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RESULTS FROM A BOTTOM TRAWL SURVEY OF GROOVED TANNER CRAB, *Chionoecetes tanneri* RATHBUN, STOCKS OFF THE WEST COAST OF VANCOUVER ISLAND, JULY 21 – AUGUST 3, 1999

by

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ABSTRACT

Workman, G.D., J.A. Boutillier, A.C. Phillips, G.E. Gillespie, W-G. Park, D. Clark, and B. Pennell. 2001. Results from a bottom trawl survey of Grooved Tanner Crab, *Chionoecetes tanneri* Rathbun, stocks off the west coast of Vancouver Island, July 21 – August 3, 1999. Can. Manuscr. Rep. Fish. Aquat. Sci. 2568: 79 p.

As part of the ongoing assessment of the fishery potential of Tanner crab (*Chionoecetes tanneri*) off the West coast of Canada, a trawl survey was undertaken between July 21 and August 3, 1999. The primary objective of the survey was to assess the abundance of Tanner crab in a selected study area off the west coast of Vancouver Island. Secondary objectives included collecting detailed biological data on Tanner crabs, comparing catch rates between trap and trawl gear, collecting detailed community structure data by depth from the deep continental slope region and collecting cross shelf physical and biological oceanographic data.

A total of 34 trawl sets were completed over 5 depth strata from 400 – 1200 m depth. The total catch by trawl of Tanner crabs was 313.48 kg. Tanner crabs were caught in all but 4 tows. The angle Tanner (*Chionoecetes angulatus*) was caught in two tows. The catch was clearly partitioned by depth with males being found in all depth strata but dominating the shallowest (400 – 560 m), while females and juveniles dominated the four deeper strata (560 – 1200 m). Tanner crabs ranging in size from 10 to 176 mm carapace (CW) width were retained by the trawl net.

Six strings of 15 conical top loading crab traps were set during the survey. Trap catches were much higher than trawl catches, with the 6 sets yielding 345.37 kg of Tanner crabs. The depth stratification noted in the trawl catches was apparent in the trap catches as well.

Biomass was computed over the study area for the population as a whole and for animals larger than and smaller than 100 mm. A total biomass of 122.5 metric tonnes (mt) was estimated, of which 52.0 mt were ≥ 100 mm CW and 70.6 mt were < 100 mm CW. Ninety five percent confidence intervals (95 % CI) computed by bootstrapping were narrowest when computing the biomass of animals ≥ 100 mm CW, 36 – 71 mt or 69 – 137 % of the biomass estimate. The wider 95 % CI for the population as a whole, 70 – 221 mt or 57 – 180 % of the estimate, and for crabs < 100 mm CW, 29 – 176 mt or 42 – 249 % of the estimate, reflects the contagious distribution of smaller crabs that appear to occur in widely dispersed but very dense patches.

The catch partitioned into three size classes, <40 mm, 40 – 75 mm and >75 mm cw. By number, crab larger than 75 mm cw dominated above 560 m, from 560 to 880 crabs < 40 mm cw dominated, and between 880 and 1040 m crabs 40 – 75 mm cw were most abundant. Length weight relationships were derived for tanner crabs by sex; these indicate that throughout their lives males are heavier at a given width than females. Maturity ogives were plotted for tanner crabs and size at 50 % morphometric maturity was estimated to be 112 mm cw for males and 88 mm cw for females.

RÉSUMÉ

Workman, G.D., J.A. Boutillier, A.C. Phillips, G.E. Gillespie, W-G. Park, D. Clark, and B. Pennell. 2001. Results from a bottom trawl survey of Grooved Tanner Crab, *Chionoecetes tanneri* Rathbun, stocks off the west coast of Vancouver Island, July 21 – August 3, 1999. Can. Manuscr. Rep. Fish. Aquat. Sci. 2568: 79 p.

Dans le cadre de l'évaluation continue du potentiel de pêche du crabe Tanner (*Chionoecetes tanneri*) au large de la côte ouest canadienne, un relevé au chalut a eu lieu du 21 juillet au 3 août 1999. L'objectif principal du relevé était d'évaluer l'abondance de ce crabe dans la zone d'étude sélectionnée, au large de la côte ouest de l'île de Vancouver. Les objectifs secondaires étaient de comparer les taux de capture entre les engins de pêche au casier et au chalut, et de recueillir des données biologiques détaillées sur ce crabe, ainsi que sur la structure des communautés en fonction de la profondeur, à partir de la région profonde de la pente continentale, et enfin des données océanographiques physiques et biologiques d'un bout à l'autre du plateau.

On a réalisé en tout 34 traits de chalut sur cinq strates de profondeur variant de 400 à 1200 m. Le total des captures par chalut a été de 313,48 kg. On a capturé le crabe *Chionoecetes tanneri* dans tous les traits de chalut sauf quatre, et le crabe *Chionoecetes angulatus* dans deux traits de chalut. Les prises étaient clairement réparties selon la profondeur : les mâles se retrouvaient dans toutes les strates, mais ils étaient dominants en eau peu profonde (400-560 m), tandis que les femelles et les jeunes dominaient dans les quatre strates plus profondes (560-1200 m). Les crabes Tanner dont la largeur de la carapace (LC) variait de 10 à 176 mm étaient retenus dans le chalut.

Six groupes de 15 casiers à crabe de type conique ont été déposés durant la période d'évaluation. Les captures ont été plus élevées avec les casiers qu'avec les chaluts : les six groupes ont donné un rendement de 345,37 kg de crabes Tanner. On a retrouvé la même répartition des crabes en fonction des strates de profondeur que dans les captures au chalut.

On a calculé la biomasse dans la zone d'étude pour la population globale et pour les animaux plus grands et plus petits que 100 mm. On a estimé une biomasse totale de 122,5 tonnes (t), de laquelle 52,0 t représentent les crabes de LC > 100 mm et 70,6 t représentent les crabes de LC < 100 mm. Les intervalles de confiance de 95 % obtenus par la méthode d 'auto-amorçage (bootstrapping) étaient plus petits quand on tenait compte de la biomasse des animaux de LC > 100 mm, représentant 36-71 t ou 69-137 % de l'estimation de la biomasse. L'intervalle de confiance plus grand de 95 % pour la population globale, 70-221 t ou 57-180 % de l'estimation de la biomasse et pour les crabes de LC < 100 mm représentant 29-176 t ou 42-249 % de l'estimation, réflète la distribution contagieuse des petits crabes qui semble se retrouver en bancs largement dispersés mais très denses.

Les prises se répartissent en trois classes de taille : LC < 40 mm, 40-75 mm et > 75 mm. Par nombre, les crabes plus gros que 75 mm de LC dominent au-dessus de 560 m, ceux plus petits que 40 mm de LC dominent entre 560 et 880 m et ceux de 40-75 mm de LC étaient

les plus abondants entre 880 et 1 040 m. Chez le crabe Tanner, la correspondance entre la taille et le poids est reliée au sexe : durant toute leur vie, à une même taille, les mâles sont plus lourds que les femelles. Des ogives de maturité ont été établies pour le crabe Tanner : la taille à laquelle 50 % des crabes atteignent la maturité morphométrique a été estimée à 112 mm de LC chez le mâle et à 88 mm de LC chez la femelle.

INTRODUCTION

SPECIES ACCOUNT

The grooved Tanner crab (*Chionoecetes tanneri*) is a large deep-water spider crab belonging to the family Majidae. Majids are true crabs having 4 sets of walking legs and two claws unlike Lithodid or king crabs, which have 3 sets of walking legs and 2 claws. The genus Chionoecetes has four species in the eastern Pacific: *C. bairdi* or the Alaskan Tanner crab, *C. opilio* or Snow crab, *C. tanneri,* and *C. angulatus*, the angle tanner. Three of these have been reported from waters off the coast of British Columbia: *C. tanneri, C. angulatus* and *C. bairdi.* The genus is split into deep and shallow water forms. *C. bairdi* and *C. opilio* are found at depths less than 450 m, and the deep water species, *C. tanneri* and *C. angulatus,* are found deeper, 400-1200 m and 1300-3000 m respectively. Deep water forms have enlarged brachial lobes and larger gills as an adaptation to living in a low oxygen environments, and longer and thinner legs than the shallow water congeners, *C. opilio* or *C. bairdi*. Grooved Tanner crabs are noted for their scarlet/orange coloration, deep chocolate eye color and are distinguished from, *C. angulatus* by the presence of a deep groove separating the brachial lobes. They range from Mexico to the Gulf of Alaska. Throughout the rest of this report "Tanner crab" refers to the grooved Tanner crab, *Chionoecetes tanneri.*

BACKGROUND

An experimental fishery for *C. tanneri* was permitted off the coast of British Columbia (BC) between 1988 and 1990. Exploratory fishing took place under scientific permits issued by the Canadian Department of Fisheries and Oceans (DFO). The purpose of the fishery was to gather biological information that would assist in determining if a sustainable commercial fishery for Tanner crab could be established. The coast of BC seaward of the surf line was divided into 6 fishing zones, with two permits issued for each zone. With no biological basis for assigning a size limit fishermen imposed their own based on market preferences, and only landed male crab larger than 110 mm carapace width. Two vessels fishing exclusively off the west coast of Vancouver Island prosecuted the entire fishery. Most of the fishing took place in 580 – 670 m depth during the late fall and early spring (Jamieson 1990). The catch was processed locally with the main markets being in Japan and Korea. The fishery ended in 1990 when neither of the participants came forward for new fishing permits. The reason stated for not continuing with the fishery was the low price for Tanner crab brought about by competition from large harvests of Snow and Alaskan Tanner Crab from the Gulf of Alaska and the Bering Sea.

Because the fishing was conducted primarily as a commercial fishery, there was no requirement for specific at-sea observers and no survey design was imposed on the fishers' activities. Observers were deployed however on several trips during which size composition and catch rate data were collected and port samples were collected at the processing plant to determine the size composition of the catch. Jamieson (1990) reviewed the experimental fishery concluding that the Tanner crab population off BC was probably small and unique.

In 1990, before there was further investigation of the fishery potential for this species, a moratorium was placed on the development of new invertebrate fisheries, thereby acknowledging the Department of Fisheries and Oceans' lack of resources to properly assess and manage additional fisheries. Although it was acknowledged that unfished or under utilized species may exist off the coast of British Columbia little could be done at the time to address development of those resources until policy and guidelines were produced and resources made available to assess and manage them. In an effort to address these issues a memorandum of understanding (MOU) on Seafood Diversification between the DFO and the provincial Ministry of Agriculture, Fisheries and Food (MAFF) was signed in December 1995. The objective of the MOU was to ensure an orderly approach to the development of new commercial fishing opportunities in British Columbia. In 1996 the "Phased Approach" (Perry et al. 1999) was first presented to the Pacific Stock Assessment Review Committee (PSARC) outlining a framework for providing scientific advice for the management of new and developing fisheries. Tanner crab was one of the first species to be investigated under the "Phased Approach". The "Phased Approach" consists of following three stages:

Phase 0 Information review stage: A complete review of existing literature and data is undertaken for the target species, related species and other species exploited using similar gear or found in similar habitats. Information gaps, which will impact the assessment or management of the species, are identified.

Phase 1 Gathering new information: Activities are undertaken to address the information gaps identified in the Phase 0 review. These activities can include, but are not limited to, experimental fisheries, fishery independent surveys, biological sampling programs, and laboratory analysis. The purpose of these studies is often to determine the distribution or abundance of the target species; appropriate harvest technology; and incidental impacts on habitat or other species.

Phase 2 Fishing for commerce: The resource is harvested under experimental management regimes to ascertain the productivity of the stock in question; determine whether the species or stock can sustain a commercially viable fishery; and test the effectiveness of capture techniques. Ongoing monitoring and biological information collection is an integral part of this phase in the development of the fishery and would likely remain an ongoing requirement of any future commercial fishery.

