Shrimp Survey and Resulting Management Actions, Fraser River Shrimp Management Area, August 1998

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SHRIMP SURVEY AND RESULTING MANAGEMENT ACTIONS, FRASER RIVER SHRIMP MANAGEMENT AREA, AUGUST 1998

by

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ABSTRACT

Boutillier, J.A., J.A. Bond, H. Nguyen, and K. West. 1999. Shrimp survey and resulting management actions, Fraser River Shrimp Management Area, August 1998. Can. Manuscr. Rep. Fish. Aquat. Sci. 2494: 33 p.

This report forms part of a series that details 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 the Fraser River Shrimp Management Area (FR SMA) in August, 1998. The DFO research vessel Caligus was used to complete the survey, which covered portions of Pacific Fisheries Management Areas (PFMA) 28 and 29. The fisheries in this area are primarily for the smooth pink shrimp, *Pandalus jordani*, the Northern pink shrimp, *Pandalus borealis eous*, and the sidestripe shrimp, *Pandalopsis dispar*.

Biomass indices of shrimp by species were determined in select trawlable areas of the FR SMA. While the collection of shrimp data and the bycatch of halibut and eulachon were priorities over detailed information on bycatch, catch information on all species was collected. Landings of prawns were minor, and no halibut or eulachon were caught during the survey.

Because of conservation concerns, a fixed exploitation rate of 25% (as opposed to the standard exploitation rate of 33%) was applied to the biomass estimates of shrimp by species. Catch ceilings, quotas, and other management actions as results of the survey are discussed.

These survey data are the first data in developing a time series of survey indices for the area. This survey data set will complement established logbook and biological sampling data sets from the area and will be used in combination to provide an assessment of the health of the stocks in the area. Until a long-term database is available, the initial survey biomass indices will be used as absolute estimates for the purpose of setting quotas.

RÉSUMÉ

Boutillier, J.A., J.A. Bond, H. Nguyen, and K. West. 1999. Shrimp survey and resulting management actions, Fraser River Shrimp Management Area, August 1998. Can. Manuscr. Rep. Fish. Aquat. Sci. 2494: 33 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 de gestion de la crevette du Fraser (RGCF) a été effectuée en août 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 28 et 29. 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 la RGCF. La collecte de données sur les crevettes ainsi que sur les prises accessoires de flétans et d'eulakanes constituait la priorité de l'étude mais celle-ci a en fait été étendue à toutes les espèces. Les captures de crevettes ont été minimes et aucun flétan ni aucun eulakane n'a été pris au cours de l'étude.

Pour des raisons de conservation, un taux d'exploitation fixe de 25 % (et non de 33 %, taux d'exploitation standard) a été appliqué aux estimations de biomasse pour chaque espèce de crevettes. Le compte rendu traite aussi des plafonds de capture, des quotas et autres initiatives de gestion qui ont résulté de l'étude.

Ces données sont les premières d'une série temporelle d'indicateurs pour la région. Ces indicateurs viendront compléter les bases de données issues des livres de bord et des échantillonnages biologiques pour offrir un moyen d'évaluation de l'état de santé des stocks dans la région. 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 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 25 or 33%, depending on the health of the stocks.

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.

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[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).

One of the key tools used in collection of the data is fishery independent biomass surveys. Area-swept trawl surveys are the key survey tool used to calculate biomass indices. The data from these trawl surveys are complemented by using survey data to estimate the amount of shrimp available to the trawl using vertical trapping 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 as with the development of a consistent data base of survey indices and catches, 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, to determine appropriate levels of exploitation by area and species and 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

The Fraser River shrimp management area is a small-boat beam trawl fishery. The most common trawl fished is the 12 to 15 m pole beam trawl. Over time, there have been a variety of otter trawls used in Area 29, but this use has been fairly minimal with otter trawl catches amounting to less than 1% of the total catch.

In the 1950's and early 1960's total catches of shrimp were substantially higher than they have been in the 1970's, 1980's and 1990's. For example, the average annual catch up to 1963 was 295 t (with a peak of 443 t in 1957), however, the average catch for the years after 1963 has dropped by more than 50% (Figure 1).

This report summarises the management and assessment activities in the FR SMA in 1998. The report will include the data collection process, analysis, interpretation and resulting management actions of a fishery independent shrimp survey.

OBJECTIVE

The Fraser River (FR) Shrimp Management Area opened on April 16, 1998 with a quota based on recent trends in catches from the area. The fishery took the preliminary quota for the area and the area was closed on July 1, 1998. An area swept trawl survey was then conducted to provide inseason biomass indices of shrimp by species in trawlable areas of Areas 28 and 29. These indices were then used to adjust catch ceilings for the various areas by species for the remainder of the fishing year.

METHODS

The biomass survey was conducted over a period of ten days (August 12 to 21, 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. The survey provided inseason fishery biomass indices of shrimp abundance for portions of PFMA 28-1, 29-2, and 29-3 in the Fraser River Shrimp Management Area (Figure 2).

Industry representatives (Satoshi (Sugar) Hamada and Josef Bauer) familiar with the area provided input into the survey. The industry representatives oversaw operations on the vessel during portions of the survey and provided advice on the design and implementation of the survey by providing local knowledge on how 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 no selectivity grid was used with the net. A Nordmore fish exclusion device is used with the net during select surveys to reduce the size of the bycatch and optimise the sampling time.

The Caligus carried two biological technicians, who were jointly funded by DFO science and industry stock assessment funds. The catches from the survey were recorded and sampled. Subsequent to the survey, this catch is accounted for in any 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 sectoral 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 mile (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 (PFMA); 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 is necessary as this will be the prime vessel and equipment for the development of a time series of assessment indices.

AREA SWEPT TRAWL SURVEY

Trawl tows were spaced systematically over the fishing grounds on a 300-m by 300-m 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 for 4-hour soaks. Traps were spaced along the groundline at distances 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 to be 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 for an area 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 for each Subarea was mapped and divided into grid cells representing areas of 90,000 square meters (i.e.

squares with sides of length 300 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 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

EFFORT STANDARDIZATION

From the gear information, the effective mouth opening of the trawl was estimated to be 50% of the footrope length (Hannah 1995).

TRAWL SURVEY

A total of 33 successful tows (of 38 total tows) were completed in all areas combined. The tows sampled from 0.08 to 0.15% of the total area surveyed (see Table 2).

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 19 successful sets (of 21 total sets) were made in all areas combined. No shrimp were found in traps set above 0 m. Thus, no correction for availability was necessary.

AGE CLASS ESTIMATES

The size of the animals by age class and species varied between locations (see Table 3).

SURVEY BIOMASS INDICES

The survey indices and total catch to date are 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 from the fishery prior to the survey, we are assuming that over the period of time from the fishery start and the survey estimate, growth and natural mortality

balance. Survey biomass, catch, estimated total biomass, and calculated quotas are shown in Table 4.

Critical to the estimate of biomass and the remaining quota is the estimate of total catch by area and species. There appears to be a major discrepancy between the reported catch composition and the survey and commercial sampling catch composition by species.

DISCUSSION

Although there appears to be additional quota available, the one major concern is that the majority of the shrimp that makes up the biomass of Northern pinks is composed of age 1+ animals. The proportion of 1+ shrimp is quite high for Northern pink shrimp (80.5%). This was also evident in the reports of large quantities of discarded pinhead shrimp from the commercial fishery. The 1+ and 2+ sidestripes, which are equivalent in size to the pink shrimp, make up the majority of the catch of sidestripes: 68.2% by numbers, but only 47.1% by weight.

