

**English Sole Tagging in
Hecate Strait, R/V G. B. Reed,
June 6-24, 1983**

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Numbers 1-25 in this series were issued as Fisheries and Marine Service Data Records. Numbers 26-160 were issued as Department of Fisheries and the Environment, Fisheries and Marine Service Data Reports. The current series name was changed with report number 161.

The correct citation appears above the abstract of each report.

Rapport statistique canadien des sciences halieutiques et aquatiques

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Les numéros 1 à 25 de cette série ont été publiés à titre de Records statistiques, Service des pêches et de la mer. Les numéros 26-160 ont été publiés à titre de Rapports statistiques du Service des pêches et de la mer, Ministère des Pêches et de l'Environnement. Le nom de la série a été modifié à partir du numéro 161.

Le titre exact paraît au haut du résumé de chaque rapport.

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ENGLISH SOLE TAGGING IN HECATE STRAIT,
R/V G.B. REED, June 6-24, 1983

by

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ABSTRACT

Fargo, J., R. P. Foucher, S. C. Shields, and D. Ross. 1984. English sole tagging in Hecate Strait, R/V G.B. REED, June 6-24, 1983. Can. Data Rep. Fish. Aquat. Sci. No. 427: iii + 49 p.

English sole (Parophrys vetulus) were tagged aboard the research vessel G.B. REED in Hecate Strait during June 1983. The primary purpose of the tagging experiment was to validate age determination methods for the species. Tagging took place on 3 major fishing grounds in International Areas 5C and 5D.

A total of 5376 fish were tagged, injected with oxytetracycline (intramuscular) for age validation, and released. Immediate post-tagging mortality for the experiment was estimated at 0.01. Secondary activities included collecting length-weight data for English sole, collecting data on Pacific cod (Gadus macrocephalus) size and age composition, vertical water temperature profiles, vertical and surface plankton tows and sampling bottom sediment types.

Key words: English sole tagging, age validation, temperature profiles, plankton hauls, surficial sediments, types.

RÉSUMÉ

Fargo, J., R. P. Foucher, S. C. Shields, and D. Ross. 1984. English sole tagging in Hecate Strait, R/V G. B. REED, June 6-24, 1983. Can. Data Rep. Fish. Aquat. Sci. No. 427: iii + 49 p.

En juin 1983, des soles anglaises (Parophrys vetulus) capturées dans le détroit d'Hécaté ont été étiquetées à bord du navire de recherche G. B. REED. Cette expérience visait principalement la validation des méthodes de détermination de l'âge de l'espèce. L'étiquetage a été effectué dans trois importantes pêcheries situées dans les zones internationales 5C et 5D.

Au total, 5376 poissons ont été étiquetés, injectés d'oxytétracycline (injection intramusculaire) pour valider l'âge, puis relâchés. On a évalué le taux de mortalité immédiatement après l'étiquetage à 0,01. Les activités secondaires ont consisté en la collecte de données sur la longueur en fonction du poids des soles anglaises et sur la taille et la répartition des âges de la morue du Pacifique (Gadus macrocephalus), en la détermination des profils verticaux de la température de l'eau, des levés verticaux et en surface du plancton et en l'échantillonnage des sédiments.

INTRODUCTION

Age validation is one problem of primary concern to sequential population analyses used as stock assessment tools for English sole (Parophrys vetulus) in Hecate Strait.

Recent innovations in ageing techniques at the Pacific Biological Station (Chilton and Beamish 1982) have indicated a longer life span (d21 yr) for English sole than previously believed. The new ageing techniques have the effect of increasing the number of age groups subject to fishery exploitation, and reducing estimates of natural mortality rates for the species.

New ageing techniques are unvalidated for English sole although they have been validated for other groundfish species using oxytetracycline (OTC) (Chilton and Beamish 1982).

A tagging experiment for English sole was designed to provide validation for ageing techniques using OTC. This report summarizes results of the tagging operation carried out in Hecate Strait June 6-24, 1983, as well as the ancillary projects undertaken.

MATERIALS AND METHODS

VESSEL AND FISHING GEAR

The research vessel G.B. REED was used for the English sole tagging experiment. The net used was a modified Eastern trawl (Fig. 1) with a 33.2-m (109-ft) rubber disc groundline. The net was fished with 64-m (35-fath) sweepnet lines and 635-kg (1400-lb) Brompton doors.

FISHING PROCEDURE

Fishing locations were based on the best catch rates for English sole observed on the April 1983 flatfish survey of Hecate Strait (Fargo et al. 1983), as well as commercial landing statistics. Haul duration was adjusted to obtain an optimum (d 400) number of fish for tagging.

Once the codend was brought aboard, fish were immediately dumped into a large checker flooded with water. English sole in the catch were picked by hand from the checker, placed into plastic tubs (d12 fish/tub) and transferred to two small holding tanks (780-L capacity) and one larger holding tank (1400-L capacity) when necessary. A maximum of \approx 100 fish were placed in each of the smaller tanks while 200-300 fish were held in the large holding

tank. Excess numbers of English sole in the catch were discarded. Estimates of the total catch and species percent composition were made by eye so as not to slow down the tagging operation.

TAGGING

The tag type used was a Floy FD68B (9.5 cm long -- 2.5 cm nylon shank attached to 7.0-cm length of #20 yellow vinyl tubing). The tags were inserted in the mid-body region of the eyed side of the fish midway between the lateral line and dorsal fin.

Each fish selected from the catch for tagging was examined for injuries and, if acceptable, measured fork length to the nearest cm (fish <25 cm were rejected), tagged, injected with oxytetracycline and placed in a recovery tank (1748-L capacity) hinged to the vessel rail. A constant supply of fresh seawater was pumped to the recovery tank via deck hose.

Anesthetic was not used during the course of the experiment.

When the recovery tank's holding capacity was reached (~500-600 fish), tagged fish were released by tilting the recovery tank overboard, dumping tagged fish and holding water simultaneously. This procedure is fully outlined by Harling et al. (1982).

A constant supply of seawater was provided to each holding tank as well as the recovery tank via deck hoses with flow diffusing nozzles. Each holding tank was drained and refilled after each haul when tagging was completed.

OTC INJECTION FOR AGE VALIDATION

Oxytetracycline was injected into tagged English sole to validate age determination. Injections were intramuscular and posterior to the point of tag insertion. This location seemed to minimize loss of OTC after injection.

The dosage of OTC used, .25 cc/kg body wt. was derived from results of a series of laboratory experiments on English sole conducted prior to the tagging. Weight of individual fish was calculated according to the formula $W = 0.0143 L^{2.86}$ where W = grams, L = centimeters, (sexes combined) (unpublished 1979 data). Dosages were assigned to length intervals with homogeneous weights as follows:

<u>Size range (cm)</u>	<u>Dosage (cc)</u>
25-32	0.05
33-38	0.10
39-43	0.15
44-47	0.20
48-51	0.25

OTC was administered using auto-loading pipettes graduated to 0.1 cc. Length intervals on measuring boards were marked with appropriate dosage levels to aid taggers.

PRE-RELEASE MORTALITY

On one occasion, tagged fish were held overnight in the recovery tank to assess immediate post-tagging effects. The next day, all dead fish were removed from the recovery tank, tag numbers recorded and live fish released.

BIOLOGICAL SAMPLING

Upon completion of the tagging experiment a sample of English sole was collected to derive additional length-weight relationships. Each fish was sexed, measured for fork length to the nearest cm and weighed to the nearest gram.

An electronic digimetric scale was used for recording weights (averaged from 10 weighings electronically). All weight measurements were taken at anchor in calm water to minimize effects of vessel roll and engine vibration on weighings.

Length frequencies were collected from incidental catches of Pacific cod during the trip, as well as a stratified sample of fin rays.

OCEANOGRAPHIC SAMPLING

Oceanographic stations were occupied on the trip out as well as the return trip (Fig. 2). Stations were monitored for vertical temperature profiles with XBT.

Plankton samples were collected with a SCOR net with 350 μ mesh used for vertical tows and a neuston sampler with 500 μ mesh used for surface tows. All plankton samples were labelled (Station #, date, location) and preserved in 10% buffered formalin for future processing at PBS.

GEOLOGICAL SAMPLING

A series of tracklines (Fig. 3) were laid out and surficial sediments were sampled at pre-selected intervals with a Shipek bottom grab. Initially, stations were established at 5 M intervals. If bottom type changed

dramatically, additional stations were established. Qualitative data on bottom sediment types was recorded after each grab. Detailed analysis will be undertaken by geologists at the Geo-Science Center, Patricia Bay, B.C.

RESULTS

GENERAL

A total of 26 hauls were made in 3 principal localities in International Areas 5C and 5D (Fig. 3). Principal species caught included:

<u>Species</u>	<u>Estimated wt (kg)^a</u>	<u>% of total catch</u>
English sole	3839	38.1
Turbot	1781	17.7
Halibut ^b	1077	10.7
Dogfish	1032	10.2
Pacific cod	415	4.1
Rex sole	414	4.1
Walleye pollock	352	3.5
Ratfish	213	2.1
Rock sole	205	2.0
Invertebrates	205	2.0
Dover sole	109	1.1
Sablefish	102	1.0
Others ^c	340	3.4
<hr/>		
Total	10,084	100.0

^aBased on an estimated percentage of each species in the total catch of each haul where the weight of the total catch was estimated by the chief scientist.

^bHalibut caught were measured and released.

^cIndividual totals for other species were <1.0% of the total catch.

A detailed summary of haul locations and catch composition is contained in Appendix table 1. Scientific and common names of species caught are listed in Appendix table 2.

TAGGING

A total of 5376 English sole were tagged, injected and released during the tagging experiment. A total of 57 dead fish were removed from the recovery tank and length measurements of 14 tagged fish were not recorded.

Length frequencies of tagged fish by haul are listed in Appendix table 4. A summary of the length frequency of all fish tagged is contained in Fig. 4.

Tag number series used during the experiment were F82039225 - F82041999 and F8297000 - F8299819. A summary of tag numbers by haul is included in Appendix table 3.

Condition of fish at the time of tagging is summarized by tagging area in Table 1. Percent incidence of injuries was highest in the Butterworth area. This was probably because of the large incidental catch of starfish which tended to cause abrasions on fish species in the same hauls.

OTC INJECTION FOR AGE VALIDATION

Loss of OTC after injection was experienced intermittently at the beginning of the tagging experiment. Moving the point of OTC injection posterior to the point of tag implanting seemed to minimize this problem. If the amount of OTC loss after injection was close to the total amount injected, a second injection was made and the loss was not recorded.

PRE-RELEASE MORTALITY

From haul 9, 148 fish were held overnight in the recovery tank to assess post-tagging effects. The following morning the condition of these fish was examined, and all dead fish removed from the tank and their tag numbers noted. The dead fish accounted for 1.4% of the total number of fish kept in the recovery tank. No sluggishness was noted in any of the remaining fish in the recovery tank. Fish bleeding from tag wounds the previous day showed no signs of bleeding after 14 hours.

BIOLOGICAL SAMPLING

A sample collected from Haul 26 in the White Rock area was used to develop length-weight relationships for English sole in that area. Previous length-weight data had been collected for English sole in the Butterworth area.

Standard regression methods (log transformation) were used to fit the data to the equation $W = aL^b$. Predictive formulas were $W = 8.36 \times 10^{-3} L^{3.01}$ for males and $W = 6.13 \times 10^{-3} L^{3.10}$ for females (length in centimeters and weight in grams). Fitted curves are shown in Fig. 5 for males and Fig. 6 for females. Regression formulas previously derived for English sole at Butterworth (1979 sample) were $W = 1.03 \times 10^{-2} L^{2.88}$ for males and $W = 1.02 \times 10^{-2} L^{2.89}$ for females, where weight is in grams and length in centimeters. The Butterworth sample included very few fish >35 cm. Length-weight data summaries for both Butterworth and White rocks samples are presented in Appendix table 5.

