Chatham Sound Shrimp Survey and Resulting Management Actions, August to September, 1998

J.A. Boutillier, J.A. Bond, H. Nguyen, and D. Gueret

Fisheries and Oceans Canada
Science Branch, Pacific Region
Pacific Biological Station
Nanaimo, British Columbia
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CHATHAM SOUND SHRIMP SURVEY AND RESULTING MANAGEMENT ACTIONS, AUGUST TO SEPTEMBER, 1998

J.A. Boutillier, J.A. Bond, H. Nguyen, and D. Gueret[1]

Fisheries and Oceans Canada

Science Branch, Pacific Region

Pacific Biological Station

Nanaimo, British Columbia

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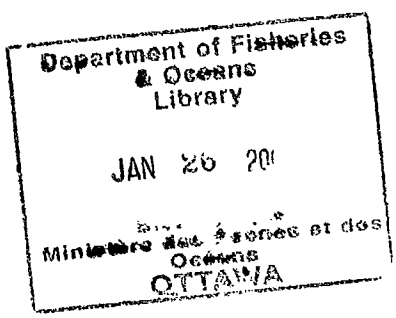

[1]Fisheries and Oceans Canada

Operations Branch, Pacific Region

2nd Avenue West

Prince Rupert, British Columbia

V8J 1G8

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ABSTRACT

Boutillier, J.A., J.A. Bond, H. Nguyen, and D. Gueret. 1999. Chatham Sound shrimp survey and resulting management actions, August to September, 1998. Can. Manuscr. Rep. Fish. Aquat. Sci. 2496: 38 p.

This document forms part of a series of manuscripts that detail the assessment and management actions undertaken in the shrimp trawl fisheries off the Pacific coast of Canada in 1998.

An area-swept shrimp trawl survey was undertaken in Chatham Sound in August and September 1998. The DFO research vessel Caligus was used to complete the survey, which covered portions of Pacific Fisheries Management Areas (PFMA) 3 and 4. The fisheries in this area are primarily for smooth pink shrimp, *Pandalus jordani*; northern pink shrimp, *Pandalus borealis eous*; and sidestripe shrimp, *Pandalopsis dispar*.

Biomass indices of shrimp by species were determined in select trawlable areas of Chatham Sound. While the collection of data on the shrimp (including prawns), halibut and eulachon catches were priorities, catch information on all species was collected. Catches of prawns and halibut were minor in the area. However, because of concerns about the status of eulachon populations, biomass indices of eulachon stocks on the shrimp grounds were also calculated.

A fixed exploitation rate of 33% was applied to the biomass estimates of shrimp by species. Catch ceilings, quotas, and other management actions that resulted from the survey are discussed.

These survey data are the first in what is hoped to be a long time series of fishery independent survey indices which will be combined with logbook data, biological sampling and other fishery data to provide information as to the status of the stocks. Until a long-term database is available, the initial biomass indices will be used as absolute estimates for the purpose of setting quotas.

RÉSUMÉ

Boutillier, J.A., J.A. Bond, H. Nguyen, and D. Gueret. 1999. Chatham Sound shrimp survey and resulting management actions, August to September, 1998. Can. Manuscr. Rep. Fish. Aquat. Sci. 2496: 38 p.

Ce document fait partie d'une série de manuscrits qui décrivent en détail les initiatives d'évaluation et de gestion menées à bien dans les sites de chalutage de la crevette sur la côte du Pacifique en 1998.

Une étude sur la pêche de la crevette au chalut dans toute la région du passage Chatham a été effectuée en août et septembre 1998. Le navire de recherche de P&O, Caligus, a été utilisé pour l'étude qui portait sur certaines parties des aires de gestion des pêches du Pacifique 3 et 4. Les pêches dans cette région ciblent principalement la crevette océanique (*Pandalus Jordani*), la crevette nordique (*Pandalus borealis*) et la crevette à flancs rayés (*Pandalopsis dispar*).

Les indicateurs de biomasse pour chaque espèce de crevettes ont été déterminés pour certaines zones accessibles au chalutage dans le passage Chatham. La collecte de données sur les crevettes, les flétans, et les eulakanes constituait la priorité de l'étude mais celle-ci a en fait été étendue à toutes les espèces. Les captures de crevettes et de flétans sont restées minimes dans le secteur étudié. Les inquiétudes entourant l'état des populations d'eulakanes ont motivé le calcul des indicateurs de biomasse pour cette espèces sur les secteurs à crevettes.

Un taux d'exploitation fixe de 33 % a été appliqué aux estimations de biomasse pour chaque espèce de crevettes. Le compte rendu d'étude traite aussi des plafonds de capture, des quotas et d'autres initiatives de gestion qui ont résulté de l'exercice.

On espère que les données recueillies à l'occasion de cette étude seront les premières d'une longue série temporelle d'indicateurs accumulés à l'occasion d'études indépendantes futures sur les pêches. Ces indicateurs devraient finalement être combinés aux données des livres de bord, aux résultats des échantillonnages biologiques et à d'autres données sur les pêches pour constituer une source d'information intéressante sur l'état des stocks. Les indicateurs de biomasse initiaux seront utilisés comme référence pour l'établissement des quotas jusqu'à ce qu'une base de données à long terme devienne disponible.

ASSESSMENT AND MANAGEMENT FRAMEWORK

This report forms part of a series of documents that outline the assessment data and management processes that were used in 1998 in the shrimp trawl fishery for specific areas along the British Columbia coastline. The shrimp trawl fishery takes place in a variety of areas ranging from large offshore grounds to small isolated inshore waters. These fisheries also vary with respect to the target species. There are seven species of shrimp that are harvested commercially in British Columbia and fisheries vary in complexity from single to multiple species fisheries. Many of these shrimp trawl fisheries are new or developing and there is little or no information available from which to assess the stocks.

A suite of management principles were developed for these fisheries as a result of discussions and concerns outlined in PSARC assessments of inshore (Boutillier et al 1996) and offshore (Boutillier et al 1997) shrimp fisheries. The management systems adopted in 1998 varied depending on the nature and complexity of the fishery.

For the offshore fisheries in the southern and central regions off the West Coast of Vancouver Island (WCVI), time and area closures were implemented. The recruitment process for these offshore fisheries appears to be strongly influenced by environmental factors, which affect the strength and direction of surface currents. There also appears to be a strong south to north recruitment interdependence between grounds (Boutillier et al 1997).

For inshore fisheries and the remaining offshore areas, fixed arbitrary, historically based, or forecasted[1] catch ceilings were initially assigned to each shrimp management area. These catch ceilings can be adjusted inseason, if information from fishery independent biomass indices and catches indicate that the area can sustain fishing pressure either less than or greater than the initial levels. The biological reference point for sustainable fishing pressure that is used at this time is the biomass of the area multiplied by an exploitation rate of 33%.

The use of biological reference points discussed above is based on precautionary principles discussed in Boutillier et al (1996) and is designed to meet conservation and sustainable utilisation goals in data limited situations. Over the long term, the management and assessment systems for these fisheries will undergo a number of changes that reflect a better understanding of these initial and hopefully conservative thresholds. The major changes will come about by scientifically addressing key biological and technological issues. These include: the biotic and abiotic factors that affect the population; quantifying biological compensatory mechanisms; calculating depensatory mortality thresholds; evaluating factors affecting availability; developing survey designs which quantify shrimp abundance in untrawlable areas; and accounting for variations in availability to trawl surveys due to vertical migrations.

One of the key components to addressing these issues is the use of data from fishery independent biomass surveys. The area-swept trawl survey is the key fishery independent survey

[1] Forecasting only took place in Pacific Fisheries Management Area 12 for *P. borealis eous* where there was information from fishery independent trawl surveys conducted the previous year (both in April and November 1997).

tool used to calculate biomass indices. These trawl data are complemented by using vertical trapping data to estimate the amount of shrimp available to the trawl and data from on-bottom long-line trapping to estimate the density of shrimp in untrawlable areas. In combination these data provide immediate indices of abundance for the surveyed areas and over the long-term population trends for the area. Initially the survey biomass indices will be used as absolute estimates for the purpose of setting the biological reference point catch ceilings. Over the long-term, when a consistent data base of survey indices and catches is available, the trends will be modelled with the catch history from the area and provide more reliable estimates of absolute abundance. The management and assessment process is an iterative process, which demands a constant building and learning. It will take years of careful assessment and testing of critical basic biological parameters such as: growth, mortality, and recruitment; and appropriate levels of exploitation by area and species etc., to address the issues as stated above. This will take a collaborative effort on the part of department and stakeholders to achieve meaningful results while adhering to precautionary principles.

INTRODUCTION

This report summarises the results of a fishery independent shrimp survey that was conducted August 27 to September 7, 1998 in portions of the Prince Rupert District (PRD) Shrimp Management Area (SMA) off the Pacific coast of Canada, which includes portions of Pacific Fisheries Management Areas (PFMA) 3 and 4. The survey area is shown in Figure 1.

The PRD Shrimp Management Area has historically been a small-boat beam trawl fishery, however in recent years larger otter trawlers have been working the area and accounted for 64% of the pink shrimp catch and 41% of the sidestripe catch in 1997.

