

# **Pacific Commercial Fishery Updates for Invertebrate Resources (1994)**

R. Harbo and K. Hobbs (editors)

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### ABSTRACT

Harbo, R. M. and K. Hobbs (Editors) 1997. Pacific Commercial Fishery Updates for Invertebrate Resources (1994). Can. Manuscr. Rep. Fish. Aquat. Sci. 2369: + 181 p.

Fishery updates present catch and effort data and identify issues in the many invertebrate fisheries on the Pacific coast of Canada. These papers often form the basis for requests for stock assessment advice.

There are more than 30 species of invertebrates exploited commercially and in 1993 the reported landings were 27,255 tonnes, a slight reduction from 1992 primarily due to quota reductions in the red sea urchin and geoduck clam fisheries. The landed value of invertebrates increased to approximately \$80 million.

The report has been organised by sections on molluscs, echinoderms and crustaceans. Specific gear types are identified in each section.

### RÉSUMÉ

Les mises à jour donnent les données de capture et d'effort de pêche et identifient les problèmes rencontrés dans les diverses pêches aux poissons invertébrés de la côte canadienne du Pacifique. Ces documents constituent souvent la base des demandes d'avis en matière d'évaluation des stocks.

On compte plus de trente espèces d'invertébrés exploitées commercialement. En 1993, les débarquements ont représenté 27 255 tonnes de poisson, soit une légère diminution par rapport aux années précédentes en raison principalement des réductions de quotas dans les pêches d'oursins rouges et de panopes. La valeur des débarquements d'invertébrés a enregistré une hausse, et représente environ 80 millions de dollars.

Ce rapport se présente en plusieurs sections concernant les mollusques, les échinodermes et les crustacés. Les engins spécifiques utilisés sont identifiés dans chaque section.

## 1.0 Introduction

This is one of a series of documents reporting on the fisheries and stock status of invertebrate resources on the Pacific coast of Canada. Earlier reports include Bernard (1982), Jamieson (1985), Jamieson and Francis (1986), Harbo and Jamieson (1987), and Thomas (1990, 1992).

Since 1986 there have been annual summaries of invertebrate fisheries published in the annual reports of the Pacific Stock Assessment Review Committee (PSARC): Stocker, et al, 1987; Stocker, et al, 1988; Farlinger, et al, 1989; Farlinger, et al, 1990; Farlinger, et al, 1991; Irvine, et al, 1992; Irvine, et al, 1993; Humphreys, et al, 1994; and Rice, et al, 1995.

This manuscript presents fishery data and preliminary analyses of catch and effort data from fish slips and harvest logs. More detailed stock assessments are presented in another document (Hand, C.M. and B.J. Waddell (eds), 1996).

Fishery updates are presented to the invertebrate PSARC subcommittee annually in the fall. Management recommendations are developed through PSARC, meetings of the regional D.F.O. shellfish working group and regional advisory committees with client representatives.

The updates in this document are organised by species groups rather than fishery gear types.

### 1.1. Invertebrate Species Exploited

There are three major groups of invertebrates harvested, molluscs, crustaceans and echinoderms. A list of common names and scientific names are presented in Table 1.1, as well as licence categories, gear types and numbers of licences issued in 1994.

### 1.2. Landings and Landed Values

The landings and landed values of invertebrate fisheries resources are listed in Tables 1.2 and 1.3.

### **1.3. Pacific Fishery Management Areas**

The Pacific fishery management areas are shown for the south coast (Fig. 1.1) and the north coast (Fig. 1.2). The fisheries management sector is divided into three divisions for marine fisheries: the north coast division (Areas 1 to 10), south coast division (Areas 11 to 27), and the Fraser River Division (Areas 28 and 29). Invertebrate resources in offshore areas are now managed by the adjoining inshore divisions.

### **1.4 Management Framework for Invertebrate Fisheries**

A brief description of fishery management framework by species for 1994 is shown in Table 1.4.

Table 1.1. List of common and scientific names of commercially exploited species of invertebrates in British Columbia.

Phylum - Class common name	Scientific name	Gear Type	Licence Category	# of eligible Licences <sup>1</sup>	Comments
(A) PHYLUM MOLLUSCA					
CLASS GASTROPODA					
abalone (northern, pinto)	<u>Haliotis kamschatkana</u>	dive	E	(26)	fishery closed Dec. 1990
CLASS BIVALVIA					
geoduck (king clam)	<u>Panopea abrupta</u>	dive	G	55	
horse clam (gaper clam)	<u>Tresus capax</u>	dive	G	55	
	<u>Tresus nuttallii</u>	intertidal	G	55	
manila clam	<u>Tapes philippinarum</u>	intertidal	Z2	1844	Not limited entry
littleneck (native) clam	<u>Protothaca staminea</u>	intertidal	Z2	1844	Not limited entry
butter clam	<u>Saxidomus giganteus</u>	intertidal	Z2	1844	Not limited entry
razor clam	<u>Siliqua patula</u>	intertidal			Not limited entry
blue (bay) mussel	<u>Mytilus edulis</u> complex	intertidal	N/A		Experimental, closed
California (sea) mussel	<u>Mytilus californianus</u>	intertidal	N/A		Experimental, closed
pink (smooth, swimming) scallop	<u>Chlamys rubida</u>	dive/net	ZI,ZR	ZI-37,ZR-32	Not limited entry
spiny (pink, swimming) scallop	<u>Chlamys hastata</u>	dive/net	ZI,ZR	ZI-37,ZR-32	Not limited entry
deepwater littleneck	<u>Compsomyax subdiaphana</u>	net	N/A		Experimental, closed
CLASS CEPHALOPODA					
Pacific octopus	<u>Octopus dofleini</u>	dive/trap	ZG,ZP	ZG-62,ZP-161	
opal squid	<u>Loligo opalescens</u>	net	ZE	48	
(B) PHYLUM ARTHROPODA					
CLASS CRUSTACEA					
SUBCLASS MALACOSTRACA					
euphausiids (krill)	<u>Euphausia pacifica</u>	net	ZF	19	
prawn (spot shrimp)	<u>Pandalus platyceros</u>	trap	W	260	
smooth pink shrimp	<u>Pandalus jordani</u>	trap/net	W,S	W-260, S-249	
northern (spiny) pink shrimp	<u>Pandalus borealis</u>	trap/net	W,S	W-260, S-249	
sidestripe shrimp	<u>Pandalopsis dispar</u>	trap/net	W,S	W-260, S-249	
coonstripe shrimp	<u>Pandalus danae</u>	trap/net	W,S	W-260, S-249	
humpback shrimp	<u>Pandalus hypsinotus</u>	trap/net	W,S	W-260, S-249	

Table 1.1. continued.

Phylum - Class common name	Scientific name	Gear Type	Licence Category	# of eligible Licences <sup>1</sup>	Comments
Dungeness crab	<u>Cancer magister</u>	trap	R	226	
red rock crab	<u>Cancer productus</u>	trap	R	226	
red (Alaska) king crab	<u>Paralithodes camtschatica</u>	trap	R	226	
golden (brown) king crab	<u>Lithodes aequispina</u>	trap	R	226	
tanner crab	<u>Chionoecetes bairdi</u>	trap	N/A		Experimental fishery, offshore
SUBCLASS CIRRIPIEDIA					
goose-neck barnacles	<u>Pollicipes polymerus</u>	intertidal	Z6	114	Not limited entry
(C) PHYLUM ECHINODERMATA					
CLASS ECHINOIDEA					
red sea urchin	<u>Strongylocentrotus franciscanus</u>	dive	ZC	110	
green sea urchin	<u>Strongylocentrotus droebachiensis</u>	dive	ZA	49	
purple sea urchin	<u>Strongylocentrotus purpuratus</u>	dive	N/A	N/A	Experimental fishery - 1989 and 1990, west coast Vancouver Island
CLASS HOLOTHURIOIDEA					
California sea cucumber	<u>Parastichopus californicus</u>	dive	ZD	85	

<sup>1</sup> - number of eligible commercial fishing licences in 1994

Table 1.2. Landings of invertebrates in tonnes in British Columbia, 1981-1993

	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993
<b>INTERTIDAL CLAMS - Commercial Fishery:</b>													
Razor	30	68	31	100	90	142	142	155	117	114	117	55	44
Butter	120	103	77	130	251	158	68	134	92	109	42	132	102
Manila <sup>1</sup>	317	597	1048	1677	1913	1893	3607	3909	2764	1456	982	923	1047
Nat. Ln.	179	241	324	294	191	284	373	290	433	465	201	116	131
Mixed	161	155	279	410	477	371	87	27	159	339	137	112	121
SubTotal: Commercial Fishery	807	1164	1759	2611	2922	2848	4277	4515	3565	2483	1479	1338	1445
FARMED CLAMS					4	7	25	30	31	39	169	300	300
<b>TOTAL INTERTIDAL CLAMS</b>	<b>807</b>	<b>1164</b>	<b>1759</b>	<b>2611</b>	<b>2926</b>	<b>2855</b>	<b>4302</b>	<b>4545</b>	<b>3596</b>	<b>2522</b>	<b>1648</b>	<b>1638</b>	<b>1745</b>
GEODUCK	2704	3135	2636	3483	5370	5006	5734	4567	3985	3956	3333	2864	2455
HORSE CLAM	51	321	21	7	6	96	355	325	115	124	110	2	23
SHRIMP	581	413	411	408	678	768	2644	2561	2299	1940	3265	2683	3283
PRAWN	358	274	331	505	514	550	620	720	820	761	961	1168	1215
CRAB	1317	1003	960	1155	1165	1321	1631	1508	1518	2129	1858	3334	6289
ABALONE	85	82	56	58	42	52	49	49	49	50	N/A	N/A	N/A
OCTOPUS		18	30	25	32	53	129	209	217	198	131	117	145
SEA URCHIN	116	160	986	1764	1815	2067	2223						
RED								2116	2658	3158	6945	12018	6388
GREEN								444	609	475	607	1042	714
SEA CUCUMBER <sup>2</sup>				113	346	786	1722	1922	1144	870	1340	1242	812
SCALLOP		8	11	18	53	68	66	67	75	69	82	91	90
PLANKTON	19		47	103	131	166	130	247	360	530	450	380	53
SQUID		29	15	69	111	79	86	88	70	72	116	93	13
MUSSELS			tr	1	tr	2	2	3	4	1	tr	0	0
GOOSENECK BARNACLES					tr	2	32	49	30	37	40	38	30
OYSTERS - Farmed		1579	2453	2897	3420	2864	3482	3702	3721	4547	4482	4500	4000
<b>TOTAL TONNES</b>	<b>6038</b>	<b>8186</b>	<b>9716</b>	<b>13217</b>	<b>16609</b>	<b>16735</b>	<b>23207</b>	<b>23122</b>	<b>21270</b>	<b>21439</b>	<b>25368</b>	<b>31210</b>	<b>27255</b>

<sup>1</sup> the sum of commercial fishery landings and production from clam tenures

<sup>2</sup> landings are round weight

Table 1.3. Landed value of invertebrates in thousands of dollars in British Columbia, 1981-1993

	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993
<b>INTERTIDAL CLAMS - Commercial Fishery:</b>													
Razor	24	55	24	123	95	127	126	137	124	130	129	82	67
Butter	42	36	33	55	138	75	40	63	44	53	34	81	60
Manila	323	611	1043	1813	2278	2762	6003	7175	6003	3761	2574	2180	2570
Nat. Ln.	195	263	329	311	202	327	474	359	588	710	327	190	212
Mixed	175	169	293	455	575	510	132	36	196	625	238	187	215
SubTotal: Commercial Fishery:	759	1134	1722	2757	3288	3801	6775	7770	6955	5279	3302	2720	3124
Farmed Clams:					4	14	43	59	96	140	556	1000	1200
<b>TOTAL INTERTIDAL CLAMS</b>	<b>759</b>	<b>1134</b>	<b>1722</b>	<b>2757</b>	<b>3292</b>	<b>3815</b>	<b>59</b>	<b>7829</b>	<b>7051</b>	<b>5419</b>	<b>3858</b>	<b>3720</b>	<b>4324</b>
GEODUCK	2434	2814	1818	2937	4605	4294	6184	9762	12967	10582	9659	16237	26994
HORSE CLAM	42	235	12	5	6	63	309	300	144	274	119	2	46
SHRIMP	912	644	1073	1022	1180	1240	4609	2802	2985	2637	4430	2831	3494
PRAWN	2019	1545	2138	3262	3379	3734	4326	5724	7083	7006	7728	8380	10121
CRAB	3556	2345	3320	4558	4719	5661	6452	5945	6046	8919	8342	11008	18607
ABALONE	721	696	462	530	442	734	973	1076	1170	1347	N/A	N/A	N/A
OCTOPUS		39	63	56	82	136	381	651	707	657	415	350	447
SEA URCHIN	34	56	358	712	763	1011	1276						
RED								1241	1631	1953	4187	8660	5271
GREEN								584	1020	948	1795	4424	3777
SEA CUCUMBER				22	94	236	768	961	998	1168	1029	1363	982
SCALLOP		17	24	56	95	212	244	285	316	317	387	420	423
PLANKTON	6	0	19	42	89	113	102	192	223	415	390	318	41
SQUID		22	21	84	184	127	132	113	94	81	148	135	17
MUSSELS		tr	tr	tr	0	tr	tr	tr	tr	1	tr	tr	tr
GOOSENECK BARNACLES					1	4	211	479	343	413	418	448	320
OYSTERS - Farmed		981	1554	2109	2613	2515	2548	2725	2938	3613	3465	3600	4700
<b>TOTAL VALUE (\$000)</b>	<b>10483</b>	<b>10528</b>	<b>12584</b>	<b>18152</b>	<b>21544</b>	<b>23895</b>	<b>28574</b>	<b>40669</b>	<b>45716</b>	<b>45750</b>	<b>46370</b>	<b>61896</b>	<b>79564</b>

<sup>1</sup> the sum of commercial fishery landings and production from clam tenures

Table 1.4. Management framework for invertebrate fisheries, 1994.

SPECIES	LICENCES	QUOTA	SEASONS	COMMENTS
Geoduck	Limited entry (G tab). 55 licenses. Vessels may have more than licence (stacked licences) Licence conditions include notification, validation and catch reporting requirements Validation costs funded by licence holders.	1994 quota is 2245.3 t for I.V.Q.'s of 40.8 t (90,000 lb) of coastwide quota). Quota not taken in 1994 cannot be carried to 1995.	Varies by area	Fishery areas are in a three year rotation. Quotas based on an annual yield of 1% of the virgin biomass.
Horse Clam	Limited to the 55 geoduck licences	Catch ceilings were recommended for open south areas: West: 118.4 t Inside: 124 t	Varies by area and only in areas open to geoduck harvesting	Area 24 has been divided into 3 areas with a three year rotation
Green Sea Urchin	Limited entry. 49 licences Notification required prior to commencement and termination of fishing in an area. (ZA tab)	Quotas set in 1994. in South: 449 t, with area quotas North: no quota	Nov to Feb with area and seasonal openings incl. North coast	Handpicking by divers only. Permanent closures in marine protected areas. Minimum size limit in effect.
Red Sea Urchin	Limited entry. 109 licences ZC tab with area election. Notification required prior to commencement of fishing. Weekly catch hails required on the south coast	South coast quota: 1543 t quota overruns to be deducted from 1995 quotas. North coast quota: 5897 t	South coast: 2 to 4 days per week. North coast fishing periods: Jan-May, June, Aug, Oct-Dec.	Rotational areas in the north Minimum size limit in effect.  Voluntary I.V.Q. system undertaken by the licence holders.
Gooseneck Barnacle	Not limited entry (Z6 tab) 105 licences issued in 1993.	None.	All year.	Less than 10% of the stock is available for harvest due to harvest conditions or unsuitable size and quality for the available markets.
Pink and Spiny Scallop (Net Gear)	Not limited entry. ZR - 44 licences issued in 1993 for trawl or drag	None. Managed by size limit.	Some permanent area closures	
Pink and Spiny Scallop (Dive Gear)	Not limited entry. Z1 - 35 licences issued in 1993 for diving.	None. Managed by size limit.	Some permanent area closures	
Plankton - Euphausiids	Limited entry. 19 ZF licences	Mainland inlets: 285 t. Strait of Georgia: 215 t.	Closed June 1 to August 15.	Poor markets are limiting this fishery in 1993-1994

Table 1.4. (continued)

SPECIES	LICENCES	QUOTA	SEASONS	COMMENTS
Octopus (by Trap)	Not limited entry. ZP tab. 175 licences issued in 1993	None.	Inshore: Apr to Dec subject to prawn closures Off shore: all year. Seasonal closures for spawning	Open only in times and areas open to shrimp trap in Inside. Offshore open Jan 1 to Dec 31.
Octopus (by Dive)	Not limited entry. ZG tab. 71 licences issued in 1993	None.	All year with seasonal closures for spawning	Harvest from shore without a vessel is not permitted.
Prawn/Shrimp by Trap	Limited entry. W tab. 273 licences eligible 1993	Managed by time and area closures based on a minimum escapement of the spawner cohort. Minimum size limit and gear escapement regulations.	3 month seasonal closure: Jan - Mar.	Delayed openings in Salmon/Secht Inlets, Saanich Inlet, Howe Snd., Alberni Inlet with trap and fishing time limitations in these areas.
Shrimp Trawl	Limited entry. 249 S tab licences.	None.	All year, with inseason monitoring of shrimp counts. Area closures. No prawn retention in areas closed to prawn trap fishing	Bycatch: Prawn - not exceeding the greater of 2% or 5 lb. of total weight of shrimp on board. Groundfish: no retention Squid: not exceeding 2% Octopus: may retain all incidental caught octopus.
Squid	Not limited entry. ZE tab. 47 licences issued in 1993.	None.	Permanent area closures.	Select areas with a landings in Pacific Rim National Park will be closed.
Crab	Limited entry. R tab. 230 licences were eligible in 1993.	Managed by size limit. No quota. Area-specific trap limits. Trap escapement regulations.	Area licencing, area closures due to softshell or allocation to aboriginal or sport fisheries.	Non-retention of females. Rot panel size set for traps without hinged lids from 20 to 11 cm Crab traps to be fitted with one escape hole at least 100 mm diameter
Intertidal Clam	Not limited entry. Z2 tab. 1639 licences issued in 1993	Managed by size limit, not quota	Seasonal openings and closures, staggered openings to maintain market supply. Closures for allocation to aboriginal and sport fisheries.	Area-specific licences, licence holders choose 1 of 7 areas. Ongoing federal/provincial consultation for changes to fishery management with all user groups. Depurated harvest and clam culture issues.
Sea Cucumber	Limited entry. ZD tab. 85 eligible licences.	1994 quotas set at 27.5 t split wt (South Coast) and 183 t split wt in the North. Voluntary I.V.Q. program by licence holders, with area licencing	Open Oct 19 for a 2 week period. Landings monitored by port validators. Area rotation in the south.	No fishing in area 12 and 13 in 1994 due to quota overruns in 1992. 1994 opening delayed to Oct. pending I.V.Q. development. I.V.Q's may be stacked.

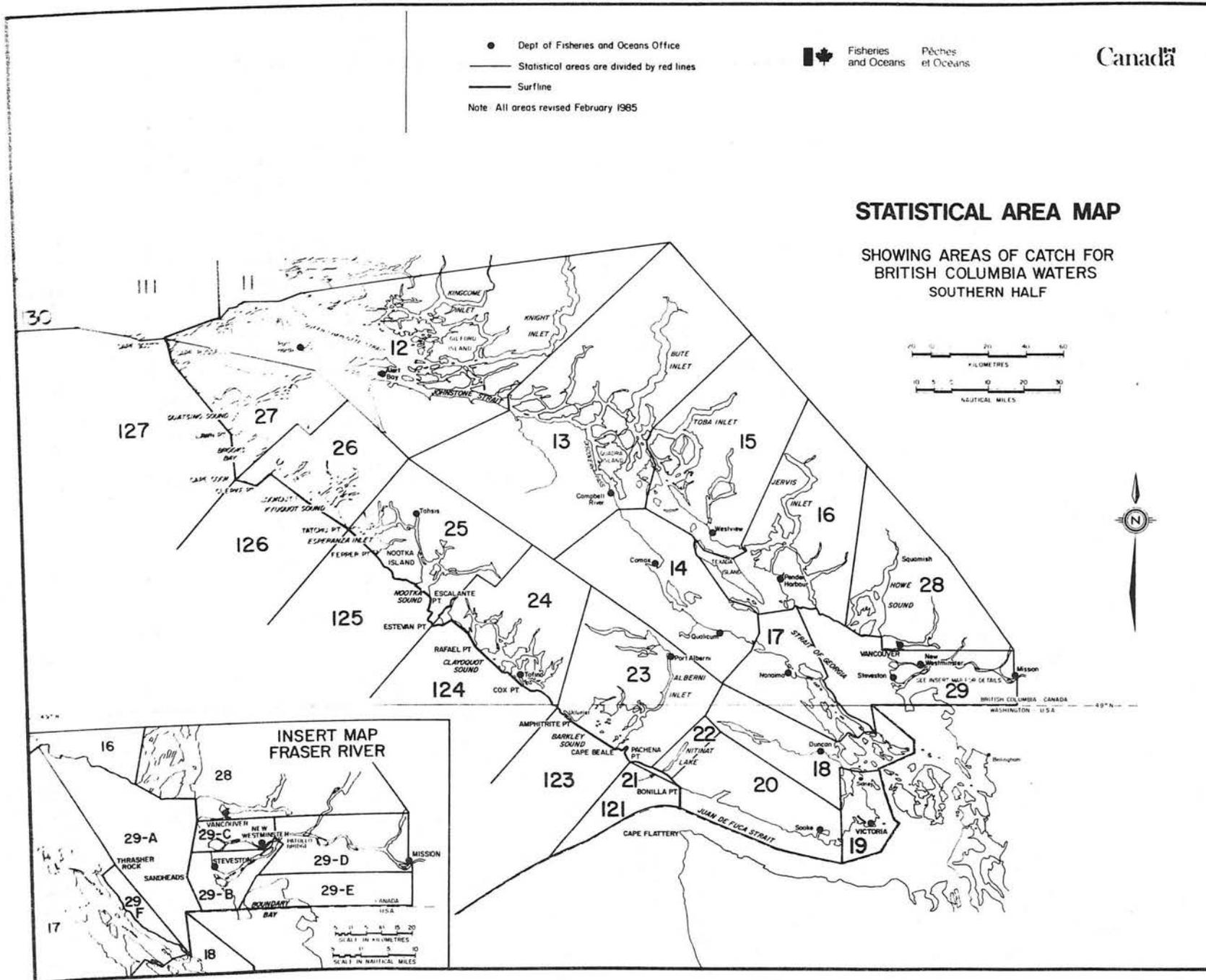


Figure 1.1 Pacific Fishery Management Areas, southern coast of British Columbia.

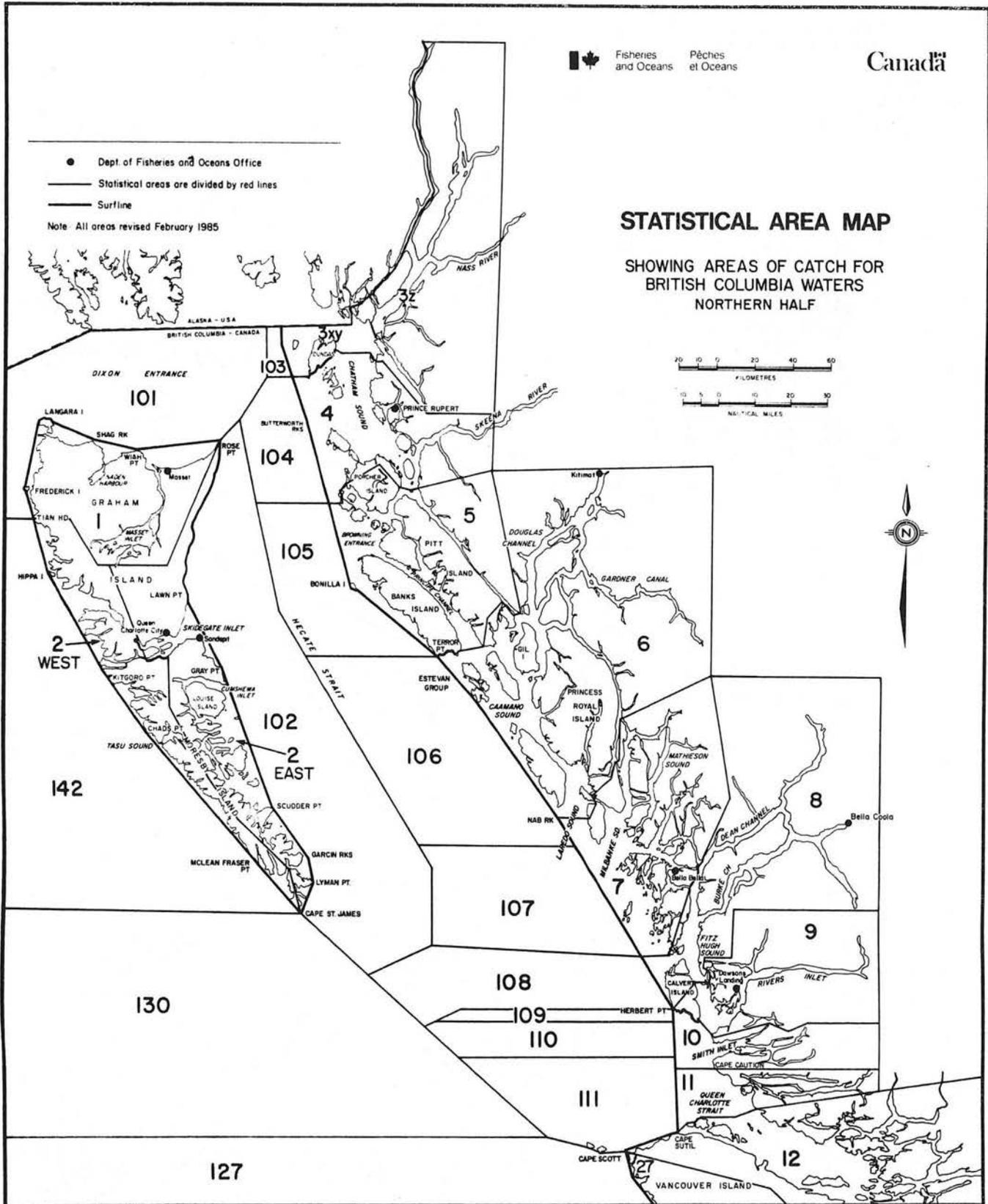


Figure 1.2 Pacific Fishery Management Areas, northern coast of British Columbia.

## 2.1. GEODUCK CLAM DIVE FISHERY 1993/94

R. Harbo, G. Thomas and K. Hobbs

### 2.1.1. Introduction

The geoduck (Panope abrupta) has been fished by divers in British Columbia for 19 years, since 1976. Annual landings peaked at 5735 t in 1987, and were reduced to 2434 t in 1993. The commercial fishery has landed over 123 million lb. (55,780 t) over the period 1976 to 1993 ( Tables 2.1.1, 2.1.2 and 2.1.3).

The price paid to fishermen for geoduck continued to increased significantly in 1993, as a result of increased prices primarily for live market. The total annual value of the fishery increased to \$27 million, the highest in value among shellfish species (Table 2.1.1).

Geoduck are marketed live now whenever possible due to high prices, and some are processed as neck and body meat primarily for east Asian markets. P-licences for processing at sea are issued for the north coast and the option has been available for the W.C.V.I. In 1993, however, there was no processing at sea due to higher prices for live geoducks.

### 2.1.2. Fishery Management

Catches are limited by **quotas** based on estimates of density, geoduck "bed" area from harvest logs, mean weight, and an annual yield of 1% of the virgin biomass. Bed area and catch information are reviewed annually with fishers. As a result of potential over-harvesting of some beds and low density concerns, quotas were reduced again in 1993 and 1994. A review of quota management from 1976 to 1990 and proposed quotas for 1991 was presented by Harbo et al. (1992). Quota set for 1992 and 1993 were given in Harbo et. al (1993), and the 1994 quotas are reviewed in Harbo et. al 1994.

The 1993 fishery was the fifth year of an **Individual Vessel Quota program** in which annual TAC's are divided equally between 55 G licences. Figure 2.1.1 shows that the declining landings (reflecting annual quota reductions) have been compensated for by increased landed values in this fishery.

Following a preliminary analysis of logbook data, industry accepted a 15% annual reduction of quota over the period 1992-1993. In 1992, the total TAC was 6,311,250 lb. (2368 t) so that the I.Q.'s in 1992 were 114,750 lb. and in 1993, the total TAC set was 5,362,500 lb. (2433 t) for IQ's of 97,500 lb.

The program has also included **area selection**. Licences can elect to fish one of three areas. In 1993, the North Coast had 24 licences, 19 licences were on the West Coast Vancouver Island and 12 licences fished the Inside Southern Waters. **Rotational areas** are fished once every 3 years (except Area 24). A **landing validation program** to track vessel and area quotas is paid for by licence holders. The number of area licences has changed in 1992, 1993 and 1994 ( Table 2.1.4) with W.C.V.I. decreasing from 20 in 1992 to 19 in 1993 and 18 in 1994. The north coast licences increased correspondingly from 23 in 1992, 24 in 1993, and 27 in 1994. Licences in Inside Waters decreased from 12 in 1992 and 1993 to 10 in 1994.

#### 2.2.2.1 South Coast Fishery - 1993

The Inside Waters of Vancouver and the mainland have very large beds identified and measured that maintained the allocation of 12 licences from 1989 and an IVQ of 160,000 lb through to 1993, with an IVQ of 97,500 lb per licence. In 1994 the IVQ was reduced by 7.7% and the number of Inside Waters licences were reduced to 10.

Harvest bed area estimates have been reduced in most areas based on landings criteria, and on advice from fishers. Due to overharvesting concerns, several bed closures have been initiated since 1992 in heavily harvested areas. These areas require assessment. As a result of bed closures, the number of licences on the west coast of Vancouver Island were reduced in 1992 and 1993.

The openings, landings and closure dates for 1993 are given in Table 2.1.5.

#### 2.1.2.2 North Coast Fishery - 1993

In 1993, the North Coast fishery was carried out in the Prince Rupert District. The fishery was organized and scheduled to accommodate on-grounds monitoring by a charter vessel and to prevent conflict with the herring fishery and herring spawn. The 1993 quota was 2,340,000 lb. (1061 t), which included 114,000 lb. (51.7 t) of exploratory quota ( 5% of the northern quota). This supported 24 licences at I.Q.'s of 97,500 lb. Vessel

activity and landings were monitored by one on-grounds patrolman and observers at five designated landing ports.

Table 2.1.6 summarizes the north coast quotas, landings and fishing dates for 1993.

### 2.1.3. Catch and Effort

Tables 2.1.2 and 2.1.3 provide annual catches by Management Area. The total validated landings in 1993 of 2434 t exceeded the TAC by nearly 1%. The 1993 harvest log data showed 4803 diver days fished coastwide, with an average C.P.U.E. of 856 kg/diver\_hour.

#### 2.1.3.1 South Coast

There were 31 IQ's (50%) assigned to the south coast in 1993, 12 for Inside waters and 19 for the W.C.V.I. Validated landings for 1993 in the south coast were 1371 t, slightly less (<1%) than the 1371 t quota. The 1993 landings were 531 t on the Inside (507 t quota) and 840 on the W.C.V.I. (841 t quota). Fishing took place all year for live markets. Monthly landings for 1993 are shown in Table 2.1.7.

#### 2.1.3.2 North Coast

Validated landings in 1993 from the North Coast were 1,063 t, 2 t more than the quota of 1,061 t. Prior 1992, all product harvested from the north coast had to be processed due to PSP risk. Starting in 1993, licence holders funded water quality testing and PSP monitoring, allowing north coast fishers to sell to live markets.

Landings by month for the north coast are given in Table 2.1.8.

Landings were made by 22 vessels fishing the 24 north coast licences in 1993. Some vessels fished as many as three licences, while other licences were transferred in-season between vessels that fished portions of the I.V.Q.'s landings.

There were no P-licences issued or catch processed on board north coast vessels in 1993.

#### 2.1.4.0 Issues

The fishery has faced a reduction in quotas annually since 1991. A two year plan was set for 1992-1993 to give some stability to the fishery while an assessment was carried out.

There remain great uncertainties about average densities and the size of geoduck beds. Additional data on recruitment and natural mortality are required for yield models, also under review.

There are continued reports of dumping low quality geoducks, or "high grading". There is pressure from within industry to land and sell all geoducks regardless of their size and quality.

There is a continuing interest in 1994 in enhancement and aquaculture of geoducks. A policy is being developed for these activities.

In 1993, closures at times of Paralytic Shellfish Poison (PSP) occurrences included geoduck clams. The harvest and processing of geoducks was not allowed in areas of PSP risk.

#### **2.1.4.1 South Coast**

There have been a number areas closed in the south until an assessment is carried out. A survey of bed area and density was carried out at Marina Island in June-July, 1992 and Comox Bar in July, 1993.

#### **2.1.4.2 North Coast**

There has been a major change in the north coast fishery so that geoducks can be shipped live to markets. Water quality and PSP sampling was initiated in 1992 in the North Coast. Quota was transferred inseason from Principe Channel, areas D3 (10,000 lb.) and D4 (10,000 lb.) to area A8 (Laredo Channel) because water quality programs had not been completed. Fishermen have contributed to the funding of these programs. Some of the cost to the fishers should be recovered from higher prices received for live market clams over processed product.

There have been concerns about the length of the fishing season on the north coast extending past the length of time that the on-grounds observer was contracted. There was very little surveillance provided by DFO patrol vessels. There is a concern that preferred beds will be overfished when on-grounds surveillance is not provided and that exploration of new beds will be minimal.

Table 2.1.1. Number of licences issued, number of vessels fished, landings and landed values of geoduck clams in British Columbia, as reported on sales slips (1976 to 1988), and on validation logs (1989 to 1993).

Year	Licences issued	Vessels with Landings	Total Landings		Total Value <sup>1</sup> \$10 <sup>-3</sup>	Mean Price <sup>2</sup>		Price Range <sup>2</sup>	
			(lb)	(t)		(\$·lb)	(\$·kg)	(\$·lb)	(\$·kg)
1976	7	5	97,002	44	N/A	N/A	N/A	N/A	N/A
1977	30	14	540,898	245	89	0.17	0.37	N/A	N/A
1978	54	27	2,239,950	1,016	569	0.25	0.55	0.15 - 0.35	0.33 - 0.77
1979	101	72	5,429,886	2,463	1,669	0.31	0.68	0.13 - 0.40	0.29 - 0.88
1980	95	63	6,186,067	2,806	2,299	0.37	0.82	0.30 - 0.48	0.66 - 1.06
1981	52	49	5,961,405	2,704	2,162	0.36	0.79	0.32 - 0.70	0.71 - 1.54
1982	52	53	6,910,800	3,134	2,814	0.40	0.89	0.22 - 0.46	0.44 - 1.01
1983	54	53	5,810,913	2,635	1,804	0.31	0.68	0.00 - 0.60	0.00 - 1.32
1984	54	44	7,678,465	3,484	2,937	0.38	0.84	0.00 - 0.95	0.00 - 2.09
1985	55	52	11,838,624	5,370	4,599	0.40	0.89	0.00 - 1.00	0.00 - 2.20
1986	55	55	11,035,396	5,005	4,605	0.39	0.86	0.00 - 0.85	0.00 - 1.87
1987	55	56	12,643,298	5,735	6,184	0.49	1.08	0.00 - 1.05	0.00 - 2.31
1988	55	56	10,068,830	4,567	9,807	0.97	2.14	0.03 - 1.88	0.07 - 4.14
1989	55	47	8,784,247	3,985	12,571	1.43	3.15	0.25 - 1.75	0.55 - 3.85
1990	55	46	8,722,366	3,956	10,581	1.21	2.67	0.14 - 2.27	0.31 - 5.00
1991	55	47	7,346,864	3,333	9,659	1.29	2.84	0.58 - 2.55	1.27 - 5.62
1992	55	45	6,313,748	2,864	16,237	2.56	5.64	1.60 - 5.01	3.53 - 11.04
1993	55	44	5,365,420	2,434	26,994	4.99	11.00	1.00 - 9.38	2.20 - 20.68
Total:			122,974,179	55,780	115,580				

<sup>1</sup> Price ranges taken from market reports and sales slips.

<sup>2</sup> Price paid to commercial fishermen

Table 2.1.2. Summary of geoduck landings (tonnes) by South Coast Management Area, as reported on sales slips (1976 to 1988) and on validation logs (1989 to 1993). A three year rotation of areas was initiated in 1989, with the exception of area 24.

SOUTH COAST MANAGEMENT AREAS																					Annual Landings
Year	East Coast Vancouver Island										E.C.V.I. Total	West Coast Vancouver Island							W.C.V.I. Total		
	11	12	13	14	15	16	17	18	19	28		29	20	21	23	24	25	26		27	
1976				10			8		26		44							0	44		
1977			14	9	77		137	2			239			6				6	245		
1978			8	261	321	3	24	19	136		773	1	3	2	236	2		243	1016		
1979		24	160	276	263	148	209	3	159		1242			153	950	87	22	9	1221	2463	
1980			97	215	17	301	225	34	91		980	5		288	841	321	303		1758	2738	
1981			41	180	29	70	155	44	28		547	8		187	819	473	156	6	1648	2195	
1982		83	14	144	33	103	17	1	14		409	14		174	1218	366	726		2498	2907	
1983		16	29	340	29	42	13	2	10		481			84	1066	215	287	1	1653	2134	
1984	8	302	150	285	54	129	128	1	118		1175			219	628	442	443	2	1734	2909	
1985	13	490	81	172	42	38	137	4	78		1055	0		227	730	599	272	1050	2878	3934	
1986	21	212	148	200	137	117	136	13	124	11	1119	96		231	803	450	226	388	2194	3313	
1987		275	112	286	98	159	265	103	50	100	1448	40		247	661	552	398	241	2139	3587	
1988	62	290	51	191	59	95	110	2	116	1	995	49		192	633	187	206	279	1546	2541	
1989	5	662	203								870			538	633			345	1516	2386	
1990				605		258					864				540		614	343	1497	2360	
1991					258		181	37	244	14	734	1			416	702	153		1272	2006	
1992		256	78	291							625			255	479			306	1040	1665	
1993				349		182					531				497		220	124	840	1371	
1976 to 1993	109	2610	1186	3814	1417	1645	1745	264	1194	1	142	14129	214	3	2803	11149	4396	4025	3094	25685	39813
Inside Waters Total:				14,129				West Coast Total:				25,685									

Table 2.1.3. Summary of geoduck landings (tonnes) by North Coast Management Area, as reported on sales slips (1980 to 1988), and on validation logs (1989 to 1993). A three year rotation of areas was initiated in 1989.

NORTH COAST MANAGEMENT AREA												
Year	1	2E	2W	3	4	5	6	7	8	9	10	Annual Landings
1980		31			4					28	5	68
1981		11				84	6	370	18		20	509
1982								227				227
1983								202	299			501
1984		4		3		214	8	109	183	54		575
1985		341	213			291	60	494	37			1436
1986	7	254	325	120	125	323	24	392	2	103	17	1692
1987	137	391	179	134	95	287	484	222	91	11	117	2148
1988	119	462	45	77	150	191	423	309	250			2026
1989							149	1269	40		142	1600
1990				77	356	441	721					1596
1991	91	848	388									1327
1992							202	853	83	23	39	1199
1993				37	170	411	445					1063
1976 to 1993	354	2341	1150	448	900	2242	2521	4447	1003	219	340	15965

Table 2.1.4. Summary of quotas, landings and management actions from 1976 to 1994.