This was the first time the *Caligus* had been used for this type of survey with this gear, and there were some unusable tows. In addition, some of the tows had large bycatches of fish, which slowed down the processing time. Both of these factors reduced the number of tows that were completed which resulted in Subarea 28-4 not being surveyed and only 60% of the desired tows being completed in the Subareas surveyed.

Catch records (logbooks) report a catch composition of approximately 77% pinks and 23% sidestripes. The 1998 survey results show 67% pinks and 33% sidestripes. The AMR landing records report a catch that is 84% pinks and 16% sidestripes. This difference is likely due to the sorting of shrimp by sizes by the fishers, rather than sorting by species. Many of the smaller sidestripes are included in the "pink" landings, so landing records tend to under-estimate sidestripe catch and over-estimate pink catch.

Fishery Management Actions, Fraser River Shrimp Management Area (PFMA 28 and 29)

BACKGROUND

In 1996, fisheries managers, stock assessment scientists and the Pacific Stock Assessment Review Committee (PSARC) recommended that precautionary catch ceilings be implemented to protect inshore shrimp stocks. Historical shrimp catches for Areas 28 and 29 were at a high in the 1950's and early 1960's, with an average annual catch at that time of 295 t and a peak of 443 t (1957). Since then the average annual catch reported by sales slips and mandatory vessel harvest logs has dropped by more than 50% with an average catch between 1982 and 1994 of 141.3 t.

Conservation concerns, including declining landings and primary sidestripe females were identified in the scientific advice presented to the Pacific Stock Assessment Review Committee in

September of 1996 (Boutillier et al 1996). An important feature of the biological data for sidestripes in Areas 28 and 29 (sample taken in June 1996) was the missing Age 2 males. Sidestripes were bypassing the male phase and going directly through transition to females. This was unique to Areas 28 and 29 and was considered to be a possible response to overfishing. Landings reported in sales slips for 1996 were 64.9 t for Area 28 (the highest since 1987) and 133.8 t for Area 29 (the highest since 1983).

Catch ceilings were required as a precautionary measure to protect the long-term viability of shrimp stocks. As a result of conservation concerns the catch ceilings for Areas 28 and 29 for the 1997/98 and 1998/99 seasons were set at a combined precautionary level of 90 t, the 10th percentile of historical landings.

1998/99 SEASON

The shrimp trawl fishery in SMA FR opened on April 1, 1998 and closed on July 1, 1998, when the catch ceiling (198,410 lb. or 90 t) was attained. The main target species in SMA FR are Northern pink (*Pandalus borealis eous*), smooth pink (*P. jordani*), and sidestripe shrimp (*Pandalopsis dispar*).

A survey in SMA FR took place between August 12 and 21, 1998 with the preliminary results being forwarded to managers. A quota for the 1998/99 season (Table 4) was calculated based on a fixed exploitation rate of 0.25 of the total biomass (calculated based on a sum of the August survey and the fishery landings from April 1 to July 1, 1998).

Catch ceilings are adjusted inseason if other information from fishery independent surveys and catches indicate that the biomass of the area multiplied by a fixed exploitation rate results in a quota (or total allowable catch) for the area which is either less than or greater than the arbitrary levels. For most areas an exploitation rate of 0.33 has been used, but a more conservative exploitation rate of 0.25 is presently being applied in Areas 28 and 29 due to the conservation concerns for the stocks.

Concern was expressed by stock assessment scientists after reviewing the biological data collected during the survey, that the majority of the shrimp making up the biomass of Northern pinks in SMA FR in 1998 was composed of a single year class (1+ animals). This information was substantiated by reports, during the fishery, of large numbers of pinheads in the catch. These additional pieces of information further supported the conservative exploitation rate of 0.25, rather than the rate of 0.33 used for many other areas.

With advice from the Shrimp Trawl Sectoral Committee on November 3, 1998 to reopen areas as soon as possible after additional quota is identified, a Notice to Industry opening SMA FR was issued on November 5, 1998. This notice opened the shrimp trawl fishery at 0001 hrs, November 6, 1998 for an additional quota, for the 1998/99 season, of 100 tonnes or 220,000 lb. based on the sum of the quotas for the different species provided in Table 4. The area closed at midnight on March 2, 1999 when the catch ceiling for SMA FR was attained.

ACKNOWLEDGEMENTS

We would like to thank Satoshi Hamada, Josef Bauer, and the Captain and crew of the research vessel Caligus for their cooperation. The biological technicians for the survey included Steve Head, Peter Mattson, Jeff Olsson, and Annie Smith. 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 areas.

Subarea	Location	Area surveyed (km^2)
28-01	Howe Sound	52.29
29-02 & portions of 29-03	McCall & Halibut Banks	327.51
portions of 29-03, 28-02, 28-07, 29-10, 29-04, & 29-06	Sturgeon & Roberts Banks	192.24

Table 2. The locations and Subareas that were surveyed in the August survey, the total number of tows made, and area sampled as a percentage of the total survey area.

Location	Subareas	Number of tows	% Area Swept
Howe Sound	28-01	5	0.15%
McCall & Halibut Banks	29-02 & portions of 29-03	16	0.08%
Sturgeon & Roberts Banks	portions of 29-03, 28-02, 28-07, 29-10, 29-04, & 29-06	12	0.09%

Table 3: The size (carapace length, in mm) and weight (g) of shrimp by cohort, by species, by location for the August 1998 survey.

Location	Species	Age1 length	Age2 length	Age3 length	Age-1 Wt	Age-2 Wt	Age-3 Wt
Howe Sound & Halibut & McCall Banks	Northern Pink	16.6	21.9	24.7	3.45	7.10	9.72
Sturgeon & Roberts Banks	Northern Pink	16.5	22.0	25.7	3.39	7.19	10.78
Sturgeon & Roberts Banks	Sidestripe	16.5	21.5	29.5	2.89	6.41	16.61
Howe Sound & Halibut & McCall Banks	Sidestripe	17.5	21.7	28.1	3.45	6.59	14.35

Table 4: Survey estimates, AMR validated landings to June 10, 1998 and quota estimates and remaining quotas.

Species	Biomass (t)	Total Catch (t)	Total Biomass (t)	Annual Quota (t) 1998/99	Remaining Quota (t) 1998/99
Northern Pink	437.8	74.3	512.1	128.0	53.7
Smooth Pink	10.6	0.3	10.9	2.7	2.4
Sidestripe	222.5	14.3	236.8	59.2	44.9