ASSESSMENTS

The 'Phase 0' assessment was completed and reviewed by PSARC in 1996 (Phillips and Lauzier 1997). The information identified as lacking or insufficient was an understanding of the distribution and abundance of the species, stock unit composition, and knowledge of its life history. Features such as moult timing, longevity, spawn timing, recruitment, and mortality rates were poorly understood. In a subsequent paper Boutillier et al. (1998) describe a framework for the development of a commercial Tanner crab fishery identifying the following as pre-requisites to a fishery:

1. A structured trap survey undertaken by the proponents of the fishery to gain information on stock distribution.

2. An area-swept trawl survey undertaken by the DFO to collect baseline density data and estimate stock levels.

The framework also recommended developing a multi-year experimental fishing plan that would be based on distributional, relative abundance and density data from the above surveys. In July and August of 1999 the DFO undertook the first area-swept trawl survey, industry proponents followed this in December of 1999 with the inception of a distributional trap survey. By March of 2000, when funding for the trap survey was exhausted, the industry proponents had completed approximately 40% of the BC coast, primarily off the west coast of Vancouver Island. In June of 2000 data from these two surveys, analysis of those data and an experimental fishing plan were presented to PSARC (Workman et al. 2000). The assessment approach and experimental fishing plan were later reviewed at an international crab symposium in January of 2001 (Workman et al. submitted).

DFO TRAWL SURVEY

This manuscript summarizes the results of the area-swept trawl survey undertaken by the DFO between July 21 and August 3, 1999, aboard the Canadian Coast Guard Science (CCGS) vessel WE RICKER in fulfillment of prerequisite 2 listed above. The primary objective of the survey was to assess the abundance of Tanner crab in a selected study area off the west coast of Vancouver Island. The secondary objectives included collecting detailed biological data, comparing catch rates between trap and trawl gear, collecting detailed community structure data by depth from the deep continental slope region and collecting cross shelf physical and biological oceanographic data. A second exploratory trawl survey was undertaken in August and September of 2000 off the central coast of BC and will be the subject of a separate report.

METHODS AND MATERIALS

VESSEL AND GEAR

The CCGS vessel WE RICKER, a 2500 hp, 57.3 m steel stern trawler was used for the survey. The vessel is equipped with trawl winches, each carrying approximately 2500 m of 1 1/8" (28 mm) steel cable and a set of 1135 kg USA Jet-P combination doors. A Campelen 1800 shrimp trawl was used for all trawl sets during the survey. This trawl has a 29.5 m (97') headline rigged with 80, 203 mm (8 ") deep water plastic floats rated for 1800 m depth, and a footrope of 19.5 m (64'). A 356 mm (14") rockhopper groundline built of sets of three rubber disks separated by iron and rubber spacers was used for the survey. Polyethylene web was used throughout to build the net with mesh size ranging from 80 mm in the wings and 1st side panel to 60 mm in square and first bellies to 44 mm in the 2nd and 3rd bellies, intermediate and codend. For this survey we equipped the net with a 7 mm knotless mesh codend liner. This trawl has been used on the east coast of Canada to conduct multi-species trawl surveys of both groundfish and Snow crab (*C. opilio*) and has proven both versatile and durable. For a complete description of the Campelen 1800 trawl and its performance characteristics see McCallum and Walsh (1997) and Walsh and McCallum (1997).

Trapping was also performed during the survey using conical, top loading, traps (Fig. 1). Traps were meshed with 70 mm (2 3/4") stretched mesh web. Traps were not equipped with escape rings but were rigged with rot panels. Traps where deployed in strings of 15 spaced 100 m apart on 7/8 "POLYSTEEL" or "ICELINE" groundlines. Each trap was baited with 1 kg of herring in a perforated plastic jar and 1 kg of offal in a mesh bag.

SURVEY DESIGN

The northwest coast of Vancouver Island was selected as the study area (Fig. 2). There were several reasons for this, the most significant being that this was the area where the experimental fishery had taken place in 1988 through 1990. The second reason for working in this area was the existence of data from the commercial groundfish trawl fisheries targeting thornyheads, *Sebastolobus alascanus* and *S. altivelis,* and Dover sole, *Microstomus pacificus*, showing both trawlable areas and locations were Tanner crab had been caught incidentally to

the target species between 1996 and 1998. The final reason for choosing this area was the proponent's expression that this would be the most desirable area in which to commence a future commercial fishery.

For the purposes of this survey the continental slope off the west coast of Vancouver Island (Fig. 2) was divided into a series of study areas (Fig. 3). These were based on either the presence of groundfish trawl bycatch of Tanner crabs (Study area 1), the existence of a previous experimental fishery (Study area 2) or the presence of "Tanner crab habitat" based on assumed preferred habitat features (depth, slope, substrate, Study areas 3 and 4). Because there was insufficient data to support random or stratified random designs (Scheaffer et al. 1986) a systematic survey design was employed to select sampling locations within study areas 1 and 2. Transects stratified by depth were placed systematically at an interval of 6.2 and 4.3 nautical miles, in Study areas 1 and 2 respectively, perpendicular to the continental slope. Stratum boundaries were 400-560, 560-720, 720-880, 880-1040, 1040-1200 m. The goal was to place one tow in each depth stratum across each transect. In Study areas 3 and 4 transect placement was arbitrary with the intent of placing transects across depth gradients and around prominent topographic features.

Trap sites were selected based on the results of the trawl portion of the survey. If possible trapping was to be conducted along transects with both high and low trawl catch rates. One string of 15 traps was to be deployed in each depth stratum along each transect. The intent was to collect data on trap catch rates with nearly simultaneous trawl data to explore the relationship between the two.

TRAWLING

Once the vessel arrived at a trawl station the area was sounded to locate trawlable ground. The vessel would then start deploying the net up to 4 kilometers away from the station due to the amount of main trawl warp required to reach the target depths. Because the desired ratio of main warp to bottom depth is approximately 2.0:1, in 1000 m of water 2000 m of main trawl warp was required. Consequently, 2 km were required to deploy the main warp and an additional 2 km was required for the gear to sink. Start position, time and depth were recorded once the gear reached bottom. Touch down, or the moment when the net reached the bottom was determined for most tows using either the SIMRAD ITI system, or the FURUNO FS 3300 headrope sonar. Both devices provided a means of accurately determining the start and end position and the duration of each tow. The net was towed for 30 minutes after touch down at which time retrieval began. Once the gear left the bottom, the time, position, depth, duration, distance covered, direction and average speed were recorded. If the fishing master felt for any reason that the gear was at risk the tow was terminated and the gear retrieved.

CATCH PROCESSING

Once the net was retrieved, the codend was dumped into a hopper that fed a conveyor system in the wet lab directly below the fishing deck. As the catch moved along the conveyer it was sorted by species into baskets of approximately 50 kg capacity. Baskets were weighed to the nearest 0.1 kilogram using a MAREL 2200 motion compensated digital platform scale

with a 60 kg load cell or a top load MAREL 2200 motion compensated bench scale with an 8 kg load cell.

BIOLOGICAL SAMPLING

For each tow either the entire catch or a sub-sample of all the crabs caught were assessed for carapace width (CW) inside the spines (Fig. 4), sex (Appendix 1), shell condition (Appendix 2), injuries (Appendices 3 and 4), and weight. For male tanner crab, claw length and height (Fig. 5), and for females, width of the 5th abdominal somite (Fig. 6) were measured to assess functional maturity. For ovigerous crabs, egg color and clutch condition were also assessed. Detailed morphometric measurements including carapace width outside the spines, carapace length overall, and carapace length from the notch between the rostral horns to the posterior margin of the carapace were taken for a sub-sample of 25 crabs from selected tows. All measurements were recorded to the nearest mm using machine calipers. When the catches were large and sub-sampling was required the catch was divided into adult, > 80 mm, and juvenile, < 80 mm, components and each sub-sampled separately with the goal of measuring up to 100 of each. Individual weights were recorded for intact complete crabs using a top loading MAREL 2200 motion compensated bench scale with an 8 kg load cell.

OCEANOGRAPHIC SAMPLING

Across transect 1 CTD casts were made in each depth stratum using a Guildline CTD, series 8770, model 87107. At each station the CTD probe was lowered to within 100 m of the bottom before being retrieved. The CTD recorded measurements of temperature and conductivity at 0.1 m intervals during the descent of the probe. Cast procedures are summarized by Shaw (1994). All CTD data were processed using IOSSHELL (Pearson 1994).

Bongo tows were also performed at stations along transect 1; the net was deployed to within 100 m of the bottom (estimated from wire angle and wire length) and held at depth for 10 minutes prior to retrieval. The net was retrieved at 1 m/s to ensure a gradual assent. The nets were equipped with flow meters to measure the volume of water filtered by the net. The catch from each net of the bongo was rinsed into a separate jar with a deck hose and fixed by adding 100 ml of 37 % formaldehyde to each 1 l jar.

BIOMASS ESTIMATION

Biomass for Tanner crabs within the survey area was estimated using stratified random sampling methods (Cochran 1977). While this was a systematic rather than a random stratified design the point estimate of biomass is unaffected by this discrepancy. The consequence of using random stratified methods on data collected using a systematic design is an inaccurate estimate of the true variance. This results in artificially narrow or wide confidence intervals. The notation used for the various estimators is provided in the following table (from Workman et al. 1998):

Symbol	Description
h	Stratum index
i	Haul index
C_{hi}	Observed catch in haul i for stratum h
k_{hi}	Area of bottom fished in haul i for stratum h
N	Total number of sampling units in the population
N_h	Total number of sampling units in stratum h
n	Number of units in the sample, or sample size
n_h	Number of units in the sample from stratum h
y_{hi}	Adjusted catch in haul i for stratum h
$\overline{y}_h$	The estimated mean in stratum h
$\overline{y}_{st}$	The estimated population mean
$\hat{\tau}_{st}$	The estimated population total
$\hat{V}(\hat{\tau}_{st})$	The estimated variance of the population total
s_h^2	The sample variance in stratum h

For a given species, the adjusted catch or density is calculated as follows: let C_{hi} be the catch observed in haul i for stratum h and the area of bottom fished in each haul, k_{hi},

$$y_{hi} = \left(\frac{1}{k_{hi}}\right) C_{hi} \quad .$$

The stratified random sampling estimators were applied to the set of adjusted observations, y_{hi}, to compute total biomass for Tanner crabs. Estimators of the mean catch per area and the total biomass are given by

$$\overline{y}_{st} = \frac{1}{N} \sum_{h=1}^{H} N_h \overline{y}_h \quad ,$$

and

$$\hat{\tau}_{st} = N\overline{y}_{st} = \sum_{h=1}^{H} N_h \overline{y}_h \quad ,$$

respectively, where

$$\overline{y}_h = \sum_{i=1}^{n_h} \frac{y_{hi}}{n_h} \quad .$$

An estimator of the variance of the total biomass is given by the equation

$$\hat{V}(\hat{\tau}_{st}) = \hat{V}(N\overline{y}_{st}) = \sum_{h=1}^{H} N_h^2 \left(\frac{N_h - n_h}{N_h}\right) \frac{s_h^2}{n_h} \quad ,$$

where

$$s_h^2 = \frac{\sum_{i=1}^{n_h}\left(y_{hi} - \bar{y}_h\right)^2}{n_h - 1} = \frac{\sum_{i=1}^{n_h} y_{hi}^2 - \sum_{i=1}^{n_h}\left(y_{hi}\right)^2 \Big/ n_h}{n_h - 1} \quad .$$

Confidence intervals for population biomass estimates were computed utilized a non-parametric bootstrap procedure (Efron and Tibshirani 1993). Bootstrapping was conducted by randomly drawing a sample of size N from the observed data with replacement, and computing the stratified estimate of the total from each resample. For each resample, a sample of size n_h was drawn independently from each stratum. A total of 1000 estimates were generated to yield a bootstrap distribution. Confidence limits were calculated using bias-corrected and adjusted (BCa) percentiles of 0.025 and 0.975 (Efron and Tibshirani 1993).