The fishery in this area in recent years has been at historically high levels. Previous high catches occurred in the 1960's with the peak catch of 160 t taken in 1963 (Boutillier 1987). The recent catches from the area have substantially surpassed this historic peak as is evidenced in Figure 2.

OBJECTIVE

This area opened on April 16, 1998 with separate quotas set for both pink and sidestripe shrimp based on recent trends in catches from the area. The fishery had not taken the preliminary quotas for the area at the time of the survey. This survey was conducted to provide inseason fishery biomass indices of shrimp by species in select trawlable areas of Areas 3 and 4, and develop inseason quotas for the various shrimp species. To do this, an area swept trawl survey was conducted to determine the fishable biomass index for each species of shrimp in the various trawlable areas.

METHODS

The survey in August and September 1998 provided inseason fishery biomass indices of shrimp abundance for portions of PFMA 3-02, 4-05, 4-09, and 4-12 in the PRD Shrimp Management Area. This area swept trawl survey was conducted over a period of ten days (August 29 to September 7, 1998) using the research vessel Caligus. For logistic purposes, the survey was restricted to area swept trawling and vertical trapping only. No trapping of hard bottom areas was conducted to determine the presence or absence of shrimp on untrawlable bottom.

Industry representatives (primarily Gray McPhedran and Charles Page) familiar with the area provided input into the survey by giving advice on the design and implementation of the survey by providing local knowledge on how and where to conduct tows in certain areas.

The Caligus was fitted with an otter trawl and doors specified by the industry representatives of the survey subcommittee. The gear includes a 17.7-m high-rise, otter trawl and 1.7 m Whitewater combination trawl doors. For this survey a Nordmore fish exclusion grid was

used with the net to reduce the amount of bycatch sorting and thus allow for an increased number of tows.

The Caligus carried two biological technicians, who were jointly funded using DFO Science and industry stock assessment funds. The catches from the survey were recorded and sampled. Subsequently the catch from the survey is accounted for in the calculation of additional quotas assigned to the area.

MAPPING

Locations of shrimp trawl activity were identified through examination of the 1996 and 1997 logbook records as well as through consultation with industry representatives. Locations were incorporated into CompuGrid, the proprietary raster-based geographic information system (GIS) utilised by DFO, Shellfish StAD, and displayed in relation to land mass, Pacific Fishery Management Areas and depth contours. Masks were initially drawn around the areas of most concentrated effort (clusters of location points), using the 50 m and 200 m contour lines as rough guides; these were subsequently modified slightly as a result of the survey results. The masks were captured digitally and incorporated into the GIS. Within each mask, a sampling grid was established which broke the masked area into blocks of 0.25 square nautical miles (i.e. each block had sides of length 0.5 nautical miles).

FIELD DATA

All data was collected in a standard format with each tow uniquely and sequentially numbered. Detailed information was collected from each tow including: time and date; duration; Pacific Fisheries Management Area (PMFA); latitude and longitude of the start and finish of the tow; direction of the tow; distance travelled; depth; remarks on usability; and detailed catch information on total catch weight and weight by species (for commercial shrimp species #/kg information was also collected). Biological samples of at least 100 (if available) shrimp by species were collected from each tow for later processing by size and sex. Biological samples were taken of any eulachon and halibut caught in the survey as by-catch.

EFFORT STANDARDIZATION

With the use of a standard research vessel and standard trawl, no effort standardisation was necessary. It was recommended by the industry that a single standard vessel and equipment be used to develop of a time series of assessment indices.

AREA SWEPT TRAWL SURVEY

Trawl tows were spaced systematically over the fishing grounds on a 0.5 by 0.5 nautical mile grid, which overlaid the defined survey area by major fishing area (see Table 1).

Tows were to be 30 minutes in duration, however, they were shortened if snags or bad bottom were encountered. The start and stop latitude and longitude co-ordinates were used to calculate the distance towed. The density of animals by species per square meter was then calculated using the following equation:

$$\text{Density (kg/m}^2\text{)} = \text{Catch (kg)}/(\text{Distance towed} * \text{Net opening})$$

This density per square meter was then used in the calculations of the biomass indices.

VERTICAL TRAPPING

In an effort to estimate the proportion of shrimp available to the bottom trawls, strings of fine mesh (7-10 mm) Pardiac traps (23.25 cm diameter by 10.25 cm high) were set vertically in the water column from the bottom to 40 m off bottom. Traps were set in the morning and afternoon for 4-hour soaks. Traps were spaced along the groundline at distances of 0, 5, 10, 15, 20, 30, and 40 m off bottom. The traps were then sampled to determine the number of shrimp caught at various heights off bottom. These catch rates by depth were then used to estimate the proportion of the shrimp that were available to trawl at the time that the survey was conducted.

AGE CLASS ESTIMATES

To estimate the abundance and size range of each cohort, samples of approximately 100 (if available) shrimp from each species were collected from each tow. Each sample was then processed to determine the number of shrimp per kilogram, and the size and sex of each individual animal. The histogram and length frequency distributions for all samples within an area were analysed, using Schnute and Fournier's (1980) length frequency modal analysis (a minimal desirable total sample size is 1000 animals), to give the proportion by age and the mean size of each age group. Using the resulting mean sizes for each year class plus and minus a proportionally calculated standard deviation, the minimum and maximum size of animals assigned to each age class were calculated. These minimum and maximum sizes for each age class allow us to estimate the proportion by age of the catch from each sampled tow. This information was subsequently used to calculate the density of shrimp by number for each age class in the area sampled.

CALCULATION OF BIOMASS INDICES

To estimate indices of biomass and year class abundance, the total survey area was mapped and divided into grid cells. Calculations were completed for a range of grid cell sizes i.e. squares with sides of length 200, 250, 300, 350, 400, 450, and 500 meters. The centre point of each tow was assigned to the appropriate grid cell along with the calculated weight and age class density information (calculated using the above methods).

A bicubic spline geospatial interpolation was then used to calculate values for empty grid cells within the total sampling area. Once blank grid cells were filled in with interpolated values, indices of biomass and year class abundance were calculated by adding the values in each grid cell

within the entire survey area. The calculations of the indices were done within the CompuGrid GIS software package.

RESULTS

AREA SWEPT

The effective mouth opening of the trawl was estimated to be 50% of the footrope length (Hannah 1995). The distance travelled is the true distance between the DGPS position when the net touches bottom and the DGPS position when the net comes off the bottom.

TRAWL SURVEY

A total of 42 successful tows (of 43 total tows) were completed. The area covered by the tows sampled 0.1% of the total survey area.

A summary of the total catch is shown in Appendix 1 and detailed catch records are shown in Appendix 2.

VERTICAL TRAP SETS

A total of 13 successful sets (of 14 total sets) were made in all areas combined.

The proportion of shrimp available to trawl varied depending on the species and the area. Humpback and sidestripe shrimp were determined to be 100% available to the trawl i.e. there were no catches of these two species of shrimp in any of the traps off the bottom. Northern pink and smooth pink shrimp, however, did vary with respect to their availability to the trawl. The correction factors used to account for this variation in availability to the trawl ranged from 84.9% to 100% for northern pink shrimp and 81.2% to 100% for smooth pink shrimp depending on the location of the tow.

AGE CLASS ESTIMATES

The size of the animals by age class and species varied between Pacific Fisheries Management Subareas (see Table 2).

SURVEY BIOMASS INDICES

The survey indices and total catch to date were combined to estimate the total biomass at the beginning of the fishery. By assuming that biomass prior to the fishery is equal to the survey biomass index plus the catch, we are assuming that over the period of time from the fishery start and the survey estimate, growth and natural mortality balance. The survey biomass estimate used was the median value from the range of estimates calculated using the different cell sizes. Table 3 shows the survey biomass, catch, estimated total biomass, and quotas.

DISCUSSION

Critical to the estimate of biomass and the remaining quota is the estimate of total catch. There appear to be discrepancies between the reported catch composition and the survey and commercial sampling catch composition by species. The survey estimated the shrimp population in Chatham Sound to consist of 69.2% pink shrimp and 30.8% Sidestripes. Landing reports from AMR show 61.9% pinks and 38.1% Sidestripes (SMA PRD). Bycatch observers (Chatham Sound) reported catches that were 31.3% pinks and 67.0% Sidestripes. Logbooks (SMA PRD) show catches that are 47.4% pinks and 52.6% Sidestripes.

The situation of over-reporting of Sidestripes in SMA PRD is very different from other areas of the coast where the sorting of shrimp by size rather than by species causes under-reporting, because the small sidestripes are mixed in with the pink shrimp catch. This discrepancy between this area and others may suggest that for SMA PRD boats are either successfully targeting through gear and area selectivity on large sidestripes and not catching pink shrimp (as seen in the observer catches) or they are dumping pinks and only landing large sidestripes. We need to undertake the following initiatives to better understand this issue:

1) conduct plant sampling to determine the proportion of small sidestripes mixed with the pink catch,
2) conduct more onboard observer sampling to get a better range of the species composition being targeted, and
3) examine gear differences in relation to catch composition.

Table 4 shows the survey results expressed in terms of percentage of shrimp by age class.

There is concern about the relative proportions of age classes in that the percentage of 2+ seems low in comparison to the 3+ animals for both smooth pink and sidestripe shrimp. This trend would indicate a significant reduction in the large female component of the population of these shrimp species in next year's fishery.

