species. They have been found on the bottom, in a "complex" type habitat such as rock reefs.

While some rockfish species have relatively stable recruitment, recruitment in other species is thought to be in pulses. Both the length and strength of the pulses vary with species. The pulses are probably environmentally driven although the mechanism is unknown.

**Common and scientific names of rockfish species
caught in the trawl fishery off the west coast of
Vancouver Island.**

Common Name	Scientific Name
Bocaccio rockfish (b)	<i>Sebastes paucispinis</i>
Canary rockfish (c)	<i>Sebastes pinniger</i>
Darkblotched rockfish (db)	<i>Sebastes crameri</i>
Greenstripe rockfish (gs)	<i>Sebastes elongatus</i>
Pacific Ocean Perch (op)	<i>Sebastes alutus</i>
Redbanded rockfish (rb)	<i>Sebastes babcocki</i>
Redstripe rockfish (rs)	<i>Sebastes proriger</i>
Rosethorn rockfish (rt)	<i>Sebastes helvomaculatus</i>
Rougheye rockfish (re)	<i>Sebastes aleutianus</i>
Sharpchinned rockfish (sc)	<i>Sebastes zacentrus</i>
Shortraker rockfish (st)	<i>Sebastes borealis</i>
Silvergray rockfish (sg)	<i>Sebastes brevispinis</i>
Shortspine thornyhead (st)	<i>Sebastolobus alascanus</i>
Splitnose rockfish (sn)	<i>Sebastes diploproa</i>
Widow rockfish (w)	<i>Sebastes entomelas</i>
Yellowmouth rockfish (ym)	<i>Sebastes reedi</i>
Yellowtail rockfish (yt)	<i>Sebastes flavidus</i>

FISHERY: Commercial trawl fishery
SPECIES: Petrale sole (*Eopsetta jordani*)

DATA SOURCES

Personal Communication:

Jeff Fargo # Gary Buechler • Susan Hahn • Barry Ackerman

References:

Forrester, C.R. 1969. Life history information on some groundfish species. Fish. Res. Bd. Can. Tech. Rep. 105: 16 p.
Fargo, J. 1991. Flatfish. p. 71-116. *In*: J. Fargo and B.M. Leaman [eds.] Groundfish stock assessments for the west coast of Canada in 1990 and recommended yield options for 1991. Can. Tech. Rep. Fish. Aquat. Sci. 1778. 320 p.

NOTES

Fishery Characteristics: Fished in deep water by bottom trawl. The value of petrale sole (\approx \$1.70/kg) is one of the highest in the groundfish trawl fishery. Off the west coast of Vancouver Island the average annual landings between 1989-93 were 519 tonnes; about 69% of the landings were from area 3C.

Regulations: The number of trips per quarter are limited. In addition, there is a limit placed on the catch per trip during the first quarter. The size limit for petrale sole is 30 cm (head on).

Depth: Petrale sole are fished in deep water (350 - 750 m) while they are spawning. The rest of the year they are spread out on sandy bottom in shallow water (50 - 150 m) where their prey (euphausiids, herring and sandlance) is concentrated.

Geographic Location and Effort: The primary fishing ground is along the slope edge off southwest Vancouver Island and along the upper slopes of Barkley, Father Charles, Loudon and Clayoquot canyons. There are also landings from some of the deeper trawl grounds north of Estevan Point such as Kains and Top Knot.

Seasons: Petrale sole are primarily fished while they are spawning from January to March. It is thought that they probably move into U.S. waters during the summer and fall as catch rates are low this time of year on those Canadian trawl grounds where their feeding habitat is found. When petrale sole are caught outside their spawning grounds it is mostly by trawlers targeting rockfish.

Biological notes relevant to oil spill response: The majority of petrale sole spawn in areas where the water depth is 350 - 750 m. Spawning takes place from January to March but may begin as early as November or December. The eggs and larvae are mostly found in the upper 50 m of the water column.

FISHERY: Commercial trawl

SPECIES: Dover sole (*Microstomus pacificus*)

DATA SOURCES

Personal Communication:

Jeff Fargo # Gary Buechler • Susan Hahn • Barry Ackerman

References:

Forrester, C.R. 1969. Life history information on some groundfish species. Fish. Res. Bd. Can. Tech. Rep. 105: 16 p.

Fargo, J. 1991. Flatfish. p. 71-116. In: J. Fargo and B.M. Leaman [eds.] Groundfish stock assessments for the west coast of Canada in 1990 and recommended yield options for 1991. Can. Tech. Rep. Fish. Aquat. Sci. 1778. 320 p.

NOTES

Fishery Characteristics: Fished in deep water by bottom trawl. The average price in the last five years has been about \$0.60/kg; much lower than for petrale sole. Off the west coast of Vancouver Island the average annual landings between 1989-93 were 1581 tonnes; about 73% of the landings were from area 3C.

Regulations: The number of trips per quarter are limited. In addition, there is a limit placed on the catch per trip during the first quarter. The TAC for areas 3C and 3D for 1994 is 1,650 tonnes.

Depth: Dover sole spawn and are fished in deep water (350 - 750 m). The rest of the year they are spread out onto sandy bottom in shallow water (50 - 150 m) where their prey (polychaetes and small clams) is concentrated.

Geographic Location and Effort: Dover sole are fished while spawning when they are most concentrated. The trawl grounds are similar to those for petrale sole.

Seasons: Dover sole are primarily fished while they are concentrated for spawning from January to April. It is thought that they probably move into U.S. waters during the summer and fall as catch rates are low on those Canadian trawl grounds where their feeding habitat is found. When Dover sole are caught outside their spawning grounds it is mostly by trawlers targeting rockfish.

Bycatch: Arrowtooth flounder is a deep water sole caught incidental to Dover sole; it is mostly caught in the U.S.

Biological notes relevant to oil spill response: The majority of Dover sole spawn in areas where the water depth is 350 - 750 m. Spawning takes place from January to March but may begin as early as November or December. The eggs and larvae of Dover sole are mostly found in the upper 80 m of the water column.

FISHERY: Commercial trawl

SPECIES: Shallow water soles: English sole (*Parophrys vetulus*), Rock sole (*Lepidopsetta bilineata*), Rex sole (*Glyptocephalus zachirus*), Starry flounder (*Platichthys stellatus*)

DATA SOURCES

Personal Communication:

Jeff Fargo # Gary Buechler • Susan Hahn • Barry Ackerman

References:

Forrester, C.R. 1969. Life history information on some groundfish species. Fish. Res. Bd. Can. Tech. Rep. 105: 16 p.

Fargo, J. 1991. Flatfish. p. 71-116. *In*: J. Fargo and B.M. Leaman [eds.] Groundfish stock assessments for the west coast of Canada in 1990 and recommended yield options for 1991. Can. Tech. Rep. Fish. Aquat. Sci. 1778. 320 p.

NOTES

Fishery Characteristics: These shallow flatfish species are landed in small amounts off the west coast of Vancouver Island; the average annual landing from 1989-93 for all shallow soles and flounders combined was only 357 tonnes. They are fished in shallow water by bottom trawl. English and rock soles are the predominant species except in area 3C during December when catches of starry flounder become significant. The price in 1993 ranged from \$0.385/kg for starry flounder to \$0.731/kg for rock sole.

Regulations: For English and rock sole the number of trips per quarter are limited and there is a limit placed on the catch per trip during the first quarter. All species except rex sole have a size limit of 30 cm (head on).

Depth: All species are bottom fish. English sole are abundant between 35 and 125 m; rock sole are found at 18-55 m. They generally tend to shift to deeper water (>75 m) in the winter to spawn and return to shallower water in the summer.

Geographic Location and Effort: English sole are found in small numbers off Barkley Sound on fairly shallow sandy bottom. There is also a local population inshore in Barkley Sound. Most rock sole are found north of Vancouver Island; small numbers are found off the west coast of Vancouver Island. Starry flounder are found south of Estevan Point (area 3C) during the winter months and rex sole are only landed in small numbers in either area 3C or 3D.

Seasons: Fished year round in small numbers.

Biological notes relevant to oil spill response: Female English sole spawn for the first time at age 3; the greatest age recorded is 17 years. The species has a high

fecundity (150,000-2,000,000 eggs). Spawning occurs between December and March. The pelagic egg stage lasts from 6-10 weeks and the metamorphosing larvae are encountered on the beaches in mid-April. The young inhabit intertidal areas but move to deeper water by November. English sole tend to move deeper as they get older.

Rock sole spawn at depths of 18 to 55 m in late winter - early spring. By age 1, juveniles are found on the adult grounds. They are highly fecund and reproduce by age 4 years; life expectancy is about 15 years. There is no evidence of migration and the populations are probably discrete.

FISHERY: Commercial trawl

SPECIES: Spiny dogfish (*Squalus acanthias*)

DATA SOURCES

Personal Communication:

Gary Buechler # Mark Saunders • Susan Hahn • Barry Ackerman
• G.A. (Sandy) McFarlane

References:

- Ketchen, K.S. 1986. The spiny dogfish (*Squalus acanthias*) in the Northeast Pacific and a history of its utilization. Can. Spec. Publ. Fish. Aquat. Sci. 88: 78 p.
- Saunders, M.W. and G.A. McFarlane. 1993. Age and length at maturity of the female spiny dogfish, *Squalus acanthias*, in the Strait of Georgia, British Columbia, Canada. Environmental Biology of Fishes 38: 49-57.
- Thompson, B.L., M.W. Saunders and M.S. Smith. 1991. Spiny Dogfish. p. 165-178. In: J. Fargo and B.M. Leaman [eds.] Groundfish stock assessments for the west coast of Canada in 1990 and recommended yield options for 1991. Can. Tech. Rep. Fish. Aquat. Sci. 1778. 320 p.

NOTES

Fishery Characteristics: The spiny dogfish trawl fishery primarily uses bottom trawl gear, although some landings are made using mid-water trawl gear. The catch is processed in the U.S. because of economics and the demand is mostly for larger (>30 cm) female fish. There is a new, pharmaceutical market for shark cartilage which processes the fish locally.

The spiny dogfish trawl fishery is allocated 12,000 tonnes annually, however, this amount is not fished due to lack of market. The average trawl landings from 1989-93 for the west coast of Vancouver Island were 700 tonnes. There are currently only two trawlers which target dogfish in this area.

Depth: Dogfish can be found as deep as 550 m; however, the concentrations of marketable fish tend to be mainly on the continental shelf. Dogfish are caught in shallower water in summer (up to 18 m) and in deeper water (>94 m) in winter.

Geographic Location and Effort: The offshore spiny dogfish stock ranges from Alaska to California and while spiny dogfish move extensively throughout the coast, almost all of the dogfish off the west coast of Vancouver Island comes from south of Estevan Point, the majority from statistical area 23. The landings are not differentiated between onshore (statistical area 23) and offshore (statistical area 123). The area near the mouth of Barkley Sound, is the most important trawl ground for the west coast dogfish trawl fishery.

Seasons: The dogfish trawl fishery currently occurs in October/November and January through June; over 96% of the annual spiny dogfish trawl landings were in January through May.

Bycatch: Skate is caught as a bycatch.

Biological notes relevant to oil spill response: The age at maturity of spiny dogfish is estimated to be about 35 years and life expectancy in excess of 60 years. Females produce 2-16 eggs (average of 6-7) which are hatched and incubated internally for approximately 2 years. At birth, dogfish are about 26-27 cm. There is no seasonality to reproduction. The young are released in midwater at depths of 165-350 m. Adults and juveniles are distributed throughout the water column and feed mainly on midwater species like euphausiids, herring and hake; the largest concentrations of young juveniles are found at depths of 11-12 m and large adults (>70 cm) are frequently caught on or near the bottom. Of the 150-200,000 t of dogfish currently estimated in B.C. waters, about 30% is off of Vancouver Island.

FISHERY: Commercial midwater trawl
SPECIES: Pacific hake (*Merluccius productus*)

DATA SOURCES

Personnel Communications:

Gary Buechler # Mark Saunders # G.A. (Sandy) McFarlane
• Susan Hahn • Barry Ackerman • Bruce Leaman

References:

- Anon. 1994. DFO Pacific Region 1994 Management Plan for the British Columbia offshore hake fishery.
- Leaman, B.M., D. Davenport, J.R. Seslby, and D.C.H. Yao. 1981. Biological observer coverage of foreign fisheries off Canada's Pacific coast, 1979. Can. Tech. Rpt. Fish. Aquat. Sci. No. 1006: 64 p.
- Saunders, M.W. and L.J. Richards and A.V. Tyler. 1991. Pacific hake, West Coast Vancouver Island. p. 139-164. In: J.Fargo and B.M. Leaman [eds.] Groundfish stock assessments for the west coast of Canada in 1990 and recommended yield options for 1991. Can. Tech. Rep. Fish. Aquat. Sci. 1778. 320 p.
- Smith, B.D., G.A. McFarlane and M.W. Saunders. 1990. Variation in Pacific hake (*Merluccius productus*) summer length-at-age near southern Vancouver Island and its relationship to fishing and oceanography. Can. J. Fish. Aquat. Sci. 47: 2195-2211.
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- Ware, D.M. and G.A. McFarlane. 1993. Climate-induced changes in Pacific hake (*Merluccius productus*) abundance and pelagic community interactions in the Vancouver Island upwelling system. Can. Spec. Publ. Fish. Aquat. Sci. (in press).

NOTES

Fishery Characteristics: Since 1968, more Pacific hake has been landed than any other species in the groundfish fishery on Canada's west coast. Allocated landings for 1994 are 111,000 tonnes of hake; the landings allocated for all other groundfish combined are 55-60,000 tonnes. Most of the hake is exported to Poland, Russia and Asia. Pacific hake are worth about \$0.10 - 0.18/ kg; the fishery was worth \$18-19 million in 1994.

Pacific hake requires rapid processing (< 24 hours) as it is subject to a parasite that breaks the flesh down quickly when the fish dies. Canadian vessels have been unable to compete with the subsidized foreign fleets with on-board processing facilities; as a consequence, a large domestic fleet has never been established.

Pacific hake are fished by midwater trawl which limits the fishery to the larger trawlers with the necessary horsepower. Since 1990 there have been only two hake fisheries:

- **Domestic:** a small fishery, allocated 20-30,000 tonnes based on requests from local processing plants (2 in Ucluelet that produce surimi).
- **Joint venture:** the largest proportion of the fishery; allocated 81-91,000 tonnes in 1994. The fleet in 1994 is comprised of 81 domestic boats (up from 60 in 1993) and 10-15 foreign factory ships. In 1994 there is a joint venture with Poland, Russia and China; Korea, Japan and Greece have also participated in the past. The domestic boats transfer catch in the cod end to the foreign factory ship.

Regulations: To fish hake requires a "T" (groundfish Trawl) licence with special permission. The catch is limited by a coastwide total allowable catch which is calculated annually. The fishery continues to be supported by a series of strong year classes.

Depth: The fishery is mainly at depths of 80-120 m; within basins on the shelf, along the edges of banks and along the shelf break. Vessels fish midwater, typically approximately 1 m off the bottom.

Geographic location and effort: Currently almost all fishing activity is south of Estevan Point and most is south of Amphitrite Point. Although hake are found as far north as Queen Charlotte Sound, the hake fleet does not exploit these northern areas yet for two reasons: it is currently able to fill its quota in the south where ports and onshore processing plants are closer, and the potential for significant bycatch (primarily rockfish) are much greater north of Estevan Point.

Nonetheless, there is a desire to spread the fishery northward as congestion in southern waters increases. Currently, an experimental fishery is taking place from Amphitrite Point to Cape Cook and north into Queen Charlotte Sound. High concentrations of Pacific hake have been found in the trawl areas around Brooks Peninsula. The numbers of hake north of Estevan Point vary inter-annually in response to water temperature; in warm years they move further north. There are also several small distinct but unfished populations of hake in the inlets along the west coast of Vancouver Island. These fish spawn locally and account for about 5% of the hake biomass in Canadian waters.

There is a striking progression in the geographic distribution of hake over the summer; in June hake are caught predominantly off Barkley Sound, in July and August the main concentration is further south near the Juan de Fuca Eddy, and by August hake begin moving to the shelf break. The offshore movement continues during September and so by October the main concentrations occur in the Eddy region and along the shelf-break.

Season: The fish move into Canadian waters from the United States in late-April to early-May and remain there until sometime in October when they move offshore and to

the south until the next spring. The precise timing of hake movements is thought to be dependent on temperature. Most of the hake trawl landings are in the third quarter (June, July, August). While the domestic fishery may start in May, the joint venture fishery usually gets under way in June when fish are available in greater concentrations, fishing until the quota is taken, sometime in September or October.

Bycatch: Walleye pollock is a major incidental catch in the hake fishery.

Biological notes relevant to oil spill response: Offshore Pacific hake stocks spawn off the coasts of northern California, and until about age 3 years, they reside year-round off the coast of southern California and northern Mexico. At age 3+ hake begin an annual feeding migration at depths of 100-250 m to the continental shelf off the coasts of northwest United States and southern British Columbia where summer time oceanographic conditions promote a high rate of primary and secondary productivity. The northern extent of the feeding migration increases with fish age and length: the larger and therefore faster fish travel further north while the smaller, slower fish do not make it to Canadian waters. Pacific hake are usually about 4-5 years old when they first enter Canadian waters but may be as young as 3+ years. Most fish in the fishery are 8-9 years old; the maximum age is about 15-20 years.

The biomass of Pacific hake in the La Perouse Bank area has fluctuated significantly reaching a high of 439,000 t in 1983; the biomass has averaged 262,000 t between 1983 and 1993. In El Niño years with higher water temperature, the hake move further offshore, near the outer edge of the continental margin, and further north.

FISHERY: Commercial midwater trawl
SPECIES: Walleye pollock (*Theragra chalcogramma*)

DATA SOURCES

Personal Communications:

Gary Buechler • Mark Saunders • G.A. (Sandy) McFarlane

References:

Bakkala, R., T. Maeda and G.A. McFarlane. 1986. Distribution and abundance of pollock (*Theragra chalcogramma*) in the North Pacific Ocean. INPFC Bull. 45: 3-20.
Workman, G. and M.W. Saunders. 1991. Walleye Pollock p. 179-200. *In*: J. Fargo and B.M. Leaman [eds.] Groundfish stock assessments for the west coast of Canada in 1990 and recommended yield options for 1991. Can. Tech. Rep. Fish. Aquat. Sci. 1778. 320 p.

NOTES

Fishery Characteristics: Walleye pollock is the most abundant fish species in the North Pacific Ocean. Along the North American coast it ranges along the continental shelf from southern Oregon to the Gulf of Alaska. It also supports the largest single species fishery in the world with catches at times in excess of 6 million tonnes annually mostly from Asian waters.

Walleye pollock remain a small incidental fishery in the joint venture and foreign Pacific hake fishery off the west coast of Vancouver Island (areas 3C and 3D). This accounts for 99% of all pollock landed in this region. Small quantities of pollock are caught incidentally by the groundfish fleet while targeting other groundfish species in Areas 3C and 3D.

Geographic Location and Effort: Four fishing areas for pollock are located in British Columbia waters; each of these is probably an independent stock. The northern pollock populations are found along the northeast coast of the Queen Charlotte Islands and in Queen Charlotte Sound (statistical areas 111 and 130). Small populations of pollock are also found off Vancouver Island on the southwest (statistical areas 123-125) and southeast (statistical areas 17, 18 and 29) coasts.