The area of bottom fished during each tow was computed as the product of the distance towed and the average net opening. Distance towed was calculated from the start and end positions of each tow using a great circle algorithm (Robinson et al. 1978). The effective path width of the net was the distance between the wingtips of the net measured using either the Simrad ITI or the FS3300 trawl eye.

Biomass computations not only require estimates of catch density but also habitat area against which to apply those estimates. For this analysis ARCVIEW GIS was used to generate those estimates. Input data (position and depth) were extracted from Natural Resource Maps obtained from the Ocean Mapping Section of the Canadian Hydrographic Service. These data were used to build a Digital Elevation Matrix or DEM, a computer model of the ocean floor. The DEM was generated from the point data by building a Triangulated Irregular Network or TIN from the point data and converting the TIN to a GRID. The resultant DEM was then partitioned into relevant strata or areas. Area estimates for each stratum and study area were then extracted.

The estimation of biomass was contingent upon the following assumptions:

1. All crabs within the path of the net doors are captured, *i.e.* no crabs escape under the footrope, around the wing tips or outrun the net so that the catch coefficient was assumed to be 1;

2. The catch rate and species composition observed in each haul is representative of the entire sampling unit (crabs are distributed homogeneously within each 1 km^2 unit);

3. Crab distribution remains constant over the duration of the survey.

These assumptions are not entirely met in practice. For example, crabs may pass under the footrope or be patchily distributed based on some environmental correlated such as food availability. Thus, the estimates should be interpreted as relative or minimum estimates rather than as an absolute measure of biomass.

RESULTS

CATCH

The survey was conducted between July 21 and August 3, 1999. Due to complications associated with deep water trawling only one of the four potential study areas was adequately surveyed. A total of 34 bottom trawls were completed, of which 29 were usable (Table 1, Appendix 5, Fig. 7). In strata 1 and 2: 7 tows were completed, in strata 3: 6 tows were completed, in strata 4: 5 tows were completed and in strata 5: 4 tows were completed. Two additional tows were completed at depths beyond the survey coverage (tows 6 and 16) and three were fouled (23, 32, 34). A total of 9,912 kg of invertebrates and fish were caught by trawl; Table 2 summarizes the catch by species. Approximately 140 species of invertebrates and fish were encountered, most were keyed to species but in some cases identification was limited to genus or above. *C. tanneri* was the most common invertebrate at 313.48 kg total weight but ranked 8th overall in catch weight behind sablefish, long and shortspine thornyheads, Dover sole and three species of grenadiers. Only two sets were completed deep enough to capture *C. angulatus* for a total catch of 3.5 kg. A summary of trawl catches by strata is presented in Table 3. Appendix Table 6 lists the gastropods and bivalves and the tows in which they where encountered. Because only representative specimen were set aside for identification these data were not included in the detailed catch record in Appendix Table 5 as there are no catch wieghts for each species.

Six survey trap sets consisting of 15 top loading conical traps baited with squid and herring were completed, 2 sets in the shallowest strata and 1 in each of strata 2, 3 and 4; the last set was deeper than the deepest stratum (Fig. 8). The catch by species by trap is presented in Table 4. The most common species caught by trap gear were *C. tanneri* (345 kg) and sablefish (107 Kg). Detailed catch information by set is presented in Appendix Table 7 and a summary of Tanner crab trap catches by set and sex is presented in Table 5.

SURVEY DESIGN

There were several departures from the design throughout the course of the survey. The most significant being that due to the time required to deploy and retrieve the net in the target depths the number of tows achievable had to be reduced. To obtain the best data possible with which to estimate abundance requires adequate sampling within the survey frame thus the survey was constrained to Study area 1 until sufficient coverage was achieved. As the survey progressed towards the northern part of study area 1 the bottom topography became increasingly variable making it difficult to fish at the target depths. This required moving one transect from the northern end to the southern end of Study area 1 (Transect 0 in Table 1). Once Study area 1 was complete an attempt was made to continue surveying in study area 2, this however proved difficult, and after hanging up several times we abandoned further trawling in favor of collecting trap data.

DISTRIBUTION

In the shallowest stratum only large male crab were encountered. In Stratum 2 large numbers of juveniles were caught dominating the catch by number (89%) but only accounting for 6% of the catch by weight. The catch of larger crabs in stratum 2 was composed of large new and old shell males and larger new and old shell, ovigerous, female crabs. All of the juvenile crab in this stratum came from tow 14. Stratum 3 was likewise dominated by juvenile crabs, 86 % by number, with most of the juveniles coming from tow 18 and a few from tows 9 and 20. In both strata 2 and 3 females account for approximately 33% of the catch of crabs larger than 75 mm with a higher proportion of the crabs in stratum 2 being ovigerous. Stratum 4 was dominated by sub-adults in the 40 to 75 mm size class accounting for 86.5% of the animals caught by number. All the sub-adults came from tows 4 and 15 and trap set 38. Stratum 5 was not dominated by any one size class or sex of animals.

Catch weights for tanner crab by trawl ranged from 0 to 106 kg per tow, with a mean of 9.2 kg and standard deviation of 18.2. If one removes the single large set (tow 4), the mean drops to 6.3 kg and the standard deviation to 6.3 kg. The average catch in stratum 1 was 1 kg per 30 minute tow; in stratum 2 it was 6.5 kg; in stratum 3, 8.1 kg per tow; in stratum 4, 29.5 kg; and in stratum 5 the average was 4.6 kg. The average catch of crabs over 100 mm CW in stratum 1 was 1 kg per tow; in stratum 2, 6.1 kg; in stratum 3, 5.8 kg per tow; in stratum 4, 6.4 kg; in stratum 5 the average was 3.6 kg. At depths greater than 1200 m the angle tanner (*C. angulatus*) dominated the catch.

The average catch of Tanner crabs per trap was 0.13 at 400 m, 5.3 at 525 m, 9.9 at 700 m, 13.7 at 824 m, 91.5 at 939 m and 0.13 at 1370 m. Also at 1370 m, 1.53 *C. angulatus* were caught per trap. By-catch was minimal with trap gear with only the occasional sablefish or grenadier retained.

BIOMASS ESTIMATES

Catch, catch density and area swept by the net are presented in Table 1. As stated previously area swept by the net is the product of distance towed and the average wingtip spread. Wingtip spread was variable and depended on the device used to obtain the measurements. The FURUNO FS 3300 net sonar reported wingtip spreads varying between 12.1 m and 15.1 m, with an average of 13.65, this however is the cross section of the net at the point at which sonar transducer attaches to the headrope not the wingtip spread. The SIMRAD ITI sensors, which attach directly to the wings of the net, reported wingtip spreads varying from 13.1 to 17 m, with an average of 14.97 m, which was used when computing area swept.

Estimates of Tanner crab habitat by depth stratum for Study area 1 are presented in Table 6. Strata 1 – 4 are almost equal in size accounting for 87 – 100 km^2 of habitat; stratum 5 however is significantly larger accounting for 154 km^2. Assuming each tow fully samples the 1 km^2 block within which it falls the percentage of each stratum sampled is 5.4 – 7.0 % for strata 1-4 and 2.5 % for strata 5.

Biomass estimates for Study area 1 along with boot strapped 95 % confidence intervals are presented in Table 7. The catch was partitioned into two components, the proportion larger or smaller than 100 mm using the biological data (Table 8). Using these data separate estimates of biomass were generated for crabs ≥ 100 mm CW and < 100 mm CW. We used 100 mm because in early consultation with industry this was deemed the size of a commercially viable crab. The estimate of biomass for study area 1 for all sizes of crabs is 122.5 metric tonnes (mt), the 95 % CI is 69.7 to 221.1 mt. For crabs under 100 mm CW the estimate is 70.6 mt with a 95% CI of 29.3 to 175.5 mt. For crab over 100 mm CW the estimate is 52.0 mt with a 95 % CI of 35.9 to 71.4 mt. The confidence intervals are 69 % - 137%, 57% - 180 % and 42% - 249 % of the point estimate for crabs ≥ 100 mm, all sizes and crabs < 100 mm respectively. The confidence interval is narrowest relative to the point estimate for crab 100 mm CW and larger. When looking at the biomass estimates by strata we see that for all sizes and for crabs < 100 mm CW stratum 4 not only contributes most to the estimate of biomass but also most of the variability due to a single large catch (tow 4). The estimate of biomass for larger crabs is less variable because by selecting catch on the basis of size most of the catch weight from tow 4 is effectively eliminated from the computation of biomass.

BIOLOGICAL DATA

A total of 2140 crabs were examined (1272 caught by trawl and 868 caught by trap) from a total catch of 8401 crabs (6617 by trawl and 1784 by trap). The catch partitions neatly into three size classes, animals less than 40 mm, 40-75 mm, and greater than 75 mm. Of the total catch by numbers 3343 were under 40 mm (40 %), 4064 were between 40 and 75 mm (48%), and 992 were larger than 75 mm (12%).

Shell conditions by size class and sex are presented in Table 9. For the smallest size class shell condition was undetermined for 2955 crab, 88.4%; for those with determined shell conditions most were new hard shell, 7.9%, with a few new shell hardening and new shell soft, 1.6 % and 1.7 % respectively. In the middle size class there was a great deal of variability in the shell condition: 45.0 % were new shell hard, 29.9 % were new shell hardening, 21.0 % were new shell soft and 3.2% had plastic soft shells. In the largest size class most crabs were new shell hard, 32.3 %, or old shell, 28.6%; of the remaining crabs almost equal proportions were in new shell hardening, 9.1%, new shell soft, 14.0% or plastic soft-shell conditions, 9.7 %. Only 4 moulting crabs were encountered during the survey, two in the intermediate size class and two in the largest size class. Of the crabs biosampled 11.1 % were missing legs and 2.1% were missing claws. Males were missing claws 8 times more often than female and legs twice as often. The most common injuries were: a regenerating limb (0.7%); a regenerating limb in combination with another injury (0.4%); or a hole in the carapace (0.1%). Throughout the survey only one crab was encountered with black mat disease, a systemic fungal infection caused by *Trichomaris invadens*. Most oldshell crabs, however, showed some evidence of shell degeneration in the form of chitinoclastic bacterial infections (*Photobacterium* sp.; Jadamec et al. 1999) at the sites of minor injuries. The most common observation aside from the injuries and missing limbs noted above were grasping marks on females.

Carapace width histograms are presented in Fig. 10 through Fig. 18. Fig. 10 presents the width frequency histogram in aggregate for both sexes across strata. Fig 11 presents the same data by sex. In aggregate there are prominent narrow modes at 15, 21, 26 and 36 mm. There are larger wider modes in the distribution between 45 and 55 mm with a peak at 52 mm and between 60 and 72 mm with a peak at 67 mm. Smaller less obvious modes occur at the larger sizes at 80, 84, 88, 100, 113, 119, 130 and 150 mm. When presented by sex in Fig. 11 the modes are similar between the sexes with males showing a wider range of sizes and more numerous modes. In stratum 1, Fig. 12, in which only male Tanner crabs were caught, the width frequency histogram peaks at 152 mm. In strata 2 and 3 (Fig. 13, Fig. 14) very small juveniles dominated the catches with modes at 14-16 mm and 21-25 mm. The main difference in the size composition between strata 2 and 3 is the presence of a larger number of larger females in stratum 3. The size composition in stratum 4 (Fig. 15) is dominated by sub-adults with modes at 50 mm and 63 mm for females and 52 mm and 67 mm for males. The small juveniles that dominated the catch in strata 2 and 3 are absent from this stratum. Catches were limited in stratum 5 (Fig. 16), with weak modes at 35, 50 and 98 mm for females and 49 and 52 mm for males. Width frequency distribution data for ovigerous females, Fig. 17, show a mode at 100 mm. The smallest ovigerous female was 82 mm and the largest 120 mm. Width frequency histograms for females larger than 75 mm and males larger than 80 mm are presented in Fig. 18.

Carapace width/body weight relationships have been derived for male, female and ovigerous female Tanner crabs. These are presented in Figures 19 - 22 and in Table 10. Males are heavier than females at the same width. Ovigerous females are proportionally heavier than non-ovigerous females at the same width.