FISHERY MANAGEMENT ACTIONS, SMA PRD

1998/99 SEASON

The SMA Prince Rupert District (PRD) shrimp trawl fishery (PFMA 103 and 104, and subareas 3-1 to 3-4, 4-1 to 4-16, 5-1, 5-2, and 5-23) opened as per the management plan on April 1, 1998.

The 1998/99 catch ceiling of 220,460 lb. (100 t) of Sidestripes and 220,460 lb. (100 t) of all other shrimp species combined was based on an average annual catch as reported from logbooks for the last ten years (1987 to 1996). It was noted in the management plan that catch

ceilings could be adjusted in-season based on information from fishery independent biomass surveys.

A survey was conducted in SMA PRD from August 29 to September 7, 1998. Biomass estimates were provided to fishery managers and the annual quotas (Table 3) were calculated using a fixed exploitation rate of 33% of the total biomass (calculated as a sum of the survey and the fishery landings from April 1 to September 30, 1998).

At the 33% exploitation rate, the annual catch ceilings for SMA PRD for 1998/99 were increased from the initial 100 t quotas as set out in the management plan, to 128.78 t (283,911 lb.) for Sidestripes and 279.71 t (616,662 lb.) for all other species of shrimp combined.

At the time the quota was increased, the fishery in SMA PRD had not yet attained the initial catch ceiling and remained open. The new annual quota for 1998/99 based on survey results was announced by a Notice to Industry on Friday, October 23, 1998. The area will close upon attaining either of these catch ceilings, as no means for directed fisheries has yet been addressed.

StAD has indicated that the lower proportion of age 2+ sidestripes in this survey would indicate a lower proportion of the large female sidestripes, age 3+, for next year's fishery.

Further Recommendations

Recommendations are for further catch composition sampling and gear analysis to resolve the issue of targeting on sidestripes through gear or area selectivity, and to examine the potential for future directed fisheries in SMA PRD.

ACKNOWLEDGEMENTS

We would like to thank Gray McPhedran, Charles Page, and the captain and crew of the DFO vessel Caligus for their co-operation. Biological technicians for the survey included Steve Head and Peter Mattson. Leslie Barton handled all the GIS mapping issues for the project, and Georg Jorgensen wrote the report generator for the Appendix tables in this report.

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Table 1. The Pacific Fishery Management Areas and Subareas surveyed and the respective sampling area.

Subareas	Location	Area surveyed (km^2)
3-02, 4-05, 4-09, and 4-12	Chatham Sound	682.2

Table 2. The size (carapace length in mm) and weight (g) of shrimp by cohort, by species, by Subarea for the August/September 1998 survey.

Subarea	Species	Age 0 leng	Age1 leng	Age2 leng	Age3 leng	Age 0 Wt	Age 1 Wt	Age 2 Wt	Age 3 Wt
4-05	Northern Pink	9.4	15.7	21.1	24.7	0.78	2.98	6.44	9.72
4-05	Smooth Pink	9.8	15.8	20.5	22.9	0.59	2.68	6.12	8.69
4-05	Sidestripe		20.1	25.1	31.3		5.24	10.22	19.84
4-09	Northern Pink	9.3	16.5	20.8		0.76	3.39	6.21	
4-09	Smooth Pink	8.8	16.8	18.7	22.4	0.42	3.25	4.57	8.10
4-09	Sidestripe	11.1	21.7	28.4	31.3	0.88	6.59	14.81	19.84

Table 3. Median survey estimates, estimated catch (a combination of AMR validated and missing landings to September 30, 1998 and survey catch), quota estimates and remaining quotas. Reported catch of GS (Generic Shrimp) has been proportioned between Northern and smooth pinks according to research catch proportions.

Species	Survey Biomass (t)	Catch (t)	Total Biomass (t)	Estimated Quota (t)	Remaining Quota (t)
Northern Pink	459	42	501	165	123
Smooth Pink	340	7	347	114	108
Sidestripe	356	35	390	129	94
Humpback	1	0.0	1	0.3	0.3
Flexed Pink		0.04			

Table 4. The percentage of each age class of shrimp by species as estimated from the biomass survey.

Species	% 0+	% 1+	% 2+	% 3+
Northern Pink	5.50%	54.20%	33.44%	6.86%
Smooth Pink	4.39%	35.74%	29.06%	30.80%
Sidestripe	3.95%	44.12%	22.57%	29.36%

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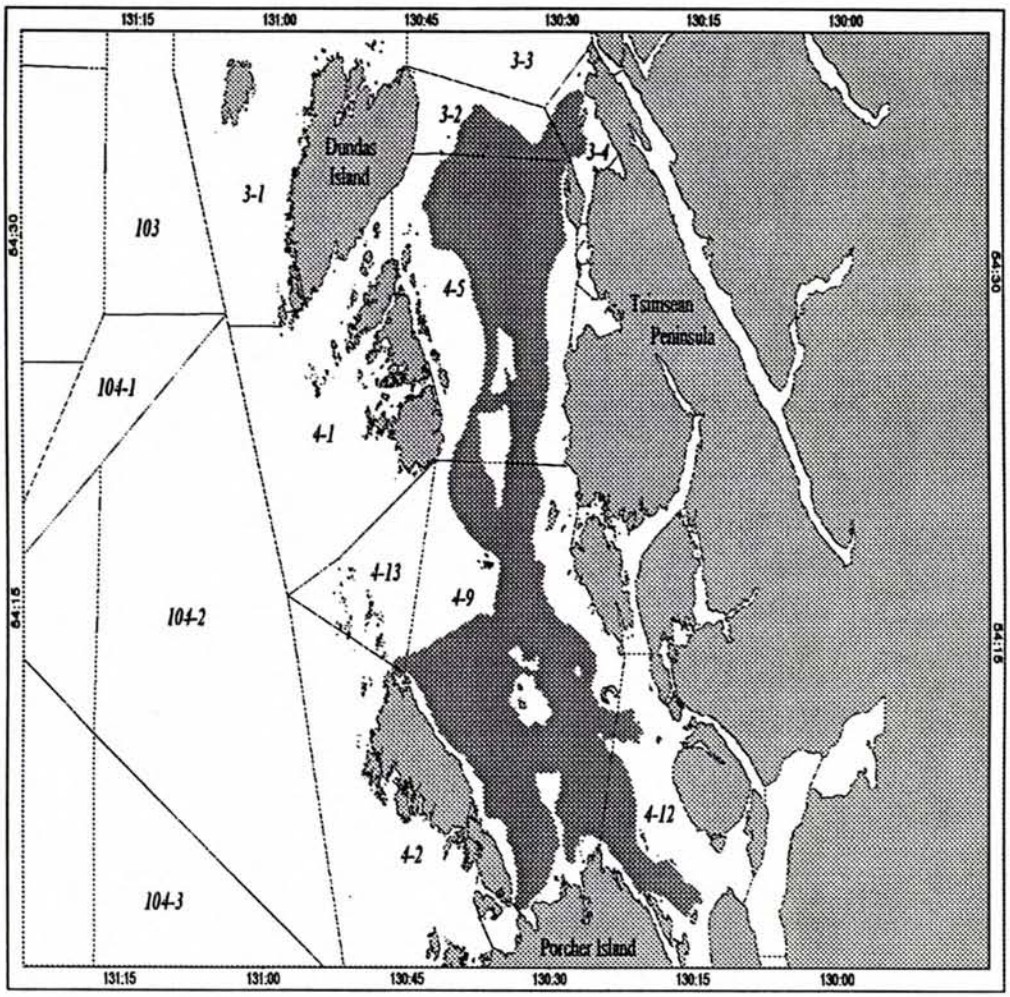

Figure 1. Areas surveyed in Chatham Sound, August and September, 1998.

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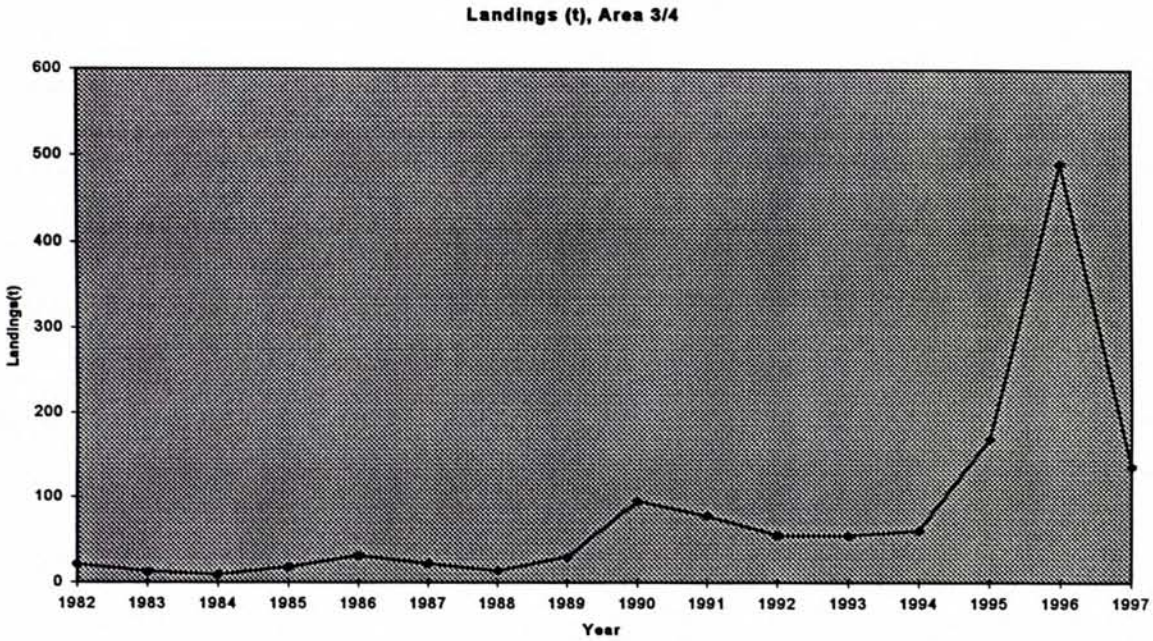

Figure 2. Landings (tonnes) in PFMA 3 and 4.