FISHERY: Commercial trawl

SPECIES: Sablefish (*Anoplopoma fimbria*)

DATA SOURCES

Personal Communications:

Gary Buechler • Mark Saunders • G.A. (Sandy) McFarlane

References:

Saunders, M.W. and G.A. McFarlane. 1991. Sablefish p. 117-136. *In*: J. Fargo and B.M. Leaman [eds.] Groundfish stock assessments for the west coast of Canada in 1990 and recommended yield options for 1991. Can. Tech. Rep. Fish. Aquat. Sci. 1778. 320 p.

NOTES

Fishery Characteristics: Sablefish are caught on deep banks by bottom trawl. It is a minor component of the trawl fishery; from 1989-93 the average landings off the west coast of Vancouver Island were 335 tonnes compared to the total average landings of 16,617 tonnes for the domestic fishery and 75,075 tonnes caught in the joint venture fishery for Pacific hake. The trawl catch is also minor compared to the trap and longline landings for sablefish. The high price paid for sablefish (over \$2.60/kg) results in landings off the west coast of Vancouver Island being worth an average of over \$870,000 annually. The price received by the trawl fishery for sablefish, although high with respect to other trawl caught fish, may be up to \$2.00/kg less than that obtained by the trap/longline fishery.

Regulations: The trawl fishery for sablefish is managed using a size limit, coastwide total allowable catch (TAC) and trip limits during the first quarter. The TAC is divided between the trap/longline fishery and the trawl fishery with the latter allocated only a small portion; in 1994 the trawl fishery is allocated 430.4 tonnes or 8.75% of the TAC.

Depth: Adult sablefish are abundant along the coast at depths exceeding 200 m. As such, they are taken by trawlers on the deeper trawl grounds along the edge of the continental shelf.

Geographic Location and Effort: Almost 70% of the sablefish trawl landings come from trawl grounds in area 3C; there is little sablefish landed north of Brooks Peninsula.

Seasons: Over the last 5 years, catches have typically been highest during July and lowest during the winter months. This is opposite to the trap/longline fishery and is probably a function of factors related to the characteristics of the fleet, the biology of the species and the nature of the regulations:

- the trawl fleet is generally most active during the period of June to September because of the better weather;

- as the season progresses sablefish move slightly inshore and are, therefore, more available to the trawl fishery;
- July is the start of a quarter and so the quarterly quota is still all available; and
- the quarterly quotas are still reasonably high as it is still early in the year; by the last quarter quotas are usually lower.

3. COMMERCIAL GROUND FISH HOOK-AND-LINE AND TRAP FISHERIES

DATA SOURCES

Personal Communications:

Gary Buechler • Susan Hahn • Barry Ackerman

DATA COMPILED

Database file structure: Table B2, Appendix B

Database: HOOKLINE.dbf

Map: Groundfish Hook and Line, and Trap Fisheries

USE LEVEL RATING

Use level for groundfish hook/line and trap fisheries indicates presence or absence of fishing of a particular species in a polygon. Therefore, the coding is:

0 = not used for that fishery.

1 = used for that fishery.

GENERAL NOTES FOR ALL GROUND FISH HOOK-AND-LINE OR TRAP FISHERIES

Species which are taken by hook-and-line, or trap in the offshore region of the west coast of Vancouver Island include:

Species	Gear
Lingcod	hand-line, troll, longline
Rockfish	hand-line, troll, longline, rod-and-reel
Sablefish	trap, longline
Pacific halibut	longline
Spiny dogfish	longline (set lines, sunken gillnet)
Pacific hagfish	trap

Each species is discussed individually in the following sections. Although each species is subject to its own regulations there is one coastwide regulations for all hook-and-line, or trap fisheries which states that:

"All hook and line fisheries are closed year-round in portions of 121-1 and 121-2 (Swiftsure bank) inside a line bounded by 48034'N/125006'W - 48034'N/124054'20"W - 48029'62"N/124043'40"W and along U.S. border."

FISHERY: Commercial hook and line
SPECIES: Lingcod (*Ophiodon elongatus*)

DATA SOURCES

Personal Communication:

G.A. (Sandy) McFarlane # Mark Saunders # Gary Buechler
• Susan Hahn • Barry Ackerman

References:

Richards, L.J. and C.M. Hand. 1991. Lingcod. p. 19-42. *In*: J. Fargo and B.M. Leaman [eds.] Groundfish stock assessments for the west coast of Canada in 1990 and recommended yield options for 1991. Can. Tech. Rep. Fish. Aquat. Sci. 1778. 320 p.
Cass, A.J. R.J. Beamish and G.A. McFarlane. 1990. Lingcod (*Ophiodon elongatus*). Can. Spec. Publ. Fish. Aquat. Sci. 109: 40 p.

NOTES

Fishery Characteristics: Lingcod is the only dedicated hook and line fishery on the west coast of Vancouver Island other than rockfish. The fish are sold mainly as fresh product to local restaurants and retail stores. Fishing is primarily by longline or troll although there is some hand jigging. Hook and line landings are minor compared to trawl landings on the west coast of Vancouver Island.

Regulations: A "C" licence is required to fish lingcod with hook and line. There are separate TACs assigned for south of Estevan Point (1994: 2,100 tonnes) and for north of Estevan Point (1994: 600 tonnes). The fishery is open from April 15 to November 14 or until the quota is taken.

Geographic Location and Effort: The hook and line fishery occurs over rocky bottom areas which are not suitable for trawling. Lingcod is primarily fished north of Estevan Point on reefs < 180 m. "Hot Spots" are found off Estevan Point, Brooks Peninsula, Cape Beale and Cape Cook. There are also fisheries off the entrances to Nootka Inlet and Quatsino Sound.

Seasons: The season for lingcod is open April 15 - November 14. The salmon troll fleet tend to target lingcod April 15 to mid-June and mid-September to mid-November (prior to and after the salmon fishery).

Depth: Adult lingcod are found at depths ranging from 10-400 m, although most occur in rocky areas between 10-100 m. The hook and line fishery is primarily in water less than 180 m.

Bycatch: The hook and line fishery for lingcod in area 3C includes a target longline and incidental catches by the salmon troll fleet and the hook and line rockfish and Pacific halibut fleets.

FISHERY: Commercial hook and line
SPECIES: Rockfish (*Sebastes spp.*, *Sebastolobus spp.*)

DATA SOURCES

Personal Communication:

Laura Richards # Rick Stanley # Gary Buechler
• Susan Hahn • Barry Ackerman

References:

Hand, C.M. and L.J. Richards. 1991. Inshore Rockfish. p. 277-302. *In*: J. Fargo and B.M. Leaman [eds.] Groundfish stock assessments for the west coast of Canada in 1990 and recommended yield options for 1991. Can. Tech. Rep. Fish. Aquat. Sci. 1778. 320 p.

NOTES

Fishery Characteristics: The Rockfish hook and line fishery off the west coast of Vancouver Island has increased dramatically since 1985 and exceeded landings from other areas of the coast since 1986. There are two targeted fisheries:

- **Rockfish "live" fishery:** Fish are kept on board and shipped in tanks to serve the Chinese market. The live fishery is done by small boats (14-30 ft.) using hand-lines or rod-and-reel. The average price in 1993 was \$4.48/kg with landings and values of 277 tonnes (\$1.24 million). The "live" rockfish fishery focuses on quillback, copper, China and tiger rockfish which are shallow water species fished mainly inside sounds in depths of less than 35 m.

- **Rockfish "dead" fishery:** Fish are not kept alive but are delivered fresh to the local restaurant markets. The fishery uses longlines. The average price in 1993 was \$2.52/kg with landings and values of 538 tonnes (\$1.35 million). Yelloweye rockfish comprise most of the "dead" longline catch.

On the west coast of Vancouver Island the main fishery is the "dead" rockfish fishery.

Regulations: The fishery is restricted using a limited entry licensing (ZN licence). In 1994, there are about 200 boats licensed to fish rockfish with hook and line gear outside the Strait of Georgia. There is an annual TAC for "live" and "dead" rockfish combined.

Geographic Location and Effort: Both fisheries occur along the entire west coast of Vancouver Island on rocky outcrops mixed with sand and other bottoms. Most of the longline catch on the west coast of Vancouver Island is from statistical area 27 and the "live" fishery catch is from statistical areas 23, 24 and 27 (including offshore regions).

Seasons: The fishery opens on April 15 and continues until the total rockfish quota is taken - usually the third week in July.

Depth: The hand-line and rod and reel fishery occurs in depths of < 50 m while the longline fishery occurs in depths of up to 150 m, although mostly in areas with depths <100 m. Each species does, however, have its own depth range.

Bycatch: Much of the hook and line catch of Vancouver Island is incidental to other fisheries such as Pacific halibut, lingcod and spiny dogfish (47%). Salmon trollers can retain up to 20 rockfish of any species per day; halibut licenced vessels can also retain a certain poundage of rockfish caught.

FISHERY: Commercial longline and trap
SPECIES: Sablefish (*Anoplopoma fimbria*)

DATA SOURCES

Personal Communications:

Gary Buechler # Mark Saunders # G.A. (Sandy) McFarlane
• Susan Hahn • Barry Ackerman

References:

- Beamish, R.J. and G.A. McFarlane. 1988. Resident and dispersal behaviour of adult sablefish (*Anoplopoma fimbria*) in the slope waters off Canada's west coast. *Can. J. Fish. Aquat. Sci.* 45: 152-164.
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- McFarlane, G.A. and R.J. Beamish. 1990. Effect of an external tag on growth of sablefish (*Anoplopoma fimbria*), and consequences to mortality and age at maturity. *Can. J. Fish. Aquat. Sci.* 47: 1551-1557.
- McFarlane, G.A. and R.J. Beamish. 1983. Biology of adult sablefish (*Anoplopoma fimbria*) in waters off western Canada. p. 59-93. *In: Proceedings of the International Sablefish Symposium. Lowell Wakefield Series. B. Metteff [ed.]. Alaska Sea Grant Rep, 83-8.*
- McFarlane, G.A. and R.J. Beamish. 1983. Overview of the fishery and management strategy for sablefish (*Anoplopoma fimbria*) off the west coast of Canada. p. 13-35. *In: Proceedings of the International Sablefish Symposium. Lowell Wakefield Series. B. Metteff [ed.]. Alaska Sea Grant Rep, 83-8.*
- McFarlane, G.A. and R.J. Beamish. 1983. Preliminary observations on the juvenile biology of sablefish (*Anoplopoma fimbria*) in waters of the west coast of Canada. p. 119-135. *In: Proceedings of the International Sablefish Symposium. Lowell Wakefield Series. ed. B. Metteff. Alaska Sea Grant Rep, 83-8.*
- McFarlane, G.A., M.W. Saunders, R.E. Thompson and R.I. Perry. 1994. Larval distribution and abundance of Sablefish (*Anoplopoma fimbria*), off the west coast of Vancouver Island and linkages to physical oceanography. *Proc. Int. Sablefish Symp. in press*
- Manson, J.C., R.J. Beamish and G.A. McFarlane. 1983. Sexual maturity, fecundity, spawning, and early life history of sablefish (*Anoplopoma fimbria*) in waters of the Pacific coast of Canada. p. 137-140. *In: Proceedings of the International Sablefish Symposium. Lowell Wakefield Series. ed. B. Metteff. Alaska Sea Grant Rep, 83-8.*
- McFarlane, G.A. and R.J. Beamish. 1992. Climatic influence linking copepod production with strong year-classes in sablefish, *Anoplopoma fimbria*. *Can. J. Fish. Aquat. Sci.* 49: 743-753.
- Saunders, M.W. and G.A. McFarlane. 1991. Sablefish. p. 117-136. *In: J. Fargo and B.M. Leaman [eds.] Groundfish stock assessments for the west coast of Canada in 1990 and recommended yield options for 1991. Can. Tech. Rep. Fish. Aquat. Sci. 1778. 320 p.*

NOTES

Fishery Characteristics: In terms of dollar value, the sablefish trap and longline fishery is currently one of the most important groundfish fisheries on Canada's west coast, with catches worth \$25 million per annum. Sablefish is the one of the higher priced groundfish species on the British Columbia coast, currently selling for \$2.00 - \$6.00 per pound. The major market is Japan where sablefish is eaten as a winter dish.

The fishery uses either large conical traps or longlines; vessels are allowed to switch between the two gear types at will. About 75% of sablefish landed off the west coast of Vancouver Island are caught by baited traps; the 25% taken by longlines is expected to decrease to 10-15% in 1994.

The west coast Vancouver Island catch previously accounted for 50% of the British Columbia sablefish catch. However, given the higher price paid for larger fish, and the fact that fish tend to be larger in northern waters, the fleet has moved north to Queen Charlotte Strait and Hecate Strait, and fishing has diminished off west coast Vancouver Island. The catch off the west coast Vancouver Island in 1989 was 2,595.4 tonnes by trap and 430.4 tonnes by trawl.

Regulations: The fishery is managed using a coastwide total allowable catch (TAC) and individual vessel quotas (IVQ). In 1994, 48 vessels were licensed to fish sablefish ("K" licence) of which 23 were active. Of the 4,521.1 metric tonnes TAC in 1994, 8.75% was allocated to trawlers, and 91.25% to vessels using longlines or traps. There is a size limit of ≥ 55 cm and the fishery is open year round.

Depth: Adult sablefish are abundant along the west coast of British Columbia at depths exceeding 200 m. Adults are abundant between 400 and 1,830 m and have been caught at depths of up to 2,740 m. Most of the commercial fishery is currently at depths between 300 and 1,200 m. No size segregation by depth is apparent in the commercial catch although it appears that older fish may be deeper. In the late 1970s, a high proportion of effort was directed at depths of 800-900 m while in recent years most of the effort has been directed at depths of 450-800 m.

Geographic Location and Effort: Much of the fishing in the study area is now carried out by smaller, local vessels. Most of the west coast Vancouver Island catch is taken in Barkley, Clayoquot, Father Charles, Nitinat and Ououkinsh Canyons.

Seasons: The fishery is open year-round. However, market demand concentrates fishing from January to April and September/October to mid-December.

Bycatch: There is very little bycatch in the sablefish fishery, especially with traps.

Biological notes relevant to oil spill response: Sablefish are a long lived fish that occur along the continental coast from California to Alaska. Most commercially caught

sablefish range in age from 4 to 35 years but can be as old as 70 years. Over a 9-year period fishing and natural mortality remove about 90% of all adult fish in a cohort.

Sablefish constitute one genetic population throughout their range. Recruitment to an area is primarily from juveniles and is heavily dependent on periodic strong year classes. Sablefish on seamounts are distinct stocks to those on the continental slope and are probably recruited as juveniles at age 3+ and 4.

Sablefish spawn simultaneously all along the coast from January to late March peaking in mid-February. Spawning occurs midwater at depths of 300-500 m in areas along the shelf-slope edge where the depth is >1,000 m. The eggs rise to a depth of between 200 and 300 m immediately after fertilization. They remain at this depth until about 24 hours prior to hatching (12 days at 6°C), when the egg density increases and the eggs begin to sink. The newly hatched larvae become denser and continue to sink for the next 6-7 days reaching a maximum depth of 1,000 - 1,200 m. Feeding (on calanoid copepods) begins about 20 days after hatching and the larvae begin to rise. Approximately 40 days after hatching they are near the surface >160 km offshore. Young juveniles are found in surface waters in July and August and generally located in shallow inshore waters, including inlets, at depths of 50 - 300 m until maturity (3+ years) when they return to the spawning areas.

The following table summarizes the change in depth distribution and location with development for young of the year sablefish. The dates given are extrapolated from an average spawning date of February 12. (Information is abstracted from McFarlane and Beamish 1983; Manson *et al.* 1983; McFarlane and Beamish 1992).

Approximate Date	Depth (m) in the water column	Location	Stage
Feb 12	300 - 500	along slope-shelf break where water depth >1000 m	eggs released
Feb 24	200 - 300	along slope-shelf break where water depth >1000 m	hatching begins
March 3	1000 - 1200		eye pigmentation (max depth)
March 14	800		start feeding
April 10	surface	> 160 km from shore	full yolk sac utilization
July - August	surface	beach to 80 km offshore	young juveniles

The geographic distribution of sablefish larvae in April in the surface waters varies considerably among years and areas. Centres of abundance were typically found off the shelf (300-1,000 m depth) in the La Perouse Bank and Brooks Peninsula areas. In all years it was found that larvae tend to accumulate in areas where currents were weakest or surface gyres occurred.

FISHERY: Commercial hook and line

SPECIES: Pacific halibut (*Hippoglossus stenolepis*)

DATA SOURCES

Personal Communications:

Gary Buechler # Bruce Leaman • Susan Hahn • Barry Ackerman

NOTES

Fishery Characteristics: All commercial Pacific halibut is caught by longline. Coastwide, 435 vessels are licensed to retain halibut. Most of the fishery in the study area is concentrated along the north coast of Vancouver Island in Area 11. The west coast Vancouver Island represents only about 10% of the fish caught coastwide in B.C. (\approx 1 million pounds).

Regulations: The dedicated Pacific halibut fishery requires an "L" licence. No retention of halibut by trawl gear is allowed. The fishery is managed using an individual vessel quota (IVQ) and a restricted season to protect spawning stocks. There is a minimum size limit of 81.3 cm (head on).

Depth: Most fishing occurs at depths of 90-180 m, though inshore fisheries can be as shallow as 20-30 m.

Geographic Location and Effort: Off the west coast of Vancouver Island, most fish are caught south of Estevan Point on Big Bank, off Barkley Sound and around the edges of Swiftsure Bank (Swiftsure Bank itself is closed to all hook and line finfish fisheries). Some fishing also occurs around Barrier Island off Kyuquot and around Cape Scott (Topknot to Triangle Island - most is in statistical area 111).

Seasons: Fishing is open March 1 - November 15.

Bycatch: The rockfish fleet is allowed to retain halibut as a bycatch equivalent to 20% of total catches; however, bycatches typically reach only 6-8%.

Biological notes relevant to oil spill response: Spawning occurs between November and March along the edge of the continental shelf at depths from 180 to 450 m. The major spawning grounds are in northern British Columbia and Alaska coastal waters and in the Bering Sea. The widespread winter distribution of mature Pacific halibut suggests that spawning occurs throughout their range in low densities. The eggs and larvae are planktonic and most settle out in the Gulf of Alaska. With increasing age the juveniles move to deeper waters and migrate east and south. The waters off the west coast of Vancouver Island are primarily summer feeding grounds for the adults.

FURTHER INFORMATION

The Department of Fisheries and Oceans does not maintain information on the distribution of the Pacific halibut fleet and the information provided in this report is incomplete. The Pacific Halibut Commission, based in Seattle, Washington, is responsible for managing this fishery and has detailed information on the distribution of the fleet obtained through log book monitoring. The Pacific Halibut Commission should be contacted for further information on this fishery.

FISHERY: Commercial hook and line
SPECIES: Spiny dogfish (*Squalus acanthias*)

DATA SOURCES

Personal Communication:

Gary Buechler # Mark Saunders • Susan Hahn • Barry Ackerman
• G.A. (Sandy) McFarlane

References:

Ketchen, K.S. 1986. The spiny dogfish (*Squalus acanthias*) in the Northeast Pacific and a history of its utilization. Can. Spec. Publ. Fish. Aquat. Sci. 88: 78 p.
Thompson, B.L., M.W. Saunders and M.S. Smith. 1991. Spiny Dogfish. p. 165-178. In: J. Fargo and B.M. Leaman [eds.] Groundfish stock assessments for the west coast of Canada in 1990 and recommended yield options for 1991. Can. Tech. Rep. Fish. Aquat. Sci. 1778. 320 p.