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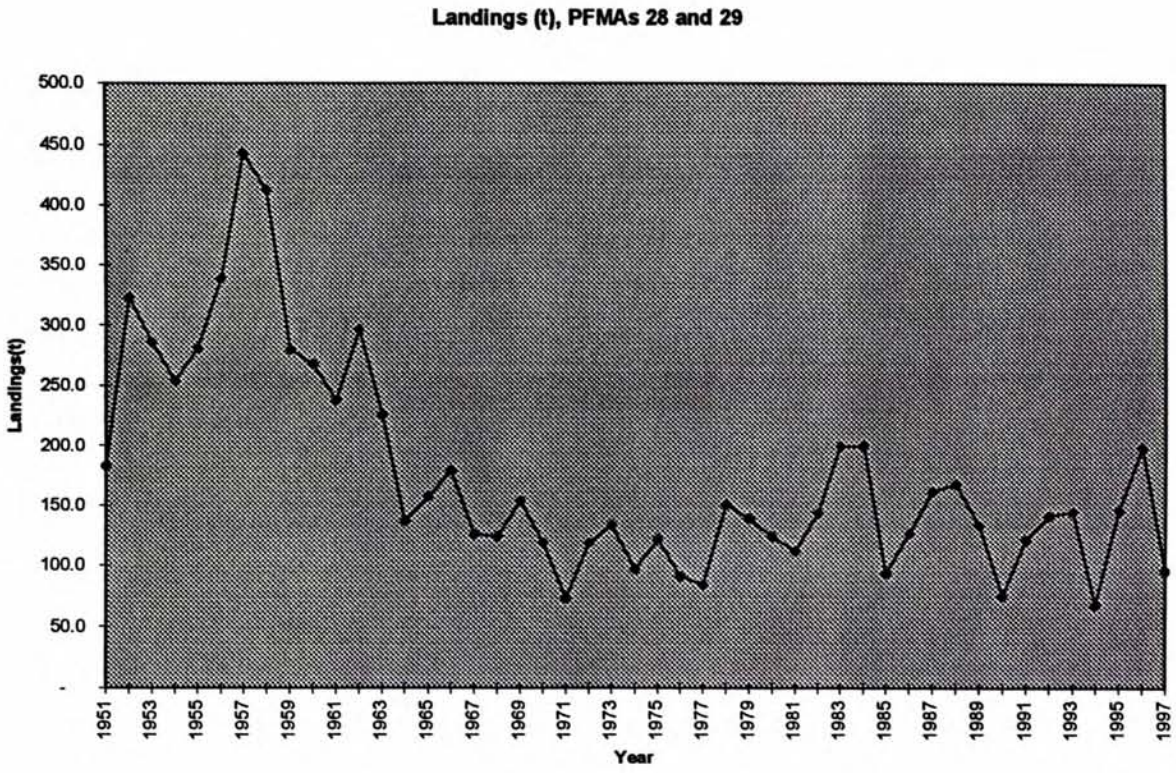

Figure 1. Catch history of PFMA 28 and 29.

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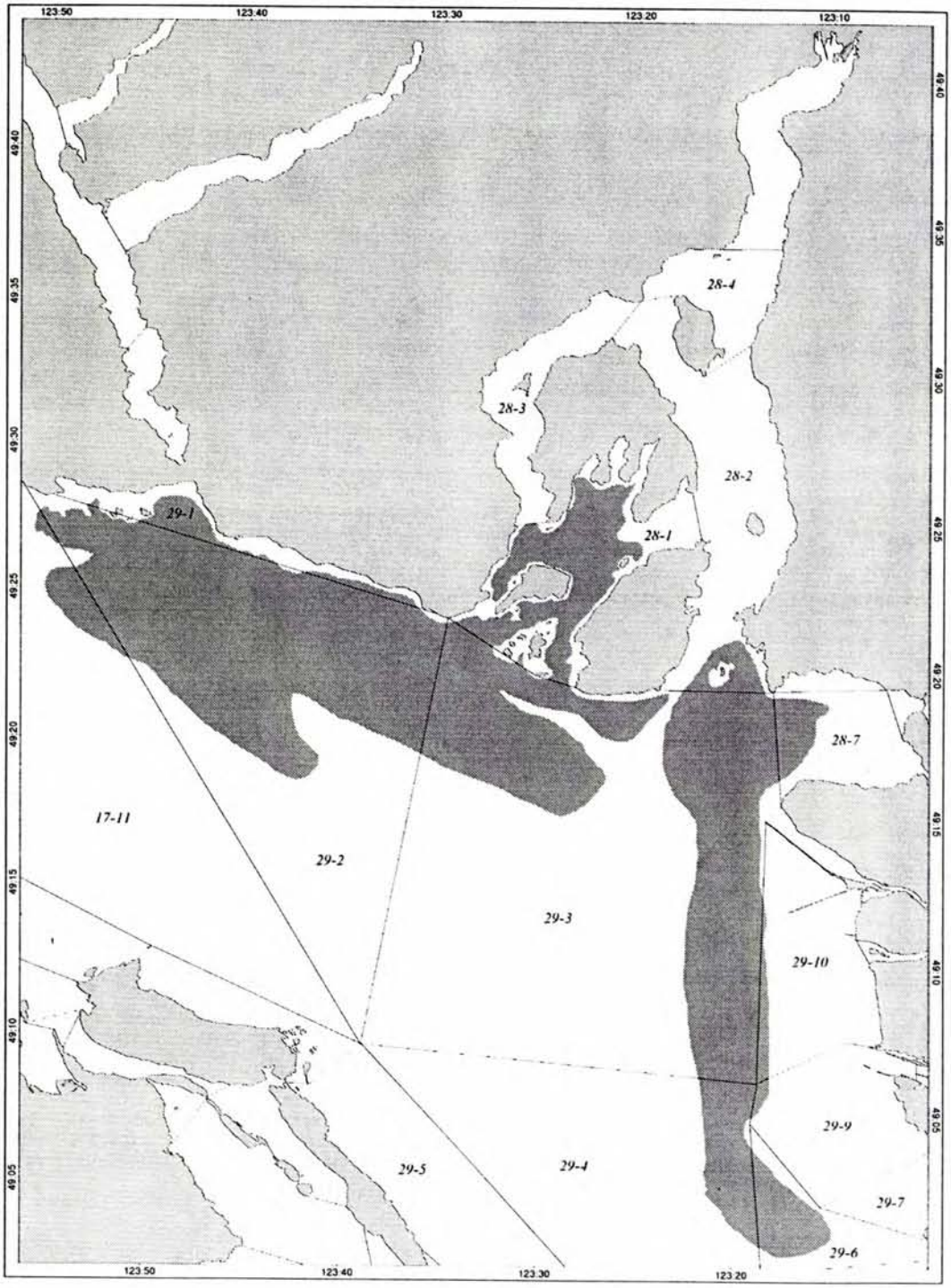

Figure 2. Areas surveyed in August, 1998, in the Fraser River Shrimp Management Area.

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Appendix 1

Shrimp Biomass Survey, Areas 28 and 29, August, 1998

There were 38 Tows. Total Weight for all tows, 6,732 Kg.

		Weight in Kg	Percent of Total	Number of Tows
Shrimp Species				
Northern Pink	Pandalus borealis eous	469.45	6.9736	33
Smooth Pink	Pandalus jordani	13.30	0.1976	8
Prawn	Pandalus platyceros	20.90	0.3105	19
Humpback	Pandalus hypsinotus	0.40	0.0059	3
Sidestripe	Pandalopsis dispar	250.40	3.7196	33
Crangons	Crangon spp	7.30	0.1084	30
Eualus	Eualus spp	2.30	0.0342	20
Glass Shrimp	Pasiphaea pacifica	0.40	0.0059	4
Other Invertebrates				
Anemone	Actiniaria (Order)	0.30	0.0045	1
Jellyfish	Scyphozoa (Class)	28.90	0.4293	21
Octopus	Octopoda (Order)	0.10	0.0015	1
Squat Squid	Rossia pacifica	1.20	0.0178	9
Squid	Teuthoidea (Order)	2.00	0.0297	10
Sponges	Phylum Porifera	2.30	0.0342	3
Starfish	Asteroidea (Class)	1.30	0.0193	4
Dungeness Crab	Cancer magister	20.60	0.3060	9
Tanner Crab	Chionoecetes tanneri	0.30	0.0045	2
Squat Lobster	Munida quadrispina	5.60	0.0832	12
Flatfish				
Dab (Pacific)	Citharichthys sordidus	1.50	0.0223	5
Dover Sole	Microstomus pacificus	15.50	0.2302	14
English Sole	Pleuronectes vetulus	95.10	1.4127	25
Flathead Sole	Hippoglossoides elassodon	20.10	0.2986	10
Rex Sole	Errex zachirus	17.70	0.2629	17
Turbot	Atheresthes stomias	12.50	0.1857	8
Dab (Speckled)	Citharichthys stigmaeus	0.60	0.0089	2
Slender Sole	Eopsetta exilis	80.50	1.1958	30
Rockfish				
Yellowtail	Sebastes flavidus	0.40	0.0059	1
Rougheye	Sebastes aleutianus	0.10	0.0015	1
Silvergray	Sebastes brevispinis	1.80	0.0267	1
Splitnose	Sebastes diploproa	171.60	2.5491	16
Greenstriped	Sebastes elongatus	32.50	0.4828	17
Bocaccio	Sebastes paucispinis	3.00	0.0446	1
Yelloweye	Sebastes ruberrimus	4.30	0.0639	3
Copper	Sebastes caurinus	7.50	0.1114	7
Black	Sebastes melanops	1.20	0.0178	1
Roundfish				
Pacific Herring	Clupea pallasi	19.40	0.2882	13
Lingcod	Ophiodon elongatus	4.10	0.0609	2
Pacific Cod	Gadus macrocephalus	3.00	0.0446	2

Shrimp Biomass Survey, Areas 28 and 29, August, 1998

There were 38 Tows. Total Weight for all tows, 6,732 Kg.