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Appendix 1

Shrimp Biomass Survey, Chatham Sound, August-September 1998

There were 43 Tows. Total Weight for all tows, 2,488 Kg.

		Weight in Kg	Percent of Total	Number of Tows
Shrimp Species				
Northern Pink	Pandalus borealis eous	505.20	20.3071	34
Smooth Pink	Pandalus jordani	353.70	14.2174	25
Prawn	Pandalus platyceros	13.20	0.5306	30
Coonstripe	Pandalus danae	0.10	0.0040	1
Humpback	Pandalus hypsinotus	2.00	0.0804	11
Sidestripe	Pandalopsis dispar	411.00	16.5206	37
Yellowleg	Pandalus montaqui tridens	0.30	0.0121	2
Bluespot	Pandalus stenolepsis	0.20	0.0080	2
Crangons	Crangon spp	5.60	0.2251	35
Eualus	Eualus spp	1.00	0.0402	10
Glass Shrimp	Pasiphaea pacifica	18.00	0.7235	6
Other Invertebrates				
Brittle Stars	Ophiurae (Order)	0.80	0.0322	8
Anemone	Actiniaria (Order)	0.30	0.0121	1
Bivalves	Bivalvia (Class)	0.20	0.0080	2
Stony Corals	Madreporia (Order)	0.30	0.0121	3
Jellyfish	Scyphozoa (Class)	6.60	0.2653	17
Squat Squid	Rossia pacifica	1.10	0.0442	11
Scallop	Pectinidae (Family)	0.30	0.0121	2
Squid	Teuthoidea (Order)	1.00	0.0402	8
Sponges	Phylum Porifera	26.40	1.0612	4
Starfish	Asteroidea (Class)	0.40	0.0161	4
Basket Stars	Euryalae (Order)	0.30	0.0121	3
Tritons	Fusitriton oregonensis	0.10	0.0040	1
Box Crabs	Lopholithodes spp	0.10	0.0040	1
Hermit Crabs	Paguridae (Family)	0.30	0.0121	3
Squat Lobster	Munida quadrispina	0.30	0.0121	3
Flatfish				
Dover Sole	Microstomus pacificus	10.20	0.4100	14
English Sole	Pleuronectes vetulus	13.30	0.5346	9
Flathead Sole	Hippoglossoides elassodon	60.60	2.4359	31
Rex Sole	Errex zachirus	21.90	0.8803	37
Turbot	Atheresthes stomias	37.60	1.5114	25
Slender Sole	Eopsetta exilis	52.60	2.1143	36
Rockfish				
Rougheye	Sebastes aleutianus	0.10	0.0040	1
Darkblotched	Sebastes crameri	1.50	0.0603	7
Splitnose	Sebastes diploproa	1.40	0.0563	3
Quillback	Sebastes maliger	0.20	0.0080	1
Yelloweye	Sebastes ruberrimus	1.50	0.0603	1
Roundfish				
Eulachon	Thaleichthys pacificus	338.30	13.5984	34

Shrimp Biomass Survey, Chatham Sound, August-September 1998

There were 43 Tows. Total Weight for all tows, 2,488 Kg.

		Weight in Kg	Percent of Total	Number of Tows
Pacific Herring	Clupea pallasi	35.40	1.4229	23
Walleye Pollock	Theragra chalcogramma	43.50	1.7485	30
Pacific Tomcod	Microgadus proximus	9.00	0.3618	13
Sablefish	Anoplopoma fimbria	5.90	0.2372	6
Eelpouts	Zoarcidae (Family)	240.70	9.6752	36
Pacific Hake	Merluccius productus	162.00	6.5118	24
Poachers	Agonidae (Family)	0.50	0.0201	5
Sculpins	Cottidae (Family)	1.20	0.0482	4
Shiner Perch	Cymatogaster aggregata	0.90	0.0362	5
Lanternfishes	Myctophidae (Family)	0.30	0.0121	3
Pricklebacks	Stichaeidae (Family)	0.10	0.0040	1
Dwarf Wrymouths	Cryptacanthodes aleutensis	0.20	0.0080	2
Selachii				
Skates	Rajidae (Family)	1.20	0.0482	3
Spotted Ratfish	Hydrolagus colliei	96.40	3.8749	29

Appendix 2

Shrimp Biomass Survey, Chatham Sound, August-September 1998

Date Sep 2 1998 **Time** 15 : 25 **Duration (min)** 30 **Area** 3 - 2 **Haul No.** 18
Depth M 144 150 Direction 215
Water Temp: Surface Bottom Distance 0.8 Naut. Mi.
Type of Gear D Total Catch Remark Usable Vessel 3
Net Effective Opening (feet) 30.0

Shrimp	**Weight**	**Num/Kg**
Northern Pink	1.40	
Smooth Pink	0.90	
Prawn	0.50	
Sidestripe	45.10	110

Invertebrates	

Flatfish	
Rex Sole	0.50
Slender Sole	0.50

Rockfish

Roundfish	
Eulachon	46.00
Sculpins	0.90

Selachii

Date Sep 3 1998 **Time** 9 :50 **Duration (min)** 25 **Area** 3 - 2 **Haul No.** 21
Depth M 200 240 Direction 330
Water Temp: Surface Bottom Distance 0.8 Naut. Mi.
Type of Gear D Total Catch 11 Remark Usable Vessel 3
Net Effective Opening (feet) 30.0

Shrimp	**Weight**	**Num/Kg**
Northern Pink	0.10	
Smooth Pink	0.10	
Prawn	0.20	
Sidestripe	2.70	105
Yellowleg	0.20	
Crangons	0.10	
Eualus	0.10	
Glass Shrimp	1.80	

Invertebrates	
Brittle Stars	0.10
Bivalves	0.10
Squat Squid	0.10
Squid	0.10
Starfish	0.10
Tritons	0.10

Flatfish	
Dover Sole	0.20
Rex Sole	0.50
Turbot	0.70

Rockfish
Splitnose 0.10

Roundfish	
Eulachon	3.50
Eelpouts	0.40
Pacific Hake	0.40

Selachii

All weights are in Kilograms

Shrimp Biomass Survey, Chatham Sound, August-September 1998

Date Sep 2 1998 **Time** 10 : 13 **Duration (min)** 29 **Area** 3 - 4 **Haul No.** 14
Depth M 130 135 Direction 185
Water Temp: Surface Bottom Distance 0.9 Naut. Mi.
Type of Gear D Total Catch 59 Remark Usable Vessel 3
Net Effective Opening (feet) 30.0

Shrimp	Weight	Num/Kg
Northern Pink	29.30	328
Prawn	0.50	
Humpback	0.10	
Sidestripe	13.20	105
Crangons	0.10	
Eualus	0.10	

Invertebrates	
Jellyfish	0.10
Squat Lobster	0.10

Flatfish	
English Sole	0.10
Flathead Sole	0.20
Rex Sole	0.10
Turbot	0.90
Slender Sole	0.60

Rockfish

Roundfish	
Eulachon	4.10
Walleye Pollock	0.10
Eelpouts	1.10
Pacific Hake	8.50
Sculpins	0.10
Pricklebacks	0.10

Selachii

Date Aug 30 1998 **Time** 8 :35 **Duration (min)** 15 **Area** 4 - 5 **Haul No.** 7
Depth M 155 170 Direction 140
Water Temp: Surface Bottom Distance 0.6 Naut. Mi.
Type of Gear D Total Catch 0 Remark Mechanical Problem Vessel 3
Net Effective Opening (feet) 30.0

Shrimp	Weight	Num/Kg

Invertebrates

Flatfish

Rockfish

Roundfish

Selachii

All weights are in Kilograms

Shrimp Biomass Survey, Chatham Sound, August-September 1998

Date Aug 30 1998 **Time** 10 : 15 **Duration (min)** 30 **Area** 4 - 5 **Haul No.** 8
Depth M 143 160 Direction 320
Water Temp: Surface Bottom Distance 1.1 Naut. Mi.
Type of Gear D Total Catch 282 Remark Usable Vessel 3
Net Effective Opening (feet) 30.0

Shrimp	**Weight**	**Num/Kg**
Northern Pink	95.70	242
Smooth Pink	13.90	231
Prawn	0.90	
Sidestripe	26.80	123
Crangons	0.10	
Eualus	0.10	