NOTES

Fishery Characteristics: The spiny dogfish hook and line fishery primarily uses longline gear although set lines and sunken gillnets have also been used. The fixed gear is able to better select for the larger fish which the market prefers. The catch is processed in the U.S. because of economics. Currently, fishing effort is limited due to underdeveloped markets. There is a new, pharmaceutical market for shark cartilage which processes the fish locally.

The spiny dogfish fixed gear fishery has a coastwide TAC of 15,000 tonnes outside of the Strait of Georgia. This amount is not fished due to the lack of a market. The longline catch has increased in the last few years, especially in area 3C. The longline landings in 1989 for the west coast of Vancouver Island were 989.3 tonnes compared to 862.9 tonnes taken by the trawl fishery.

Regulations: The fishery is managed by an annual TAC.

Depth: The concentration of marketable fish tends to be mainly on the continental shelf in shallower water in summer (can be 18 m or less) and deeper water in winter (>94 m). Spiny dogfish can be found up to 550 m in low numbers.

Geographic Location and Effort: While spiny dogfish move extensively throughout the coast, the majority of the spiny dogfish longline catch off the west coast of Vancouver Island comes from statistical area 23; the landings are not differentiated between onshore (statistical area 23) and offshore (statistical area 123). The offshore area near the mouth of Barkley Sound is one of the most important areas for the west coast spiny dogfish longline fishery.

Seasons: The spiny dogfish longline fishery occurs during the winter and spring months; landings in 1989 were reported for October through May; over 87% of the annual spiny dogfish trawl landings were in February through May.

Bycatch: Skate and rockfish are caught as bycatch.

FISHERY: Commercial trap**SPECIES: Pacific hagfish (*Eptatretus stouti*)****DATA SOURCES****Personal Communications:**

Barry Ackerman • Susan Hahn • Gary Buechler

References:

Neville, C.M. and R.J. Beamish. 1991. Pacific Hagfish. p. 303-308. *In*: J. Fargo and B.M. Leaman [eds.] Groundfish stock assessments for the west coast of Canada in 1990 and recommended yield options for 1991. Can. Tech. Rep. Fish. Aquat. Sci. 1778. 320 p.

NOTES

Fishery Characteristics: The fishery for Pacific hagfish is small and experimental; only two boats are currently active. Traps are small and baited; the fish are killed in the trap with high doses of the anaesthetic MS222. The experimental Pacific hagfish trap fishery was initiated in British Columbia in late 1988 to service the Korean market for "eel skin". The fish were frozen and sent whole to Korea. Pacific hagfish was worth about \$0.45/kg frozen in the round delivered to Port Alberni or Ucluelet. The flesh is also eaten in Korea; however, Canadians use too high a level of MS222 to kill the fish and the Canadian meat was banned in Korea. The Koreans switched to the Canadian east coast as a source for hagfish where the price is lower. Consequently, the market for west coast hagfish collapsed in 1992 and there is no sign of a resurgence.

The number of permits from 1988 - 1990 varied from 0-11. In statistical area 123 there have been only 2 permitted boats.

Regulations: The fishery was experimental and fishing is by permit; permit holders are allowed to fish in statistical areas 23-27 and 123. There are trap limits of 3500 in offshore waters.

Geographic Location and Effort: Pacific hagfish are found from Baja to Alaska on predominantly mud or sand substrate. Fishing has been concentrated in statistical areas 23 and 123; "3 mile hole" was the favoured location. Inshore fishing occurred in statistical areas 23-27 but populations were small and these areas were fished out quickly.

Biological notes relevant to oil spill response: Little is known about Pacific hagfish biology but is known to have low fecundity (20-30 eggs). Stocks appear to be locally declining in response to the experimental fishery but this may be a local phenomenon.

4. COMMERCIAL TROLL FISHERIES

FISHERY: Commercial troll

SPECIES: Pacific salmon (*Oncorhynchus spp.*)

DATA SOURCES

Personal communication:

Tom Shardlow # Carmen McConnell

References:

Map of "West Coast Vancouver Island Troll Fishery - Conservation Areas" showing general and high catch fishing areas (see discussion under "Use Level Rating" below).

Ryall, P.J. 1993. Review of 1991 South Coast Salmon Troll Fisheries. Can. MS Rep. Fish. Aquat. Sci. 2194.

Ryall, P.J. and T.F. Shardlow. 1992. Review of 1990 South Coast Salmon Troll Fisheries. Can. MS Rep. Fish. Aquat. Sci. 2129.

Shardlow, T.F., T.G. Hoyt and A.D. Anderson. 1988. Review of 1986 South Coast Salmon Troll Fisheries. Can. Tech. Rep. Fish. Aquat. Sci. 1560.

DATA COMPILED

Database file structure: Table B3, Appendix B

Database: SALMON.DBF

Map: Commercial Salmon Troll Fisheries - charts 3602, 3603, 3001

USE LEVEL RATING

The areas shown on map "Salmon Troll Fisheries" were identified by C. McConnell through discussions with fishers involved in the troll test fishery in 1989-91. The areas were identified as those areas most frequently fished on average over the past 10 years. The fishers involved had extensive experience in the troll fishery throughout west coast Vancouver Island. The areas are colour-coded and rated for individual species as:

1 = general fishing area (chinook and coho only).

2 = high catch fishing area (for individual species: chinook, coho, sockeye).

However, Mr. McConnell stressed the variability of these areas and their ratings from year to year and from operator to operator.

NOTES

Fisheries characteristics: All five species of Pacific salmon are caught in the commercial troll fishery along offshore west Vancouver Island. Approximately 1,200 trollers are licensed to fish off west coast Vancouver Island and the north coast, and

while some operate in both regions, slightly more than half fish primarily in west coast Vancouver Island.

Season: The overall salmon trolling season runs from late June to mid-late September, with the different species dominating at different times during that season. Based on generalized migration patterns, the sequencing of the fisheries can be roughly characterized as:

- Early season (late June - mid/late July): chinook and coho.
 - Mid season (late July - mid August): sockeye and pink.
 - Late season (late August - mid/late September): coho, pink, chinook.
- Chum are taken throughout season in small numbers.

Regulations: Trollers are licensed for fishing either outside or inside waters. Fishing plans are developed in conjunction with the Outside Troll Advisory Committee. Catches are subject to limits set by Pacific Salmon Treaty quotas, domestic allocations, and stock abundance. Fishing is regulated by season and area openings/closures to meet the prescribed allocations.

A series of troll fishery conservation areas have been defined for southern waters from Cox Point south to the U.S. border, to allow for localized regulation in areas that are heavily fished (see map). The southeasterly areas "G" and "S" are normally closed at the start of the season, and opened only if sockeye catches are low, to allow the troll fleet to catch its quota. Areas that are close to shore ("H" and "I") have tended to be closed in the last few years to conserve coho stocks.

The following table provides an indication of allocations, seasons and area closures for west coast Vancouver Island using information from the 1991 management plan as a case example.

Species	Limits (1991)	Season Open (1991)	Other regulatory measures
Sockeye	18.3% of Canadian Total Allowable Catch	August 11-20	Season closed when allocation reached. Some conservation areas may be closed. Non-retention in effect in other fisheries once season is closed.
Pink	29% of Canadian Total Allowable Catch	June 28-Sept.18	Subject to periodic: - closure of southwest coast to protect South Coast Study Area stocks. - area-specific closures. - non-retention regulations in northwest coast.
Chinook	ceiling 360,000 pieces	June 28-Sept.18	Subject to periodic: - south coast-wide closures to protect certain species/stocks. - area-specific closures.
Coho	ceiling 1.8 million pieces	June 28- Sept.7	Season closed once ceiling reached. Some conservation areas closed to prevent coho shaking.
Chum	NA	June 28- Sept.18	

Depth, Geographic Location and Effort: Up to 700 vessels can be fishing along west coast Vancouver Island at the peak of the season (mid-July and/or mid-August, depending on species' cycles). Because salmon are migratory and move in schools, the fisheries tend to be wide-ranging but areas of concentrated effort targeting on individual species can be identified. The areas identified on the "Salmon Troll Fisheries" map represent areas where trollers tend to "tack" or move back and forth. In the southern half of the study area, closures in salmon troll conservation areas also determine the location of the fleet.

Fishing behaviour and effort are discussed further in the following species-specific notes.

Chinook: The majority of the chinook fishery occurs south of Estevan Point, with areas of concentrated effort over the edges of banks (e.g. Amphitrite Bank) and over rock piles and pinnacles (e.g. off Solander Island). Fishing occurs from late June to mid to late September. Swiftsure Bank is a chinook rearing area. The conservation area that includes this bank (area "S") is normally closed to salmon fishing (see "Regulations" below).

Coho: The coho fishery is a major fishery off west coast Vancouver Island, based on a mix of stocks originating primarily from the United States. Most fishing occurs south of Estevan Point, with trollers ranging from very shallow waters out to 100 fathoms. High catches occur over or on the edges of banks. Fishing occurs throughout the season (late June to late September) but is concentrated in July.

Sockeye: The sockeye fishery is characterized by a four-year cycle of dominant and subdominant years linked to the Adams River run (1994 was a dominant year). Fishing occurs from mid-July to the end of August; seasons are set within that general time frame (see "Regulations" below).

During migration, sockeye runs tend to "hit" the coast of Vancouver Island either at the northern tip or about midway around Tatchu Point and Esperanza Inlet. The schools tend to move close to shore favouring deeper, cooler waters. Depending on the location and direction of migration of the fish, the fleet may be concentrated either at the north end of the study area or north and south of Barkley Sound. Most trolling occurs along the 50-fathom (100 m) line, between 20 and 100 fathoms (40 and 200 m).

Pink: (not mapped) The pink salmon fishery is dominated by the two-year cycle of Fraser River runs. The timing and pattern of the pink salmon fishery overlaps that of the sockeye fishery in that pink salmon are fished coast-wide primarily along the 50-fathom line; there are no identifiable areas of concentrated effort. Most trollers target on either pink or sockeye but there is always a bycatch of the other species. The relative location and timing of migrating schools dictate which species is being targeted at any particular time during the season. However, since pink salmon is a less valuable species, sockeye tend to be the primary target in the dominant years of their cycle.

Chum: (not mapped) Chum salmon are a minor species in the troll fishery, mostly caught incidentally in fisheries targeting on the other species. Fishing occurs all season (June to September). Most fish are caught north of Estevan Point from stocks heading for Johnstone Strait to reach spawning habitat in inside waters.

FURTHER INFORMATION

- Counts of fishing boats are reported twice daily during the troll season from the Ucluelet radar station for statistical areas 21, 23 and 24. An example of a radar count report is attached (Figure 2).
- Weekly overflights of the entire offshore Vancouver Island area produce maps showing distribution and numbers of trollers (see Figure 3). These are compiled annually as troll effort reports for DFO by J. O. Thomas Inc. However, the overflight program was discontinued in 1994.

FIGURE 2: Example of Ucluelet radar count of salmon trollers in statistical areas 123, 124, and 125.

UCLUELET RADAR COUNTS

Observer: SHIRLEY BAIRD
 Date: Day: 16 Month: 07 Yr: 91
 Time: (24 hr clock): 1500
 Windspeed (knots/hr):
 Amphitrite: NW 04 Estover: SW 04

Estimated Number of Boats:

Area 21
 Sub 52 (Switsure) 47
 53 37
Total 84

Area 23
 Sub 58 (7 & 12 mile) 30
 57 (20 mile) 60
 58 (South Bank) 37
 59 (Big Bank) 15
 113 (Finger Bank) 6
Total 148

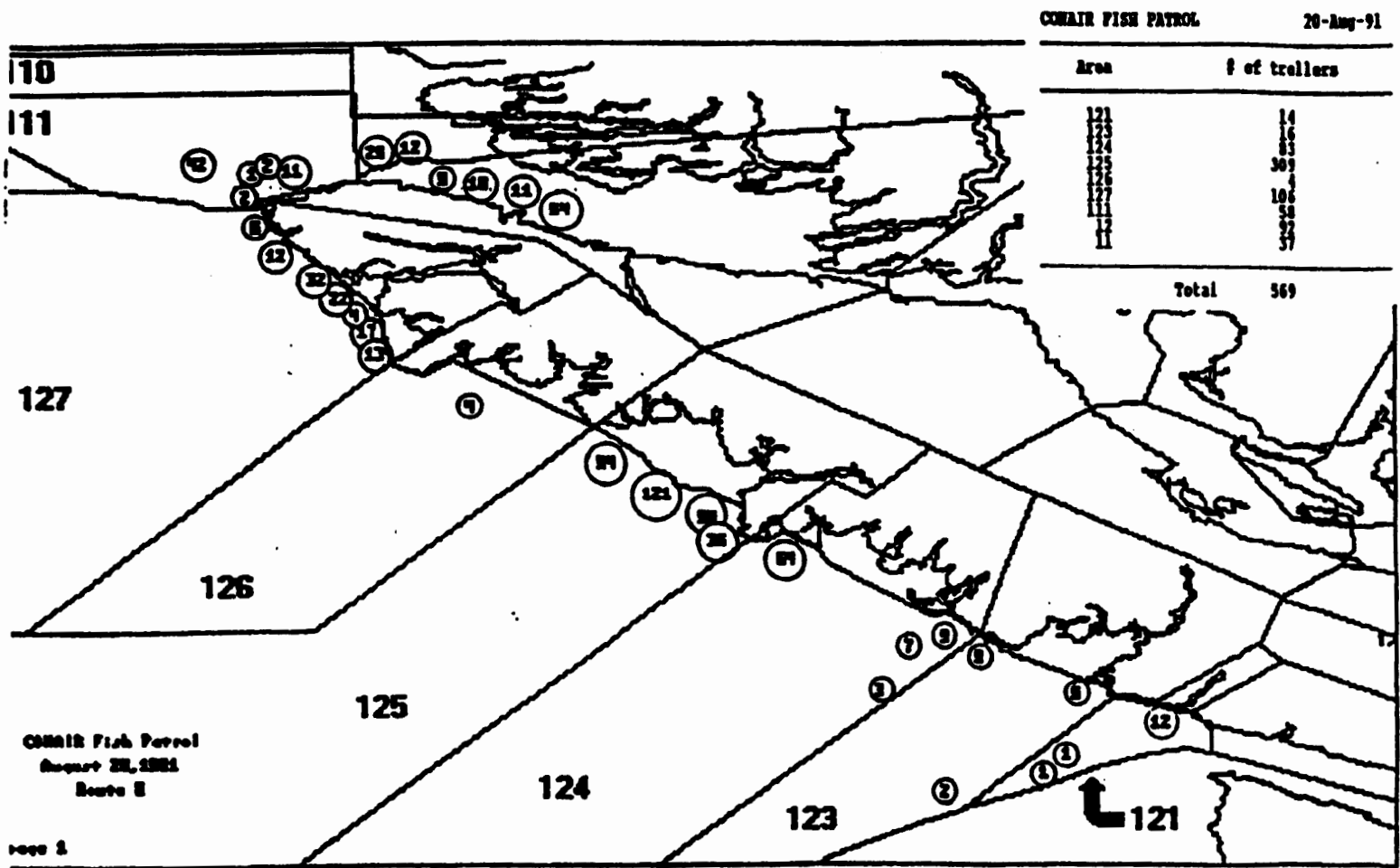
Area 24
 Sub 60 (La Perouse) 71
 61 4
 62 (Portland Pt) 140
 63 10
 64 (Estover Pt) 20
 65 2
Total 217

Total for SWTR 449



Comments: CLOUDY - BREAKING

FIGURE 3: Example of west coast salmon troll fishery overflight report.



FISHERY: Commercial troll
SPECIES: Albacore tuna (*Thunnus alalunga*)

DATA SOURCES

Personal communication:

Barry Ackerman # Gary Buechler • Susan Hahn

DATA COMPILED

Database file structure: No database.

Database: None.

Map: Albacore Tuna - Figure 4 (in report)

USE LEVEL RATING: No rating; mapped polygons represent areas where trolling known to occur.

NOTES

Fisheries characteristics: In Canadian waters, Albacore tuna are fished by troll boats and frozen at sea. Some 200-300 Canadian vessels are licensed to fish tuna, but only about 100 participate. The vast majority of boats are salmon trollers operating between salmon seasons. Therefore, the number of participating boats is proportional to the status of the salmon fisheries. Canadian boats will often delay entering the tuna fishery if salmon fishing is favourable.

In addition, 100-200 United States vessels fish tuna in Canadian waters (within the 200-mile limit). Unlike Canadian vessels, U.S. boats are dedicated to tuna trolling.

Albacore tuna are worth about \$1.00 per lb; the annual catch ranges to \$0.5 million.

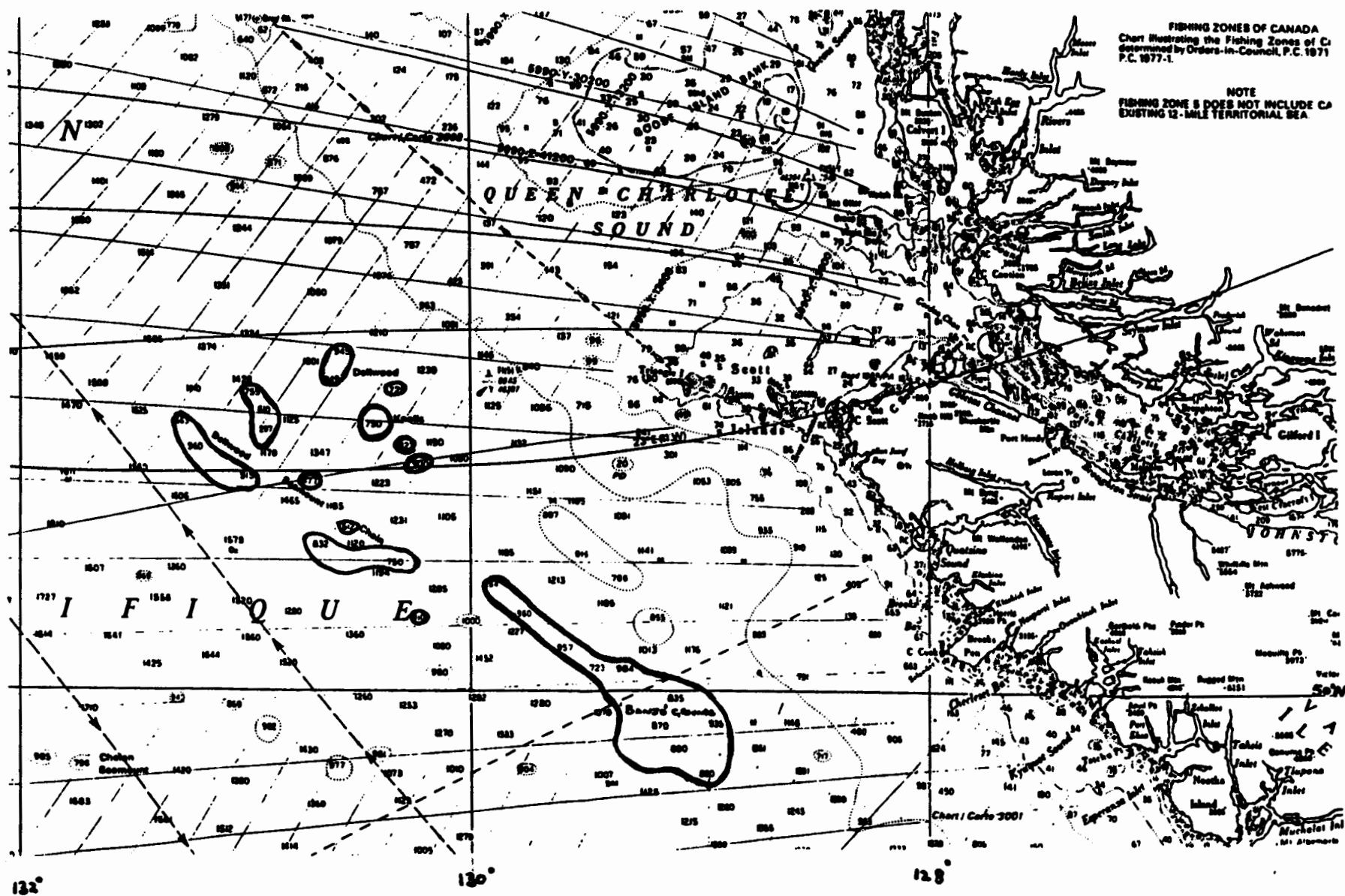
Regulations: The fishery requires a "C" licence; fishers must submit a letter of intent to participate in the fishery.