Maturity data were examined in two ways for both females and males. For males, the log of chela length was plotted against the log of carapace width, (Fig. 23; Jamieson et al. 1990; Conan and Comeau 1986). The data partition neatly into two groups, morphometrically mature (large clawed) and morphometrically immature (small clawed). Maturity codes were calculated using the following equation (Jamieson et al. 1990):

$$MC = \log(\text{Chela Length}) - \log 1.41 \log(\text{Min. Carapace Width}) + 2.92$$

If the result is positive the crab is mature, if negative the crab is immature. Mature males ranged in size from 94 to 166 mm. Morphometrically immature males ranged in size from 29-176 mm. Of the 68 crabs 110 mm CW or larger classified as immature, most had maturity codes that were only slightly negative suggesting that the above algorithm may be somewhat insensitive. Jamieson et al. (1990) notes that the above algorithm would be improved by additional data from morphometrically immature crabs, which was lacking during their original analysis. A future paper will revisit the derivation of the above algorithm incorporating the data collected here. Size at 50 % maturity for male Tanner crab, or the size at which half the males in the population are morphometrically mature, was determined by calculating the proportion of crabs in each 1 mm size increment that were mature, using the above algorithm, and plotting this as a function of carapace width. The resulting plot was fit with a logistic curve resulting in a value of 112 mm for the width at 50 % maturity for males (Fig. 24). For females we plotted the log of the 5th abdominal somite width against the log of

carapace width (Fig. 25); the morphometrically mature females were clearly distinct as a cluster in the upper right of the plot. Without an algorithm to assign maturity codes for females the following was used: the width of the 5th abdominal somite divided by the carapace width. This partitioned the data into two fairly distinct groups: immature, where the values ranged from 0.29 to 0.48 and mature with values ranging from 0.51 to 0.66. Using a value of 0.50 as the criterion for maturity in females we found immature non-ovigerous females ranged from 25 to 97 mm, mature non-ovigerous females ranged in size from 90 to 123 mm. Ovigerous females raged in size from 83 to 120 mm. The single spent female caught during the survey was 106 mm wide. As with males the size at 50 % maturity was determined for females by plotting the proportions mature at each 1 mm size increment as a function of width (Fig. 26) and fitting a logistic curve to the data resulting in a size at 50 % maturity for females of 88 mm.

ECOLOGICAL OBSERVATIONS

The role of Tanner crabs in the deep slope ecosystem is not well understood, however, their anatomy suggests they are equipped to dismember large pieces of food that sink to the bottom, and are capable of travelling over comparatively large distances to do so. They also undoubtedly feed on benthic and interstitial organisms and themselves provide a food source for a number of species. Of a sample of 20 shortspine thornyhead (*Sebastolobus alascanus*) examined for stomach contents, 14 were full of Tanner crab juveniles exclusively, 4 were empty and 1 contained the remains of a small fish. The crabs from the stomachs were identifiable to sex and some could be measured, as their shells were intact. The size of crabs found in stomachs broke into two groups: 20-30 mm and 70 – 100mm; those from 70-100mm were softshell while the 20-30 mm size were hardshell. Stomach content of other fish species were not examined, although Pereyra (1966) records the smallest size range of crabs from fish stomachs, notably Dover sole (*Microstomus pacificus*) and sablefish (*Anaplopoma fimbria*).

OCEANOGRAPHIC DATA

CTD (temperature/salinity) data were collected at 5 sites along transect 1 with one cast completed in each depth strata (Table 11, Fig. 9). Plankton samples were collected using a Bongo net with one sample collected from each depth stratum and one additional sample from a deeper tow (Table 12, Fig. 9).

Cast profiles were plotted for each of the CTD casts performed during the cruise (Fig. 27). The most obvious features of the temperature and salinity data are the distinct thermocline and halocline between 50 and 100 m at all stations. At all five sites the surface temperature dropped quickly to approximately 7 degree C and salinity increased to 34 ppt by 100 m depth, thereafter the decline in temperature and the increase in salinity was much more gradual. Surface temperature at the site furthest offshore was the highest. The temperature and salinity where Tanner crabs were most abundant ranged from 4.2-4.5 degrees C and from 34.0 to 34.25 ppt salinity.

DISCUSSION

The findings from this survey are similar to those of earlier work off Oregon (Pereyra 1966, 1968; Tester and Carey 1986), in Alaska (Somerton and Donaldson 1996) and in BC (Jamieson 1990). Tanner crabs were found between 436 m and 1301 m depth, mature males were found throughout the depth range but clearly dominated the catch between 450 m to 720 m depth. Females and juveniles (male and female, 10 – 40 mm CW) dominated the catch between 720 and 900m, while ovigerous females were shallower than non-ovigerous females. Sub-adults (male and female, 40 – 75 mm CW) dominated between 900 m and 1100 m. This pattern is almost identical to that found by Pereyra (1966, 1968) off of Oregon where adult males dominated between 500 and 640 m while females dominated between 640 and 690 m. Likewise the pattern of juvenile distribution was nearly identical with juvenile crabs (< 40 mm CW) found between 690 m and 865 m and sub-adults (immature crabs over 40 mm) being found below 865 m. These finding support the life history model proposed by Pereyra (1968) in which males and females were segregated by depth for most of the year, with males being shallower than females. Then throughout the late fall, winter and early spring both sexes undertaking bathymetric migrations with males moving deeper and females shallower. This migration being for the purposes of mating and coincident with the release of larvae and ovulation of fresh egg clutches. Once new egg clutches were extruded the sexes would again segregate. The larvae, once released, would be advected offshore as planktonic zoea for up to 80 days; once metamorphosed to megalopae they would settle to the bottom in deeper water and recruit from deep to shallow. During this survey juvenile, < 40 mm CW, crabs were found a various depths, but sub-adult crabs, 40 – 75 mm CW, were only found below 900 m suggesting there may be an ontogenetic migration to this depth from both deep and shallow areas, and that while juveniles, this species may use deeper water as a refuge from potential predators. This is substantiated by the depth distribution of known Tanner crab predators such as Shortspine thornyhead, (*Sebastolobus alascanus*), Dover sole (*Microstomus pacificus*) and Sablefish (*Anoplopoma fimbria*) (Pereyra 1966; this study).

Males ranged in size from 10 mm – 176 mm CW, females from 10 to 123 mm, and ovigerous females from 82 to 120 mm. The maximum size of males is similar to values reported for Alaska (170 mm CW, Somerton and Donaldson 1996) and Oregon (181 mm CW, Pereyra 1966; 162 mm CW, Tester and Carey 1986). The maximum size reported for females is likewise similar to that reported for Alaska (126 mm CW, Somerton and Donaldson 1996) and Oregon (126 mm CW, Pereyra 1966; 122 mm CW, Tester and Carey 1986).

The width frequency histogram for the population as a whole or by sex, Figure 10 and 11, are nearly identical to that presented in Tester and Carey (1986) in which they identify moult increments. Using the size at instar relationship presented in Tester and Carey (1986), the first instar captured during this survey was instar IV corresponding to the mode at 10 mm. Instar V is represented by the mode at 15 mm, instar VI corresponds to the mode at 21 mm and instar VII corresponds to the peak at 26 mm. For instars I – VII, Tester and Carey (1986) estimated a mean increase in carapace width per moult increment of 39 %. If one assumes that relationship holds true until the puberty moult, the modes identifies at 36 mm, 52 and 67 mm correspond to moults VIII – X (calculated modes should appear at 37 mm, 52 mm and 72 mm).

Size at 50 % morphometric maturity and mean size of morphometrically mature crabs were estimated by sex. The size of 50 % maturity for males and females is 112 mm and 88 mm respectively. For males this is slightly less than the value reported from Alaska while for females it is significantly greater, 119 mm for males and 79 mm for females (Somerton and Donaldson 1996). When compared to values reported from Oregon, 118 mm and 85 mm for males and females (Tester and Carey 1986), the males are maturing at a smaller size and the females at a larger size. The mean CW of morphometrically mature individuals was 136 mm for males and 102 mm for females. These correspond well with values from Alaska, 138 mm and 100 mm for males and females respectively (Somerton and Donaldson 1996) and Oregon, 149 and 103 mm (Pereyra 1966) and 143 and 102 mm (Tester and Carey 1986). While the findings from the biological data are not new for this species, they are new for BC waters and correspond well with observed values from Alaska and Oregon.

In an effort to assess the quality of our trawl data two other sources of data were examined: groundfish trawl by-catch data and CPUE data from previous trawl surveys of Tanner crabs conducted by other researchers. The CPUE achieved during our 1999 Tanner crab trawl survey ranged from 0.0 to 130.22 kg/hr with a mean of 13.08 and standard deviation of 22.88 kg/hr. This corresponds to a density of crabs of 208.17 kg/km^2 with a standard deviation of 403.18 kg/km^2. CPUEs in the groundfish trawl fishery for the same area as that surveyed ranged from 0 to 112.8 kg per hour with a mean of 6.13 kg/hr and a standard deviation of 7.56 kg/hr. This corresponds to an average density of 142.36 kg/km^2 with a standard deviation of 276.31 kg/km^2. Pereyra (1966) observed CPUEs for Tanner crab ranging from 18.6 kg /hr to 21.8 kg/hr. There are very few other published CPUE or density estimates for *C. tanneri*. The values obtained during the trawl survey are approximately twice those observed in the groundfish trawl fishery and are close to but less than the values observed by Pereyra off Oregon in the early 1960s. The discrepancy between our current catch rates and those from Oregon in the early sixties may reflect trawl impacts on the abundance of Tanner crabs in our study area, differences in the fishing power of the nets or changes in the absolute abundance between time periods.

The primary objective of this survey was to produce baseline estimates of abundance for *C. tanneri*. The estimated biomass for all sizes of Tanner crabs in the study area was 122.5 metric tonnes (mt) of which 52.0 mt had a CW $\geq$ 100 mm. The bootstrapped 95 % confidence interval was 69.7 to 221.1 mt for all crabs and 35.9 to 71.4 mt for crabs larger than 100 mm. The average density of tanner crab on the bottom was 223 kg/km^2 the average density of crabs larger than 100 mm was 104 kg/km^2.

One of the questions presented by industry has been whether or not a trawl survey is the best means of assessing the abundance of Tanner crabs. The data gathered during this survey demonstrate the effectiveness of trawl surveys as a tool for assessing Tanner crabs for the following reasons:

- The relatively narrow confidence intervals computed for the estimate of adult marketable biomass indicate that as adults the species is fairly uniformly distributed, making them a good candidate for assessment by trawl.

- All size classes of crabs down to 10 mm CW as well as infaunal invertebrates whale bones and empty shells were retained by the net indicating that the trawl was able to capture and retain anything within the path of net.
- The FS3300 and Simrad ITI sensors attached to the net confirmed that the gear remained in contact with the bottom and maintained geometry once it reached the bottom.

The estimates produced here should be interpreted as either relative or possibly minimum estimates of the available biomass. Fishermen previously involved in the Tanner crab experimental fishery indicate that this species may have a preference for harder substrates than those sampled during this survey. Clearly the disparity between trap catch rates and trawl catch rates indicate that trapping is a much more efficient means of capturing this species. However a trap index alone would be unlikely to track changes in abundance with any certainty due to variables such as gear saturation, bait load, soak time and gear placement. It would seem prudent at the outset of investigating the fishery potential of this species to develop both trawl and trap indices to track the abundance of this species.

The primary biological and ecological findings of this survey include:

- The distribution, depth segregation by sex, size composition and maturity schedules for Tanner crab off the coast of British Columbia are similar to those for stocks off of Oregon and Alaska.
- The pattern of juvenile distribution tends to support the life history model proposed by Pereyra (1968) for Tanner crab stocks off of Oregon.
- The deep (500-1300m) continental slope ecosystem is an exceptionally diverse one dominated by thornyhead rockfish, sablefish, grenadiers, Tanner crab, cephalopods, ophiurids, gastropods and bathypelagic shrimp and fishes.
- Thornyhead rockfish are a major predator on juvenile Tanner crab.