Fin rays were collected from 91 Pacific cod (Table 3) and length measurements were taken for 854 fish. Pacific cod is listed in Table 3. Pacific cod length frequencies by haul are contained in Appendix table 6.

OCEANOGRAPHIC SAMPLING

A summary of surface and bottom temperatures by area is contained in Table 2. A detailed summary of vertical temperature profiles by station is listed in Appendix table 7.

GEOLOGICAL SAMPLING

A summary of surficial sediment samples is listed in Appendix table 8. The majority of bottom grabs taken were in the 10-20 fath depth range and bottom sediments were generally shelly sand and sandy gravel interspersed with patches of coral. The trackline scheme proved to fit the bottom dynamics well as few extra grabs needed to be taken.

MISCELLANEOUS

An investigator from the National Museum was aboard to collect marine leeches associated with fish species on the Pacific coast and to collect other marine invertebrate specimens for the museum. A list of scientific and common names for invertebrates captured on the cruise is contained in Appendix table 9. Identifications were made by staff of the National Museum of Natural Sciences in Ottawa, Ontario.

An ornithologist from the Canadian Wildlife Service collected data on abundance and associations of seabirds found on B.C. inshore waters.

A researcher from INPFC was aboard to photograph fish species caught to supplement a publication reviewing marine fishes in the north Pacific Ocean.

PERSONNEL

J. Fargo (i/c)	PBS	June 6-24, 1983
R. P. Foucher	PBS	June 6-24, 1983
Shelley Shields	PBS	June 6-24, 1983
Don Ross	PBS	June 6-24, 1983
Jaqueline Madill	Nat. Museum, Ottawa	June 6-24, 1983
Yves Turcotte	Canadian Wildlife Service	June 6-24, 1983
Shuichi Takehana	INPFC	June 6-19, 1983

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Table 1. Injuries to tagged English sole by locality, R/V G.B. REED, June 6-24, 1983.

Area	No. tagged	% injured by type									Total % injured
		Bleeding	Cut or wound	Dropped	Fin	Scale Loss	Scar	Other	Multiple injuries	Extruded gut	
Horseshoe	836	4.9	0.1	1.4	0.5	1.3	-	0.1	0.4	0.2	8.9
White Rocks, Bonilla	4251	1.7	0.2	1.0	0.8	0.8	0.1	-	0.2	0.5	5.3
Butterworth	346	3.8	-	0.9	2.0	2.3	0.3	-	1.4	-	10.7

Table 2. Water temperature data (XBT) G.B. REED cruise, June 6-24, 1983.

Area	Average bottom depth (m)	Surface temp (°C)		Bottom temp (°C)		n
		min.	max.	min.	max.	
Queen Charlotte Sound	299.6	12.4	14.5	5.0	6.7	10
Hecate Strait	122.1	11.0	14.0	5.6	11.5	8
Dixon Entrance	215	10.5	10.5	6.7	6.7	1

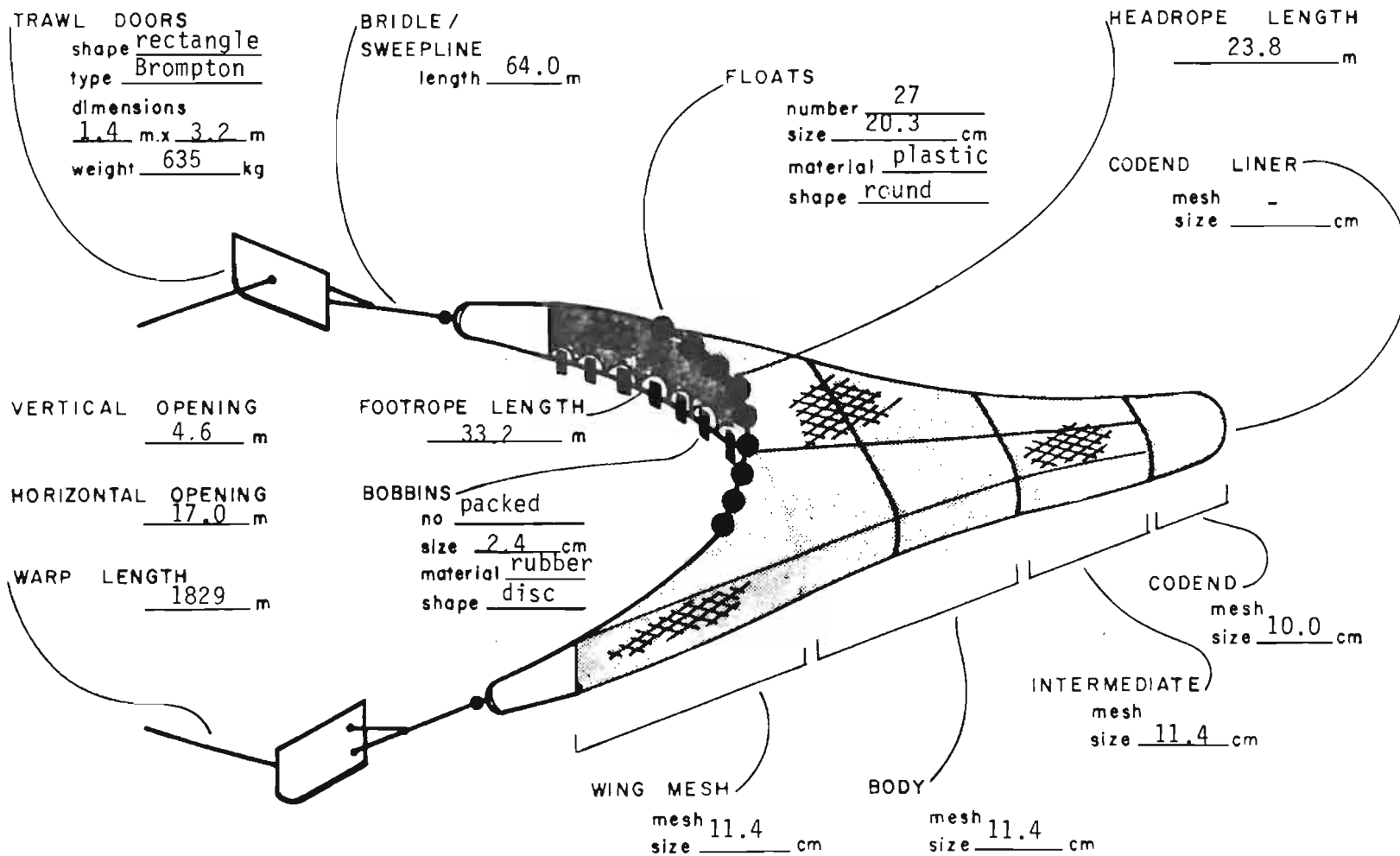
Table 3. Pacific cod sampling summary (fin rays),
R/V G.B. REED, June 6-24, 1983.

Length interval (cm)	No. sampled (fin rays)
20	-
23	-
26	5
29	5
32	5
35	5
38	5
41	5
44	4
47	5
50	5
53	5
56	5
59	5
62	5
65	5
68	3
71	5
74	2
77	2

Fig. 1. NET DIMENSIONS AND CHARACTERISTICS FOR BOTTOM TRAWL

VESSEL G.B. REED NET modified Eastern trawl

OBSERVATION PERIOD June 6-24, 1983



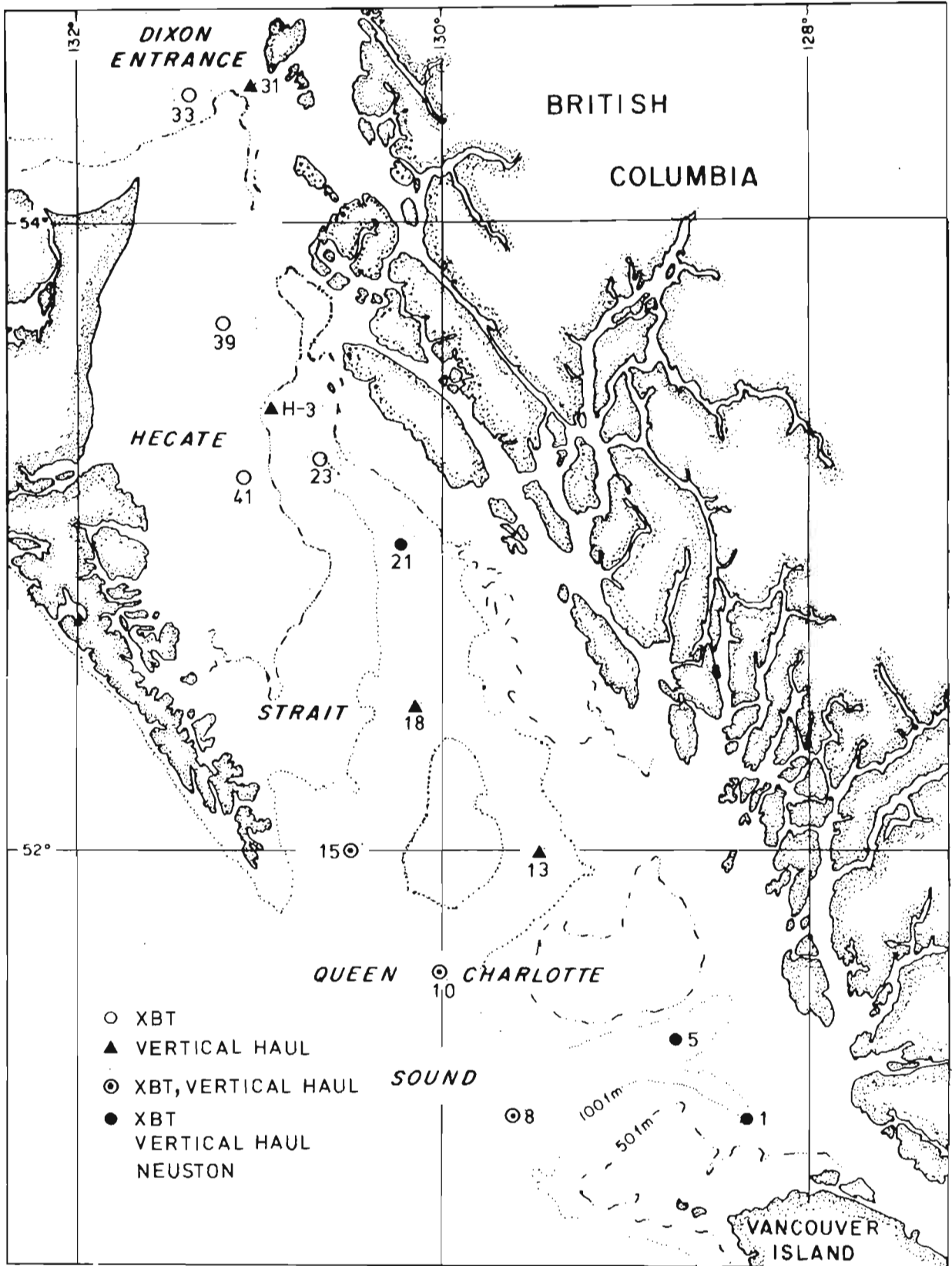


Fig. 2. Oceanographic stations occupied by R/V G.B. REED, June 6-24, 1983.