Depth: Fishing occurs at the surface.

Geographic Location and Effort: Albacore tuna migrate from Harrier Island, hitting land at Cape Medicago where they veer north or south depending on the water temperature. They favour water that is 10-15°C ("blue water"). The fishing in Canadian waters is concentrated on the "Banjo" grounds (an upwelling 60-70 miles offshore due west of Cape Scott at 2000 m) in July, then the Dellwood Seamount range in August. Trollers then follow the tuna up to the Queen Charlotte Islands.

Seasons: Albacore tuna usually enter British Columbia waters in the second or third week of July and stay until the first week of October.

FIGURE 4: Distribution of the Albacore tuna fishery.



5. ABORIGINAL FISHERIES

DATA SOURCES

Personal communication:

F. Crabbe • Susan Hahn • Gary Buechler

DATA COMPILED

Database file structure: Table B4, Appendix B

Database: ABORIGIN.dbf

Map: Aboriginal and Recreational Fisheries

USE LEVEL RATING

Based on number of boats using each polygon (traditional area), as provided by F. Crabbe:

- 1 = low: 1-9 boats
- 2 = medium: 10-20 boats
- 3 = high: >20 boats

This use level rating does not take into account the relative importance of the fishery to the needs of the First Nations involved. Given the federal government's fiduciary responsibilities to uphold aboriginal fishing rights, the use level rating should probably not be used as a significant determining factor in oil spill contingency planning.

NOTES

Fishery Characteristics: Each of the 14 First Nations along west coast Vancouver Island has traditional fishing areas (see map). However, as members of the Nuuchahnulth Tribal Council (NTC), they have agreed that all offshore waters (outside the surf line) are common property such that members of any First Nation may fish in another's traditional area.

Over 200 unlicensed vessels are involved in the aboriginal food fishery. The majority of fishing in the offshore is by troll, although there is some fishing by longline and jigging. There are no trawlers in the food fishery; however, the Nuuchahnulth First Nations also collectively own over 100 "A"-licensed commercial fishing vessels.

The First Nations vary in their concentration on groundfish versus salmon when fishing in offshore waters, depending on the availability of salmon in inshore waters and the relative dependence on groundfish as a food source. As a general rule, there is little offshore fishing for salmon except in years when there is a major diversion of sockeye along the west coast. However, First Nations whose traditional areas do not encompass strong salmon streams rely more heavily on offshore fishing for salmon. In

groundfish, the main species targeted are lingcod, shallow water rockfish and Pacific halibut. Juvenile sablefish are caught in the inlets.

In 1994, licenses were issued for the first time to First Nations in the Clayquot Sound area to harvest marine mammals: 15 sea lions, 15 fur seals, and 15 harbour seals.

Regulations: There are no gear or seasonal restrictions on aboriginal food fisheries. A total salmon catch (all species) of 92,000 fish was allocated for the NTC in 1994. An upper limit for the total groundfish catch by NTC members is established on an annual basis in consultation with the NTC. In 1994, the groundfish limit was set at 300,000 lb. divided into: rockfish - 120,000 lb; halibut - 120,000 lb; and Black cod (sablefish) - 60,000 lb. Each First Nation is issued a communal licence, primarily to keep track of the level of effort and harvest.

Season: The aboriginal groundfish fishery generally shoulders the salmon season. From June to October, groundfish tend to be caught incidental to salmon; before and after that time period, fishing is targeted on groundfish.

Depth, Location and Effort: The majority of fishing occurs within 100 m (50 fathoms), with most aboriginal fishers favouring depths around 40 m (20 fathom). Associated mapping shows the following 6 traditional areas used by the 14 west coast First Nations:

Traditional Area (approximate)	First Nations	No. unlicensed boats (approx.)*
Owen Pt. to Pachena Pt. Swiftsure Bank for halibut	Ditidaht	6
Pachena Pt. to Portland Pt.	Ohiaht, Opetchesaht, Tseshahht, Toquaht, Ucluelet, Uchucklesaht	196
Wikaninnish Beach to Nootka Sound	Ahousaht, Hesquiaht, Tla-o-qui-saht	77
Estevan Pt. to Ferrer Pt.	Mowachaht	5
Bajo Pt. to Tatchu Pt.	Ehattesaht, Nuchatlaht	12
Tatchu Pt. to Clerk Pt.	Kyuquot	10

*Numbers are derived from a survey of First Nations fishers in 1993, based on 1988-1992 information.

FURTHER INFORMATION

Nuu-chah-nulth Tribal Council; First Nations offices or Councils; local fishery officers.

6. RECREATIONAL FISHERIES

DATA SOURCES

Personal communication:

Frank Crabbe • Gary Buechler • Susan Hahn

References:

Fisheries and Oceans Canada. 1994. British Columbia Tidal Waters Sport Fishing Guide April 1, 1994 to March 31, 1995 inclusive.

DATA COMPILED

Database file structure: Table B5, Appendix B

Database: RECREATN.dbf

Map: Aboriginal and Recreational Fisheries

USE LEVEL RATING

Relative rating based on estimates of number of boats frequenting the area (polygon):

- 1 = low: 1-9 boats**
- 2 = medium: 10-20 boats**
- 3 = high: >20 boats**

NOTES

Fishery characteristics: Most recreational fishing in the offshore west coast Vancouver Island is for salmon. Pacific halibut and canary and yelloweye rockfish are targeted to a lesser extent. Fishing for groundfish is primarily by jigging although some are taken incidentally while trolling for salmon.

Regulations: All recreational fishers require a tidal water fishing licence. The following regulations apply to recreational fishing in the study area in 1994:

Species	Minimum size	Daily Limit	Possession Limit	Season Open	Gear Permitted
Chinook	45 cm	2: Dec.1- Mar.31 4: Ap.1 - Nov.30	Combined fresh /canned limits	All year	Hook and line
Other salmon sp.	30 cm	4	Combined fresh /canned limits	All year	Hook and line
Halibut	None	2	2	Feb.1 - Dec.31	Hook and line
Lingcod	None	3	6	May 1 - Nov.15	Hook and line, spear
Perch	None	8	16	All year	Hook and line, spear
Flounder, sole	None	8	16	All year	Hook and line
Rockfish	None	8	16	All year	Hook and line, spear
Dogfish	None	None	None	All year	Hook and line
Dungeness crab	165 mm	6	12	All year	Max. 2 rings, dip nets or traps/person.
Alaska King crab	None	2	4	All year	Max. 2 rings, dip nets or traps/person.
Shrimp & prawns	None	12 kg (in shell)	24 kg (in shell)	All year	Max. 4 traps/person

Swiftsure Bank - is closed to all finfish hook and line fishing (recreational and commercial). Heavy fishing on Swiftsure Bank, primarily by American recreational fishers out of Neah Bay, caused severe declines in halibut stocks, forcing the total closure of all finfish hook and line fishing on the Bank in the late 1980s.

Depth: Generally, 20-25 fathom (40-50 m) depths are favoured.

Season: Most recreational fishing occurs during the summer months. Southern areas are fished as early as April and early May, lasting until October. Northern areas are fished mostly from June to August.

Geographic Location and Effort: Six areas can be identified, based primarily on the presence of fishing lodges and charter operations, and secondarily on use by other recreational fishers. These areas are shown on the map and identified in the database. Up to 200 recreational boats have been counted between Cape Beale and Amphitrite Point within 5 - 7 km of the surfline during the summer.

FURTHER INFORMATION

Charter fishing and lodge operators.

7. COMMERCIAL SHELLFISH FISHERIES

FISHERY: Commercial trawl

SPECIES: Shrimp

DATA SOURCES

Personal Communication:

Jim Boutillier # Barry Ackerman

References:

Department of Fisheries and Oceans Pacific Region 1993 Management Plan - Shrimp by trawl.

DATA COMPILED

Database file structure: None.

Database: None.

Map: Commercial Shellfish Fisheries and Euphausiid Distribution

USE LEVEL RATING

No rating: map indicates presence only.

NOTES

Fishery Characteristics: The largest shrimp fishery in British Columbia occurs off Vancouver Island. The fishery uses bottom trawl primarily; smaller vessels working farther inshore use beam trawl. Widespread distribution of the fishery may be limited by access to processing facilities. Most landings occur at Ucluelet where there is a shrimp processing plant, and in Tofino from where it is shipped by truck to Vancouver. The fishery appears to have little impact on shrimp stocks overall, with the possible exception of the Tofino grounds.

Regulations: A "S" licence is required to trawl for shrimp. All areas are open year round. A quota was established in 1989, with an annual target catch of 5 million lb.

Depth: Most fishing occurs at depths of 90-180 m, averaging 140 m.

Geographic Location and Effort: There are 3 major grounds:

- the Tofino grounds in statistical area 124.
- the Nootka grounds in statistical area 125.
- the Canada/United States border waters (statistical area 121 and 123).

The Tofino grounds was historically the dominant fishing area, but in recent years, more boats have been fishing over both Tofino and Nootka grounds, blurring the

boundary between them. Some 20-25 vessels may fish these two areas combined during peak season.

Local fishing by "homesteaders" also occurs in a small ground off Cape Beale; 20 vessels at most use this area. A fishery is also developing off Quatsino Sound; 3-4 vessels are typically observed at any one time.

Seasons: Fishing effort peaks June to October, and continues into early November. Fishing tends to be more intense before and after salmon trolling season.

FISHERY: Commercial trap
SPECIES: Tanner crab (*Chionoecetes tanneri*)

DATA SOURCES

Personal Communication:

Glen Jamieson # Barry Ackerman

References:

Jamieson, G.S., G.D. Heritage and N. Noakes. 1990. Life History Characteristics of *Chionoecetes tanneri* off British Columbia. Proc. Int. Symp. King and Tanner Crabs, Nov. 1989, Anchorage Alaska. P.153-162.

Jamieson, G.S. 1990. Development of a Fishery for *Chionoecetes tanneri* on the Continental Slope off British Columbia: Management Considerations. Proc. Int. Symp. King and Tanner Crabs, Nov. 1989, Anchorage Alaska. P.587-592.

Department of Fisheries and Oceans Pacific Region 1993 Management Plan - Crab. Provides additional information on openings, closures and regulatory controls.

DATA COMPILED

Database file structure: None.

Database: None.

Map: Commercial Shellfish Fisheries and Euphausiid Distribution

USE LEVEL RATING

None; map indicates presence only.

NOTES

Fishery Characteristics: Two species of Tanner crab occur in British Columbia: *Chionoecetes bairdi* in mainland fiords; and *C. tanneri* along the continental slope off the west coast. An experimental fishery was conducted off Vancouver Island by 2 vessels in 1988 - 1990. Large, heavy conical pots or traps are used.

Several factors appeared to have worked against establishment of a commercially viable fishery: Snow crab (*C. opilio*) are preferred over Tanner crab on the predominantly oriental market; Canadian fisheries cannot compete effectively with Alaskan Snow crab fisheries on that market; there was a glut of Tanner crab on the market at the time; and processing techniques in British Columbia may not have been optimal.

Two vessels currently hold experimental permits, though only one has been active in the past few years. Some proportion of the catch is taken live to Tofino, cooked and then shipped to Vancouver. Otherwise, the fishery is for the small local market as "cracker legs".

Regulations: The fishery in 1994 is still classed as an experimental fishery.

Depth: Commercial concentrations occur primarily at depths of 500-700 m; the species range from 420-1,100 m, with females and juveniles occurring more frequently at the greater depths. Fishing effort is concentrated between 650-1,000 m.

Geographic Location and Effort: Effort is concentrated in a canyon off Nootka Island in statistical area 125.

Season: Most fishing is done from August to March.

FISHERY: Commercial trap
SPECIES: Dungeness crab (*Cancer magister*)

DATA SOURCES

Personal Communication:
Jim Boutillier

References:
Department of Fisheries and Oceans Pacific Region 1993 Management Plan - Crab.
Provides additional information on openings, closures and regulatory controls.

DATA COMPILED

Database file structure: None.
Database: None.
Map: Commercial Shellfish Fisheries and Euphausiid Distribution

USE LEVEL RATING

No rating; map indicates presence only.

NOTES

Fishery Characteristics: Most trapping for dungeness crab occurs in inshore waters, but a limited amount occurs off beaches outside the surf line. The fishery off Wikaninnish Beach is particularly significant.

FISHERY: Commercial fisheries
SPECIES: Squid (*Loligo sp.*)

DATA SOURCES

Personal Communication:
Glen Jamieson

References:

Department of Fisheries and Oceans Pacific Region 1993 Management Plan - Squid.
Bernard, F.R. 1980. Preliminary report on the potential commercial squid fishery of British Columbia . Can. Tech. Rep. Fish. Aquat. Sci. 942: 1-51.
Jefferts, K. 1986. Cephalopod fisheries of the North Pacific and their management, p 34-56. *In* G.S. Jamieson and N. Bourne [ed.] North Pacific Workshop on stock assessment and management of invertebrates. Can. Spec. Publ. Fish. Aquat. Sci. 92. 430 p.

DATA COMPILED

Database file structure: None.
Database: None.
Map: None.

USE LEVEL RATING

None.

NOTES

Opal squid (*Loligo opalescens*) is fished primarily in inshore waters where they are concentrated; though they occur offshore, populations tend to be too dispersed to be commercially fished. It has a life span of about 1-2 years. It migrates inshore to spawn (usually 5-40 m) typically in inshore sites with sand and mud bottoms. The main spawning season in British Columbia is from July to late summer; the eggs hatch in 70 to 90 days depending on the temperature (7-10°C range).

Red squid occur in offshore waters, but again, do not occur in sufficient concentrations to be commercially exploitable.

FISHERY: Commercial fisheries

SPECIES: Flying squid (*Ommastrephes bartrami*)

DATA SOURCES

Personal Communications:

Gary Buechler # Susan Hahn # Barry Ackerman

DATA COMPILED

Database file structure: None.

Database: None.

Map: None.

USE LEVEL RATING

None.

NOTES

In the early 1980s, a foreign driftnet (drift gillnet) fleet successfully fished flying squid 100-200 miles offshore. However, driftnets were banned from Canadian waters in 1986 because of perceived threats to other fisheries.

Some interest in reviving a flying squid fishery has been expressed. An experimental foreign jig fishery was conducted in 1991, concentrating on seamounts, but was not very successful. Success with gear other than driftnets appears to be limited because in the northern waters off Canada the species tends to occur in small groups of 15-30 animals and not in the larger concentrations found in the Kuroshio current waters off Japan. The primary target is the Japanese food fish market.

8. OTHER RESOURCES

SPECIES: Harbour seal (*Phoca vitulina*)

DATA SOURCES

Personal Communication:
Peter Olesiuk

DATA COMPILED

Database file structure: None.

Database: None.

Map: None.

USE LEVEL RATING

None.

NOTES

Harbour seals are predominantly a coastal species and are seldom observed in the offshore region.

SPECIES: Northern elephant seal (*Mirounga angustirostris*)

DATA SOURCES

Personal Communication:
Peter Olesiuk

DATA COMPILED

Database file structure: None.
Database: None.
Map: None.

USE LEVEL RATING

None.

NOTES

Northern elephant seal are found in the north Pacific between California and southern Alaska. The population is currently about 100,000 animals and is continuing to rise. There are two annual migrations through British Columbia waters.

- Animals move north from California in late summer (July/August) to feeding grounds in Alaska passing through British Columbia waters again in September/October on their way back to California to breed in December through February.
- After breeding, the seals again head north from California to Alaska and then return south to moult on islands and beaches off the California coast in June through August.

During their migrations Northern elephant seals tend to forage on the continental slope in waters as deep as 1,500 m on deep water species such as ratfish, sharks, cusk eels and squid.

SPECIES: Northern fur seal (*Callorhinus ursinus*)

DATA SOURCES

References:

Bigg, M.A. 1990. Migration of Northern fur seals (*Callorhinus ursinus*) off western North America. Can. Tech. Rpt. Fish. Aquat. Sci. No. 1764: 64p.

DATA COMPILED

Database file structure: None.

Database: None.

Map: None.

USE LEVEL RATING

None.

NOTES

The northern fur seal consists of three main breeding stocks; one off the north coast of Japan, a second in the eastern Bering Sea and a third on the Pribilof Islands in the western Bering Sea. Only this third stock which consists of about 900,000 seals, is found off the coast of North America.

Northern fur seals enter the waters off the coast of Vancouver Island during their annual migrations between their breeding grounds in the Bering Sea and their over-wintering grounds to the south. The southward migration is rapid with seals leaving the Pribilof Islands in October-November and arriving along the coast between the Western Gulf of Alaska and California by December. Although most seals go to California, some remain offshore along the British Columbia coast. The favoured wintering habitat is located over or near the edge of the continental shelf within 150 km of shore.

The return migration to the Pribilof Islands takes place more slowly. Seals begin their northern migration in March-April and pass through the coastal waters of Oregon, Washington and British Columbia during March to May.

Migration varies with age and sex; most adult females and a few juveniles migrate to California and pass through British Columbia waters. Many immature seals (males 1-3 years and females 1-2 years) remain offshore in the eastern North Pacific all year moving onto the continental shelf and into coastal inlets in the winter and spring months (January through May). Older seals tend to remain further offshore, taking a more direct route between California and the Pribilof Islands.

**SPECIES: California and Steller sea lions (*Zalophus californianus*,
Eumentopias jubatus)**

DATA SOURCES

Personal Communication:
Peter Olesiuk

References:

Bigg, M.A. 1984. Sighting and kill data for the Steller sea lion (*Eumentopias jubatus*) and California sea lion (*Zalophus californianus*) in British Columbia. 1892-1982, with some records from Washington and southeastern Alaska. Can. Data Rpt. Fish. Aquat. Sci. No. 460: 191 p.

DATA COMPILED

Database file structure: None.
Database: None.
Map: None.

USE LEVEL RATING

None.