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Table 1. Summary of trawl activities and catches of Tanner crab from the 1999 Tanner crab trawl survey.

Tow	Transect	Strata	Area Swept Km^2	Duration Min.	Crab Species	Catch Kg.	Density Kg/Km^2	Usability	Mean Depth
1	1	1	0.017075	16	*C. tanneri*	0.90	52.71	Usable	460
2	2	2	0.043810	42	*C. tanneri*	7.40	168.91	Usable	643
3	1	3	0.043420	43	*C. tanneri*	1.30	29.94	Usable	781
4	2	4	0.042753	49	*C. tanneri*	106.35	2,487.56	Usable	855
5	1	5	0.043581	43	*C. tanneri*	14.70	337.30	Usable	1170
6	3	6	0.044764	44	*C. angulatus*	1.60	35.74	Usable	1150
6	3	6	0.044764	44	*C. tanneri*	16.60	370.84	Usable	1150
7	3	5	0.041017	45	*C. tanneri*	5.10	124.34	Usable	1143
7	3	5	0.041017	45	*C. angulatus*	1.90	46.32	Usable	1143
8	3	4	0.049426	47	*C. tanneri*	6.61	133.74	Usable	949
9	3	3	0.043585	46	*C. tanneri*	8.90	204.20	Usable	825
10	3	2	0.053102	43	*C. tanneri*	15.90	299.42	Usable	667
11	3	1	0.050797	40	*C. tanneri*	0.00	0.00	Usable	481
12	2	1	0.056455	43	*C. tanneri*	1.00	17.71	Usable	436.5
13	1	1	0.053840	38	*C. tanneri*	0.90	16.72	Usable	525
14	1	2	0.052818	41	*C. tanneri*	7.80	147.68	Usable	667
15	1	4	0.052589	42	*C. tanneri*	21.00	399.33	Usable	946.5
16	1	6	0.031741	47	*C. tanneri*	15.00	472.57	Unusable	1301.5
17	2	2	0.054119	40	*C. tanneri*	0.00	0.00	Usable	533.5
18	2	3	0.052049	42	*C. tanneri*	8.76	168.36	Usable	731
19	4	4	0.019142	27	*C. tanneri*	2.11	110.23	Usable	913.5
20	4	3	0.027825	27	*C. tanneri*	18.90	679.24	Usable	725
21	4	2	0.034171	30	*C. tanneri*	6.20	181.44	Usable	565
22	4	5	0.051269	45	*C. tanneri*	0.00	0.00	Usable	1286
23	6	4	0.016233	28	*C. tanneri*	0.50	30.80	Unusable	927.5
24	6	2	0.073137	45	*C. tanneri*	3.20	43.75	Usable	610
25	6	1	0.052993	40	*C. tanneri*	2.20	41.51	Usable	507
26	6	3	0.038996	42	*C. tanneri*	0.00	0.00	Usable	884
27	4	1	0.048843	39	*C. tanneri*	1.50	30.71	Usable	539
28	0	1	0.041530	33	*C. tanneri*	1.00	24.08	Usable	540
29	0	2	0.047376	40	*C. tanneri*	5.30	111.96	Usable	666.5
30	0	3	0.047400	40	*C. tanneri*	11.00	232.07	Usable	749
31	0	4	0.037900	44	*C. tanneri*	11.64	307.13	Usable	912.5
32	0	5	0.037918	45	*C. tanneri*	9.90	261.09	Unusable	1033
33	7	5	0.021726	21	*C. tanneri*	1.80	82.85	Usable	906
34	7	3	0.014336	4	*C. tanneri*	0.00	0.00	Unusable	753

Table 2. Total catch by species by trawl gear during the 1999 Tanner crab trawl survey off the west coast of Vancouver Island. Species have been keyed to the lowest taxonomic level possible. Occasionally organisms where only recorded to the level of Order, Family or Genus. Total catch weight is in kilograms. "Trace" indicates that in no single tow was there more than 0.1 kg recorded for the species.

Latin Name	Common Name	Total Catch
Crab:		
Chionoecetes tanneri	**Grooved Tanner crab**	313.48
Chionoecetes angulatus	**Angle Tanner crab**	3.50
Lithodes couesi	Scarlet King crab	0.50
Calastacus stilirostris	a burrowing crab	Trace
Munida quadrispina	Squat lobster	Trace
Pagurus splendescens	a hermit crab	Trace
Calocaris quinqueseriatus	a burrowing crab	Trace
Calocaris investigatoris	a burrowing crab	Trace
Shrimp:		
Pasiphaea pacifica	Glass shrimp	59.15
Eualus macrophthalmus	Large eyed eualid	4.40
Eualus biunguis	Deepsea eualid	1.00
Pandalopsis dispar	Sidestripe shrimp	0.30
Eualus (Genus)	a shrimp Genus	0.30
Sergestes similis	Pacific sergestid	0.06
Systellaspis braueri	Quayle's spinytail	Trace
Notostomus japonicus	Spiny ridge shrimp	Trace
Sergia tenuiremis	Ocean sergestid	Trace
Acanthephyra curtirostris	Peaked shrimp	Trace
Bentheogennema borealis	Northern blunt-tailed shrimp	Trace
Bentheogennema (Genus)	a shrimp Genus	Trace
Hymenodora frontalis	Pacific ambereye	Trace
Parapasiphae sulcatifrons	Grooved-back shrimp	Trace
Pasiphaea tarda	Crimson pasiphaeid	Trace
Crangon dalli	Ridged crangon	Trace
Pandalus montagui tridens	Yellowleg shrimp	Trace
Gnathophausia(Family)	Order Mysidacea	Trace
Mysidacea (Order)	Mysids	Trace
Parapasiphae(Genus)	A shrimp Genus	Trace
Mollusca:		
Berryteuthis magister	Schoolmaster gonate squid	97.64
Opisthoteuthis californiana	Flapjack devilfish	34.12

Table 2 (cont'd)

Latin Name	Common Name	Total Catch
Mollusca: Cont'd		
Gastropoda (Class)	Mixed snail species	9.54
Octopoteuthis deletron	a species of squid	4.60
Benthoctopus(Genus)	An octopus genus	3.30
Cephalopoda(Class)	Unidentified squid or octopus	2.02
Gonatus (Genus)	a squid genus	1.10
Chiroteuthis calyx	a species of squid	0.60
Graneledone boreopacifica	a species of squid	0.50
Galiteuthis armata	a species of squid	0.40
Teuthoidea(Order)	Unidentified squid	0.35
Histioteuthis heteropsis	Flowervase jewel squid	0.30
Nudibranchiata (suborder)	Seaslugs	0.30
Japetella diaphana	a species of squid	0.20
Berryteuthius anonychus	Smallfin gonate gquid	Trace
Onychoteuthis borealijaponicus	Boreal clubhook squid	Trace
Vampyroteuthidae(Family)	Vampire squids	Trace
Idas washingtonius	Washington combmussel	Trace
Benthoctopus robustus	a species of octopus	Trace
Echinoderm:		
Ophiurae (order)	Brittle stars	26.13
Asteroidea(Class)	Starfish	22.19
Solaster borealis	Northern Sunstar	19.07
Allocentrotus fragilis	Fragile urchin	9.78
Brisaster latifrons	Heart urchin	2.84
Holothuroidea (class)	Sea cucumbers	1.24
Echinacea (superorder)	Sea urchins	0.82
Synallactes challengeri	Papillose sea cucumber	0.80
Ctenodiscus crispatus	Mud star	0.70
Molpadia intermedia	Sweet potato sea cucumber	0.30
Hippasteria spinosa	Spiny red sea star	0.10
Euryalae (Order)	Basket stars	Trace
Psolus squamatus	Scaly sea cucumber	Trace
Crinodea (class)	Sea lilies and feather stars	Trace
Groundfish:		
Anoplopoma fimbria	Sablefish	2,871.64
Sebastolobus altivelis	Longspine thornyhead	1,550.55
Microstomus pacificus	Dover sole	940.30
Sebastolobus alascanus	Shortspine thornyhead	820.24
Albatrossia pectoralis	Pectoral rattail	592.44
Coryphaenoides filifer	Filamented rattail	439.39

Table 2 (cont'd)

Latin Name	Common Name	Total Catch
Groundfish: Cont'd		
Coryphaenoides acrolepis	Roughscale rattail	425.98
Sebastes aleutianus	Rougheye rockfish	220.60
Antimora microlepis	Pacific flatnose	184.59
Sebastolobus(Gunus)	Thornyheads	155.30
Raja rhina	Longnose skate	109.50
Atheresthes stomias	Arrowtooth flounder	104.20
Lycodes diapterus	Black eelpout	93.11
Apristurus brunneus	Brown cat shark	86.36
Bothrocara brunneum	Twoline eelpout	73.22
Sebastes borealis	Shortraker rockfish	65.10
Merluccius productus	Pacific hake	42.64
Embassichthys bathybius	Deepsea sole	36.17
Bathyraja trachura	Roughtail skate	34.90
Eptatretus deani	Black hagfish	33.03
Alepocephalidae(Family)	Slickheads	24.20
Errex zachirus	Rex sole	19.70
Talismania bifurcata	Threadfin slickhead	18.22
Lycodapus fierasfer	Blackmouth slipskin	17.03
Lycodes cortezianus	Bigfin eelpout	7.60
Lycenchelys crotalina	Snakehead eelpout	7.50
Sebastes malostomus	Blackgill rockfish	6.30
Careproctus melanurus	Blacktail snailfish	5.11
Psychrolutes phrictus	Blob sculpin	4.70
Hydrolagus colliei	Spotted ratfish	2.40
Sebastes aurora	Aurora rockfish	2.00
Sebastes alutus	Pacific ocean perch	1.90
Bathyraja interrupta	Sandpaper skate	1.40
Derepodichthys alepidotus	Cuskpout	1.17
Bothrocara remigerum	Longsnout eelpout	1.00
Lampetra tridentata	Pacific lamprey	0.86
Squalus acanthias	Spiny dogfish	0.70
Eptatretus stouti	Pacific hagfish	0.60
Bathyagonus nigripinnis	Blackfin poacher	0.28
Agonidae(Family)	Poachers	0.20
Lycodapus mandibularis	Pallid slipskin	Trace
Bathypelagic Fish:		
Stenobrachius leucopsarus	Northern lampfish	49.61
Icosteus aenigmaticus	Ragfish	34.10
Bathylagus milleri	Stout blacksmelt	19.82

Table 2 (cont'd)

Latin Name	Common Name	Total Catch
Bathypelagic Fish: Cont'd		
Chauliodus macouni	Pacific viperfish	16.59
Tactostoma macropus	Longfin dragonfish	2.73
Sagamichthys abei	Shining tubeshoulder	0.60
Tarletonbeania crenularis	Blue lanternfish	0.26
Scopelosaurus harryi	Scaly waryfish	0.25
Poromitra crassiceps	Crested ridgehead	0.20
Anotopterus pharao	Daggertooth	0.20
Nemichthyidae(Family)	Snipe eels	0.12
Myctophidae (Family)	Lanternfishes	0.11
Oneirodes bulbosus	Bulbous dreamer	0.10
Benthalbella dentata	Northern pearleye	0.10
Malacosteidae(Family)	Loosejaws	0.10
Diaphus theta	California headlightfish	0.04
Nanensia candida	Bluethroat argentine	0.04
Melamphaes lugubris	Highsnout ridgehead	Trace
Aristostomias scintillans	Shining loosejaw	Trace
Notolepis rissoi	Ribbon barracudina	Trace
Nemichthys scolopaceus	Slender snipe eel	Trace
Anaplogastridae (Family)	Fang tooths	Trace
Melamphaidae(Family)	Ridgeheads	Trace
Oneirodidae(Family)	Dreamers	Trace
Bathylagus pacificus	Slender blacksmelt	Trace
Argyropelecus sladeni	Lowcrest hatchetfish	Trace
Avocettina infans	Closespine snipe eel	Trace
Other Inverts.		
Actiniaria (Order)	Anemone	101.15
Scyphozoa (Class)	Jellyfish	24.26
Aphrodita (Genus)	Sea mouse	0.28
Isopoda (Order)	Isopods	0.15
Thaliacea (Class)	Salps	Trace
Pennatulacea (Order)	Sea pens	Trace
Brachiopoda (Phylum)	Lamp shells	Trace
Ctenophora (Phylum)	Comb Jellies	Trace
Polychaeta(Class)	Polychaete worms	Trace
Misc.		
	Unidentified matter	17.45
	Unknown fish	0.68
	Whale bones	~300.00
	Kelp (Mixed species)	~50.00

Table 3. Total and average catch and average density of all Grooved Tanner crab (CT, *C. tanneri*) by stratum. Total and average catch and average density of CT larger than 100 mm carapace width by stratum. Stratum boundaries were 400-560, 560-720, 720-880, 880-1040, 1040-1200 m, for strata 1-5 respectively and >1200 m for stratum 6. N is the number of tows performed in each stratum.