		Weight in Kg	Percent of Total	Number of Tows
Walleye Pollock	Theragra chalcogramma	320.00	4.7535	22
Pacific Tomcod	Microgadus proximus	0.70	0.0104	1
Eelpouts	Zoarcidae (Family)	182.00	2.7036	29
Pacific Hake	Merluccius productus	1,121.90	16.6656	34
Midshipman	Porichthys notatus	78.10	1.1602	15
Poachers	Agonidae (Family)	0.70	0.0104	6
Sculpins	Cottidae (Family)	0.50	0.0074	5
Shiner Perch	Cymatogaster aggregata	5.20	0.0772	3
Pacific Sardine	Sardinops sagax	0.10	0.0015	1
Selachii				
Spiny Dogfish	Squalus acanthias	3,067.30	45.5640	33
Skates	Rajidae (Family)	4.50	0.0668	9
Spotted Ratfish	Hydrolagus colliei	624.20	9.2723	30

Appendix 2

Shrimp Biomass Survey, Areas 28 & 29, August, 1998

Date Aug 21 1998 **Time** 9:30 **Duration (min)** 15 **Area** 28 - 1 **Haul No.** 133
Depth M 99 115 Direction 355
Water Temp: Surface Bottom Distance 0.7 Naut. Mi.
Type of Gear DH Total Catch Remark Usable Vessel 3
Net Effective Opening (feet) 30.0

Shrimp	**Weight**	**Num/Kg**	**Invertebrates**		**Flatfish**	
Northern Pink	1.70	254	Jellyfish	1.40	English Sole	1.00
Smooth Pink	1.90	110	Squat Squid	0.10	Slender Sole	1.10
Prawn	2.40		Dungeness Crab	0.60		
Humpback	0.10		Squat Lobster	2.30		
Sidestripe	0.40	125				
Crangons	0.10					
Eualus	0.10					
Rockfish			**Roundfish**		**Selachii**	
Splitnose	0.30		Walleye Pollock	0.10	Spiny Dogfish	1.60
Greenstriped	0.10		Eelpouts	0.10		
Copper	0.50		Pacific Hake	16.70		
			Poachers	0.10		
			Sculpins	0.10		
			Shiner Perch	0.10		

Date Aug 12 1998 **Time** 10:55 **Duration (min)** 15 **Area** 28 - 1 **Haul No.** 201
Depth M 90 90 Direction 190
Water Temp: Surface Bottom Distance Naut. Mi.
Type of Gear DH Total Catch 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, Areas 28 & 29, August, 1998

Date Aug 12 1998 **Time** 14:15 **Duration (min)** 5 **Area** 28 - 1 **Haul No.** 202
Depth M 74 Direction 350
Water Temp: Surface Bottom Distance 0.3 Naut. Mi.
Type of Gear DH Total Catch 4 Remark Mechanical Problem Vessel 3
Net Effective Opening (feet) 30.0

Shrimp	Weight	Num/Kg	Invertebrates		Flatfish	
Rockfish			**Roundfish**		**Selachii**	

Date Aug 13 1998 **Time** 14:50 **Duration (min)** 30 **Area** 28 - 1 **Haul No.** 205
Depth M 88 106 Direction 190
Water Temp: Surface Bottom Distance 1.3 Naut. Mi.
Type of Gear DH Total Catch 298 Remark Usable Vessel 3
Net Effective Opening (feet) 30.0

Shrimp	Weight	Num/Kg	Invertebrates		Flatfish	
Northern Pink	2.00		Jellyfish	1.00		
Prawn	4.00		Squat Lobster	1.00		
Sidestripe	5.00					
Rockfish			**Roundfish**		**Selachii**	
Bocaccio	3.00		Pacific Herring	5.00	Spiny Dogfish	182.00
			Walleye Pollock	90.00		
			Shiner Perch	5.00		

Date Aug 21 1998 **Time** 6:25 **Duration (min)** 20 **Area** 28 - 2 **Haul No.** 131
Depth M 93 97 Direction 350
Water Temp: Surface Bottom Distance 0.7 Naut. Mi.
Type of Gear DH Total Catch Remark Usable Vessel 3
Net Effective Opening (feet) 30.0

Shrimp	Weight	Num/Kg	Invertebrates		Flatfish	
Northern Pink	1.70		Jellyfish	3.70	English Sole	3.90
Smooth Pink	5.70	114	Squat Squid	0.10	Flathead Sole	2.30
Prawn	1.40		Squat Lobster	0.10	Rex Sole	0.30
Sidestripe	1.90	120			Dab (Speckled)	0.40
Crangons	0.20				Slender Sole	0.60
Eualus	0.10					
Rockfish			**Roundfish**		**Selachii**	
Greenstriped	0.10		Walleye Pollock	1.40	Spiny Dogfish	11.60
Copper	0.40		Eelpouts	3.30	Spotted Ratfish	0.80
			Pacific Hake	74.00		
			Midshipman	0.40		
			Poachers	0.10		

All weights are in Kilograms

Shrimp Biomass Survey, Areas 28 & 29, August, 1998

Date Aug 21 1998 **Time** 8 :05 **Duration (min)** 20 **Area** 28 - 2 **Haul No.** 132
Depth M 103 120 Direction 122
Water Temp: Surface Bottom Distance 0.8 Naut. Mi.
Type of Gear DH Total Catch Remark Usable Vessel 3
Net Effective Opening (feet) 30.0

Shrimp	**Weight**	**Num/Kg**	**Invertebrates**		**Flatfish**	
Northern Pink	6.70	190	Jellyfish	0.50	Dover Sole	0.40
Prawn	1.50		Squat Squid	0.10	English Sole	3.60
Sidestripe	5.50	78	Dungeness Crab	0.60	Flathead Sole	0.50
Crangons	0.20		Squat Lobster	0.20	Rex Sole	0.10
Eualus	0.10				Slender Sole	2.60
Rockfish			**Roundfish**		**Selachii**	
Splitnose	0.80		Walleye Pollock	0.90	Spiny Dogfish	11.60
Greenstriped	1.80		Eelpouts	2.30	Skates	0.40
Copper	0.80		Pacific Hake	10.60	Spotted Ratfish	0.40
			Poachers	0.20		
			Sculpins	0.10		

Date Aug 20 1998 **Time** 13 :55 **Duration (min)** 20 **Area** 28 - 6 **Haul No.** 130
Depth M 166 167 Direction 70
Water Temp: Surface Bottom Distance 1 Naut. Mi.
Type of Gear DH Total Catch Remark Mechanical Problem Vessel 3
Net Effective Opening (feet) 30.0

Shrimp	**Weight**	**Num/Kg**	**Invertebrates**	**Flatfish**
Rockfish			**Roundfish**	**Selachii**