NOTES

The Steller sea lion is a year round resident which congregates on local breeding rookeries mainly in June-July and disperses along the coast in winter. Although juveniles have been found up to 1,500 km from their place of birth, adults tend to be non-migratory. The current estimate for number of animals in British Columbia is about 7,000 and has increased slowly since the mid-1960's.

The California sea lion is a winter migrant (September/October to April/May) to southern British Columbia from summer breeding sites off California and Mexico. Mostly only adult and sub-adult male California sea lions occur in British Columbia, venturing as far north as central Vancouver Island. Currently about 3,000 California sea lions winter in Canadian waters but many of those are located in Georgia Strait.

While both species tend to remain within a few kilometres offshore, they are occasionally seen as far as 130 km offshore feeding on the continental shelf. Their distribution offshore is probably tied to that of their main prey species, Pacific hake, Pacific herring, walleye pollock and spiny dogfish.

SPECIES: Killer whale (*Orcinus orca*)

DATA SOURCES

Personal Communications:
Graeme Ellis

DATA COMPILED

Database file structure: None.
Database: None.
Map: None.

USE LEVEL RATING

None.

NOTES

There are three races of killer whales off the coast of British Columbia, all of which potentially pass through the offshore region of Vancouver Island:

- a "resident" race consisting of a northern group of about 95 animals and a southern group of about 210 animals. Whales from both of these groups may be found in the offshore region of Vancouver Island during any time of the year although they tend to concentrate in the Johnstone Strait and San Juan Island areas during the summer months. Members of this race are known to move along the entire outer west coast of British Columbia and up into southeast Alaska following the salmon migrations. Concentrations of "resident" killer whales have been observed in concentrations on La Perouse Bank.
- a "transient" race consisting of about 160 animals which move up and down the entire west coast frequenting bays and inlets where they feed on marine mammals. They are primarily found close to shore but have been observed in the offshore as well.
- an "offshore" race which has only recently been discovered. Consisting of at least 160 whales, it ranges from Victoria to southeast Alaska. Animals belonging to this race spend most of their time offshore on the continental shelf possibly feeding on migrating salmon and offshore herring.

SPECIES: Gray whale (*Eschrichtius robustus*)

DATA SOURCES

Personal Communications:

Graeme Ellis

References:

Reeves, R.R. and E. Mitchell. 1988. Current status of the Gray Whale, *Eschrichtius robustus*. Canadian Field-Naturalist 102(2): 369-390.

DATA COMPILED

Database file structure: None.

Database: None.

Map: None.

USE LEVEL RATING

None.

NOTES

The east Pacific stock of gray whales consists of about 12,000 to 17,000 whales and ranges from as far south as the Baja California peninsula and lower Gulf of California to the Chukchi sea. Over that range, gray whales do not occur outside the continental shelf. They are coastal animals which congregate near shore and in embayments during the winter, follow the continental shelf during migrations, and breed on the broad, shallow shelf of the Bering and Chukchi Seas.

Almost the entire gray whale population undergoes an annual migration from their wintering grounds off the coast of California to the summer breeding grounds in the Arctic. Migrating whales are encountered alone or in groups of up to 16 animals. They pass along the coast of Vancouver Island during February through May; they pass over the continental shelf off the coast of British Columbia again in September through November on their southward migration. A few gray whales remain off the coast of Vancouver Island all summer while feeding in nearshore areas.

Gray whales are primarily shallow bottom feeders taking benthic and epibenthic amphipods, fish, shrimp and mysids. They use suction in feeding and consequently, take in large amounts of bottom sediments. This feeding pattern makes them highly vulnerable to the impacts of oil contamination.

SPECIES: Other Cetaceans

DATA SOURCES

Personal Communications:

Graeme Ellis

References:

Leatherwood, S., R.R. Reeves, W.F. Perrin and W.E. Evans. 1982. Whales, Dolphins, and Porpoises of the Eastern North Pacific and Adjacent Waters: a guide to their identification. NOAA Tech. Rpt. NMFS Circular 444. v + 245p.

DATA COMPILED

Database file structure: None.

Database: None.

Map: None.

USE LEVEL RATING

None.

NOTES

Several other cetacean species have been reported from the offshore waters of Vancouver Island but little is known of their biology or distribution. These include:

whales: blue, fin, sei, humpback, sperm, Right, Minke, Baird's beaked, Cuvier's beaked, Hubb's beaked, false killer

dolphins: Risso's, striped, common, Pacific white-sided, northern Right whale

porpoises: Dall's, harbour

SPECIES: Euphausiids

DATA SOURCES

Personal Communication:

David Mackas

References:

Mackas, D.L. 1992. Seasonal cycle of zooplankton off southwest British Columbia: 1979-89. *Can. J. Fish. Aquat. Sci.* 49:903-921.

Mackas, D.L. and M. Galbraith. 1992. Zooplankton on the west coast of Vancouver Island: distribution and availability to birds. *In*: K. Vermeer, R.W. Butler, and K.H. Morgan (ed), The ecology, status, and conservation of marine and shoreline birds off the west coast of Vancouver Island. *Can. Wildl. Serv. Occasional paper. No. 75.* p.15-21.

Simard, Y. and D.L. Mackas. 1989. Mesoscale aggregations of euphausiid sound scattering layers on the continental shelf of Vancouver Island. *Can. J. Fish. Aquat. Sci.* 46: 1238-1249.

DATA COMPILED

Database file structure: None.

Database: None.

Map: Commercial Shellfish Fisheries and Euphausiid Distribution

USE LEVEL RATING

Concentrated: areas where euphausiids are abundant ($\approx > 0.25$ g dry wt.⁻²)

Highly concentrated: locations where euphausiids have been found to be especially abundant within the areas of concentration ($\approx > 4.0$ g dry wt.⁻²)

NOTES

Surveys on La Perouse Bank found the euphausiids were the dominant food of walleye pollock, Pacific hake, coho salmon, spiny dogfish, and sablefish; they are also significant items in the diet of flounders, chinook salmon, Pacific herring, rockfish and Pacific cod and are important in the diets of many seabird species and baleen whales. A dozen or more species of euphausiid species occur off the outer coast of British Columbia but only two abundant species (*Thysanoessa spinifera* and *Euphausia pacifica*) and one less abundant species (*Thysanoessa inspinata*) account for nearly all of the biomass off the west coast of Vancouver Island.

Distributions are strongly tied to bottom topography. Off the west coast of Vancouver Island, abundances much higher than the regional average occur along bathymetric "edges" such as the continental shelf break and the margins of banks, basins, and the

Juan de Fuca canyon. *Thysanoessa spinifera* is the only abundant euphausiid species on the continental shelf where depths are shallower than about 150 m, whereas *Euphausia pacifica* (and occasionally *T. inspinata*) dominates at deeper locations. Within these broad distributions the horizontal patchiness of euphausiids is extreme; 10-100 fold changes in scattering layer density can occur over horizontal distances of a few kilometres.

Late juveniles and adults of both species are strong diel vertical migrants. All three of the locally dominant species feed near the surface at night and migrate downward to depths of >100 m at daylight. The depths to which they migrate during the day vary with location from 100-150 m on the shelf to 150-200 m along and seaward of the shelf break. Occasionally euphausiids may swim near the surface in daylight but this is not typical.

The seasonal cycles of adult and juvenile euphausiid biomass off the west coast of Vancouver Island is known only approximately, because of the confounding effects of intense patchiness, however, the euphausiids do not appear to have the intense spring maximum and summer decline that has been observed in the shelf copepod community. There are two strong peaks in abundance of larval euphausiids; May-June and August-September.

APPENDIX A

DATA SOURCES:

People

Maps

Documents

PEOPLE

Operations Branch, Fisheries Management Sector

Groundfish Management Unit, Regional Headquarters, Vancouver

Barry Ackerman. Head of Special Services and Management Unit. Has been employed with DFO groundfish unit since June 1977 and in present position since 1982. In present position is responsible for managing the offshore groundfish hook and line and trap fisheries. From 1978-82 was a groundfish field officer.

Gary Buechler. Head of Management Operations, Surveillance and Enforcement. In this position since 1985. Currently manages the groundfish trawl fleet; previously also managed the hook and line fishery. From 1978-85 was a groundfish field officer.

Fraser River Division, General Investigation Services

Susan Hahn. Fishery Officer (groundfish). Has been employed with DFO groundfish unit since June 1977 and from 1989 to 1993 was offshore field officer for groundfish, shrimp, and hake; transferred in 1994 to the Fraser River Division.

South Coast Division, Fisheries Management Sector

Carmen McConnell. Hook and Line Management Technician. Has been in salmon management since 1987; designed the salmon troll test fishery 1989-1991. Provided detailed information on distribution of salmon troll fishery.

Tom Shardlow. Hook and Line Management Biologist. In this position since 1982. Provided information on management system and distribution of salmon troll fishery.

South Coast Division, Aboriginal Fisheries Sector

Frank Crabbe. Co-management Coordinator and Acting Aboriginal Fisheries Strategy Officer Program, South Coast. Has been co-management coordinator since 1993. Fishery officer in the Tahsis Subdistrict 1988-1993; offshore fishery officer 1985-88; port sampler/commercial fishery liaison officer 1981-85. Provided detailed information on aboriginal and recreational fisheries; specific information on aspects of trawl fisheries.

Management Services Branch, Marine Division

Capt. A.B.O. (Ozzie) Nilssen. Captain of the offshore fisheries patrol boat the TANU for many years. Provided information on both general and specific trawl grounds and the species that are fished on each. Also indicated the locations of offshore hook and line and trap fisheries.

Biological Sciences Branch, Pacific Biological Station

Marine Fish Division, Shellfish Section

Jim Boutillier. Acting Head of Aquaculture Section. Has worked in Shellfish Section since 1975. Provided information on shrimp and Dungeness crab; advised on other offshore fishery resources.

Glen Jamieson. Scientist in population dynamics; former head of Shellfish Section. Provided information on Tanner crab and squid.

Marine Fish Division, Marine fish Population Dynamics/Assemblage Management Sections

G.A. (Sandy) McFarlane. Head of Marine Fish Population Dynamics Section and scientist responsible for research and stock assessments for west coast Vancouver Island sablefish, lingcod, spiny dogfish, and Pacific hake. Provided information on the location and timing of fisheries as well as species biology.

Laura Richards. Head of Assemblage Management Section and scientist responsible for research and stock assessments for west coast Vancouver Island slope and shallow water rockfish species. Provided information on the biology of rockfish species.

Bruce Leaman. Scientist responsible for research and stock assessments for west coast Vancouver Island rockfish and commissioner for International Pacific Halibut Commission.

Rick Stanley. Scientist responsible for research and stock assessments for west coast Vancouver Island shelf rockfish species. Provided information on where individual species of rockfish were caught by the groundfish trawl fishery.

Mark Saunders. Scientist responsible for research and stock assessments for west coast Vancouver Island sablefish, lingcod, spiny dogfish, and Pacific hake. Provided information on the location and timing of fisheries as well as the species biology.

Jeff Fargo. Scientist responsible for research and stock assessments for west coast Vancouver Island flatfish (sole) species. Provided information on the location and timing of fisheries as well as the species biology.

Claudia Hand. Scientist responsible for research and stock assessments for west coast Vancouver Island Pacific cod. Provided information on the location and timing of fisheries as well as the species biology.

Kathy Rutherford. Biologist responsible for compilation of groundfish trawl statistics. Reviewed the "Use Level" rating system for the groundfish trawl grounds and provided maps of groundfish trawl ground regions and landing statistics for areas 3C and 3D for 1989-93.

Salmon Division, Marine Mammals Section

Graeme Ellis. Responsible for killer whale studies. Has studied whale populations in British Columbia since 1968. Has been employed in the Marine Mammal Unit at PBS since 1989. Provided information on killer whale and gray whale distributions and populations.

Peter Olesiuk. Biologist responsible for seal and sea lion studies. Reviewed information on harbour seal and sea lion text and provided new information on elephant seal migrations.

Biological Sciences Branch, Institute of Ocean Sciences

Marine Fish Division, Ocean Environment and Fisheries Section

David Mackas. Head of Ocean Environment and Fisheries Section. Provided information on euphausiid distributions; provided publications, reviewed text and maps.

Marine Fish Division, Population Dynamics Section, Vancouver Port Sampling Office

Nev Venables. Groundfish Port Liaison Officer. Has worked in monitoring and port sampling for DFO since 1972, on the north coast and in Vancouver. Has worked on commercial fishing vessels coast-wide as an observer and sampler.

MAPS

Description of unpublished maps provided by some personnel:

Map:	Major offshore groundfish trawl grounds
Source:	PBS (J. Fargo, B. Leaman, R. Stanley, G. McFarlane, M. Saunders)
Date:	≈ 1986
Provided by:	Gary Buechler
Description:	Location and names of 14 major trawl grounds on chart 3001.
Map:	Identified offshore groundfish trawl grounds
Source:	Compiled by Frank Crabbe from interviews with groundfish trawl vessel captains and from groundfish logbook data. Grounds were located either directly on chart 3001 by vessel captains or from Loran or other geographical coordinates in the logbooks indicating the start and end of the tows.
Date:	≈ 1986/87
Provided by:	Capt. A.B.O. Nilssen
Description:	Location, name and species fished on 28 groundfish trawl grounds off the west coast of Vancouver Island. Location of trawl grounds off north Vancouver Island and in Juan de Fuca, Georgia and Johnstone Straits are also indicated.
Map:	Salmon troll grounds and conservation areas in southwest coast Vancouver Island
Source:	Carmen McConnell and salmon troll test fishery operators.
Date:	1989, verified 1991
Provided by:	Carmen McConnell
Description:	Location of troll fishery conservation areas and major troll areas south of Flores Island for chinook and coho.

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APPENDIX B

DATABASE STRUCTURES

Table B1: Commercial Groundfish Trawl Fishery - structure for database TRAWL.dbf

Field Name	Field Type	Field Length	Description
POLYGON	N	3	Unique numeric tag for map polygon
LOCATION	C	45	Name of bank, fishing ground or description of the location
LICOD_UL	N	1	Use level rating for Lingcod
LICOD_REF	C	7	Data sources for Lingcod
PACOD_UL	N	1	Use level rating for Pacific cod
PACOD_REF	C	7	Data sources for Pacific cod
ROCKF_UL	N	1	Use level rating for rockfish
ROCKF_REF	C	7	Data sources for rockfish
ROCKF_SP	C	20	Rockfish species identified
SOLED_UL	N	1	Use level rating for deep water soles
SOLES_UL	N	1	Use level rating for shallow water soles
SOLE_REF	C	7	Data sources for soles
SOLE_SP	C	7	Sole species identified
SABLE_UL	N	1	Use level rating for Sablefish
SABLE_REF	C	7	Data sources for Sablefish
HAKE_UL	N	1	Use level rating for Pacific hake
HAKE_REF	C	7	Data sources for Pacific hake
DOGF_UL	N	1	Use level rating for Spiny dogfish
DOGF_REF	C	7	Data sources for Spiny dogfish
JAN_UL	N	2	Use level rating for polygon for January
FEB_UL	N	2	Use level rating for polygon for February
MAR_UL	N	2	Use level rating for polygon for March
APR_UL	N	2	Use level rating for polygon for April
MAY_UL	N	2	Use level rating for polygon for May
JUN_UL	N	2	Use level rating for polygon for June
JUL_UL	N	2	Use level rating for polygon for July
AUG_UL	N	2	Use level rating for polygon for August
SEP_UL	N	2	Use level rating for polygon for September
OCT_UL	N	2	Use level rating for polygon for October
NOV_UL	N	2	Use level rating for polygon for November
DEC_UL	N	2	Use level rating for polygon for December
Q1_SPECIES	C	100	Species assemblage fished at location in 1st quarter
Q2_SPECIES	C	100	Species assemblage fished at location in 2nd quarter

continued.....

Table B1: continued.....

Q3_SPECIES	C	100	Species assemblage fished at location in 3rd quarter
Q4_SPECIES	C	100	Species assemblage fished at location in 4th quarter

Table B2: Commercial Groundfish Hook and Line and Trap Fisheries - structure for database HOOKLINE.dbf

Field Name	Field Type	Field Length	Field Description
POLYGON	N	2	Unique numeric tag for map polygon
LOCATION	C	45	Description of location
DOGFISH	N	1	presence (1)/absence (0) of spiny dogfish longline fishery
ROCKFISH	N	1	presence (1)/absence (0) of rockfish hook & line fishery
LINGCOD	N	1	presence (1)/absence (0) of lingcod hook & line fishery
SABLEFISH	N	1	presence (1)/absence (0) of sablefish trap/longline fishery
HAGFISH	N	1	presence (1)/absence (0) of Pacific hagfish fishery
HALIBUT	N	1	presence (1)/absence (0) of Pacific halibut fishery
CLOSURE	N	1	presence (1) absence (0) of hook & line fishery closure
SOURCE	C	45	Primary data source
COMMENTS	C	45	Site specific information

Table B3: Commercial Salmon Troll Fishery - structure for database SALMON.dbf

Field Name	Field Type	Field Length	Field Description
POLYGON	N	2	Unique numeric tag for map polygon
LOCATION	C	45	Description of location
CHART_NO	N	4	Number of chart on which polygon is mapped
USE_LEVEL	N	1	Use level rating: <i>see text for details</i>
SOURCE	C	45	Primary data source
COMMENTS	C	25	Site specific information on who is using the area

Table B4: Aboriginal Fisheries - structure for database ABORIGIN.dbf

Field Name	Field Type	Field Length	Field Description
POLYGON	N	2	Unique numeric tag for map polygon
LOCATION	C	45	Description of location
BANDS	C	90	First Nation bands utilizing the area
USE_LEVEL	N	1	Use level rating: <i>see text for details</i>
USE	C	45	Approximate number of boats using area
SOURCE	C	45	Primary data source
COMMENTS	C	45	Site specific information on who is using the area

Table B5: Recreational Fisheries - structure for database RECREATN.dbf

Field Name	Field Type	Field Length	Field Description
POLYGON	N	2	Unique numeric tag for map polygon
LOCATION	C	25	Description of location
USE_LEVEL	N	1	Use level rating: <i>see text for details</i>
USE	C	50	Approximate number and type of boats using area
SOURCE	C	45	Primary data source
COMMENT_1	C	90	Site specific information on who is using the area
COMMENT_2	C	90	Site specific information on who is using the area
COMMENT_3	C	90	Site specific information on who is using the area

APPENDIX C

DATABASE LISTINGS

Table C1-a: Commercial Groundfish Trawl Fisher Relative Use Level by Month - database TRAWL.dbf

Polygon	Location	Relative Use level by month											
		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	Swiftsure	1	2	1	1	4	6	7	6	6	4	1	1
2	Cloose	1	2	1	1	3	5	5	4	4	3	1	1
3	area surrounding Swiftsure and Loose	1	1	1	1	2	2	2	2	2	2	1	1
4	South Fingers	1	2	1	1	4	6	6	6	6	5	1	1
5	Finger Bank	1	2	1	1	5	6	7	6	6	5	1	1
6	40 Mile Bank	1	1	1	1	1	2	2	2	2	2	1	1
7	SE corner of Big Bank	1	2	2	1	2	3	3	2	3	2	1	1
8	Big Bank	1	3	2	2	4	6	7	6	6	4	1	1
9	Lennard Island	1	2	2	1	3	4	4	4	4	3	1	1
10	Clayoquot	1	2	2	2	2	3	3	2	2	3	1	1
11	La Perouse Bank	1	1	1	1	1	2	2	2	2	2	1	1
12	Cape Beale	1	2	1	1	1	1	1	1	1	1	1	1
13	Cabbage Patch	1	2	1	1	1	1	1	1	1	2	1	1
14	Firing Range	1	1	1	1	1	1	1	1	1	1	1	1
15	off mouth of Barkley Sound	1	1	1	1	1	1	1	1	1	1	1	1
16	Nitinet Canyon-Barkley Canyon-Deep Big Bank	2	2	2	2	4	5	5	4	4	5	1	1
17	head of Ucluelet Canyon	2	3	2	3	4	5	5	4	4	6	1	1
18	Estevan to Cape Beale offshore along canyons	2	2	2	2	2	1	1	1	1	4	1	1
19	Father Charles Canyon	2	3	2	3	2	1	2	1	1	4	1	1
20	Clayoquot Canyon	2	3	2	3	2	1	2	1	1	4	1	1
21	Sydney Inlet	1	1	1	1	1	1	1	1	1	1	1	1
22	S Nootka	2	2	1	2	2	2	2	1	1	4	1	1

continued.....