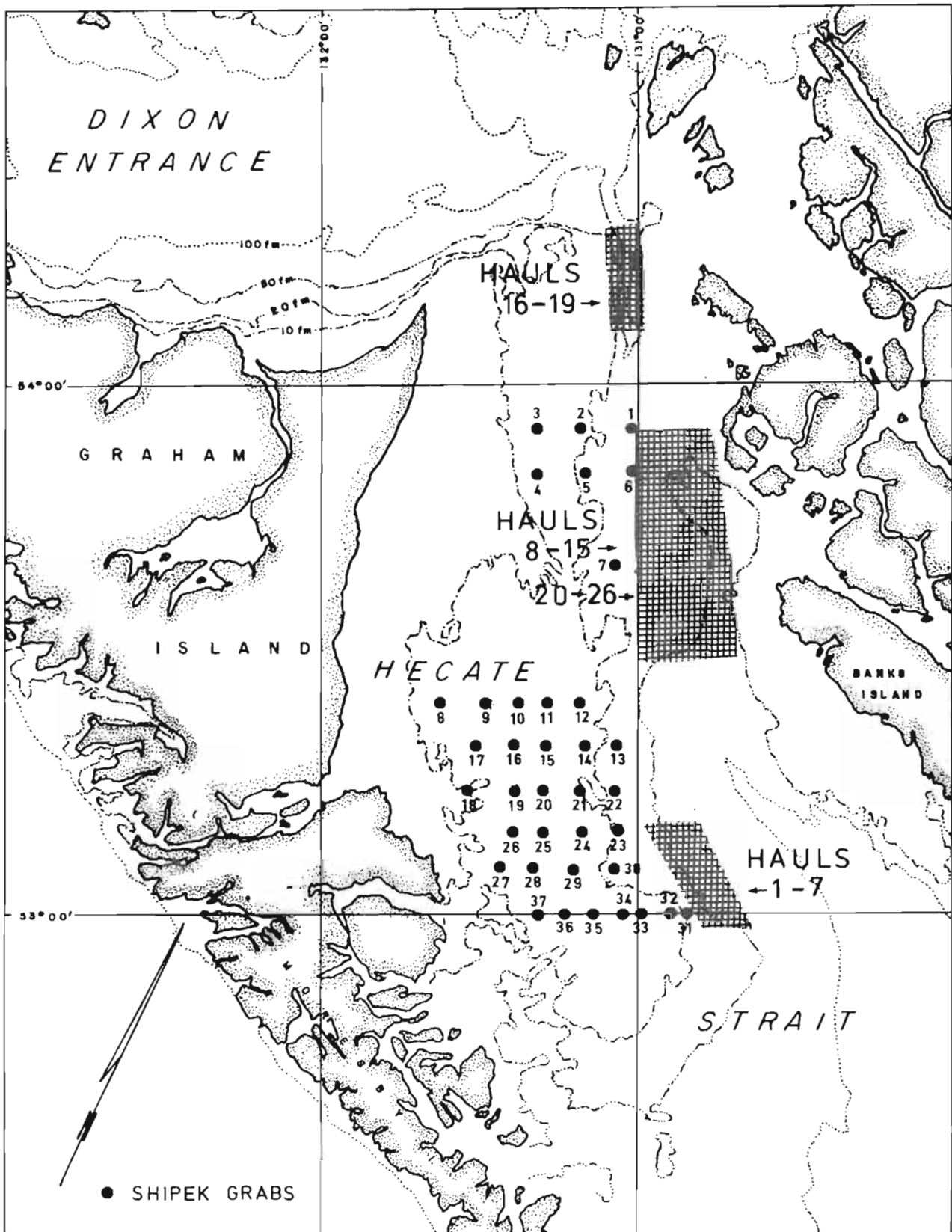


Fig. 3. Tagging locations and Shipek bottom grab tracklines for R/V G.B. REED English sole tagging cruise, June 6-24, 1983.

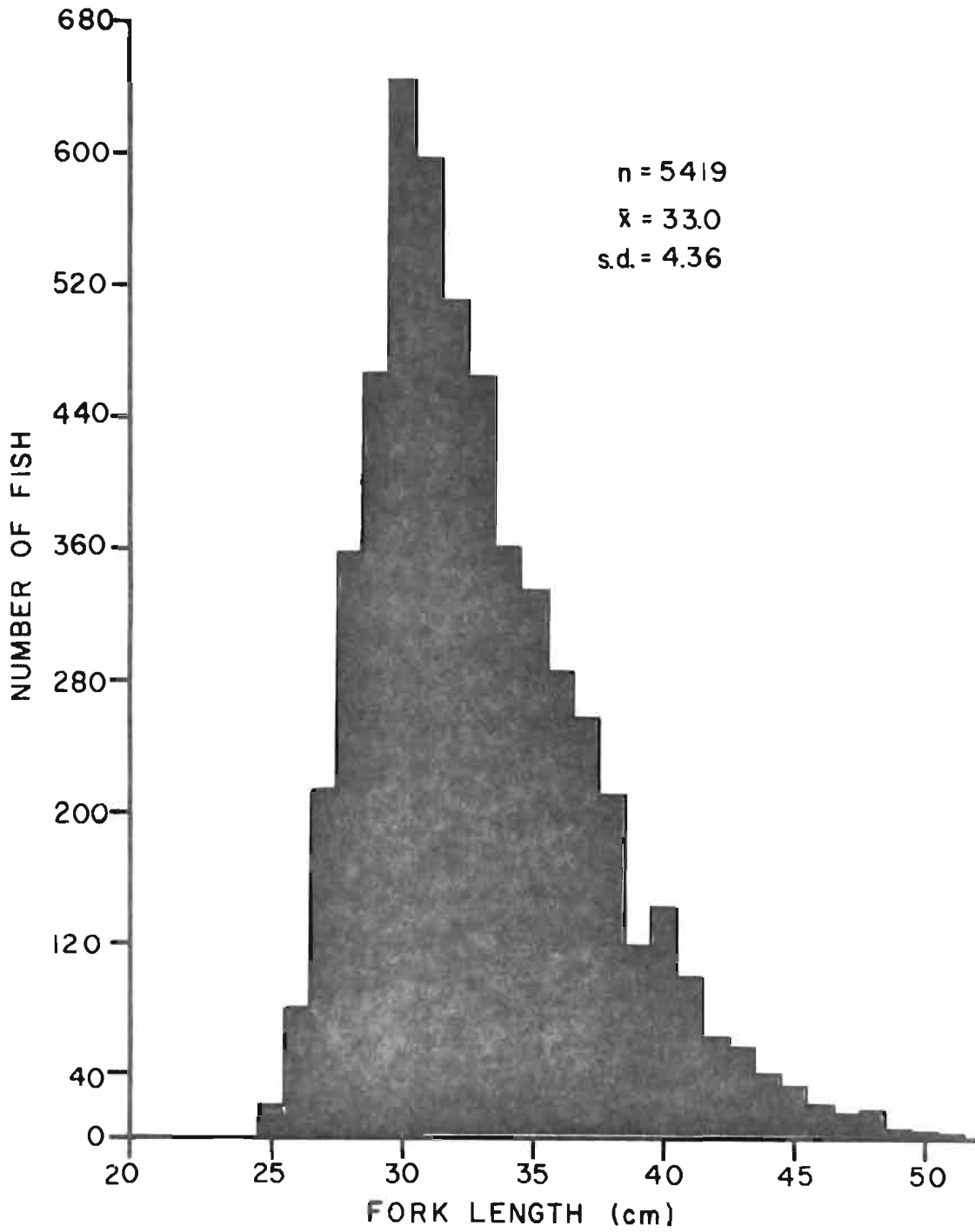


Fig. 4. Length frequency of all tagged English sole, R/V G.B. REED, June 6-24, 1983.

Fig. 5. English sole males length-weight relationship derived from White Rocks locality, R/V G.B. REED, June 6-24, 1983.

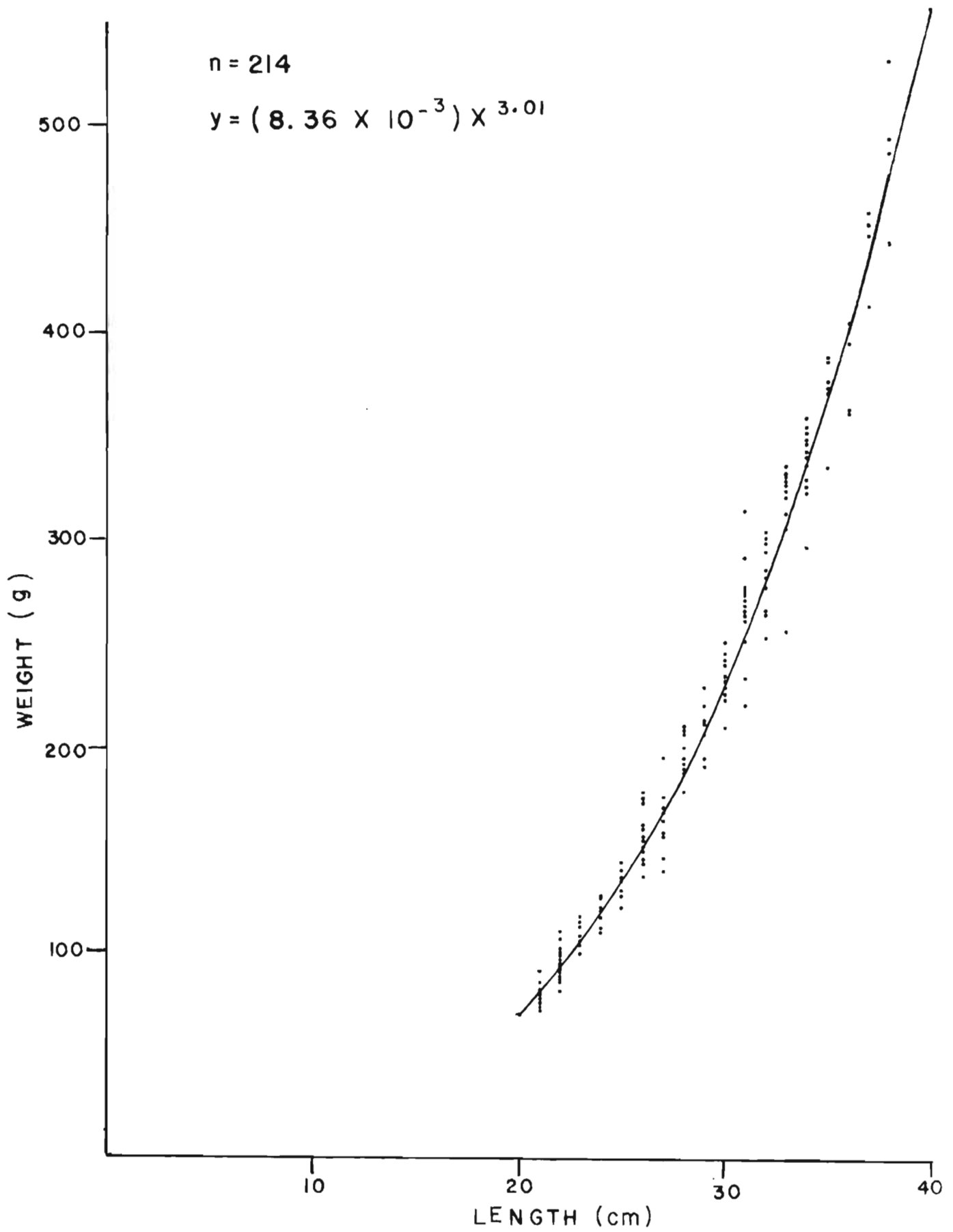
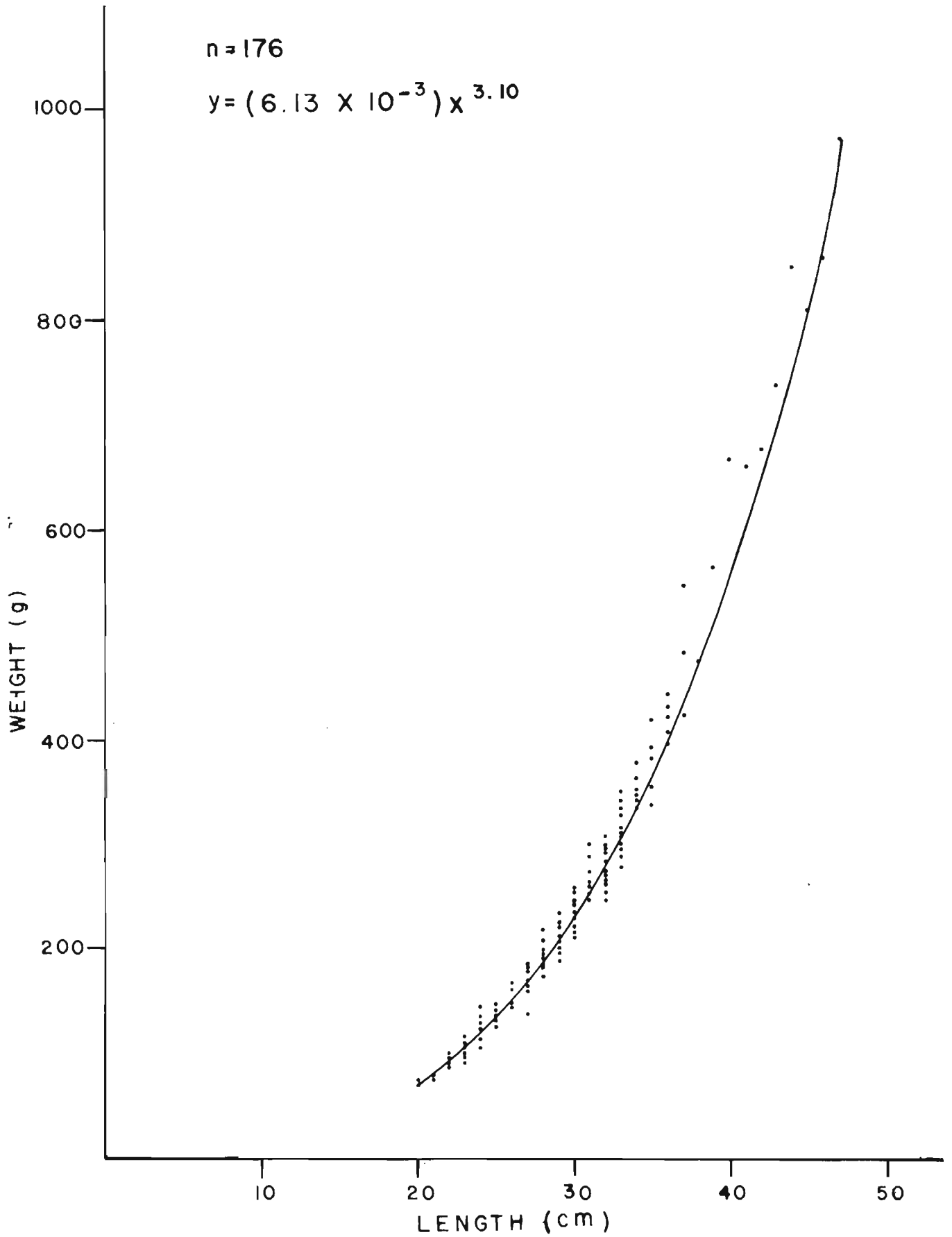