Date Aug 14 1998 **Time** 9 :00 **Duration (min)** 30 **Area** 29 - 2 **Haul No.** 101
Depth M 110 123 Direction 110
Water Temp: Surface Bottom Distance 1.1 Naut. Mi.
Type of Gear DH Total Catch Remark Usable Vessel 3
Net Effective Opening (feet) 30.0

Shrimp	**Weight**	**Num/Kg**	**Invertebrates**		**Flatfish**	
Northern Pink	31.00	300	Squat Squid	0.10	English Sole	1.60
Prawn	0.50		Squat Lobster	0.10	Flathead Sole	0.40
Sidestripe	8.00	110			Slender Sole	1.80
Crangons	0.40					
Rockfish			**Roundfish**		**Selachii**	
			Pacific Herring	0.30	Spiny Dogfish	14.90
			Eelpouts	6.60	Spotted Ratfish	0.30
			Pacific Hake	47.30		

All weights are in Kilograms

Shrimp Biomass Survey, Areas 28 & 29, August, 1998

Date Aug 14 1998 **Time** 10 :45 **Duration (min)** 30 **Area** 29 - 2 **Haul No.** 102
Depth M 135 160 Direction 250
Water Temp: Surface Bottom Distance 1.1 Naut. Mi.
Type of Gear DH Total Catch Remark Usable Vessel 3
Net Effective Opening (feet) 30.0

Shrimp	Weight	Num/Kg
Northern Pink	23.60	298
Prawn	0.70	
Sidestripe	23.20	114
Crangons	0.50	

Invertebrates	
Jellyfish	0.80

Flatfish	
Slender Sole	1.40

Rockfish	
Splitnose	4.40
Greenstriped	0.90

Roundfish	
Eelpouts	0.50
Pacific Hake	5.80
Midshipman	0.20

Selachii	
Spiny Dogfish	23.60
Spotted Ratfish	1.70

Date Aug 14 1998 **Time** 13 :45 **Duration (min)** 25 **Area** 29 - 2 **Haul No.** 103
Depth M 150 Direction 100
Water Temp: Surface Bottom Distance 0.9 Naut. Mi.
Type of Gear DH Total Catch Remark Mechanical Problem Vessel 3
Net Effective Opening (feet) 30.0

Shrimp	Weight	Num/Kg

Invertebrates	
Jellyfish	1.40
Squat Squid	0.10
Squid	0.10
Squat Lobster	0.10

Flatfish	
Slender Sole	0.10

Rockfish	
Splitnose	1.60

Roundfish	
Eelpouts	0.10
Pacific Hake	0.10

Selachii

Date Aug 14 1998 **Time** 15 :05 **Duration (min)** 30 **Area** 29 - 2 **Haul No.** 104
Depth M 180 181 Direction 280
Water Temp: Surface Bottom Distance 1.2 Naut. Mi.
Type of Gear DH Total Catch Remark Usable Vessel 3
Net Effective Opening (feet) 30.0

Shrimp	Weight	Num/Kg
Northern Pink	0.15	
Sidestripe	4.80	104
Crangons	0.10	
Eualus	0.10	
Glass Shrimp	0.10	

Invertebrates	
Squid	0.60

Flatfish	
English Sole	0.60
Turbot	1.60
Slender Sole	1.40

Rockfish

Roundfish	
Pacific Hake	56.40

Selachii	
Spiny Dogfish	21.40
Spotted Ratfish	58.90

All weights are in Kilograms

Shrimp Biomass Survey, Areas 28 & 29, August, 1998

Date Aug 15 1998 **Time** 9:50 **Duration (min)** 30 **Area** 29 - 2 **Haul No.** 105
Depth M 131 140 Direction 285
Water Temp: Surface Bottom Distance 0.9 Naut. Mi.
Type of Gear DH Total Catch Remark Usable Vessel 3
Net Effective Opening (feet) 30.0

Shrimp	**Weight**	**Num/Kg**	**Invertebrates**		**Flatfish**	
Northern Pink	0.10		Sponges	0.90	Rex Sole	0.40
Prawn	3.00				Turbot	1.80
Sidestripe	1.70	70			Slender Sole	2.10
Rockfish			**Roundfish**		**Selachii**	
Rougheye	0.10		Pacific Hake	10.00	Spiny Dogfish	17.60
Splitnose	107.30				Spotted Ratfish	13.70
Greenstriped	17.10					
Yelloweye	4.10					

Date Aug 15 1998 **Time** 11:45 **Duration (min)** 15 **Area** 29 - 2 **Haul No.** 106
Depth M 150 Direction 280
Water Temp: Surface Bottom Distance 0.5 Naut. Mi.
Type of Gear DH Total Catch Remark Usable Vessel 3
Net Effective Opening (feet) 30.0

Shrimp	**Weight**	**Num/Kg**	**Invertebrates**		**Flatfish**	
Northern Pink	0.40	335			Slender Sole	0.20
Smooth Pink	0.50	122				
Sidestripe	4.80	118				
Crangons	0.10					
Eualus	0.10					
Rockfish			**Roundfish**		**Selachii**	
Yellowtail	0.40		Eelpouts	0.10	Spiny Dogfish	12.10
Splitnose	31.50		Pacific Hake	8.30	Spotted Ratfish	4.20
Greenstriped	2.70					
Yelloweye	0.10					

All weights are in Kilograms

Shrimp Biomass Survey, Areas 28 & 29, August, 1998

Date Aug 15 1998 **Time** 12:40 **Duration (min)** 30 **Area** 29 - 2 **Haul No.** 107
Depth M 155 165 Direction 110
Water Temp: Surface Bottom Distance 1.2 Naut. Mi.
Type of Gear DH Total Catch Remark Usable Vessel 3
Net Effective Opening (feet) 30.0

Shrimp	Weight	Num/Kg
Northern Pink	0.10	
Sidestripe	0.10	
Crangons	0.10	

Rockfish	
Splitnose	4.00

Invertebrates	
Jellyfish	0.60
Squid	0.10

Roundfish	
Eelpouts	0.10
Pacific Hake	0.90

Flatfish	

Selachii	
Spiny Dogfish	1.90
Spotted Ratfish	1.20

Date Aug 15 1998 **Time** 15:05 **Duration (min)** 25 **Area** 29 - 2 **Haul No.** 108
Depth M 134 136 Direction 95
Water Temp: Surface Bottom Distance 1 Naut. Mi.
Type of Gear DH Total Catch Remark Usable Vessel 3
Net Effective Opening (feet) 30.0

Shrimp	Weight	Num/Kg
Northern Pink	24.40	336
Sidestripe	7.30	148
Crangons	0.80	

Rockfish	
Splitnose	0.80

Invertebrates	
Jellyfish	4.10

Roundfish	
Eelpouts	0.90
Pacific Hake	25.60

Flatfish	
Slender Sole	2.10

Selachii	
Spiny Dogfish	10.60
Skates	0.80
Spotted Ratfish	0.10

Date Aug 15 1998 **Time** 16:50 **Duration (min)** 30 **Area** 29 - 2 **Haul No.** 109
Depth M 120 125 Direction
Water Temp: Surface Bottom Distance 1.2 Naut. Mi.
Type of Gear DH Total Catch Remark Usable Vessel 3
Net Effective Opening (feet) 30.0

Shrimp	Weight	Num/Kg
Northern Pink	44.80	312
Prawn	0.30	
Sidestripe	11.10	124
Crangons	0.10	
Eualus	0.10	

Rockfish	
Splitnose	0.20
Greenstriped	1.50

Invertebrates	
Jellyfish	0.60
Squid	0.10
Squat Lobster	0.10

Roundfish	
Pacific Herring	0.10
Walleye Pollock	3.10
Eelpouts	2.90
Pacific Hake	21.80