Invertebrates	
Sponges	24.30

Flatfish	
Dover Sole	0.70
Rex Sole	0.20
Turbot	13.60
Slender Sole	1.80

Rockfish	
Yelloweye	1.50

Roundfish	
Eulachon	64.00
Walleye Pollock	1.50
Sablefish	1.30
Eelpouts	2.70

Selachii	
Spotted Ratfish	33.40

Date Aug 30 1998 **Time** 13 : 20 **Duration (min)** 30 **Area** 4 - 5 **Haul No.** 9
Depth M 125 131 Direction 335
Water Temp: Surface Bottom Distance 0.8 Naut. Mi.
Type of Gear D Total Catch 132 Remark Usable Vessel 3
Net Effective Opening (feet) 30.0

Shrimp	**Weight**	**Num/Kg**
Northern Pink	36.60	192
Sidestripe	9.00	76

Invertebrates

Flatfish	
Flathead Sole	0.70

Rockfish

Roundfish	
Eulachon	32.10
Eelpouts	0.70
Pacific Hake	53.00

Selachii

All weights are in Kilograms

Shrimp Biomass Survey, Chatham Sound, August-September 1998

Date Sep 1 1998 **Time** 13 :00 **Duration (min)** 25 **Area** 4 - 5 **Haul No.** 10
Depth M 114 130 Direction 145
Water Temp: Surface Bottom Distance 1 Naut. Mi.
Type of Gear D Total Catch 45 Remark Usable Vessel 3
Net Effective Opening (feet) 30.0

Shrimp	**Weight**	**Num/Kg**
Northern Pink	4.80	278
Smooth Pink	24.60	374
Prawn	0.80	
Sidestripe	11.50	62

Rockfish	
Darkblotched	0.20

Invertebrates	
Squat Squid	0.10
Sponges	0.80

Roundfish	
Eulachon	0.20
Walleye Pollock	0.10
Pacific Hake	0.20
Lanternfishes	0.10

Flatfish	
Rex Sole	0.40
Turbot	0.30
Slender Sole	0.50

Selachii	
Spotted Ratfish	0.30

Date Sep 1 1998 **Time** 14 :55 **Duration (min)** 30 **Area** 4 - 5 **Haul No.** 11
Depth M 95 99 Direction 295
Water Temp: Surface Bottom Distance 0.7 Naut. Mi.
Type of Gear D Total Catch 51 Remark Usable Vessel 3
Net Effective Opening (feet) 30.0

Shrimp	**Weight**	**Num/Kg**
Northern Pink	4.70	204
Smooth Pink	39.40	192
Prawn	0.10	
Sidestripe	0.10	
Crangons	0.10	

Rockfish	
Darkblotched	0.50

Invertebrates	
Brittle Stars	0.10
Jellyfish	0.20
Scallop	0.10
Sponges	0.40
Basket Stars	0.10

Roundfish	
Eulachon	1.80
Pacific Herring	0.10
Walleye Pollock	0.10
Pacific Hake	0.50

Flatfish	
Dover Sole	0.80
Flathead Sole	0.40
Rex Sole	0.30
Turbot	2.00
Slender Sole	0.10

Selachii	
Spotted Ratfish	0.40

All weights are in Kilograms

Shrimp Biomass Survey, Chatham Sound, August-September 1998

Date Sep 1 1998 **Time** 16:26 **Duration (min)** 24 **Area** 4 - 5 **Haul No.** 12
Depth M 132 150 Direction 160
Water Temp: Surface Bottom Distance 1.2 Naut. Mi.
Type of Gear D Total Catch 23 Remark Usable Vessel 3
Net Effective Opening (feet) 30.0

Shrimp	**Weight**	**Num/Kg**
Northern Pink	3.40	272
Smooth Pink	0.10	
Prawn	0.30	
Humpback	0.10	
Sidestripe	9.70	72
Yellowleg	0.10	
Bluespot	0.10	
Crangons	0.10	
Eualus	0.10	

Invertebrates	
Brittle Stars	0.10
Squat Squid	0.10
Squat Lobster	0.10

Flatfish	
Flathead Sole	0.70
Rex Sole	0.10
Turbot	1.20

Rockfish

Roundfish	
Eulachon	5.20
Pacific Hake	1.50
Dwarf Wrymouths	0.10

Selachii	
Skates	0.60
Spotted Ratfish	0.30

Date Sep 1 1998 **Time** 17:40 **Duration (min)** 30 **Area** 4 - 5 **Haul No.** 13
Depth M 124 130 Direction 185
Water Temp: Surface Bottom Distance 0.9 Naut. Mi.
Type of Gear D Total Catch 211 Remark Usable Vessel 3
Net Effective Opening (feet) 30.0

Shrimp	**Weight**	**Num/Kg**
Northern Pink	64.10	240
Prawn	0.10	
Sidestripe	30.40	104
Crangons	0.60	

Invertebrates	
Brittle Stars	0.10
Squat Lobster	0.10

Flatfish	
Flathead Sole	1.10
Rex Sole	2.20
Slender Sole	3.40

Rockfish

Roundfish	
Eulachon	29.20
Eelpouts	8.10
Pacific Hake	70.90

Selachii	
Skates	0.10

All weights are in Kilograms

Shrimp Biomass Survey, Chatham Sound, August-September 1998

Date Sep 2 1998 **Time** 11:35 **Duration (min)** 35 **Area** 4 - 5 **Haul No.** 15
Depth M 104 120 Direction 150
Water Temp: Surface Bottom Distance 0.9 Naut. Mi.
Type of Gear D Total Catch 1 Remark Usable Vessel 3
Net Effective Opening (feet) 30.0

Shrimp	**Weight**	**Num/Kg**
Northern Pink	0.10	
Smooth Pink	0.20	
Prawn	0.10	
Sidestripe	0.10	
Crangons	0.10	
Rockfish		
Darkblotched	0.10	

Invertebrates	
Jellyfish	0.10
Roundfish	

Flatfish	
Dover Sole	0.10
Flathead Sole	0.40
Rex Sole	0.10
Slender Sole	0.10
Selachii	
Spotted Ratfish	0.10

Date Sep 2 1998 **Time** 13:00 **Duration (min)** 30 **Area** 4 - 5 **Haul No.** 16
Depth M 121 134 Direction 335
Water Temp: Surface Bottom Distance 0.9 Naut. Mi.
Type of Gear D Total Catch 46 Remark Usable Vessel 3
Net Effective Opening (feet) 30.0

Shrimp	**Weight**	**Num/Kg**
Northern Pink	0.10	
Smooth Pink	7.20	252
Prawn	1.40	
Sidestripe	5.80	130
Rockfish		
Darkblotched	0.40	

Invertebrates	
Roundfish	
Eulachon	28.40
Pacific Herring	0.10
Walleye Pollock	0.10
Eelpouts	0.40
Pacific Hake	1.40
Lanternfishes	0.10
Dwarf Wrymouths	0.10

Flatfish	
Flathead Sole	0.20
Rex Sole	0.10
Turbot	0.40
Slender Sole	0.10
Selachii	

All weights are in Kilograms

Shrimp Biomass Survey, Chatham Sound, August-September 1998

Date Sep 2 1998 **Time** 14 : 05 **Duration (min)** 25 **Area** 4 - 5 **Haul No.** 17
Depth M 218 225 Direction 15
Water Temp: Surface Bottom Distance 1.1 Naut. Mi.
Type of Gear D Total Catch 10 Remark Usable Vessel 3
Net Effective Opening (feet) 30.0

Shrimp	**Weight**	**Num/Kg**
Northern Pink	0.10	
Sidestripe	3.70	98
Crangons	0.40	
Glass Shrimp	0.50	

Invertebrates	
Jellyfish	0.20
Squid	0.10

Flatfish	
Rex Sole	2.50
Slender Sole	1.80

Rockfish	
Darkblotched	0.10

Roundfish	
Eulachon	0.40
Pacific Hake	0.30
Lanternfishes	0.10

Selachii

Date Sep 2 1998 **Time** 17 : 25 **Duration (min)** 35 **Area** 4 - 5 **Haul No.** 19
Depth M 95 103 Direction 330
Water Temp: Surface Bottom Distance 0.8 Naut. Mi.
Type of Gear D Total Catch Remark Usable Vessel 3
Net Effective Opening (feet) 30.0

Shrimp	**Weight**	**Num/Kg**
Northern Pink	0.10	
Smooth Pink	1.70	170
Prawn	0.20	
Crangons	0.10	

Invertebrates	
Brittle Stars	0.10
Bivalves	0.10
Stony Corals	0.10
Squat Squid	0.10
Hermit Crabs	0.10

Flatfish	
Flathead Sole	2.00
Rex Sole	0.20
Turbot	0.70
Slender Sole	1.30

Rockfish

Roundfish	
Eulachon	2.50
Pacific Herring	0.40
Eelpouts	0.60
Pacific Hake	0.20

Selachii	
Spotted Ratfish	0.10

All weights are in Kilograms

Shrimp Biomass Survey, Chatham Sound, August-September 1998

Date Sep 3 1998 **Time** 8 :30 **Duration (min)** 30 **Area** 4 - 5 **Haul No.** 20
Depth M 93 108 Direction 340
Water Temp: Surface Bottom Distance 0.9 Naut. Mi.
Type of Gear D Total Catch 16 Remark Usable Vessel 3
Net Effective Opening (feet) 30.0