Fig. 6. English sole females length-weight relationship derived from White Rocks locality, R/V G.B. REED, June 6-24, 1983.



Appendix Table 1. Bridge log data, R/V G.B. REED,
Hecate Strait English sole tagging, June 6-24, 1983.

HAUL NO.	1		2	
MAJOR AREA	5C		5C	
MINOR AREA	2B EAST		2B EAST	
DATE	JUNE 09		JUNE 09	
DEPTH MODE F/(M)	51 / (93)		52 / (95)	
DURATION (H)	0.33		0.33	

	START	STOP	START	STOP
TIME	12:42	13:02	15:08	15:28
LAT. (DEG,MIN)	53 00.5	52 59.7	53 00.5	52 59.7
LONG. (DEG,MIN)	130 47.6	130 46.5	130 47.4	130 46
LC-5990-X	12303	12311	12304	12314
LC-5990-Z	30419	30417	30419	30417
DEPTH (F)	51	50	51	52

SPECIES CATCH (KG.)

BUTTER SOLE	-	-
DAB (PACIFIC)	9	27
DAB (SPECKLED)	-	-
DOVER SOLE	-	-
ENGLISH SOLE	109	191
FLATHEAD SOLE	-	27
HALIBUT	7	-
PETRALE SOLE	4	-
REX SOLE	5	27
ROCK SOLE	-	-
TURBOT	-	TRACE
S. ALEUTIANUS	-	-
S. ALUTUS	-	-
S. BREVISPINIS	-	-
S. MALIGER	-	-
S. PAUCISPINIS	-	-
S. PINNIGER	-	-
S. RUBERRIMUS	-	-
HERRING	-	-
LINGCOD	TRACE	-
PACIFIC COD	9	-
PACIFIC TOMCOD	-	-
SABLEFISH	-	-
WALLEYE POLLOCK	-	TRACE
DOGFISH	TRACE	TRACE
RATFISH	TRACE	TRACE
SKATES	-	-
INVERTEBRATES	-	-
TOTAL CATCH (KG.)	143	272
REMARKS	USABLE	USABLE

Appendix Table 1. Bridge log data, R/V G.B. REED,
Hecate Strait English sole tagging, June 6-24, 1983.

HAUL NO.	3	4		
MAJOR AREA	5C	5C		
MINOR AREA	2B EAST	2B EAST		
DATE	JUNE 10	JUNE 10		
DEPTH MODE F/(M)	51 / (93)	51 / (93)		
DURATION (H)	0.30	0.33		
	START	STOP	START	STOP
TIME	8:25	8:43	10:10	10:30
LAT. (DEG,MIN)	53 00.6	52 59.8	53 02.2	53 01.3
LONG. (DEG,MIN)	130 46.8	130 45.9	130 48.5	130 48
LC-5990-X	12305	12323	12286	12294
LC-5990-Z	30419	30418	30423	30421
DEPTH (F)	51	51	52	50
SPECIES CATCH(KG.)				
BUTTER SOLE	-	-	-	-
DAB (PACIFIC)	9	-	TRACE	-
DAB (SPECKLED)	-	-	-	-
DOVER SOLE	TRACE	-	-	-
ENGLISH SOLE	91	-	95	-
FLATHEAD SOLE	TRACE	-	-	-
HALIBUT	15	-	4	-
PETRALE SOLE	TRACE	-	TRACE	-
REX SOLE	36	-	48	-
ROCK SOLE	-	-	-	-
TURBOT	TRACE	-	-	-
S. ALEUTIANUS	-	-	-	-
S. ALUTUS	-	-	-	-
S. BREVISPINIS	-	-	-	-
S. MALIGER	-	-	-	-
S. PAUCISPINIS	-	-	-	-
S. PINNIGER	-	-	-	-
S. RUBERRIMUS	-	-	-	-
HERRING	-	-	-	-
LINGCOD	9	-	TRACE	-
PACIFIC COD	9	-	TRACE	-
PACIFIC TOMCOD	-	-	-	-
SABLEFISH	-	-	-	-
WALLEYE POLLOCK	-	-	-	-
DOGFISH	9	-	16	-
RATFISH	TRACE	-	TRACE	-
SKATES	TRACE	-	-	-
INVERTEBRATES	-	-	TRACE	-
TOTAL CATCH (KG.)	178	-	163	-
REMARKS	USABLE	-	USABLE	-

Appendix Table 1. Bridge log data, R/V G.B. REED,
Hecate Strait English sole tagging, June 6-24, 1983.

HAUL NO.	5		6	
MAJOR AREA	5C		5C	
MINOR AREA	2B EAST		2B EAST	
DATE	JUNE 10		JUNE 10	
DEPTH MODE F/(M)	53 / (96)		53 / (96)	
DURATION (H)	0.33		0.50	
	START	STOP	START	STOP
TIME	12:46	13:06	14:05	14:35
LAT. (DEG, MIN)	53 06.9	53 06.1	53 08.9	53 07.5
LONG. (DEG, MIN)	130 53.1	130 52.7	130 54.3	130 53.9
LC-5990-X	12234.2	12241.4	12214.5	12226.5
LC-5990-Z	30433	30430.5	30436.5	30432.5
DEPTH (F)	53	52	53	52
SPECIES CATCH (KG.)				
BUTTER SOLE	-	-	-	-
DAB (PACIFIC)	-	-	-	14
DAB (SPECKLED)	-	-	-	-
DOVER SOLE	-	-	-	-
ENGLISH SOLE	45	-	82	-
FLATHEAD SOLE	-	-	-	-
HALIBUT	23	-	47	-
PETRALE SOLE	TRACE	-	-	-
REX SOLE	TRACE	-	14	-
ROCK SOLE	TRACE	-	27	-
TURBOT	-	-	-	-
S. ALEUTIANUS	-	-	-	-
S. ALUTUS	-	-	-	-
S. BREVISPINIS	-	-	-	-
S. MALIGER	-	-	-	-
S. PAUCISPINIS	-	-	-	-
S. PINNIGER	-	-	-	-
S. RUBERRIMUS	-	-	-	-
HERRING	-	-	-	-
LINGCOD	-	-	-	-
PACIFIC COD	132	-	-	-
PACIFIC TOMCOD	-	-	-	-
SABLEFISH	TRACE	-	-	-
WALLEYE POLLOCK	-	-	TRACE	-
DOGFISH	27	-	82	-
RATFISH	TRACE	-	TRACE	-
SKATES	-	-	TRACE	-
INVERTEBRATES	-	-	-	-
TOTAL CATCH (KG.)	227	-	266	-
REMARKS	USABLE	-	USABLE	-

Appendix Table 1. Bridge log data, R/V G.B. REED,
Hecate Strait English sole tagging, June 6-24,1983.

HAUL NO.	7	8		
MAJOR AREA	5C	5D		
MINOR AREA	2B EAST	5 UPPER		
DATE	JUNE 10	JUNE 11		
DEPTH MODE F/(M)	53 / (96)	49 / (89)		
DURATION (H)	0.47	0.50		
	START	STOP	START	STOP
TIME	15:31	15:59	8:57	9:27
LAT. (DEG,MIN)	53 09.4	53 08.3	53 30.6	53 29.6
LONG. (DEG,MIN)	130 54.3	130 54	130 52.4	130 54.1
LC-5990-X	12210.5	12208.5	12022.5	12063.5
LC-5990-Z	30437.5	30434	30504.5	30487.5
DEPTH (F)	54	51	48	50
SPECIES CATCH(KG.)				
BUTTER SOLE	-	-	-	-
DAB (PACIFIC)	-	-	-	23
DAB (SPECKLED)	-	-	-	-
DOVER SOLE	-	-	-	-
ENGLISH SOLE	45	-	364	-
FLATHEAD SOLE	-	-	-	-
HALIBUT	9	-	13	-
PETRALE SOLE	-	-	-	-
REX SOLE	-	-	-	46
ROCK SOLE	45	-	23	-
TURBOT	-	-	-	-
S. ALEUTIANUS	-	-	-	-
S. ALUTUS	-	-	-	-
S. BREVISPINIS	-	-	-	-
S. MALIGER	TRACE	-	-	-
S. PAUCISPINIS	-	-	-	-
S. PINNIGER	-	-	-	-
S. RUBERRIMUS	TRACE	-	-	-
HERRING	-	-	-	-
LINGCOD	11	-	-	-
PACIFIC COD	11	-	-	-
PACIFIC TOMCOD	-	-	-	-
SABLEFISH	-	-	TRACE	-
WALLEYE POLLOCK	TRACE	-	-	-
DOGFISH	68	-	TRACE	-
RATFISH	TRACE	-	TRACE	-
SKATES	-	-	-	-
INVERTEBRATES	TRACE	-	-	-
TOTAL CATCH (KG.)	189	-	469	-
REMARKS	USABLE	-	USABLE	-

Appendix Table 1. Bridge log data, R/V G.B. REED,
Hecate Strait English sole tagging, June 6-24, 1983.