Table C1 -a: continued...

23	entrance to Nootka Sound	2	2	1	2	2	1	2	1	1	4	1	1
24	N Nootka	1	1	1	1	1	1	1	1	1	2	1	1
25	NW Nootka	2	2	2	2	2	1	1	1	1	4	1	1
26	inshore Bejo Pt to Tatchu Pt.	1	1	1	1	1	1	1	1	1	2	1	1
27	Esperanza - Lookout Island	2	2	1	1	2	1	2	1	1	4	1	1
28	Kyuquot Sound	1	2	2	2	2	1	2	1	1	3	1	1
29	Cape Cook	1	2	2	2	1	1	1	1	1	2	1	1
30	Oououkinah	1	1	1	1	1	1	1	1	1	3	1	1
31	Cape Cook	2	2	1	1	2	1	2	1	1	4	1	1
32	entrance to Quatsino Sound	2	2	1	2	2	1	2	1	1	4	1	1
33	Kains Island	2	2	2	2	2	2	2	1	1	4	1	1
34	Quatsino Sound	1	1	1	1	1	1	1	1	1	2	1	1
35	Top Knot	2	3	2	2	2	2	2	1	1	4	1	1
36	South Scott Is. and South Triangle Is.	1	1	1	1	1	1	1	1	1	2	1	1
37	N South Triangle Is.	2	2	1	1	2	1	1	1	1	4	1	1

Table C1-b: Commercial Groundfish Trawl Fishery Species Composition by Quarter - database
TRAWL.dbf

Polygon	Location	Species			
		1st Quarter	2nd Quarter	3rd Quarter	4th Quarter
1	Swiftsure	Pacific cod, rockfish (yt), shallow soles (E), sablefish, spiny dogfish	Pacific cod, lingcod, rockfish (yt), shallow soles (E), sablefish, Pacific hake, spiny dogfish	Pacific cod, lingcod, rockfish (yt), shallow soles (E), sablefish, Pacific hake	lingcod, rockfish (yt), shallow soles (E), sablefish
2	Cloose	Pacific cod, rockfish (yt), shallow soles	Pacific cod, lingcod, rockfish (yt), shallow soles, Pacific hake	Pacific cod, lingcod, rockfish (yt), shallow soles, Pacific hake	lingcod, rockfish (yt), shallow soles
3	area surrounding Swiftsure and Cloose	Pacific cod, rockfish (yt), shallow soles	Pacific cod, lingcod, rockfish (yt), shallow soles, Pacific hake	Pacific cod, lingcod, rockfish (yt), shallow soles, Pacific hake	lingcod, rockfish (yt), shallow soles
4	South Fingers	Pacific cod, rockfish (yt)	Pacific cod, lingcod, rockfish (yt), Pacific hake	Pacific cod, lingcod, rockfish (yt), Pacific hake	lingcod, rockfish (yt)
5	Finger Bank	Pacific cod, rockfish (yt), shallow soles, sablefish, spiny dogfish	Pacific cod, lingcod, rockfish (yt), shallow soles, sablefish, Pacific hake, spiny dogfish	Pacific cod, lingcod, rockfish (yt), shallow soles, sablefish, Pacific hake	lingcod, rockfish (yt), shallow soles, sablefish
6	40 Mile Bank	rockfish (yt), spiny dogfish	rockfish (yt), Pacific hake, spiny dogfish	rockfish (yt), Pacific hake	rockfish (yt)
7	SE corner of Big Bank	Pacific cod, rockfish (yt), deep soles (p)	Pacific cod, lingcod, rockfish (yt), deep soles (p), Pacific hake	Pacific cod, lingcod, rockfish (yt), deep soles (p), Pacific hake	lingcod, rockfish (yt), deep soles (p)
8	Big Bank	Pacific cod, rockfish (yt), deep and shallow soles (p), sablefish, spiny dogfish	Pacific cod, lingcod, rockfish (yt), deep and shallow soles (p), sablefish, Pacific hake, spiny dogfish	Pacific cod, lingcod, rockfish (yt), deep and shallow soles (p), sablefish, Pacific hake	lingcod, rockfish (yt), deep and shallow soles (p), sablefish
9	Lennard Island	Pacific cod, rockfish (yt), deep and shallow soles (p,E,r)	Pacific cod, lingcod, rockfish (yt), deep and shallow soles (p,E,r), Pacific hake	Pacific cod, lingcod, rockfish (yt), deep and shallow soles (p,E,r), Pacific hake	lingcod, rockfish (yt), deep and shallow soles (p,E,r)
10	Clayoquot	rockfish (yt,op), deep soles (D,p), sablefish	rockfish (yt,op), deep soles (D,p), sablefish, Pacific hake	rockfish (yt,op), deep soles (D,p), sablefish, Pacific hake	rockfish (yt,op), deep soles (D,p), sablefish
11	La Perouse Bank	rockfish (yt)	rockfish (yt), Pacific hake	rockfish (yt), Pacific hake	rockfish (yt)
12	Cape Beale	Pacific cod, deep and shallow soles (p,E)	Pacific cod, lingcod, deep and shallow soles (p,E)	Pacific cod, lingcod, deep and shallow soles (p,E)	lingcod, deep and shallow soles (p,E)
13	Cabbage Patch	Pacific cod, rockfish (sg,o), shallow soles (E)	Pacific cod, lingcod, rockfish (sg,o), shallow soles (E)	Pacific cod, lingcod, rockfish (sg,o), shallow soles (E)	lingcod, rockfish (sg,o), shallow soles (E)
14	Firing Range	Pacific cod, shallow soles (E,r)	Pacific cod, lingcod, shallow soles (E,r)	Pacific cod, lingcod, shallow soles (E,r)	lingcod, shallow soles (E,r)

continued.....

Table C1-b: continued....

15	off mouth of Barkley Sound	shallow soles (E)	lingcod, shallow soles (E)	lingcod, shallow soles (E)	lingcod, shallow soles (E)
16	Nitinat Canyon-Barkley Canyon-Deep Big Bank	rockfish (op,en,ym,sg,b,sc), deep soles (D), sablefish	rockfish (op,en,ym,sg,b,sc), deep soles (D), sablefish, Pacific hake	rockfish (op,en,ym,sg,b,sc), deep soles (D), sablefish, Pacific hake	rockfish (op,en,ym,sg,b,sc), deep soles (D), sablefish
17	head of Ucluelet Canyon	rockfish (op,sc,en,rb), deep soles (p), sablefish	rockfish (op,sc,en,rb), deep soles (p), sablefish, Pacific hake	rockfish (op,sc,en,rb), deep soles (p), sablefish, Pacific hake	rockfish (op,sc,en,rb), deep soles (p), sablefish
18	Estevan to Cape Beale offshore along canyons	rockfish (op,en,sc), deep soles	rockfish (op,en,sc), deep soles	rockfish (op,en,sc), deep soles	rockfish (op,en,sc), deep soles
19	Father Charles Canyon	rockfish (op,re,en,rs,ym,sc), deep soles (p), sablefish	rockfish (op,re,en,rs,ym,sc), deep soles (p), sablefish	rockfish (op,re,en,rs,ym,sc), deep soles (p), sablefish	rockfish (op,re,en,rs,ym,sc), deep soles (p), sablefish
20	Clayoquot Canyon	rockfish (op,sg,c), deep soles (D,p), sablefish	rockfish (op,sg,c), deep soles (D,p), sablefish	rockfish (op,sg,c), deep soles (D,p), sablefish	rockfish (op,sg,c), deep soles (D,p), sablefish
21	Sydney Inlet	Pacific cod, shallow soles (E,r), sablefish	Pacific cod, lingcod, shallow soles (E,r), sablefish	Pacific cod, lingcod, shallow soles (E,r), sablefish	lingcod, shallow soles (E,r), sablefish
22	S Nootka	Pacific cod, rockfish (sg,c)	Pacific cod, lingcod, rockfish (sg,c)	Pacific cod, lingcod, rockfish (sg,c)	lingcod, rockfish (sg,c)
23	entrance to Nootka Sound	rockfish (sg,c), shallow soles	lingcod, rockfish (sg,c), shallow soles	lingcod, rockfish (sg,c), shallow soles	lingcod, rockfish (sg,c), shallow soles
24	N Nootka	rockfish (w,yt)	rockfish (w,yt)	rockfish (w,yt)	rockfish (w,yt)
25	NW Nootka	rockfish (w,yt,op,en,st,re,gs), deep soles	rockfish (w,yt,op,en,st,re,gs), deep soles	rockfish (w,yt,op,en,st,re,gs), deep soles	rockfish (w,yt,op,en,st,re,gs), deep soles
26	inshore Bajo Pt to Tatchu Pt.	rockfish (sg,c), shallow soles	lingcod, rockfish (sg,c), shallow soles	lingcod, rockfish (sg,c), shallow soles	lingcod, rockfish (sg,c), shallow soles
27	Esperanza - Lookout Island	rockfish (sg,c)	lingcod, rockfish (sg,c)	lingcod, rockfish (sg,c)	lingcod, rockfish (sg,c)
28	Kyuquot Sound	Pacific cod, rockfish (w,yt), deep and shallow soles (r,D,p), sablefish	Pacific cod, lingcod, rockfish (w,yt), deep and shallow soles (r,D,p), sablefish	Pacific cod, lingcod, rockfish (w,yt), deep and shallow soles (r,D,p), sablefish	lingcod, rockfish (w,yt), deep and shallow soles (r,D,p), sablefish
29	Cape Cook	rockfish (sg,c,w,yt), deep soles	rockfish (sg,c,w,yt), deep soles	rockfish (sg,c,w,yt), deep soles	rockfish (sg,c,w,yt), deep soles
30	Ououkinsh	rockfish (sg,c), shallow soles (r)	lingcod, rockfish (sg,c), shallow soles (r)	lingcod, rockfish (sg,c), shallow soles (r)	lingcod, rockfish (sg,c), shallow soles (r)
31	Cape Cook	rockfish (sg,c)	lingcod, rockfish (sg,c)	lingcod, rockfish (sg,c)	lingcod, rockfish (sg,c)
32	entrance to Quatsino Sound	rockfish (sg,c), shallow soles	lingcod, rockfish (sg,c), shallow soles	lingcod, rockfish (sg,c), shallow soles	lingcod, rockfish (sg,c), shallow soles

continued.....

Table C1-b: continued...

33	Kains Island	rockfish (sg,c), deep soles (p)	lingcod, rockfish (sg,c), deep soles (p)	lingcod, rockfish (sg,c), deep soles (p)	lingcod, rockfish (sg,c), deep soles (p)
34	Quatsino Sound	rockfish (sg,c,op,ec,ym,rs)	rockfish (sg,c,op,ec,ym,rs)	rockfish (sg,c,op,ec,ym,rs)	rockfish (sg,c,op,ec,ym,rs)
35	Top Knot	Pacific cod, rockfish (sg,c), deep soles	Pacific cod, lingcod, rockfish (sg,c), deep soles	Pacific cod, lingcod, rockfish (sg,c), deep soles	lingcod, rockfish (sg,c), deep soles
36	South Scott Is. and South Triangle Is.	rockfish (w)	rockfish (w)	rockfish (w)	rockfish (w)
37	N South Triangle Is.	rockfish (ym,w,op,rs)	rockfish (ym,w,op,rs)	rockfish (ym,w,op,rs)	rockfish (ym,w,op,rs)

Table C1-c: Commercial Groundfish Trawl Fishery Species by Trawl Ground - database TRAWL.dbf

P o l y g o n	Location	Relative Use level by species								Species	
		lingcod	Pacific cod	rockfish	deep soles	shallow soles	sablefish	Pacific hake	spiny dogfish	rockfish	soles
1	Swiftsure	3	3	1	0	3	1	3	1	yt	E
2	Cloose	3	3	1	0	1	0	2	0	yt	
3	area surrounding Swiftsure and Cloose	1	1	1	0	1	0	1	0	yt	
4	South Fingers	2	2	2	0	0	0	3	0	yt	
5	Finger Bank	2	2	2	0	1	2	3	3	yt	
6	40 Mile Bank	0	0	1	0	0	0	1	3	yt	
7	SE corner of Big Bank	2	2	1	2	0	0	1	0	yt	p
8	Big Bank	2	3	1	2	1	2	3	1	yt	p
9	Lennard Island	2	2	1	2	3	0	2	0	yt	p,E,r
10	Clayoquot	0	0	2	2	0	1	1	0	yt,op	D,p
11	La Perouse Bank	0	0	1	0	0	0	1	0	yt	
12	Cape Beale	2	2	0	2	3	0	0	0		p,E
13	Cabbage Patch	3	3	1	0	2	0	0	0	sg,c	E
14	Firing Range	3	2	0	0	3	0	0	0		E,r
15	off mouth of Barkley Sound	1	0	0	0	3	0	0	0		E
16	Nitinat Canyon-Barkley Canyon-Deep Big Bank	0	0	3	2	0	2	2	0	op,en,ym,sg, b,sc	D
17	head of Ucluelet Canyon	0	0	3	3	0	2	2	0	op,sc,en,rb	p
18	Esteven to Cape Beale offshore along canyons	0	0	3	3	0	0	0	0	op,en,sc	
19	Father Charles Canyon	0	0	3	3	0	1	0	0	op,re,en,rs, ym,sc	P
20	Clayoquot Canyon	0	0	3	3	0	1	0	0	op,sg,c	D,p
21	Sydney Inlet	2	2	0	0	3	1	0	0		E,r

continued.....

Table C1-c: continued...

22	S Nootka	2	1	3	0	0	0	0	0	sg,c	
23	entrance to Nootka Sound	2	0	3	0	3	0	0	0	sg,c	
24	N Nootka	0	0	2	0	0	0	0	0	w,yt	
25	NW Nootka	0	0	3	2	0	0	0	0	w,yt,op,en, st,re,gs	
26	inshore Bajo Pt to Tetchu Pt.	1	0	2	0	1	0	0	0	sg,c	
27	Esperanza - Lookout Island	2	0	3	0	0	0	0	0	sg,c	
28	Kyuquot Sound	2	1	2	2	3	1	0	0	w,yt	r,D,p
29	Cape Cook	0	0	2	2	0	0	0	0	sg,c,w,yt	
30	Ououkinsh	2	0	2	0	3	0	0	0	sg,c	r
31	Cape Cook	2	0	3	0	0	0	0	0	sg,c	
32	entrance to Quatsino Sound	2	0	3	0	3	0	0	0	sg,c	
33	Kaine Island	2	0	3	2	0	0	0	0	sg,c	p
34	Quatsino Sound	0	0	2	0	0	0	0	0	sg,c,op,sc, ym,rs	
35	Top Knot	2	2	3	2	0	0	0	0	sg,c	
36	South Scott Is. and South Triangle Is.	0	0	2	0	0	0	0	0	w	
37	N South Triangle Is.	0	0	3	0	0	0	0	0	ym,w,op,rs	

**Table C1-d: Commercial Groundfish Trawl Fishery References by Trawl Ground and Species - database
TRAWL.dbf**

P o l y g o n	Location	References						
		lingcod	Pacific cod	rockfish	soles	sablefish	Pacific hake	spiny dogfish
1	Swiftsure	1,2,3	1,2,3, 4	4	1,2	1	1,2,3,4	1
2	Cloose	2,3	2,3,4	4	2		2,3,4	
3	area surrounding Swiftsure and Cloose	2	2	4	2		2,4	
4	South Fingers	1	1	1,4			1,2,4	
5	Finger Bank	1,3	1	1,4	3	1,3	1,2,3,4	4
6	40 Mile Bank			4			2,4	4
7	SE corner of Big Bank	1	1	4	1		2,4	
8	Big Bank	1,3	1,3,4	3,4	1,3	1,3	1,2,3,4	1
9	Lennard Island	1	1	4	1		2,3,4	
10	Clayoquot			1,4	1	1	2,4	
11	La Perouse Bank			4			2,4	
12	Cape Beale	1,3	1		1,2			
13	Cabbage Patch	1,3	1,3,4	3	2,3			
14	Firing Range	1,3	3		1,2,3			
15	off mouth of Barkley Sound	3			2,3			
16	Nitinat Canyon-Barkley Canyon-Deep Big Bank			1,3,4	1,3	1,3	2,3,4	
17	head of Ucluelet Canyon			1,3,4	1,3,4	1,3	2,3,4	
18	Estevan to Cape Beale offshore along canyons			4	4			
19	Father Charles Canyon			1,4	1,4	1		
20	Clayoquot Canyon			1,2,3,4	1,3,4	1		
21	Sydney Inlet	1	1		1	1		
22	S Nootka	1	1	1,2,4				
23	entrance to Nootka Sound	3		3	3			
24	N Nootka			2,4				

continued.....

Table C1-d: continued....