Shrimp	**Weight**	**Num/Kg**
Northern Pink	4.50	322
Smooth Pink	8.10	243
Prawn	0.10	
Sidestripe	0.10	
Crangons	0.10	

Invertebrates	
Brittle Stars	0.10
Starfish	0.10

Flatfish	
Dover Sole	0.30
Flathead Sole	0.20
Rex Sole	0.70
Turbot	1.00
Slender Sole	0.30

Rockfish

Roundfish	
Eulachon	1.00
Walleye Pollock	0.10
Eelpouts	0.50
Pacific Hake	0.20

Selachii	
Spotted Ratfish	0.10

Date Sep 3 1998 **Time** 11 :50 **Duration (min)** 30 **Area** 4 - 5 **Haul No.** 22
Depth M 110 117 Direction 160
Water Temp: Surface Bottom Distance 0.9 Naut. Mi.
Type of Gear D Total Catch Remark Usable Vessel 3
Net Effective Opening (feet) 30.0

Shrimp	**Weight**	**Num/Kg**
Northern Pink	1.50	360
Smooth Pink	0.30	313
Prawn	0.10	
Sidestripe	2.00	81
Crangons	0.10	
Glass Shrimp	0.20	

Invertebrates	
Brittle Stars	0.10
Stony Corals	0.10
Squat Squid	0.10
Squid	0.30

Flatfish	
Dover Sole	2.80
Flathead Sole	2.20
Rex Sole	0.80
Turbot	1.10
Slender Sole	0.60

Rockfish

Roundfish	
Eulachon	0.10
Sablefish	1.10
Eelpouts	0.10
Pacific Hake	0.20

Selachii	
Spotted Ratfish	0.40

All weights are in Kilograms

Shrimp Biomass Survey, Chatham Sound, August-September 1998

Date Sep 3 1998 **Time** 14 :15 **Duration (min)** 30 **Area** 4 - 5 **Haul No.** 23
Depth M 92 97 Direction 170
Water Temp: Surface Bottom Distance 1 Naut. Mi.
Type of Gear D Total Catch 30 Remark Usable Vessel 3
Net Effective Opening (feet) 30.0

Shrimp	Weight	Num/Kg
Smooth Pink	20.40	148
Prawn	0.60	
Humpback	0.30	
Sidestripe	1.20	
Crangons	0.10	

Rockfish	
Darkblotched	0.10

Invertebrates	
Stony Corals	0.10

Roundfish	
Eulachon	3.40
Pacific Herring	0.10
Walleye Pollock	0.30
Eelpouts	0.90
Pacific Hake	0.90

Flatfish	
Dover Sole	0.10
Flathead Sole	1.50
Rex Sole	0.40
Turbot	1.20
Slender Sole	0.50

Selachii	
Spotted Ratfish	0.20

Date Aug 29 1998 **Time** 9 :25 **Duration (min)** 35 **Area** 4 - 9 **Haul No.** 1
Depth M 100 109 Direction
Water Temp: Surface Bottom Distance 0.7 Naut. Mi.
Type of Gear D Total Catch 19 Remark Usable Vessel 3
Net Effective Opening (feet) 30.0

Shrimp	Weight	Num/Kg
Northern Pink	5.90	266
Prawn	0.10	
Sidestripe	6.10	91
Crangons	0.10	
Eualus	0.10	

Rockfish	
Darkblotched	0.10

Invertebrates	
Jellyfish	0.50

Roundfish	
Eulachon	0.30
Walleye Pollock	0.40
Eelpouts	3.20
Shiner Perch	0.10

Flatfish	
Rex Sole	0.20
Turbot	0.40
Slender Sole	0.60

Selachii	
Spotted Ratfish	0.90

All weights are in Kilograms

Shrimp Biomass Survey, Chatham Sound, August-September 1998

Date Aug 29 1998 **Time** 10:45 **Duration (min)** 10 **Area** 4 - 9 **Haul No.** 2
Depth M 88 92 Direction 350
Water Temp: Surface Bottom Distance 0.6 Naut. Mi.
Type of Gear D Total Catch 20 Remark Usable Vessel 3
Net Effective Opening (feet) 30.0

Shrimp	Weight	Num/Kg
Northern Pink	5.20	237
Prawn	0.10	
Sidestripe	3.10	70
Crangons	0.10	

Invertebrates	
Jellyfish	1.30
Squat Squid	0.10

Flatfish	
Flathead Sole	0.80
Rex Sole	0.10
Turbot	2.40
Slender Sole	0.60

Rockfish

Roundfish	
Eulachon	1.00
Pacific Herring	0.60
Walleye Pollock	0.40
Pacific Tomcod	0.10
Sablefish	1.20
Eelpouts	3.20
Pacific Hake	0.10
Sculpins	0.10

Selachii	
Spotted Ratfish	0.10

Date Aug 29 1998 **Time** 11:50 **Duration (min)** 40 **Area** 4 - 9 **Haul No.** 3
Depth M 126 133 Direction 105
Water Temp: Surface Bottom Distance 1.4 Naut. Mi.
Type of Gear D Total Catch 58 Remark Usable Vessel 3
Net Effective Opening (feet) 30.0

Shrimp	Weight	Num/Kg
Northern Pink	24.60	248
Prawn	0.30	
Sidestripe	27.00	92
Crangons	0.10	

Invertebrates	
Jellyfish	0.10
Squat Squid	0.10

Flatfish	
Flathead Sole	0.40
Turbot	0.10

Rockfish

Roundfish	
Eulachon	5.00
Walleye Pollock	0.10
Eelpouts	0.40

Selachii	
Spotted Ratfish	0.50

All weights are in Kilograms

Shrimp Biomass Survey, Chatham Sound, August-September 1998

Date Aug 29 1998 **Time** 13 : 55 **Duration (min)** 30 **Area** 4 - 9 **Haul No.** 4
Depth M 94 95 Direction 330
Water Temp: Surface Bottom Distance 1.2 Naut. Mi.
Type of Gear D Total Catch 103 Remark Usable Vessel 3
Net Effective Opening (feet) 30.0

Shrimp	**Weight**	**Num/Kg**
Northern Pink	12.00	264
Coonstripe	0.10	
Sidestripe	7.70	62
Crangons	0.10	
Eualus	0.10	

Invertebrates

Flatfish

Dover Sole	0.30
Flathead Sole	4.30
Rex Sole	0.50
Slender Sole	0.70

Rockfish

Roundfish	
Eulachon	57.40
Pacific Herring	0.50
Walleye Pollock	0.10
Pacific Tomcod	0.10
Eelpouts	5.00
Pacific Hake	16.90

Selachii

Date Aug 29 1998 **Time** 15 : 30 **Duration (min)** 25 **Area** 4 - 9 **Haul No.** 5
Depth M 163 180 Direction 275
Water Temp: Surface Bottom Distance 1.2 Naut. Mi.
Type of Gear D Total Catch 36 Remark Usable Vessel 3
Net Effective Opening (feet) 30.0

Shrimp	**Weight**	**Num/Kg**
Northern Pink	2.50	214
Sidestripe	20.30	90
Crangons	0.30	
Glass Shrimp	0.30	

Invertebrates	
Jellyfish	0.40

Flatfish	
Flathead Sole	2.10
Turbot	0.50
Slender Sole	2.20

Rockfish

Roundfish	
Eulachon	5.90
Pacific Herring	0.10
Eelpouts	0.10
Pacific Hake	0.90

Selachii	
Spotted Ratfish	1.40

All weights are in Kilograms

Shrimp Biomass Survey, Chatham Sound, August-September 1998

Date Aug 29 1998 **Time** 17 :55 **Duration (min)** 25 **Area** 4 - 9 **Haul No.** 6
Depth M 66 66 Direction 85
Water Temp: Surface Bottom Distance 0.9 Naut. Mi.
Type of Gear D Total Catch 28 Remark Usable Vessel 3
Net Effective Opening (feet) 30.0

Shrimp	**Weight**	**Num/Kg**
Northern Pink	0.10	
Smooth Pink	1.00	
Prawn	0.10	
Humpback	0.50	
Crangons	0.10	

Invertebrates	
Jellyfish	0.10
Squid	0.10

Flatfish	
Flathead Sole	0.90
Rex Sole	0.30
Slender Sole	0.50

Rockfish

Roundfish	
Pacific Herring	5.60
Walleye Pollock	15.70
Pacific Tomcod	1.00
Eelpouts	1.00
Shiner Perch	0.30

Selachii	
Spotted Ratfish	1.10

Date Sep 4 1998 **Time** 9 :05 **Duration (min)** 30 **Area** 4 - 9 **Haul No.** 24
Depth M 71 74 Direction 190
Water Temp: Surface Bottom Distance 0.9 Naut. Mi.
Type of Gear D Total Catch 19 Remark Usable Vessel 3
Net Effective Opening (feet) 30.0

Shrimp	**Weight**	**Num/Kg**
Smooth Pink	3.90	268
Prawn	0.10	
Crangons	0.10	

Invertebrates	
Jellyfish	0.10
Squat Squid	0.10
Squid	0.10
Hermit Crabs	0.10

Flatfish	
English Sole	0.30
Flathead Sole	1.80
Rex Sole	0.40
Turbot	3.90
Slender Sole	0.20