HAUL NO.	9		10	
MAJOR AREA	5D		5D	
MINOR AREA	5 UPPER		5 UPPER	
DATE	JUNE 11		JUNE 12	
DEPTH MODE F/(M)	52 / (95)		47 / (85)	
DURATION (H)	0.50		0.33	
	START	STOP	START	STOP
TIME	13:26	13:56	8:27	8:47
LAT. (DEG,MIN)	53 30.3	53 29.3	53 41.2	53 40.2
LONG. (DEG,MIN)	130 52.4	130 54.7	130 46.7	130 46.5
LC-5990-X	12067	12065	12004	12012.5
LC-5990-Z	30491.3	30487	30520.5	30518.5
DEPTH (F)	52	52	45	48
SPECIES CATCH (KG.)				
BUTTER SOLE	-		-	
DAB (PACIFIC)	-		TRACE	
DAB (SPECKLED)	-		-	
DOVER SOLE	-		-	
ENGLISH SOLE	232		228	
FLATHEAD SOLE	-		-	
HALIBUT	6		37	
PETRALE SOLE	19		-	
REX SOLE	8		46	
ROCK SOLE	19		-	
TURBOT	-		TRACE	
S. ALEUTIANUS	-		-	
S. ALUTUS	-		TRACE	
S. BREVISPINIS	-		-	
S. MALIGER	-		-	
S. PAUCISPINIS	-		TRACE	
S. PINNIGER	-		-	
S. RUBERRIMUS	-		-	
HERRING	-		-	
LINGCOD	-		-	
PACIFIC COD	39		46	
PACIFIC TOMCOD	-		-	
SABLEFISH	TRACE		TRACE	
WALLEYE POLLOCK	-		-	
DOGFISH	58		68	
RATFISH	-		23	
SKATES	TRACE		-	
INVERTEBRATES	-		-	
TOTAL CATCH (KG.)	381		448	
REMARKS	USABLE		USABLE	

Appendix Table 1. Bridge log data, R/V G.B. REED,
Hecate Strait English sole tagging, June 6-24, 1983.

HAUL NO.	11		12	
MAJOR AREA	5D		5D	
MINOR AREA	5 UPPER		5 UPPER	
DATE	JUNE 12		JUNE 12	
DEPTH MODE F/(M)	54 / (98)		47 / (85)	
DURATION (H)	0.33		0.33	
	START	STOP	START	STOP
TIME	12:03	12:23	13:48	14:08
LAT. (DEG,MIN)	53 41	53 42.3	53 41.8	53 41
LONG. (DEG,MIN)	130 46.6	130 46.9	130 47.4	130 46.4
LC-5990-X	12008	11997.5	11996	12012
LC-5990-Z	30520	30522.5	30521.5	30520.3
DEPTH (F)	48	60	44	50
SPECIES CATCH(KG.)				
BUTTER SOLE	-		TRACE	
DAB (PACIFIC)	-		TRACE	
DAB (SPECKLED)	-		-	
DOVER SOLE	TRACE		-	
ENGLISH SOLE	127		102	
FLATHEAD SOLE	-		-	
HALIBUT	5		271	
PETRALE SOLE	TRACE		TRACE	
REX SOLE	16		-	
ROCK SOLE	-		TRACE	
TURBOT	32		17	
S. ALEUTIANUS	-		-	
S. ALUTUS	-		-	
S. BREVISPINIS	TRACE		-	
S. MALIGER	-		-	
S. PAUCISPINIS	TRACE		17	
S. PINNIGER	TRACE		-	
S. RUBERRIMUS	-		-	
HERRING	-		-	
LINGCOD	-		-	
PACIFIC COD	TRACE		17	
PACIFIC TOMCOD	-		-	
SABLEFISH	TRACE		TRACE	
WALLEYE POLLOCK	32		TRACE	
DOGFISH	64		-	
RATFISH	16		TRACE	
SKATES	16		17	
INVERTEBRATES	-		-	
TOTAL CATCH (KG.)	308		441	
REMARKS	USABLE		USABLE	

Appendix Table 1. Bridge log data, R/V G.B. REED,
Hecate Strait English sole tagging, June 6-24, 1983.

HAUL NO.	13		14	
MAJOR AREA	5D		5D	
MINOR AREA	5 UPPER		5 UPPER	
DATE	JUNE 12		JUNE 13	
DEPTH MODE F/(M)	52 / (95)		33 / (60)	
DURATION (H)	0.33		0.33	
	START	STOP	START	STOP
TIME	14:55	15:15	8:30	8:50
LAT. (DEG,MIN)	53 41	53 40.1	53 52	54 00
LONG. (DEG,MIN)	130 46.2	130 46.5	131 00.3	131 00.6
LC-5990-X	12012	12014	11864.5	11800
LC-5990-Z	30520.3	30520.4	30534	30550.5
DEPTH (F)	52	51	29	37
SPECIES CATCH (KG.)				
BUTTER SOLE	-	-	-	-
DAB (PACIFIC)	-	-	-	-
DAB (SPECKLED)	-	-	-	-
DOVER SOLE	-	-	-	-
ENGLISH SOLE	75	-	TRACE	-
FLATHEAD SOLE	-	-	-	-
HALIBUT	12	-	225	-
PETRALE SOLE	-	-	-	-
REX SOLE	-	-	-	-
ROCK SOLE	-	-	91	-
TURBOT	75	-	-	-
S. ALEUTIANUS	-	-	-	-
S. ALUTUS	-	-	-	-
S. BREVISPINIS	-	-	-	-
S. MALIGER	-	-	-	-
S. PAUCISPINIS	TRACE	-	-	-
S. PINNIGER	-	-	-	-
S. RUBERRIMUS	-	-	-	-
HERRING	-	-	-	-
LINGCOD	-	-	-	-
PACIFIC COD	TRACE	-	91	-
PACIFIC TOMCOD	-	-	-	-
SABLEFISH	-	-	91	-
WALLEYE POLLOCK	13	-	-	-
DOGFISH	75	-	45	-
RATFISH	-	-	45	-
SKATES	-	-	-	-
INVERTEBRATES	-	-	TRACE	-
TOTAL CATCH (KG.)	250	-	588	-
REMARKS	USABLE	-	USABLE	-

Appendix Table 1. Bridge log data, R/V G.B. REED,
Hecate Strait English sole tagging, June 6-24, 1983.

HAUL NO.	15		16	
MAJOR AREA	5D		5D	
MINOR AREA	5 UPPER		4	
DATE	JUNE 13		JUNE 15	
DEPTH MODE F/(M)	52 / (95)		47 / (85)	
DURATION (H)	0.33		0.50	
	START	STOP	START	STOP
TIME	10:23	10:43	8:21	8:51
LAT. (DEG,MIN)	53 50.4	53 51.3	54 15.7	54 14.7
LONG. (DEG,MIN)	130 56.3	130 57.1	131 04.2	131 03.6
LC-5990-X	11893.5	11882.5	11658	11668.5
LC-5990-Z	30533.5	30535	30579.2	30578
DEPTH (F)	50	54	43	50
SPECIES CATCH (KG.)				
BUTTER SOLE	-		TRACE	
DAB (PACIFIC)	-		-	
DAB (SPECKLED)	-		-	
DOVER SOLE	TRACE		-	
ENGLISH SOLE	18		409	
FLATHEAD SOLE	-		-	
HALIBUT	27		41	
PETRALE SOLE	TRACE		-	
REX SOLE	TRACE		5	
ROCK SOLE	-		TRACE	
TURBOT	91		409	
S. ALEUTIANUS	-		-	
S. ALUTUS	-		-	
S. BREVISPINIS	-		-	
S. MALIGER	-		-	
S. PAUCISPINIS	-		-	
S. PINNIGER	-		-	
S. RUBERRIMUS	-		TRACE	
HERRING	-		-	
LINGCOD	-		TRACE	
PACIFIC COD	9		TRACE	
PACIFIC TOMCOD	-		TRACE	
SABLEFISH	-		-	
WALLEYE POLLOCK	18		TRACE	
DOGFISH	18		136	
RATFISH	18		TRACE	
SKATES	-		TRACE	
INVERTEBRATES	-		205	
TOTAL CATCH (KG.)	199		1205	
REMARKS	USABLE		USABLE	

Appendix Table 1. Bridge log data, R/V G.B. REED,
Hecate Strait English sole tagging, June 6-24, 1983.

HAUL NO.	17		18	
MAJOR AREA	5D		5D	
MINOR AREA	4		4	
DATE	JUNE 15		JUNE 15	
DEPTH MODE F/(M)	55 /(100)		56 /(102)	
DURATION (H)	0.25		0.25	
	START	STOP	START	STOP
TIME	10:40	10:55	13:20	13:35
LAT. (DEG,MIN)	54 13	54 12.3	54 11.3	54 10.5
LONG. (DEG,MIN)	131 03.5	131 03.4	131 03.8	131 04.3
LC-5990-X	11682.5	11689	11695	11700
LC-5990-Z	30574.5	30573.5	30571.5	30569.5
DEPTH (F)	55	55	56	55
SPECIES CATCH(KG.)				
BUTTER SOLE	-	-	-	-
DAB (PACIFIC)	-	-	-	-
DAB (SPECKLED)	-	-	-	-
DOVER SOLE	18	-	91	-
ENGLISH SOLE	55	-	TRACE	-
FLATHEAD SOLE	TRACE	-	TRACE	-
HALIBUT	22	-	20	-
PETRALE SOLE	-	-	-	-
REX SOLE	18	-	46	-
ROCK SOLE	-	-	-	-
TURBOT	18	-	228	-
S. ALEUTIANUS	-	-	TRACE	-
S. ALUTUS	-	-	-	-
S. BREVISPINIS	-	-	TRACE	-
S. MALIGER	-	-	-	-
S. PAUCISPINIS	-	-	-	-
S. PINNIGER	-	-	-	-
S. RUBERRIMUS	-	-	-	-
HERRING	-	-	-	-
LINGCOD	TRACE	-	-	-
PACIFIC COD	9	-	TRACE	-
PACIFIC TOMCOD	-	-	-	-
SABLEFISH	-	-	-	-
WALLEYE POLLOCK	-	-	23	-
DOGFISH	9	-	68	-
RATFISH	9	-	TRACE	-
SKATES	36	-	-	-
INVERTEBRATES	TRACE	-	-	-
TOTAL CATCH (KG.)	194	-	476	-
REMARKS	USABLE	-	USABLE	-

Appendix Table 1. Bridge log data, R/V G.B. REED,
Hecate Strait English sole tagging, June 6-24, 1983.

HAUL NO.	19		20	
MAJOR AREA	5D		5D	
MINOR AREA	4		5 UPPER	
DATE	JUNE 15		JUNE 17	
DEPTH MODE F/(M)	48 / (87)		50 / (91)	
DURATION (H)	0.25		0.33	
	START	STOP	START	STOP
TIME	14:30	14:45	8:32	8:52
LAT. (DEG,MIN)	54 08.9	54 08	53 45	53 44.2
LONG. (DEG,MIN)	131 04.5	131 04.8	130 51.1	130 49.9
LC-5990-X	11712	11719	11957	11968
LC-5990-Z	30565.5	30564	30525	30524
DEPTH (F)	52	44	52	48
SPECIES CATCH (KG.)				
BUTTER SOLE	-	-	-	-
DAB (PACIFIC)	-	-	-	-
DAB (SPECKLED)	-	-	-	-
DOVER SOLE	TRACE	TRACE	TRACE	TRACE
ENGLISH SOLE	9	9	68	68
FLATHEAD SOLE	TRACE	TRACE	-	-
HALIBUT	59	59	55	55
PETRALE SOLE	-	-	-	-
REX SOLE	9	9	11	11
ROCK SOLE	-	-	-	-
TURBOT	109	109	45	45
S. ALEUTIANUS	-	-	-	-
S. ALUTUS	-	-	-	-
S. BREVISPINIS	TRACE	TRACE	-	-
S. MALIGER	-	-	-	-
S. PAUCISPINIS	-	-	-	-
S. PINNIGER	-	-	-	-
S. RUBERRIMUS	-	-	-	-
HERRING	-	-	TRACE	TRACE
LINGCOD	TRACE	TRACE	-	-
PACIFIC COD	TRACE	TRACE	TRACE	TRACE
PACIFIC TOMCOD	TRACE	TRACE	-	-
SABLEFISH	TRACE	TRACE	-	-
WALLEYE POLLOCK	27	27	34	34
DOGFISH	9	9	23	23
RATFISH	TRACE	TRACE	23	23
SKATES	TRACE	TRACE	TRACE	TRACE
INVERTEBRATES	-	-	TRACE	TRACE
TOTAL CATCH (KG.)	222	222	259	259
REMARKS	USABLE	USABLE	USABLE	USABLE

Appendix Table 1. Bridge log data, R/V G.B. REED,
Hecate Strait English sole tagging, June 6-24, 1983.