25	NW Nootka			2,3,4	3			
26	inshore Bejo Pt to Tatchu Pt.	3		2	2			
27	Esperanza - Lookout Island	1		1,2,4				
28	Kyuquot Sound	1	1	2,4	1,3	1		
29	Cape Cook			2,3,4	3			
30	Ououkinsh	1,3		4	1			
31	Cape Cook	1,3		1,2,4				
32	entrance to Quatsino Sound	3		3	3			
33	Kains Island	1,3		1,2,4	1			
34	Quatsino Sound			2,4				
35	Top Knot	1,3	1,3,4	1,2,3,4	3			
36	South Scott Is. and South Triangle Is.			2,4				
37	N South Triangle Is.			1,2,4				

Codes used for references:

- 1 = Frank Crabbe
- 2. = Captain A.B.O. (Ozzie) Nilssen
- 3 = Gary Buechler
- 4 = personal communication or published reports with staff at the Pacific Biological Station (see text)

Table C2: Commercial Groundfish Hook and Line and Trap Fisheries - database HOOKLINE.dbf

P O L Y G O N	LOCATION	D O G F I S H	R O C K F I S H	L I N G C O D	S A B L E F I S H	H A G F I S H	H A L I B U T	C L O S U R E	SOURCE	COMMENTS
1	top of Swiftsure Bank	0	0	0	0	0	0	1	Management Plans	Closed to all hook and line fisheries
2	area surrounding Swiftsure Bank	0	0	0	0	0	1	0	G.Buechler	
3	Finger Bank	0	0	0	0	0	1	0	G.Buechler	
4	Big Bank and off Barkley Sound	0	0	0	0	0	1	0	G.Buechler	
5	Cape Beale	0	0	1	0	0	1	0	G.Buechler	
6	Barkley Sound	1	0	0	0	0	0	0	M.Saunders	
7	Area 23 - 3 mile hole	0	0	0	0	1	0	0	B.Akerman	only spot consistently fished for hagfish
8	Flores Island	1	0	0	0	0	0	0	M.Saunders	
9	50 fathoms line Rafael Pt to Bajo Pt	0	1	1	0	0	0	0	Capt. A.B.O.Nilsen	longline only
10	Nootka Sound	1	0	1	0	0	0	0	M.Saunders (dogfish), G.Buechler (lingcod)	
11	Esperanza Inlet	1	1	0	0	0	0	0	M.Saunders	about 3 boats in live rockfish fishery
12	50 fathom line off Kyuquot Sound	0	1	1	0	0	0	0	Capt. A.B.O.Nilsen	longline and jig fishing
13	off Fair Harbour	0	1	0	0	0	1	0	F.Crabbe	6 14-20'boats from Fair Hbr; live RF Mar-Jul
14	off Checleset Inlet	0	1	1	0	0	0	0	Capt. A.B.O.Nilsen	jig fishing
15	Brooks Bay	0	1	1	0	0	0	0	Capt. A.B.O.Nilsen	longline and jig fishing
16	Quatsino Sound	1	0	1	0	0	0	0	M.Saunders (dogfish), G.Buechler (lingcod)	
17	off Cape Palmerston	0	1	1	0	0	0	0	Capt. A.B.O.Nilsen	longline and jig fishing
18	Beresford Island	0	1	1	0	0	1	0	Capt. A.B.O.Nilsen, F.Crabbe, G.Buechler	longline and jig fishing
19	offshore slope and canyons South of Bajo Pt	0	0	0	1	0	0	0	G.McFarlane, Capt. A.B.O. Nilsen	
20	offshore on slope and canyons Bajo -Cape Cook	0	0	0	1	0	0	0	Capt. A.B.O.Nilsen	
21	offshore slope off Cape Scott	0	0	0	1	0	0	0	Capt. A.B.O.Nilsen	

Table C3: Commercial Salmon Troll Fisheries - database SALMON.dbf

POLYGON	CHART_NO	SPECIES	USE_LEVEL	SOURCE	COMMENT
1	3602	sockeye	2	C.McConnell	In conservation area G
2	3602	coho, chinook	1	Map by C.McConnell, troll test fishers	In conservation area F-1
3	3602	coho, chinook	1	Map by C.McConnell, troll test fishers	In conservation area F-1
4	3602	coho, chinook	1	Map by C.McConnell, troll test fishers	In conservation area F-1
5	3602	coho, chinook	1	Map by C.McConnell, troll test fishers	In conservation areas H,I
6	3602	coho, chinook	1	Map by C.McConnell, troll test fishers	In conservation areas B,I
7	3602	chinook	2	Map by C.McConnell, troll test fishers	In conservation areas B,I
8	3602	chinook	2	Map by C.McConnell, troll test fishers	In conservation area A
9	3602	coho, chinook	1	Map by C.McConnell, troll test fishers	In conservation area A
10	3602	coho, chinook	1	Map by C.McConnell, troll test fishers	
11	3602	coho, chinook	1	Map by C.McConnell, troll test fishers	In conservation area A
12	3602	coho, chinook	1	Map by C.McConnell, troll test fishers	In conservation areas A,D
13	3603	coho, chinook	1	Map by C.McConnell, troll test fishers	
14	3603	coho, chinook	1	Map by C.McConnell, troll test fishers	In conservation areas D,E
15	3603	coho, chinook	1	Map by C.McConnell, troll test fishers	In conservation areas C,D
16	3603	chinook	2	Map by C.McConnell, troll test fishers	In conservation areas C,D
17	3603	chinook	2	Map by C.McConnell, troll test fishers	In conservation areas D,K
18	3603	coho	2	Map by C.McConnell, troll test fishers	In conservation area K
19	3603	chinook	2	Map by C.McConnell, troll test fishers	In conservation area J

continued.....

Table C3: continued...

20	3803	sockeye	2	C.McConnell	In conservation area K
21	3803	sockeye	2	C.McConnell	In conservation area D,K
22	3803	chinook	2	Map by C.McConnell, troll test fishers	In conservation area L
23	3803	coho, chinook	1	Map by C.McConnell, troll test fishers	In conservation area D,E
24	3803	coho, chinook	1	Map by C.McConnell, troll test fishers	In conservation area E,L
25	3803	coho, chinook	1	Map by C.McConnell, troll test fishers	In conservation area L
26	3803	coho, chinook	1	Map by C.McConnell, troll test fishers	In conservation area E
27	3803	coho, chinook	1	Map by C.McConnell, troll test fishers	
28	3001	coho, chinook	1	C.McConnell	
29	3001	coho, chinook	1	C.McConnell	
30	3001	coho, chinook	1	C.McConnell	
31	3001	coho, chinook	2	C.McConnell	
32	3001	chinook	2	C.McConnell	
33	3001	sockeye	2	C.McConnell	
34	3001	sockeye	2	C.McConnell	
35	3001	sockeye	2	C.McConnell	

Table C4: Aboriginal Fisheries - database ABORIGIN.dbf

P O L Y G O N	LOCATION	BANDS	U S E - L E V E L	USE	SOURCE	COMMENTS
1	Owen Pt. to Pachena Pt., Swiftsure Bank	Ditidaht	1	6 boats	F.Crabbe	Swiftsure Bank for Halibut only
2	Pachena Pt. to Portland Pt.	Ohiaht, Opetohesaht, Tseshaht, Toquaht, Uckwalet, Uchucklesaht	3	196 boats	F.Crabbe	125 boats attributed to Tseshaht alone
3	Wikaninnish Beach to Nootka Sound	Ahouseht, Hesquiaht, Tia-o-qui-saht	3	77 boats	F.Crabbe	Primarily for groundfish
4	Esteven Pt. to Ferrer Pt.	Mowachaht	1	5 boats	F.Crabbe	Targets groundfish and salmon
5	Bajo Pt. to Tatchu Pt.	Ehattesaht, Nuchatlaht	3	12 boats	F.Crabbe	Groundfish and salmon targeted
6	Tatchu Pt. to Clerk Pt.	Kyuquot	3	10 boats	F.Crabbe	Targeting groundfish primarily

Table C5: Recreational Fisheries - database RECREATN.dbf

P O L Y G O N	LOCATION	U S E - L E V E L	USE	SOURCE	COMMENT_1	COMMENT_2	COMMENT_3
1	edge of Swiftsure Bank	3	?	F.Crabbe	U.S. fishers from Neah Bay	Canadian fishers from Port Renfrew, Bamfield and Ucluelet	Charter operator (Cdn. Princess) from Ucluelet: 20-30 boats with up to 15-20 people each
2	Swiftsure Bank to Tofino	3	30-35 total at any one time; 14-20 charter boats	F.Crabbe	Cdn. Princess from Ucluelet main operator; 20-30 boats, 15-20 people each; fishes same	areas as commercial troll; troll, jig 10-15 miles out, 20-25 fathoms; mid-May to September	Up to 200 boats counted Cape Beale-Amphitrite Pt. within 5-7 km of surfline
3	Tofino to Hesquiat	2	?	F.Crabbe	Several lodges and charter operators from Tofino; largest is Weigh West	Cdn. Princess will also fish this area	
4	Nootka Sound	3	40 charter boats	F.Crabbe	Six lodges in Tahsis and Tiupana Inlets	Fishing concentrated from mid-May to mid-August	
5	Esperanza Inlet	1	8-10 charter boats	F.Crabbe	One of the lodges in Tahsis Inlet also operates in this area	Popular for halibut	
6	Kyuquot Sound	1	3-4 charter boats	F.Crabbe	One charter operator on Spring Island	Kyuquot Band may establish a fishing lodge in the area with significantly more boats	
7	off Nitinat Narrows	2	popular; number of boats is unknown	C. McConnell			

APPENDIX D

CHARTS BASED ON GROUNDFISH TRAWL LANDING STATISTICS 1989 - 1993

Figure 1: Average domestic and foreign or joint-venture groundfish trawl landings by species in Major statistical areas 3C and 3D, 1989-93.

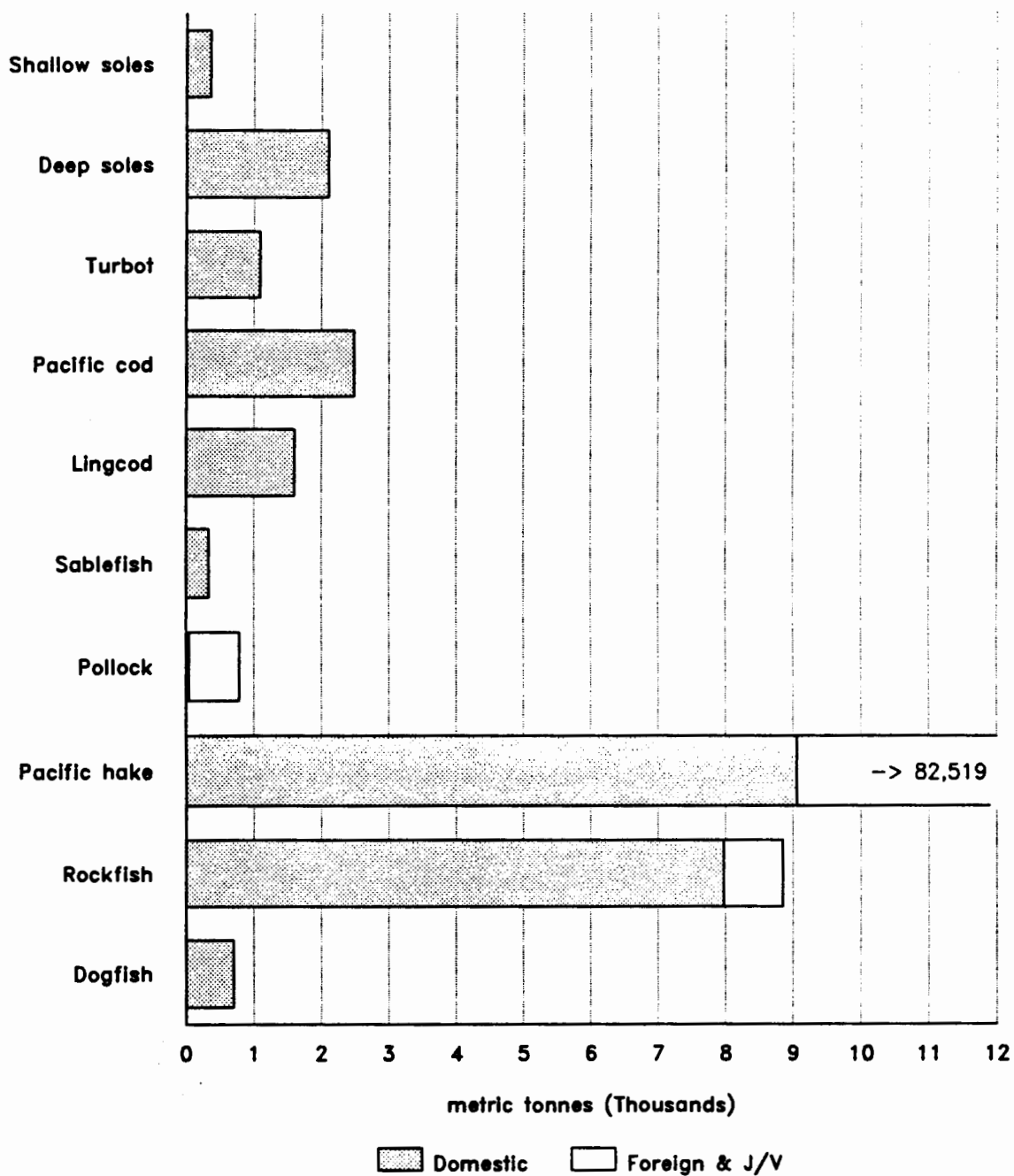
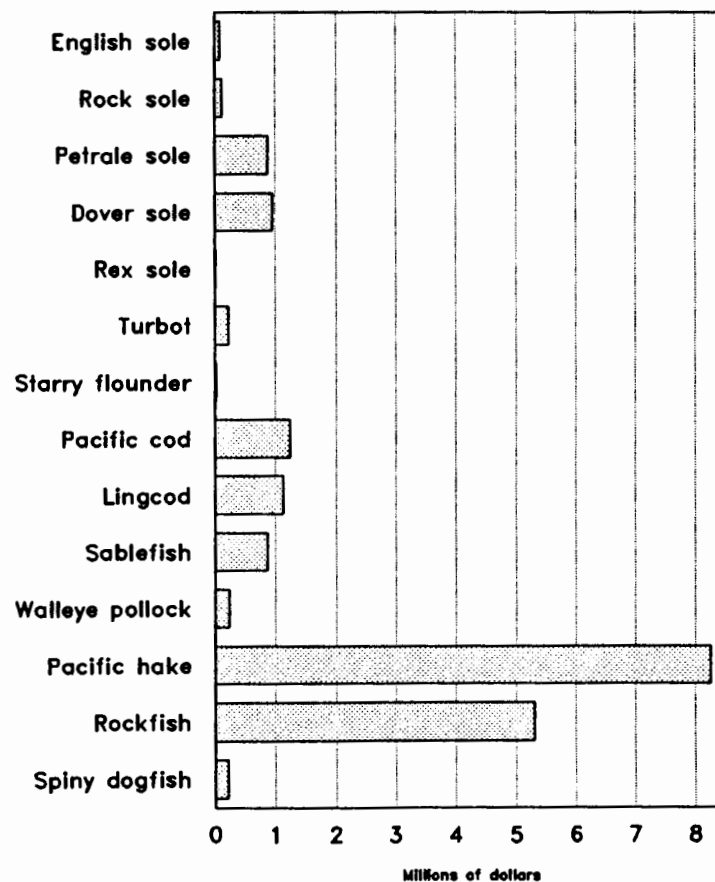
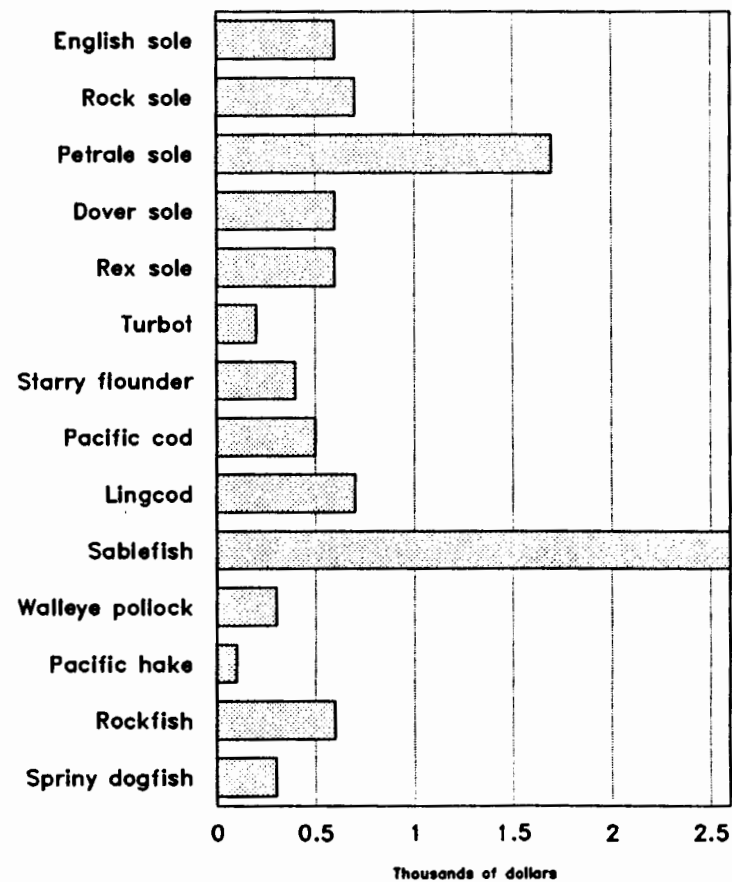


Figure 2: Average value of the groundfish trawl fishery (1989-93) including both domestic and foreign or joint venture fisheries; average value per metric tonne is based on 1992/93 prices.



Average landed value of fishery 1989-93



Average price per metric tonne 1992-1993

Figure 3: Average % composition of the domestic groundfish trawl fishery by species for major statistical areas 3C and 3D from 1989-93. (Pacific hake has not been included)

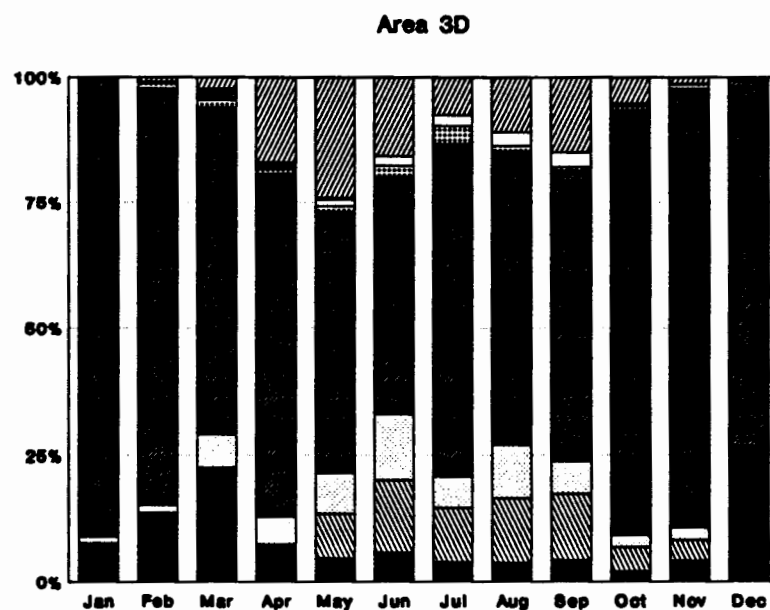
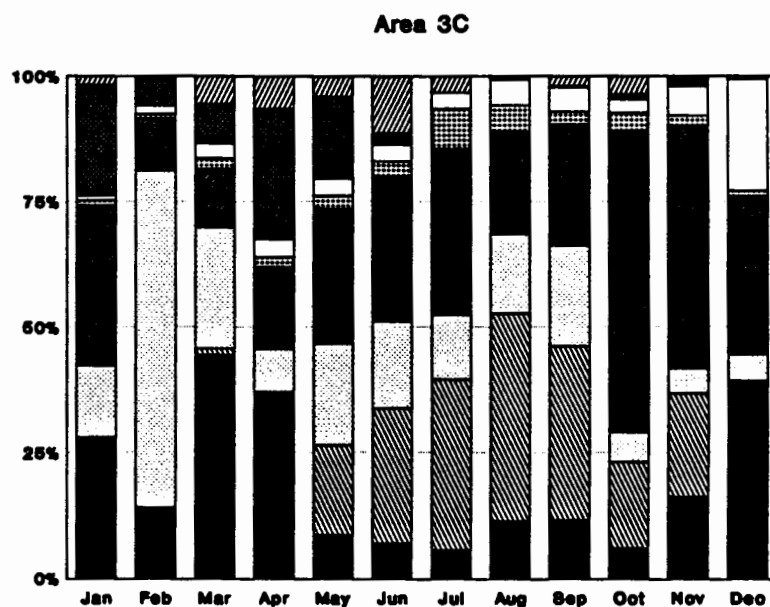


Figure 4: Average monthly landings of Lingcod by the domestic groundfish trawl fishery from 1989-93, shown for major statistical areas 3C and 3D.