Year	Management Units Areas	Quota (tonnes)	Landings <sup>1</sup> (tonnes)	Management	Eligible Licences	Vessels Fished <sup>2</sup>
1976	South Coast, Strait of Georgia	No quotas	44	Five operators harvested in designated areas in the Strait of Georgia.	7	5
1977	Coastwide opening	No quotas	245	All landings from south coast - Strait of Georgia and Tofino region, Area 24	30	14
1978	Coastwide opening	No quotas	1,016	Licences issued pursuant to Pacific Shellfish Regulations - mechanical harvesting	54	27
1979	North Coast - 1 management unit South Coast - 1 management unit	1,587 2,041	0 2,463	Because of increase in effort and landings, licence moratorium and quotas were introduced. South coast Areas 13-19 and 24 were closed Sept. 29, 1979. Other areas in Strait of Georgia and west coast Vancouver Island open to Dec. 31	101	72
1980	North Coast - 4 management units South Coast - 8 management units Inside - 5 units West Coast - 3 units	1,587 2,041 771 1,270	68 2,733 980 1,758	Licences limited, South coast areas closed by August 31. First landings from north coast fishery.	95	63
1981	North Coast - 11 management units South Coast - 10 management units Inside - 7 units West Coast - 3 units	986 1,815 397 1418	509 2,195 547 1648	Licences limited based on previous landing criteria of 13.6 t in 1978 or 1979 for licence eligibility. Closure of areas on west coast of Vancouver Island during herring season. Quotas grouped in-season to 8 units.	52	49
1982	Coastwide opening	2,930	3,134	With whole coast open, majority of landings came from south coast. Coast closure on September 1, 1982. Pearse Commission recommended a vessel quota and area licencing system.	52	53
1983	North Coast - 3 management units South Coast - 2 management units Inside - 1 unit West Coast - 1 unit	907 2,041 454 1,587	501 2,134 481 1,653	Some areas open to December 31, Return to management units. Introduction of vessel G licence, transferable to a vessel of equal or shorter length. Grading introduced by processors - problems with product dumping on the fishing grounds	54	53

Table 2.1.4. continued

Year	Management Units Areas	Quota (tonnes)	Landings <sup>1</sup> (tonnes)	Management	Eligible Licences	Vessels Fished <sup>2</sup>
1984	North Coast - 3 management units	907	575	Catch and effort increased. Exploratory areas opened in winter to maintain year round fishery. Vessel processing licenced.	54	44
	South Coast - 12 management units	2,086	2,909			
	Inside - 6 units	680	1,175			
	West Coast - 6 units	1,406	1,734			
1985	North Coast - 4 management units	907	1,436	Openings were set to maintain a year round supply of geoducks for live markets. Several exploratory quotas set.	55	52
	South Coast - 19 management units	2,063 <sup>3</sup>	3,934			
	Inside - 10 units	748	1,055			
	West Coast - 9 units	1,315	2,878			
1986	North Coast - 11 management units	1,474 <sup>3</sup>	1,692	South coast quotas increased. North coast quotas 1.5 million pounds.	55	55
	South Coast - 22 management units	2,506	3,313			
	Inside - 11 units	919	1,119			
	West Coast - 11 units	1,588	2,194			
1987	North Coast - 16 management units	1,608	2,148	Quotas increased coastwide based on new grounds and exploratory fisheries. All north coast quotas taken for the first time.	55	56
	South Coast - 27 management units	2,630	3,587			
	Inside - 13 units	839	1,448			
	West Coast - 14 units	1,792	2,139			
1988	North Coast - 16 management units	1,576	2,026	South coast quotas reduced by 700,000 lb. Quotas calculated from log book data, some exploratory fishing.	55	56
	South Coast - 27 management units	2,196	2,541			
	Inside - 11 units	794	995			
	West Coast - 16 units	1,520	1,546			
<b>FIRST THREE YEAR ROTATION (78 UNITS)</b>						
1989	North Coast - 7 management units	1,597	1,600	First year of trial I.Q. Coastwide quota divided equally among 55 licences; 160,000 lb. Area licensing: 12 inside south, 21 west coast Vancouver Is., 22 north coast licences. First of three year area rotation.	55	47
	South Coast - 13 management units	2,395	2,387			
	Inside - 4 units	871	870			
	West Coast - 5 units	1,524	1,516			

Table 2.1.4. continued

Year	Management Units Areas	Quota (tonnes)	Landings <sup>1</sup> (tonnes)	Management	Eligible Licences	Vessels Fished <sup>2</sup>
1990	North Coast - 5 management units	1,597	1,596	Second year of trial I.Q. 160,000 lb./licence.	55	46
	South Coast - 13 management units	2,395	2,361	Second year of the three year area rotation		
	Inside - 5 units	871	864			
	West Coast - 8 units	1,524	1,497			
1991	North Coast - 19 management units	1,347	1,327	Third year of I.Q. 135,000 lb/licence (15.6% reduction)	55	47
	South Coast - 22 management units	2,020	2,006	Third year of area rotation.		
	Inside - 10 units	735	734			
	West Coast - 12 units	1,286	1,272			
<u>SECOND THREE YEAR ROTATION (186 UNITS)</u>						
1992	North Coast - 24 management units	1,197	1,199	First year of area rotation. I.Q. 114,750 lb/licence. (15% reduction)	55	45
	South Coast - 37 management units	1,666	1,665	23 licences North; 12 Inside South; 20 W.C.Vancouver Is.		
	Inside - 16 units	625	625			
	West Coast - 21 units	1,041	1,040			
1993	North Coast - 27 management units	1,061	1,063	Second year of area rotation. I.Q. 97,500 lb/licence.(15% reduction)	55	44
	South Coast - 20 management units	1,371	1,371	24 licences North; 12 Inside South; 19 W.C.Vancouver Is.		
	Inside - 7 units	507	531			
	West Coast - 13 units	840	840			
1994	North Coast - 32 management units	1,102	1,091	Third year of rotation. I.Q. 90,000 lb./licence (7.7% reduction)	55	
	South Coast - 30 management units	1,143	1,136	27 licences North, 10 Inside South; 18 W.C.V.I.		
	Inside - 15 units	408	408			
	West Coast - 15 units	735	728			

<sup>1</sup> Reported landings from sales slip submissions, revised from Harbo et. al. 1986. 1989 to 1993 landings are I.Q. validated weights.

<sup>2</sup> Some licences were transferred to other vessels or vessels were replaced so that more than one vessel may have reported landings on the same licence. Licences (quotas) were "stacked" on vessels in 1989.

<sup>3</sup> plus exploratory quotas

Table 2.1.5. 1993 geoduck quotas, landings, opening and closing dates for South Coast Areas.

Area	Description	Opening Date	Quota		Landings		Closing Date	Comments
			(lb.)	(t)	(lb.)	(t)		
<b>INSIDE WATERS</b>								
<b>Area 14:</b>								
14-D	Hornby Is. (ptns of 14-7, 14-9, 14-10 and 14-12)	Jan 1 Jul 21	253,000	114.8	252,904	114.7	Feb 2 Oct 8	
14-E	South - Maplegard Pt. to Northwest Bay (14-1, -4, and -5)	May 6	517,000	234.5	516,997	234.5	Nov 12	
AREA 14 TOTAL:			770,000	349.3	769,901	349.2		
<b>Area 16:</b>								
16-A	W. shore Texada Is. (16-21, 16-22)	Feb 3 Nov 9	175,000	79.4	181,361	82.3	Mar 18	
16-B	Lasqueti Island (16-19, 16-20 and ptn 14-3)	Feb 3 Dec 3	125,000	56.7	119,491	54.2	Mar 18 Dec 31	
16-C	East shore Texada Is. (16-18)	Mar 19	50,000	22.7	50,005	22.7	Apr 8	
16-D	Entrance to Jervis In., Thormanby Is., Frances Penn. and Bjerre Shoal (16-2, -2, -11 and ptn of 16-17)	Apr 9	40,000	18.1	40,003	18.1	Apr 29	
16-E	Salmon/Sechelt Inlets (16-5 to -9, 29-1)	Apr 30	10,000	4.5	9,537	4.3	May 5	
AREA 16 TOTAL:			400,000	181.4	400,397	181.6		
<b>TOTAL INSIDE WATERS: 12 QUOTAS @ 97,500 LB. =</b>			<b>1,170,000</b>	<b>530.7</b>	<b>1,170,298</b>	<b>530.8</b>		
<b>WEST COAST VANCOUVER ISLAND</b>								
<b>Area 24:</b>								
24-A	Inside (ptn 24-6, -7 and -9)	Jan 1 Jun 1	390,000	176.9	389,555	176.7	Jan 22 Jun 7	
24-A2	Northern portion of 24-8	Jan 25	70,000	31.8	70,692	32.1	Jan 29	
24-A3	Southern portion of 24-8 Tonquin-Echachis-Wickaninish	May 28	43,500	19.7	44,045	20.0	May 31	
24-B	Outside - portion of 24-6	Jan 30 Mar 15	275,000	124.7	274,613	124.6	Feb 19 Mar 17	
24-B2	Coomes Bank (ptn. 24-6)	Apr 16 Jul 29	134,000	60.8	134,129	60.8	May 14	
24-B3	Ahousaht (ptns 24-4 and 24-6)		closed	0.0				
24-B4	Kutcouc/Russell Ch (ptn 24-6)	May 15	180,000	81.6	182,598	82.8	May 27	
AREA 24 TOTAL:			1,092,500	496	1,095,632	497.0		
<b>Area 26:</b>								
26-A	N. Inlets (ptns of 26-8,-9, and -10)	Jun 28	100,000	45.4	97,180	44.1	Jul 25	
26-B1	Mission Group (ptn 26-1)		closed	0.0				
26-B2	Mission Group (ptn 26-1)	Jul 25	135,000	61.2	135,345	61.4	Dec 31	
26-C	Inside (ptns of 26-2, -5, -6)		closed	0.0				
26-D	South - Kyuquot/Clear Passage (ptns of 26-1 and 26-2)	Nov 1	250,000	113.4	251,644	114.1	Dec 31	
AREA 26 TOTAL:			485,000	220	484,169	219.6		
<b>Area 27:</b>								
27-H	Klaskino Inlet ( 27-5)	Jun 12	275,000		272,877	123.8	Jun 26	
AREA 27 TOTAL:			275,000					
<b>WEST COAST VANCOUVER ISLAND: 19 QUOTAS @ 97,500 LB. =</b>			<b>1,852,500</b>	<b>716</b>	<b>1,579,801</b>	<b>717</b>		

Table 2.1.6. 1993 geoduck quotas, landings, opening and closing dates for north coast areas.

Area	Description	Opening Date	Quota		Landings		Closing Date	Comments
			(lb.)	(t.)	(lb.)	(t.)		
<b>A: Surf Inlet and west Arizabal Is.</b>								
A1 - Surf Inlet	(6-12, ptn. 6-10 E. of Duckers Is.)	12-Mar-93	101,000	45.8	100,810	45.7	4-May-93	
A2 - Anderson Is.	(ptn. 6-13 W. of 129° 20' W and N. of Wigglesworth Point)	12-Mar-93	17,000	7.7	17,457	7.9	17-Mar-93	
A3 - Borrowman Bay	(ptn. 6-13 E. of 129° 20' W and N. of Wigglesworth Point)	12-Mar-93	42,000	19.1	41,828	19.0	26-Mar-93	
A4 - Kettle Inlet	(ptn. 6-13 Wigglesworth Pt. to Bonson Rk)	12-Mar-93	59,000	26.8	58,755	26.7	1-Apr-93	
A5 - Clifford Bay (upper)	(ptn. 6-13 from Bonson Rk. to Hawkins Rk)	12-Mar-93	171,000	77.6	171,170	77.6	7-Apr-93	
A6 - Clifford Bay (lower)	(ptn. 6-13 from Hawkins Rk. to north tip of Arriaga Is.)	12-Mar-93	100,000	45.4	99,996	45.4	13-Apr-93	
A7 - Weeteam Bay	(ptn. 6-13 from N. tip Arriaga Is. to 52° 28' N lat.)	12-Mar-93	153,000	69.4	153,703	69.7	19-Apr-93	
A8 - Laredo Ch. East	(ptn. 6-14 and 6-15 within .5 m. of Princess Royal Is. shore)	19-Apr-93	40,000	18.1	40,779	18.5	21-Apr-93	quota increased in-season
<b>A TOTAL:</b>			<b>683,000</b>	<b>310</b>	<b>684,498</b>	<b>310</b>		
<b>B: Calamity Bay, Estevan Group, Campania Is.</b>								
B1 - Calamity Bay	(ptn. 6-9 N. of Otter Pt.)	22-Apr-93	163,000	73.9	163,183	74.0	4-May-93	
B2 - Estevan Group	(ptn. 6-9 S. of Otter Pt.)	22-Apr-93	118,000	53.5	118,244	53.6	12-May-93	
B3 - Campania Is. area	(ptn. 6-10 W. of Duckers Is.)	22-Apr-93	14,000	6.4	14,473	6.6	13-May-93	
<b>B TOTAL:</b>			<b>295,000</b>	<b>134</b>	<b>295,900</b>	<b>134</b>		
<b>C. Banks Island (5-22):</b>								
C1 - Wreck Is./North	(ptn. 5-22 north of Waller Bay)	29-Sep-93	111,000	50.3	110,633	50.2	12-Oct-93	
C2 - S. Banks Is.	(ptn. 5-22 Waller Bay and South)	12-Oct-93	86,000	39.0	86,531	39.3	24-Oct-93	
<b>C TOTAL:</b>			<b>197,000</b>	<b>89</b>	<b>197,164</b>	<b>89</b>		
<b>D. Area 5 North:</b>								
D1 - Freeman Pass	(5-12)	21-Oct-93	25,000	11.3	25,053	11.4	29-Oct-93	
D2 - Shakes Is.	(5-10)	21-Oct-93	7,000	3.2	7,543	3.4	29-Oct-93	
D3 - Principe Ch. Upper	(5-13, 5-16, ptn. 5-17 N. of Gale Pt.)	14-May-93	(10,000)	0.0	-	0.0	6-Jul-93	quota transferred to A8
D4 - Principe Ch. Lowe	(5-17 S. of Gale Pt.)	14-May-93	(10,000)	0.0	-	0.0	6-Jul-93	quota transferred to A8
D5 - Griffiths Hbr.	(ptn. 5-20 N. of Solander Pt.)	9-Sep-93	398,000	180.5	396,185	179.7	18-Sep-93	
D6 - Sneath Is.	(ptn. 5-20 Solander to Laverock Pt.)	17-Sep-93	148,000	67.1	147,350	66.8	29-Sep-93	
D7 - Kingkown Inlet	(ptn. 5-20 S. of Laverock Pt., 5-21)	27-Jul-93	133,000	60.3	133,060	60.4	10-Sep-93	
<b>D TOTAL:</b>			<b>711,000</b>	<b>323</b>	<b>709,191</b>	<b>322</b>		

Table 2.1.6. 1993 geoduck quotas, landings, opening and closing dates for north coast areas.

Area	Description	Opening Date	Quota		Landings		Closing Date	Comments
			(lb.)	(t.)	(lb.)	(t.)		
<b>E. Area 3 and Upper Area 4:</b>								
E1 - Dundas Is.	(3-1, ptn.-2, ptn.-3)	9-Nov-93	35,000	15.9	35,473	16.1	17-Nov-93	
E2 - Wales Is to Big Bay	(ptn. 3-2, ptn. 3-3, 3-4, 3-5, 4-5 to 4-8, and 4-14)	9-Nov-93	29,000	13.2	23,879	10.8	17-Nov-93	
E3 - Lower Dundas Is.	( ptn. 3-1)	8-Dec-93	21,000	9.5	21,586	9.8	31-Dec-93	
<b>E TOTAL:</b>			<b>85,000</b>	<b>39</b>	<b>80,938</b>	<b>37</b>		
<b>F. Lower Area 4:</b>								
F1 - Stephens Is.	(ptn.4-2, 4-4, 4-9)	25-Oct-93	42,000	19.1	42,538	19.3	8-Nov-93	
F2 - Oval Bay	(4-3)	25-Oct-93	25,000	11.3	26,306	11.9	20-Nov-93	
<b>F TOTAL:</b>			<b>67,000</b>	<b>30</b>	<b>68,844</b>	<b>31</b>		
<b>G. Melville to Archibald Is.:</b>								
G1 - Melville/Dunira Is.	(4-1, 4-5)	24-Nov-93	188,000	85.3	189,097	85.8	31-Dec-93	
G2 - Tree Nob Group	(4-13)	19-Nov-93	96,000	43.5	97,054	44.0	3-Dec-93	
G3 - Archibald Is.	(ptn. 4-2, Archibald Is. only)	8-Nov-93	20,000	9.1	19,758	9.0	20-Nov-93	
<b>G TOTAL:</b>			<b>304,000</b>	<b>138</b>	<b>305,909</b>	<b>139</b>		
<b>NORTH COAST TOTALS:</b>			<b>2,342,000</b>	<b>1,062</b>	<b>2,342,444</b>	<b>1,063</b>		

NORTH COAST TOTAL: 24 QUOTAS @ 97,500 lb. = 2,340,000 lb. Note that landings exceeded the quota in the North Coast by 2000 lb.

Table 2.1.7. Summary of geoduck landings (tonnes) by South Coast Management Areas in 1993, as reported on validation logs.

Month	SOUTH COAST MANAGEMENT AREAS																	Monthly Totals		
	East Coast V.I.									West Coast V.I.										
	11	12	13	14	15	16	17	18	19	28	29	20	21	23	24	25	26		27	
Jan				14.5											171.9					186
Feb				2.7		41.0									94.5					138
Mar						36.2									22.1					58
Apr						27.2									35.8					63
May				19.3						4.3					127.9					152
June				30.8										44.8				123.8		199
July				63.5													55.4			119
Aug				62.9													5.4			68
Sept				54.3													5.8			60
Oct				87.5													28.7			116
Nov				13.6		13.2											93.0			120
Dec						59.7											31.4			91
<b>Area Totals</b>				349.2		177.3				4.3				497.0		219.6	123.8			1371.2
<b>Mainland and East Coast Vancouver Is.:</b>										531										840
										<b>South Coast Total:</b>				1371						

**Table 2.1.8. Summary of geoduck landings (tonnes) by North Coast Management Areas in 1993, as reported on validation logs.**

<b>NORTH COAST MANAGEMENT AREAS</b>												
<b>Month</b>	<b>1</b>	<b>2E</b>	<b>2W</b>	<b>3</b>	<b>4</b>	<b>5</b>	<b>6</b>	<b>7</b>	<b>8</b>	<b>9</b>	<b>10</b>	<b>Monthly Totals</b>
<b>Jan</b>												
<b>Feb</b>												
<b>Mar</b>							186.1					186
<b>Apr</b>							173.5					174
<b>May</b>						32.9	85.1					118
<b>June</b>						46.8						47
<b>July</b>						19.4						19
<b>Aug</b>						102.5						102
<b>Sept</b>						102.8						103
<b>Oct</b>					2.7	106.7						109
<b>Nov</b>				21.0	84.7							106
<b>Dec</b>				9.8	88.6							98
<b>Area Totals</b>				30.8	175.9	411.1	444.7					1062.5

# Annual Geoduck Landings 1976 to 1994

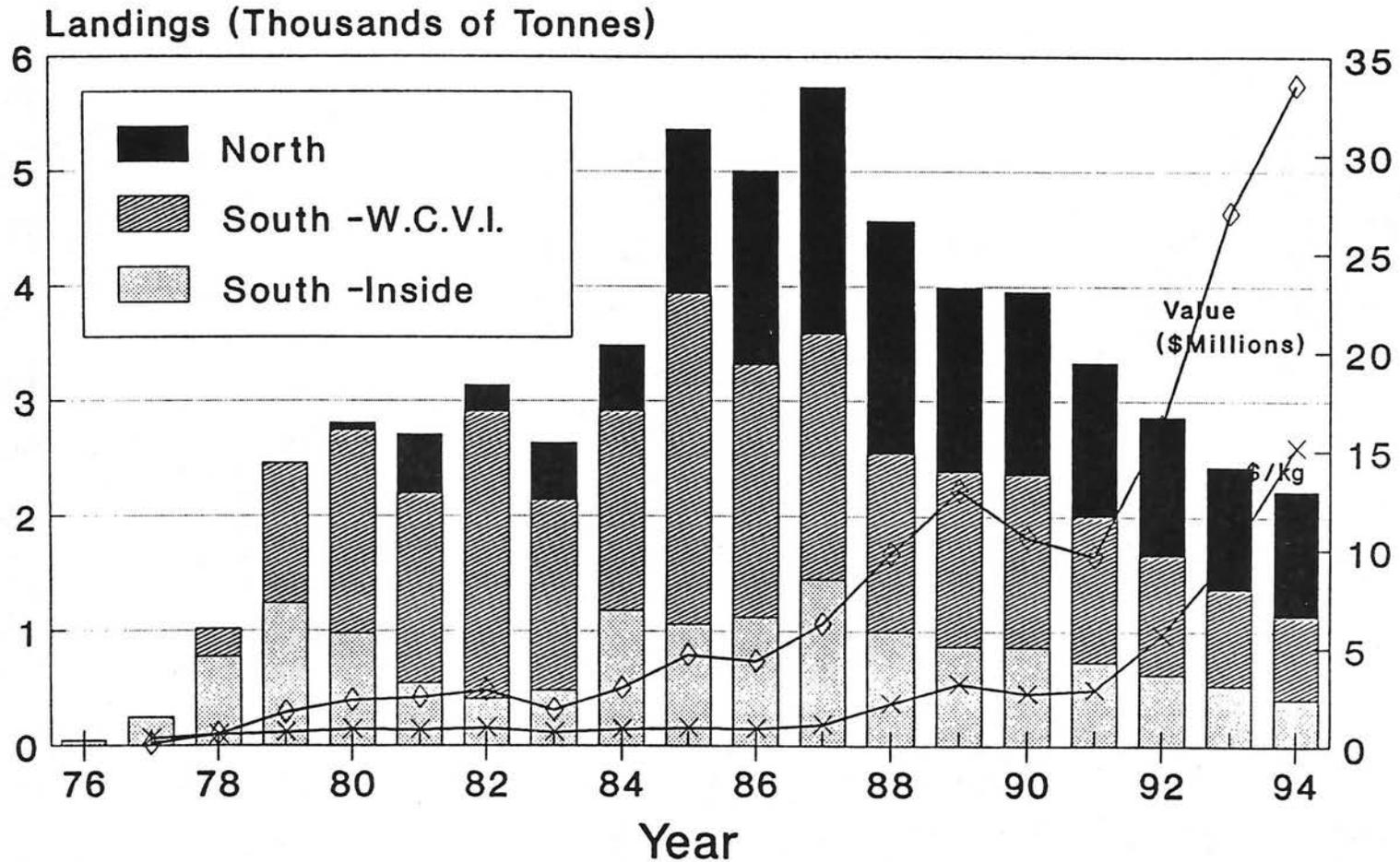


Figure 2.1.1 Annual Geoduck Landings 1976 to 1994

## 2.2 HORSE CLAM DIVE FISHERY

R. Harbo and K. Hobbs

### 2.2.1. Introduction

This dive fishery is limited under the 55 G licences for geoducks and horse clams. Landings have been recorded since 1979. Less than half the fleet typically participate in this fishery.

Two species of horse clams are taken, *Tresus capax* and *T. nuttallii*.

The lack of markets for the processed necks and body meat has limited landings in this fishery. There is no market currently for live horse clams.

### 2.2.2. Fishery Management

The fishery is limited to the subtidal area. Harvesting must take place at least 10 feet below chart datum by condition of licence. This restriction was put in place to protect intertidal vegetation and habitats that support herring spawn. The Elbow Bank and Yellow Bank areas have been closed to the harvest of horse clams since 1988, to protect herring spawn habitat.

The G licence requires submission of harvest log data to document catch and effort in the fishery.

Initially, the management advice was to monitor the size and species composition of the catch. If there were significant declines in the mean size of clams landed effort restrictions should be considered.

Management restrictions recommended at PSARC 1992 for this fishery limit the fishery to those areas open to geoducks. This allows for fishing in an area once every three years, with the exception of Areas 14 and 24.

#### AREA 24 -

Area 24 was first subdivided into separate horse clam harvest areas in 1988 (Figure 2.2.1). In 1990, the area

subdivisions were modified into three areas for rotation and an annual precautionary harvest limit of 200,000 lb. (90.7 tonnes) was set. The three rotational areas are:

Lemmens Inlet: Subarea 24-9  
 Morfee - Dunlap Islands: described as "that portion of subarea 24-6 from the northernmost point on Morfee Island along the shore to the southernmost point on Morfee Island, thence a straight line to the southernmost point of Dunlap Island, thence along the shore to the northernmost point of Dunlap Island, thence a straight line to Roberts Point, thence a straight line half way between Roberts Point and Kraan Head and thence in a straight line in a westerly direction back to the point of commencement on Morfee Island.

Epper Pass - Yellow Bank: Subarea 24-7 and that portion of 24-6 described as " bounded by or inside of line running from Kraan Head, south to the northernmost point of Morfee Island, thence westerly to the unnamed prominent point on Vancouver Island on the northerly shore of Epper Pass, thence northerly along the shore of Epper Pass to the point of commencement at Kraan Head.

#### AREA 14 -

In 1992 and 1993 Area 14 was divided for the geoduck and horse clam fishery (Figure 2.2.2). Due to heavy fishing in Area 14 at Comox Bar, Seal Islands and Sandy Island, this portion was closed for the rotation period 1991 to 1993, by no permitting horse clam harvest in geoduck management areas 14-B, 14-C, or 14-D. Surveys of horse clams and biological samples were taken in 1993 at Comox Bar. (Alan Campbell, pers. comm.)

#### 2.2.3. Catch and Effort

Table 2.2.1 presents a summary of landings from 1979 to 1993. The effort and landings in 1992 were the lowest on record, with only one vessel reporting landings in the north (Areas 7 and 8) and one from the south (Area 12). No landings were reported from the west coast of Vancouver Island in 1992. Landings were minor, 23 t, in 1993, but the price increased to \$1.85/kg or \$0.84/lb.

Table 2.2.2 presents annual landings by statistical area from 1979 to 1993. Most of the fishing has taken place in Areas 14, 17 and 24. Due to the low market demand and low prices offered, there has been little fishing activity in the north coast.

Tables 2.2.3 and 2.2.4 present a history of horse clam landings from harvest logs and sales slips for the rotational areas in Area 24 and for Comox Bar in Area 14.

Landings by month for 1993 for south coast areas are shown in table 2.2.5. There were no landings of horse clams in north coast areas in 1993.

#### 2.2.4. Issues

A market sample has been taken June 23, 1993 from Klaskino Inlet, Area 27 on the west coast of Vancouver Island. Other market samples were taken in 1993 and 1994. This data will be reported in the 1995 meetings. (A. Campbell, pers. comm.)

The fishery has been limited to an incidental fishery, open only when the geoduck fishery is open. Horse clams have been opened and closed concurrently with geoducks since 1992. Obviously, this has reduced opportunities and landings in the fishery. Processors do not usually want horse clams when they are buying geoducks.

There continues to be concern about the impact of harvesting horse clams in eelgrass beds. In many areas the horse clams are in the intertidal zone or shallow subtidal zone. The G licence restricts harvest to depths greater than 10 feet below chart datum.

The potential for poaching geoducks during a horse clam fishery would be alleviated by requiring horse clam landings to be validated by a port observer.

For the most part, compliance with submission of harvest logs has been good. However, in 1990, there was low compliance with this condition of licence, resulting in only 55% of the catch reported on logs.

#### RECOMMENDATIONS

The fishery should be restricted until some stock assessment has been carried out. Some studies have been undertaken at Comox Bar

(Area 14) and Ritchie Bay (Area 24) and the results are being analyzed for 1995 meetings: depth distribution, population estimates and yield modelling.

Table 2.2.1. Horse clam landings (tonnes) and effort for British Columbia, 1979 to 1993, as reported on sales slips and harvest logs.

Year	Type and Number of Licences Issued	Number of Vessels with Landings	Fishing Days	Landings (t)	Landed Value (\$·10 <sup>3</sup> )	Whole Landed Value (\$/t)	X CPUE <sup>1</sup> (t/vessel day)	X CPUE <sup>2</sup> (kg/diver hr)	X CPUE <sup>2</sup> (kg/diver day)
1979	G 101	N/A	N/A	37	N/A		N/A	N/A	N/A
1980	G 95	28	N/A	128	79	617	0.6	65	232
1981	G 52	12	N/A	51	38	745	1	ND	ND
1982	G 52	40	N/A	321	235	732	0.5	87	225
1983	G 54	8	N/A	21	12	571	0.7	ND	ND
1984	G 54	5	N/A	6.7	5.5	821	0.2	N/A	N/A
1985	G 55	7	N/A	6.3	5.9	937	0.1	N/A	N/A
1986	G 55	15	193	96	63	656	0.5	170	630
1987	G 55	27	471	355	359	1011	0.8	152	621
1988	G 55	33	405	325	300	923	0.8	119	588
1989	G 55	16	118	116	144	1241	1	220	559
1990	G 55	22	254	124	138	1113	0.5	120	312
1991	G 55	17	183	110	119	1082	0.6	128	479
1992	G 55	2	8	2	2	1088	0.2	N/A	N/A
1993 <sup>3</sup>	G 55	17	118	23	43	1858	0.2	N/A	N/A

N/A - data not available

ND - no data

<sup>1</sup> from sales slip data

<sup>2</sup> data from harvest logs

<sup>3</sup> preliminary data for 1993

Table 2 2.2. Summary of horse clam landings (tonnes) from South coast and North Coast areas, 1979 to 1993, as reported on sales slips.

Year	MANAGEMENT AREAS																				Total Landings
	North Coast					Mainland and East Coast V.I.										West Coast V.I.					
	2E	4	5	7	8	12	13	14	15	16	17	18	19	29	20	23	24	25	26	27	
1979							*	27	0.3	6.5	0.2							4.3			38
1980						0.1	0.5	22	46	50	9		*			0.4		*	*		128
1981						5.2	*	7.3	1.4	1.7	4.2		2.3			1.2	27.1	0.7			51
1982						3.1	0.3	163	0.3	2.6	14.8					2.3	123.6	3.4	6.6		320
1983								0.2		*						0.2	4.5	*	15.7		21
1984							3.9	2.3													6
1985								6		*	0.1								*		6
1986							23	67	0.9	0.2	2	3				*	0.2	0.2			97
1987	0.2					24	0.5	132	42	5.9	146	0.3		3.4	0.1	0.1	1.1				356
1988	0.7		0.1				14.4	57.7	0.3	9.2	77.1	4.9	1.5	5.3		7.3	140.7	0.9	4.2	1.2	326
1989				0.1		22.5	1.6	0.2		0.2	7.9		0.1			4.8	78.1			0.1	116
1990								29		6			*				90				125
1991		1							6.0		22.0						78.0	2.0			109
1992				1	1	0.2															2
1993 <sup>1</sup>							6.645		1.594							14.07				0.861	23
Area																					
Totals	1	1	0	1	1	55	44	520	97	84	283	8	4	9	0	16	557	12	27	2	1723

\* landings less than 100 kg

<sup>1</sup> preliminary landings for 1993

Table 2.2.3. Horse clam landings from Comox Bar, bed 4601, from harvest log reports, 1986 to 1994

Year	Landings (kg) from logs			Total Area 14 Harvest Logs	Total Area 14 Sales Slips	% Complete
	Bed 4601	Bed 4801	Bed 5001			
1986	45,848	16,781		62,629	66,716	94
1987	61,966	36,484	5,635	135,014	132,036	102
1988	29,144			43,208	57,700	75
1989	0	0	0	0	200	0
1990	0	7,829	0	24,487	29,000	84
1991	0	0	0	0	0	0
1992	0	0	0	0	0	0
1993				n/a	6,645	0
1994				n/a	0	0
<b>Total</b>	<b>136,958</b>	<b>61,093</b>	<b>5,635</b>	<b>265,337</b>	<b>292,297</b>	<b>91</b>

Table 2.2.4. Horse clam landings from Area 24 rotational areas, from harvest log reports, 1988 to 1994

Year	Landings (kg) from logs				Total Area 24 Harvest Logs	Total Area 24 Sales Slips	% Complete
	Yellow Bank	Morfee Dunlap Is.	Lemens Inlet	Total			
1988	15,870	97,310	5,957	119,137	140,923	140,700	100
1989	37,936	5,364	15,659	58,959	73,693	78,100	94
1990	41,670			41,670	41,670	89,600	47
1991		54,706		54,706	77,995	78,000	100
1992			0		0	0	
1993	14,065				n/a	14,065	
1994		0			n/a	0	
<b>Total</b>	<b>109,541</b>	<b>157,379</b>	<b>21,616</b>	<b>274,471</b>	<b>334,282</b>	<b>400,465</b>	<b>83</b>

n/a - harvest log data not yet summarised for 1993 and 1994.

Table 2.2.5. Summary of horse clam landings (tonnes) by South Coast Management Areas in 1993, as reported on sales slips.

Month	SOUTH COAST MANAGEMENT AREAS											Monthly Totals									
	East Coast V.I.												West Coast V.I.								
	11	12	13	14	15	16	17	18	19	28	29	20	21	23	24	25	26	27			
Jan															1.2					1	
Feb																					
Mar																					
Apr						0.0															0
May				0.2																	0
June				0.4											12.2			0.9			13
July				1.5											0.6						2
Aug				0.6																	1
Sept				1.7																	2
Oct				0.2																	0
Nov				1.4																	1
Dec				0.6		1.6															2
Area Totals				7		2									14			1			23
Mainland and East Coast Vancouver Is.:												8	West Coast Vancouver Is.:					15			
South Coast Total:																	23				

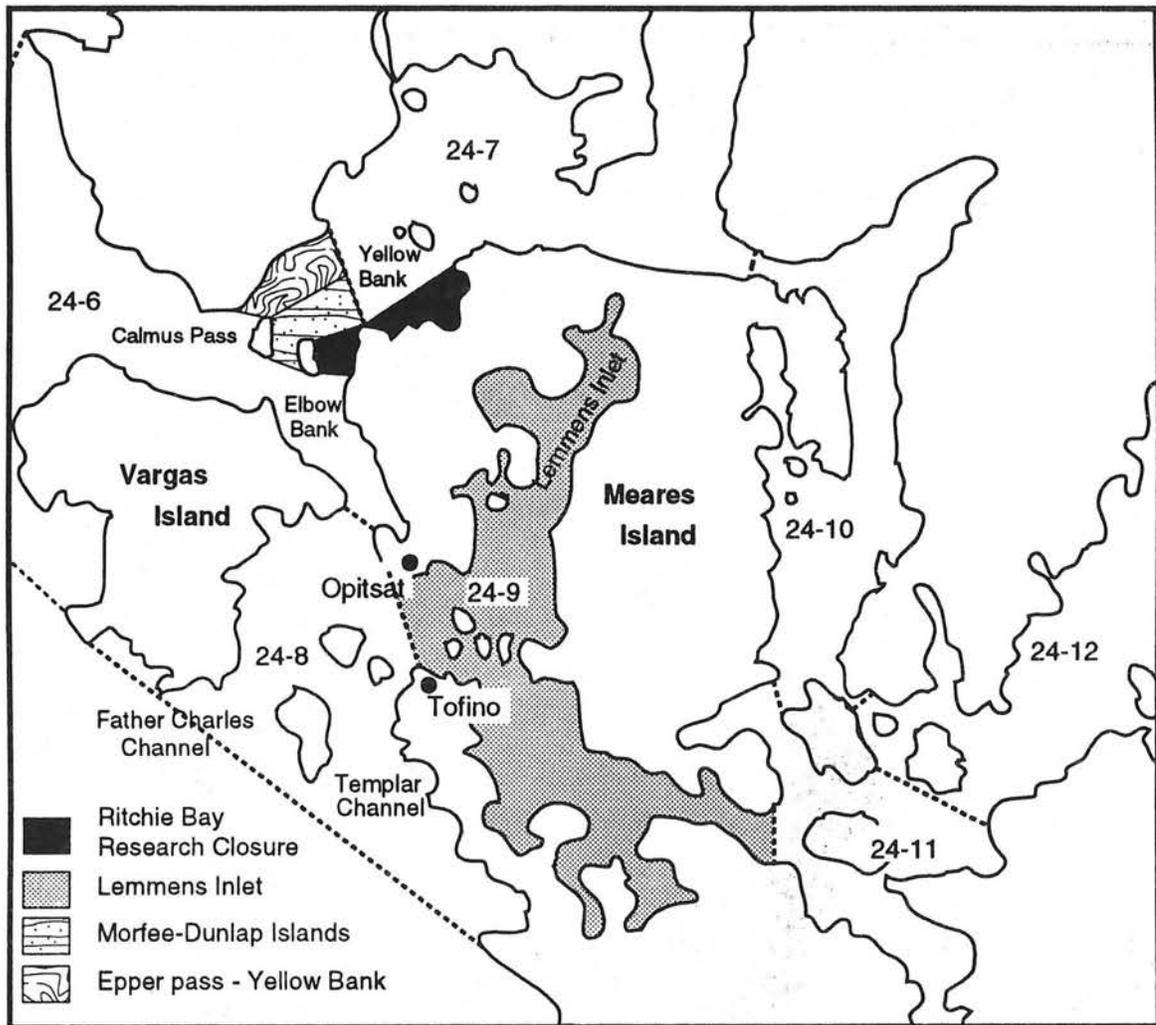


Figure 2.2.1. Horse clam management areas: Lemmens Inlet, Epper Pass - Yellow Bank, and Morfee - Dunlap Islands.

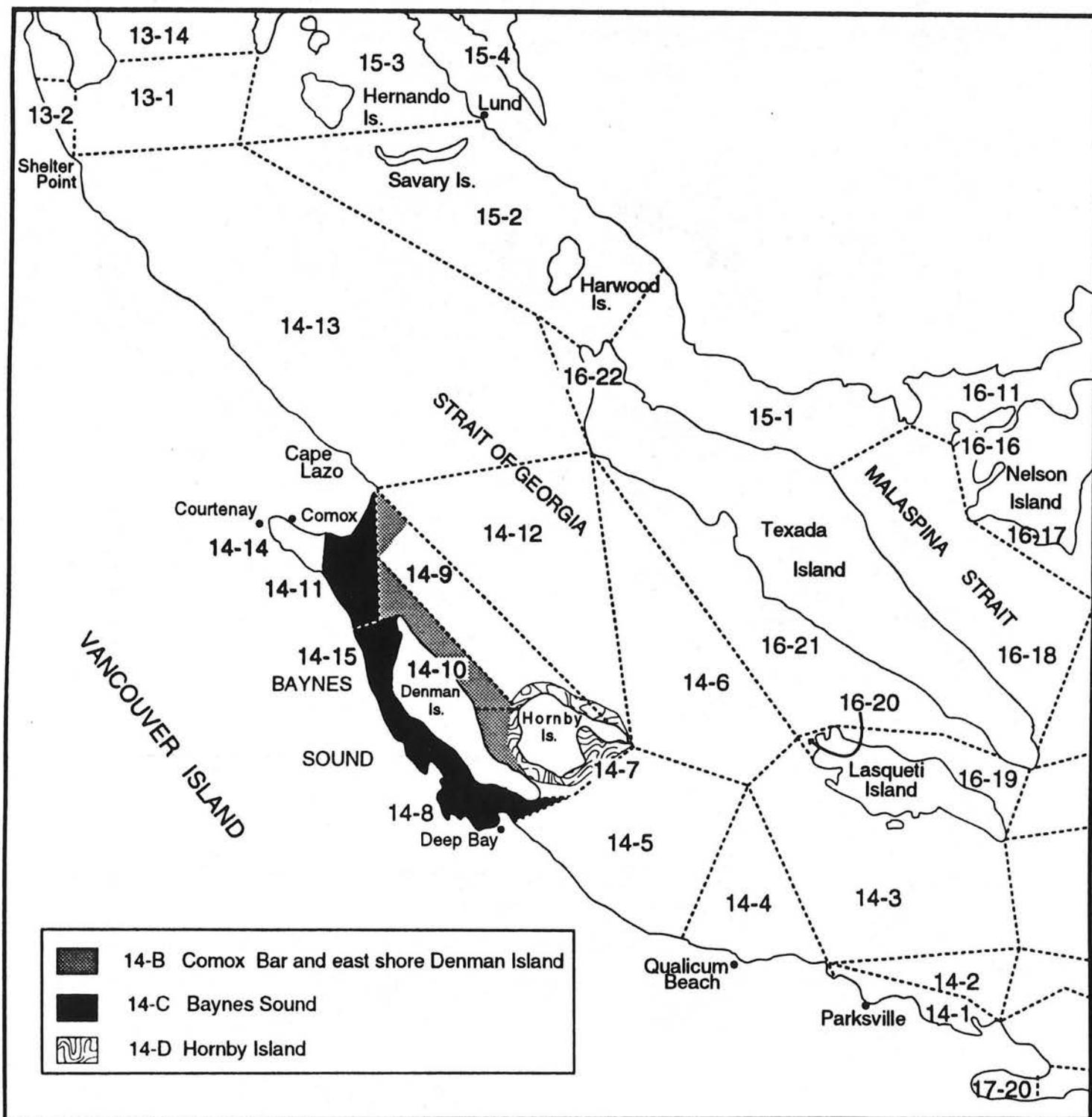


Figure 2.2.2 .Geoduck management areas where horse clam fishing is closed:14B- Comox Bar and east Denman Island; 14C - Baynes Sound; and 14D - Hornby Island .

## 2.3 SCALLOP DIVE AND TRAWL FISHERIES

R.Harbo and K.Hobbs

### 2.3.1. Introduction

Two species of scallops, spiny *Chlamys hastata* (to 80 mm) and pink *C. rubida* (to 71 mm) are harvested in inshore waters by divers and by small drags. A permit to trawl for weathervane scallops, *Patinopecten caurinus*, was issued for offshore waters in 1992, but no landings were reported. Permits were denied for inshore waters because of limited stocks. A moratorium on experimental fisheries has been in effect since 1992.

The depth distribution of the *C. hastata* is from the intertidal zone to 160 m while *C. rubida* is listed as from 1 m to 200 m. *C. rubida* is not as abundant in the catches as *C. hastata*.

There has been experimental culture of the Japanese scallop, *Mizuhopecten (=Patinopecten) yessoensis* in B.C. since 1985.

### 2.3.2. Fishery Management

In 1982, a Z-I licence was required to harvest pink and spiny scallops by dive or drag. In 1993, a Z-I licence was required for the dive fishery and a separate licence category, Z-R, was created for fishing with drag (net) gear and 44 licences were issued (Table 2.3.1).

Minimum size limits are 55 mm for *Chlamys* spp. and 120 mm for weathervane scallops, measured through the longest diameter of the shell perpendicular to the hinge. An experimental licence is required for the harvest of weathervane scallops.

The size of the drags has been limited to a maximum width of 2 metres. There are numerous small closures in park and study areas. Fishers are required to submit logbooks and copies of sales slips.

### 2.3.3. Catch and Effort

Landings of scallops did not increase in 1993; they were 89 t and a landed value of \$422,000 (Tables 2.3.1 and 2.3.2). Landings were evenly spaced throughout the year and ranged from a

low of 6 t in several months to a high of 12 t in April, 1993 (Table 2.3.3). This pattern of landings probably reflects a small but stable market that demands a continuous low supply of fresh product.

Most of the 1993 landings (98%) were from the Strait of Georgia, areas 13, 14, 16, 17, 18, 19 and with minor landings from Area 29 (Table 2.3.3). Small landings have occurred on the West Coast of Vancouver Island in Areas 20 and 24 in the past. No landings were made in Area 24, in 1993, and few in Area 20, in Juan de Fuca Strait due to chronic PSP problems in scallops tested.