HAUL NO.	21		22	
MAJOR AREA	5D		5D	
MINOR AREA	5 UPPER		5 UPPER	
DATE	JUNE 17		JUNE 17	
DEPTH MODE F/(M)	51 / (93)		54 / (98)	
DURATION (H)	0.33		0.33	
	START	STOP	START	STOP
TIME	9:37	9:57	12:13	12:33
LAT. (DEG,MIN)	53 44.4	53 43.7	53 44.2	53 43.4
LONG. (DEG,MIN)	130 50.1	130 48.7	130 49.4	130 48
LC-5990-X	11964.5	11977	11970	11982.5
LC-5990-Z	30524.5	30524	30525	30524
DEPTH (F)	51	51	53	54
SPECIES CATCH (KG.)				
BUTTER SOLE	-	-	-	-
DAB (PACIFIC)	-	-	-	-
DAB (SPECKLED)	-	-	-	-
DOVER SOLE	-	-	TRACE	-
ENGLISH SOLE	89	-	55	-
FLATHEAD SOLE	-	-	-	-
HALIBUT	34	-	41	-
PETRALE SOLE	TRACE	-	TRACE	-
REX SOLE	TRACE	-	TRACE	-
ROCK SOLE	-	-	-	-
TURBOT	148	-	109	-
S. ALEUTIANUS	-	-	-	-
S. ALUTUS	-	-	-	-
S. BREVISPINIS	TRACE	-	-	-
S. MALIGER	-	-	-	-
S. PAUCISPINIS	-	-	-	-
S. PINNIGER	-	-	-	-
S. RUBERRIMUS	TRACE	-	-	-
HERRING	-	-	-	-
LINGCOD	-	-	-	-
PACIFIC COD	TRACE	-	27	-
PACIFIC TOMCOD	-	-	-	-
SABLEFISH	TRACE	-	TRACE	-
WALLEYE POLLOCK	30	-	27	-
DOGFISH	30	-	27	-
RATFISH	TRACE	-	TRACE	-
SKATES	-	-	TRACE	-
INVERTEBRATES	-	-	-	-
TOTAL CATCH (KG.)	331	-	286	-
REMARKS	USABLE	-	USABLE	-

Appendix Table 1. Bridge log data, R/V G.B. REED, Hecate Strait English sole tagging, June 6-24, 1983.

HAUL NO.	23		24	
MAJOR AREA	5D		5D	
MINOR AREA	5 UPPER		5 UPPER	
DATE	JUNE 17		JUNE 17	
DEPTH MODE F/(M)	56 / (102)		49 / (89)	
DURATION (H)	0.33		0.33	
	START	STOP	START	STOP
TIME	13:35	13:55	15:55	16:15
LAT. (DEG, MIN)	53 40.7	53 39.7	53 41.3	53 40.6
LONG. (DEG, MIN)	130 46	130 46.5	130 46.5	130 46.4
LC-5990-X	12012	12015.5	12014.5	12010
LC-5990-Z	30518.5	30516	30520	30518
DEPTH (F)	58	54	48	50
SPECIES CATCH (KG.)				
BUTTER SOLE	-	-	-	-
DAB (PACIFIC)	-	-	-	-
DAB (SPECKLED)	-	-	-	-
DOVER SOLE	-	-	TRACE	-
ENGLISH SOLE	445	-	223	-
FLATHEAD SOLE	-	-	-	-
HALIBUT	30	-	28	-
PETRALE SOLE	TRACE	-	TRACE	-
REX SOLE	TRACE	-	TRACE	-
ROCK SOLE	-	-	-	-
TURBOT	64	-	16	-
S. ALEUTIANUS	-	-	-	-
S. ALUTUS	-	-	-	-
S. BREVISPINIS	-	-	-	-
S. MALIGER	-	-	-	-
S. PAUCISPINIS	-	-	TRACE	-
S. PINNIGER	-	-	-	-
S. RUBERRIMUS	-	-	-	-
HERRING	-	-	-	-
LINGCOD	-	-	-	-
PACIFIC COD	TRACE	-	16	-
PACIFIC TOMCOD	-	-	-	-
SABLEFISH	TRACE	-	TRACE	-
WALLEYE POLLOCK	64	-	16	-
DOGFISH	32	-	32	-
RATFISH	TRACE	-	TRACE	-
SKATES	-	-	TRACE	-
INVERTEBRATES	-	-	-	-
TOTAL CATCH (KG.)	635	-	331	-
REMARKS	USABLE	-	USABLE	-

Appendix Table 1. Bridge log data, R/V G.B. REED,
Hecate Strait English sole tagging, June 6-24, 1983.

HAUL NO.	25		26	
MAJOR AREA	5D		5D	
MINOR AREA	5 UPPER		5 UPPER	
DATE	JUNE 18		JUNE 18	
DEPTH MODE F/(M)	50 / (91)		49 / (89)	
DURATION (H)	0.33		0.42	
	START	STOP	START	STOP
TIME	8:22	8:42	10:38	11:03
LAT. (DEG,MIN)	53 29.3	53 29.7	53 38	53 39.3
LONG. (DEG,MIN)	130 55.2	130 53.4	130 47.2	130 46.8
LC-5990-X	12480.5	12485	12455	12447.5
LC-5990-Z	30322	30324	30352.5	30357
DEPTH (F)	50	50	46	52
SPECIES CATCH (KG.)				
BUTTER SOLE	-	-	-	-
DAB (PACIFIC)	-	-	-	-
DAB (SPECKLED)	23	-	-	-
DOVER SOLE	-	-	TRACE	-
ENGLISH SOLE	136	-	546	-
FLATHEAD SOLE	-	-	-	-
HALIBUT	17	-	29	-
PETRALE SOLE	TRACE	-	TRACE	-
REX SOLE	11	-	68	-
ROCK SOLE	TRACE	-	-	-
TURBOT	11	-	409	-
S. ALEUTIANUS	-	-	-	-
S. ALUTUS	-	-	-	-
S. BREVISPINIS	-	-	-	-
S. MALIGER	-	-	-	-
S. PAUCISPINIS	-	-	68	-
S. PINNIGER	-	-	-	-
S. RUBERRIMUS	-	-	-	-
HERRING	-	-	TRACE	-
LINGCOD	-	-	TRACE	-
PACIFIC COD	TRACE	-	TRACE	-
PACIFIC TOMCOD	-	-	-	-
SABLEFISH	11	-	TRACE	-
WALLEYE POLLOCK	-	-	68	-
DOGFISH	TRACE	-	136	-
RATFISH	11	-	68	-
SKATES	11	-	-	-
INVERTEBRATES	-	-	-	-
TOTAL CATCH (KG.)	231	-	1392	-
REMARKS	USABLE	-	USABLE	-

Appendix table 2. Common and scientific names of fish species caught,
R/V G.B. REED, June 6-24, 1983.

<u>Common name</u>	<u>Scientific name</u>
<u>Flatfish</u>	
Butter sole	<u>Isopsetta isolepis</u>
Dover sole	<u>Microstomus pacificus</u>
English sole	<u>Parophrys vetulus</u>
Flathead sole	<u>Hippoglossoides elassodon</u>
Pacific halibut	<u>Hippoglossus stenolepis</u>
Pacific sanddab	<u>Citharichthys sordidus</u>
Petrale sole	<u>Eopsetta jordanii</u>
Rex sole	<u>Glyptocephalus zachirus</u>
Rock sole	<u>Lepidopsetta bilineata</u>
Speckled sanddab	<u>Citharichthys stigmaeus</u>
Turbot	<u>Atheresthes stomias</u>
<u>Rockfish</u>	
Rougheye rockfish	<u>Sebastes aleutianus</u>
Pacific ocean perch	<u>Sebastes alutus</u>
Silvergray rockfish	<u>Sebastes brevispinis</u>
Quillback rockfish	<u>Sebastes maliger</u>
Bocaccio	<u>Sebastes paucispinis</u>
Canary rockfish	<u>Sebastes pinniger</u>
Yelloweye rockfish	<u>Sebastes ruberrimus</u>
<u>Roundfish</u>	
Blackcod	<u>Anoplopoma fimbria</u>
Lingcod	<u>Ophiodon elongatus</u>
Pacific cod	<u>Gadus macrocephalus</u>
Pacific herring	<u>Clupea harengus pallasii</u>
Pacific pollock	<u>Theragra chalcogramma</u>
Tomcod	<u>Microgadus proximus</u>
<u>Selachii</u>	
Big skate	<u>Raja binoculata</u>
Ratfish	<u>Hydrolagus coltiei</u>
Spiny dogfish	<u>Squalus acanthias</u>

Appendix table 3.

Date	Haul no.	Tag number ^a F82-	No. released	Broken tags ^a	Dead in recovery tank	
					No.	% of no. tagged ^b
June						
9	1	039225-039392	169	13	1	1
		039400-039414				
9	2	039393-039399	142	6	0	0
		039415-039539				
		039559-039574				
10	3	039540-039558	138	2	1	1
		039575-039695,				
		039700				
10	4	039696-039699	134	9	0	0
		039701-039839				
10	5	039840-039895	57	4	0	0
		039900-039904				
10	6	039896-039899	156	5	0	0
		039905-040057				
		040075-040078				
10	7	040058-040074	38	2	0	0
		040079-040098				
		040150-040152				
11	8	040099-040149	595	23	3	1
		040153-040722				
11	9	040723-041322	576	21	3	1
12	10	041323-041780	449	13	3	1
		041800-041806				
12	11	041781-041799	162	8	0	0
		041807-041949				
		041967-041974				
12	12	041950-041966	236	1	0	0
		041975-041999				
		97000-97193				
12	13 ^c	97194-97372	178	11	0	0
		97375-97383				
13	15	97373-97374	106	3	0	0
		97384-97490				
15	16	97491-97568	58	3	42	42
		97575-97599				
15	17	97569-97574	142	3	3	2
		97600-97741				
15	18	97742-97757	15	1	0	0
15	19	97758-97808	86	11	0	0
		97825-97845				
		97850-97874				
17	20	97809-97824	203	2	0	0
		97846-97849				
		97875-98048				
		98050-98060				

Appendix table 3.

Date	Haul no.	Tag number ^a F82-	No. released	Broken tags ^a	Dead in recovery tank	
					No.	% of no. tagged ^b
17	21	98049 98061-98266 98275-98283	214	2	0	0
17	22	98267-98274 98284-98393 98400-98414	132	1	0	0
17	23	98394-98399 98415-98999 99000-99145 99150-99177	756	8	1	0
17	24	99146-99149 99178-99508 99525-99531	334	8	0	0
18	25	99509-99524 99532-99819	300	4	0	0
Total			5376	164	57	1

^aincludes broken tags and tags removed from dead fish (broken tags were replaced).

^bno. tagged is total of no. released and no. dead after tagging.

^ctwo no. 97221 in series

Appendix table 4. Summary of English sole tagged by haul, R/V G.B. REED, June 6-24, 1983.