Rockfish

Roundfish	
Eulachon	0.10
Pacific Herring	1.70
Walleye Pollock	3.90
Pacific Tomcod	0.40
Sablefish	1.70
Eelpouts	0.10
Poachers	0.10
Shiner Perch	0.30

Selachii	
Spotted Ratfish	0.20

All weights are in Kilograms

Shrimp Biomass Survey, Chatham Sound, August-September 1998

Date Sep 4 1998 **Time** 10 : 15 **Duration (min)** 35 **Area** 4 - 9 **Haul No.** 25
Depth M 104 107 Direction 215
Water Temp: Surface Bottom Distance 1.2 Naut. Mi.
Type of Gear D Total Catch 144 Remark Usable Vessel 3
Net Effective Opening (feet) 30.0

Shrimp	**Weight**	**Num/Kg**
Northern Pink	5.40	206
Smooth Pink	51.20	214
Prawn	1.10	
Sidestripe	21.80	80
Crangons	0.10	

Invertebrates

Flatfish	
English Sole	0.10
Flathead Sole	15.30
Rex Sole	0.10
Turbot	1.60
Slender Sole	3.30

Rockfish

Roundfish	
Walleye Pollock	0.10
Pacific Tomcod	0.10
Eelpouts	43.20
Pacific Hake	1.60

Selachii

Date Sep 4 1998 **Time** 11 : 45 **Duration (min)** 30 **Area** 4 - 9 **Haul No.** 26
Depth M 118 130 Direction 315
Water Temp: Surface Bottom Distance 1.1 Naut. Mi.
Type of Gear D Total Catch 78 Remark Usable Vessel 3
Net Effective Opening (feet) 30.0

Shrimp	**Weight**	**Num/Kg**
Northern Pink	0.10	
Smooth Pink	44.50	207
Sidestripe	7.90	65
Crangons	0.10	

Invertebrates

Flatfish	
Flathead Sole	1.10
Rex Sole	0.10
Turbot	0.10
Slender Sole	10.10

Rockfish

Roundfish	
Eulachon	7.90
Walleye Pollock	0.10
Eelpouts	6.90

Selachii

All weights are in Kilograms

Shrimp Biomass Survey, Chatham Sound, August-September 1998

Date Sep 4 1998 **Time** 14 : 05 **Duration (min)** 30 **Area** 4 - 9 **Haul No.** 27
Depth M 105 114 Direction 118
Water Temp: Surface Bottom Distance 1.1 Naut. Mi.
Type of Gear D Total Catch Remark Usable Vessel 3
Net Effective Opening (feet) 30.0

Shrimp	Weight	Num/Kg
Northern Pink	40.00	253
Prawn	0.10	
Sidestripe	11.70	111
Crangons	0.10	
Eualus	0.10	

Invertebrates	
Jellyfish	0.10

Flatfish	
Dover Sole	2.10
Flathead Sole	0.40
Rex Sole	0.30
Slender Sole	2.70

Rockfish

Roundfish	
Eulachon	5.50
Pacific Herring	0.70
Walleye Pollock	0.70
Eelpouts	45.10

Selachii	
Spotted Ratfish	6.20

Date Sep 4 1998 **Time** 15 : 15 **Duration (min)** 30 **Area** 4 - 9 **Haul No.** 28
Depth M 85 87 Direction 100
Water Temp: Surface Bottom Distance 0.9 Naut. Mi.
Type of Gear D Total Catch 43 Remark Usable Vessel 3
Net Effective Opening (feet) 30.0

Shrimp	Weight	Num/Kg
Smooth Pink	23.20	260
Prawn	2.00	
Sidestripe	9.60	131

Invertebrates

Flatfish	
Flathead Sole	1.40
Slender Sole	0.10

Rockfish
Rougheye 0.10

Roundfish	
Eulachon	2.10
Pacific Herring	0.30
Walleye Pollock	0.10
Eelpouts	4.20
Pacific Hake	0.10

Selachii	
Skates	0.50
Spotted Ratfish	0.10

All weights are in Kilograms

Shrimp Biomass Survey, Chatham Sound, August-September 1998

Date Sep 4 1998 **Time** 16 : 35 **Duration (min)** 30 **Area** 4 - 9 **Haul No.** 29
Depth M 114 140 Direction 100
Water Temp: Surface Bottom Distance 1.1 Naut. Mi.
Type of Gear D Total Catch 45 Remark Usable Vessel 3
Net Effective Opening (feet) 30.0

Shrimp	**Weight**	**Num/Kg**
Northern Pink	2.40	256
Sidestripe	5.60	139
Glass Shrimp	14.40	

Invertebrates

Flatfish

Rockfish

Roundfish	
Eulachon	14.00
Walleye Pollock	2.80
Eelpouts	0.10

Selachii	
Spotted Ratfish	6.00

Date Sep 4 1998 **Time** 17 : 50 **Duration (min)** 30 **Area** 4 - 9 **Haul No.** 30
Depth M 60 60 Direction 290
Water Temp: Surface Bottom Distance 0.9 Naut. Mi.
Type of Gear D Total Catch 24 Remark Usable Vessel 3
Net Effective Opening (feet) 30.0

Shrimp	**Weight**	**Num/Kg**
Northern Pink	9.20	306
Prawn	0.10	
Humpback	0.10	
Sidestripe	0.40	
Crangons	0.10	
Eualus	0.10	

Invertebrates	
Jellyfish	0.40
Squid	0.10
Starfish	0.10

Flatfish	
Dover Sole	0.10
English Sole	0.50
Flathead Sole	4.20
Rex Sole	0.40
Slender Sole	0.40

Rockfish

Roundfish	
Pacific Herring	2.10
Walleye Pollock	5.00
Pacific Tomcod	0.40
Sablefish	0.30
Eelpouts	0.10
Pacific Hake	0.10
Shiner Perch	0.10

Selachii	
Spotted Ratfish	0.80

All weights are in Kilograms

Shrimp Biomass Survey, Chatham Sound, August-September 1998

Date Sep 5 1998 **Time** 8:05 **Duration (min)** 30 **Area** 4 - 9 **Haul No.** 31
Depth M 84 89 Direction 285
Water Temp: Surface Bottom Distance 1.2 Naut. Mi.
Type of Gear D Total Catch 62 Remark Usable Vessel 3
Net Effective Opening (feet) 30.0

Shrimp	**Weight**	**Num/Kg**
Northern Pink	13.00	290
Prawn	0.60	
Humpback	0.10	
Sidestripe	10.30	101
Crangons	0.10	

Invertebrates

Flatfish

Flathead Sole	2.10
Rex Sole	0.30
Slender Sole	0.60

Rockfish

Roundfish	
Pacific Herring	1.50
Walleye Pollock	0.90
Pacific Tomcod	0.30
Eelpouts	32.60

Selachii

Date Sep 5 1998 **Time** 10:35 **Duration (min)** 20 **Area** 4 - 9 **Haul No.** 32
Depth M 114 130 Direction 275
Water Temp: Surface Bottom Distance 0.7 Naut. Mi.
Type of Gear D Total Catch 4 Remark Usable Vessel 3
Net Effective Opening (feet) 30.0

Shrimp	**Weight**	**Num/Kg**
Northern Pink	0.10	
Smooth Pink	0.10	
Prawn	0.10	
Humpback	0.10	
Crangons	0.10	
Eualus	0.10	

Invertebrates	
Brittle Stars	0.10
Anemone	0.30
Jellyfish	1.40
Squat Squid	0.10
Scallop	0.20
Sponges	0.90
Box Crabs	0.10
Hermit Crabs	0.10

Flatfish	
Dover Sole	0.10
Rex Sole	0.30
Slender Sole	0.10

Rockfish

Roundfish	
Walleye Pollock	0.10
Eelpouts	0.10
Poachers	0.10
Sculpins	0.10

Selachii	
Spotted Ratfish	0.40

All weights are in Kilograms

Shrimp Biomass Survey, Chatham Sound, August-September 1998

Date Sep 5 1998 **Time** 11 : 40 **Duration (min)** 27 **Area** 4 - 9 **Haul No.** 33
Depth M 104 118 Direction 125
Water Temp: Surface Bottom Distance 0.9 Naut. Mi.
Type of Gear D Total Catch 53 Remark Usable Vessel 3
Net Effective Opening (feet) 30.0

Shrimp	Weight	Num/Kg
Smooth Pink	32.90	240
Sidestripe	5.20	64
Crangons	0.10	

Invertebrates	
Jellyfish	0.10
Starfish	0.10
Basket Stars	0.10

Flatfish	
Dover Sole	0.70
Flathead Sole	3.50
Rex Sole	0.50
Turbot	0.50
Slender Sole	1.10

Rockfish

Roundfish	
Eulachon	0.90
Pacific Herring	0.20
Walleye Pollock	0.10
Eelpouts	6.10
Poachers	0.10

Selachii	
Spotted Ratfish	1.20

Date Sep 5 1998 **Time** 14 : 40 **Duration (min)** 30 **Area** 4 - 9 **Haul No.** 34
Depth M 128 137 Direction 100
Water Temp: Surface Bottom Distance 1.1 Naut. Mi.
Type of Gear D Total Catch 53 Remark Usable Vessel 3
Net Effective Opening (feet) 30.0