As in previous years, most of the reported catch, 82 t (92%) was from diving operations. Catch by divers increased slightly from 70 tonnes in 1992 to 82 tonnes in 1993 (Table 2.3.4). The number of divers ranges from 15 to 20 per year.

There was a decrease in dragging activity for scallops in 1992 and 1993 as shown in Tables 2.3.1 and 2.3.5. Some vessels may not be reporting their catch. In 1993, only 8 vessels of 44 licensed vessels reported landings by drag. This is a slight decrease from 1991, when 12 vessels fished by drag. Dragging operations in 1993 were almost all in Area 14 and accounted for most of the landings in Area 14 ( Tables 2.3.4 and 2.3.5).

No commercial catches have been sampled since 1986. In previous years it was determined that almost 100% of scallops caught by divers were spiny scallops, *C. hastata*, and it is presumed this situation continued in diving operations in 1992. Sampling in Area 14 in 1986 (Harbo, unpublished), showed that up to 34% of the catch in dragging operations was pink scallops, *C. rubida*, but only 1% of these were legal size, 55 mm shell height. Pink scallops are smaller and reach a maximum size of about 70 mm. The largest in our sample was 65 mm, compared to 82 mm for spiny scallops. Pink scallops tend to occur on softer bottom and in deeper water, too deep to be harvested by divers. No recent catch sampling of drag catches has been carried out.

#### 2.3.4. Issues

There is continued interest in the drag fishery but landings appeared to have decreased or the catch is not being reported. This should be investigated to determine if the decline is from stock declines, market declines or a failure to report catch.

There is interest in using an Alaskan-style drag for weathervane scallops. However, there is currently a moratorium on experimental fisheries for invertebrates.

At the request of dive fishermen, drag or trawl closures were set in 1993 in Subareas 17-10, 29-4, 29-5, 18-1, 19-5 and 19-6. Divers have the ability to harvest scallops more selectively with less undersize mortality and no physical disruption to the grounds. These areas are also close to the live markets.

There is concern from Fish Inspection and D.O.E. that some areas of fishing have not been classified as approved shellfish growing and harvesting areas.

Some further analyses of logs should be undertaken to determine:

- range of fishing depths in the drag fishery
- range of depths in the dive fishery
- first recorded landings of scallops
- historical landings of weathervane scallops
- summary of catch by area over time
- analyses of catch over time at specific harvest locations
- of catch over time at specific harvest locations

Table 2.3.1. Annual landings (tonnes), value and effort for pink and spiny scallops, 1982 to 1993, as reported on sales slips and harvest logs.

Year	Type and # of Licences Issued		Number of Vessels with Landings		Total Vessel Fishing Days		Coastwide Landings (t)	Dredge Gear Landings (t)	Dive Gear Landings (t)	Landed Value (\$·10 <sup>3</sup> )	Whole Landed Value (\$/t)	CPUE <sup>1</sup> (t/vessel day)	Diver CPUE <sup>2</sup> (kg/diver hr)
	Dive	Trawl	Dive	Trawl	Dive	Trawl							
1982			8				8			19	2375		
1983	Z 11		6				11			24	2182		
1984	Z 17		13				18			56	3111		
1985	Z 22		13				53			291	5491		
1986	Z 24		15		481		68			212	3118	0.14	61
1987	ZI 29		10		592		66			244	3697	0.11	54
1988	ZI 17		15		905		67			286	4269	0.07	118
1989	ZI 43		15		777		77	37	40	316	4104	0.10	65
1990	ZI 57		11		367		69	10	59	317	4594	0.19	74
1991	ZI 61		21		670		82	23	59	387	4700	0.12	50
1992	ZI 83		17		676		91	19	72	420	4638	0.13	59
1993*	ZI 35	ZR 44	10	8	703	82	89	7	82	422	4712	0.11	N/A

<sup>1</sup> from sales slip data

<sup>2</sup> CPUE [ ] from harvest log data

\* preliminary data for 1993

Table 2.3.2. Pink and spiny scallop landings (tonnes) by management area, 1982 to 1993, as reported on sales slips.

Year	<u>East Coast Vancouver Island</u>									<u>West Coast Vancouver Island</u>					Total
	12	13	14	15	16	17	18	19	20	21	23	24	25	27	
1982			0.1	*			0.1	2.9	4.8		0.2				8
1983						0.3	8.3	2.2	0.1						11
1984		*	1			0.2	15.1								16
1985			4				47.6	0.8							52
1986			12.6		*	18.2	20.3	2.4	*						54
1987	0.7	1.5	0.4	0.1	0.2	24.9	26.4	0.5		0.2			0.3		55
1988		*	3.9			19.5	22.8	2.8	10.7	0.3				0.1	60
1989		0.1	*			16	19.8	0.5	35.8		0.1		0.1	*	72
1990			0.2			30.4	28.4		9.4						68
1991		*	19.6		0.2	27.8	29.1	0.3	2.6			2			82
1992			18.1		0.4	38.6	23.1	0.1				1.8			82
1993 <sup>1</sup>		1	5.5		0.4	53.3	17.4	0.4	2						80
Total	0.7	2.6	65.4	0.1	1.2	229	258	12.9	65.4	0.5	0.3	3.8	0.4	0.1	641

\* less than 100 kg

<sup>1</sup> preliminary landings

**Table 2.3.3. Summary of scallop landings (tonnes) by all gear types, by South Coast Management Areas in 1993, (preliminary) as reported on sales slips.**

<b>SOUTH COAST MANAGEMENT AREAS</b>									
<b>Month</b>	<b>East Coast V.I.</b>							<b>W. Coast V.I.</b>	<b>Monthly Totals</b>
	<b>13</b>	<b>14</b>	<b>16</b>	<b>17</b>	<b>18</b>	<b>19</b>	<b>29</b>	<b>20</b>	
Jan	0.5		3.7	1.5			0.1		6
Feb	0.4		3.3	2.5	0.1	0.1			6
Mar	0.4		3.0	2.4			0.2		6
Apr	0.9	0.1	7.6	2.9	0.0	0.0		0.1	12
May	0.5		2.3	1.4			1.1	0.3	6
June	0.7	0.1	2.7	0.5			1.6	0.5	6
July	0.2		4.8				3.5	0.6	9
Aug			3.8	0.8			1.4	0.2	6
Sept			5.6	0.5	0.2	1.0		0.3	8
Oct	0.2		6.8	1.4			0.4		9
Nov	0.6		4.5	0.9					6
Dec	1.0	1.1	0.2	5.2	2.5				10
<b>Area Totals</b>	<b>1</b>	<b>5</b>	<b>0</b>	<b>53</b>	<b>17</b>	<b>0</b>	<b>10</b>	<b>2</b>	<b>89</b>
<b>Mainland and East Coast Vancouver Is.:</b>									<b>87</b>
<b>West Coast Vancouver Is.:</b>									<b>2</b>
<b>South Coast Total:</b>									<b>89</b>

Table 2.3.4. Summary of scallop landings (tonnes)  
by South Coast Management Areas in 1993,  
by dredge as reported on sales slips (preliminary).

SOUTH COAST MANAGEMENT AREAS							
Month	East Coast V.I.						Monthly Totals
	14	17	18	19	28	29	
Jan		3.7	1.5			0.1	5.4
Feb		3.3	2.5	0.1		0.1	6.0
Mar		3.0	2.4			0.2	5.6
Apr	0.1	7.6	2.9	0.0		0.0	10.7
May		2.3	1.4			1.1	4.8
June		2.7	0.5		0.3	1.6	5.1
July	0.2	4.8			0.5	3.5	9.0
Aug		3.8	0.8			1.4	6.0
Sept		5.6	0.5	0.2		1.0	7.3
Oct		6.8	1.4			0.4	8.7
Nov	0.3	4.5	0.9				5.7
Dec	0.1	5.2	2.5				7.8
<b>Area Totals</b>	<b>1</b>	<b>53</b>	<b>17</b>	<b>0.4</b>	<b>1</b>	<b>10</b>	<b>82</b>
<b>Mainland and East Coast Vancouver Is.:</b>							<b>82</b>
<b>West Coast Vancouver Is.:</b>							
<b>South Coast Total:</b>							<b>82</b>

Table 2.3.5. Summary of scallop landings (tonnes)  
by South Coast Management Areas in 1993,  
by dredge as reported on sales slips (preliminary).

SOUTH COAST MANAGEMENT AREAS						
Month	East Coast V.I.			West Coast V.I.	Monthly Totals	
	13	14	16			20
Jan		0.5			1	
Feb		0.4			0	
Mar		0.4			0	
Apr		0.8	0.1	0.1	1	
May		0.5		0.3	1	
June		0.7	0.1	0.2	1	
July				0.1	0	
Aug				0.2	0	
Sept				0.3	0	
Oct		0.2			0	
Nov		0.3			0	
Dec	1.0	1.0	0.2		2	
<b>Area Totals</b>	<b>1</b>	<b>5</b>	<b>0.4</b>	<b>1</b>	<b>7</b>	
<b>Mainland and East Coast Vancouver Is.:</b>					<b>6</b>	
<b>West Coast Vancouver Is.:</b>					<b>1</b>	
<b>South Coast Total:</b>					<b>7</b>	

## 2.4. INTERTIDAL CLAMS

Randy Webb and Kerry Hobbs

### 2.4.1. INTRODUCTION

The increased level of clam harvest effort in the past five years has resulted in very short intensive fisheries. The fishery has also become less lucrative on an individual basis and harvesters, processors and First Nations peoples are calling for changes to management of this fishery. A joint federal provincial review of clam management has taken place with all client groups and will likely lead to changes in the fishery by 1995.

#### 2.4.1.1 Description of the Commercial Fishery

Over 400 species of intertidal clams are found along the coast of British Columbia, but only a few are commercially or recreationally harvested. Four species of intertidal clams; butter, littleneck, manila, and razor clams, comprise the major portion of landings in commercial and recreational fisheries. A few other species occasionally enter the commercial fishery and are utilized to a somewhat greater extent in the recreational fishery. The manila clam was accidentally introduced in the 1930's with oyster seed from Japan. It is currently the most important species, comprising over 70% of intertidal clam landings.

Historically, clams were utilized as a source of food by Native peoples on the west coast of Canada, as is indicated by large quantities of clam shells often found in Indian middens. They were also important to early settlers. Fishing methods have not changed appreciably since white explorers first came to the coast. The equipment used is simple and inexpensive; it includes some type of transportation to a clam beach, a lantern (since much commercial digging occurs in the fall and winter when low tides occur in darkness), a fork, rake or shovel, and a sack. Hydraulic or mechanical harvesting gear is prohibited. Diggers usually arrive at the beach 3 to 4 hours before low tide and work for a similar period after low tide. The location of beaches with clam densities that will support commercial digging is largely a matter of local knowledge but an indication of clam density can frequently

be obtained from the type of bottom, presence or absence of siphon holes or squirting clams, and by test digging.

Although a commercial clam fishery began just before the turn of the century, landings were not reliably recorded until 1951. Table 2.4.1 summarizes intertidal clam landings by species from 1951 to 1993. Figures 2.4.1 and 2.4.2 show clam landings and values coastwide, 1985 to 1993. Figure 2.4.3 shows cumulative clam landings by Statistical Area for steamer clams (manila, littleneck and mixed clams), 1985 to 1993. The 1993 data is incomplete to date (August, 1994).

Although the intertidal clam fishery is small in relation to many other British Columbia fisheries, it is important to coastal communities and provides needed employment to many people. Furthermore, intertidal clams are widely used in the recreational fishery.

Since 1971, strong markets and higher prices for littleneck and manila clams have focused the intertidal fishery on these two species. The landings of butter clams, which enter the market as a canned product, had been declining because of the high cost of processing and a shift in demand toward fresh steamer clams. However, efforts have been made in the past two years to reactivate the butter clam fishery.

From 1984 to 1988, clam landings increased steadily, largely owing to strong markets in the United States. The increased landings mainly consisted of increases in manila clam landings; there was only a minor increase in landings of native littleneck clams.

The Department has recently compiled an inventory of clam beaches reported in the south coast of British Columbia, in an attempt to assess where clams are harvested by Indian food fishers, commercial and recreational fishers. In the South Coast, over 800 beaches have been identified: 664 commercial, 636 recreational, and at least 216 beaches regularly used for food fishing. The estimate of the area of the beaches is 8110 hectares (Harbo, pers.comm). It is important to note that a large number of these beaches can be accessed by road or small vessels. Many of these beaches are harvested by all user groups.

Most of the north coast is closed to the harvest of all intertidal clams, with the exception of razor clams, due to the fact that Paralytic Shellfish Poisoning (PSP) monitoring programs are not in place due to funding shortfalls. Clam

beaches in the central coast area were inventoried in 1990 and 1991 (Bourne, pers. comm) in order to assess commercial fishery potential. A limited fishery for manila clams occurred in the Bella Bella area in 1992 to 1994 under an agreement with the Heltsiuk Band through the Aboriginal Fishery Strategy (AFS) program.

#### 2.4.2. Fishery Management

The commercial clam fishery is managed as a common property fishery with licence holders competing each season for a share of the harvest. Share competition does not create an incentive to properly husband or enhance the resource.

A variety of regulatory controls have been put in place to support management objectives. The regulatory controls are intended to restrain the commercial harvesting efforts to match the sustainable harvest.

##### 2.4.2.1 Licencing in the Commercial Fishery

The intertidal clam fishery has been a loosely regulated fishery in terms of licencing. There are only estimates regarding the number of clam harvesters prior to 1989, since, until then, there was no unique commercial clam licence. Any holder of a Personal Commercial Fishing Licence (PCFL) was entitled to harvest clams. Since all commercial fishers are required to have PCFL's, it was difficult to determine how many individuals exercised the privilege of commercial clam digging.

In May, 1989, a commercial clam licence was introduced with Area licencing restrictions. The South Coast was divided into 6 "areas" and fishers had to choose to fish one of these six licensed areas. The breakout of effort and opportunity by Area is identified in Table 2.4.2. The fee for a clam Z licence is \$10.00 and to obtain one, a fisher must purchase a \$10.00 Fisher's Registration Card (FRC).

The issue of licence was changed in 1990. Clam diggers under sixteen were no longer required to have clam licences so comparisons with 1989 figures are difficult to make. In 1992, an additional licence area was created, Area G, Queen Charlotte Sound, which was previously contained within Area B (Figure 2.4.4). As a general rule, the number of licences issued each year has declined since 1990 but the fishery is still substantially over subscribed.

#### 2.4.2.2 Size Limits

The main management tool utilized in this fishery is a minimum size limit. Until 1966, there was both a seasonal restriction to harvesting butter, littleneck and manila clams, and a minimum size limit in both commercial and recreational fisheries: 63 mm shell length for butter clams and 38 mm for littleneck and manila clams. In the razor clam fishery, beaches were closed from June 15 to August 31, with a size limit of 90 mm.

#### 2.4.2.3 Seasons and Area Openings

Seasonal restrictions were subsequently removed. Undercurrent regulations, the fisheries are opened for seasons in consultation with industry, subject to closures for PSP or coliform contamination. The size limit was retained for the commercial fishery but was replaced by a daily limit in the recreational fishery. Both seasonal closures and the size limit were retained in the commercial razor clam fishery. Application of a minimum size limit ensures that clams become sexually mature and can spawn at least once before they can be legally harvested. The minimum size limit is currently the key management tool for this commercial fishery.

In 1988, due to concerns of overharvesting, it became necessary to eliminate a year round fishery and reduce opening times in some areas to either a shortened season or a reduced fishing week. In 1989, there were further reductions in fishing times, coupled with staggered area openings and area licencing restrictions in an attempt to maintain a continuous market supply. Since 1990, in-season monitoring has played a key role in active management of the fishery. When catch per digger per tide begins to fall dramatically, and reduced numbers of legal sized clams become available, beaches are closed to commercial harvest.

In 1991 through 1994, fishery openings became even shorter, down to one or two days every week or ten days in most areas, with fisheries lasting only one to two months of the year. In season meetings are held with industry representatives in each area to determine fishery openings and closures in season.

In contrast to the general management scenario, a pilot project has been undertaken in the Powell River, Savary Island Area for 1994. This pilot incorporates a community

management board and a limited entry fishery with 50% participation by the native community guaranteed. The pilot will be evaluated at the end of the 1994 season to determine if it should continue.

#### 2.4.3. CATCH AND EFFORT

There has been a dramatic shift in landings of the four species of clams (Figure 2.4.1). Historically butter clams dominated the commercial fishery but there was a strong shift to manila clams in the 1980's due to market demand for steamer clams. Landings of clams peaked in 1988.

In 1993 the combined landings of clams was 1396 metric tonnes. Average price per pound for manila clams is approximately \$1.00. The general decline in clam landings since 1989 is largely attributable to reduced fishing times and areas open to commercial fisheries. The active, in-season management has restricted the fishery considerably from pre 1989 years. The fishery in the south coast was only open 129 days in 1993 (Table 2.4.2). Reasons for reduced openings or areas open to harvest include PSP blooms, growing faecal coliform contamination problems (a 28% increase in shellfish area closed since 1987), and conservation closures (Savary Island closed since 1990, Area 26 was closed in 1992). Landings by Statistical Area in the South Coast are given in Table 2.4.4.

Harvestable wild clam stocks are dependent on annual recruitment which can vary widely from year to year. Manila clams are highly susceptible to winter kills which can result from freezing; these mortalities can dramatically affect stock sizes. The 1993 landings and values show a minor increase over 1992. Openings are staggered throughout the South Coast to try to maintain a year round supply to the market.

##### 2.4.3.1 North Coast - Razor Clams

Razor clams are dug in Area 1 in the Queen Charlotte Islands and delivered to the B.C. Packers Plant in Masset. The clams are primarily sold as bait to be used in the crab fisheries in Washington and Oregon. The landed value of the fishery in 1993 was \$67K. Digging occurs primarily in the months April to June. Most of the participants in the fishery are Haida natives.

An agreement between DFO and the Haida has been signed which will create a community based management and licencing

system for this fishery. Conservation is effected through a minimum size limit of 90 mm.

#### 2.4.3.2 Clam Culture

Interest in clam culture continues to grow in B.C. despite the moratorium which restricts clam culture opportunities to shellfish tenures approved prior to September 30, 1990; the only exception is to Native Indian Bands applying for farms on beaches fronting reserve lands. Clam aquaculture is managed and licensed by the provincial Ministry of Agriculture Fisheries and Food. In order to maintain a tenure, the Ministry requires diligent use of the site. In the case of clam farms, production from a tenure must be equivalent to or exceed 559 kg/ha each year. Non compliance with this criteria may be cause for cancellation of the tenure.

Clam farm production is increasing (Table 2.4.5) (M.A.F.F. production statistics). Production for 1993 is estimated at 300 t with a farm gate value of \$1.2 M. Production for 1992 is estimated to be 300 metric tonnes with a farm gate value of \$1 M. Of this production, 25 percent was harvested through undersize clam harvesting permits issued by the Department of Fisheries and Oceans to allow farmers to cull out high density undersize or stunted clams to enhance growth of remaining clams on the lease and/or to make room for addition of new seed. The harvest of undersize from leases in 1993 is at least equivalent to if not greater than in 1992. As new farmers get into operation, there is potential to substantially increase clam production in B.C.

At this time (Aug/94), 98 Clam Culture Farms have been licensed by the Province.

#### 2.4.4. ISSUES

##### 2.4.4.1 Commercial Fisheries

The clam resource has been treated as common property shared by an ever increasing number of licensed harvesters. While some harvesters are willing to husband the resource, this is not feasible because they must compete with other harvesters for part of the harvest and there is no mechanism to collect a royalty for seeding. The pressing issues in clam management are classic symptoms of common property management.

##### Short Fishing Seasons and Reduced Income and Employment

The fishery is heavily over subscribed. In response to market demand and rising prices, competition for the clam harvest has escalated. In order to manage the intensive harvesting effort the commercial openings are short in duration (generally one or two days per tide cycle) and most areas are closed within a few months. The impacts of the shorter fisheries and reduced number of clams available for harvest has been greatest on those who traditionally were able to fish clams commercially on a part-time or seasonal basis in order to supplement their incomes from other sources. This is particularly true for many residents of native and other coastal communities.

#### Lost Clam Beds

Pollution from municipal sewage and stormwater outfalls, faulty septic fields, agricultural run-off or discharge from vessels contaminated 73,000 hectares of shellfish habitat in 1993. This is an increase of approximately 40% since 1972 (Hal Nelson, D.O.E. - pers comm). Additional foreshore is being closed each year and the incidence of contaminated bivalves is becoming a serious problem in the Strait of Georgia.

#### Illegal Harvesting

Due to reduced fishing days on open beaches, there is an increasing problem with monitoring and enforcing illegal clam harvesting on beaches closed for conservation reasons or beaches closed due to faecal contamination. Poaching of contaminated clams poses a serious health risk and could cause serious marketing problems for the B.C. shellfish industry. The ability of the Department to control contaminated and closed area fishing is questionable with present resource cutbacks and reorganization. There are also problems with fishermen fishing illegally in areas for which they are not licensed.

#### Market Considerations

Short, intense commercial fisheries can result in market gluts of fresh product. Staggered openings have been used in an attempt to keep clam supply available year round, but limited supplies of clams, PSP closures, and faecal contamination problems make this difficult.

#### Uncertain Stock Levels

There is concern that intensive commercial harvesting and repeated digging may negatively impact clam survival and growth rates. There is also concern that even with existing minimum legal size limits, which are set above the size of reproductive maturity, heavy exploitation of the entire legal sized clam resource may negatively affect recruitment rates.

#### Underfunded programs

Much of the B.C. coast is closed to clam harvesting due to lack of funding for required growing water surveys and PSP monitoring. Little is known about stock composition of clams on the north coast.

Manila clam stocks have been identified as far north as Aristazabel Island (52° 30' N) (G.Gillespie - pers comm). Littlenecks and butters are common but poor markets limit fishery growth. In order to open the entire North Coast to bivalve harvesting by all user groups, additional funding is required for management and enforcement costs. Industry has indicated a willingness to participate in funding new programs needed to develop new fisheries. For example, commercial geoduck harvesters contribute to the monitoring expenses incurred in shellfish harvesting in the Central Coast. The Aboriginal Fishery Strategy has funded some programs in the Central Coast to allow for PSP monitoring which has permitted the development of a limited commercial fishery by the local Band in Bella Bella.

#### Depuration

Two processing plants are currently harvesting and depurating clams from marginally contaminated areas in the South Coast. These two plants harvested <200 t of manila and littleneck clams in 1993. These landings are included as part of the wild commercial landings. (Tables 2.4.1, 2.4.3 and 2.4.4)

Depuration licences assign the processor control and responsibility for harvest on designated beaches. The plants operate year round and provide a consistent supply to the market. Depuration has a world wide reputation as a means of producing high quality clam products. There are several other processors wishing to licence plants for depuration.

While there are benefits to expanding depuration activity in the province, there are difficulties as well. Clams in contaminated areas may be a brood stock reserve providing seed for adjacent wild beaches and their harvest may negatively impact the sustainability of the overall clam population.

Depuration facilities and therefore harvesting requests for contaminated areas are on the increase. As more and more shellfish beach is considered to be contaminated each year, it is obvious that the industry will look to depuration as a way of maintaining production. A management plan for dealing with depuration requests must be developed and applied consistently as the demand for depuration licences increases.

For the interim, harvest levels have been arbitrarily set at 50% of standing stock on a beach. Surveys must be first conducted, by the applicant (depuration facility) to determine the standing stock. Survey guidelines must be provided to the harvester and the results reviewed before a recommended harvest level is set. This is a very time consuming process for both the harvesters and DFO staff.

Depuration harvest have caused controversy as many local residents are objecting to increased harvesting in residential neighbourhoods and the majority of contaminated areas suitable for depuration operations are located within these areas.

#### 2.4.4.2 Native Fisheries

##### Native Food Fishing

First Nations residents of B.C. have the right to harvest clams to meet their food, social and ceremonial needs. The Government of Canada is obligated to respect these requirements while maintaining conservation of the clam resource. Upon requests from Native Bands, some beaches have been closed to commercial fishing in order to allow Native food fishing year round. However, pollution has forced the closure of shellfish beaches near Native villages, and some Native harvesters are having to travel greater distances to find clams for food fish.

##### Native Commercial Fishing

The Government of Canada also recognizes the needs of First Nations for commercial clam fishing opportunities. The Department of Fisheries is committed to:

- \* Negotiating Native fisheries agreements. These agreements may provide a specific quantity of fish for food purposes and may also allot a proportion of the catch to be used for economic development opportunities.
- \* Protecting existing Native participation in commercial fisheries and encouraging new native entrants.
- \* Establishing areas reserved for Native subsistence (food) fisheries.

Present management of the commercial clam fishery conflicts with development opportunities for B.C.'s First Nations. Intensive commercial effort has forced the closure of many clam beaches after only a few weeks of annual harvest. These closures displace commercial Native diggers who have traditionally harvested part time throughout the year.

Intensified harvesting efforts have also resulted in the utilization of small pocket beaches which were previously deemed to be uneconomical to harvest but which provided opportunities for the Native harvester. As well, areas available for harvest are being reduced each year due to growing coliform contamination closures, restriction of fishing on foreshore fronting provincial parks, formation of recreational reserves and expansion of oyster and clam culture tenures.

Pilot projects using co-management arrangements are providing commercial opportunities for First Nations in the North Coast. For example, the continuation of a 1992 pilot project in the Central Coast supplies additional clams to the market and provides much needed employment in the Bella Bella area.

#### Native Co-Management

First Nations are becoming involved in monitoring the clam resource in cooperation with the Department of Fisheries. The Heltsiuk Band Council has been given exclusive harvesting privileges in the Bella Bella area from 1992 through 94. In 1993, 93 t of manila clams worth

approximately \$235 K were harvested from Area 7 (subareas 7-12, -17, -21, -23, -24).

The Haida Nations in the Queen Charlottes are working with DFO to establish a co-management program for razor clam fisheries in the Queen Charlottes (Area 1-5)

First Nations in the Alert Bay to Sunshine Coast areas and the west coast of Vancouver Island are becoming more active in participating in the management of the local clam fisheries.

#### 2.4.4.3 Recreational Fisheries

Recreational clam digging is enjoyed by local residents and visitors to B.C. The value of this fishery is closely tied to enjoyment of the marine environment and year round opportunities for beach combing. Reserves have been created to preserve recreational opportunities in areas of high demand. Recreational fishing pressure is controlled with a daily limit of 75 clams. The Department is receiving requests for additional reserves near coastal communities.

Some coastal residents have expressed frustration with the intensity of the commercial clam fisheries and the perceived disturbance created on their local beaches. Crowds of commercial diggers on the beaches disrupt residential enjoyment of the waterfront.

In Canada's Policy for Recreational Fisheries the Department of Fisheries and the Provinces of Canada announced a commitment to "maintain a high quality and diversity of recreational fishing opportunities". Additional efforts will need to be made to maintain quality recreational clam fishing in British Columbia.

#### 2.4.5. Proposed Changes

1. The current status quo of fisheries management is unacceptable to many user groups. It appears that there may be benefits to moving towards privatization of this fishery or at least moving towards community based management programs however, there is a fundamental problem of over subscription in the fishery that must be dealt with. A discussion document proposing changes in clam management has been issued cooperatively with the Province and widespread consultation may lead to substantive changes in this fishery. A pilot project involving licence limitation

and community based management is being implemented in the Sunshine Coast (Area "C") for 1994.

2. The recreational tidal waters licence is being amended so that it will be a requirement for all sport fisheries including those who harvest shellfish to be in possession of a licence.

2.4.6. **Recommendations**

1. More research is required to establish a stock recruitment relationship for clams in view of a move to harvest undersize clams on some clam tenures and the move towards an expanded depuration fishery.
2. A review of survey methodology for biomass estimates is required by First Nations for co-management programs, and for harvest/depuration fisheries in contaminated areas.

Table 2.4.1. Annual commercial clam fishery landings and landed values, 1951 to 1993, for British Columbia.

YEAR	BUTTER (t)	LITTLE- NECK (t)	MANILA (t)	MIXED (t)	RAZOR (t)	LANDED VALUE (\$000)	TOTAL LANDINGS (t)
1951	1,597	237	81	65	61	149	2,041
1952	2,490	224	184	65	57	222	3,020
1953	1,674	140	176	20	70	127	2,081
1954	1,314	66	204	5	123	104	1,712
1955	2,170	36	207	3	99	159	2,515
1956	1,454	14	99	**	108	102	1,676
1957	1,606	10	29	11	84	102	1,739
1958	987	18	15	6	75	65	1,101
1959	1,094	22	25	13	90	75	1,244
1960	1,800	41	6	23	101	133	1,971
1961	857	46	48	34	104	76	1,089
1962	1,533	92	69	43	77	139	1,813
1963	1,144	59	59	**	67	103	1,329
1964	570	69	26	1	48	59	714
1965	704	82	97	0	68	106	951
1966	831	105	149	1	35	125	1,121
1967	975	139	92	**	46	163	1,252
1968	399	91	164	15	12	98	681
1969	378	107	81	7	8	85	581
1970	792	144	79	15	18	184	1,049
1971	568	361	153	11	62	235	1,156
1972	645	631	265	1	17	382	1,559
1973	298	207	134	0	76	196	715
1974	531	328	182	0	69	383	1,110
1975	746	236	158	6	27	333	1,173
1976	655	173	199	70	82	340	1,179
1977	649	209	394	59	78	545	1,389
1978	383	159	753	245	47	834	1,587
1979	613	273	251	374	101	916	1,612
1980	760	358	288	151	75	1,001	1,632
1981	119	179	318	161	30	737	806
1982	102	242	598	155	68	1,135	1,165
1983	77	324	1,048	279	31	1,723	1,759
1984	130	294	1,677	410	100	2,757	2,610
1985	251	191	1,913	477	90	3,288	2,922
1986	158	284	1,893	371	142	3,801	2,848
1987	68	373	3,607	87	142	6,775	4,277
1988	134	290	3,909	27	155	7,770	4,515
1989	92	433	2,764	159	117	6,955	3,565
1990	109	465	1,456	339	114	5,279	2,483
1991	42	201	982	137	117	3,302	1,479
1992	132	116	923	112	55	2,720	1,338
1993	102	131	1,047	121	44	3,124	1,445
<b>Totals</b>	<b>31,907</b>	<b>8,291</b>	<b>28,072</b>	<b>4,181</b>	<b>3,294</b>	<b>60,916</b>	<b>75,746</b>

\*\* Less than 500 kg.

Note

Years 1957-69 from Quayle and Bourne. (1972)

Years 1970-93 from sales slip records. 1993 includes depuration and aboriginal licenced harvest in Area 7

Table 2.4.2

**1991 to 1993 FISHING OPPORTUNITIES**

LICENCE AREA	DESCRIPTION	DAYS OPENED		
		1991	1992	1993
A	North Coast (Subarea 1-5) Razor clam fishery	all year	all year	all year
B	Johnstone Strait Area 12	38	n/a	n/a
	Area 13	28	18	8
C	<b>SUNSHINE COAST</b> Savary Island closed	48	38	16
D	<b>UPPER STRAIT OF GEORGIA</b> Lower Portion - Qualicum/Parksville and Lasqueti Island	7	9**	4**
	Upper Portion - Baynes Sound	5	6**	3**
E	<b>LOWER STRAIT OF GEORGIA</b>	19	9	7
F	West Coast Vancouver Island only limited areas open on given days due to PSP; Area 26 closed	20	20	24
G	Queen Charlotte Strait (Area 12)		47	68
<b>TOTAL (Areas B-G)</b>		<b>165</b>	<b>132</b>	<b>129</b>

\*\* Area D - total - 10 days in 1992, 6 days in 1993

Others	Bella Bella Area		42	
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<sup>1</sup> 50 diggers maximum under one Communal Licence

Table 2.4.3

**COMPARISON OF 1989 TO 1993 B.C. INTERTIDAL CLAM FISHERIES**

Landed Weight (metric tonnes)	1989	1990	1991	1992	1993
Butter	92	109	42	132	102
Manila	2,764	1,456	982	923	1,047
Mixed	159	339	137	112	121
Native Ln	433	465	201	116	131
Razor	117	114	117	55	44
<b>TOTAL</b>	<b>3565</b>	<b>2483</b>	<b>1479</b>	<b>1338</b>	<b>1445</b>

Landed Value (\$000)	1989	1990	1991	1992	1993
Butter	44	53	34	81	60
Manila	6,003	3,761	2,574	2,180	2,570
Mixed	196	625	238	187	215
Native Ln	588	710	327	190	212
Razor	124	130	129	82	67
<b>TOTAL</b>	<b>6955</b>	<b>5279</b>	<b>3302</b>	<b>2720</b>	<b>3124</b>

Licences Issued	1989	1990	1991	1992	1993
Area A North Coast	10	69	28	10	11
Area B Johnstone Strait	224	426	323	263	314
Area C Sunshine Coast	400	184	198	173	199
Area D Upper Strait of Georgia	421	516	598	436	533
Area E Lower Strait of Georgia	374	440	365	587	387
Area F West Coast Vancouver Is.	441	433	331	269	134
Area G Queen Charlotte Strait	76 **			76	61
<b>TOTAL</b>	<b>1870</b>	<b>2068</b>	<b>1843</b>	<b>1814</b>	<b>1639</b>

\*\*this area was previously part of Area B

Table 2.4.4. Manila, littleneck and mixed clam landings (tonnes), from the south coast of British Columbia (areas 11 to 29) by species and by year, 1985 to 1993 from sales slip data.

Year	Species	Pacific Fishery Management Area																Total	
		11	12	13	14	15	16	17	18	19	28	29	20	23	24	25	26		27
1985	manila		5.8	272.1	297.4	241.4	108.2	372.3	25.1	4.7			37.8	29.6	247.6	143.9	98.5	28.3	1912.7
	littleneck		31.7	27.1	53.5	9.0	11.7	25.8	2.5	1.0			16.9	1.4	9.5	1.5			191.6
	mixed		8.8	176.3	36.9	77.3	43.0	40.5	9.5	4.1			22.3	9.4	16.2	11.8	21.1		477.2
	TOTAL		46.3	475.5	387.8	327.7	162.9	438.6	37.1	9.8			77.0	40.4	273.3	157.2	119.6	28.3	2581.5
1986	manila		4.3	291.4	375.4	362.7	79.9	367.1	25.6	1.3		1.0	6.2	2.5	146.5	197.5	22.5	9.0	1892.9
	littleneck		36.2	32.5	104.4	14.2	8.1	58.2	2.7	0.6		0.1	6.3		4.2	11.7	3.0	2.0	284.2
	mixed		16.4	72.4	19.9	93.2	23.7	91.2	2.1	2.7		1.4	20.6	0.2	7.1	17.3	1.0	1.5	370.7
	TOTAL		56.9	396.3	499.7	470.1	111.7	516.5	30.4	4.6		2.5	33.1	2.7	157.8	226.5	26.5	12.5	2547.8
1987	manila		16.2	513.7	898.7	617.5	109.7	676.9	26.6	6.6	0.8	0.1	12.3	114.6	210.4	255.8	122.7	23.6	3606.2
	littleneck		68.9	80.2	66.6	18.0	2.3	66.6	10.9	3.7			30.7	0.7	7.8	14.2	1.9	0.6	373.1
	mixed		0.5	20.1	5.8	23.9	2.4	16.9	1.4	0.3			4.6		0.6	8.3	1.8		86.6
	TOTAL		85.6	614.0	971.1	659.4	114.4	760.4	38.9	10.6	0.8	0.1	47.6	115.3	218.8	278.3	126.4	24.2	4065.0
1988	manila	0.1	14.8	593.1	749.2	586.9	157.1	848.8	107.8	11.6	0.2	3.2	0.4	92.0	304.8	254.8	182.5	1.1	3908.4
	littleneck		55.2	71.1	24.4	21.8	2.5	65.5	7.6	5.6			15.2	0.2	14.6	2.3	4.1		290.1
	mixed			3.5	6.0	1.2	0.1	2.8	0.4	1.9			9.2		0.5	1.3	0.3		27.2
	TOTAL	0.1	70.0	667.7	779.6	609.9	159.7	917.1	115.8	19.1	0.2	3.2	24.8	92.2	319.9	258.4	186.9	1.1	4225.7
1989	manila		5.9	295.5	441.4	663.8	241.0	370.6	37.4	56.8			0.2	182.0	128.8	224.3	94.7	21.6	2764.0
	littleneck	0.1	87.1	161.3	23.4	59.3	11.3	38.0	5.8	4.3				1.6	21.3	9.8	0.7	9.5	433.5
	mixed			1.0	1.8	29.6	6.5	10.8	4.1	10.0			94.6	0.1	0.4	0.3			159.2
	TOTAL	0.1	93.0	457.8	466.6	752.7	258.8	419.4	47.3	71.1			94.8	183.7	150.5	234.4	95.4	31.1	3356.7
1990	manila		1.9	434.7	313.8	64.3	110.6	212.2	13.0	11.0		0.6		104.3	95.9	89.0	0.6	4.5	1456.4
	littleneck		57.5	291.7	85.6	2.4	7.4	6.3	1.2				0.1	1.0	8.2	1.6		2.2	465.2
	mixed		2.0	97.2	45.3	0.1	7.0	20.9		29.2			82.3	0.7	4.3	49.7			336.7
	TOTAL		61.4	823.6	444.7	66.8	125.0	239.4	14.2	40.2		0.6	82.4	106.0	108.4	140.3	0.6	6.7	2260.3
1991	manila		6.4	157.0	252.6	108.9	93.1	189.7	26.3	12.9			0.1	12.4	39.9	82.9			982.2
	littleneck		49.2	53.3	53.7	7.1	10.0	10.9	12.5					0.1	2.9	0.7			200.4
	mixed		1.0	14.1	5.9	1.6	7.9	28.7	3.0	19.7			54.8		0.1	0.4			137.2
	TOTAL		56.6	224.4	312.2	117.6	111.0	229.3	41.8	32.6			54.9	12.5	42.9	84.0			1319.8
1992	manila		4.2	111.7	245.4	83.9	78.7	222.2	3.5	7.4			4.1	79.7	30.2	68.2			939.2
	littleneck		63.0	8.4	27.8	2.1	2.5	11.3						0.4	0.4	0.4			116.3
	mixed		0.5	0.6	1.1	0.1		39.3		28.8			36.1		0.2	0.4			107.1
	TOTAL		67.7	120.7	274.3	86.1	81.2	272.8	3.5	36.2			40.2	80.1	30.8	69.0			1162.6
1993*	manila		1.4	107.6	311.2	43.3	98.9	240.5	4.8	2.5				3.1	56.3	84.7			954.2
	littleneck		62.2	9.7	53.6	0.4	1.3	2.9	0.2					0.0	0.5	0.1			130.8
	mixed		0.6	0.6	2.1	0.1	0.7	61.4		42.0			13.2						120.8
	TOTAL		64.3	117.8	366.9	43.7	100.9	304.8	5.0	44.5			13.2	3.1	56.8	84.8			1205.8
Total		0.2	601.8	3897.8	4502.0	3134.0	1225.6	4098.3	334.0	268.7	1.0	6.4	468.0	636.0	1359.2	1632.9	555.4	103.9	22726.1

\* Note: Depuration fishery landings are included. Aquaculture landings are not.

Table 2.4.5

**ANNUAL CLAM AQUACULTURE PRODUCTION,  
LANDINGS AND VALUES**

<b>YEAR</b>	<b>TONNES</b>	<b>\$000</b>
1985	4	4
1986	7	14
1987	25	43
1988	30	59
1989	31	96
1990	39	140
1991	169	556
1992	310	1000
1993*	400	1300

\* Note: 1993 landings and values preliminary .