Fork length (cm)	Haul																								
	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
24	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5	-	-	-	-	-	-	1	2	2	-	-	-	-	-	1	-	-	-	-	3	5	1	5	-	1
6	4	3	-	2	-	-	0	1	3	2	-	3	2	-	1	-	-	-	2	5	10	8	25	6	3
7	6	10	-	0	2	7	0	2	14	18	4	8	2	-	5	-	-	-	7	18	17	9	43	15	26
8	8	2	-	3	3	7	2	16	22	37	3	12	9	-	3	3	-	-	7	19	18	20	95	40	29
9	8	8	3	6	4	15	5	30	54	45	11	14	11	-	4	1	2	1	3	27	21	14	100	46	33
30	6	18	10	7	9	12	5	54	98	77	15	17	20	-	8	2	1	1	13	28	33	15	114	42	39
1	12	13	7	9	4	18	3	72	80	61	21	24	19	-	4	11	3	0	6	18	26	18	105	36	27
2	9	6	11	13	5	18	3	76	60	39	13	18	35	-	8	10	7	0	8	18	24	9	66	31	24
3	14	13	15	12	4	12	2	67	62	35	14	18	19	-	8	14	3	0	7	13	12	7	62	22	29
4	9	7	11	6	5	13	5	56	43	25	11	16	16	-	7	16	10	1	8	6	10	7	41	17	17
5	18	11	6	13	6	10	1	55	40	20	9	12	13	-	6	16	21	0	5	9	4	4	31	12	13
6	9	7	8	15	3	10	5	56	31	18	10	6	5	-	4	5	10	1	4	10	11	3	23	18	13
7	10	7	10	12	4	10	2	36	25	13	9	13	4	-	7	7	16	3	6	8	5	7	17	11	15
8	8	5	12	12	1	10	2	19	15	18	9	13	10	-	8	7	15	0	4	6	5	1	10	12	9
9	6	9	8	5	1	2	1	7	5	8	6	10	3	-	10	2	10	2	1	5	4	2	5	4	2
40	6	7	12	8	1	5	1	13	6	7	8	13	4	-	6	3	14	2	2	3	2	4	3	8	4
1	8	5	5	1	2	2	-	9	7	8	5	6	2	-	4	2	13	1	1	3	0	2	4	5	3
2	6	2	4	1	0	0	-	8	6	6	4	3	1	-	1	1	6	0	1	1	0	0	2	3	6
3	5	3	5	1	1	0	-	4	4	3	2	10	1	-	3	-	6	1	0	0	3	0	0	3	1
4	4	0	5	2	1	1	-	2	-	4	2	7	0	-	2	-	3	0	0	1	0	1	2	1	2
5	4	1	5	1	1	2	-	3	-	0	4	6	1	-	1	-	0	0	0	0	1	-	2	0	0
6	3	3	1	2	-	-	-	1	-	1	0	2	1	-	2	-	1	0	1	1	1	-	1	0	0
7	3	1	1	2	-	-	-	3	-	1	0	1	-	-	0	-	1	0	-	-	1	-	-	0	0
8	3	0	-	1	-	-	-	-	-	3	1	1	-	-	1	-	2	2	-	-	0	-	-	0	3
9	0	0	-	-	-	-	-	-	-	1	-	0	-	-	1	-	1	-	-	-	1	-	-	1	0
50	0	0	-	-	-	-	-	-	-	-	-	2	-	-	1	-	-	-	-	-	-	-	-	-	1
1	1	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total	170	142	139	134	57	156	38	593	577	450	161	235	178	0	106	100	145	15	86	202	214	132	756	333	300

Appendix table 5. English sole length-weight summaries from Hecate Strait.

	Butterworth 1979a				White Rocks 1983b			
	males		females		males		females	
	$\bar{W}(g)$	N	$\bar{W}(g)$	N	$\bar{W}(g)$	N	$\bar{W}(g)$	N
20	74.3	3	-	-	68.5	4	71.7	3
1	82.0	2	88.5	2	79.0	17	75.7	3
2	96.3	6	98.0	4	93.3	19	92.9	8
3	114.2	10	110.7	6	106.0	21	100.7	9
4	123.1	7	131.3	4	120.5	13	120.6	10
5	144.9	11	140.1	7	131.8	11	135.3	10
6	154.9	7	168.3	13	154.6	16	149.0	10
7	174.4	9	182.8	5	164.3	10	166.7	10
8	184.0	1	206.7	6	195.3	10	195.3	14
9	221.0	1	228.3	3	207.6	11	207.4	10
30	236.0	1	228.3	3	234.3	10	235.9	14
1	-	-	-	-	266.9	15	266.9	10
2	-	-	297.0	1	282.0	10	279.3	15
3	-	-	-	-	317.7	11	309.0	16
4	-	-	-	-	337.7	17	350.8	8
5	-	-	412.0	1	371.0	7	382.2	5
6	-	-	-	-	380.0	4	415.3	6
7	-	-	-	-	441.5	4	483.0	3
8	-	-	521.0	1	487.5	4	474.0	1
9	-	-	-	-	-	-	537.0	2
40	-	-	-	-	-	-	665.0	1
1	-	-	646.0	1	-	-	659.0	2
2	-	-	500.0	1	-	-	674.0	1
3	-	-	-	-	-	-	735.0	1
4	-	-	-	-	-	-	857.0	1
5	-	-	-	-	-	-	806.0	1
6	-	-	-	-	-	-	856.0	1
7	-	-	784.0	1	-	-	966.0	1
8	-	-	-	-	-	-	-	-
9	-	-	1059.5	2	-	-	-	-
50	-	-	1036.0	2	-	-	-	-
1	-	-	-	-	-	-	-	-
2	-	-	1220.0	1	-	-	-	-
3	-	-	1343.0	1	-	-	-	-
Total		58		65		214		176

^aSampled Sept/79 aboard M/V BLUE WATERS on Dover sole tagging charter (Stocker et al. 1979).

^bSampled June/83 aboard R/V G.B. REED on English sole tagging charter.

Appendix Table 6. Size composition (nos. sampled) of Pacific cod sampled in Hecate Strait, R/V G.B. REED, June 6-24, 1983.

Fork length (cm)	Haul																						
	1	2	3	4	5	6	7	9	10	11	12	13	14	15	17	18	19	20	21	22	24	25	26
25	-	-	-	-	-	-	1	-	-	-	1	-	13	-	-	-	-	-	-	-	-	-	-
6	-	-	-	1	-	-	1	1	-	-	0	-	18	-	-	-	-	-	-	-	-	-	-
7	-	-	1	1	-	-	0	0	-	-	2	-	39	-	-	-	-	-	-	-	-	-	1
8	-	2	2	0	-	-	3	0	-	-	1	-	59	-	-	-	-	-	-	-	-	-	8
9	3	1	0	0	-	-	9	0	1	-	3	-	50	-	-	-	-	-	-	-	-	-	6
30	2	4	1	0	1	-	12	1	1	-	2	1	55	-	-	-	-	-	-	-	-	-	6
1	3	2	7	2	0	-	11	7	2	-	1	0	32	-	-	-	1	-	-	-	-	-	11
2	4	3	5	1	0	1	8	1	0	-	0	1	35	-	-	-	2	-	-	2	1	2	15
3	3	4	3	1	1	0	3	1	0	-	2	0	15	-	-	-	0	-	-	2	0	1	10
4	1	1	6	1	0	0	5	2	0	-	5	1	15	-	-	-	1	-	-	0	1	0	7
5	1	2	0	-	1	0	2	0	2	2	0	1	5	-	-	-	1	-	-	1	0	0	10
6	0	1	0	-	0	0	0	0	0	0	3	0	4	1	-	-	0	-	-	0	0	0	8
7	2	1	2	-	0	0	0	0	2	0	3	0	5	0	-	1	0	-	-	1	0	0	3
8	-	-	0	-	0	0	0	1	0	0	0	0	1	1	1	1	0	-	-	0	0	0	1
9	-	-	0	-	0	0	0	0	1	0	0	0	1	0	0	0	0	-	-	0	0	0	2
40	-	-	0	-	0	0	0	0	0	0	1	1	2	0	1	0	0	-	-	0	0	0	1
1	-	-	0	-	0	0	0	0	0	0	1	0	0	0	0	0	0	-	-	0	0	0	0
2	-	-	0	-	0	0	0	0	0	0	0	0	0	0	1	0	0	-	-	0	0	0	0
3	-	-	0	-	0	0	0	0	1	0	0	0	0	0	0	0	0	-	-	0	0	0	0
4	-	-	0	-	0	0	0	1	0	0	0	0	0	0	0	1	0	-	-	0	0	0	0
5	-	-	0	-	0	0	0	0	0	0	0	0	0	0	0	1	1	-	-	0	0	0	0
6	-	-	0	-	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	0	0	0	1
7	-	-	0	-	1	0	0	0	0	0	0	0	0	0	1	0	1	-	-	0	0	0	0
8	-	-	0	-	1	0	0	0	0	0	0	0	2	0	1	0	1	-	2	0	0	0	0
9	-	-	0	-	3	0	0	1	0	0	0	0	3	1	0	0	0	-	0	0	0	0	2
50	-	-	0	-	1	0	0	0	1	0	1	0	1	1	2	1	1	-	0	0	0	0	0
1	-	-	0	-	0	0	0	0	0	0	2	0	0	0	1	0	0	-	1	0	1	0	0
2	-	-	0	-	2	0	1	0	1	0	0	0	1	0	0	0	0	-	0	0	0	0	1
3	-	-	0	-	1	0	-	0	0	0	1	0	0	1	0	0	1	-	0	0	1	0	2
4	-	-	0	-	5	0	-	0	1	0	0	1	3	-	0	0	0	-	0	0	3	1	0
5	-	-	1	-	4	0	-	0	0	0	2	0	1	-	1	0	0	-	0	1	1	-	1

Appendix Table 6 (cont'd)

Fork length (cm)	Haul																						
	1	2	3	4	5	6	7	9	10	11	12	13	14	15	17	18	19	20	21	22	24	25	26
56	-	-	-	-	1	0	-	0	1	0	1	0	0	-	0	0	0	-	0	0	0	-	0
7	-	-	-	-	3	0	-	0	0	0	1	1	1	-	0	0	0	-	0	0	1	-	1
8	-	-	-	-	1	0	-	0	0	0	0	1	0	-	0	0	1	-	0	1	0	-	2
9	-	-	-	-	5	0	-	0	1	0	1	0	0	-	0	0	0	-	0	0	1	-	0
60	-	-	-	-	6	0	-	0	0	0	1	1	3	-	0	0	-	0	0	0	1	-	1
1	-	-	-	-	2	0	-	0	1	1	1	0	1	-	0	0	-	0	0	0	1	-	2
2	-	-	-	-	7	0	-	0	2	1	0	0	0	-	1	0	-	0	1	0	0	-	0
3	-	-	-	-	4	0	-	1	1	0	1	0	2	-	1	0	-	0	0	0	0	-	1
4	-	-	-	-	5	0	-	1	2	0	1	0	0	-	0	0	-	0	0	0	2	-	2
5	-	-	-	-	1	0	-	1	0	0	0	1	1	-	1	0	-	1	0	0	0	-	0
6	-	-	-	-	1	1	-	0	0	1	0	1	0	-	0	0	-	-	1	0	0	-	1
7	-	-	-	-	1	0	-	0	0	0	1	-	0	-	0	1	-	-	-	0	0	-	3
8	-	-	-	-	1	0	-	1	0	0	1	-	0	-	0	0	-	-	-	0	0	-	0
9	-	-	-	-	0	0	-	0	0	0	0	-	1	-	1	1	-	-	-	0	0	-	2
70	-	-	-	-	0	0	-	0	1	1	0	-	-	-	-	-	-	-	-	1	0	-	2
1	-	-	-	-	0	0	-	1	0	-	0	-	-	-	-	-	-	-	-	-	1	-	1
2	-	-	-	-	0	0	-	-	0	-	1	-	-	-	-	-	-	-	-	-	-	-	0
3	-	-	-	-	0	1	-	-	1	-	0	-	-	-	-	-	-	-	-	-	-	-	2
4	-	-	-	-	0	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-
5	-	-	-	-	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
6	-	-	-	-	0	-	-	-	-	-	-	-	-	-	-	-	-	2	-	-	-	-	-
7	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total	19	21	28	7	60	3	56	21	23	6	42	11	369	5	13	7	13	1	5	9	15	4	116

Appendix table 7. Vertical temperature profiles, G.B. REED cruise, June 6-24, 1983.