Shrimp	Weight	Num/Kg
Smooth Pink	31.90	206
Sidestripe	7.80	71
Crangons	0.10	

Invertebrates	
Squat Squid	0.10

Flatfish	
Flathead Sole	0.20
Rex Sole	0.30
Turbot	0.20
Slender Sole	0.60

Rockfish

Roundfish	
Eulachon	0.50
Pacific Herring	0.10
Eelpouts	3.80
Pacific Hake	0.10

Selachii	
Spotted Ratfish	7.60

All weights are in Kilograms

Shrimp Biomass Survey, Chatham Sound, August-September 1998

Date Sep 5 1998 **Time** 16 :10 **Duration (min)** 30 **Area** 4 - 9 **Haul No.** 35
Depth M 114 118 Direction 80
Water Temp: Surface Bottom Distance 0.9 Naut. Mi.
Type of Gear D Total Catch 52 Remark Usable Vessel 3
Net Effective Opening (feet) 30.0

Shrimp	Weight	Num/Kg
Northern Pink	24.00	258
Smooth Pink	4.70	388
Sidestripe	10.90	86
Crangons	0.10	
Glass Shrimp	0.80	

Invertebrates

Flatfish

Flathead Sole	0.10
Rex Sole	1.00
Turbot	0.30
Slender Sole	1.90

Rockfish

Roundfish

Eulachon	0.60
Pacific Herring	0.10
Walleye Pollock	0.10
Eelpouts	3.30
Pacific Hake	1.30

Selachii

Spotted Ratfish	3.20

Date Sep 5 1998 **Time** 17 :40 **Duration (min)** 30 **Area** 4 - 9 **Haul No.** 36
Depth M 106 116 Direction 110
Water Temp: Surface Bottom Distance 1.1 Naut. Mi.
Type of Gear D Total Catch 64 Remark Usable Vessel 3
Net Effective Opening (feet) 30.0

Shrimp	Weight	Num/Kg
Northern Pink	15.70	404
Smooth Pink	10.40	296
Sidestripe	20.00	101
Crangons	0.10	
Eualus	0.10	

Invertebrates

Flatfish

Dover Sole	0.20
English Sole	0.50
Rex Sole	0.60
Turbot	0.50
Slender Sole	3.60

Rockfish

Roundfish

Eulachon	1.00
Pacific Herring	0.40
Walleye Pollock	0.10
Eelpouts	8.00
Pacific Hake	0.20

Selachii

Spotted Ratfish	2.50

All weights are in Kilograms

Shrimp Biomass Survey, Chatham Sound, August-September 1998

Date Sep 6 1998 **Time** 9:05 **Duration (min)** 30 **Area** 4 - 9 **Haul No.** 37
Depth M 101 129 Direction 180
Water Temp: Surface Bottom Distance 1.8 Naut. Mi.
Type of Gear D Total Catch 68 Remark Usable Vessel 3
Net Effective Opening (feet) 30.0

Shrimp	**Weight**	**Num/Kg**
Smooth Pink	16.40	198
Prawn	0.30	
Humpback	0.10	
Sidestripe	14.00	91
Crangons	0.10	

Invertebrates

Flatfish

Dover Sole	1.70
Rex Sole	2.90
Slender Sole	1.70

Rockfish

Roundfish	
Eulachon	1.70
Pacific Herring	0.60
Walleye Pollock	0.10
Pacific Tomcod	1.70
Eelpouts	3.70

Selachii

Spotted Ratfish	23.40

Date Sep 6 1998 **Time** 10:30 **Duration (min)** 25 **Area** 4 - 9 **Haul No.** 38
Depth M 65 77 Direction 295
Water Temp: Surface Bottom Distance 1.1 Naut. Mi.
Type of Gear D Total Catch 4 Remark Usable Vessel 3
Net Effective Opening (feet) 30.0

Shrimp **Weight** **Num/Kg**

Invertebrates

Jellyfish	1.30
Squid	0.10

Flatfish

English Sole	0.20
Flathead Sole	0.10
Rex Sole	0.80
Turbot	0.20

Rockfish

Roundfish	
Pacific Herring	1.30
Walleye Pollock	0.10
Pacific Tomcod	0.30
Eelpouts	0.20
Shiner Perch	0.10

Selachii

Spotted Ratfish	0.50

All weights are in Kilograms

Shrimp Biomass Survey, Chatham Sound, August-September 1998

Date Sep 6 1998 **Time** 12 : 15 **Duration (min)** 30 **Area** 4 - 9 **Haul No.** 39
Depth M 96 96 Direction 230
Water Temp: Surface Bottom Distance 1 Naut. Mi.
Type of Gear D Total Catch 30 Remark Usable Vessel 3
Net Effective Opening (feet) 30.0

Shrimp	**Weight**	**Num/Kg**
Smooth Pink	3.00	208
Humpback	0.40	
Sidestripe	0.60	
Bluespot	0.10	
Crangons	0.10	

Rockfish	
Quillback	0.20

Invertebrates	
Squat Squid	0.10
Squid	0.10

Roundfish	
Eulachon	3.40
Pacific Herring	1.30
Walleye Pollock	1.10
Pacific Tomcod	1.30
Eelpouts	12.90
Pacific Hake	0.10
Poachers	0.10

Flatfish	
English Sole	0.70
Flathead Sole	1.10
Rex Sole	1.10
Turbot	0.20
Slender Sole	2.20

Selachii	
Spotted Ratfish	0.60

Date Sep 6 1998 **Time** 14 : 30 **Duration (min)** 30 **Area** 4 - 9 **Haul No.** 40
Depth M 72 99 Direction 150
Water Temp: Surface Bottom Distance 1 Naut. Mi.
Type of Gear D Total Catch 27 Remark Usable Vessel 3
Net Effective Opening (feet) 30.0

Shrimp	**Weight**	**Num/Kg**
Northern Pink	1.70	362
Smooth Pink	13.60	199
Prawn	0.10	
Humpback	0.10	
Sidestripe	4.20	65
Crangons	0.10	

Rockfish

Invertebrates	
Jellyfish	0.10

Roundfish	
Pacific Tomcod	2.30
Sablefish	0.30
Eelpouts	0.80
Poachers	0.10

Flatfish	
English Sole	1.30
Flathead Sole	0.20
Rex Sole	0.80
Slender Sole	0.40

Selachii	
Spotted Ratfish	0.80

All weights are in Kilograms

Shrimp Biomass Survey, Chatham Sound, August-September 1998

Date Sep 7 1998 **Time** 8 :55 **Duration (min)** 30 **Area** 4 - 12 **Haul No.** 41
Depth M 77 91 Direction 175
Water Temp: Surface Bottom Distance 1 Naut. Mi.
Type of Gear D Total Catch 42 Remark Usable Vessel 3
Net Effective Opening (feet) 30.0

Shrimp	**Weight**	**Num/Kg**
Northern Pink	7.80	235
Prawn	0.20	
Humpback	0.10	
Sidestripe	6.60	78
Crangons	0.10	

Rockfish

Invertebrates	

Flatfish	
Flathead Sole	7.60
Rex Sole	0.20
Slender Sole	0.50

Roundfish	
Eulachon	1.80
Pacific Herring	4.80
Walleye Pollock	1.10
Pacific Tomcod	0.20
Eelpouts	11.80

Selachii

Date Sep 7 1998 **Time** 10 :20 **Duration (min)** 30 **Area** 4 - 12 **Haul No.** 42
Depth M 95 119 Direction 120
Water Temp: Surface Bottom Distance 1.1 Naut. Mi.
Type of Gear D Total Catch 47 Remark Usable Vessel 3
Net Effective Opening (feet) 30.0

Shrimp	**Weight**	**Num/Kg**
Northern Pink	19.60	262
Prawn	0.80	
Sidestripe	8.10	77
Crangons	0.10	

Rockfish	
Splitnose	0.10

Invertebrates	
Jellyfish	0.10
Basket Stars	0.10

Flatfish	
Flathead Sole	3.40
Rex Sole	0.40
Slender Sole	2.10

Roundfish	
Eulachon	2.50
Pacific Herring	2.10
Walleye Pollock	2.10
Pacific Tomcod	0.80
Eelpouts	5.50

Selachii

All weights are in Kilograms

Shrimp Biomass Survey, Chatham Sound, August-September 1998

Date Sep 7 1998 **Time** 11 :30 **Duration (min)** 30 **Area** 4 - 12 **Haul No.** 43
Depth M 103 108 Direction 120
Water Temp: Surface Bottom Distance 1.1 Naut. Mi.
Type of Gear D Total Catch 184 Remark Usable Vessel 3
Net Effective Opening (feet) 30.0

Shrimp	**Weight**	**Num/Kg**
Northern Pink	69.40	224
Prawn	1.20	
Sidestripe	40.70	184
Crangons	1.20	

Invertebrates

Flatfish	
English Sole	9.60
Rex Sole	1.20
Turbot	3.60
Slender Sole	4.80

Rockfish	
Splitnose	1.20

Roundfish	
Eulachon	4.80
Pacific Herring	10.70
Walleye Pollock	6.00
Eelpouts	23.80
Pacific Hake	2.40

Selachii	
Spotted Ratfish	3.60

All weights are in Kilograms