Stratum	N	Total Catch (Kg)	Average Catch per Strata (Kg)	Average Density (Kg/Km^2)	Catch >100 Mm (Kg/Km^2)	Average Catch >100 Mm (Kg/Km^2)	Average Density >100 Mm (Kg/Km^2)
1	7	7.50	1.07	26.21	7.50	1.07	26.21
2	7	45.80	6.54	136.17	43.14	6.16	128.22
3	6	48.86	8.14	218.97	35.10	5.85	153.72
4	5	147.71	29.54	687.60	32.17	6.43	156.19
5	4	21.60	5.40	136.12	16.75	4.19	106.27
6	1	16.60	16.60	370.84	7.82	7.82	174.66

Table 4. Total catch by species by trap gear during the 1999 Tanner crab survey off the west coast of Vancouver Island. Species have been keyed to the lowest taxonomic level possible. Occasionally organisms where only recorded to the level of Order, Family or Genus. Total catch weight is in kilograms. Trace quanties are less than 0.1 kg.

Latin Name	Common Name	Total Catch
Crabs:		
Chionoecetes tanneri	Grooved Tanner crab	345.37
Chionoecetes angulatus	Angle Tanner Crab	11.81
Chorilia longipes	Redclaw crab	Trace
Mollusca:		
Gastropoda (Class)	Gastropods	Trace
Echinoderm:		
Ophiuridae (Family)	Brittle stars	0.10
Holothuroidea (Class)	Sea cucumbers	Trace
Sinalyctese challengeri	Papillose sea cucumber	Trace
Echinacea (Super order)	Sea urchins	Trace
Solaster endeca	Northern sunstar	Trace
Thrissacanthus pencillatus	Mud star	Trace
Ophiurida (Order)	Basket stars	Trace
Groundfish:		
Anoplopoma fimbria	Sablefish	107.00
Paralomis multispina		3.40
Coryphaenoides acrolepis	Roughscale rattail	0.80
Other Invertebrates:		
Actiniaria (Order)	Anemone	Trace
Scyphozoa (Class)	Jellyfish	Trace

Table 5. Average Catch per trap by set and sex, in both numbers and kilograms. Species are *C. tanneri* (CT) and *C. angulatus* (CA), sex codes are 1 for males and 2 for females. Catch weights are in kilograms. Stratum boundaries were 400-560, 560-720, 720-880, 880-1040, 1040-1200 m, for strata 1-5 respectively and >1200 m for stratum 6.

Set Number	Stratum	Start Depth (M)	Finish Depth (M)	Species	Sex	Total Catch Weight	Mean Catch per Trap	Total Number Caught	Mean Number per Trap
1	1	525	513	CT	1	72.90	4.86	80	5.33
2	2	770	700	CT	1	70.30	5.02	92	6.57
2	2	770	700	CT	2	18.50	1.85	57	5.70
3	3	824	829	CT	1	77.00	5.13	137	9.13
3	3	824	829	CT	2	4.77	0.34	61	4.36
4	4	939	939	CT	1	35.70	2.38	472	31.47
4	4	939	939	CT	2	64.90	4.33	905	60.33
5	1	400	400	CT	1	1.30	0.65	2	1.00
6	6	1370	1360	CA	1	11.41	1.14	21	2.10
6	6	1370	1360	CA	2	0.40	0.40	2	2.00

Table 6. Number and depth interval for each stratum. Estimated habitat area per stratum in km^2, the proportion of the total habitat area in each stratum, and the number of tows completed in each. The percentage of each stratum sampled assuming each tow fully samples the 1 km^2 within which it occurs.

Stratum	Depth Interval (m)	Total Area (Km^2)	Proportion of Area	Number of Tows	Percentage of Stratum Sampled
1	400-560	100.14	0.187486	7	6.990
2	560-720	99.92	0.187074	7	7.006
3	720-880	87.07	0.163016	6	6.891
4	880-1040	92.42	0.173032	5	5.410
5	1040-1200	154.57	0.289392	4	2.588
Deeper	>1200	Na	Na	1	Na
Total	400-1400	534.12	1.00	31	5.804

Table 7. Biomass estimates, in metric tonnes, for Tanner crab, *C. tanneri*, in Study area 1; separate estimates are presented for all sizes of Tanner crabs, all animals under 100 mm and all animals 100 mm and greater. The upper and lower bound of the 95 % confidence interval are the 2.5th and 97.5th percentiles of 1000 bootstrapped biomass estimates.

Strata	Biomass	95% Confidence Interval	
		Lower	Upper
All sizes of crabs:			
1	2.5	1.2	3.6
2	12.7	6.5	19.2
3	17.8	6.3	36.0
4	59.4	15.7	141.2
5	30.1	4.5	50.0
All Strata	122.5	69.7	221.1
Crabs > 100 mm			
1	2.5	1.2	3.6
2	11.1	5.6	18.6
3	7.9	2.8	12.3
4	12.6	6.4	25.5
5	17.9	5.4	31.3
All Strata	52.0	35.9	71.4
Crabs < 100 mm			
1	0.0	0.0	0.0
2	1.6	0.4	3.9
3	9.9	2.7	28.8
4	46.8	10.5	146.1
5	12.14	2.6	26.9
All Strata	70.6	29.3	175.5

Table 8. Weights and proportions of the catch less than or greater than or equal to 100 mm by set number. Weights are corrected for subsampling. Proportions were computed by weight and by number of Tanner crab. These proportion were computed based on the biological samples collected. The weights presented are in grams of crabs bio-sampled.

Set Number	Weight <100 mm (g)	Weight >100 mm (g)	Total Sample Weight (g)	Proportion >100 mm by Weight	Proportion >100 mm by Number
1		918	918	1.00	1.00
2		7166	7166	1.00	1.00
3	700	735	1435	0.51	0.08
4	7167	1388	8556	0.16	0.02
5	3488	13276	16764	0.79	0.24
6	8313	7412	15726	0.47	0.08
7	2013	4692	6705	0.70	0.23
8	3454	3606	7060	0.51	0.10
9	4498	7250	11748	0.68	0.05
10	170	14734	14904	0.99	0.81
12		1471	1471	1.00	1.00
13		888	888	1.00	1.00
14	1888	5631	7519	0.75	0.01
15	16312	6540	22852	0.29	0.04
18	3133	5646	8779	0.64	0.01
19	249	2120	2369	0.89	0.75
20	6678	11954	18632	0.64	0.50
21	440	4951	5391	0.92	0.78
23	475		475	0.00	0.00
24		2973	2973	1.00	1.00
25		2583	2583	1.00	1.00
27		1426	1426	1.00	1.00
28		942	942	1.00	1.00
29	8	5114	5122	1.00	0.60
30	349	10408	10757	0.97	0.24
31	8467	3895	12362	0.32	0.11
32	4348	6386	10734	0.59	0.43
33	257	1528	1785	0.86	0.25
35		69769	69769	1.00	1.00
36	3152	83798	86950	0.96	0.90
37	5823	72022	77845	0.93	0.53
38	23911	7547	31458	0.24	0.03
39		1246	1246	1.00	1.00
40	787	13724	14511	0.95	0.89
Grand Total	106080	383742	489822	0.78	0.28

Table 9. Summary of shell conditions by size category and sex. Counts are estimated from the biological data, which has been extrapolated to total catch for each tow.

Carapace Width	Sex	Shell Condition	Count
< 40 mm	Undetermined	Undetermined	73
< 40 mm	Undetermined	New Shell, Hard	4
< 40 mm	Male	Undetermined	1,345
< 40 mm	Male	New Shell, Hard	122
< 40 mm	Male	New Shell, Hardening	18
< 40 mm	Male	New Shell, Soft	50
< 40 mm	Male	Plastic Soft	1
< 40 mm	Male	Old Shell	5
< 40 mm	Female	Undetermined	1,538
< 40 mm	Female	New Shell, Hard	140
< 40 mm	Female	New Shell, Hardening	36
< 40 mm	Female	New Shell, Soft	7
< 40 mm	Female	Plastic Soft	2
< 40 mm	Female	Old Shell	2
40 - 75 mm	Undetermined	New Shell, Hard	1
40 - 75 mm	Undetermined	Plastic Soft	13
40 - 75 mm	Male	New Shell, Hard	798
40 - 75 mm	Male	New Shell, Hardening	584
40 - 75 mm	Male	New Shell, Soft	501
40 - 75 mm	Male	Plastic Soft	44
40 - 75 mm	Male	Moulting	1
40 - 75 mm	Male	Old Shell	2
40 - 75 mm	Male	Real Old Shell	3
40 - 75 mm	Female	Undetermined	3
40 - 75 mm	Female	New Shell, Hard	1,032
40 - 75 mm	Female	New Shell, Hardening	634
40 - 75 mm	Female	New Shell, Soft	355
40 - 75 mm	Female	Plastic Soft	90
40 - 75 mm	Female	Moulting	1
40 - 75 mm	Female	Old Shell	4
> 75 mm	Male	Undetermined	1
> 75 mm	Male	New Shell, Hard	240
> 75 mm	Male	New Shell, Hardening	68
> 75 mm	Male	New Shell, Soft	84
> 75 mm	Male	Plastic Soft	50
> 75 mm	Male	Moulting	1
> 75 mm	Male	Old Shell	190
> 75 mm	Male	Real Old Shell	5
> 75 mm	Male	Not sure	33
> 75 mm	Female	New Shell, Hard	51
> 75 mm	Female	New Shell, Hardening	23
> 75 mm	Female	New Shell, Soft	55
> 75 mm	Female	Plastic Soft	47
> 75 mm	Female	Moulting	1
> 75 mm	Female	Old Shell	4
> 75 mm	Ovigerous	Undetermined	1
> 75 mm	Ovigerous	New Shell, Hard	30
> 75 mm	Ovigerous	Old Shell	90
> 75 mm	Ovigerous	Real Old Shell	1
> 75 mm	Ovigerous	Not sure	16
> 75 mm	Spent	Undetermined	1
> 75 mm	Spent	Old Shell	1

Table 10. Length-weight parameters for Tanner crab. Carapace widths are in millimeters and weight is in grams.

The relationship is:

$$w_i = \alpha l_i^{\beta} \quad ,$$

where w_i = the weight of crab i, l_i = the carapace width of crab i and α and β are regression parameters corresponding to the intercept and slope of the linearized model.