### ANNUAL CLAM LANDINGS 1985 TO 1993 TOTAL FOR B.C.

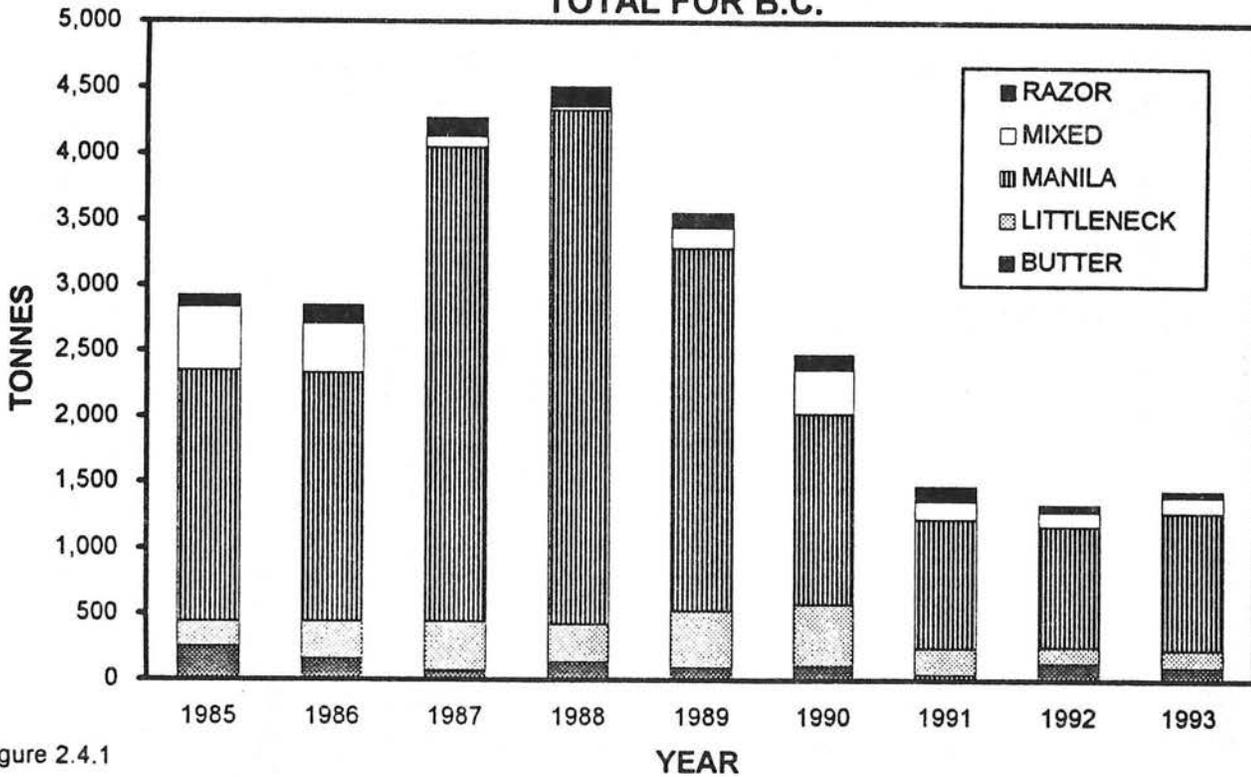


Figure 2.4.1

### LANDED VALUES OF INTERTIDAL CLAMS 1985 TO 1993

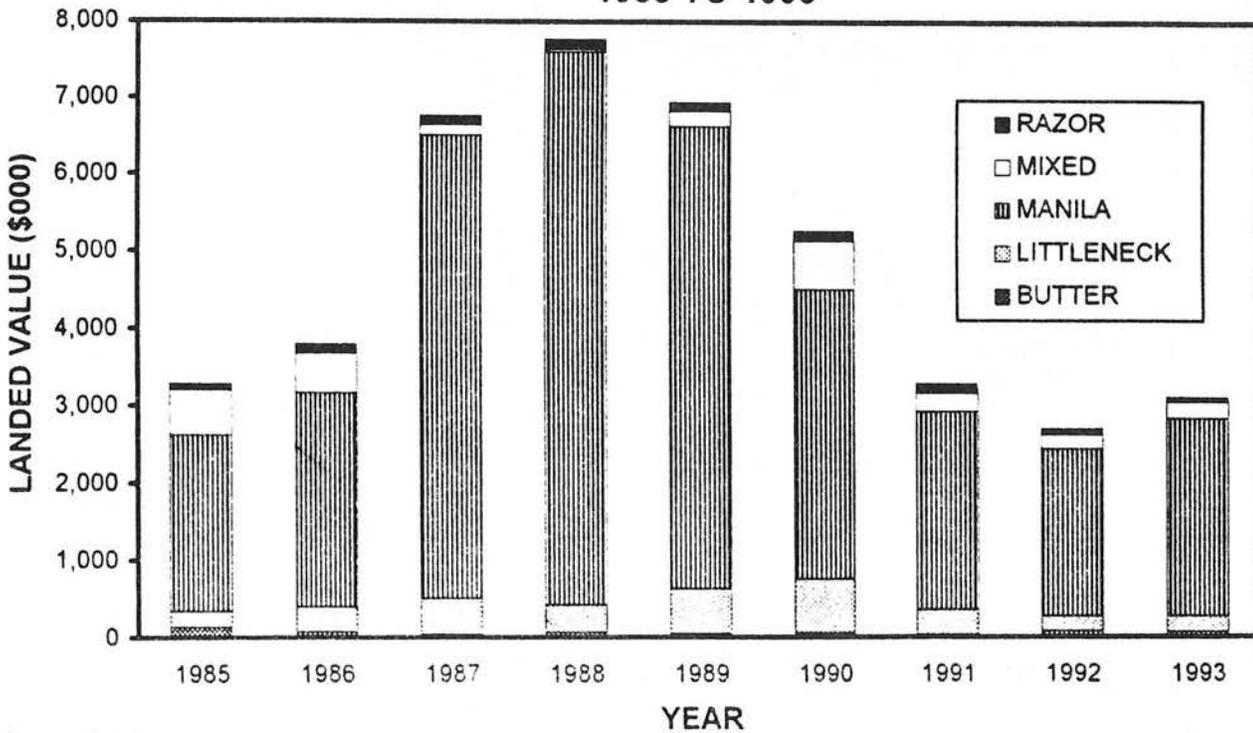


Figure 2.4.2

### LITTLENECK, MANILA & MIXED CLAM LANDINGS BY AREA, 1985 TO 1993

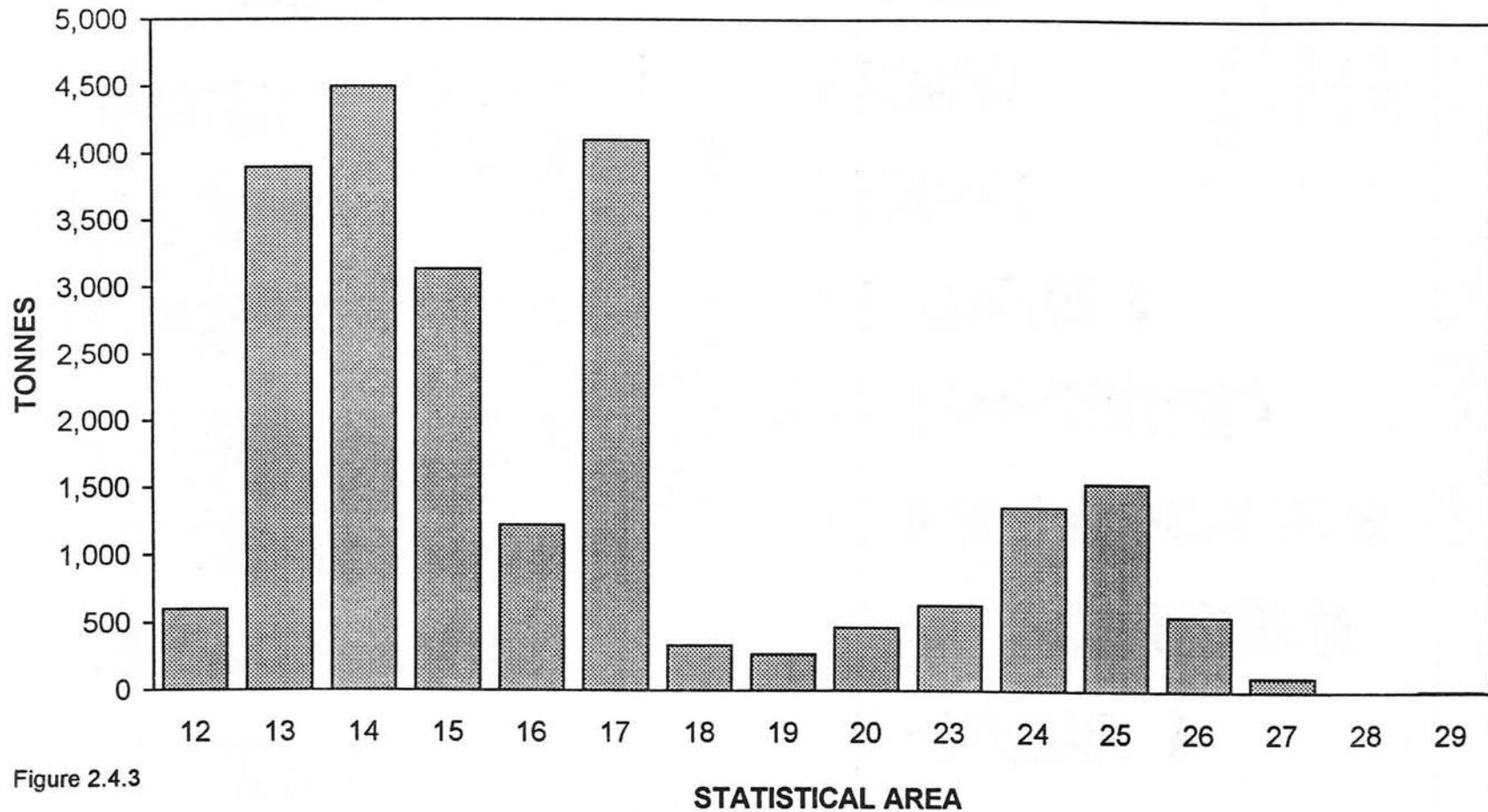


Figure 2.4.3

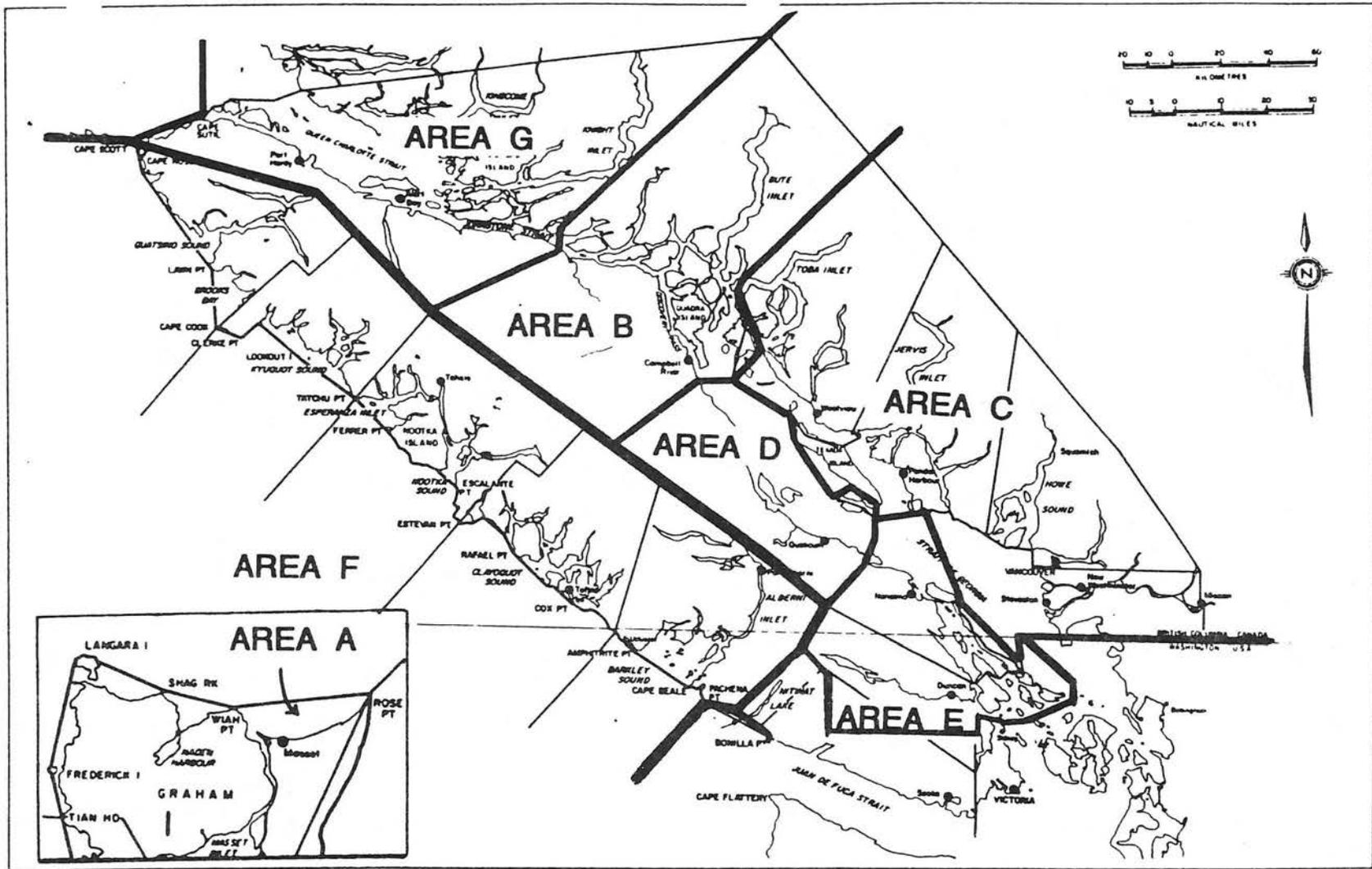


Figure 2.4.4 Commercial Clam Harvesting – Licence Areas

- A: North Coast
- B: Johnstone Strait
- C: Sunshine Coast
- D: Upper Strait of Georgia
- E: Lower Strait of Georgia
- F: West Coast of Vancouver Island
- G: Queen Charlotte Sound

## 2.5. SQUID (Loligo) NET FISHERY

B.Adkins

### 2.5.1. Introduction

Squid (Loligo opalescens) are largely taken by seine, but hook and line and side catcher or frame nets are also used, to a lesser extent. A category Z-E squid license is required to participate in this fishery. Squid landed in British Columbia are mainly used as bait in the crab and sablefish fisheries, however, there is interest in marketing squid as a food product in B.C. The large California squid fishery produces a low priced food product, making it difficult for B.C. squid to compete in this market.

Preliminary reported landings of squid in 1993 were 13 tonnes, the lowest landings on record, down by 86% from the landings reported in 1992. The total landed value of this fishery in 1993 was \$17,000 compared to \$135,000 in 1992. The average ex-vessel price was \$1.26@kg<sup>-1</sup> (Table 2.5.1).

### 2.5.2. Fishery Management

The fishery for opal squid requires an annual licence to harvest squid by seine, frame net or hook and line. A current moratorium on new and developing fisheries in the Pacific Region prevents the harvest of other species of squid or the use of alternate gear types.

This fishery is closed by regulation January 1 to December 31 and areas are open by Variation Order upon request. Some permanent area closures exist. Logbooks and Fish Slips are required as a condition of licence.

### 2.5.3. Catch and Effort

Landings for 1993 were 13 tonnes reported in Areas 23 and 29, which produced 82 and 18% of the catch respectively. No landings were reported from north coast areas (Tables 2.5.2 and 2.5.3).

Effort data is preliminary as logbook data for 1993 has not yet been analyzed. CPUE estimated from Fish Slips was only 0.4 t@vessel<sup>-1</sup>@day<sup>-1</sup>; one-third of that reported in 1992, but

consistent with most years where landings have been (Table 2.5.1). Seven vessels reported landings of squid in 1993 which was similar to all years since 1986.

Table 2.5.4 shows annual squid landings by month from areas within Pacific Rim National Park ( Management Areas 124-1, 123-1 and 123-5) where the majority of this fishery has taken place in recent years. Since 1989 the entire fishery in these areas has occurred during May and June.

#### 2.5.4. Issues

1. Landings are likely under-reported on logbooks as fishers have little incentive to report catch. Much of the catch is landed for personal use as bait.
2. The decline in landings evident in 1993 may be the result of the increased use of hake as bait in the sablefish fishery and therefore does not suggest a depletion of stock.
3. Permanent net closures included in the management plan need to be evaluated as there is growing interest to harvest squid as a food product in some of these areas.

Table 2.5.1. Squid landings, value and effort, as determined from sales slips and harvest log data, 1984-1993.

Year	No. licenses issued	No. licenses fished	Fishing days	Total Landings (t)	Landed Value (\$·10 <sup>3</sup> )	CPUE (t/vessel day)	
						sales slips	harvest logs
1984 <sup>1</sup>		26	N/A	69	25	N/A	N/A
1985		24	274	111	184	0.4	0.9
1986		18	288	89	127	0.3	0.7
1987		8	123	86	132	0.7	1.1
1988		8	98	88	113	0.9	N/A
1989		7	56	70	94	1.3	0.8
1990		9	115	72	81	0.6	0.8
1991		9	65	116	148	1.8	1.6
1992	47	5	77	93	135	1.2	1.2
1993 <sup>2</sup>	47	7	32	13	17	0.4	-

<sup>1</sup> Days fished not available.

<sup>2</sup> Preliminary data from sales slips

Table 2.5.2. Annual squid landings (tonnes) by South Coast Management Area, 1984 to 1993, as reported on sales slips.

Year	SOUTH COAST MANAGEMENT AREAS													Annual Totals
	East Coast Vancouver Is.							West Coast Vancouver Is.						
	11	12	13	14	17	18	19 <sup>1</sup>	28	29	20	23	24	27	
1984 <sup>1</sup>														69
1985		0.2		0.2	0.1	0.2	0.2				72.0	19.0	0.2	92
1986						0.2	0.2				61.0	16.0	0.1	78
1987		0.2								0.1	67.0	18.0		85
1988											85.0			85
1989			0.5					0.1	0.1		60.0			61
1990		0.2				0.3		0.1	0.1		68.0	2.3	0.8	72
1991	0.4	0.3		0.5							99.6	15.1		116
1992		0.2									92.4			93
1993 <sup>2</sup>									2.5		10.7			13
Area Totals	0.4	1.1	0.5	0.7	0.1	0.7	0.4	0.2	2.7	0.1	615.7	70.4	1.1	763
East Coast Vancouver Is.:	6.8							West Coast Vancouver Island:	687.3					

<sup>1</sup> Only coastwide catches available for 1984 (see Table1).

<sup>2</sup> Preliminary data from sales slips.

Table 2.5.3. Annual squid landings (tonnes) by North Coast Management Area, 1984 to 1993, as reported on sales slips.

Year	NORTH COAST MANAGEMENT AREAS										Totals	
	1	2	3	4	5	6	7	8	9	10		
1984 <sup>1</sup>												NA
1985	0.2	0.4					0.6	1.9				3.1
1986	2.0	0.9				0.1	7.3	2.3				12.6
1987	0.3											0.3
1988	0.2	0.1						1.2	1.9			3.4
1989							8.8					8.8
1990		0.6										0.6
1991												0.0
1992												0.0
1993 <sup>2</sup>												0.0
Area Totals	2.7	2.0	0.0	0.0	0.0	0.1	16.7	5.4	1.9	0.0		28.8

<sup>1</sup> Only coastwide catch is available for 1984 (see Table 1).

<sup>2</sup> preliminary data only

Table 2.5.4. Squid landings (pounds) in Pacific Rim National Park, Pacific Fishery Management Areas 124-1, 123-1 and 123-5, by month from harvest logs, 1986 to 1993.

MONTH	Year								Total
	1993	1992	1991	1990	1989	1988	1987	1986	
MAY	6.7	49.1	43.4	38.0	0.0	2.1	5.9	11.2	149.8
JUNE	3.9	18.4	27.9	9.0	0.0	0.0	0.0	4.5	59.9
JULY	0.0	0.0	0.0	0.0	5.0	0.0	0.0	0.0	5.0
AUG	0.0	0.0	0.0	0.0	4.2	0.0	0.0	0.0	4.2
SEPT	0.0	2.0	0.0	0.1	9.0	0.0	11.9	0.0	23.0
OCT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
NOV	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
DEC	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<b>Total</b>	<b>10.6</b>	<b>69.5</b>	<b>71.3</b>	<b>47.2</b>	<b>18.2</b>	<b>2.1</b>	<b>17.9</b>	<b>15.7</b>	<b>241.9</b>

## 2.6 OCTOPUS DIVE, TRAP AND TRAWL FISHERIES - 1993/94

B. Adkins

### 2.6.1. Introduction

Most octopus (Octopus spp.) landed in British Columbia are utilized as halibut bait although there has been increased interest in octopus as a food product. The majority of octopus are landed by divers and lesser amounts are taken incidentally in the prawn trap fishery and the groundfish and shrimp trawl fisheries. Since 1990 there has been some effort in establishing a directed trap fishery for octopus in the offshore areas along the west coast of Vancouver Island.

Up to and including 1991 octopus fishing was licensed under a category Z-J licence. In 1992, upon the advice of industry, separate licences were issued for; octopus by diving (Z-G) and octopus by trap and trawl (Z-P). This allowed retention of incidentally caught octopus from trap and trawl fisheries. Harvest logs are required as a condition of both licenses.

Between 1988 and 1990 the coast wide catch of octopus from all gear types was about 200 t annually but has since declined and was 142 t in 1993 (Table 2.6.1). Most octopus are harvested by divers from south coast areas (Tables 2.6.2 and 2.6.3). Catch data for 1993 (preliminary) show low landings from the dive fishery compared to landings reported prior to 1991 (Table 2.6.2).

The average whole landed value for octopus by all gear types in 1993 was \$3.09 kg<sup>-1</sup>, approximately the same as in previous years (Table 2.6.1). This varied by gear type where in 1993 the whole landed value was \$3.55 kg<sup>-1</sup> for dive caught octopus, \$2.49 kg<sup>-1</sup> for trawl caught octopus, \$3.12 kg<sup>-1</sup> for trap caught octopus and \$3.39 kg<sup>-1</sup> for hook and line caught octopus.

### 2.6.2. Fishery Management

In 1994 the octopus fishery was open January 1 to December 31 in all management areas by varying the regulatory closed time. Octopus by trap is closed in areas during times when prawn fishing by trap is closed to eliminate the possibility of incidentally caught prawns during those closed times. There are a number of permanently closed areas, one seasonal closure, and

the possibility of other seasonal closures, considered on advice from the advisory committee. Gear is restricted to dive and trap and trawl. This allows a directed dive fishery for octopus, year round, and allows W, R, S and T licensed vessels to retain incidentally caught octopus. Daily harvest logs and sales slips are required from all gear types. No in-season monitoring of this fishery occurs.

### 2.6.3. Catch and Effort

#### 2.6.3.1 Landings

Landings of octopus increased substantially between 1985 and 1988 from 32 t to 209 t but have since declined and were 142 t in 1993 (preliminary data); 73 t (51%) by Z-P (trap and trawl) vessels and 67 t (47%) by Z-G (dive) vessels (Table 2.6.1). Prior to 1991, 70 to 80% of the annual landings was from the dive fishery and about 10% was reported as incidental catch from trap fisheries. The declining annual catch since 1991 has been the result of declining catches in the dive fishery where landings fell from a high of 171 t in 1989 to 70 t since 1991 (Table 2.6.2). Trap caught octopus landings doubled during the same period from 20 t in 1989 to 40 t in 1993.

The octopus fishery has occurred largely in south coast areas where most of the catch has been reported from areas 12, 18, 19 and 20 (Tables 2.6.3 and 2.6.4). Annual landings of octopus in 1992 were 118 t; 85 t (72%) from the south coast and 33 t (28%) from the north coast. Preliminary landings for 1993 were 143 t; 93 t (65%) from the south coast and 49 t (35%) from the north coast (Tables 2.6.3 and 2.6.4). Since 1989 south coast landings of octopus have declined by more than 50%.

#### 2.6.3.2 Effort

Effort (vessel days from sales slips) increased between 1985 and 1988, paralleling landings, but since 1988 has remained relatively constant at between 150 and 180 active participants and about 4,500 to 5,000 fishing days despite the declines in catch (Table 2.6.1). Most effort is reported by trap fishers. Between 1992 and 1993 there was a 43% decline in effort reported by octopus dive fishers, from 897 to 511 fishing days (Table 2.6.1).

#### 2.6.3.3 CPUE

CPUE estimated from sales slips and harvest log data has remained relatively constant throughout this fishery at about 30 to 50 kg@vessel<sup>-1</sup>@day<sup>-1</sup> (Table 2.6.1). Data for 1992 and 1993, which is separated by licence, shows CPUE highest for octopus harvested by divers (80 to 130 kg@vessel<sup>-1</sup>@day<sup>-1</sup>). Trap and trawl caught octopus averaged only 10 to 20 kg@vessel<sup>-1</sup>@day<sup>-1</sup> in comparison (Table 2.6.1). Preliminary information from the offshore trap fishery in 1992 indicated that catch rates were about 0.25 octopus@trap<sup>-1</sup> and that average weight of octopus caught was about 11 kg.

#### 2.6.4. Issues

Studies were carried out near Prince Rupert and near Tofino in 1992 to evaluate the effectiveness of different trap types in harvesting octopus. Catch rates varied between 0.00 and 0.25 octopus@trap<sup>-1</sup> depending on trap, soak time, area and depth. Catch rates using "Alaskan type traps" were comparable to catch rates in the Alaskan octopus trap fishery where it is considered commercial. Further work is proposed to determine the economic viability of a directed trap fishery for octopus in British Columbia (IEC Collaborative Marine Research and Development Ltd., 1992). A continued development of the octopus trap fishery is anticipated to occur as European and Asian markets are developed for octopus as a food product. No update of this research was available for this report.

Saanich Inlet, management sub-areas 19-07 and 19-08, was closed in 1992 to commercial octopus fishing to provide native food fishing and marine research and recreational opportunities in the inlet. This closure affected less than 1% of the coast wide catch of octopus by divers.

Concerns with the use of chemicals to harvest octopus in the intertidal zone were brought to our attention. This appeared to be an area specific problem at this time and could be controlled through the enforcement of the daily bag limit of one octopus per day. A regulation prohibiting the use of chemicals as a means to harvest fish (as defined in the Fishery Act) in the intertidal zone is needed.

The decline in landings of octopus from the dive fishery has largely been a function of a decreased demand for octopus as halibut bait as a result of the Halibut IQ fishery. This fishery now allows more flexibility in fishing times and hence an opportunity to secure bait from more competitive sources. The Alaskan octopus trap fishery has also recently increased and

provides competition for this market. The British Columbia fishery for octopus is currently undersubscribed.

Table 2.6.1. Octopus catch per unit effort, as determined from sales slips and harvest log data, 1985-1993.

Year	No. licences issued	No. licences fished	Fishing days	Total Landings (t)	Landed Value (\$·10 <sup>3</sup> )	Whole Landed Value (\$·kg <sup>-1</sup> )	CPUE (t·vessel day <sup>-1</sup> )
1985		131	1898	32.0	82	2.56	0.02
1986		131	1850	52.4	136	2.60	0.03
1987		149	3439	128.8	381	2.96	0.04
1988		150	4302	208.9	651	3.12	0.05
1989		179	4608	217.0	707	3.26	0.05
1990		181	4586	198.0	657	3.32	0.04
1991	306	179	4897	130.9	415	3.17	0.03
1992	Z-P - 199	126	4017	45.1	110	2.44	0.01
	Z-G - 73	36	897	70.0	233	3.33	0.08
	Total - 272 <sup>2</sup>	162	5039	117.2	350	2.99	0.02
1993 <sup>1</sup>	Z-P - 175	142	4121	72.7	191	2.71	0.02
	Z-G - 71	20	511	66.6	238	3.57	0.13
	Total - 246 <sup>2</sup>	162	4696	141.8	438	3.09	0.03

<sup>1</sup> Preliminary data from sales slips.

<sup>2</sup> includes minor catch by hook and line.

Table 2.6.2. Landings of octopus by gear types, 1984 to 1993, as reported on sales slips.

Year	Total Landings (t)	Gear Type			
		Hook & Line (t)	Trawl (t)	Dive (t)	Trap (t)
1984	25	1.2	6.7	13	4.0
1985	34	2.9	4.2	20	6.7
1986	53	2.8	5.5	40	4.7
1987	130	1.5	21	95	12
1988	209	3.2	28	161	17
1989	217	5.3	21	171	20
1990	197	4.9	30	132	19
1991	131	5.7	29	70	27
1992	118	2.6	12	70	33
1993 <sup>1</sup>	143	2.7	33	67	40

<sup>1</sup> Preliminary data

Table 2.6.3. Annual octopus landings (tonnes) by North Coast Management Area, 1984 to 1993, as reported on sales slips.

Year	NORTH COAST MANAGEMENT AREAS											Annual Totals	
	1	2E	2W	3	4	5	6	7	8	9	10		
1984	0.4	1.9	0.1	0.3	1.9	4.0	1.4		0.2				10.2
1985	0.3	0.9		1.0	2	2	1.0	0.5	0.5	0.3			8.5
1986	0.2	2.2	*	*	1.6	1.1	0.3	*	1.7		0.5		7.6
1987	0.2	2.8	0.3	0.4	4	12	1.9	1.3	3.6	0.2	0.6		27.3
1988	3.8	5.7		0.6	4.5	13	2.9	2.0	6.9	0.4	0.8		40.6
1989	0.8	4.1		0.4	6.7	12.1	2.0	2.4	3.5	0.8	1.0		33.8
1990	0.7	7.7	*	0.8	5.8	15.4	1.1	1.3	0.9	0.7	1.0		35.4
1991	2.7	3.8		3.1	7.8	15.3	3.1	2.9	1.4	0.7	3.5		44.3
1992	2.8	1.8	0.1	1.8	4.2	7.6	3.1	6.4	2.0	2.0	0.8		32.6
1993 <sup>1</sup>	6.4	5.8	0.4		6.8	9.5	6.6	10.1	1.4	1.0	0.9		48.9

<sup>1</sup> Preliminary data from sales slips.

\* Less than 100 kg.

Table 2.6.4. Annual octopus landings (tonnes) by South Coast Management Area, 1984 to 1993, as reported on sales slips.

Year	SOUTH COAST MANAGEMENT AREAS																	Annual Totals	
	East Coast Vancouver Island										West Coast Vancouver Island								
	11	12	13	14	15	16	17	18	19	28	29	20	21	23	24	25	26		27
1984	0.4	0.3	2.1	0.1	*	*	0.1	1.7	5.6			2.0	*	0.1	0.1	*	*	*	12.5
1985	0.3	1.5	3.0	1.0	*	*	0.8	3.5	7.5	0.1	0.1	4.6	0.2	0.7	0.2	*	*	*	23.5
1986	0.7	4.1	4.2	0.5	0.5	0.9	6.7	5.1	11.0	*	0.3	6.3	0.6	1.0	1.8	0.3	0.7	0.6	45.3
1987	0.8	18.0	14.0	1.0	0.3	0.9	7.2	9.4	29.0	*	1.6	8.9	0.1	4.4	6.3	*	0.2	*	102.1
1988	1.2	41.0	21.0	1.7	1.5	0.1	8.0	12.0	50.0	0.4	1.0	7.6	0.1	3.1	10.0	0.3	0.1	10.0	169.1
1989	0.7	43.0	17.4	3.7	1.1	1.4	13.3	34.0	37.2	0.1	0.8	6.9		5.8	11.0	4.6	0.8	0.2	182.0
1990	1.1	52.6	6.4	0.8	3.0	3.7	7.1	17.5	29.8	0.1	1.6	12.7	1.8	8.9	10.8	1.2	1.2	1.1	161.4
1991	1.5	28.3	7.2	0.4	1.4	1.3	6.3	8.0	11.5		0.9	3.9		5.1	6.9	1.1	1.2	1.5	86.5
1992	1.7	13.9	7.7	1.7	1.4	0.8	8.7	5.7	14.5		0.5	9.8	0.4	1.6	11.3	0.3	2.5	2.5	85.0
1993 <sup>1</sup>	3.6	17.3	9.1	1.9	0.8	2.6	10.2	9.7	18.8		0.4	2.3	0.8	2.5	6.3	0.9	4.0	1.8	93.0

<sup>1</sup> Preliminary data from sales slips.

## 2.7 EXPERIMENTAL FISHERY FOR DEEP WATER CLAMS- MILKY VENUS (1994)

R. Harbo

Bourne and Harbo (1993) presented a science update to PSARC in September, 1992 and a summary to the National Shellfisheries Association (Harbo and Bourne, 1992).

### 2.7.1 Distribution Of Milky Venus Clams

The milky venus, *Compsomyax subdiaphana* (Carpenter, 1864), belongs to the bivalve family Veneridae, which includes other commercially important clams, the native littleneck (*Protothaca staminea*), manila (*Tapes philipinarum*) and butter clams (*Saxidomus giganteus*).

This clam is widely distributed along the Pacific coast of North America from 28-61° N in soft muddy substrates in depths from 2 to 550 m (Bernard 1983). This clam has also been commonly called "deep water littleneck".

### 2.7.2 Fishery Exploration

Quayle (1961,1963) found *Compsomyax* at several locations during a survey for deep water clam populations. Localities from this survey are listed in Table 2.7.1. Localities where this clam has been collected and recorded at the Royal B.C. Museum are given in Table 2.7.2. (P. Lambert and K. Sendall, pers. comm.)

During the period 1965 to 1966, Ellis (1968) found *Compsomyax* in Satellite Channel in densities varying from 200 wet grams/m<sup>2</sup> to 600 w.g./m<sup>2</sup> off Cowichan Bay.

In 1991, while testing a small drag to harvest pink and spiny scallops (*Chlamys* spp.), a fisher accidentally landed a quantity of clams, *Compsomyax*. In May, 1991 a fisher began attempts to harvest this resource using a 42 foot seiner "Pacific Rancher" in the Trincomali Channel area, from Blackbery Point, Valdes Island and south of Walker Rock (Fig. 2.7.1) under scientific licences. There were six fishing days in 1991 for landings of 0.6 t and 8 days in 1992 for landings of 0.8 t (Table 2.7.3).

Exploratory drags were undertaken outside of Nanoose Bay, in Baynes Sound (Sept. 1992) finding only small numbers of live *Compsomyax* and some shell.

Further exploratory work at 32 sites (Fig. 2.7.1) was undertaken in February, 1994 in the vicinity of:

1. the lower Gulf Islands (Satellite Channel, Swanson Channel and Plumper Sound),
2. Haro Strait, Strait of Juan de Fuca (Sooke to Jordan River)
3. Cape Lazo

The survey indicated concentrations of *Compsomyax* in the lower Gulf Islands but only sparse numbers in other areas (Krause, 1994).

### 2.7.3 Fishery Monitoring

The exploratory fishery has been monitored by D.F.O. and contract personnel and several biological samples were taken. Harvesting occurred mostly at 35 to 45 m in areas with muddy substrates.

Fishing was undertaken with a Fall River rocker dredge and catches ranged from 27 to 50 kg per 20 minute tow, with an average of about 40 kg/tow. Tows probably were less than a km in distance. A wide range of clam sizes (14 to 68 mm, shell length) were observed in catches that indicated recruitment had occurred in recent years. The size of clams collected are determined by the spacing of the teeth at the mouth of the dredge.

The incidental catch or bycatch was minimal, estimated to be less than 5% of the total catch, by weight and did not include commercial species of invertebrates. Discarded or broken clams accounted for 4 to 13% of *Compsomyax* catch rates in June, 1991 (Cousens and Lee, 1991).

### 2.7.4 Clam Gonads

An interesting and unusual feature of this clam are the colored gonads. The male gonads were white to cream colored while the female gonads were orange-red.

### 2.7.5 Guidelines For A Developing Fishery For The Deep Water Milky Venus Clam

#### 2.7.5.1 Gear restrictions

A decision was made early in this fishery that it should remain a small experimental fishery using rocker type dredges until more information is obtained on the extent of the stocks and before consideration is given to expanding it or using other harvesting methods (Bourne and Harbo, 1993).

#### 2.7.5.2 Health and Safety - Shellfish Growing Waters and Shellstock Monitoring

There are a number of health and safety issues that need to be addressed before fishing in an area. A survey of shellfish growing waters and assessment of potential pollution sources is required and a regular monitoring program must be in place to test for biotoxins (Paralytic Shellfish Poison, PSP and Amnesic Shellfish Poison, ASP).

#### 2.5.7.3 Other Fishery Management Guidelines

A number of fishery management issues would have to be discussed and a developing fishery policy developed including;

- i) the areas to be fished
- ii) precautionary quotas set for each area or an exploratory fishing protocol developed
- iii) licensing policies: a process of allocating licences, the term of licences, licence eligibility and transferability
- iv) gear restrictions
- v) size restrictions if required
- vi) catch and effort data
- vii) quality management program (QMP) for the handling, storage, transportation and processing of clams

#### 2.5.7.4 Stock Assessment

There will be a requirement to report catch and effort data for specific fishing areas. A logbook will have to be designed. There will be a need for biological sampling and stock assessment to determine harvest strategies to maintain a sustainable fishery.

There may be required monitoring of catch rates, breakage, discard of clams that are too small or too large, and bycatches in different areas. Some field or laboratory work may be required to examine if discarded clams can be reburied.

Seasonal sampling for gonadal development and spawning times may be required to document the reproductive cycle.

Samples to determine the age and size structure of the population may have to be collected independently of the fishery since the dredge does not capture all size ranges. Recruitment, mortality and biomass estimates may be necessary as well as the determination of harvest rates.

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Table 2.7.1. Locations where deep water clams, *Compsomyax subdiaphana*, were found during surveys, as reported in Quayle, 1960 and 1961.

Location	Date	Longitude		Latitude		Gear	Depth (fathoms)	Tow (minutes)	Bottom Type
		deg.	min.	deg.	min.				
Off Galiano Is.	21-Jun-60	123	28.47	48	55.2	Rocker Dredge			mud
Off Galiano Is.	21-Jun-60	123	28.48	48	55	Rocker Dredge	27		6 clay
Off Galiano Is.	21-Jun-60	123	29.21	48	54.57	Rocker Dredge	23		4
Off Galiano Is.	21-Jun-60	123	36.13	49	0.24	Scallop Dredge	26		20 mud and sand
Maple Bay	22-Jun-60	123	34.16	48	48.3	Rocker Dredge	50-60		10 mud
Nanoose Bay	24-Jun-60	124	9.12	49	15.3	Rocker Dredge	18		mud
N. Denman Is	24-Jun-60	124	52.48	49	38.48	Scallop Dredge	20		20 sand
off Decourcy Is.	26-Jun-60	123	47.3	49	5.36	Rocker Dredge	25		10 sand
Fleming Island	8-Apr-61	125	10	48	53	Digby Scallop Dredge	43		20 sandy mud
Sechart Channel	8-Apr-61	125	13	48	56	Digby Scallop Dredge	45		10 sandy
Sechart Channel	9-Apr-61	125	21	48	58	Digby Scallop Dredge	21		20 mud
Sechart Channel	9-Apr-61	125	26.2	48	56	Digby Scallop Dredge	26		15 mud and sand
Cypress Bay	12-Apr-61	125	25	49	15	Digby Dredge	25		10 mud and sand
Sydney Inlet	12-Apr-61	126	14	49	23	Rocker Dredge	34		5 soft mud
Ferrer Point	14-Apr-61	127	11	49	43	Digby Dredge	50		10 hard sand
Forward Inlet	15-Apr-61	128	2	50	29.5	Digby Dredge	20		10 gravel
	30-Apr-61	132	36	54	0.5	Rocker Dredge	6		10 mud
Naden Harbour	30-Apr-61	132	36	54	0.5	Rocker Dredge	6		10 mud
	30-Apr-61	132	36.6	53	58.5	Rocker and Digby	10		10 mud
Naden Harbour	30-Apr-61	132	36.6	53	58.5	Rocker and Digby	10		10 mud
Stuart Channel	11-May-61	123	45.5	48	58.3	Rocker Dredge	30		10 mud
Plumper Sound	12-May-61	123	14.2	48	47	Georges Bank Scallop Dredge	8-10		15 mud
Navy Channel	12-May-61	123	14.5	48	48.5	Georges Bank Scallop Dredge	12-18		30 mud
Satellite Channel	13-May-61	123	23.5	48	48.6	Digby Dredge	20		15 mud
Trincomali Channel	13-May-61	123	23.5	48	52	Digby Dredge	26		10 sandy mud
Satellite Channel	13-May-61	123	24.7	48	44.5	Digby Dredge	18		15 mud
Satellite Channel	13-May-61	123	26.5	48	43	Digby Dredge	28		15 mud
Satellite Channel	13-May-61	123	26.5	48	0.5	Digby Dredge	10		15 soft mud
Trincomali Channel	13-May-61	123	29.4	48	54.5	Georges Bank Scallop Dredge	22		25 soft mud
Trincomali Channel	13-May-61	123	29.4	48	53.7	Georges Bank Scallop Dredge	14		20 mud, sand

Table 2.7.2. Royal B.C. Museum Bivalve Collection - Locations where *Compsomyx subdiaphana* have been collected excluding the Gulf Islands

Location	Pacific Fishery Management Area
Queen Charlotte Islands; Gowgaia Bay	2
Chatham Sound	4
Burke Channel; Elcho Harbour	7
Bella Bella; Fisher Channel	7
Hecate Strait	10
Queen Charlotte Strait; Cape Caution	10
Queen Charlotte Strait; Nugent Sound	11
Knight Inlet	12
Campbell River; Willow Point	13
Quadra Island; Granite Bay	13
Cowichan Bay	17
Nanaimo; Nanoose Bay	17
Point Atkinson	18
Saanich Inlet; Coles Bay	19
Sooke; Albert Head	20
Strait of Juan de Fuca	20
Barkley Sound	23
Nootka Sound; Cook Channel	25
Nootka Sound; Discovery Point	25
Esperanza Inlet; Port Eliza; Queen Cove off Esperanza Inlet	25
Kyuquot Sound; Checleset Bay	26
Kyuquot Channel	26
Brooks Bay; off Lawn Point	26
Cape Scott	27
Quatsino Sound; Bedwell Island	27
Quatsino Sound; between Brockton and Drake Islands	27
Mexico; San Luis Islands; El Muerte Island	
El Muerte Island	n/a

Table 2.7.3. Landings and effort for deepwater clams, *Compsomyx subdiaphana*, 1991 to June 1992.