Consec. no.	Stn. no.	Day/Mo.	Time (PST)	Position		Bottom depth (m)	Depth (m)/Temperature (°C)																		
				Lat. N	Long. W		0	10	25	27	28	30	31	35	56	76	82	90	111	180	182				
1	1	08/06	0929	51°07.0'	128°20.0'	182	0	10	25	27	28	30	31	35	56	76	82	90	111	180	182				
							13.0	12.5	12.0	11.5	11.0	10.5	10.0	9.5	9.0	8.5	8.0	7.5	7.0	6.5	6.5				
2	5	08/06	1155	51°24.0'	128°42.5'	215	0	12	14	18	22	25	32	62	104	121	135	144	164	199	215				
							12.4	12.0	11.5	11.0	10.5	10.0	9.5	9.0	8.5	8.0	7.5	7.0	6.5	6.0	6.0				
3	8	08/06	1614	51°06.8'	129°37.2'	438	0	16	24	27	51	53	67	73	93	103	140	160	182	260	371	438			
							12.6	12.0	11.5	11.0	10.5	10.0	9.5	9.0	8.5	8.0	7.5	7.0	6.5	6.0	5.5	5.1			
4	10	08/06	1937	51°36.0'	130°02.5'	270	0	15	16	21	25	28	36	50	68	69	105	140	197	257	270				
							12.5	12.0	11.5	11.0	10.5	10.0	9.5	9.0	8.5	8.0	7.5	7.0	6.5	6.0	5.7				
5	15	09/06	0213	52°00.0'	130°31.0'	402	0	15	19	25	30	33	37	50	70	97	102	127	160	200	250	380	402		
							12.5	12.0	11.5	11.0	10.5	10.0	9.5	9.0	8.5	8.0	7.5	7.0	6.5	6.0	5.5	5.0	5.0		
6	21	09/06	0835	52°29.7'	130°12.5'	200	0	23	28	30	32	35	40	68	85	101	115	121	138	163	200				
							12.5	12.0	11.5	11.0	10.5	10.0	9.5	9.0	8.5	8.0	7.5	7.0	6.5	6.0	5.6				
7	23	10/06	1700	53°15.5'	130°41.0'	192	0	1	22	25	30	37	51	74	95	100	111	133	144	192					
							12.2	12.0	11.5	11.0	10.5	10.0	9.5	9.0	8.5	8.0	7.5	7.0	6.5	6.2					
8	41	10/06	1840	53°12.5'	131°06.5'	40	0	5	11	22	40														
							12.0	11.5	11.0	10.5	10.2														
9	39	11/06	1746	53°41.5'	131°13.0'	42	0	10	20	26	34	42													
							13.0	12.5	12.0	11.5	11.0	10.5													
10	33	16/06	1145	54°24.5'	131°23.0'	215	0	50	51	52	54	75	99	125	215										
							10.5	10.0	9.5	9.0	8.5	8.0	7.5	7.0	6.7										

Appendix table 8. Contents and locations^a of Shipek bottom grabs completed in Hecate Strait during G.B. REED English sole tagging cruise June 6-24, 1983.

Grab no. GBR83-	Latitude	Longitude	Depth		Contents of grab ^b	Contents
			(fm)	(m)		
1	53°55.0'	131°02.0'	20	37	sG;shell	-
2	53°55.0'	131°09.9'	14	26	shS	2 attempts
3	53°55.1'	131°22.3'	13	24	shS	-
4	53°50.0'	131°21.8'	13	24	sG	-
5	53°50.0'	131°11.4'	14	26	shS	-
6	53°50.0'	131°03.4'	24	44	mS;shell	-
7	53°39.2'	131°05.6'	21	38	shS	-
8	53°25.0'	131°12.1'	16	29	shS	-
9	53°25.0'	131°18.8'	14	26	shS	-
10	53°25.0'	131°25.5'	13	24	gS;shell	-
11	53°25.0'	131°32.5'	12	22	shS	-
12	53°25.0'	131°39.3'	15	27	shS	-
13	53°20.0'	131°32.8'	21	38	S	-
14	53°20.0'	131°25.8'	16	29	sG;shell	2 attempts
15	53°20.0'	131°19.0'	16	29	shG	-
16	53°20.0'	131°12.2'	17	31	shS	some coral
17	53°20.0'	131°05.6'	28	51	sG;shell	-
18	53°15.0'	131°07.1'	22	40	shS	-
19	53°15.0'	131°13.6'	22	40	sG;shell	-
20	53°15.0'	131°20.7'	19	35	shS	-
21	53°15.0'	131°27.5'	14	26	shS	-
22	53°10.0'	131°33.0'	11	20	sG;shell	2 attempts
23	53°10.0'	131°26.0'	15	27	shG	-
24	53°10.0'	131°19.3'	15	27	sG;shell	-
25	53°10.0'	131°12.1'	20	37	gSh	-
26	53°10.0'	131°05.0'	23	42	sG;shell	-
27	53°05.0'	131°07.0'	20	37	shS	-
28	53°05.0'	131°14.2'	17	31	shS	2nd attempt-all shell and not kept.
29	53°05.0'	131°21.0'	14	26	shS	-
30	53°05.0'	131°28.0'	14	26	Sh	-
31	53°00.0'	131°20.0'	11	20	sG;shell	-
32	53°00.0'	131°15.0'	13	24	shS	-
33	53°00.0'	131°10.0'	15	27	sG;shell	-
34	53°00.0'	131°05.0'	13	24	sG;shell	-
35	53°00.0'	131°00.0'	16	29	shS	-
36	53°00.0'	130°55.0'	20	37	sG;shell	-
37	53°00.0'	130°51.0'	35	64	S	-

^aSee Figure 3 for chart with grab locations

^bG = gravel g = gravelly
M = mud m = muddy
S = sand s = sandy
Sh = shell sh = shelly

Appendix table 9. Identification^a of invertebrates from Hecate Strait, R/V G.B. REED Cruise, June 6-24, 1983b.

- Phylum porifera (Sponges)
- Phylum chidaria (Coelenterates)
 - Class Anthozoa (Anemones)
 - Order Actinaria
 - Order Madreporaria
 - Anthopleura sp.
 - Stylatula elongata
 - Ptilosarcus gurneyi
- Phylum Platyhelmenthes (Flatworms)
 - Class Trematoda (Flukes)
- Phylum Nemertinea (Proboscis worms)
- Phylum Sipunculida (Peanut worms)
- Phylum Annelida (Segmented worms)
 - Class Hirudinea (Leeches)
 - Oceanobdella sp.
 - Oceanobdella pallida
 - Levinsenia rectangularata
 - Class Polychaeta (Marine worms)
 - Family Spionidae
 - Family Spiroboridae
 - Family Terbellidae
 - Aphrodita japonica
 - Arctonoe pulchra
 - Cualleriella sp.
 - Cualleriella alata
 - Dorvillea pseudorubrovittata
 - Euclymene sp.
 - Euclymene sp. cf. zonalis
 - Glycera capitata
 - Harmothoe sp.
 - Harmothoe imbricata
 - Harmothoe lunulata
 - Hemipodus borealis
 - Idanthysus armatus
 - Laonice cirrata
 - Macrochaeta pege
 - Micropodarke dubia
 - Nephtys caeca
 - Notomatus lineatus
 - Nothria sp.
 - Onuphis elegans
 - Opiodromus pugettensis
 - Owenia fusiformes
 - Owenia fusiformes delle
 - Pectinaria granulata
 - Phyllodoce groenlandica
 - Pista cristata
 - Scolelepis squamata
 - Spiophanus bombyx
 - Spiochaetopterus costarum

Appendix table 9 (cont'd)

- Spiophanus costarum
- Syllis sp.
- Syllis elongata
- Syllis spongiphila
- Travisa pupa
- Phylum Arthropoda (Trilobites)
- Class Crustacea (Mandibulates)
- Order Decapoda (Shrimp and Crabs)
- Cancer sp.
- Cancer branneri
- Cancer productus
- Cryptolithodes typicus
- Hemigrapsus nudus
- Hemigrapsus oregonensis
- Hyas lyatrus
- Lopholithodes foraminatus
- Mesocrangon munitella
- Oregonia gracilis
- Pagurus sp.
- Pagurus beringanus
- Pagurus caurinus
- Paguristes sp.
- Paguristes turgidus
- Order Amphipoda (Amphipods)
- Family Ampeliscidae
- Family Aoridae
- Family Ischyroceridae
- Family Isaeidae
- Family Lafystiidae
- Family Photidae
- Family Phoxocephalidae
- Family Pleustidae
- Family Pontogeneiidae
- Family Stenothoidae
- Order Isopoda (Isopods)
- Rocinela belliceps
- Subclass Copepoda (Copepods)
- Acanthochondria sp.
- Clavella adunca
- Clavella irina
- Haemobaphes disceraus
- Lepeophtheirus pravipes
- Lepeophtheirus parviventris
- Naobranchia occidentalis
- Pandarus bicolor
- Phrixocephalus cincinnatus
- Phylum Mollusca (Mollusks)
- Class Gastropoda (Snails)
- Acmaea sp. cf. funiculata
- Armina californica
- Buccinum scalariforme

Appendix table 9 (cont'd)

Ceratostoma foliatum
Crepidula sp.
Crepidula nummaria
Fusitriton oregonensis
Halistylus pupoides
Ischnochiton sp.
Lepidopleurus sp.
Lepidozona mertensii
Littorina sp.
Littorina sitkana
Margarites sp.
Mitella sp.
Neptunea tabulata
Nitidella gouldi
Notoacmea scutum
Olivella baetica
Propebela turricula
Solariella peramabilis
Turbonilla macouni

Class Bivalvia (Bivalves)

Acila castrensis
Astarte sp.
Axinopsida serricata
Callistoma ligatum
Chlamys sp.
Chlamys sp. cf. rubia
Crepidula nummaria
Crepidatella lingulata
Glycymeris subobsoleta
Hiatella arctica
Macoma brota
Margarites pupillus
Mytilis edulis
Pecten caurinus
Tellina nuculoides

Class Scaphopoda (Tooth shells)

Class Cephalopoda (Cephalopods)

Rossia sp.

Phylum Bryozoa (Lophophores)

Phylum Brachiopoda (Lamp shells)

Phylum Echinodermata (Echinoderms)

Class Echinoidea (Urchins and Sand dollars)

Strongylocentrotus sp.

Strongylocentrotus droebrachiensis

Class Asteroidea (Starfishes)

Crossaster papposus

Gorgonocephalus eucnemis

Hippasteria spinosa

Luidia foliolata

Mediaster aequalis

Orthasterias koehleri

Appendix table 9 (cont'd)

Piaster sp.
Pteraster tessellatus
Pycnopodia helianthoides
Solaster sp. cf. dawsoni
Class Ophiuroidea (Brittle stars)
Ophiopholis aculeata
Ophiura sarsi
Class Holothuroidea (Sea cucumbers)
Parastichopus californicus
Phylum Chordata (Deuterostomes)
Subphylum Tunicata (Tunicates)
Class Ascidiacea (Sea squirts)
Halocynthia igaboja

^aIdentifiers:

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J. Madill, National Museum
F. Rafi, National Museum
M. F. I. Smith, National Museum

^bSpecimens collected by trawl, SCOR net, neuston sampler, and Shipek grab.