Sex	Intercept (α)	Exponent (β)
Males	-8.100721	3.100721
Female	-7.18909	2.718035
Ovigerous	-6.06632	2.53917

Table 11. CTD casts performed during the 1999 Tanner crab survey off the west coast of Vancouver Island

Cast Number	Latitude		Longitude		Bottom Depth (m)	Max. Cast Depth (m)
1	49	3.545	127	8.582	1375	1000
2	49	5.949	127	2.996	1000	900
3	49	6.914	127	0.993	681	640
4	49	7.495	126	59.419	510	470
5	49	8.233	126	57.636	380	335

Table 12. Bongo Tows completed during the 1999 Tanner crab trawl survey off the west coast of Vancouver Island Cruise 9918

Set		Date	Time	Latitude	Longitude	Depth	Target Depth	Flowmeter	Wire out	Angle	Serial number
1											
	Start	23-Jul-99	18:32	49 06.850	127 06.100	1400	1000	475354	1400	45	12963
	Finish		20:06	49 06.215	127 01.404	1400		712810			
2											
	Start	30-Jul-99	19:51	49 04.399	127 11.536	1707	1400	712811	1700	45-60	12963
	Finish		21:27	49 05.611	127 15.269	1530		919358			
3											
	Start	31-Jul-99	6:59	49 05.917	127 00.539	705	600	919364	900	45	12963
	Finish		7:54	49 07.211	127 01.320	708		33201			
4											
	Start	1-Aug-99	6:20	49 05.610	126 56.300	415	375	33200	500	42-48	12963
	Finish		7:00	49 06.578	126 56.578	392		93848			
5											
	Start	1-Aug-99	717	49 06.233	126 58.404	503	410	93848	650	44	12963
	Finish		755	49 05.228	126 57.417	500		187950			
6											
	Start	1-Aug-99	1615	49 04.575	127 01.880	-	900	187938	1150	33	12963
	Finish		1712	49 03.535	127 01.278	-		312902			

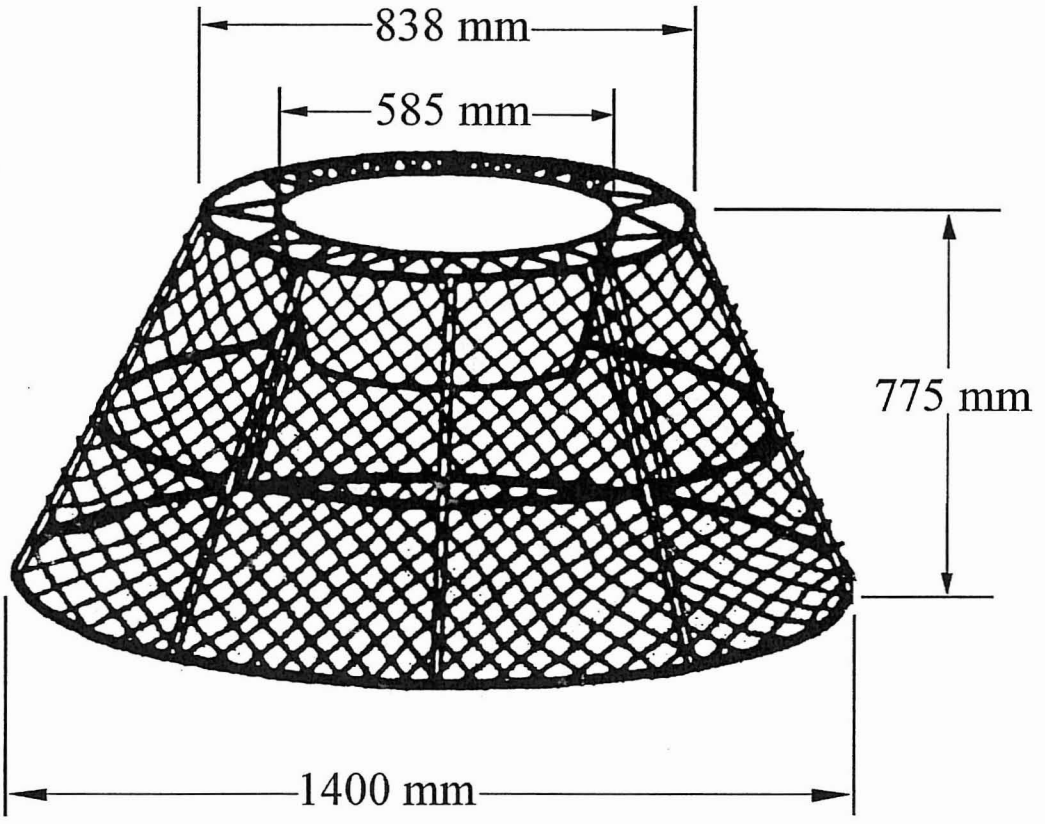


Figure 1. Tanner crab traps employed during the 1999 Tanner crab survey off the west coast of Vancouver Island.

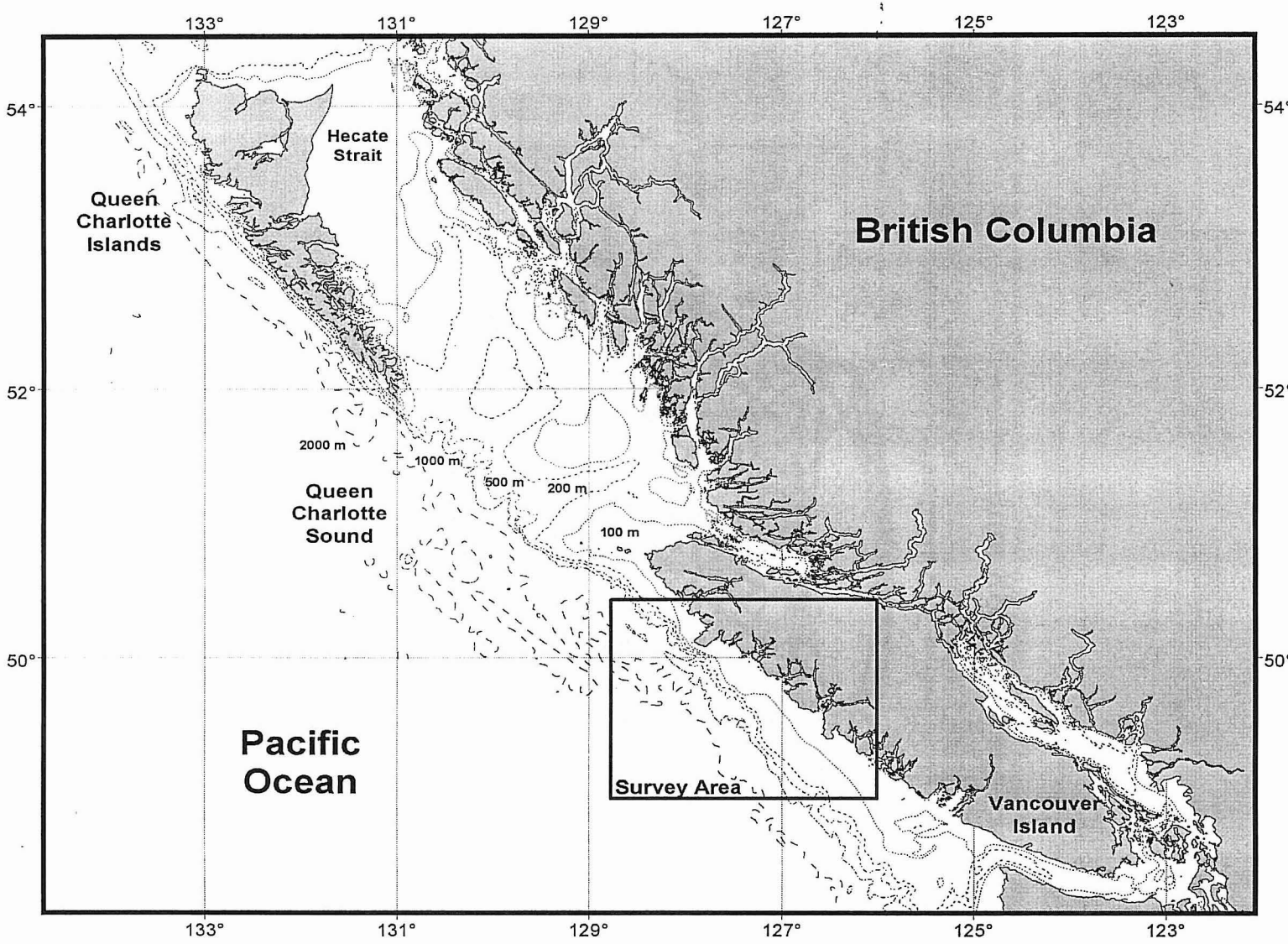


Figure 2. The West Coast of Canada indicating the survey area for the 1999 Tanner crab trawl survey. The depth contours shown are the 100, 200, 500, 1000 and 2000 m isobaths.

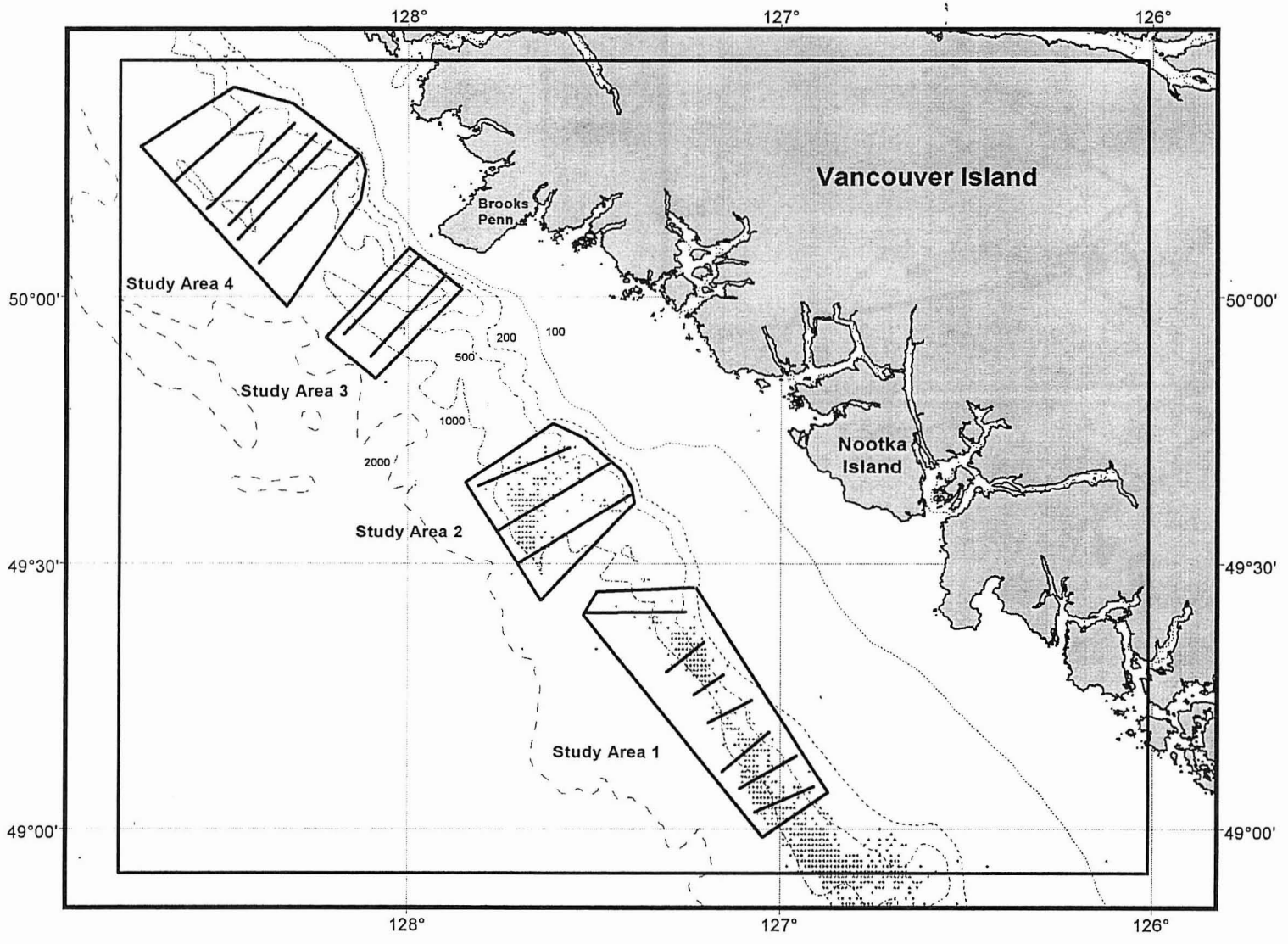


Figure 3. Survey area indicating the four selected study areas and the survey transects in each. Depth contours mark the 100, 200, 500, 1000 and 2000 m isobaths. The grey dots on the map represent locations where Tanner crab was caught incidentally during a commercial groundfish trawl set.