Location	Pacific Fishery Management Area	Date	Fishing Days	Landings (kg)	Value \$/kg
Trincomali Ch.	17	9-Jun-91	1	30	0.55
Trincomali Ch.	17	26-Nov-91	1	145	1.10
Nanoose Bay	17	28-Nov-91	1	0	0.00
Trincomali Ch.	17	1,3,4,6-Dec-91	4	406	1.10
1991 Total				581	
Trincomali Ch.	17	1,18,19,23-Jan-9	4	512	
Trincomali Ch.	17	22,23,24-Mar-92	3	268	
Sidney	18-19	Apr-92	1	0	
Trincomali Ch.	17	Jun-92	1	23	
1992 Total				803	

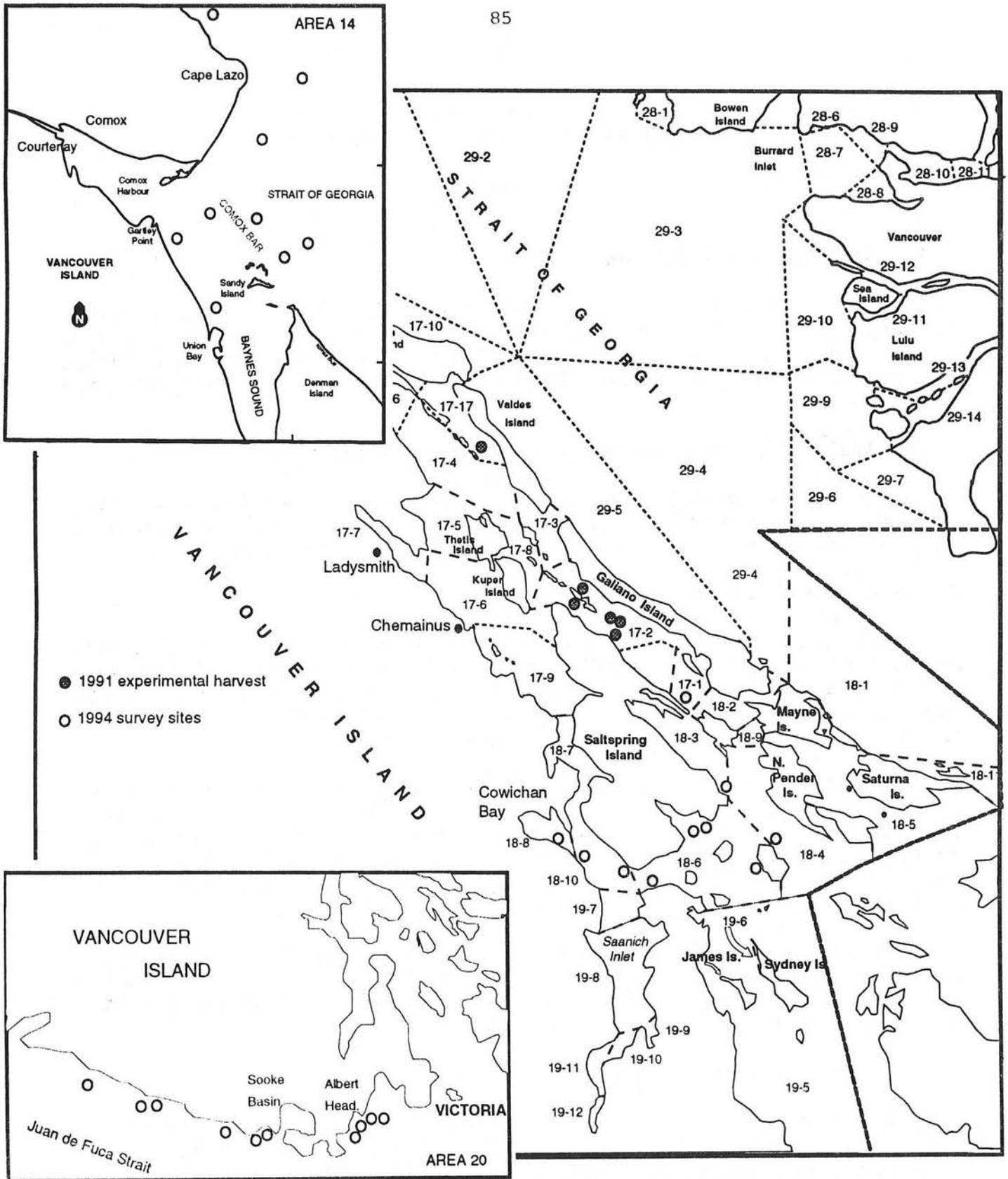


Figure 2.7.1. Exploratory sites for Deep Water clams, 1991 and 1994, in the lower Gulf Islands, in Area 14 and Area 20.

## 2.8 ABALONE DIVE FISHERY (CLOSED)

Rick Harbo

### 2.8.1 Abalone Distribution

The northern or pinto abalone, *Haliotis kamtschatkana* (Jonas, 1845) ranges from the northern tip of Sitka Island, Alaska (58°) to Baja, California (27.5°) (Sloan and Breen, 1988). The majority of the fishery landings in B.C. have been from the north coast.

### 2.8.2 Abalone Quotas, Landings and Landed Values

The annual abalone quotas, landings and landed values, 1952 to 1990 are presented in Table 2.8.1 and Figure 2.8.1. Landings by Statistical Areas are given in Table 2.8.2 and Figure 2.8.2.

### 2.8.3 Abalone Fishery Closures

The life history information and discussions of fisheries management are summarized by Sloan and Breen (1988), Farlinger (1990) and Farlinger and Campbell (1992). Abalone are relatively slow growing species, reaching a legal harvestable size of 100 mm shell length in six to seven years or more.

The aboriginal, sports, and commercial fisheries for abalone in British Columbia have been closed since December 15, 1990. The closure was based on stock assessments that showed a continuing decline in the relative numbers of abalone at index sites, not only in areas of commercial fishing but also in areas open only to aboriginal and sports fishing.

It was suggested that the total abalone stocks in 1990 were less than 20% of the levels observed in the late 1970's. Fishing may not be the only reason for declines. A contributor to the declines could be parasites and diseases.

#### 2.8.3.1 Abalone Licence Transferability

Abalone licences will not be re-issued until stocks have been rebuilt. Applications for licences will be subject to the licensing policies in effect at the time of reopening of the fishery. The Minister afforded the one time opportunity

for the licence holder of record to nominate the 1990 operator for the licence eligibility.

#### 2.8.3.1 Abalone Surveys Following the 1990 Closure

The abalone surveys prior to the closure are summarized and discussed by Sloan and Breen (1988) and Farlinger and Campbell (1992).

Two surveys have been undertaken since the closure but there has been little evidence of any rebuilding of the abalone populations.

There was a survey in June, 1993 in the central coast, at Aristazabel Island, the Estevan Group and Banks Island, which demonstrated that there was no evidence of abalone stock rebuilding at indicator sites (Thomas et al., in prep).

A second survey was undertaken in 1994 off the southeast Queen Charlotte Islands (Winther et. al, in prep). The total abundance of abalone declined by 30% since the survey in 1990.

The discussion and recommendations of the invertebrate subcommittee of the Pacific Stock Assessment Review Committee (PSARC) are presented in Rice et al. (1995). It was acknowledged that poaching presented a serious threat to the recoveries of the stocks. A continued closure was recommended and a review of survey objectives and methodologies is required prior to undertaking further abalone surveys.

The subcommittee recommended that the total closure should be continued until there is evidence that realistic rebuilding targets have been identified and achieved.

Given that when there is evidence of recruitment, it may be six to seven years or more for those abalone to reach a harvestable size of 100 mm shell length.

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Table 2.8.1. Number of licences issued, number of vessels fished, landings and landed values of abalone in British Columbia, as reported on sales slips and harvest logs (1969 to 1990).

Year	Licences Issued	Vessels with Landings	Quota (t)	Total	Total	Total Value <sup>2</sup> \$10 <sup>-3</sup>	Price (\$/t)
				Harvest Log <sup>1</sup> Landings (t)	Sale Slip <sup>2</sup> Landings (t)		
1952	open	NA	none		5.4	NA	NA
1953	open	NA	none		10.3	NA	NA
1954	open	NA	none		6.8	NA	NA
1955	open	NA	none		3.5	NA	NA
1956	open	NA	none		0.5	NA	NA
1957	open	NA	none		1.0	NA	NA
1958	open	NA	none		5.3	NA	NA
1959	open	NA	none		0.2	NA	NA
1960	open	NA	none		1.5	NA	NA
1961	open	NA	none		9.4	NA	NA
1962	open	NA	none		17.5	NA	NA
1963	open	NA	none		7.4	NA	NA
1964	open	NA	none		57.1	NA	NA
1965	open	NA	none		3.1	NA	NA
1966	open	NA	none		0.7	NA	NA
1967	open	NA	none		0.9	NA	NA
1968	open	NA	none		0.1	NA	NA
1969	open	NA	none		0.6	NA	NA
1970	open	NA	none		16	15	938
1971	open	NA	none		6	5	833
1972	open	NA	none		60	59	983
1973	open	NA	none		68	94	1,382
1974	open	NA	none		26	43	1,654
1975	open	NA	none		57	132	2,316
1976	open	NA	none		273	860	3,150
1977	29	22	none	481	428	1733	4,049
1978	27	25	none	404	433	1864	4,305
1979	26	25	226.8	209	186	1062	5,710
1980	26	25	113.4	105	97	601	6,196
1981	26	24	94.3	94	85	795	9,353
1982	26	22	94.3	82	54	457	8,463
1983	26	22	70.6	55	56	464	8,286
1984	26	16	58.9	58	58	530	9,138
1985	26	15	47.2	45	42	442	10,524
1986	26	18	47.2	46	52	734	14,115
1987	26		47.2	46	49	973	19,857
1988	26		47.2	47	49	1,096	22,367
1989	26		47.2	47	48	1,151	23,979
1990	26		47.2	47	50	1,347	26,940
Total:							

<sup>1</sup> landings reported on harvest logs may differ from the B.C. Catch Statistics and may be more complete for some areas.

<sup>2</sup> From 'Summary of B.C. Catch Statistics'

<sup>3</sup> Price paid to commercial fishermen, from B.C. Catch Statistics. Note that the vanded value from any additional catch reported on harvest logs is not included in this figure.

Table 2.8.2 Abalone landings (t) by Pacific Fishery Management Area, 1977 to 1990, from harvest logs.

Year	Pacific Fishery Management Area																				Total
	1	2E	2W	3	4	5	6	7	8	9	10	11	12	19	20	23	24	25	26	27	
1977	45.46	259.51	13.56	10.19		94.07	32.79	5.60				0.19	9.13		1.43		0.18	4.55	2.33	2.36	481
1978	12.89	101.15	14.60	0.25	6.39	88.29	160.27	10.92					0.46		3.03			5.72			404
1979	2.61	29.53	5.73		2.93	40.48	88.71	11.70				5.55	17.31	1.41	0.28			0.44	0.21	1.76	209
1980	3.20	16.15	3.72	2.14	2.69	11.22	47.65	1.94	0.24		1.00	0.55	12.13		2.00						105
1981	1.92	21.32	6.05		5.19	2.86	37.76	1.78		0.55		1.83	9.60		4.81						94
1982	13.02	13.62	0.16	1.67	1.38	2.20	27.06	0.90			1.12	3.54	5.05		8.60	1.00	0.02			2.87	82
1983	12.11	20.28			0.88	3.97	7.35	0.55	0.15				2.45		7.68						55
1984	14.19	14.03	0.94	3.18	0.24	6.28	7.71						3.27		6.59			0.39		0.91	58
1985	9.62	4.41		4.20	0.88	3.66	10.82						5.54		3.78			1.96		0.29	45
1986	15.32	6.45	2.12	0.74	1.82	3.87	3.83			0.01	3.02	0.05	8.45								46
1987	4.50	14.34	3.13	1.95	0.24	2.04	10.78						3.91		2.14		2.67			0.69	46
1988	8.05	19.06	1.44	4.45	0.76	1.17	4.88	2.71			0.06	0.10	3.08		0.36		1.18				47
1989	5.29	11.24	3.18	2.87	0.10	2.32	7.45	0.10				2.00	11.02		0.93		0.67				47
1990	5.92	12.21	0.56	0.05	0.03	3.79	6.54	0.83		0.13	0.16	5.41	10.77							0.56	47
<b>Total by Area</b>	<b>154</b>	<b>543</b>	<b>55</b>	<b>32</b>	<b>24</b>	<b>266</b>	<b>454</b>	<b>37</b>	<b>0</b>	<b>1</b>	<b>5</b>	<b>19</b>	<b>102</b>	<b>1</b>	<b>42</b>	<b>1</b>	<b>5</b>	<b>13</b>	<b>3</b>	<b>9</b>	<b>1766</b>

**Annual Abalone Landings and Landed Values,  
1952 - 1990**  
(from sale slip data)

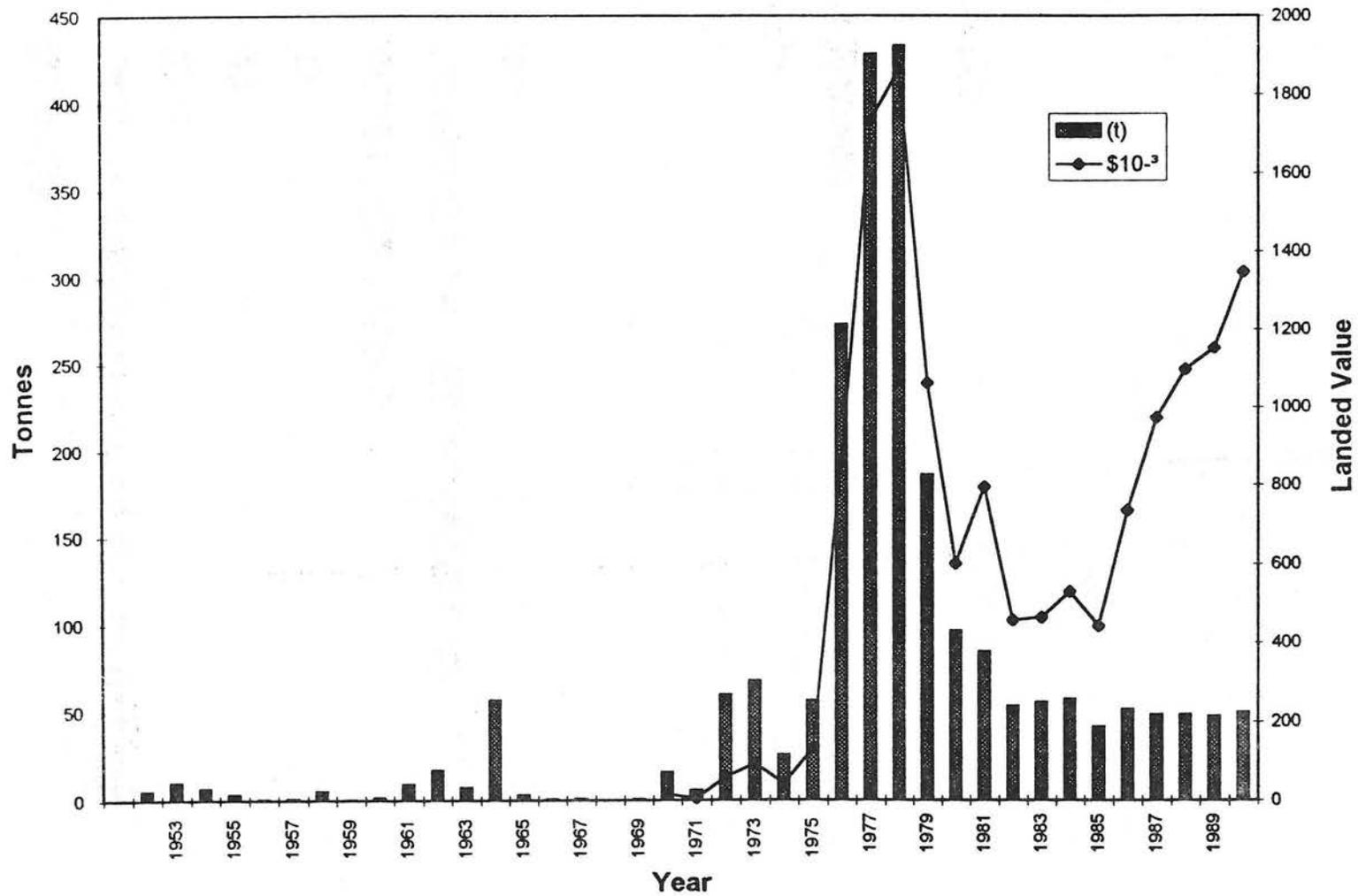


Figure 2.8.1. Annual abalone landings 1952 to 1990., from sale slip data.

### Abalone Landings from Harvest Log Data, 1977 to 1990

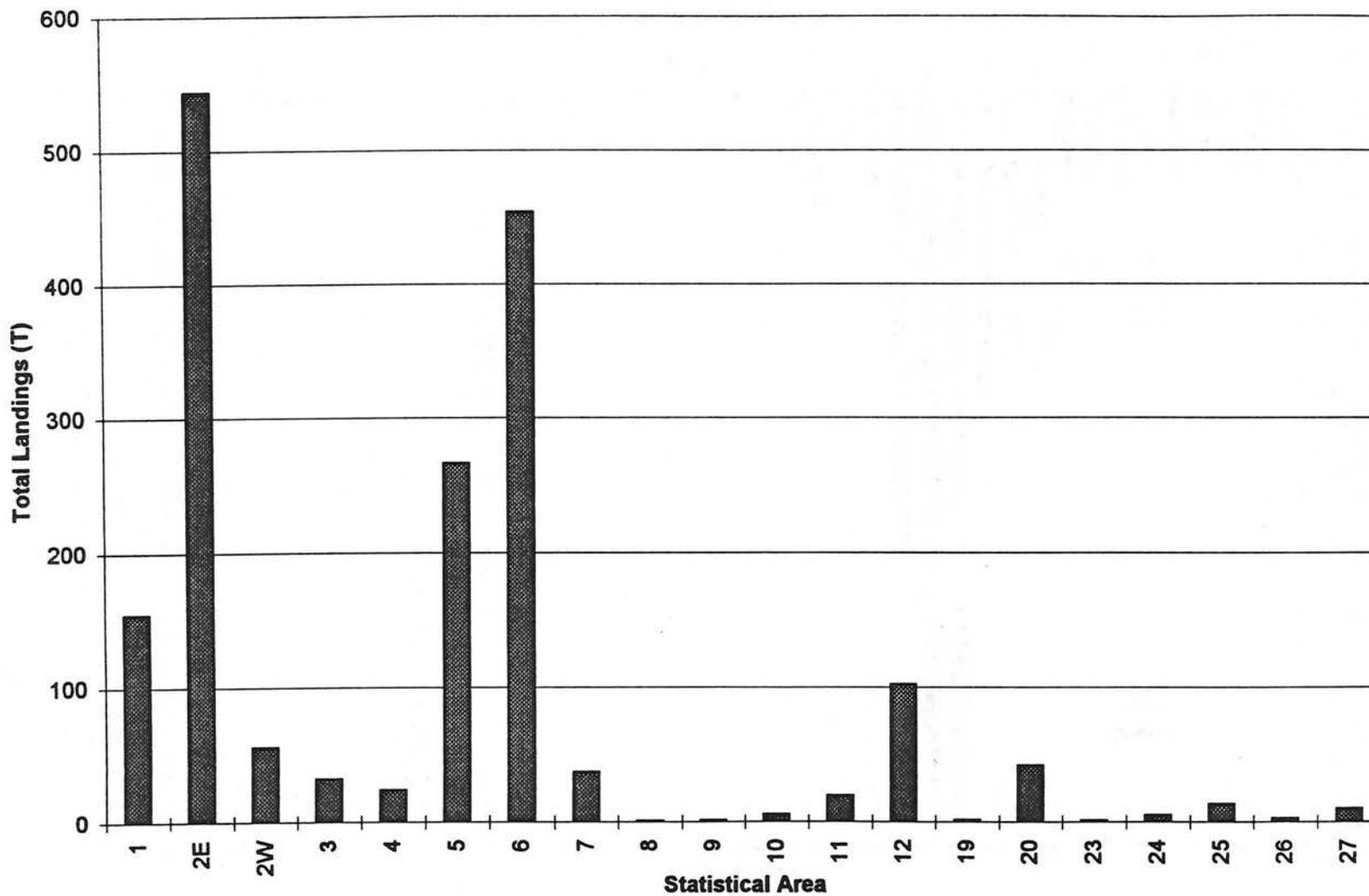


Figure 2.8.2. Abalone landings by Pacific Fishery Management Areas, 1977 to 1990.

### 3.1 RED SEA URCHIN DIVE FISHERY

S. Heizer, G. Thomas, and K. Hobbs

#### 3.1.1.0 Introduction

Red urchins (Strongylocentrotus franciscanus) are one of three sea urchin species fished in B.C. waters. Red and green urchins are fished under authority of a limited Z licence (categories C and A). Purple urchins were fished under scientific permit in 1990-1992. No permits were issued in 1993 or 1994. Red urchin licences were limited to 102 in 1991, a reduction of approximately 50% from the previous year. Urchins are harvested by divers and delivered fresh to plants for processing. The roe is extracted and treated, and sold in Japan as **uni**. Yields of roe from whole animals range from 5 to 15%.

The fishery began on the South Coast of B.C. in 1978 and expanded to the North Coast in 1984. Landings and value have increased in recent years, as a result of expansion in the North, so that red urchins, in 1992, ranked highest in landings (12,018 t) and fourth in value (\$8.0 M) among B.C. shellfish species. This declined in 1993 with the reduction of the catch in the North so that it ranks second in landed weight (6148 t), but still fourth in value (\$4.9 M). The overall landed price of red urchins remained stable over the period 1989 to 1991, and increased significantly in 1992 and 1993 (see Table 3.1.1).

#### 3.1.2.0 Fishery Management

Conservation is effected in this fishery by a minimum size limit of 100 mm test diameter. In the South Coast, the fishery is limited by area quotas.

In the North Coast, landings were restricted by a minimum and maximum size limit and rotational openings during the years 1989 to 1992, and a quota was implemented in 1993. In 1994, voluntary individual quotas (IQs) were instituted by fishers in some areas for all or part of the season. More detail is given below.

##### 3.1.2.1 South Coast

Area quotas on the South Coast were initially set at a 5% harvest rate based on surveys, then, as the fishery expanded in

area, were based on estimates of standing stock after consultation with fishers. Scheduling fisheries and quota area definition are becoming increasingly complex. In 1993, there were 26 subarea quotas and nine openings scheduled. Days fishing per week were limited to 2 days (except the January and February fisheries in Areas 12 and 13 and exposed areas of the west coast of Vancouver Island (Areas 26 and 27) where the fishery occurred 4 days a week) to allow for tabulation of catches for quota monitoring.

At the request of fishers, DFO rescheduled the fall fisheries, in the South Coast, so as to provide a steady flow of product to market. This amended fishing plan provided about 200,000 lb of product per week from South Coast fisheries.

In 1993, fishers were required to notify Department of Fisheries District offices prior to fishing and to hail catches weekly. Quotas are often exceeded as the hailing system which tracks catch is inadequate and there is little on-ground enforcement, which is effective if available. There is some question among fishery officers that the hailing requirement is enforceable.

#### 3.1.2.2 North Coast

Management in the North Coast has progressed from an open fishery prior to 1989, to one regulated by minimum/maximum size limits in 1989 to 1992, to one regulated by a harvest ceiling in 1993. The fishery was capped in 1993 because of a concern for exponential increases in annual catch which peaked at approximately 25 million lb in 1992. In 1993, a TAC of 12 million lb was dispersed throughout the North Coast by timed area openings. Inseason, the schedule of fishing was modified a number of times to accommodate the desire of industry for sustained supply and high quality roe. In some areas, fisheries were preempted by managers when large fleets harvested excessive quantities of urchin. Because of high effort in the early months of the fishery (10 million lb were harvested by May), fishing was suspended for the summer months and 2 million lb retained for the fall. The management scheme employed in 1993 was cumbersome for managers and provided insufficient control in the fishery, so area quotas based on historic catch levels were imposed in 1994. As more information becomes available through surveys and industry experience, quotas will be modified to better reflect relative abundances.

#### 3.1.2.3 Individual quotas

In 1994, the Pacific Urchin Harvesters Association (PUHA) got a consensus from its members to go to a voluntary individual quota system. Since this was self-imposed, DFO was not in a situation where approval was required. Nonetheless, DFO facilitated the plan by altering the fishing plan to accommodate PUHA. The program resulted in improved monitoring of catch and effort and a more orderly fishery.

### 3.1.3.0 Catch and Effort

Table 3.1.1 contains annual catch, effort, CPUE, and value information. Tables 3.1.2 to 3.1.5 contain annual landings by management area and landings by month for 1993. The 1993 data are preliminary.

#### 3.1.3.1 Landings

Total annual landings in B.C. decreased by 49% to 6,148 t in 1993, as a result of the imposition of a North Coast quota. In Area 5, landings reached 462 t in 1993 compared to 3294 t in 1992. Substantial decreases in landings were also made in Area 6 (2103 t compared to 3839 t in 1992) and Area 7 (982 t compared to 2590 t in 1992). Significant landings were made throughout 1993 in the North except during the summer months of June through September (see Table 3.1.5).

In the South Coast, the WCVI summer fishery was again poorly attended due to reported poor quality. The revised fishing schedule pushed landings into November and December.

#### 3.1.3.2 Effort

The total number of vessels with red urchin landings dropped to 103 in 1993 from 110 in 1992. Average vessel CPUE has decreased in 1993 (Table 3.1.1).

### 3.1.4.0 Issues

There is still a general need for more basic biological information in support of management of this species. Fishers continue to complain that the 100 mm minimum size limit is too restrictive as the 75 - 100 mm size category is the most desirable to market. Population data supporting a North Coast quota is required. The North Coast ceiling of 5400 t is a contentious issue as there is no strong biological basis for it. Fishers and processors continue to request higher ceilings.

A Provincial government agency (MAFF) continues to be involved in an advocacy role at the request of the processors and fishers.

The Pacific Urchin Harvesters Association continues to support and participate in growth and mortality studies. An ongoing study in Campbell River area is examining the effects of fishing and minimum size limit on urchin populations. As well, abundance information from cooperative surveys in the North Coast, and bed areas provided by commercial fishers are being examined and presented in PSARC working papers.

A portion of red sea urchin management area 24D on the south east coast of Vargas Island in Clayoquot Sound has been set aside as a research area. The harvest was restricted so as to provide population data to DFO. Several areas were extensively surveyed, and experimental areas were harvested using a variety of minimum size limits to assess the effect on recruitment patterns. Another such location in Area 12 (near the Plumper Is.) has been set aside for study beginning in 1994.

A research area was also established in cooperation with PUHA and the Haida Fisheries Program in Cumshewa Inlet, QCI, in 1994. Two other areas set aside in the North Coast are: 1) Beaver Pass (a portion of Subarea 5-10) and Seaforth Channel (portion of Subarea 7-12).

As well as initiating a voluntary IQ in 1994, PUHA has also submitted a proposal for IQs sanctioned by DFO for this fishery. This proposal is currently being reviewed by senior management. PUHA presents this proposal as a way to rationalize the fishery and to make it safer. Several urchin fishers have died while fishing during the past few years.

Urchin processors are demanding a market-driven approach to management, which maximizes profits by regulating supply with the market demand. Unfortunately, it is not cost-effective at current prices for fishermen operating in remote locations to regulate supply, which has created conflict between the two industry sectors. At present, it is not possible for managers to accommodate, inseason, both the whims of the marketplace and the needs of vessel operators.

Incidents of fishing undersized and fishing in closed areas have been reported. Smaller sized urchins are more marketable and fishermen move into closed areas either because the urchin supply is exhausted in the open area or to take advantage of higher quality in a closed area. Roe yields are often low in

virgin fishing areas and companies complain that it is not economic to process this product.

An unknown amount of product goes unreported as it is exported directly to the US without sales slips being filled out. Some of this may show up on log books, but a mechanism to ensure reporting of exported catch on sales slips to the Fisheries Data Management Unit should be in place and enforced.

The lack of processing facilities in the North Coast continues to hamper the efforts of fishermen to maximize quality. Urchins packed from remote locations, especially in the Queen Charlotte Islands, are often several days in transit resulting in the loss of freshness and loss due to breakage.

In the past, several quota areas had landings far in excess of the quota. In 1993, some quota areas had their quotas reduced as a consequence.

Table 3.1.1. Annual red sea urchin landings (tonnes), value and effort for British Columbia, 1978 to 1993, as reported on sales slips and harvest logs.

Year	Type and Number of Licences Issued	South Coast Quota <sup>1</sup> (t)	North Coast Quota (t)	Number of Vessels with Landings	Total Vessel Fishing Days	Coastwide Landings (t)	Landed Value (\$·10 <sup>3</sup> )	Whole Landed Value (\$/t)	$\bar{X}$ CPUE <sup>2</sup> (t/vessel day)	$\bar{X}$ CPUE <sup>3</sup> (kg/diver hr)
1978	C			4	54	75	16	213	1.4	-
1979	C			29	298	317	76	240	1.1	-
1980	C			18	331	333	84	252	1.0	-
1981	C	136		18	127	116	34	293	0.9	-
1982	C			21	195	160	56	350	0.8	-
1983	Z 64			36	825	986	358	354	1.2[1.3] <sup>3</sup>	311
1984	Z 85			47	1,150	1,764	712	403	1.6[1.5]	281
1985	Z 86	1803		46	1,086	1,815	764	419	1.7[1.4]	360
1986	Z 103	1500		67	1,534	2,067	1,011	455	1.4[1.6]	363
1987	Z 184	1633		97	1,807	2,118	1,148	541	1.2[0.6]	325
1988	Z 184	1678		84	1,249	2,116	1,241	587	1.7[1.3]	296
1989	Z 240	1644		109	1,542	2,658	1,631	614	1.7[1.6]	360
1990	Z 188	1668		116	2651	3,158	1,953	618	1.2[1.4]	298
1991	Z 102	1531		89	3862	6,945	4,187	603	1.8[2.0]	363
1992	Z 108	1554		110 **	5789	12,018	8,002	666	2.1[2.1]	388
1993*	Z107	1401	5400	103	3204	6,148	4,900	797	1.9[NA]	NA

<sup>1</sup> South coast quota includes exploratory areas, north coast quota was new in 1993.

<sup>2</sup> From sales slip data.

<sup>3</sup> CPUE [ ] from harvest log data.

\* Preliminary data for 1993, harvest log data not complete.

\*\* Larger than the number of licences issued due to licence transfers.

Table 3.1.2. Summary of red sea urchin landings (tonnes) by South Coast Management Area 1971 to 1993, as reported on sales slips.

SOUTH COAST MANAGEMENT AREAS																					Annual Landings
East Coast Vancouver Island											West Coast Vancouver Island										
Year	11	12	13	14	15	16	17	18	19	28	29	20	21	23	24	25	26	27			
1971 to 1973 <sup>1</sup>									110.0						254.0					364	
1974 to 1977 <sup>1</sup>		1.4		*	*	1.4			66.0			*		1.3						0	
1978			*						46.0			29.0								75	
1979			*	78.0			57.0	133.0	45.0			1.8	0.9	2.5						318	
1980				18.0			162.0	54.0	97.0			1.8								333	
1981			20.0	4.0	*		5.3	47.0	22.0						17.0					115	
1982		2.5		46.0			0.8	11.0	94.0						5.0					159	
1983	7.8	99.0	264.0	260.0	*	*	59.0	38.0	112.0			24.0		22.0	38.0		62.0			986	
1984	0.3	437.0	777.3	172.0			33.0	67.4	76.3		5.7	69.1		17.3	103.0		3.9			1762	
1985		354.0	492.0	167.0	106.0	5.9	29.0	48.0	77.0		47.0	30.0		96.0	158.0	145.0	15.0	45.0		1815	
1986	27.0	548.0	376.0	178.0	56.0	4.4	57.0	129.0	105.0		2.0	40.0		154.0	285.0		2.5	91.0		2055	
1987 <sup>3</sup>	6.9	420.0	491.0	193.0	32.4		71.0	71.0	123.0	17.0	7.8	17.0		63.0	199.0	95.0	8.3	12.0		1827	
1988	2.6	534.0	480.0	78.0	21.0	2.3	*	22.0	78.0			74.0		13.0	250.0	66.0		58.0		1679	
1989		569.0	493.0	122.0	6.7		9.0	64.0	57.0		1.6	15.0			223.0	39.0		86.0		1685	
1990	84.8	437.6	428.4	56.6	1.2	0.6	43.0	46.5	58.6	0.3	1.8	7.9		59.7	215.1	56.8		68.1		1567	
1991	36.4	358.7	370.7		8.6		26.6	94.8	27.2		14.1	31.2	2.7	58.4	185.1	115.8		121.1		1451	
1992	8.0	531.0	320.0				103.0	36.0	86.0		4.0	56.0	9.0	31.0	200.0	10.0		65.0		1459	
1993	55.5	329.0	184.0				21.0	104.7	17.3			14.5		40.4	92.0	7.0	2.0	50.0		917	
1971 to 1993	229	4621	4696	1373	232	15	676	966	1297	17	84	0	411	13	559	2224	535	94	596	18638	

\* less than 500 kg.

<sup>1</sup> data for each year cannot be published separately.

<sup>2</sup> mandatory log book under Z licence came into effect in 1983.

<sup>3</sup> sales slips were combined for red and green sea urchins in 1987, later separated by price criteria, but 320 t remains missing in area table. See Table 1.

+preliminary data for 1993.

Table 3.1.3. Summary of red sea urchin landings (tonnes) by South Coast Management Areas in 1993 (preliminary), as reported on sales slips.

SOUTH COAST MANAGEMENT AREAS																				
Month	East Coast V.I.										West Coast V.I.							Monthly Totals		
	11	12	13	14	15	16	17	18	19	28	29	20	21	23	24	25	26		27	
Jan		152.7	152.5																305	
Feb																				
Mar																				
Apr																				
May																				
June																				
July																				
Aug																				
Sept																				
Oct																6.6		5.8	12	
Nov														40.4	75.1		1.7	44.1	161	
Dec	55.5	176.6	31.7			21.0	104.7	17.5				14.5			16.8				438	
<b>Area Totals</b>	55.5	329.3	184.3			21.0	104.7	17.5				14.5	40.4	91.9	6.6	1.7	49.9		917.3	
<b>Mainland and East Coast Vancouver Is.:</b>										<b>712</b>		<b>West Coast Vancouver Is.:</b>							<b>205</b>	
<b>South Coast Total:</b>												<b>917</b>								

Table 3.1.4. Summary of red sea urchin landings (tonnes) by North Coast Management Area 1984 to 1993, as reported on sales slips.

NORTH COAST MANAGEMENT AREA												
Year	1	2E	2W	3	4	5	6	7	8	9	10	Annual Landings
1984	2.2											2.2
1986											12.0	12.0
1987					23.0			179.0	91.0			293.0
1988					73.0	11.0	7.3	314.0	32.0			437.3
1989	0.2	223.0		1.6	116.0	1.3	168.0	217.0	65.0		180.0	972.1
1990		26.6	10.7	24.5	156.8	265.3	67.1	1040.1				1591.1
1991		333.1	2.7	143.3	1026.7	2577.3	77.7	774.7	114.6	24.5	304.9	5379.5
1992		1111.0		1.0		3294.0	4063.0	2763.0	140.0	114.0	38.0	11524.0
1993	97.0	189.0	88.9	127.2	1008.0	463.0	2103.0	1012.0	43.4		215.3	5346.8
1984 to 1993	97.2	1882.7	102.3	297.6	2403.5	6611.9	6486.1	6299.8	486.0	138.5	750.2	25555.8

Table 3.1.5. Summary of red sea urchin landings (tonnes) by North Coast Management Areas in 1993 preliminary), as reported on sales slips.

NORTH COAST MANAGEMENT AREAS												
Month	1	2E	2W	3	4	5	6	7	8	9	10	Monthly Totals
Jan							211.8	306.1				518
Feb		46.0	21.4	5.3	255.4	259.0		190.2	26.4		0.2	804
Mar				118.8	124.3	0.9	404.2	4.0			134.4	787
Apr				3.1		16.4	1238.6	67.9	10.6		21.9	1358
May		44.9	63.8		327.8	186.3		274.9	6.3			904
June												
July												
Aug												
Sept												
Oct	96.8	98.1	3.6									199
Nov					231.8		6.0	163.6				401
Dec					69.1		242.2	5.5			58.8	376
<b>Area Totals</b>	96.8	189.0	88.9	127.2	1008.4	462.6	2102.8	1012.1	43.4		215.3	5346.5

### 3.2 GREEN SEA URCHIN DIVE FISHERY

R. Harbo and K. Hobbs

#### 3.2.1.0 INTRODUCTION

The green sea urchin (*Strongylocentrotus droebachiensis*) has been harvested by divers since 1987. A category Z-A licence was introduced in the fall of 1988. The number of vessels participating peaked in 1989 at 113. Limited entry was introduced for 1991 and there are currently 49 eligible licences (Table 3.2.1).

Little is known about the distribution and abundance of green sea urchins in British Columbia. Green urchins appear to be more mobile than red urchins, changing depths and locations over short periods of time.

Green sea urchins are exported whole and live to Japan for final processing for "roe". In 1993, 17 companies shipped 693 tonnes (t) green sea urchins. A processor can pack about 10,000 lb. (4.5 t) of green sea urchins in 2 hours for air shipment. The sea urchins reach Japan about three days after harvest. Once processed, the roe can be held up to 15 days (processors, pers. comm.) before it is marketed.

Green sea urchins are graded A-B (orange-yellow) C-D (brown-dark brown), depending on color and roe recovery. There is 15% recovery overall but about 6% A-B.

The landed value per tonne of green sea urchins increased significantly, by 29% in 1993 over 1992 prices. The average price paid to fishers in 1993 was \$5.98/kg (\$2.71/lb), compared to \$0.79/kg (\$0.30/lb.) for red sea urchins in 1993 and \$3.95/kg (\$1.79/lb) for purple sea urchins, in 1991. The average price for greens in Jan.-Feb./94 was \$2.23/lb. or \$4.93/kg.

There is a major fishery on the Atlantic coast for this species, in Canada and the United States. Landings in Maine were over 20 million lb. for \$11 million in 1991. Fishers in Maine complain that their divers gather only half as many urchins in a day as they did five years ago (Wall Street Journal, July 31, 1992).

There were 26.5 million lb. (12,020 t) landed in Maine in 1992 for a value of \$15.4 million (\$0.58/lb. or \$1.28/kg). An urchin fishery in Nova Scotia is five years old, but the 1992 harvest - double that of 1991 - was still under 1 million lb. (454 t) (National Fisherman, Oct 1993).

### 3.2.2.0 FISHERY MANAGEMENT

A summary of management actions, 1987 to 1994 is given in Table 3.2.2. Hand picking by divers only is allowed. Suction devices or trawls are not permitted to be used.

Quotas and seasonal restrictions were set in 1994 for this fishery to control effort and to reduce landings. A ceiling catch of 449 t (990,000 lb.) was set for the south coast along with area quotas.

The fishery in the Kelsey Bay area (12-1,13-32,13-33 and 13-35) was limited to six days, Jan 3 to 9, due to intensive fishing in this area and problems of small urchins (<55 mm) being landed in past years. In 1993, the fishery was limited to seven days, Jan 6 to 10, 1993.

Effort was also restricted on the west coast of Vancouver Island, with fishing limited to October 24 to October 30, 1994, six days of fishing. This is an exploratory fishery.

In the inside waters of the south coast, fishing days were limited in Jan - Feb 1994 to cap the landings at approximately 25% (247,500 lb.) of the 1994 quota (990,000 lb.). The estimated landings over that period are 189,244 lb. Jan 3 to 23, 1994.

#### North Coast

The open times for the north coast in 1994 were also reduced to the periods Jan 3 to Feb 28 and Nov 1 to Dec 31, 1994. The periods of fishing in 1993 were Jan 1 to Feb 28 and Oct 1 to Dec 31, 1993. The fishery was open all year in 1992. This is also primarily an exploratory fishery. In 1993 the first significant landings were made, including 71 t landed from Area 4 near Prince Rupert (Table 3.2.3).

#### Minimum size limits

A minimum test (shell, excluding the spines) size limit of 55 mm has been a condition of the Z-A licence since 1987 to allow the urchins to spawn before they are harvested and to protect a portion of the population. The size limit was set as a regulation, in Feb 1993.

### Notification procedures-catch data

In 1992, fishers were required to notify the D.F.O. Operations Centre, Vancouver, prior to fishing and within 24 hours after terminating fishing in an area. The submission of sales slips and harvest logbooks are conditions of the fishing licence.

### Closures

There are a number of small closures, primarily marine parks or areas of interest to sport divers. There is a research closure at Bamfield.

#### **3.2.3.0 CATCH AND EFFORT**

Most of the harvest of green sea urchins occurs from small vessels using either Scuba or surface supplied air for divers. Divers fish from depths of 10 to 40 feet. The fishery has changed with groups of vessels fishing more remote areas with a packer.

The number of divers and diving hours decreased in 1993 (Table 3.2.1) as a consequence of reduced open times in the fishery.

The fishery has occurred primarily in inside waters of Vancouver Island and the mainland, Areas 12 and 13 and southern Areas 18 and 19, with only minor landings from the west coast of Vancouver Island and the north coast (Table 3.2.3). Areas 14 to 17, 28 and 29 have not sustained original harvest levels as shown in Table 3.2.3.

There has been a significant increase in landings in Area 20, on the west coast of Vancouver Island since 1990. Landings in the north coast increased in 1993 in the Prince Rupert District, Areas 4, 5, and 6 (Table 3.2.3).

Table 3.2.4 presents landings by month for 1993, south coast and Table 3.2.5 for the north coast. Table 3.2.6 presents data for the early fishery in 1994.

There was a continued decline in both vessel CPUE (tonnes/vessel day) as reported on sales slips and diver CPUE (kg/diver hour) as reported on harvest logs in 1993 (Table 3.2.1).

Divers were reported to be diving to 80 to 90 feet at some locations in 1992 and 1993 to harvest green sea urchins. Generally the urchins were poor quality from these depths.

#### 3.2.4.0 CATCH MONITORING AND SAMPLING

Fishery Officers conducted monitoring of catches in several areas. Generally compliance to the size limit was high but they reported some instances of small urchins being landed and some charges were laid.

Green sea urchins are most commonly landed in plastic cages (about 5 lb.) which contain 30 to 35 lb. of green sea urchins, about 120 pieces.