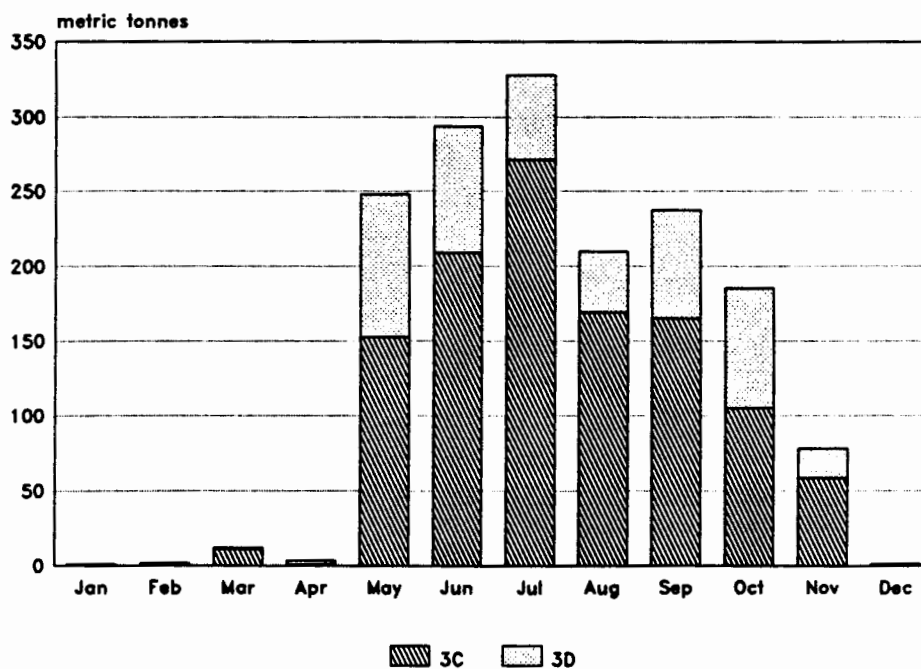


Figure 5: Average monthly landings of Pacific cod by the domestic groundfish trawl fishery from 1989-93, shown for major statistical areas 3C and 3D.

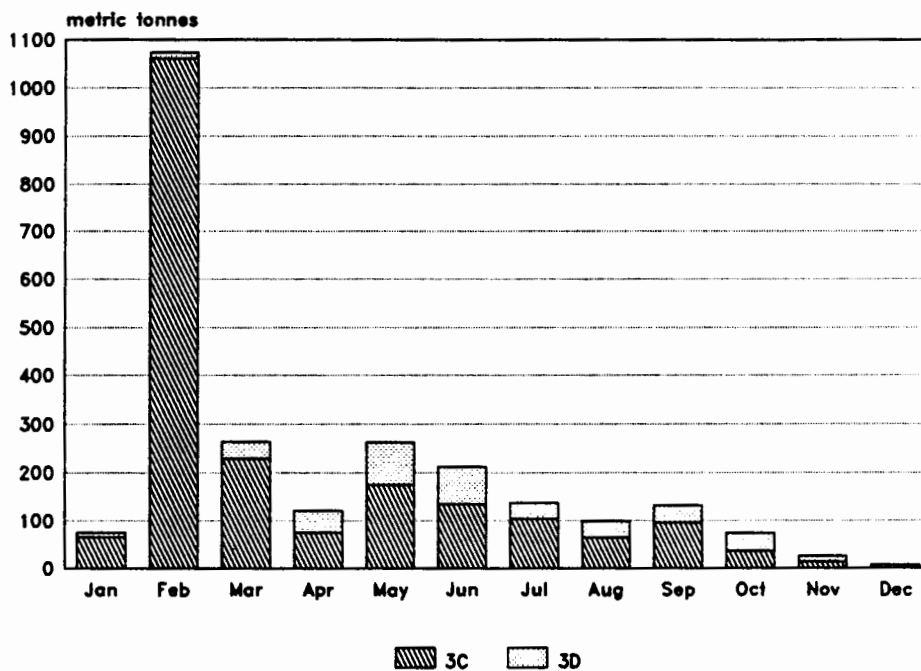


Figure 6:

Average monthly landings of deep water soles (Petrale and Dover sole) by the domestic groundfish trawl fishery from 1989-93, shown for major statistical areas 3C and 3D.

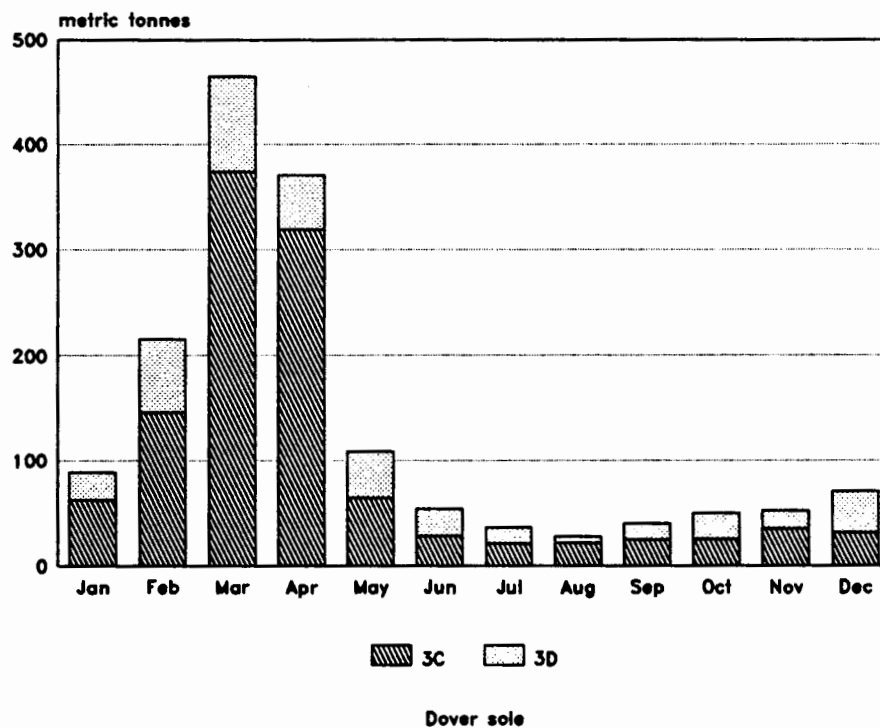
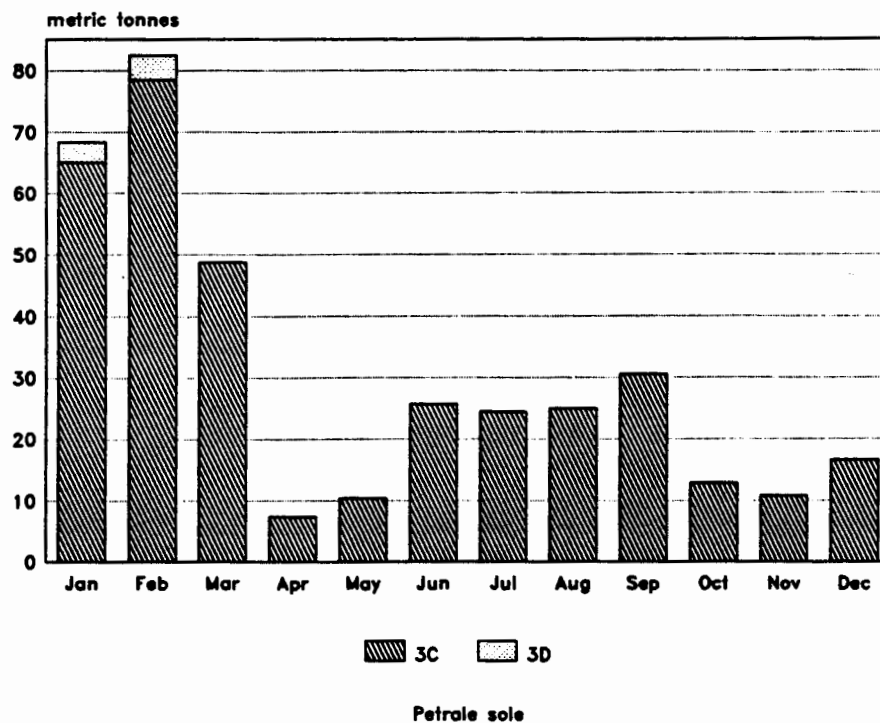


Figure 7: Average monthly landings of shallow water flatfish by the domestic groundfish trawl fishery from 1989-93, shown for major statistical areas 3C and 3D. Percent composition by species for both areas combined is shown on the top graph.

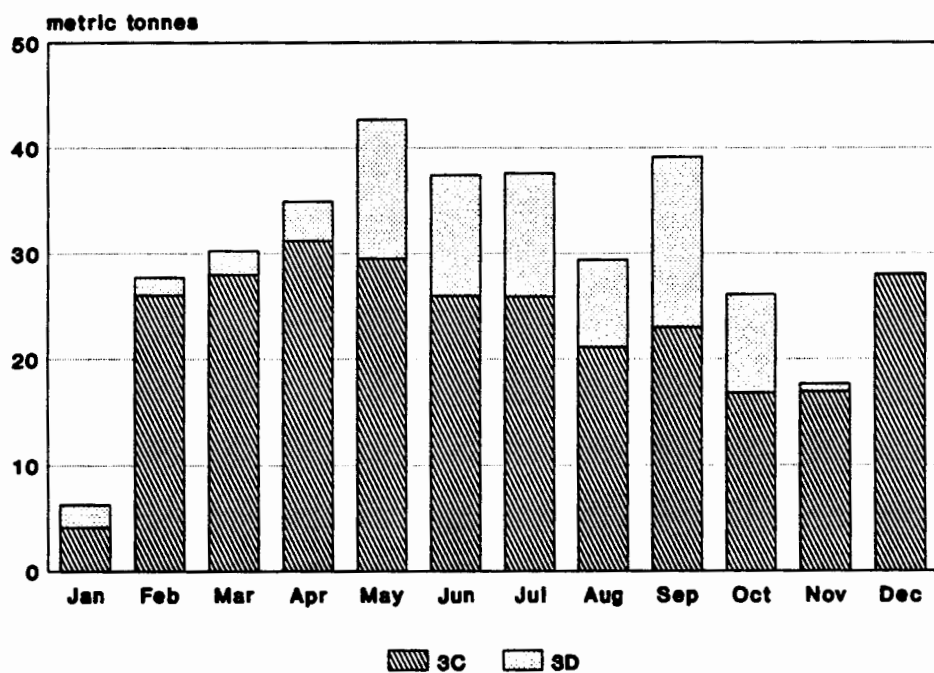
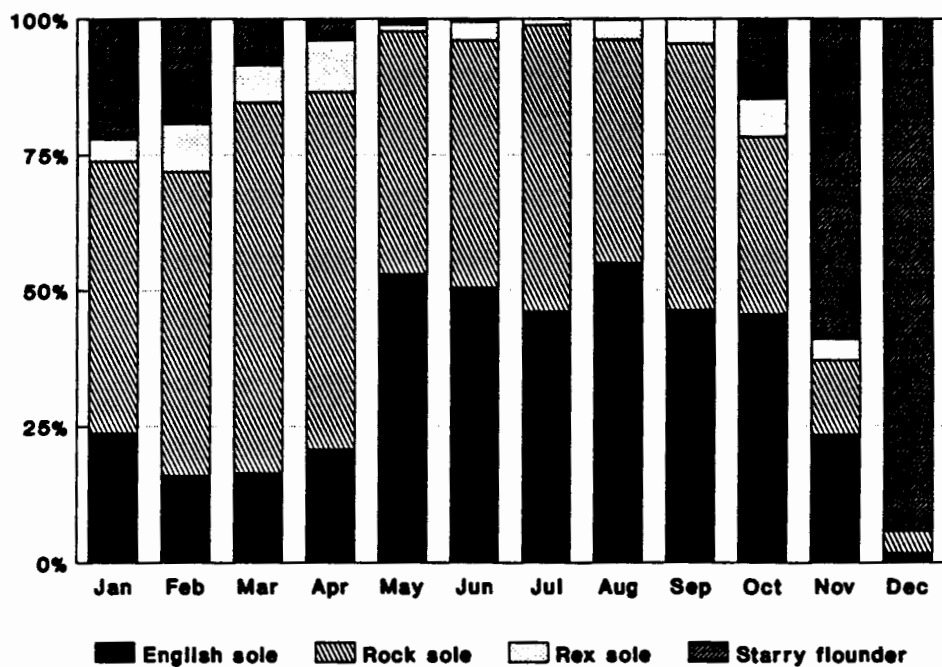


Figure 8: Average monthly landings of rockfish by the domestic groundfish trawl fishery from 1989-93, shown for major statistical areas 3C and 3D.

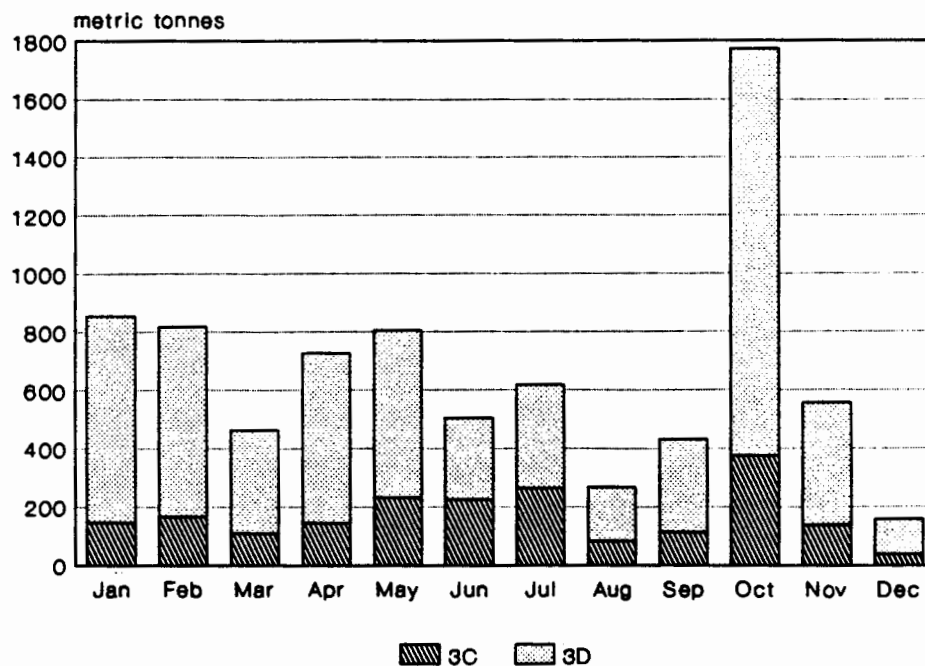


Figure 9: Average monthly landings of Turbot by the domestic groundfish trawl fishery from 1989-93, shown for major statistical areas 3C and 3D.

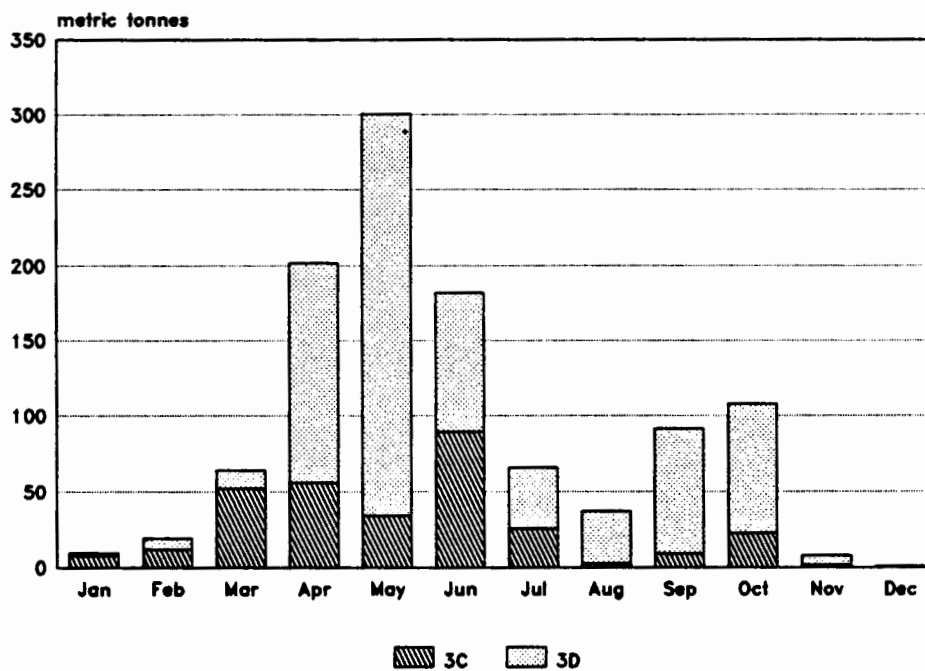


Figure 10: Average monthly landings of Sablefish by the domestic groundfish trawl fishery from 1989-93, shown for major statistical areas 3C and 3D.

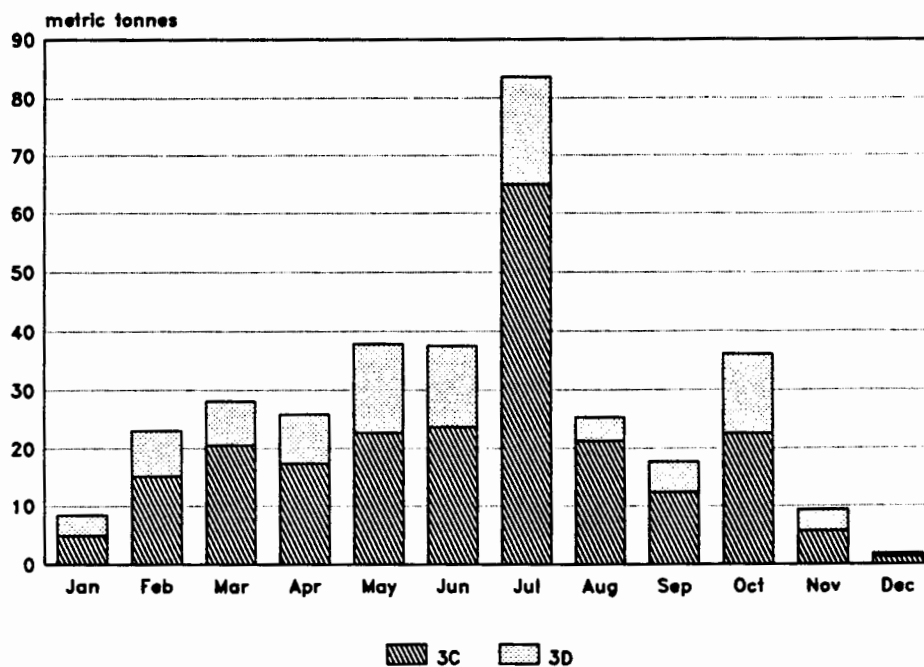


Figure 11: Average monthly landings of Spiny dogfish by the domestic groundfish trawl fishery from 1989-93, shown for major statistical areas 3C and 3D.