Flatfish	
English Sole	0.30
Rex Sole	0.20
Turbot	1.60
Slender Sole	4.10

Selachii	
Spiny Dogfish	25.70
Skates	0.20
Spotted Ratfish	2.60

All weights are in Kilograms

Shrimp Biomass Survey, Areas 28 & 29, August, 1998

Date Aug 16 1998 **Time** 9:00 **Duration (min)** 20 **Area** 29 - 2 **Haul No.** 110
Depth M 142 147 Direction 280
Water Temp: Surface Bottom Distance 0.8 Naut. Mi.
Type of Gear DH Total Catch Remark Usable Vessel 3
Net Effective Opening (feet) 30.0

Shrimp	**Weight**	**Num/Kg**	**Invertebrates**		**Flatfish**	
Northern Pink	14.90	276	Jellyfish	1.60	English Sole	2.60
Sidestripe	4.40	98	Squat Squid	0.10	Slender Sole	0.80
Crangons	0.10		Squid	0.10		
Eualus	0.10					
Rockfish			**Roundfish**		**Selachii**	
Greenstriped	0.90		Eelpouts	2.20	Spiny Dogfish	9.10
			Pacific Hake	10.10	Spotted Ratfish	6.80
			Poachers	0.10		

Date Aug 16 1998 **Time** 10:30 **Duration (min)** 15 **Area** 29 - 2 **Haul No.** 111
Depth M 95 105 Direction 260
Water Temp: Surface Bottom Distance 0.7 Naut. Mi.
Type of Gear DH Total Catch Remark Usable Vessel 3
Net Effective Opening (feet) 30.0

Shrimp	**Weight**	**Num/Kg**	**Invertebrates**		**Flatfish**	
Northern Pink	0.50	336	Jellyfish	2.20	Slender Sole	0.20
Prawn	0.10		Squid	0.10		
Sidestripe	0.10		Sponges	0.20		
Crangons	0.10					
Eualus	0.10					
Rockfish			**Roundfish**		**Selachii**	
Greenstriped	0.40		Pacific Hake	0.50	Spiny Dogfish	2.30
Yelloweye	0.10				Spotted Ratfish	0.20
Copper	1.90					

All weights are in Kilograms

Shrimp Biomass Survey, Areas 28 & 29, August, 1998

Date Aug 16 1998 **Time** 11:30 **Duration (min)** 30 **Area** 29 - 2 **Haul No.** 112
Depth M 134 136 Direction 270
Water Temp: Surface Bottom Distance 1.2 Naut. Mi.
Type of Gear DH Total Catch Remark Usable Vessel 3
Net Effective Opening (feet) 30.0

Shrimp	Weight	Num/Kg
Northern Pink	0.50	
Prawn	0.40	
Sidestripe	14.70	92
Crangons	0.10	
Eualus	0.10	

Invertebrates	
Jellyfish	1.30
Sponges	1.20

Flatfish	
English Sole	0.20
Slender Sole	2.70

Rockfish	
Splitnose	0.90
Greenstriped	1.50

Roundfish	
Eelpouts	0.30
Pacific Hake	59.40

Selachii	
Spiny Dogfish	39.60
Spotted Ratfish	22.10

Date Aug 16 1998 **Time** 13:50 **Duration (min)** 30 **Area** 29 - 2 **Haul No.** 113
Depth M 135 135 Direction 95
Water Temp: Surface Bottom Distance 1.2 Naut. Mi.
Type of Gear DH Total Catch Remark Usable Vessel 3
Net Effective Opening (feet) 30.0

Shrimp	Weight	Num/Kg
Northern Pink	14.70	332
Prawn	0.10	
Sidestripe	14.40	118
Crangons	0.60	
Eualus	0.30	

Invertebrates	
Jellyfish	1.30

Flatfish	
English Sole	0.20
Slender Sole	3.90

Rockfish	
Splitnose	11.10
Greenstriped	0.50

Roundfish	
Pacific Herring	0.20
Walleye Pollock	0.70
Eelpouts	1.10
Pacific Hake	65.50

Selachii	
Spiny Dogfish	49.80
Spotted Ratfish	3.00

All weights are in Kilograms

Shrimp Biomass Survey, Areas 28 & 29, August, 1998

Date Aug 16 1998 **Time** 15:05 **Duration (min)** 35 **Area** 29 - 2 **Haul No.** 114
Depth M 107 119 Direction 98
Water Temp: Surface Bottom Distance 1.3 Naut. Mi.
Type of Gear DH Total Catch Remark Usable Vessel 3
Net Effective Opening (feet) 30.0

Shrimp	Weight	Num/Kg
Northern Pink	87.10	214
Sidestripe	1.20	
Crangons	0.10	

Invertebrates	
Jellyfish	1.40
Squat Lobster	1.20

Flatfish	
English Sole	0.70
Slender Sole	3.60

Rockfish	
Splitnose	1.20
Greenstriped	0.40

Roundfish	
Pacific Herring	1.20
Walleye Pollock	3.20
Eelpouts	2.40
Pacific Hake	10.60

Selachii	
Spiny Dogfish	1,587.60
Spotted Ratfish	2.50

Date Aug 13 1998 **Time** 10:50 **Duration (min)** 30 **Area** 29 - 2 **Haul No.** 203
Depth M 134 138 Direction 100
Water Temp: Surface Bottom Distance 1.1 Naut. Mi.
Type of Gear DH Total Catch 14 Remark Mechanical Problem Vessel 3
Net Effective Opening (feet) 30.0

Shrimp	Weight	Num/Kg

Invertebrates	
Jellyfish	1.00

Flatfish

Rockfish

Roundfish	
Walleye Pollock	3.00
Pacific Hake	10.00

Selachii

Date Aug 13 1998 **Time** 12:20 **Duration (min)** 30 **Area** 29 - 2 **Haul No.** 204
Depth M 163 Direction 290
Water Temp: Surface Bottom Distance 1.2 Naut. Mi.
Type of Gear DH Total Catch 146 Remark Usable Vessel 3
Net Effective Opening (feet) 30.0

Shrimp	Weight	Num/Kg
Northern Pink	1.00	
Sidestripe	12.00	
Crangons	0.10	
Glass Shrimp	0.10	

Invertebrates	
Jellyfish	0.50
Squid	0.50

Flatfish

Rockfish

Roundfish	
Pacific Hake	70.20

Selachii	
Spiny Dogfish	16.70
Skates	0.50
Spotted Ratfish	37.70

All weights are in Kilograms

Shrimp Biomass Survey, Areas 28 & 29, August, 1998

Date Aug 17 1998 **Time** 7:25 **Duration (min)** 30 **Area** 29 - 3 **Haul No.** 115
Depth M 92 110 Direction 330
Water Temp: Surface Bottom Distance 1 Naut. Mi.
Type of Gear DH Total Catch Remark Usable Vessel 3
Net Effective Opening (feet) 30.0

Shrimp	Weight	Num/Kg
Northern Pink	0.80	216
Prawn	0.10	
Sidestripe	4.80	142
Crangons	0.10	
Eualus	0.10	

Invertebrates	
Jellyfish	0.60
Squid	0.10
Dungeness Crab	0.30

Flatfish	
English Sole	4.10
Flathead Sole	2.20
Rex Sole	1.00

Rockfish	
Black	1.20

Roundfish	
Lingcod	4.00
Walleye Pollock	11.90
Eelpouts	12.30
Pacific Hake	48.20
Midshipman	0.90