#### 3.2.5.0 ISSUES

**3.2.5.1. The condition of the stock is in question and there is concern about overfishing expressed by several fishers:**

3.2.5.1.1. Areas 14, 15, 16, 17 and 27, 28 and 29 have not sustained original harvest levels. Many of these areas, however, have limited current-swept reefs and are not considered to be good green sea urchin habitat.

3.2.5.1.2. Diver C.P.U.E. has declined by 33 to 52 % since 1989. The number of diver hours and diver hours/day has increased to maintain daily vessel landings. The number of divers have increased, 188 in 1993, even though the number of licences were limited in 1991 to 49.

3.2.5.1.3. The landings and C.P.U.E. are being maintained by fishing new areas with a group of vessels and packers. Three or more packers operated last season. Allegedly, one packer operated with a single licensed vessel and 12 divers.

Some product from the north coast, Smith and Rivers Inlets, was being flown to Port Hardy.

3.2.5.2 The minimum size limit of 55 mm has been set as a regulation (Pacific Fishery Regulations, Feb 1993; 70.(2)); "No person shall catch or retain green sea urchin that is less than 55 mm in width". This was previously a condition of the fishing licence and difficult to enforce as such.

3.2.5.3 Industry has requested that the fishery be open through Christmas and New Year's holidays to take advantage of peak market demand.

3.2.5.4. Japanese processors complained in 1993 that roe yields were down to 4% to 7% significantly lower from 10% in other years. Divers were fishing deeper in many areas, particularly Knight Inlet, where quality was poor.

3.2.5.5. There have been problems of catches freezing in winter months and requests from buyers that the fishery be closed.

3.2.5.6. There is interest in collecting wild sets of green urchins and impounding and feeding them. This is being reviewed as part of a policy review for aquaculture of invertebrate species.

3.2.5.7 There is interest in harvesting legal size urchins and holding and feeding them for opportune times to market them. There are disease and other transplant concerns related to this. Tenures and kelp harvesting licences may be required from the province.

#### 3.2.6.0 **RECOMMENDATIONS**

1. There appears to be a conservation problem in this fishery. A precautionary quota was set in 1994 and the PSARC Invertebrate Subcommittee recommended in the spring meeting, March 1994, that the quota should be reduced for 1995.

2. Additional analyses of catch and effort data are required by area. The habitat should be identified and estimated (ha) from log returns.

3. A review of the minimum size limit of 55 mm is required. In the north coast fishers report significant numbers of green sea urchins, 50 to 55 mm.

4. Adaptive management regimes, for example, rotational fisheries should be considered.

Table 3.2.1. Green sea urchin landings (tonnes) and effort for British Columbia, 1987 to 1994, as reported on sales slips and harvest logs.

Year	Type and Number of Licences Issued	Number of Vessels with Landings	Fishing Days	Average Fishing Days/Vessel	Landings (t)	Landed Value (\$·10 <sup>3</sup> )	Whole Landed Value (\$/t)	X CPUE <sup>1</sup> (t/vessel day)	X CPUE <sup>3</sup> (kg/diver hr)	Total Diver Hours	Average Hrs/Diver -day <sup>3</sup>	Total # Divers <sup>3</sup>	Average Hrs/Vessel -day <sup>3</sup>
1987	Permit 38 <sup>2</sup>	20	248	12.4	120	127	1058	0.48	151	729			
1988	Z 89	68	690	10.1	444	584	1315	0.64	122	2,547	2.34	123	3.97
1989	Z 191	113	1394	12.3	609	1020	1675	0.44	141	2,935	2.00	152	2.26
1990	Z 155	91	1352	14.9	475	939	1977	0.35	95	3,512	2.54	158	3.84
1991	Z 47	47	1348	28.7	607	1795	2957	0.45	85	4,335	2.17	131	3.9
1992	Z 49	49	2096	42.8	1042	4424	4246	0.50	79	10,745	2.92	190	6.09
1993*	Z 49	53	1619	30.5	712	3775	5302	0.44	65	9006	2.60	188	5.84
1994*	Z 49	(39)	(269)	(6.9)	(109)	(537)	(4927)	(0.41)	N/A	N/A	N/A	N/A	N/A

<sup>1</sup> from sales slip data

<sup>2</sup> scientific permits were issued to 38 vessels for fall 1987 to spring 1988 fishery. 1987 landings and fishing days are from harvest logs as green sea urchins were not separated from reds on sales slips until mid 1988.

Z licences were issued for the fall 1988 fishery.

<sup>3</sup> data from harvest logs

\* preliminary landing data for 1993 and 1994. 1994 data is from the Jan-Feb fishery only.

Table 3.2.2. Summary of management actions in the green sea urchin fishery, 1987 to 1994.

Year	Management Actions
1987	<p>Scientific permits were issued, July 22 to December 31, to fishing vessels for harvest by diving. Logbooks were issued with permits to collect data on stock abundance and distribution. Permits were limited to the inside waters of Vancouver Island, areas 12 to 19, 28 and 29. Some minor area closures for parks or study areas were in effect as for most dive fisheries.</p> <p>A precautionary minimum size limit of 40 mm was set as a condition of the permit. Sales slip data did not have a separate species code, so green and red sea urchin landings are mixed. As a result, landings have been estimated from logbook returns and hauls from processors.</p> <p>Effort was restricted by limiting the season to the months of traditional peak market demand for sea urchins, Oct.- Dec. and Jan.- Feb.. Nineteen vessels reported landings.</p>
1988	<p>Permits were issued for the period Jan. 16 to Feb. 28.</p> <p>Sales data for green sea urchins was recorded with a separate species code.</p> <p>A conservative closure was set, Jan. 16 to Feb. 28 in subareas 13-1 to 13-3 due to the intensive fishery in a small area.</p> <p>A Z category (Z-A) licence for green sea urchins was introduced for the fall fishery which opened Oct. 1.</p> <p>The minimum size limit was increased to 55 mm test diameter and set as a condition of licence. The season was limited again, Jan. 1 - Feb. 28 and Oct. 1 - Dec. 31. Sixty-eight vessels reported landings.</p>
1989	<p>The Z-licence, minimum size limit and seasonal restrictions continued.</p> <p>A conservation closure was set for subareas 12-1 and 13-29 to 13-40, north of Campbell River, Jan. 31 - Feb. 28/89 due to heavy fishing pressure and a high incidence of undersized urchins landed.</p> <p>One hundred thirteen vessels reported landings.</p>
1990	<p>The Z-licence, minimum size limit and seasonal restrictions continued.</p> <p>There were 91 vessels reporting landings.</p> <p>Licence limitation for 1991 was announced with the eligibility criteria of landings of 9,072 kg (20,000 lb.) over the two year period 1988 and 1989. At least 33 vessels were expected to qualify before appeals were held.</p>
1991	<p>Licence limitation - 47 vessels qualified and 47 vessels reported landings.</p>
1992	<p>A conservation closure was set in the Kelsey Bay area, subareas 12-1, 13-32, 13-33 and 13-35, Feb. 25 - Feb 28. These subareas did not reopen for fall fishing until Dec. 7.</p>
1993	<p>Licences increased to 49. Notification of fishing required. No suction devices. Additional permanent closed areas for parks and reserves, IFF.</p> <p><u>South Coast</u> Reduced fishing times; Inside waters:season Jan 4 to Jan 28 7 days/wk; Feb1 to Feb 25 4 days/wk, Mon-Thurs. Fall fishery Nov 1 to Dec 16, 4 days/wk, Mon-Thurs; Dec 6 to Dec 30, 7 days/wk. Kelsey Bay limited to 7 days, Jan. 4 to 10. W.C.V.I.: season reduced to Oct. 4 to 28, 1992, 7 days/week.</p> <p><u>North Coast</u>: 7 days/wk, season reduced to Jan 1 to Feb 28 and Oct 1 to Dec 31.</p>

Table 3.2.2. continued. Summary of management actions in the green sea urchin fishery, 1987 to 1994.

Year	Management Actions
1994	<p><u>South coast</u>: a ceiling catch of 990,000 lb. (449 t) was set along with area quotas. Fishers requested to harvest 25% in Jan.-Feb. and the balance in Nov.- Dec. The days fishing were limited to four days/week (Mon-Thurs) for some periods and others at 7 days/week.</p> <p><u>North coast</u>: no quota set; season reduced to periods Jan. 1 to Feb. 28 and Nov. 1 to Dec. 31. Consideration will be given for spring/summer fisheries depending on roe quality and landings.</p>

Table 3.2.3. Quotas and opening times for the 1994 green sea urchin fishery.

MANAGEMENT AREAS	QUOTA (LB.)	OPEN TIMES
<b>INSIDE WATERS:</b>		
KELSEY BAY (subareas 12-1,13-32,13-33 and 13-35)	incl. with Area 11 and 12 quota	i) Jan 3 to Jan 9/94 ii) Fall fishery T.B.A.
AREA 11, all subareas AREA 12, ( <b>excluding</b> 12-1)	450,000 lb. (204.1 t)	Sequence: i). Jan 3 to Jan 27, seven days/week  ii) Monday Jan 31 to Thursday Feb 24, four days/week, Mon. to Thurs. *  iii) Monday Oct 31 to Thursday Dec 1, four days/week, Mon. to Thurs.  iv) Monday, Dec 5 to Thursday Dec 29, seven days/week
AREA 13, ( <b>excluding</b> 13-32, 13-33, 13-35)	290,000 lb. (131.5 t)	
AREAS 14 TO 18 INCL. AND 29	110,000 lb. (49.9 t)	
AREA 19	81,500 lb. (36.9 t)	
AREA 28	17,500 lb. (7.9 t)	
AREA 20	40,000 lb. (18.1 t)	
<b>WEST COAST:</b>		
AREAS 23 TO 27 INCL.	1,000 lb. (0.45 t)	i) Monday, Oct 24 to Sunday, Oct. 30, seven days/week
<b>SOUTH COAST TOTAL<sup>1</sup>:</b>	990,000 lb. (449 t)	

<sup>1</sup> the total quota for 1994 is the five year average of the landings in the initial fishery, 1987 to 1991.

Table 3.2.4. Summary of green sea urchin landings (tonnes) by Management Area 1987 to 1993, as reported on sales slips and harvest logs.

FISHERY MANAGEMENT AREAS																						Annual Landings				
North Coast							East Coast Vancouver Island										West Coast Vancouver Island									
Year	1	2E	4	5	6	9	10	11	12	13	14	15	16	17	29	18	19	20	28	23	24		25	26	27	
1987								1.8	58				2.5			4	37		17							121
1988		0.4					0.4	2.8	51	169	18	9	1.2	12	10	60	79	1.4	20	2.6	4.7	0.2	4.3			444
1989	12				1			272	145		1.0			37	2.0	75	37	1.0	7.0	1.0	6.0			12	609	
1990								1.0	160	151	5.0			2		99	38	14	4.0	0.5					475	
1991	0.4				3			1.0	241	165	2.8	1.3	0.9	0.6	7.0	68	58	51	5.4		0.1			2.0	607	
1992						1.7		37	636	253	0.3		5	0.4	14	28	34	30			0.3				1040	
1993*			71	1	4	6	0.2	5	400	78	3		1		0.7	23	60	39	0.4		0.4	0.4			693	
1987 to 1993	13	0.4	71	1	7	8	1	47	1761	1019	30	10	11	52	34	357	343	136	53	4	12	0.2	4	14	3988	

\* preliminary data for 1993

Table 3.2.5. Summary of green sea urchin landings (tonnes) by month for South Coast management area, in 1993.

Month	SOUTH COAST MANAGEMENT AREAS															Monthly Totals	
	East Coast V.I.										West Coast V.I.						
	11	12	13	14	15	16	17	18	19	28	29	20	21	23	24	25	
Jan	4.9	99.3	0.6						4.4			10.5					120
Feb	1.8	99.4	1.8			0.1		1.8	10.4	1.7	0.6	9.5					127
Mar																	
Sept	Fishery closed March to November in South Coast areas																
Oct																	
Nov	1.0	124.7	32.0	0.9				8.7	12.7				3.8				184
Dec	0.5	91.4	46.6		1.0		0.8	12.5	32.6	0.4	0.7	11.6			0.4	7.0	205
Area Totals	8.2	414.9	81.1	0.9	1.0	0.1	0.8	22.9	60.0	2.1	1.3	31.6	3.8		0.4	7.0	636
Mainland and East Coast Vancouver Is.:				593											West Coast Vancouver Is.:		43
South Coast Total:												636					

Table 3.2.6. Summary of green sea urchin landings (tonnes) by North Coast Management Areas in 1993, as reported on sales slips.

NORTH COAST MANAGEMENT AREAS												Monthly Totals
Month	1	2E	2W	3	4	5	6	7	8	9	10	
Jan												
Feb												
Mar												
Apr												
May												
June												
July												
Aug												
Sept												
Oct					42.3	1.0	3.8		0.2	8.5	0.1	56
Nov								0.2				0
Dec					28.6							29
Area Totals					71	1	4	0	0	9	0	85

Table 3.2.7 Summary of green sea urchin landings (tonnes) by North Coast Management Areas and month in 1994 (preliminary to Feb/94), as reported on sales slips.

NORTH COAST MANAGEMENT AREAS												TOTALS				
Month	1	2E	2W	3	4	5	6	7	8	9	10	NORTH COAST (t)	SOUTH COAST (t)	COAST WIDE (t)	ECVI (t)	WCVI (t)
Jan													87	87	82	5
Feb				22.6								23		23		
<b>Area Totale</b>				23								23	87	109	82	5

Table 3.2.8 Summary of green sea urchin landings (tonnes) by South Coast Management Areas and month in 1994 (preliminary to Feb/94), as reported on sales slips.

SOUTH COAST MANAGEMENT AREAS																			
East Coast Vancouver Island											West Coast Vancouver Island							SOUTH COAST (t)	
Month	11	12	13	14	15	16	17	18	19	28	29	20	21	23	24	25	26		27
Jan		34.2	22.3					7.1	18.2		0.2	4.5							87
Feb																			
<b>Area Totale</b>		34	22					7	18		0	5							87

### 3.3 SEA CUCUMBER (Parastichopus californicus) DIVE FISHERY

S. Heizer and G. Thomas

#### 3.3.1.0 Introduction

This fishery is a dive fishery which began in 1980 and has recently been limited by precautionary quotas. A personal Z(D) license is required to participate in this fishery: Fishermen using P-licensed sea cucumber vessels are restricted to the North, may only fish off P-licensed vessels, and may only process their own catch. The number of eligible Z(D) licenses was limited to 78 in 1991 but has grown to 84 through successful license appeals and creation of 5 band licenses for First Nations.

Processed product from sea cucumbers consists of muscle strips and dried skin.

The pattern of exceeding quotas, which has occurred since 1987, occurred again in 1993. Landings reported on sales slips in 1993 totalled 334 t of split product: The quota was 238 t of split product. Table 3.3.1 presents the coastwide quotas and landings for the sea cucumber fishery from 1986 to 1994.

The South Coast quota in 1993 was 55 t, and 72 t were landed (Table 3.3.2). Overages in the South Coast were reported for both areas with the greatest overage on the West Coast Vancouver Island. The North Coast quota was 183 t and 262 t were landed. Overages in the North Coast were reported for each area, with the greatest overage in the Central Coast (Table 3.3.3).

Preliminary data indicate that the value of the 1993 fishery was around \$0.924 million where the 1992 value was \$1.3 million (Table 3.3.4). Average price paid in 1993 for sea cucumbers was \$2.78/kg (split weight), up from \$2.58/kg (split weight) in 1992. This fishery ranks seventh in value among shellfish species. The majority of the 72 t landed in the South Coast in 1993 were taken in Outside waters (41 t); 31 t were taken in Inside waters (Table 3.3.2).

#### 3.3.2.0 Fishery Management

Arbitrary quotas have been set for various portions of the coast until more biological information is known. The North

Coast has three annual quota areas, and the South Coast has two annual quota areas with a three year rotation of areas, initiated in 1993 (Table 3.3.5).

#### 3.3.2.1 Rotational Area Quotas

Analyses of sea cucumber data in 1993 showed that CPUE appeared to be declining. In 1992, as a consequence, PSARC supported a reduction in quota until more is known about growth and productivity of these animals (Irvine *et al.*, 1993). Each of the two South Coast quotas were reduced from 55 tonnes in 1992 to 27.5 tonnes in 1993. Quotas remained at 27.5 tonnes for each of the two South Coast areas in 1994. Quotas are adjusted annually to account for overages in past years. Therefore, in 1994, the quota for Inside Waters was reduced to 0 t due to overages in the same areas fished in 1992.

Starting in 1993, the sea cucumber fishery went into a three year rotational scheme (from the previous two year area rotation) to reduce the impacts of harvest. Areas now have a two year unfished recovery period. Table 3.3.5 describes the rotational areas starting from 1991 to the proposed areas up to 1997.

In 1992 and 1993, the open areas in the Central Coast District were restricted in order to move the fishery from heavily harvested locations in Area 7 and to better focus management efforts in season. In 1994, open areas will be confined in the other North Coast Districts as well (Table 3.3.3).

#### 3.3.2.2 Quota Monitoring

Fishing areas are opened, then closed again when the quota has been taken. Vessels on the South Coast are required to notify the Department 24 hours before fishing, and to report catches on every Thursday. These data, along with hailed landings from processors which are also due on Thursday, are designed to monitor the amount of quota taken. In fact, with the shortness of the fishery, hails are not timely enough to be useful for this purpose (see more under **Issues**).

On the North Coast, only the vessel notification requirement is in effect, that is, no catch reporting is required. Landings are monitored inseason by daily census

of processing plants and by onground hauls collected by patrol vessels.

### 3.3.2.3 Quota Adjustments.

Tables 3.3.1 to 3.3.3 summarize the history of the quotas and landings in the sea cucumber fishery. In 1992, fishers exceeded the quota set for areas 12 and 13 by as much as 3 times (Heizer and Hobbs, 1994). Policy is such that quota overages are deducted in the next year's fishery. The overage was deducted in 1994, resulting in a reduction to 0 t for the Inside Waters quota.

Areas 16 and 17 were scheduled to open (along with area 13A) in 1994. These areas had been closed since 1989, when sharply declining CPUE indicated the possibility of overharvesting. Stock size remains questionable in areas 16 and 17. It was felt that the additional unharvested area would help mitigate the overage that occurred in 1992. Areas 16 and 17 may reopen in the next area rotation in 1997.

In 1995, the quotas for the South Coast will return to the original amount of 55 t. (27.5 t for Inside Waters, 27.5 t for the West Coast of Vancouver Island). In 1996, the 1993 overage of 13.5 t from Areas 26 and 27 (Table 3.3.2) will be deducted from the West Coast quotas. Table 3.3.5 shows the proposed rotational areas and quotas for 1995 to 1997.

### 3.3.2.4 Licencing

Six vessels received P-licenses in the North Coast in 1990 of which two processed 61 t of sea cucumber. In 1991, 3 P-licenses were issued and two vessels processed 41 t. In 1992 and 1993, no P-licences were issued and no processed product was landed. The duration of the fishery has become very short. Openings were only for one or two days in all areas, in 1993, except the Queen Charlotte Islands which was opened for eight days. Likely the 'shot gun' nature of this fishery precludes any advantage for processing catch on board.

For the 1994 fishing season, the Sea Cucumber Harvesters Association, which represents harvesters in the advisory process with DFO, proposed to implement self-imposed individual quotas. Equal quotas, determined by dividing the quota by the number of licenses, were proposed. The coast was divided into two licence areas, North and South. Tentative fishing periods were set for mid October

to mid November. Validation of landings was to be done by a private contractor as is done in the geoduck fishery.

Since this was a voluntary scheme, it required no approval by DFO. DFO modified the fishing plan, however, to accommodate the timing of the fishery. DFO was willing to support the harvester's proposal if there were adequate safeguards to insure an orderly fishery, and landed product was properly validated.

Just before the fishery, the scheme was abandoned by the harvesters association, because a few licence holders refused to cooperate. The 1994 fishery was carried out in the usual 'shot gun' style, in early November.

#### 3.3.2.5 Permanent Closures

There are a number of permanent area closures on the coast, closing Marine Reserve Areas, Research Areas, Provincial and Federal Parks and for areas for Indian Food Fishery purposes.

#### 3.3.3.0 Catch and Effort

Table 3.3.4 summarizes catch, effort and value data for this fishery from 1980 to 1993. Table 3.3.6 gives the openings, closings and quotas for 1990 through 1993. Tables 3.3.7 and 3.3.8 show annual landings by statistical area and landings by month for 1993 for the South Coast. Tables 3.3.9 and 3.3.10 show annual landings by statistical area and landings by month for 1993 for the North Coast.

3.3.3.1 The number of vessels participating in the fishery and the total fishing days went down in 1993, relative to 1992. Total landings also went down (see Table 3.3.4). Landings in Area 7, totalling 1304 t since the fishery began, are greater than those in any other area on the coast (Table 3.3.9).

3.3.3.2 Vessel CPUE was marginally greater in 1993 relative to 1992. Landed value declined to pre-1988 levels, probably as a result of a quota adjustment in the South Coast (Table 3.3.4). Diver CPUE for 1993 is not yet available.

3.3.3.3 Ongoing observations of the 1993 fishery indicated that some South Coast vessels appeared to have unreasonably large loads early in the first day of the fishery. Although these observations were not quantified, they were interpreted as evidence of a possible prefishery.

Confirmation of this interpretation will have to await processing of the 1993 log book data.

#### 3.3.4.0 Issues

There is little biological data or comprehensive stock assessment done for this species. Before increases in quota are considered, the productivity and growth of these animals must be better understood. DFO will be consulting with Industry to find appropriate areas for 5 to 10 year closures, for research purposes, to examine growth, recruitment settlement and mortality in sea cucumber populations. Proposed closure areas should be productive, but perhaps less desirable for harvest due to accessibility or other logistical considerations.

An issue common to all dive fisheries is that there are inadequate resources available to deal with harvest log data. The question is whether to remove the harvest log requirement or whether to institute a cost recovery procedure to do coding and summarizing of data.

Landings continue to be difficult to monitor due to the lack of on-grounds surveillance and because the requirement for weekly hails has had little success in providing reliable data. There is some question among enforcement people as to the enforceability of the hailing requirement. If the voluntary quota system is operational in 1995, this should not be the problem it has been in the past as contract monitoring will provide timely data.

The fishery occurs over a sufficiently short time period that it could be effectively monitored for little cost by onground patrols, but these continue to be largely unavailable in the South Coast. When patrol boats are on the grounds, an officer should be available to make any decision on closing, if necessary, rather than leaving the decision to a patrol boat skipper. Again, validations from a voluntary quota plan could remove this difficulty by providing more timely catches.

Plant hails are not timely enough to control quota overages and, in the past, were ambiguous due to undetermined percentages of round or split weights reported. Often, managers talk directly to plants and do not wait for hails. In 1992 and 1993, landings were reported as split weight and the problem of ambiguous landing data has been largely remedied. Further management controls (such as DFO sanctioned IQs and adequate enforcement) continue to be needed to rationalize this fishery.

Stockpiling of sea cucumbers on the bottom prior to the fishery is alleged to be occurring (see comments in 3.3 above). Sea cucumbers can be harvested and held live for months in the water. Additional enforcement may help on this problem, but it has also been suggested that a temporal separation between the sea urchin fisheries and the sea cucumber fishery would help stop this practice. Individual quotas remove the desirability of this type of cheating by removing the race for product operational under the current 'shotgun' approach to this fishery.

The 'sport' harvest in the Campbell River to Comox area in 1992 was allegedly supplying commercial markets. This is believed to no longer be a problem as the sport fishery is closed coastwide. A sport limit should be instituted to allow a legitimate sport harvest yet still limit the practice of sport sales.

Product form on landing (either round or split) affects landing data. Unless it is specifically stated on the fish slip, the landings since 1992 are assumed by managers to be split weight. However unless otherwise stated on the slip, it is still keyed to the Fisheries Catch Data System as form 1 - round weight, thus creating some confusion. A certain amount of product is landed round, and if it is not reported as such, the quota is exhausted more quickly. The extent of the problem of premature achieving of quota is currently under investigation.

#### LITERATURE CITED

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Table 3.3.1. Sea cucumber annual quotas, areas fished and landings (t) 1986 to 1994.

COASTWIDE						
Year	Quota			Effort	Landings	
	Round (t)	Split (t)	Pieces (#)	Total Fishing Days	Round (t)	Split (t)
1986	1500		2.36 M	733	786	
1987	1500		2.36 M	1906	1722	
1988	1500		2.36 M	1512	1922	
1989	800		1.26 M	1022	1144	
1990	800		1.26 M	1153	870	
1991	800		1.26 M	535	1340	
1992	800	293 <sup>1</sup>	1.26 M	449	1422	521 <sup>1</sup>
1993	650	238 <sup>1</sup>	1.02 M	197	912	334 <sup>1</sup>
1994 <sup>2</sup>	575	210.5	.88 M	164		

<sup>1</sup> Calculated using a conversion factor of 2.73 (round to split weight)

<sup>2</sup> Quota was reduced by 27.5 t due to overages in the 1992 inside waters fishery.

Table 3.3.2. The history of quotas, fishing areas and landings in South Coast areas, 1986 to 1994.

SOUTH COAST AREAS							
Year	Inside Waters			West Coast			Total (t)
	Open Subareas	Quota (t)	Landings (t)	Open Subareas	Quota (t)	Landings (t)	
1986	11 to 19,28,29	500	777	20 to 27	500	9	786
1987	11 to 19,28,29	500	859	20 to 27	500	441	1300
1988	11 to 19, 28, 29	500	620	20 to 27	500	722	1342
1989	11 to 13, 18, 19	150	262	20 to 27	150	295	557
1990	11 to 13, 18, 19	150	236	20 to 27	150	181	417
1991	18, 19, 20	150	74	25, 26, 27	150	97	171
1992 <sup>1</sup>	12 and 13	55	221	23, 24-1 to -5, 24-10, -12 to -14	55	42	263
1993 <sup>2</sup>	18 and 19	27.5	31	26 and 27	27.5	41	72
1994	13A (13-14 to 13-23) 16 and 17	closed		23 (all), 24A (24-6, -8 to -12)	27.5		
1995	13B, 13-12, -24 to 43 and area 12 (all s/a)	27.5		24B (24-7) and 25	27.5		

1 Quotas before 1992 are in round weight; quotas in 1992 and on are in split weight.

2 In the three year rotational fishery, the areas open in 1993, 1994 and 1995 will again open in 1996, 1997 and 1998, respectively. 1993 landings are preliminary.

Table 3.3.3. History of rotational fishing areas, quotas and landings for North Coast areas 1986 to 1994.

Year	NORTH COAST AREAS									Total (t)
	Q.C.I.		Prince Rupert			Central Coast				
	Subareas	Quota (t)	Landings (t)	Subareas	Quota (t)	Landings (t)	Subareas	Quota (t)	Landings (t)	
1986 <sup>1</sup>	1,2E,2W		-	3, 4, 5		-	6, 7, 8, 9, 10		-	-
1987 <sup>1</sup>	1,2E,2W		19	3, 4, 5		8	6, 7, 8, 9, 10		394	421
1988 <sup>1</sup>	1,2E,2W		1	3, 4, 5		18	6, 7, 8, 9, 10		560	579
1989	1,2E,2W	160	117	3, 4, 5	170	220	6, 7, 8, 9, 10	170	250	587
1990	1,2E,2W	160	76	3, 4, 5	170	154	6, 7, 8, 9, 10	170	222	452
1991	1,2E,2W	160	71	3, 4, 5	170	117	6, 7, 8, 9, 10	170	132	320
1992 <sup>2</sup>	1,2E,2W	59	68	3, 4, 5	62	85	6, 7 (ptn), 8, 9, 10 <sup>4</sup>	62	108	261
1993 <sup>3</sup>	1,2E,2W	59	80	3, 4, 5	62	91	6	62	91	262
1994	2-12 to 2-14 2-17 to 2-19	59		3 and 4	62		7-18 to 7-25, and 7-32	62		

1 The North Coast quota was not divided into the three areas until 1989. The 500 t quota covered all areas (1 to 10).

2 Quotas before 1992 are in round weight; quotas in 1992 and on are in split weight.

3 In the two year rotational fishery, the areas open in 1993 and 1994 will open again in 1995 and 1996, respectively.  
1993 landings are preliminary

4 In Area 7, subareas closed were: 7-12, 7-15, 7-17, and 7-22.

Table 3.3.4. Sea cucumber catch, effort and value as determined from sales slips and harvest log data 1980-1993.

Year	Annual Quota (t) <sup>1</sup>	No. of Licences	No. of Vessels w/landings	Total Fishing Days	Total Landings (t) <sup>1</sup>	Landed Value (\$·10 <sup>3</sup> )	CPUE (t/vessel day) <sup>1</sup>	CPUE <sup>12</sup> (kg/diver hr)		Av. Diver day Length (hr) <sup>2</sup>	
								Total	(North)		(South)
1980			9	59	20		0.3	ND		ND	
1981			11	ND	27		ND	ND		ND	
1982			ND	ND	5		ND	ND		ND	
1983			19	356	527		1.5	372		3.4	
1984			12	249	113	22	0.5	318		3.6	
1985		Z 40	21	271	346	94	1.3	342		2.9	
1986	1500	Z 63	34	733	786	236	1.1	289		3.1	
1987	1500	Z 151	56	1906	1722	768	0.9	347	433	327	4.5
1988	1500	Z 160	79	1512	1922	984	1.3	281	294	276	2.7
1989	800	Z 245	91	1022	1144	977	1.1	285	307	267	2.1
1990	800	Z 215	126	1153	870	1167	0.8	208	225	192	2.7
<u>1991</u>	<u>800</u>	<u>Z 78</u>	<u>60</u>	<u>535</u>	<u>1340</u>	<u>1029</u>	<u>2.5</u>	<u>481</u>	<u>633</u>	<u>337</u>	<u>2.6</u>
<b><u>After 1991, quotas and landings are reported as split weight - up to 1991 they are reported as round weight.</u></b>											
1992 <sup>3</sup>	293 (800)	Z 84	77	449	521 (1422)	1363	1.2 (3.2)	226 (617)	222(607)	226 (616)	NA
1993 <sup>3</sup>	238 (650)	Z 84	76	197	334 (912)	924	1.7 (4.6)				

<sup>1</sup> Quota, landings and CPUE for 1986 to 1991 are in round weight. Quota, landings and CPUE for 1992 & 1993 are in split weight. Numbers in brackets for 1992 and 1993 the round weight equivalents (See \* below).

<sup>2</sup> Data from harvest logs.

<sup>3</sup> Data incomplete.

\* Landings (and CPUE calculations) for 1991 were reported as split weight: In this table, these have been converted into round weight for comparison with earlier years. For 1992 and 1993, numbers in brackets are landings (which were reported as split weight) converted to round weight for purposes of comparison. The reason for this laborious song and dance is that landings and quotas were expressed as split weight from 1992 on - this may help to clarify. Actual reported landings in 1991 were 491 t split weight times 2.73 (the conversion of round to split) = 1340 t.

**Table 3.3.5. Rotational areas in the sea cucumber fishery, 1991 to 1994, and proposed rotational areas for 1995 to 1997, on the south coast of British Columbia**

Year	Sea Cucumber Management Area	Statistical Area	Subarea	Comments	Quota (t)
1991	Inside Waters	18,19,20	all subareas		150
	West Coast V.I.	25,26,27	all subareas		150
1992	Inside Waters	12 and 13	all subareas		55
	West Coast V.I.	23 24	all subareas 24-1 to 24-5 ,24-10, and 24-12 to -14		55
1993	Inside Waters	18 and 19	all subareas		27.5
	West Coast V.I.	26 and 27	all subareas		27.5
1994	Inside Waters	13A <sup>1</sup> 16 and 17	13-14 to 13-23 all subareas	Overage in 1992 resulted in a closure in 1994.	Closed
	West Coast V.I.	23 24A <sup>2</sup>	all subareas 24-6 and -8 to -12		
1995	Inside Waters	12 13B	all subareas 13-12, -24 to -43		27.5
	West Coast V.I.	24B 25	24-7 all subareas		27.5
1996	Inside Waters	18 and 19	all subareas		
	West Coast V.I.	26 and 27	all subareas	Less 13.5 t overage in 1993.	14
1997	Inside Waters	13A 16 and 17	13-14 to 13-23 all subareas		27.5
	West Coast V.I.	23 24A	all subareas 24-6 and -8 to -12		27.5

Table 3.3.6. Sea cucumber area quotas and fishing times, 1990 - 1993.

Area Description	Year	Statistical Areas	Quota <sup>1</sup> Tonnes	# Pieces	Opening Date	Closing Date	# Days Fishing	Total Landings <sup>2</sup> (t)	Converted to Round Wt <sup>3</sup>
<b>SOUTH COAST</b>									
West Coast Vancouver Is.	1990	20 to 27	150	236,250	Jan 1	Jan 15	15	181	
	1991	25 to 27	150	236,250	Jan 14	Jan 25	12	97	265
	1992	23 and 24	55	229,167	Jan 15	Jan 23	9	41	112
	1993	26 and 27	27.5	114,583	Feb 2	Feb 3	2	41	112
Inside Waters Vancouver Is.	1990	11 to 13	150	236,250	Jan 1	Jan 12	13	236	
	1991	18 and 19	150	236,250	Jan 14	Jan 26	13	74	202
	1992	12 and 13	55	229,167	Jan 15	Jan 19	5	156	426
	1993	18 and 19	27.5	114,583	Feb 2	Feb 3	2	31	85
<b>NORTH COAST</b>									
Queen Charlotte Is.	1990	1,2E,2W	160	252,000	Jan 1	Feb 17	17	76	
	1991	1,2E,2W	160	252,000	Jan 14	Feb 2	20	71	194
	1992	1,2E,2W	59	245,833	Jan 15	Jan 30	16	68	186
	1993	1,2E,2W	59	245,833	Feb 2	Feb 9	8	80	218
Prince Rupert District	1990	3,4,5	170	267,750	Jan 1	Jan 23	23	154	
	1991	3,4,5	170	267,750	Jan 14	Jan 22	9	117	319
	1992	3,4,5	62	258,333	Jan 15	Jan 18	3.5	85	232
	1993	3,4,5	62	258,333	Feb 2	Feb 4	3	91	248
Central Coast Areas	1990	6 to 10	170	267,750	Jan 1	Jan 8	8	222	
	1991	6 to 10	170	267,750	Jan 14	Jan 17	4	132	360
	1992	6 to 10	62	258,333	Jan 15	Jan 16	2	105	287
	1993	6 to 10	62	258,333	Feb 2	Feb 3	2	91	248

<sup>1</sup> Quotas for North and South Coasts for 1992 and North Coast in 1993 appear less than 1990-91 as they are expressed as split weights, where earlier quotas were expressed as round weights -- note that number of pieces is only slightly changed due to rounding of tonnes.

<sup>2</sup> 1992 and 1993 landings are preliminary.

<sup>3</sup> 1991 and 1992 landings converted (\*2.73) to round weight to compare with previous quotas and landings. Landings for 1990 were reported as round weight.

Table 3.3. 7. Annual sea cucumber landings (tonnes) by South Coast Management Area, 1980 to 1993, as reported on sales slips.

SOUTH COAST MANAGEMENT AREAS																				
Year	East Coast Vancouver Island									West Coast Vancouver Island							Annual Totals <sup>3</sup>			
	11	12	13	14	15	16	17	18	19 <sup>1</sup>	28	29	20	23	24	25	26	27	round	split	
1980/81				8	<.1	15	16	1				6	<.1	<.1				47		
1982	No Landings Recorded																			
1983			239	6		44	13	18	152				1	1	6	47			527	
1984			2	4.8			61	15	30										113	
1985		25	144	25		15	14	45	50		1.6			27					347	
1986		0	45	85	39	84	179	183	162			1.8	4			2.8			786	
1987		135	236	22	77	178	1.7	68	91	50		<.1	36	136	169	89	11		1300	
1988	59	71	143	1	16	15	2.6	226	85	1.3		12	10	444	80	62	114		1342	
1989		60	131					43	28			51	39	143	29	2	31		557	
1990		137	54			1	5	33	6			7		133	29		12		417	
1991								57	17						49		48		476	171
1992 <sup>1</sup>		111	45										3	38					538	197
1993 <sup>2</sup>								21	10							12	29		197	72
Area																				
Totals	59	539	1039	152	132	337	291	725	632	51	2	78	93	922	362	215	245		6646	
Mainland and East Coast Vancouver Island: 3959										West Coast Vancouver Island: 1914										

<sup>1</sup> Preliminary landings from sales slips.

<sup>2</sup> Data incomplete.

<sup>3</sup> Landings through 1991 were reported in round weight, after 1991, weights were split weights. Round weight values for 1991 to 1993 are calculated as 2.73 x split weight.



Table 3.3.9. Annual sea cucumber landings (tonnes) by North Coast Management Area, 1987 to 1992, as reported on sales slips.

Year	NORTH COAST MANAGEMENT AREAS										Annual Totals <sup>3</sup>		
	1	2E	2W	3	4	5	6	7	8	9	10	round	split
1987		19			3.2	5	4.2	376	14			421	
1988		1			18	0.2	120	423	17			580	
1989		117			74	146	70	171	9			587	
1990		73	3	54	43	57	32	190				452	
1991		71		13	22	82	25	107				874	320
1992 <sup>1</sup>		66	2	18		68	51	37	17			704	258
1993 <sup>2</sup>		80			16	75	91					715	262
Area Totals	0	428	5	85	176	433	393	1304	57	0	0	4333	

<sup>1</sup> 1991 preliminary sales slip data combined with harvest logs.

<sup>2</sup> 1992 data incomplete.

<sup>3</sup> Landings through 1991 were reported in round weight, after 1991, weights were split weights. Weights shown for 1991 to 1993 are calculated as 2.73 x split weight.

**Table 3.3.10. Summary of sea cucumber landings (tonnes) by North Coast Management Areas in 1993, as reported on sales slips.**

NORTH COAST MANAGEMENT AREAS												Monthly Totals
Month	1	2E	2W	3	4	5	6	7	8	9	10	
Jan												
Feb		80.0			16.0	74.6	89.7					260
Mar							1.7					2
Apr												
May												
June												
July												
Aug												
Sept												
Oct												
Nov												
Dec												
<b>Area Totals</b>		80			16	75	91					262

## 4.1 CRAB TRAP FISHERIES

M. Joyce and S. Heizer

### 4.1.1. DUNGENESS CRAB

#### 4.1.1.0 Introduction

Dungeness crabs, (*Cancer magister*) are harvested commercially by trap under authority of an R (crab) Licence. In 1991, the Department created a limited entry, area based licence. Fishers were required to choose one of six licence areas, including the offshore area. Starting in 1992, fishers could choose between five licence areas, on an annual basis, and all licensed fishers could fish in the offshore area.

The 1993 catch of 6,292 tonnes (Table 4.1.1) was the largest catch since catches were first recorded in 1951. Despite an increase in catch of 89% over 1992 and 233% over 1991, total value for this fishery only increased by 66% and 123% for 1992 and 1991 respectively. Lower prices were paid in Area A in 1993, while in other areas the price remained average. Effort in 1992 was down by 5% from 1991 (Table 4.1.1). The 1993 catch is 374% above the 1980-89 average of 1,327 tonnes (Table 4.1.2). This increase is due, primarily, to a large increase in catch in Area A, Queen Charlotte Islands.

#### 4.1.1.2.0 Fishery Management

The dungeness fishery is managed primarily by a 165 mm minimum size limit, designed to protect sexually mature male crabs for at least one year prior to harvest. This size is measured at the widest point of the carapace. All traps are required to be fitted with an escape hole of 100 mm to allow undersize crabs to escape. In addition, rigid frame traps with hinged lids must be fitted with a biodegradable cord (#120 untreated cotton twine) on the lid tie down. All other traps without hinged lids must be fitted with a panel laced in with biodegradable cord (called a "rot panel"). These destructive mechanisms are provided to prevent lost traps from continuing to fish. All female crabs must be released. A trap limit of 125 traps per licence was implemented for the Tofino fishery in 1991, to reduce problems of congestion on the fishing grounds.

Crab "R" licences were limited in 1991. The licence eligibility criterion was 15,000 lbs cumulative landings over a three year period from 1987 - 1989. There were 222 eligible licences in 1991 of which 201 were issued. The number of eligible licences, which are subject to continuing appeals, reached 230 at the end of 1993 (Table 4.1.4) of which 221 were issued. The distribution of licences by area for 1990 through 1993 is shown in Table 4.1.4.

The Fraser River area had an extended closure from January to mid-July in 1992 to reduce the harvest of soft shell and undersized crabs. No consensus could be reached on soft shell periods in other licence areas and, as a result, no other soft shell closures were implemented in 1993. Industry agreed to continue to discuss appropriate periods soft shell closures or ring size adjustments for 1994. There were numerous Native food fishery and recreational fishery closures in the North and South Coast areas.

#### 4.1.1.3.0 Catch and Effort

Catch data presented are based on sales slip records. Log book data, which were collected starting in 1990, requires significant review and correction as many errors, missing data and other inconsistencies were found in a separate analysis.

Total landings of 6,292 tonnes are highest on record (Table 4.1.2). Total catch by statistical area is presented in Table 4.1.3. The large increase in catch is attributed to an increase in catch of 1,276% above the 1980-89 average in Area A.

Despite the large increase in catch, the total effort of 17,442 landing days (Table 4.1.1) is slightly down from effort levels for the period 1985 to 1992 and CPUE was, therefore, the highest recorded for the 1980 to 1993 period shown in Table 4.1.1.

#### 4.4.1.4.0 Issues

- a) Subsequent to the 1991 PSARC review of the proposed escape ring size increase from 100 mm to 110 mm, it was announced that the new ring size would become effective in 1992. There was continued concern on the part of the fishermen with regard to the loss of legal crab with the larger ring size. Public meetings were held early in 1992 to discuss the research and rationale for the ring size change. It was agreed to re-sample North Coast crabs as preliminary sampling indicated that this stock might be shorter in length compared to width

than South Coast stocks which would allow larger numbers of legal crabs to exit through the larger escape holes. Due to delays in consolidation, the ring size change was delayed to

1993. In 1993, implementation of the 110 mm rings was again delayed in response to strong lobbying by the crab industry. The Department agreed to investigate the possibility of closures during soft shell periods as an alternative to larger escape holes. No agreement was reached between fishers and DFO on appropriate times for soft shell closures for 1994, therefore, no new closures were implemented. Industry agreed to discuss this issue further in 1994.

- b) Reporting has become an issue of great concern for both log books and sale slips. By June of 1994, six months into the fishery, only 3 of 34 fishers had made any sale slip submission in Area B, (North Coast) and 18 of 31 fishers had submitted sales slips in Area A, (Queen Charlotte Islands). While reporting was better in other licence areas, there is still some without any record of landings.

A review of the log book data base found inconsistencies between sales slips and logbooks and missing log books. Patrols have revealed that many fishers are not completing log books in the time frame required by condition of licence.

- c) A continued concern with the crab fishery is the high incidence of poaching of undersize crabs in both the commercial and recreational fisheries. This problem is somewhat site specific, with the Fraser River and North Coast being the main problem areas.

#### 4.1.2. KING CRAB

The king crab fishery comes under the authority of the R (Crab) Licence. This is a limited entry, area based licence. All king crab are caught in the Queen Charlotte, North Coast or Offshore areas. Fishermen may not fish more than one area per licence. There is no size limit and female king crab may not be retained unless infected by the parasite *Briarosaccus callosus*. All traps must be fitted with biodegradable escapement device to prevent lost traps from continuing to fish.

King crab landings totalled 14,084 kg in 1993 (Table 4.1.5) and consisted entirely of Red King crab in Statistical Areas 3, 5 and 6. Catch and effort are 8% and 42% respectively, lower than

in 1992. King Crab taken in this fishery are from the southern distribution of the Southeast Alaskan stock.

#### 4.4.3. TANNER CRAB

The tanner crab fishery is an unlicensed fishery. A Scientific Licence is required to harvest tanner crab. A moratorium on all Scientific Licences for experimental fisheries was in place for 1993. The catch reflected in Table 4.1.6 in an incidental harvest.

Table 4.1.1 Annual catch and effort for commercial dungeness crab fishery, 1980 - 1993.

Year	No. of Licences	Catch (tonnes)	Effort (landing days)	CPUE (tonne/day)	Value (\$'000)	Price (\$/lb)
1980	343	1,701.0	13,369	0.13	N/A	N/A
1981	366	1,314.5	12,336	0.11	N/A	N/A
1982	352	998.5	12,097	0.08	N/A	N/A
1983	369	957.0	12,987	0.07	3,319.8	1.57
1984	387	1,155.6	15,731	0.07	4,557.7	1.79
1985	362	1,164.1	16,841	0.07	4,719.2	1.84
1986	386	1,319.5	19,559	0.07	5,660.9	1.95
1987	363	1,630.6	19,828	0.08	6,451.6	1.79
1988	331	1,507.9	16,214	0.09	5,945.8	1.79
1989	330	1,518.5	17,738	0.09	6,028.4	1.80
1990	495	2,129.4	19,691	0.11	8,927.0	1.90
1991	217	1,886.4	17,754	0.11	8,341.0	2.01
1992	221	3,333.6	18,468	0.18	11,203.1	1.52
1993	221	6,292.0	17,442	0.36	18,605.5	1.34
<b>Average</b>						
1980-1989	359	1,326.7	15,670	0.09	5,240.5	1.25
1990-1993	289	3,410.4	18,339	0.19	11,769.2	1.69

Source: B.C. Catch Statistics

Table 4.1.2 Dungeness crab landings (tonnes) by Licence Area, 1980 - 1993.

Year	Area A (QCI)	Area B (NCCM)	Area C (GSJS)	Area D (FR)	Area E (WCVI)	Total
1980	901.0	107.0	215.0	252.0	226.0	1,701.0
1981	548.4	126.3	171.7	229.5	238.6	1,314.5
1982	257.3	78.8	127.4	260.5	274.5	998.5
1983	141.6	160.9	141.6	274.0	238.9	957.0
1984	152.3	141.8	277.5	340.9	243.1	1,155.6
1985	166.3	107.6	180.8	352.5	356.9	1,164.1
1986	219.0	98.9	261.0	321.2	419.4	1,319.5
1987	257.6	135.4	230.1	424.3	583.2	1,630.6
1988	378.6	139.6	225.3	456.3	308.1	1,507.9
1989	351.5	237.3	227.6	407.9	294.2	1,518.5
1990	749.7	305.3	300.5	415.3	358.7	2,129.4
1991	443.0	455.2	311.3	320.6	356.3	1,886.4
1992	1,531.6	488.0	368.9	443.0	502.1	3,333.6
1993	4,642.4	437.4	407.9	502.6	301.7	6,292.0
<b>Average</b>						
1980-89	337.4	133.4	205.8	331.9	318.3	1,326.7
1990-93	1,841.7	421.5	347.1	420.4	379.7	3,410.4

## Notes:

1. Area licensing implemented in 1990.
2. Prior to 1988, data includes all species of crab (dungeness, Tanner, long and red rock)
3. Offshore catches included in Areas A and E.
4. Licence limitation implemented in 1991.
5. QCI = Queen Charlotte Islands, NCCM = North Coast and Central Coast Mainland, GSJS = Georgia Strait and Johnstone Strait, FR = Fraser River, WCVI = West Coast of Vancouver Island

## Dungeness Crab Landings

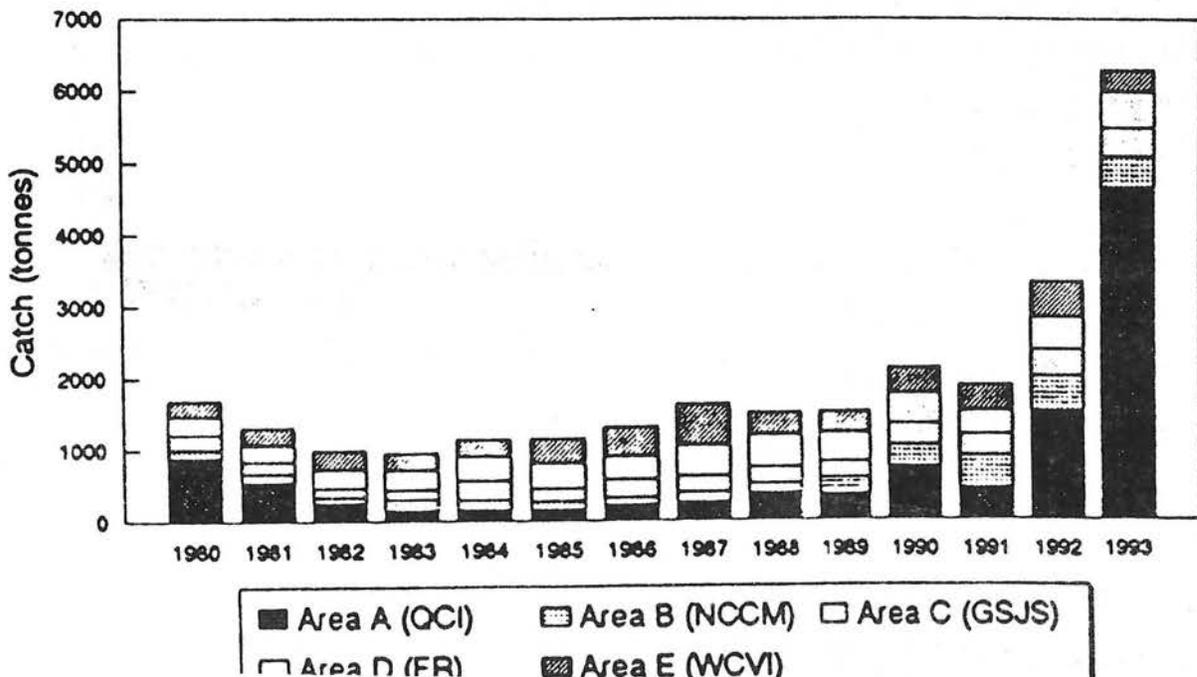


Table 4.1.3 Commercial dungeness crab landings (tonnes) by Area, 1980 - 1993.

AREA	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	TOTAL
1980	773.0	128.0	14.0	59.0	24.0	8.0	0.5	0.5	0.5	0.5	1.0	54.0	2.0	0.5	0.5	2.0	27.0	35.0	93.0	53.0	22.0	2.0	1.0	130.0	9.0	6.0	3.0	19.0	233.0	1,701.0
1981	467.7	60.7	14.0	99.6	6.6	5.5	0.0	0.0	0.3	0.1	0.4	29.3	0.6	0.0	0.1	10.6	14.7	40.2	75.4	35.2	2.0	4.9	3.9	175.1	10.3	4.7	2.5	14.5	215.0	1,314.5
1982	237.2	20.1	1.9	74.9	0.7	0.7	0.1	0.0	0.3	0.2	0.1	27.6	0.7	3.1	0.2	1.1	21.5	23.2	49.9	93.1	2.0	2.1	2.9	156.9	5.8	7.4	4.3	9.5	251.0	998.5
1983	135.6	6.0	8.7	148.6	2.6	2.4	0.1	0.0	0.2	0.3	2.3	38.6	6.9	1.1	0.1	0.3	39.0	26.6	22.3	57.4	5.9	1.2	25.2	136.3	7.1	2.5	3.3	20.6	253.2	957.0
1984	146.2	6.1	22.0	105.6	1.6	2.2	6.5	0.0	3.8	0.1	0.2	74.1	20.2	0.5	1.5	0.1	54.6	52.5	73.6	60.9	1.3	12.0	30.2	109.5	1.9	2.6	4.7	46.0	294.9	1,155.6
1985	180.3	8.0	34.3	65.2	1.0	4.1	2.2	0.0	0.2	0.6	0.5	42.4	2.5	2.1	3.6	0.6	49.6	19.6	59.5	156.3	2.3	4.9	32.0	151.7	3.9	1.1	4.7	26.9	325.6	1,164.1
1986	205.5	13.5	17.8	57.7	11.1	6.3	4.7	0.6	0.3	0.4	0.3	53.7	25.6	5.2	0.9	4.1	30.9	42.6	97.7	113.3	3.6	2.1	20.9	265.0	5.6	3.0	5.9	24.0	297.2	1,319.6
1987	246	11.6	9.1	104.2	4.2	11.2	0.7	2.3	0.6	2.9	1.2	71.6	2.5	0.2	0.9	5.3	20.9	36.2	69.3	92.7	0.4	6.2	9.0	449.2	9.9	3.1	10.7	3.7	420.6	1,630.6
1988	352.4	26.2	53.0	75.9	0.1	7.3	1.4	0.0	1.3	0.6	20.1	76.7	2.5	0.6	2.5	1.0	40.4	31.0	50.4	40.6	1.2	7.5	6.1	227.2	6.0	2.2	17.3	6.3	450.0	1,507.9
1989	343.4	6.1	1.5	197.6	6.6	15.4	4.1	1.6	0.5	9.5	1.5	43.6	10.2	1.5	2.0	6.7	36.2	52.2	73.5	32.5	9.1	7.2	22.6	202.6	12.2	1.7	5.1	5.7	402.3	1,516.5
1990	667.2	62.4	11.4	267.7	10.2	10.6	1.6	0.0	0.0	3.6	2.4	115.0	9.6	0.1	0.1	3.6	27.6	24.7	117.4	74.0	9.4	4.6	4.7	222.6	22.0	6.6	14.3	40.5	374.7	2,129.4
1991	413.5	29.6	33.5	390.0	25.9	2.0	0.7	0.0	0.0	3.0	1.0	131.2	2.3	0.1	1.9	1.3	36.6	30.2	107.5	75.6	13.9	3.0	0.4	222.0	13.1	3.6	24.6	56.1	264.6	1,666.4
1992	1,070.9	461	1.3	405.6	54.2	20.3	2.0	2.0	0.0	2.5	0.2	143.9	16.2	0.0	0.5	1.6	56.5	40.1	109.6	124.6	23.1	6.2	2.7	300.0	20.3	1.2	23.9	40.9	402.1	3,333.6
1993	1,622.0	3,020.4	52.6	201.6	166.5	16.4	0.0	0.0	0.0	0.0	1.3	137.6	7.9	0.0	0.0	4.7	53.5	55.5	147.2	57.1	1.1	7.4	1.2	160.9	17.7	3.2	33.1	33.1	469.4	6,292.0
1980-89	306.7	26.6	17.4	96.6	5.9	6.3	2.0	0.5	0.6	1.5	2.6	51.2	7.6	1.5	1.2	3.2	33.5	36.3	66.5	75.5	5.0	5.2	15.4	200.4	7.2	3.4	6.2	17.6	314.3	1,326.7
1990-93	643.4	696.3	24.6	316.3	64.2	12.4	1.1	0.5	0.0	2.3	1.2	132.0	9.0	0.1	0.6	2.6	43.4	37.6	120.5	62.9	11.9	5.3	2.3	231.4	16.3	3.7	24.0	42.7	377.7	3,410.4

Source: B.C. Catch Statistics

1993 Commercial Crab Landings

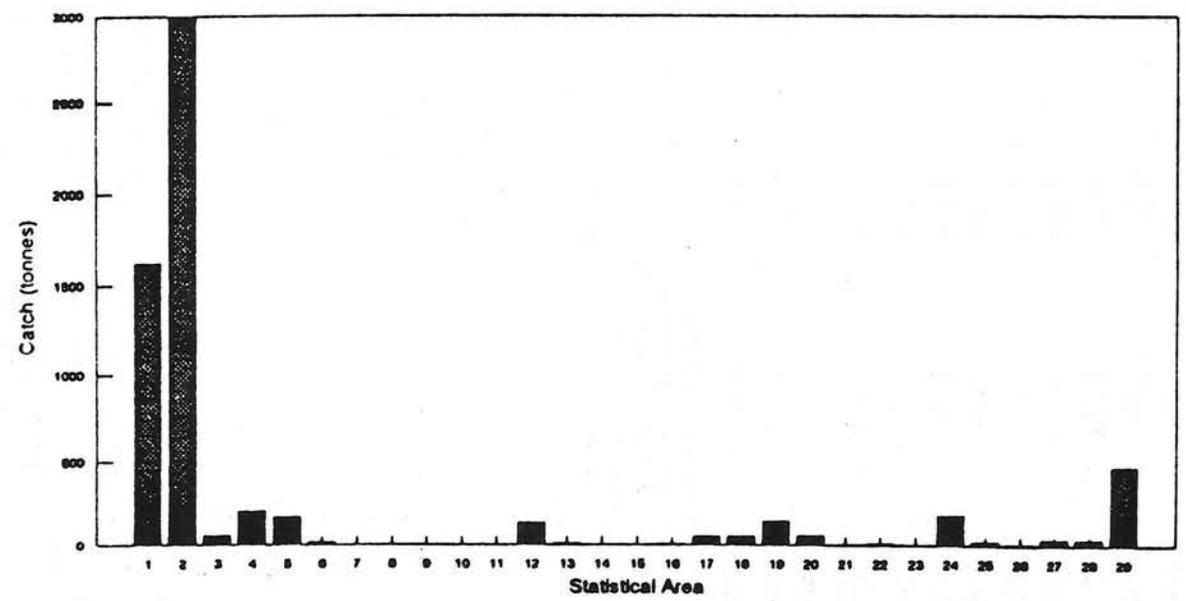


Table 4.1.4 Crab 'R' Licences issued, 1990 - 1994.

LICENCE AREA	1990	1991(1)	1992	1993	1994(3)
A. Queen Charlotte Isl.	29	18	19	25	32
B. N. Coast & Central Coast	83	38	38	38	34
C. Johnstone & Georgia Str.	158	50	53	52	49
D. Fraser River	100	47	42	44	44
E. W. Coast Van. Isl.	122	64	69	62	51
F. Offshore	3	N/A	N/A	N/A	N/A
<b>Total</b>	<b>495</b>	<b>217</b>	<b>221</b>	<b>221</b>	<b>210</b>
Eligible Licences(2)	N/A	222	227	230	226

**Notes:**

1. Licence limitation implemented in 1991.
2. The number of eligible licences is subject to continuing licence appeals.
3. Preliminary data to July 31, 1994

Table 4.1.5 King crab landings (kg) by Area, 1988 - 1993.

Year	Catch by Statistical Area								Total Catch (kg)	Effort (days)	Value (\$)
	010	021	031	040	050	060	120	260			
1988	0	16	2,396	656	0	0	1	0	3,069	116	48,837
1989	650	0	0	151	0	0	0	1,308	2,109	5	38,024
1990	0	0	33,605	904	0	0	0	0	34,509	83	374,404
1991	0	0	20,621	1,872	73	0	0	0	22,566	360	317,156
1992	0	0	10,772	2,732	512	1,291	0	0	15,308	298	180,774
1993	0	0	2,805	0	9,862	1,417	0	0	14,084	172	146,836

Data source- B.C. Catch Statistics

Table 4.1.6 Tanner crab landings (kg) by Area, 1988 - 1993

Year	Catch by Statistical Area						Total Catch (kg)	Effort (days)	Value (\$)
	010	021	031	040	050	060			
1988	0	10	401	8	0	32	451	52	2,233
1989	250	0	0	94	0	0	344	4	1,706
1990	0	0	3,413	0	0	0	3,413	47	16,906
1991	0	0	0	0	0	0	0	0	0
1992	0	0	4,616	0	0	0	4,616	88	12,006
1993	0	0	121	0	298	75	494	8	545

Notes: 1. Source: B.C. Catch Statistics

2. No permits or licences were issued to harvest tanner crab in 1993.

## 4.2 SHRIMP TRAWL FISHERY

B. Adkins

### 4.2.1.0 Introduction

The British Columbia shrimp trawl fishery targets primarily on three species of shrimp: Pandalus jordani (smooth pink), P. borealis (northern pink) and Pandalopsis dispar (sidestripe). Humpback shrimp, Pandalus hypsinotus, and prawns, P. platyceros are caught incidentally or in small quantities in this fishery. Fishing occurs in three major areas; the inshore waters of Vancouver Island including the Strait of Georgia and some mainland inlets, areas off several north coast inlets and off the lower west coast of Vancouver Island. Beam trawls deployed from small vessels are generally used in the inshore fisheries whereas otter trawls and larger vessels tend to fish the offshore areas along the west coast of Vancouver Island where the majority of the catch is reported.

The offshore areas along the west coast of Vancouver Island support stocks of P. jordani that are considered to be the northern extension of a single stock of shrimp that extends from California to mid-Vancouver Island. Because of this shrimp abundance on these grounds has fluctuated widely with landings varying between 5,000 t in 1978 to 225 t in 1980. Since 1987, however, these stocks have recovered and have sustained landings of 2,000 to 3,000 tonnes of shrimp annually from areas commonly known as the "Tofino and Nootka Grounds" (Areas 123, 124 and 125).

A category "S" licence is required for participation in this fishery. This licence was limited in 1978. Currently 249 licences are eligible for this fishery.

The landed value of the shrimp fishery is highly dependant on landings and ex-vessel prices in the Washington, Oregon and California shrimp fisheries which tend to dwarf the British Columbia fishery by comparison. The landed value of the B.C. shrimp fishery has varied between \$2.5 M and \$4.5 M annually since 1987 when this fishery showed a resurgence. In 1992 a glut of shrimp worldwide affected the British Columbia fishery as seen by a lower overall value of this fishery. Preliminary data for 1993 showed an increased value at \$3.3 M (Table 4.2.1). Ex-

vessel prices vary considerably by area. In 1993 average price for shrimp caught was  $\$5.97/\text{kg}^{-1}$  from the north coast areas;  $\$3.26/\text{kg}^{-1}$  from the inside waters of Vancouver Island and  $\$0.84/\text{kg}^{-1}$  from the offshore areas along the west coast of Vancouver Island. These price differentials are due to seasonality of the fishery, competition with foreign product, and the occurrence of sidestripe shrimp and prawns in the inshore fisheries which sell for a higher price than pinks, particularly during the closed time for prawns. Sales slip data do not separate trawl caught shrimp by species hence it is not possible to identify price differential by species composition.

#### 4.2.2.0 Fishery Management

The shrimp trawl fishery is open year round by varying the regulatory closed time by variation order. Some permanent local area closures are in effect and are described in the current management plan. Catches are monitored by sales slips and mandatory vessel harvest logs that have been a condition of licence since 1987. Biological data is collected from research cruises in offshore areas to assess abundance and year-class strengths within the stocks on the Tofino and Nootka grounds. By-catch restrictions have been set to limit the capture of prawns in this fishery as the trawl gear is non size selective.

#### 4.2.3.0 Catch and Effort

A summary of catch and effort for the period of 1982 through 1993 is shown in Table 4.2.1 and catch by management area and geographic region for the same period are shown in Tables 4.2.2 and 4.2.3. Preliminary data for 1993 showed that 164 vessels reported landings of 3,218 tonnes on sales slips for a total landed value of \$3.4 M. This represented a 29% increase in landings over that of 1992. In 1993 90% of the trawl caught shrimp were harvested from the offshore areas. As predicted from the 1992 offshore survey results, most of this catch (57%) came from the Nootka grounds. CPUE estimated from sales slip data varied between 0.4 and 0.5 tonnes@vessel-day<sup>-1</sup> between 1987 and 1992. Preliminary data for 1993 showed CPUE at 0.58 tonnes@vessel-day<sup>-1</sup>, the highest value on record since the resurgence of this fishery in 1987 (Table 4.2.1).

North coast landings have been variable and between 16 and 120 tonnes annually since 1982. Preliminary landings for 1993 show a 27% decrease from the landings reported in the north coast in 1992 (Table 4.2.2). Shrimp landings from the east coast of Vancouver Island have ranged between 160 and 320 tonnes annually

since 1982 with the majority of the catch being landed in Areas 14 and 29. In 1993 there was a 26% increase in catch from area 14 over that of the previous year but no change in the landings of shrimp reported from Area 29 (Table 4.2.3). Total landings from areas on the east coast of Vancouver Island was 309 t in 1993, only slightly less than the 1992 figures.

Tables 4.2.4 and 4.2.5 show 1993 shrimp landings by area and month. although the fishery occurs year-round most of the landings were reported during the period of April through November.

Shrimp harvest log data was not available for this summary.

#### 4.2.4.0 Issues

There are several issues facing the effective management of the shrimp trawl fishery:

1. A biological database needs to be established in order to properly assess shrimp stocks in the inshore areas on the east coast of Vancouver Island and to develop an effective management plan for this fishery.
2. Shrimp catches from the offshore areas along the west coast of Vancouver Island have continued to increase and in 1993 exceeded the 2270 tonne (5,000,000 lb) target that industry and DFO had previously set for an in-season closure. Preliminary information for 1994 indicates that ex-vessel price and landings are both up from the same period in 1993. Closures based on an estimated TAC or catch ceiling for the west coast areas may need to be discussed for 1995.
3. Incidental catches of prawns in the shrimp trawl fishery continue to be a problem particularly in the inshore areas and during the winter closed period of the prawn trap fishery. By-catch allowance of prawns should be readdressed in consultation with the Prawn and Shrimp advisory committees.
4. Delaying the opening of at least a portion of the offshore fishery until May, to take advantage of a spring growth period, would result in an increased yield per recruit and better quality product from the fishery. Although industry has rejected this for economic reasons,

further consideration is warranted considering the increased landings and value of this fishery.

Table 4.2.1 Shrimp landings (tonnes) by trawl, including effort and value from sales slips 1982 to 1993.

Year	Number of Eligible Licences	Number of Vessels with Landings	Fishing Days <sup>1</sup> (10 <sup>-3</sup> )	Shrimp Landings (t)	Total Landed Value <sup>1</sup> (\$10 <sup>-3</sup> )	Whole Landed Value <sup>1</sup> (\$ kg <sup>-1</sup> )	X CPUE <sup>2</sup> (tonnes day <sup>-1</sup> )
1982	249	n/a	4.23	398	863	2.17	0.09
1983	249	n/a	6.68	377	1,014	2.69	0.06
1984	249	n/a	5.61	388	962	2.48	0.07
1985	249	n/a	5.16	662	1,139	1.72	0.13
1986	249	n/a	4.56	729	1,110	1.52	0.16
1987	249	n/a	7.26	2,619	4,525	1.73	0.36
1988	249	n/a	5.89	2,550	3,204	1.26	0.43
1989	249	167	5.37	2,236	2,639	1.18	0.42
1990	249	175	5.08	1,906	2,529	1.33	0.38
1991	249	175	5.68	2,998	4,004	1.34	0.53
1992	249	172	5.41	2,502	2,831	1.13	0.46
1993*	249	164	5.57	3,218	3,377	1.05	0.58

<sup>1</sup> from sales slip data

\* preliminary data

Table 4.2.2 Annual shrimp landings (tonnes), by trawl gear, for North Coast Management Areas, 1982 to 1993 as reported on sales slips.

NORTH COAST MANAGEMENT AREA											Annual Landings
Year	1	2	3	4	5	6	7	8	9	10	
1982	2.6	0.0	1.4	20.3	0.4	0.0	0.0	0.0	0.3	0.0	25.0
1983	1.9	0.5	1.3	11.1	0.4	0.2	0.0	0.0	0.7	0.0	16.1
1984	5.5	0.5	0.5	7.5	8.2	3.4	0.4	0.0	1.0	0.0	27.0
1985	2.5	0.0	1.3	14.2	11.1	0.0	0.0	0.0	0.0	0.0	29.1
1986	0.2	0.0	3.1	21.6	10.5	0.0	0.0	0.0	0.0	0.5	35.9
1987	5.0	1.2	2.2	19.3	5.5	7.5	0.0	0.0	0.1	0.7	41.5
1988	0.0	2.9	2.0	9.1	7.0	1.4	0.0	0.0	1.0	1.7	25.1
1989	0.0	1.4	0.5	17.6	4.6	1.9	1.1	0.0	5.4	6.9	39.4
1990	0.6	0.6	3.0	85.5	7.8	22.2	0.2	0.0	0.0	0.0	119.9
1991	1.0	6.9	0.0	45.9	6.2	0.0	0.7	0.0	0.6	2.6	63.9
1992	2.5	0.5	0.6	49.5	8.8	0.5	3.5	0.0	1.8	4.0	71.7
1993 <sup>1</sup>	2.7	0.3	3.1	35.2	4.0	1.0	0.6	0.9	0.1	4.5	52.4

<sup>1</sup> 1993 preliminary data from sales slips

Table 4.2.3 Annual shrimp landings (tonnes) by South Coast Management Areas 1982 to 1993, as reported on sales slips.

SOUTH COAST MANAGEMENT AREAS												
East Coast Vancouver Island												East Coast Landings (t)
Year	11	12	13	14	15	16	17	18	19	28	29	
1982	0.0	0.4	0.0	18.8	0.0	6.4	20.5	6.1	0.1	53.6	90.6	196.5
1983	0.6	1.2	0.1	25.1	0.0	13.1	68.7	12.8	0.0	26.2	170.1	317.9
1984	0.0	0.5	0.5	27.6	0.0	0.9	88.8	4.5	0.5	78.9	118.2	320.4
1985	0.0	1.2	0.0	32.3	0.0	0.0	58.8	5.1	1	60.2	92.5	250.9
1986	0.0	5.8	3.1	36.2	0.7	1.3	41.4	3.8	1.3	71.0	49.8	214.4
1987	0.0	3.7	0.1	38.4	0.2	5.4	23.5	12.3	1.4	79.9	77.5	242.4
1988	0.0	6.1	0.4	49.6	1.9	0.3	33.1	8.1	3.2	53.2	114.2	270.1
1989	0.0	1.9	0.0	35.3	13.3	1.1	34.9	8.5	4.4	42.2	91.2	232.8
1990	0.0	10.8	0.3	51.4	1.2	0.5	15.2	4.5	0.1	13.9	61.4	159.3
1991	0.0	9.5	0.0	72.7	2.1	0.0	26.7	10.1	0.1	53.9	54.2	229.3
1992	0.1	1.4	23.4	88.8	52.8	0.6	28.8	8.1	0.6	48.6	71.0	324.2
1993 <sup>1</sup>	0.0	1.5	0.8	112.4	39.2	1.4	14.7	5.2	0.1	57.4	76.3	309.0

West Coast Vancouver Island								West Coast Landings (t)	Total Landings (t)
Year	20	22	23	24	25	26	27		
1982	0.5	0.0	34.5	123.0	0.0	0.0	0.0	158.0	354.5
1983	0.0	0.0	31.7	0.0	0.0	0.0	0.0	31.7	349.6
1984	0.0	0.0	38.9	0.9	0.9	0.0	0.0	40.7	361.1
1985	0.0	0.0	304.8	73.1	0.8	0.0	0.0	378.7	629.6
1986	0.2	0.0	287.9	190.3	0.0	0.0	0.1	478.5	692.9
1987	0.9	0.0	281.2	2049.6	1.5	1.2	0.5	2334.9	2577.3
1988	0.0	0.0	276.9	1972.0	2.3	0.0	3.0	2254.2	2524.3
1989	0.0	0.0	309.7	1641.3	8.9	0.0	4.0	1963.9	2196.7
1990	0.0	0.0	302.0	1320.0	4.1	0.0	0.0	1626.1	1785.4
1991	0.0	0.0	967.3	1522.3	187.3	0.0	27.9	2704.8	2934.1
1992	1.6	9.3	148.0	1072.9	849.9	4.9	37.7	2124.3	2448.5
1993 <sup>1</sup>	1.9	15.9	292.5	911.8	1627.2	6.8	1.4	2857.5	3166.5

<sup>1</sup> preliminary data

Table 4.2.4 Summary of shrimp landings (tonnes by North Coast Management Areas and month in 1993, as reported on sales slips.

NORTH COAST MANAGEMENT AREAS											TOTALS					
Month	1	2E	2W	3	4	5	6	7	8	9	10	NORTH COAST (t)	SOUTH COAST (t)	COAST WIDE (t)	ECVI (t)	WCVI (t)
Jan													18	18	7	12
Feb				0.4	0.8							1	109	111	27	82
Mar				0.9	0.8						1.2	3	121	124	35	88
Apr				0.2	13.1	1.3	0.1		0.0	0.0		15	230	245	42	188
May			0.2	1.9	4.0	0.0		0.5	0.3	0.1	1.9	9	387	395	22	384
June	0.2			0.9	3.8	0.3	0.1		0.1		1.4	7	487	494	34	454
July				0.0		0.0	0.1		0.1			0	487	487	36	452
Aug									0.4			0	429	430	1	428
Sept				0.0	0.3		0.5		0.1			1	325	325	16	309
Oct	0.7		0.1		6.3							7	415	422	43	372
Nov					3.0	0.2	0.1					3	118	121	16	101
Dec	1.7			0.0	3.8	0.5						6	39	45	31	8
Area Totals	3		0	3	35	4	1	1	1	0	5	52	3166	3218	308	2857

Table 4.2.5 Summary of shrimp landings (tonnes) by South Coast Management Areas and month in 1993, as reported on sales slips.

SOUTH COAST MANAGEMENT AREAS																			
Month	East Coast Vancouver Island										West Coast Vancouver Island						SOUTH COAST (t)		
	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26		27	
Jan				0.6	1.0		0.9	0.8		3.0	0.5				11.8			18	
Feb			0.6	14.2			2.2	0.7		4.5	4.6		2.7	69.4	10.4			109	
Mar	1.0			16.1	2.5		0.2	0.2		6.6	8.8		6.7	26.6	52.7			121	
Apr				12.9	2.3		1.8	0.1		5.6	19.3		23.2	165.2				230	
May		0.0		4.6	2.2	0.5	1.9	0.7		4.7	7.4		54.1	143.9	165.0		1.4	387	
June		0.0		15.7	7.4	0.5	1.4			3.6	4.9		65.2	111.4	254.3	2.7		487	
July		0.0		15.2			0.0			16.7	3.5		2.0	11.4	108.4	329.7		487	
Aug										0.5	0.6		4.4	18.4	109.8	295.7		429	
Sept		0.4		3.6	6.3		0.4			1.8	3.3		3.3	52.9	57.4	191.4	4.0	325	
Oct				18.6	2.3	0.4	3.7	1.2	0.0	6.1	10.2		4.0	33.9	56.7	277.4		415	
Nov			0.2	5.9	1.8		0.2	0.9		2.7	4.6		0.9	1.8	3.2	62.7	32.8	118	
Dec				4.8	13.3		2.1	0.7	0.0	1.6	8.6		1.0	0.3	0.7		5.5	0.0	36
Area Totals		1	1	112	39	1	15	5	0	57	78		2	16	292	912	1627	7	3168

### 4.3 PRAWN TRAP FISHERY

B. Adkins

#### 4.3.1.0 Introduction

The spot prawn Pandalus platyceros is the largest of six commercial pandalid shrimp species occurring in B.C waters. It occurs at depths varying between the intertidal to 487 m (Butler, 1970). Prawns are caught by traps deployed on long-lines set at variable depths along the shoreline, typically in steep inlet areas.

The prawn fishery occurs primarily in the south coast areas (Areas 11 to 27) where 73% of the annual coast wide catch was reported in 1993. Prior to 1979 no significant landings were reported from the north coast areas, however following exploratory surveys in the north coast during the mid-1970's (Boutillier and Cooke, 1975) the fishery has moved into some northern areas.

A category "W" licence is required for participation in this fishery. This licence was introduced in 1992, following a regulation consolidation, and replace the category "Z-H" licence. Licence limitation came into effect in 1990; currently there are 273 licences eligible for this fishery.

Prawns are landed live and whole or tailed in fresh or frozen form. The live and fresh products are landed generally from day vessels operating in south coast areas which are close to markets. Frozen at sea (FAS) product is produced in all areas by larger freezer vessels, however these vessels generally operate in the more northern areas where delivery to markets is more difficult. A price differential exists between the different products with the live product having the highest value and the FAS and fresh product being as much as \$2.00 per kg less in value, depending on the time of year. Landed values of the FAS product tend to be higher than the fresh product as FAS prawns are considered a better quality product. Almost all FAS prawns are sold into a premium priced export market. Because of price differential, and more limited export market for FAS product, there has been a recent trend in this fishery for more vessels to land a live product. No data is available segregating prawn catch into the various product categories.

The landed value of the prawn fishery increased up to 1989 where it has remained relatively constant at about \$7 to \$8 M annually. Preliminary sales slip data for 1993 showed landed value at \$9.1 M (Table 4.3.1), the highest landed value on record. The whole landed value of prawns also increased up to 1989 where it averaged  $\$9.51/\text{kg}^{-1}$ . Since 1989, however, the whole landed value of prawns has decreased and was  $\$8.31/\text{kg}^{-1}$  in 1993, slightly higher than what it was in 1992. The decrease in whole landed value may be the result of market glutting, as 60% of the annual catch is landed between April and July each year, and the inability of the domestic market to absorb the current level of production. April alone accounts for more than 20% of the annual coast wide catch each year (Tables 4.3.2, 4.3.2a, 4.3.3 and 4.3.3a).

#### 4.3.2.0 Fishery Management

A rapid expansion of the prawn fishery took place in 1979 which resulted in the development of an in-season management system that allowed for a minimum escapement of the spawning cohort within a management area. An index of spawner abundance is obtained by monitoring the age by length-frequency analysis and sex composition of the commercial catch. This index of spawner abundance is then compared to a monthly minimum escapement criterion (Boutillier, 1987). Closures are implemented in management areas, following in-season assessments of the commercial catch, if the estimated index of spawner abundance is significantly less than the monthly minimum escapement criterion. Closures are in place until April 1 of the following year to protect the remainder of the spawning (3<sup>+</sup>) cohort in the management area through to the end of the larval hatching period.

In-season monitoring of the commercial fishery occurs in areas where fishing effort is greatest or in areas where fishermen indicate there are declining catch rates or other concerns. Generally more than 50 vessels are boarded each season in various areas, by biologists to sample the catch by trap. Estimates of standardized CPUE and spawner indexes are used as criteria for closure. Tables 4.3.4, 4.3.4a and 4.3.4b summarize estimated spawner indices by month and management area for 1993 and 1994 to date.

A minimum size limit of 30 mm carapace length came into effect in 1985 in an attempt to reduce growth overfishing by increasing the age of first capture of prawns from 12 to 24

months. Due to difficulties in enforcement, however, this regulation was varied so that it was not in effect until 1988. Size selective modifications to prawn traps became a condition of licence in 1988 to reduce the number of undersize prawns caught.

Since 1984 an annual seasonal closure of the prawn fishery has occurred in all south coast areas for the period of approximately January 1 to March 31 inclusive. This closure was initially in response to low spawner indexes in several of the most productive areas which resulted in closures and a shift in effort to the less productive areas and further declines in index. Since 1988 a coast wide seasonal closure (January to March) has been in effect as the south coast seasonal closure caused shifts in effort to the more northern areas where monitoring was not possible during winter months. In 1993 the south coast was closed December 6 as a result of low and declining spawner indices in assessed areas, in-season closures of some of the most productive areas and effort shifts and gear concentrations into the lesser productive areas. All north coast areas were closed by December 9. This was the earliest date the annual winter closure was put into effect, and was the result of increased levels of effort, particularly early in the season in most areas.

Since 1985 four south coast inlet areas have been managed as discrete areas with management plans including delayed openings and trap limits derived through consultation with local area fishers. Up to 1992 these areas were designated study areas and were used to develop and evaluate alternate management scenarios that would allow optimum utilization of the resource. In 1992 these areas were removed from the study area status but continue to be managed as discrete units.

In the north coast Areas 2E and 2W have been managed as a discrete fisheries since 1989 due to a suspected low carrying capacity and limited stocks in these areas and have been open opened to fishing for the month of April only.

Since 1991 fishers have been required to notify DFO of their prawn fishing activity and their level of effort by area. These data have been used to monitor fleet activity and to identify areas in need of in-season assessment or closure. In addition voluntary logs have been issued to select fishers since 1993 in

some areas to report FAS catch by grade and effort. In-season spawner indexes were estimated from these logs and were included in the in-season assessments of certain areas. These logs, when available, are used extensively in some remote north coast areas to assess the fishery in-season

#### 4.3.3.0 Catch and Effort

A summary of catch and effort for the period 1982 through 1993 is shown in Table 4.3.1 and catch by management area for the period 1980 through 1993 is shown in Tables 4.3.5 and 4.3.6 for the north and south coast areas respectively.

#### 4.3.3.1 Landings

With the exception of 1990, coast wide prawn landings have increased annually since 1982 from 264 t to 1069 t in 1992. Landings for 1991 and 1992 showed the largest annual increments. Preliminary sales slip and log data for 1993 showed coast wide prawn landings of 1,090 t (Table 4.3.1).

Only 27% of the 1993 coast wide prawn landings were reported from north coast areas. North coast landings have been variable and between 70 and 280 t annually since 1981 (Table 4.3.5). The preliminary sales slip data for 1993 showed total landings from north coast areas of 282 t, an increase of 52 t from the 230 t reported in 1992. No prawn landings were reported from the Queen Charlotte Islands in 1993, however slight increases in catch were reported for all other north coast areas (Table 4.3.5).

Since 1983, prawn landings from south coast areas have generally increased annually and were 816 t in 1992. Preliminary sales slip data for 1993 showed south coast landings of 807 t; a slight decrease from 1992 (Table 4.3.6). Historically Area 12 has produced the majority of the prawn catch in the south coast and accounted for 31% of the south coast and 22% of the coast wide landings in 1992. Preliminary data for 1993 showed a decline in prawn landings reported from Area 12 from 256 t in 1992 to 165 t in 1993. Prawn landings reported from Area 12 accounted for only 22% of the total south coast catch and 16% of the coast wide catch. This has occurred despite intensive monitoring and extensive closures in Area 12 since 1989 and may be the result of a weak year-class in the fishery. During 1993 Areas 13 through 17 accounted for the majority of the south coast catch (54%) This was likely related to the increased demand for live product as these areas are all within close proximity to markets.

#### 4.3.3.2 Effort

Effort (number of trap hauls) has increased annually in the prawn fishery since 1983, from 1.6 M to more than 4.1 M trap hauls in 1992 (Table 4.3.1). The number of vessels reporting landings of prawns varied from 205 to 306 vessels between 1982 and 1989 but declined to 220 to 230 vessels since 1990 as a result of limited entry in this fishery. Currently 273 licences are eligible to participate in the prawn fishery. The number of trap hauls per vessel increased annually between 1982 and 1989 from approximately 5,000 to 12,000 trap hauls@vessel<sup>-1</sup>. Since licence limitation came into effect in this fishery effort per vessel has continued to escalate and was 15,000 trap hauls@vessel<sup>-1</sup> in 1990 and 18,600 trap hauls@vessel<sup>-1</sup> in 1992. This has largely been the result of discussions on effort control which lead to considerable speculation in this fishery. Effort data for 1993 is incomplete.

#### 4.3.3.3 CPUE

Standardized annual coast wide CPUE (CPUE standardized by trap type) showed a declining trend between 1983 and 1989 but since 1989 has increased and was .413 kg@trap<sup>-1</sup> in 1992 (Table 4.3.1). Preliminary data for 1993 was not available.

#### 4.3.4.0 Issues

Effort control in the prawn fishery remains an important issue. Recommendations from the Prawn Sectoral Committee (PSC) in 1993 were to reconsider trap limitation as a method to control the escalating effort and that this be in place for the 1995 fishery. Area licensing has also been considered as a method to control effort and alleviate early season glutting, although this has largely been rejected by industry.