Selachii	
Spiny Dogfish	128.50
Spotted Ratfish	14.90

Date Aug 17 1998 **Time** 8:45 **Duration (min)** 30 **Area** 29 - 3 **Haul No.** 116
Depth M 113 114 Direction 235
Water Temp: Surface Bottom Distance 1.1 Naut. Mi.
Type of Gear DH Total Catch Remark Usable Vessel 3
Net Effective Opening (feet) 30.0

Shrimp	Weight	Num/Kg
Northern Pink	4.70	302
Prawn	0.40	
Sidestripe	32.20	148
Crangons	0.40	
Eualus	0.20	

Invertebrates	
Squat Squid	0.40
Dungeness Crab	5.80

Flatfish	
Dover Sole	6.20
English Sole	5.00
Flathead Sole	1.20
Rex Sole	5.40
Slender Sole	7.00

Rockfish

Roundfish	
Pacific Herring	0.40
Walleye Pollock	23.20
Eelpouts	17.50
Pacific Hake	58.10
Midshipman	6.20

Selachii	
Spiny Dogfish	90.90
Skates	0.70
Spotted Ratfish	154.00

All weights are in Kilograms

Shrimp Biomass Survey, Areas 28 & 29, August, 1998

Date Aug 17 1998 **Time** 11 : 10 **Duration (min)** 20 **Area** 29 - 3 **Haul No.** 117
Depth M 116 118 Direction 320
Water Temp: Surface Bottom Distance 0.7 Naut. Mi.
Type of Gear DH Total Catch Remark Usable Vessel 3
Net Effective Opening (feet) 30.0

Shrimp	**Weight**	**Num/Kg**
Northern Pink	0.10	
Sidestripe	7.20	112
Crangons	0.10	
Eualus	0.10	

Invertebrates	
Jellyfish	0.30
Starfish	0.30

Flatfish	
Dover Sole	0.50
English Sole	1.10
Rex Sole	0.60
Turbot	0.40
Slender Sole	3.30

Rockfish

Roundfish	
Pacific Herring	0.10
Walleye Pollock	12.20
Eelpouts	5.40
Pacific Hake	29.60
Midshipman	3.10

Selachii	
Spiny Dogfish	75.20
Spotted Ratfish	16.20

Date Aug 18 1998 **Time** 8 : 30 **Duration (min)** 20 **Area** 29 - 3 **Haul No.** 119
Depth M 96 97 Direction 340
Water Temp: Surface Bottom Distance 0.7 Naut. Mi.
Type of Gear DH Total Catch Remark Usable Vessel 3
Net Effective Opening (feet) 30.0

Shrimp	**Weight**	**Num/Kg**
Northern Pink	1.60	248
Sidestripe	6.50	132
Crangons	0.10	
Eualus	0.10	

Invertebrates	
Octopus	0.10

Flatfish	
Dover Sole	0.60
English Sole	12.60
Flathead Sole	2.70
Rex Sole	2.90
Slender Sole	3.70

Rockfish

Roundfish	
Lingcod	0.10
Walleye Pollock	15.60
Eelpouts	6.90
Pacific Hake	25.10
Midshipman	11.70
Pacific Sardine	0.10

Selachii	
Spiny Dogfish	87.60
Spotted Ratfish	2.30

All weights are in Kilograms

Shrimp Biomass Survey, Areas 28 & 29, August, 1998

Date Aug 18 1998 **Time** 9 :50 **Duration (min)** 25 **Area** 29 - 3 **Haul No.** 120
Depth M 111 114 Direction 335
Water Temp: Surface Bottom Distance 1 Naut. Mi.
Type of Gear DH Total Catch Remark Usable Vessel 3
Net Effective Opening (feet) 30.0

Shrimp	**Weight**	**Num/Kg**
Northern Pink	0.20	
Prawn	0.10	
Sidestripe	9.60	126
Crangons	0.10	
Eualus	0.10	

Invertebrates	
Jellyfish	1.00
Dungeness Crab	0.60

Flatfish	
Dab (Pacific)	0.20
Dover Sole	0.40
English Sole	2.90
Flathead Sole	0.50
Rex Sole	2.90
Turbot	0.40
Slender Sole	5.00

Rockfish

Roundfish	
Pacific Cod	2.60
Walleye Pollock	15.70
Eelpouts	23.50
Pacific Hake	34.70
Midshipman	2.80
Sculpins	0.10

Selachii	
Spiny Dogfish	140.10
Skates	0.90
Spotted Ratfish	13.70

Date Aug 18 1998 **Time** 11 :30 **Duration (min)** 15 **Area** 29 - 3 **Haul No.** 121
Depth M 88 105 Direction 330
Water Temp: Surface Bottom Distance 0.6 Naut. Mi.
Type of Gear DH Total Catch Remark Usable Vessel 3
Net Effective Opening (feet) 30.0

Shrimp	**Weight**	**Num/Kg**
Northern Pink	13.60	266
Prawn	0.10	
Sidestripe	7.50	144
Crangons	0.10	

Invertebrates	
Dungeness Crab	1.80

Flatfish	
Dab (Pacific)	0.20
Dover Sole	0.10
English Sole	5.90
Flathead Sole	3.90
Rex Sole	0.80
Slender Sole	4.30

Rockfish

Roundfish	
Pacific Herring	0.10
Walleye Pollock	34.50
Eelpouts	33.90
Pacific Hake	155.60
Midshipman	15.90

Selachii	
Spiny Dogfish	109.90
Spotted Ratfish	1.60

All weights are in Kilograms

Shrimp Biomass Survey, Areas 28 & 29, August, 1998

Date Aug 18 1998 **Time** 14 : 15 **Duration (min)** 15 **Area** 29 - 3 **Haul No.** 122
Depth M 130 138 Direction 160
Water Temp: Surface Bottom Distance 0.8 Naut. Mi.
Type of Gear DH Total Catch Remark Usable Vessel 3
Net Effective Opening (feet) 30.0

Shrimp	Weight	Num/Kg
Northern Pink	8.80	286
Prawn	4.20	
Humpback	0.10	
Sidestripe	19.70	134
Crangons	0.40	
Eualus	0.10	

Invertebrates	
Anemone	0.30
Jellyfish	2.10
Dungeness Crab	0.90
Squat Lobster	0.10

Flatfish	
Dover Sole	1.10
English Sole	0.40
Rex Sole	0.80
Dab (Speckled)	0.20
Slender Sole	2.30

Rockfish	
Silvergray	1.80
Splitnose	1.60
Greenstriped	0.80

Roundfish	
Walleye Pollock	6.80
Eelpouts	7.40
Pacific Hake	47.00
Midshipman	1.10
Poachers	0.10
Sculpins	0.10

Selachii	
Spiny Dogfish	43.10
Skates	0.20
Spotted Ratfish	79.50

Date Aug 19 1998 **Time** 8 : 35 **Duration (min)** 30 **Area** 29 - 3 **Haul No.** 123
Depth M 78 79 Direction 315
Water Temp: Surface Bottom Distance 1.2 Naut. Mi.
Type of Gear DH Total Catch Remark Usable Vessel 3
Net Effective Opening (feet) 30.0

Shrimp	Weight	Num/Kg
Northern Pink	10.20	324
Smooth Pink	1.60	140
Humpback	0.20	
Sidestripe	4.20	140
Crangons	0.10	

Flatfish	
Dab (Pacific)	0.70
Dover Sole	1.10
English Sole	6.20
Flathead Sole	5.80
Rex Sole	0.80
Turbot	0.60
Slender Sole	8.90

Roundfish	
Pacific Herring	3.60
Walleye Pollock	10.90
Eelpouts	20.00
Pacific Hake	18.10
Midshipman	7.10

Selachii	
Spiny Dogfish	54.80
Spotted Ratfish	22.30

All weights are in Kilograms

Shrimp Biomass Survey, Areas 28 & 29, August, 1998

Date Aug 19 1998 **Time** 10 :20 **Duration (min)** 25 **Area** 29 - 3 **Haul No.** 124
Depth M 98 99 Direction 20
Water Temp: Surface Bottom Distance 1 Naut. Mi.
Type of Gear DH Total Catch Remark Usable Vessel 3
Net Effective Opening (feet) 30.0

Shrimp	**Weight**	**Num/Kg**
Northern Pink	23.10	362
Smooth Pink	3.20	171
Prawn	0.40	
Sidestripe	12.20	176
Crangons	0.80	
Eualus	0.10	

Invertebrates	
Starfish	0.50
Tanner Crab	0.20

Flatfish	
Dover Sole	0.80
English Sole	1.20
Turbot	0.30
Slender Sole	8.10

Rockfish	
Copper	3.60

Roundfish	
Pacific Herring	0.10
Walleye Pollock	13.10
Eelpouts	17.80
Pacific Hake	36.30
Midshipman	6.10

Selachii	
Spiny Dogfish	81.70
Spotted Ratfish	29.20

Date Aug 19 1998 **Time** 13 :35 **Duration (min)** 20 **Area** 29 - 3 **Haul No.** 125
Depth M 91 Direction 190
Water Temp: Surface Bottom Distance 1 Naut. Mi.
Type of Gear DH Total Catch Remark Usable Vessel 3
Net Effective Opening (feet) 30.0

Shrimp	**Weight**	**Num/Kg**
Northern Pink	81.60	224
Sidestripe	6.50	150
Crangons	0.80	

Invertebrates	
Squat Squid	0.10
Starfish	0.40
Dungeness Crab	0.70
Tanner Crab	0.10
Squat Lobster	0.10

Flatfish	
English Sole	1.30
Flathead Sole	0.60
Rex Sole	0.10
Slender Sole	2.40

Rockfish	
Copper	0.20

Roundfish	
Pacific Herring	1.30
Walleye Pollock	21.10
Eelpouts	5.40
Pacific Hake	10.60
Midshipman	12.20
Sculpins	0.10

Selachii	
Spiny Dogfish	57.20
Skates	0.70
Spotted Ratfish	0.20

All weights are in Kilograms

Shrimp Biomass Survey, Areas 28 & 29, August, 1998

Date Aug 19 1998 **Time** 15:05 **Duration (min)** 15 **Area** 29 - 3 **Haul No.** 126
Depth M 74 105 Direction 180
Water Temp: Surface Bottom Distance 0.7 Naut. Mi.
Type of Gear DH Total Catch Remark Usable Vessel 3
Net Effective Opening (feet) 30.0

Shrimp	Weight	Num/Kg
Northern Pink	58.20	250
Sidestripe	7.20	130

Rockfish	
Greenstriped	0.40

Invertebrates	
Squat Lobster	0.20

Roundfish	
Pacific Herring	6.80
Walleye Pollock	48.30
Eelpouts	5.60
Pacific Hake	12.10
Midshipman	7.80

Flatfish	
Dab (Pacific)	0.30
Dover Sole	0.20
English Sole	0.90
Slender Sole	0.60

Selachii	
Spiny Dogfish	70.20

Date Aug 20 1998 **Time** 8:20 **Duration (min)** 15 **Area** 29 - 3 **Haul No.** 127
Depth M 155 160 Direction 100
Water Temp: Surface Bottom Distance 0.7 Naut. Mi.
Type of Gear DH Total Catch Remark Usable Vessel 3
Net Effective Opening (feet) 30.0

Shrimp	Weight	Num/Kg
Northern Pink	0.60	374
Smooth Pink	0.10	
Sidestripe	1.50	124
Crangons	0.10	
Eualus	0.10	
Glass Shrimp	0.10	

Rockfish	
Splitnose	3.50
Greenstriped	1.40

Invertebrates	
Squat Squid	0.10
Squid	0.10
Squat Lobster	0.10

Roundfish	
Pacific Herring	0.20
Pacific Cod	0.40
Walleye Pollock	1.40
Eelpouts	0.20
Pacific Hake	31.50
Poachers	0.10

Flatfish	
Dover Sole	0.60
English Sole	1.90
Rex Sole	0.10
Slender Sole	2.10

Selachii	
Spiny Dogfish	13.20
Skates	0.10
Spotted Ratfish	25.50

All weights are in Kilograms

Shrimp Biomass Survey, Areas 28 & 29, August, 1998

Date Aug 20 1998 **Time** 9 : 45 **Duration (min)** 20 **Area** 29 - 3 **Haul No.** 128
Depth M 150 156 Direction 130
Water Temp: Surface Bottom Distance 0.8 Naut. Mi.
Type of Gear DH Total Catch Remark Usable Vessel 3
Net Effective Opening (feet) 30.0

Shrimp	Weight	Num/Kg
Northern Pink	1.10	340
Smooth Pink	0.10	
Prawn	0.30	
Sidestripe	5.10	160
Crangons	0.20	
Eualus	0.10	
Glass Shrimp	0.10	

Invertebrates	
Squid	0.20
Starfish	0.10

Flatfish	
Dover Sole	0.90
English Sole	2.30
Rex Sole	0.20
Slender Sole	2.40

Rockfish	
Splitnose	1.60
Greenstriped	0.30

Roundfish	
Eelpouts	0.20
Pacific Hake	41.70

Selachii	
Spiny Dogfish	27.60
Spotted Ratfish	47.50

Date Aug 20 1998 **Time** 11 : 10 **Duration (min)** 20 **Area** 29 - 3 **Haul No.** 129
Depth M 106 113 Direction
Water Temp: Surface Bottom Distance 1 Naut. Mi.
Type of Gear DH Total Catch Remark Usable Vessel 3
Net Effective Opening (feet) 30.0

Shrimp	Weight	Num/Kg
Northern Pink	9.40	222
Smooth Pink	0.20	
Prawn	0.90	
Sidestripe	4.20	114
Crangons	0.20	
Eualus	0.10	

Invertebrates	
Jellyfish	1.50

Flatfish	
Dab (Pacific)	0.10
Dover Sole	0.60
English Sole	1.60
Rex Sole	0.20
Slender Sole	1.50

Rockfish	
Splitnose	0.80
Greenstriped	1.70
Copper	0.10

Roundfish	
Walleye Pollock	0.60
Eelpouts	2.90
Pacific Hake	42.60
Midshipman	0.20
Shiner Perch	0.10

Selachii	
Spiny Dogfish	13.40
Spotted Ratfish	13.80

All weights are in Kilograms

Shrimp Biomass Survey, Areas 28 & 29, August, 1998

Date Aug 17 1998 **Time** 13 : 30 **Duration (min)** 15 **Area** 29 - 4 **Haul No.** 118
Depth M 110 120
Water Temp: Surface Bottom
Type of Gear DH Total Catch
Net Effective Opening (feet) 30.0
Direction 300
Distance 0.7 Naut. Mi.
Remark Usable
Vessel 3

Shrimp	Weight	Num/Kg
Northern Pink	0.10	
Sidestripe	1.40	114
Crangons	0.10	

Invertebrates	
Dungeness Crab	9.30

Flatfish	
Dover Sole	2.00
English Sole	33.00
Rex Sole	0.90
Turbot	5.80
Slender Sole	0.20

Rockfish

Roundfish	
Walleye Pollock	2.30
Pacific Tomcod	0.70
Eelpouts	0.10
Pacific Hake	26.90
Midshipman	2.40

Selachii	
Spiny Dogfish	34.20
Spotted Ratfish	47.30

All weights are in Kilograms