Technological changes in the prawn fishery over the past two to three years have made it possible for a live market, both foreign and domestic, to develop. Live prawns have the highest value, however, the markets have been limited by early season glutting where fishers are forced to dump prawns on the market at a low value due to the inability of processors to handle large quantities of product. Early closures of a number of areas as a result of increased effort during the early part of the season have had a negative effect on the development of the live market. Methods such as area licensing and trap limitation need to be considered to disperse the annual catch over a longer period of

time in order for the live markets to develop to their maximum potential.

The export market for FAS product which has historically absorbed up to 40% of the annual production of prawns, has shown little variation in ex-vessel price as a result of increased effort during the early part of the season as most of this product can easily be stored for considerable periods with little decrease in product quality. Due to competition from foreign cold water shrimp fisheries, the export market for B.C. spot prawns has become more limited. This has resulted in fewer contracts for FAS product, forcing more fishers into the live and fresh markets.

The current system of management has resulted in shorter fishing seasons and reduced returns from the resource. Export market for FAS prawns affords some fishers the opportunity to sell a significant portion of their production over only a period of a few weeks. The domestic market is over-supplied during the periods of high production, particularly April to July. Higher prices could be obtained by supplying a high quality product throughout the year, however, significant controls on catch and effort would be necessary in order to achieve these goals.

#### References

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- Boutillier, J.A. and K.D. Cooke. 1976. Prawn trap exploration, British Columbia northern and central coast, September 1975 to December 1975. Fish R. Board Can. MS Rep. No. 1388: 134 p.
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Table 4.3.1 Prawn landings (tonnes) and effort for the trap fishery, with total landings and value for all gear types, 1982 to 1993, as reported on sales slips and harvest logs.

Year	Type and Number of Licences Issued	Number of Vessels with Landings	Fishing Days <sup>1</sup> (10 <sup>-3</sup> )	Trap Landings (t)	Total Landings (t)	Total Landed Value <sup>1</sup> (\$10 <sup>-3</sup> )	Whole Landed Value <sup>1</sup> (\$ kg <sup>-1</sup> )	No. of Traps Hauled <sup>3</sup> (10 <sup>3</sup> )	X CPUE <sup>2</sup> (kg trap <sup>-1</sup> )	Standardized <sup>4</sup> X CPUE <sup>2</sup> (kg trap <sup>-1</sup> )
1982	--	218	7.4	264	274	1,633	5.96	--	--	--
1983	567	276	7.9	325	331	1,639	4.95	1,618	0.260	--
1984	693	305	11.5	378	505	3,262	4.58	2,136	0.235	0.387
1985	544	241	10.9	509	514	3,398	6.61	1,969	0.260	0.402
1986	551	227	10.7	543	550	3,768	6.85	2,089	0.261	0.350
1987	698	236	13.6	616	620	3,347	5.40	2,496	0.247	0.319
1988	677	288	13.6	714	720	5,910	8.22	2,887	0.247	0.319
1989	901	360	17.7	805	820	7,796	9.51	3,665	0.216	0.282
1990	249	234	15.3	757	761	7,006	9.20	3,284	0.231	0.305
1991	261	230	19.7	954	961	7,728	8.04	3,493	0.247	0.318
1992	263	220	19.1	1,056	1,069	8,458	8.02	4,098	0.313	0.413
1993*	257		17.3	1,046	1,090	9,081	8.33			

<sup>1</sup> from sales slip data

<sup>2</sup> from harvest log data

<sup>3</sup> calculated from total landings (sales slips + harvest logs)/CPUE

<sup>4</sup> standardized to trap type

\* preliminary data

Table 4.3.2 Summary of prawn landings (tonnes) by North Coast Management Areas and month in 1993, as reported on sales slips

NORTH COAST MANAGEMENT AREAS												TOTALS				
Month	1	2E	2W	3	4	5	6	7	8	9	10	NORTH COAST (t)	SOUTH COAST (t)	COAST WIDE (t)	ECVI (t)	WCVI (t)
Jan													0	0	0	
Feb																
Mar																
Apr			2.5		3.9	9.8	10.6	9.2	9.4	3.5		40	171	219	152	18
May			3.9		6.2	9.1	19.3	4.0	4.5	7.8		55	164	219	143	21
June			1.0	0.2	8.3	14.1	14.7	8.6	6.2	2.5		56	111	167	102	10
July			0.3		2.9	0.4	10.7	6.1	3.1	0.5		24	100	124	84	16
Aug							8.2	0.3	5.2	0.9		15	57	72	50	7
Sept			1.6		5.1	2.9	3.1	2.9	2.2	0.1		18	58	78	52	6
Oct			1.1		4.0	9.2	21.9	3.2	7.8	4.7		52	79	131	63	15
Nov					4.5	1.8	2.2	3.1				12	21	33	11	10
Dec			0.3		1.1	0.7	0.7					3	3	6	3	1
Area Totals			11	0	36	48	91	37	38	20		282	785	1046	661	104

Table 4.3.2a Summary of prawn landings (tonnes) by South Coast Management Areas and month in 1993, as reported on sales slips.

SOUTH COAST MANAGEMENT AREAS																			
East Coast Vancouver Island											West Coast Vancouver Island							SOUTH COAST (t)	
Month	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27		
Jan						0.4												0	
Feb																			
Mar																			
Apr	1.6	68.1	15.1	7.4	27.6	26.3	4.5	1.8	0.0				3.3	0.8	1.9	4.6	7.6	171	
May	3.6	58.0	15.6	7.1	26.3	26.0	4.8	1.6			0.3		3.2		4.5	2.9	10.1	164	
June	2.2	24.9	10.8	11.4	21.5	25.4	5.3	0.3					1.8		4.8	1.8	1.4	111	
July	2.4	9.4	14.1	8.6	16.4	26.8	5.1	1.0					8.0		3.1	2.1	2.7	100	
Aug		0.4	8.3	6.0	11.0	20.1	3.9	0.4					2.6		0.5	1.7	2.3	57	
Sept		2.6	6.5	4.9	14.6	16.5	3.2	0.4	3.8				1.7		1.2	1.6	1.1	58	
Oct	1.8	1.2	9.1	6.2	17.3	12.8	3.9	3.9	7.1				8.5	0.5	3.8	1.4	1.2	79	
Nov	0.7	0.4	4.4	3.8		1.3		0.1	0.2				3.0		2.1	4.9	0.3	21	
Dec	0.4		0.7	1.0		0.4		0.1					0.3		0.3	0.2	0.0	3	
Area Totals	13	165	85	56	135	156	31	9	11				0	32	1	22	21	27	765

Table 4.3.3 Summary of prawn landings (tonnes) by trap gear, by North Coast Management Areas and month in 1993, as reported on sales slips.

NORTH COAST MANAGEMENT AREAS												TOTALS				
Month	1	2E	2W	3	4	5	6	7	8	9	10	NORTH COAST (t)	SOUTH COAST (t)	COAST WIDE (t)	ECVI (t)	WCVI (t)
Jan													0	0	0	
Feb																
Mar																
Apr				2.5		3.9	9.6	10.6	9.2	9.4	3.5	48	171	219	152	18
May				3.9		6.2	9.1	19.3	4.0	4.5	7.6	55	164	219	143	21
June				1.0	0.2	8.3	14.1	14.7	8.6	6.2	2.5	56	111	187	102	10
July				0.3		2.9	0.4	10.7	6.1	3.1	0.5	24	100	124	84	16
Aug								8.2	0.3	5.2	0.9	15	57	72	50	7
Sept				1.6		5.1	2.9	3.1	2.9	2.2	0.1	18	58	76	52	6
Oct				1.1		4.0	9.2	21.9	3.2	7.8	4.7	52	79	131	63	15
Nov						4.5	1.8	2.2	3.1			12	21	33	11	10
Dec				0.3		1.1	0.7	0.7				3	3	6	3	1
Area Totals				11	0	36	48	91	37	38	20	282	765	1046	661	104

Table 4.3.3a Summary of prawn landings (tonnes) by trap gear, by South Coast Management Areas and month in 1993, as reported on sales slips.

SOUTH COAST MANAGEMENT AREAS																					
Month	East Coast Vancouver Island										West Coast Vancouver Island						SOUTH COAST (t)				
	11	12	13	14	15	16	17	18	19	28	29	20	21	23	24	25		26	27		
Jan						0.4														0	
Feb																					
Mar																					
Apr	1.6	68.1	15.1	7.4	27.6	26.3	4.5	1.8	0.0					3.3	0.8	1.9	4.6	7.8		171	
May	3.6	58.0	15.6	7.1	26.3	26.0	4.8	1.6					0.3	3.2		4.5	2.9	10.1		164	
June	2.2	24.9	10.8	11.4	21.5	25.4	5.3	0.3						1.6		4.8	1.8	1.4		111	
July	2.4	9.4	14.1	8.6	16.4	26.8	5.1	1.0						8.0		3.1	2.1	2.7		100	
Aug		0.4	8.3	6.0	11.0	20.1	3.9	0.4						2.6		0.5	1.7	2.3		57	
Sept		2.6	6.5	4.9	14.6	16.5	3.2	0.4	3.8					1.7		1.2	1.6	1.1		58	
Oct	1.8	1.2	9.1	6.2	17.3	12.8	3.9	3.9	7.1					8.5	0.5	3.6	1.4	1.2		79	
Nov	0.7	0.4	4.4	3.8		1.3		0.1	0.2					3.0		2.1	4.9	0.3		21	
Dec	0.4		0.7	1.0		0.4		0.1						0.3		0.3	0.2	0.0		3	
Area Totals	13	165	85	56	135	156	31	9	11				0	32	1	22	21	27		765	

Table 4.3.4 Annual in-season assessments of spawner index 1993 - South Coast.

Month	Area	S/A	Traps Sampled	Standardized Index	MMI <sup>1</sup>
May	12	-23	37	13.12	5.90
		-26	36	6.60	5.90
		-27	37	12.87	5.90
		-35	53	6.02	5.90
		-40	155	3.22	5.90
		-41	47	3.97	5.90
		-42	38	3.87	5.90
		-43	79	2.2	5.90
		all	482	5.19	5.90
Jun	16	-01	24	2.35	5.40
		-02	18	0.73	5.40
		-10	65	4.98	5.40
		-11	112	3.09	5.40
		-13	47	1.96	5.40
		-16	27	8.24	5.40
		-17	16	1.64	5.40
		all	309	3.50	5.40
Sep	23	-01	32	5.71	4.10
		-02	35	3.95	4.10
		-03	20	2.2	4.10
		all	87	4.19	4.10
Oct	19	-07	70	5.75	3.60
		-08	24	4.61	3.60
		all	94	5.45	3.60
	19	-07	87	1.64	3.60
		-08	60	1.47	3.60
		all	147	1.57	3.60
	15	-01	67	5.89	3.60
		-02	50	2.03	3.60
		-03	73	4.42	3.60
		-05	180	0.69	3.60
		all	370	2.56	3.60
	16	-01	33	0.04	3.60
		-10	24	0.32	3.60
		-11	24	25.00	3.60
		-13	120	0.77	3.60
		-16,-17	111	1.54	3.60
		all	312	2.80	3.60
	17	-12	95	2.33	3.60
		-13	99	2.59	3.60
		all	194	2.46	3.60
Nov	14	-01-02	110	5.39	3.20
		-05	121	6.21	3.20
		all	231	5.28	3.20

<sup>1</sup> Minimum Monthly Index

Table 4.3.4a Annual in-season assessments of spawner index 1993 - North Coast.

Month	Area	S/A	Traps Sampled	Standardized Index	MMI <sup>1</sup>
Oct	6	-14	500	10.60	3.60
		-15	275	10.40	3.60
		-16	220	8.16	3.60
		-17	275	8.16	3.60
		-18	275	7.03	3.60
		-19	266	4.90	3.60
		-20	317	6.33	3.60
		-21	225	4.59	3.60
	7	-09	5550	5.05	3.60
		-14	2047	3.50	3.60
		-15	140	2.89	3.60
		-17	280	4.06	3.60
	8	-07	650	3.40	3.60
	Nov	7	-07	2800	4.71
-11			2100	4.21	3.20
-14			968	2.85	3.20
-17			120	4.90	3.20

<sup>1</sup> Minimum Monthly Index

Table 4.3.4b Annual in-season assessments of spawner index 1994 to date - South Coast.

Month	Area	S/A	Traps Sampled	Standardized Index	MMI <sup>1</sup>	
May	12	-26	143	8.81	5.90	
		-27	27	5.26	5.90	
		-35	79	4.51	5.90	
		-40	107	7.44	5.90	
		-41	35	9.29	5.90	
		-46	44	5.36	5.90	
		all	435	7.16	5.90	
	17	-11	35	9.77	5.90	
	27	-11	12	5.08	5.90	
	Jun	16	-05	23	5.17	5.40
-06			125	12.50	5.40	
-05/-06			148	11.36	5.40	
-11			96	5.95	5.40	
-13			114	4.07	5.40	
-16			153	5.24	5.40	
-17/-18			130	1.83	5.40	
all		493	4.21	5.40		
17		-11	134	4.16	5.40	
27		-07	68	8.38	5.40	
Jul	14	-13	163	4.82	4.90	
		16	-05	25	1.24	4.90
			-06	22	6.00	4.90
			-07	48	4.46	4.90
	all	95	3.97	4.90		
	23	-01	93	2.58	4.90	
		-02	37	9.62	4.90	
		-03	35	2.86	4.90	
		all	165	4.22	4.90	
	Aug	14	-03	16	2.19	4.40
-05			150	4.59	4.40	
-07			29	6.67	4.40	
-13			67	31.94	4.40	
all			262	11.67	4.40	
15		-02	129	11.90	4.40	
		-03	292	5.91	4.40	
		-05	96	5.80	4.40	
		all	517	7.38	4.40	
16		-01	38	3.55	4.40	
		-18	43	2.57	4.40	
		-19	16	12.13	4.40	
		-20	16	7.63	4.40	
		all	113	4.97	4.40	
23		-01	90	2.14	4.40	
		-02	35	4.80	4.40	
	-03	71	1.07	4.40		
	all	196	2.23	4.40		

<sup>1</sup> Minimum Monthly Index

Table 4.3.5 Annual prawn landings (tonnes), trap and trawl gear, by North Coast Management Area 1980 to 1993, as reported on sales slips and harvest logs.

NORTH COAST MANAGEMENT AREA												
Year	1	2	2W	3	4	5	6	7	8	9	10	Annual Landings
1980			1.0	4.0	8.0	2.0	29.0	19.0	24.0	13.0	4.0	104.0
1981	0.3	2.8	0.3	3.9	0.3	1.9	51.2	27.3	23.3	0.5	3.9	115.7
1982		1.6		2.3		0.8	30.2	15.3	12.1	4.4	2.7	69.4
1983		1.1		10.3	3.3	8.2	27.4	35.3	18.1	7.6	4.9	116.2
1984		0.4	0.1	2.3	3.4	7.6	36.5	17.0	14.0	1.6	5.6	88.5
1985	0.3	1.3		14.9	1.1	6.3	15.1	25.2	24.5	6.4	3.6	98.7
1986	0.1	4.1		24.9	3.8	5.4	25.4	21.8	20.5	13.3	7.2	126.5
1987	1.9	1.4	0.1	12.5	8.4	2.1	20.6	41.5	40.0	21.0	9.9	159.4
1988	1.0	3.5	1.1	11.8	20.9	1.4	40.3	81.6	37.8	17.7	17.2	234.3
1989	3.6	0.7	0.5	8.1	12.2	2.1	49.3	69.0	33.5	15.4	24.9	219.3
1990		4.5	0.5	1.7	7.7	0.9	19.7	38.6	19.1	17.0	16.4	126.1
1991	2.0			6.0	19.0	5.0	26.0	47.0	29.0	31.0	25.0	190.0
1992	8.0	1.0	2.0	15.0	7.0	18.0	34.0	69.0	22.0	36.0	18.0	230.0
1993 <sup>1</sup>				10.6	0.2	36.1	47.8	91.4	37.4	39.6	19.9	283.0

\* less than 100 kg

<sup>1</sup> 1993 preliminary data from sales slips

Table 4.3.6 Annual prawn landings (tonnes) by South Coast Management Area 1980 to 1993, as reported on sales slips and harvest logs.

SOUTH COAST MANAGEMENT AREAS																			Annual Landings
East Coast Vancouver Island												West Coast Vancouver Island							
Year	11	12	13	14	15	16	17	18	19	28	29	20	23	24	25	26	27		
1980	2.0	49.0	24.0	13.0	8.0	47.0	33.0	13.0	7.0	26.0	3.0		17.0	1.0	14.0		7.0	264.0	
1981	0.7	39.1	9.8	8.1	7.4	44.2	9.2	9.0	1.8	17.4	5.2		18.0	1.9	29.4	3.1	3.9	208.2	
1982	2.9	32.8	7.9	3.3	3.4	21.7	11.9	5.4	0.3	19.7	5.2	0.8	13.7	6.7	58.8	0.3	7.0	201.8	
1983	6.9	75.3	9.0	12.9	14.5	21.1	10.2	4.7	0.8	25.9	6.9	0.4	10.0		11.3	0.8	1.6	212.3	
1984	8.8	62.5	23.4	11.5	20.3	52.3	21.8	13.7	1.4	22.0	13.2	0.7	21.4	4.5	7.8	2.4	0.9	288.6	
1985	1.6	157.2	30.0	16.7	39.2	59.5	31.0	4.8		31.3	14.9		17.5		5.9	1.4	2.2	413.2	
1986	1.4	158.1	31.2	8.5	54.2	63.2	28.0	3.3	12.4	24.4	10.9	0.2	20.5	2.2	2.8	0.3	1.5	422.9	
1987	15.5	79.6	39.6	10.2	74.6	98.9	21.6	3.5	10.7	36.2	11.8	10.3	23.5	7.9	12.3	1.7	1.0	458.9	
1988	8.2	129.9	33.1	21.2	89.2	62.7	17.5	5.4	8.5	23.5	15.9	8.5	19.4	1.0	22.1	17.2	1.9	485.2	
1989	8.3	112.4	48.6	32.4	87.7	116.5	41.9	7.3	2.7	15.7	15.7	2.2	15.8	0.5	34.5	41.9	16.2	600.3	
1990	3.6	231.2	53.8	26.3	93.3	77.8	33.2	5.6	4.9	12.0	13.7		13.3	3.9	20.3	21.2	16.7	630.8	
1991	12.0	255.0	63.0	38.0	99.0	138.0	37.0	6.0	4.0	22.0	2.0	0.0	25.0	1.0	21.0	11.0	36.0	770.0	
1992	7.0	258.0	69.0	49.0	148.0	103.0	38.0	7.0	14.0	13.0	9.0		24.0	0.3	20.0	30.0	27.0	816.3	
1993 <sup>1</sup>	12.7	166.0	87.6	56.5	135.0	157.0	32.4	9.6	11.2	11.7	23.5	0.0	32.3	1.3	21.9	21.3	26.8	806.8	

<sup>1</sup> preliminary data

#### 4.4. EUPHAUSIIDS TRAWL (MID-WATER) FISHERY 1993/94

B. Adkins

##### 4.4.1.0 Introduction

About twenty species of euphausiids occur in B.C. waters, but biomass is dominated by five: Euphausia pacifica, Thysanoessa spinifera, T. inspinata, T. longipes and T. rashii. Only one or two species contribute significantly to the biomass at any one location. E. pacifica is typically one of the dominants and accounts for 70 - 100% of the euphausiid biomass in the Strait of Georgia where the commercial fishery occurs (Jamieson et al, 1990). Some commercial concentrations of euphausiids have been identified on the west coast of Vancouver Island and near the southern end of the Queen Charlotte Islands (Fulton and LeBrasseur, 1984).

A trawl fishery, largely for E. pacifica, began in the Strait of Georgia in 1970 as an experimental fishery and was licensed under category "Z-F" in 1983. This licence became limited in 1993 for which 25 fishers qualified. Ten vessels reported landings in 1992 and preliminary data for 1993 shows only 1 vessel reporting landings. To date in 1994 three vessels have participated in this fishery.

Most of the euphausiids commercially harvested are frozen for use in the manufacture of fish food. A small portion of the catch is freeze dried and used as aquarium pet food. The whole landed value of euphausiids varied between \$.60 and \$.86 kg<sup>-1</sup> between 1987 and 1992 and was \$.77 kg<sup>-1</sup> in 1993. The total landed value of the euphausiid fishery is comparatively small; \$318,000 in 1992 but only \$41,000 (preliminary data) in 1993 (Table 4.4.1) due to limited markets and lack of participation in this fishery.

##### 4.4.2.0 Fishery Management

Quotas were established in 1976 for the euphausiid fishery due to concerns of harvesting a forage species upon which salmon and other commercially important finfish depend. The annual catch was set at 500 t with an open season from November to March to minimize the incidental catch of larval and juvenile fish.

The quota was estimated to be less than 3% of the annual consumption of euphausiids by all predator species in the Strait of Georgia. An additional 25 t for Howe Sound was added to the quota in 1986. In 1989 the annual quota was increased to 785 t, 500 t for the Strait of Georgia and 20 to 75 t each for several major mainland inlets. In 1990 due to concerns of declining catch rates and potential local overfishing in Jervis Inlet and Howe Sound, the inlet quotas were subtracted from the Strait of Georgia quota resulting in a quota of 215 t for the Strait and a total annual quota of 500 t. In 1991 upon the advice of industry a split season was established to allow fishing in the inlet areas during the period January to March and August 16 through December 31 and in the Strait of Georgia for the period of November through December only. This was modified in 1992, also on the advice of industry, so that the mainland inlets were open as in 1991 but to November 4 only and the Strait of Georgia opened November 4 with a quota of 215 t, as in 1991, plus the balance of the unfished quotas from the mainland inlets. This was to ensure that industry would be more able to harvest the total 500 t quota. Previous to this portions of quotas were left unfished in some of the mainland inlets as it was uneconomic for most fishers to do so. The 1993 quotas were the same as for 1992 with the exception of Loughborough Inlet where the quota was eliminated and added to the Homfray-Price-Lewis (HPL) quota. This was done in consultation with industry as fishers indicated that there were not sufficient stocks in Loughborough Inlet to support a fishery.

Quotas are managed through weekly hauls of catch to fishery managers, as a condition of licence. Compliance to this has been low and quotas in some areas have been exceeded. Prior to 1990 the total annual 500 t quota had never been reached. Limited monitoring of this fishery has taken place by Operations Branch while the fishery has been in progress.

#### 4.4.2.1 Research

Staff from BSB carried out sampling of euphausiid abundance, size composition and catch rates in Jervis Inlet and Malaspina Strait during November 1992 and January 1993. Intercalibration samples were taken in November in the same area that the commercial fishery was occurring. Size distribution and biomass estimates were made using both research samples and samples from the commercial fishery. Results of all samples overlapped well.

Biomass estimates from the commercial samples ranged between 6 and 140 g m<sup>-2</sup> wet wt. and research samples were in the range of

30 g m<sup>-2</sup> wet wt. No decline in stock abundance was evident in January 1993 following the 1992 commercial fishery.

Some industry funded research on biomass and productivity has been carried out in collaboration with BSB. In addition industry is currently conducting research on development of value added products.

#### 4.4.3.0 Catch and Effort

Table 4.4.1 describe catch and effort for the period 1983 through 1993 as reported on harvest logs and sales slips. The number of licences issued for this fishery increased annually from 7 in 1983 to 56 in 1990 then declined to 45 in 1991. In 1993 licence were limited to 25 vessels upon the advice of industry and because the annual quota was being taken by the current fleet. Only one vessel reported euphausiid landings during 1993. Preliminary data for 1994 indicates that three vessels have landed euphausiids to date.

#### 4.4.3.1 Landings

Annual landings of euphausiids increased from 47 t in 1983 to 530 t in 1990. Total catch declined since 1990 to 318 t in 1992 and 41 t in 1993. Preliminary data for 1994 indicates that more than 100 t have been landed to date. Declines in euphausiid landings have been a function of market conditions rather than a decline in stock.

Table 4.4.2 shows annual landings by management area for the period 1983 through 1993 and Table 4.4.3 shows landings by month for 1993, as reported on harvest logs and sales slips. For each year up to 1989, with the exception of 1984, the majority of the catch was taken from Jervis Inlet in Area 16. Since 1990, as a result of the mainland inlet quotas and closer monitoring of the fishery, the fishery moved into inlets in Areas 12 and 13 where significant landings were made. In 1993 no quotas were met due to limited markets and lack of participation in the fishery. To date in 1994 quotas have been reached in Jervis and Toba Inlets which have subsequently closed for the balance of the fishing season. Table 4.4.4 shows landings by quota area and tonnes remaining in quotas for 1994 to the end of August.

#### 4.4.3.2 Effort

Two types of vessels participate in this fishery; smaller freezer vessels whose catches are limited due to freezing capacity and larger vessels which land large quantities of euphausiids for onshore processing and freezing. Catch must be frozen within 24 hrs to avoid a significant deterioration of product and corresponding reduction in quality.

From 1983 to 1987 effort (hours trawling) reported on harvest logs was relatively constant and varied between approximately 300 and 600 hours annually. Since 1988 there was a significant increase in effort to more than 1,400 hours trawled in 1991. Effort has declined since 1991 and was 398 and 88 hours trawled in 1992 and 1993 respectively (Table 4.4.1).

#### 4.4.3.3 CPUE

Catch per unit effort ( $\text{kg@hr}^{-1}$ ) reported on harvest logs has remained relatively constant since 1986 at approximately 300 to 400  $\text{kg@hr}^{-1}$ . During the year of highest effort (1988) CPUE was only 255  $\text{kg@hr}^{-1}$ . The highest catch rates (1,153  $\text{kg@hr}^{-1}$ ) were reported in 1992 as fishers reported fishing extremely dense concentrations of euphausiids in Malaspina Strait during the November opening. CPUE estimated for 1993 was 565  $\text{kg@hr}^{-1}$  (Table 4.4.1). CPUE data do not reflect changes in efficiency through more efficient sounders and improved nets and fishing techniques.

#### 4.4.4.0 Issues

1. The Regional Executive Committee has stated that as a matter of policy the region is not prepared to support developmental fisheries on forage species such as euphausiids. The 500 t quota for the Strait of Georgia and mainland inlets will, therefore, remain fixed.
2. The euphausiid fishery is market limited with the majority of the product being frozen for export to the U.S., where it is used in the production of fish feed. In 1992, as a result of change in the management of the fishery, fishers chose not to fish most of the inlet quotas early in the year and opted to take the combined annual quota from Malaspina Strait in November. Catch rates in the November fishery were exceptionally high as fishers found extremely dense swarms of euphausiids. During that fishery so much product was landed in such

a short period of time that it was not possible to freeze the entire production within an appropriate time. As a result some poor quality and or spoiled product reached the market. In 1993 buyers were reluctant to purchase B.C. euphausiids, hence the fishery did not occur as anticipated. Declines in reported landings during 1993 are not related to stock reduction.

3. Landings of euphausiids during 1994 increased due to renewed market interest in B.C. product. It is anticipated that the fishery will proceed at the pre-1993 levels during the fall opening. Timed openings during period of high production should be considered to ensure a high quality product.
4. Alternate value added products are being examined by industry, to enhance the potential of this fishery. This has been supported by both DFO and the Krill Trawlers Association through changes to the 1994 fishing plan.

#### References

- Fulton J. and R. Lebrasseur. 1984. Euphausiids on the continental shelf and slope of the Pacific coast of Canada. *La Mar* 22: 182-190.
- Jamieson G. S., J. Fulton, D. Mackas, G.A. McFarlane and D. Ware. 1990. Euphausiid Fishery Review re Potential Expansion Concerns.

Table 4.4.1 Euphausiid landings (tonnes) and effort for British Columbia, 1983 to 1993, as reported on sales slips and harvest logs.

Year	Type and Number of Licences Issued	Number of Vessels with Landings	Fishing Days <sup>1</sup>	Quota (t)	Landings <sup>2</sup> (t)	Landed Value <sup>1</sup> (\$10 <sup>-3</sup> )	Whole Landed Value <sup>1</sup> (\$*t <sup>-1</sup> )	Effort <sup>2</sup> (hours)	CPUE <sup>2</sup> (kg hr <sup>-1</sup> )
1983	7 Z-F	2	50	500	47	--	--	333	142
1984	8 Z-F	4	67	500	103	38	400	563	183
1985	5 Z-F	2	65	500	131	28	230	486	270
1986	11 Z-F	2	67	525	166	98	590	475	345
1987	18 Z-F	3	36	525	130	102	780	354	331
1988	24 Z-F	4	11	525	247	191	780	1,427	255
1989	45 Z-F	15	225	785	360	215	600	1,070	306
1990	56 Z-F	17	255	500	530	415	785	1,358	368
1991	45 Z-F	14	152	500	450	391	867	1,120	508
1992	25 Z-F	10	87	500	381	318	835	398	1,153
1993*	18 Z-F	1	29	500	53	41	774	88	565

<sup>1</sup> from sales slip data

<sup>2</sup> from harvest log data

\* preliminary data

Table 4.4.2 Annual Euphausiid landings (tonnes) by Management Area 1983 to 1993, as reported on sales slips and harvest logs.

SOUTH COAST MANAGEMENT AREAS									
Year	12	13	15	16	17	28	29	23	Annual Landings
1983		0.1	0.2	47.0					47.3
1984					93.6	0.3			93.9
1985			1.6	113.4		15.7			130.7
1986				166.0					166.0
1987				130.0					130.0
1988			4.2	243.0					247.2
1989	0.2	0.1	23.8	315.0	2.7	2.5	11.9	3.9	360.1
1990	105.4	53.8	47.1	294.9		8.5	20.8		530.5
1991	21.0	43.2	46.5	339.7					450.4
1992			32.7	348.0					380.7
1993 <sup>1</sup>			19.5	33.1					52.6

<sup>1</sup> preliminary data

**Table 4.4.3 Summary of euphausiid landings (tonnes) by South Coast Management Areas and month in 1993, as reported on sales slips.**

Month	SOUTH COAST MANAGEMENT AREAS							SCOAST LANDINGS
	12	13	15	16	17	28	29	
Jan								0.0
Feb			19.5	1.4				20.9
Mar								0.0
Apr								
May								
June								
July								
Aug								
Sept								
Oct								
Nov				11.2				11.2
Dec				20.5				20.5
<b>Area Totals</b>			<b>19.5</b>	<b>33.1</b>				<b>52.6</b>

Table 4.4.4 Estimated euphausiid landings (tonnes) by quota area January to August, 1994.

Location	Management Area	Quota (tonnes)	Landings <sup>1</sup> (tonnes)	Quota Remaining <sup>1</sup> (tonnes)
Howe Sound	28-01 to - 05	32	2	30
Jervis Inlet	16-11 to -15	53	47	6
Toba Inlet	15-06	20	30	-10
H.P.L. Channels	ptn of 15-05	40	22	18
Bute Inlet	13-20 to -22	55	0	55
Locghborough Inlet	13-42 & -43	0	0	0
Knight Inlet	12-28 to -34	75	0	75
Malaspina Strait	15-01 to -03 & 16-18	215	0	215
Scientific Licence	16-11 to -15	10	1	9
<b>All Areas</b>		<b>500</b>	<b>102</b>	<b>398</b>

<sup>1</sup> Preliminary data.

## 4.5 GOOSE BARNACLE INTERTIDAL FISHERY

S. Heizer

### 4.5.1.0 Introduction

Goose barnacles, Pollicipes spp., are harvested by hand picking in intertidal areas in exposed coastal locations. Chisel-like tools are used to scrape the barnacles from their place of attachment, usually on mussels or other barnacles which are attached to the rocks. A category "Z - 6" licence for fishing without a vessel is required to harvest this species.

Almost all of the harvested barnacles are exported live to Spain or other destinations. This market is limited and has restricted the development of this fishery. The value of this fishery has been relatively minor (between \$200,000 and \$500,000 annually) since 1987. The landed value of the product, however is high; more than \$10 kg<sup>-1</sup> since 1989, and hence has attracted considerable interest in this fishery. The whole landed value of goose barnacles in 1993 was \$10.65-kg<sup>-1</sup>.

### 4.5.2.0 Fishery Management

There are currently no limits in the goose barnacle fishery since most of the stock is not available for harvest due to inaccessible harvest locations or unsuitable size or quality of the barnacles. It was estimated, in 1988, that less than 10% of the stock was available to the fishery. The low portion of the standing stock available for harvest may provide adequate biological protection for the species. Management of this fishery to date has been restricted to data collection through mandatory harvest logs and limiting harvest to hand tools only. Harvesting in some areas may be limited due to PSP or local closure areas.

### 4.5.2.1 Research

Six experimental harvest areas were established, in 1985, to assess the impacts of harvesting on goose barnacle populations (Austin, 1985). These sites were reassessed five years later, in 1991, to determine rates of recolonization and growth of goose barnacles (Austin, 1992). In 1991, six years after the initial

harvest, it was not possible to discriminate harvested from unharvested areas at each site. The size and weight of barnacles harvested in 1991 were comparable but on average less than those harvested from these sites in 1985. Differences in weights were largely attributed to the degree of increased culling of the harvested product in 1991 compared to 1985.

At two of the sites, assessments were also carried out one, two, three and four years following the initial harvest. Differences in recovery rates were noted at each site. At one site there was a significant but varying set of goose barnacles after one year and after three to four years there was no evidence of harvest. At the second site recruitment was lower and more variable. Only after three years was there any significant recruitment to the harvested areas. After four years there were goose barnacles occupying the harvested areas, some of which were of commercial size.

Austin (1992) concluded that the populations of goose barnacles can develop within three years when there is successful recruitment the first year after harvest. Recruitment, however, is variable and likely is not an annual event. Bernard (1988) saw no resettlement during a several year study (1979 to 1986) and suggested that recolonization of harvested areas is a slow process of ecological succession that could take ten or more years.

#### 4.5.3.0 Catch and Effort

A summary catch and effort for the period of 1985 through 1993 is presented in Table 4.5.1. Between 1985 and 1988, the number of licences issued to harvest goose barnacles increased from 9 to 467. Since 1988, there has been a decline in the number of licences issued, with about 105 licences issued in 1993. Prior to 1990, there is no accurate information as to the number of fishers participating in this fishery, as landings were largely reported by buyers and not the harvesters. Since then, however, as a result of more rigorous data collection, catch and effort, data is more complete. Sales slip information for 1992 and 1993 (preliminary) indicates that 39 and 20 licences, respectively, reported landings in those years. The high value of the product and the nature of this fishery, however, has resulted in considerable under-reporting of catch, hence both sales slip and harvest log information for this fishery are incomplete.

#### 4.5.3.1 Landings

There was little change in the landings of goose barnacles reported on harvest logs and sales slips between 1987 and 1992. Landings have varied between 30 t and 50 t during this period and were 38 t in 1992. Preliminary data for 1993 show landings of 20 t. (Table 4.5.1). The majority of the annual catch has been taken from management areas 23 (17%), 24 (35%) and 26 (43%) on the West Coast of Vancouver Island and only minor and periodic landings of barnacles have been reported from the North Coast and other South Coast management areas (Table 4.5.2). In 1993 landings of goose barnacles were reported for each month but with the highest landings reported for the period of June through October (Table 4.5.3).

#### 4.5.3.2 Effort

Effort is measured as fishing days, as reported on harvest logs and sales slips. There is doubt as to the completeness of this information prior to 1990 as it was not possible to cross check harvest logs with sales slips by licence holder. Table 4.5.1 shows that since 1991 effort (number of fishing days on sales slips) has declined. In 1991, 3070 fishing days were reported and preliminary information indicates that 1085 days were fished in 1993 (Table 4.5.1).

#### 4.5.3.3 CPUE

CPUE ( $\text{kg-day}^{-1}$ ) for this fishery is also incomplete up to 1991, as discussed in Section 3.2. From landings reported on harvest logs, CPUE has varied between 34 kg and 41  $\text{kg-day}^{-1}$  from 1985 to 1989 (Table 4.5.1). CPUE for 1990 through 1993 was not available for this report.

#### 4.5.4.0 Issues

Reduction in fishing times in the intertidal clam fisheries, since 1989, has resulted in an increased number of barnacle pickers. Difficulties in storing and transporting the product to market has resulted in product wastage, particularly when inexperienced pickers are attracted to the fishery due to its high value. There is interest among fisherman to form an association to provide advice on the management of this fishery which would alleviate at least some of the product loss.

In 1992 some fishers reported that sales slips were not being issued by buyers at the point of sale and as a result, licences to harvest goose barnacles were being held up pending receipt of catch information. The Department responded to these concerns and issued Section 61 requests to several of the key barnacle buyers during December 1992 and January 1993. Response from some fishers was that sales slips were not being issued regularly at the point of sale as a result of this action.

The Kyuquot Native Band has expressed concerns of stock depletion in some areas in Area 26 and has requested short term closures. Short term closures will not function to build stocks in areas where goose barnacles have been depleted. Closures may have to be for at least three to five years or as long as ten or more years for barnacles to recolonize harvested sites.

Buyers are frequently interested only in number 1 product, and will select out lower quality product. Fishers then discard this 'unmarketable' product. This is wasteful, and also creates underreporting of harvested goose barnacles. This practice may account for declines in reported landing. Since an estimated 10% of the stock is available for harvest, it is unlikely that the stock is in need of conservation measures. There may be, however, local depletions.

#### 4.5.5.0 References

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- Bernard, F.R. 1988. Potential fishery for the gooseneck barnacle Pollicipes polymerus (Sowerby, 1833) in British Columbia. Fish. Res. 6:286-298.

**Table 4.5.1** Gooseneck Barnacle landings (tonnes) and effort for British Columbia, 1985 to 1992, as reported on sales slips and harvest logs.

Year	Type and Number of Licences Issued	Number of Licences with Landings	Fishing Days <sup>1</sup>	Landings <sup>2</sup> (t)	Landed Value <sup>1</sup> (\$10 <sup>-3</sup> )	Whole Landed Value <sup>1</sup> (\$ * kg <sup>-1</sup> )	CPUE <sup>2</sup> (kg da <sup>-1</sup> )
1985	9 Z	--	145	1	1	1.00	--
1986	25 Z	--	77	2	4	2.00	35.9
1987	221 Z	--	798	32	211	6.56	40.5
1988	467 Z	--	1596	49	479	9.78	39.9
1989	130 Z-6	--	713	30	343	11.43	33.6
1990	137 Z-6	49	2278	37	413	11.14	
1991	131 Z-6	30	3070	41	418	10.31	
1992	125 Z-6	39	1878	38	448	11.80	
1993*	105 Z-6	20	1035	20	213	10.65	

<sup>1</sup> from sales slip data

<sup>2</sup> from harvest log and sales slip data

\* preliminary data

Table 4.5.2 Annual gooseneck barnacle landings (tonnes) by Management Area 1985 to 1992, as reported on sales slips.

Year	MANAGEMENT AREAS														Annual Landings
	North Coast					South Coast									
	2	5	7	8	10	11	12	20	21	23	24	25	26	27	
1985															0.0
1986							1.2			0.2	0.2				1.6
1987							0.2	*	*	11.0	18.0	0.5	1.3	0.1	31.1
1988	0.2		0.1	0.1	0.7	0.4	0.5	0.2		6.6	19.0	3.0	17.0	0.9	48.7
1989			0.7	1.2		0.1	0.1			4.9	11.0	0.1	17.0		35.1
1990				0.5						8.0	13.0		15.0	1.0	37.5
1991										9.0	16.0		15.0		40.0
1992				0.2			0.4			2.6	5.7		28.5	0.2	37.6
1993 <sup>1</sup>										0.2	5.8		13.8	0.1	19.9
Totals:	0.2		0.8	2.0	0.7	0.5	2.4	0.2		42.5	88.7	3.6	107.6	2.3	251.5

<sup>1</sup> preliminary data  
 \* less than 100 kg

Table 4.5.3 Summary of gooseneck barnacle landings (tonnes) by South Coast Management Areas in 1993, as reported on sales slips.

Month	SOUTH COAST MANAGEMENT AREAS											Monthly Totals								
	East Coast V.I.						West Coast V.I.													
	11	12	13	14	15	16	17	18	19	28	29	20	21	23	24	25	26	27		
Jan															0.3		2.3			2.6
Feb														0.1	0.2		1.1	0.1		1.5
Mar															0.5		0.7			1.3
Apr															0.1		0.5			0.6
May														0.1	0.3		1.1			1.5
June															0.3		2.0			2.4
July															0.8		1.2			2.0
Aug															0.9		0.9			1.8
Sept															1.0		0.9			1.9
Oct															1.0		1.6			2.6
Nov															0.1		0.9			0.9
Dec															0.3		0.6			0.9
<b>Area Totals</b>														0.2	5.8		13.8	0.1		19.9
<b>Mainland and East Coast Vancouver Is.: 0</b>												<b>West Coast Vancouver Is.: 19.9</b>								
<b>South Coast Total:</b>												<b>19.9</b>								

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Appendix 1. List of Participants 1994

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**Science Branch:**

Sandy McFarlane	Chairperson
Jake Rice	PBS
Jim Boutillier	PBS
Dwight Heritage	PBS
Claudia Hand	PBS
Glen Jamieson	PBS
Alan Campbell	PBS
Rob Kronlund	PBS
Dick Beamish	PBS
Howard Powles	Ottawa

**Fisheries Management:**

Rick Harbo	South Coast Division
Bruce Adkins	South Coast Division
Steve Heizer	South Coast Division
Kerry Hobbs	South Coast Division
Randy Webb	South Coast Division
Marilyn Joyce	Fraser River Division
Greg Thomas	North Coast Division
Ivan Winther	North Coast Division

**External:**

Bill Heath	B.C. - M.A.F.F.
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