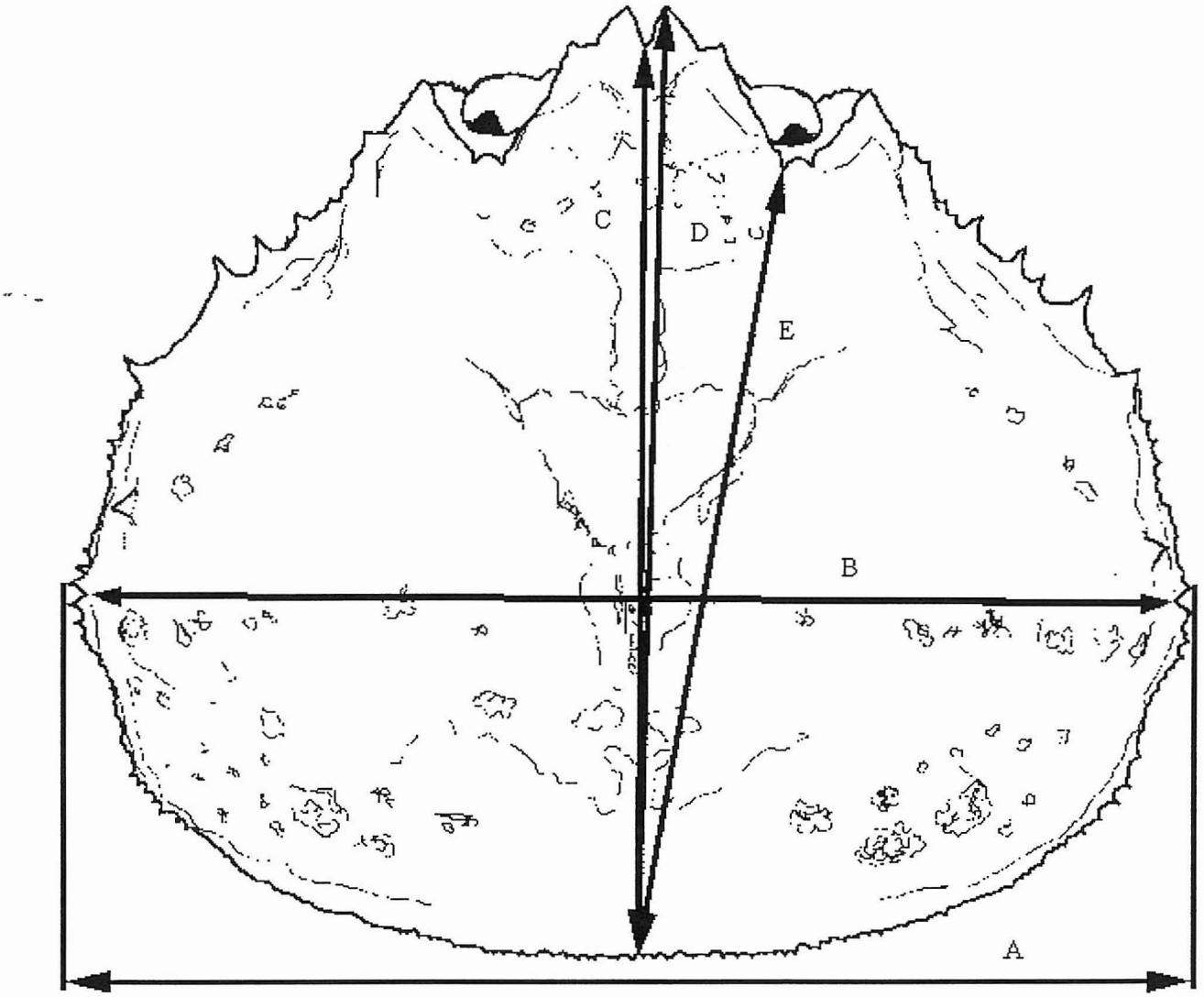


Figure 4. Tanner crab carapace measurement: **A,** carapace width including the spines, **B,** carapace width between the spines, **C,** carapace length– notch, **D,** carapace length - rostral horn, **E,** carapace length - eye orbit. Measurements **A** through **D** were collected (adapted from Jadamec et al. 1999).

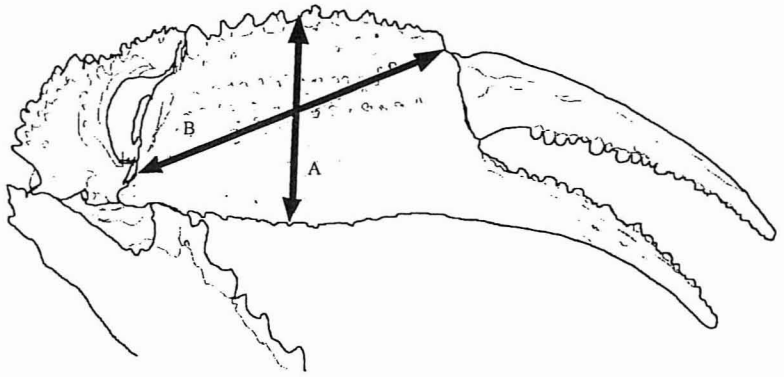


Figure 5. Lateral view of the right chela of a male Tanner crab showing the following measurements chela measurements **A,** Chela height, the greatest height measured, **B,** chela length, measured diagonally from the notch at the base of the thumb to base of the large spine on the ventral surface of the chela at the knuckle between the chela and the cheliped (adapted from Jadamec et al. 1999).

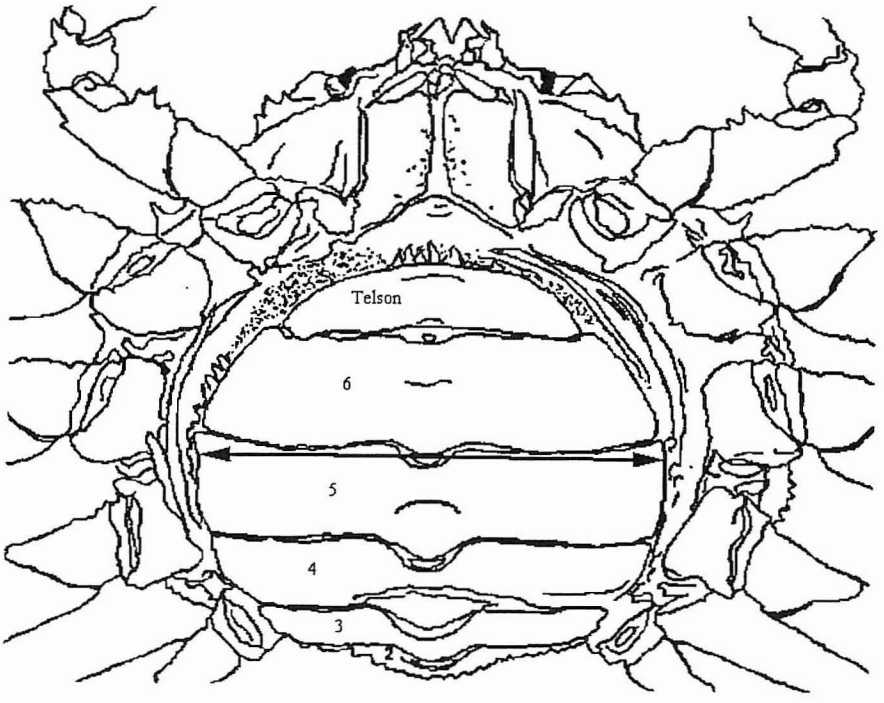


Figure 6. Ventral view of a female Tanner crab with the abdominal somites and telson identified showing the width measurement taken on the 5th abdominal somite (adapted from Jadamec et al. 1999).

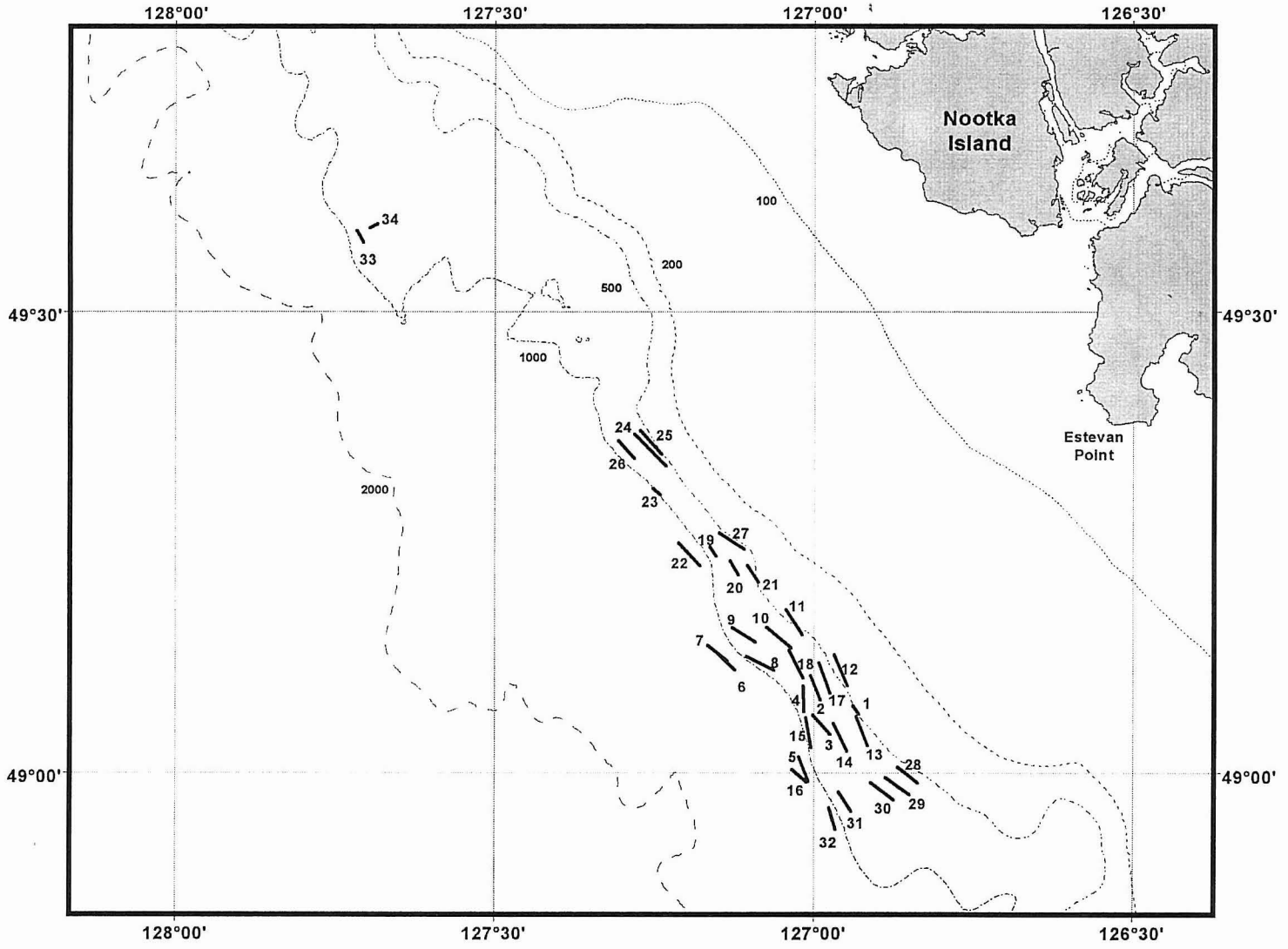


Figure 7. Trawls completed during the 1999 Tanner crab trawl survey. Depth contours mark the 100, 200, 500, 1000 and 2000 m isobaths. The lines connect the start and end positions of each tow and represent the net's path over the bottom.

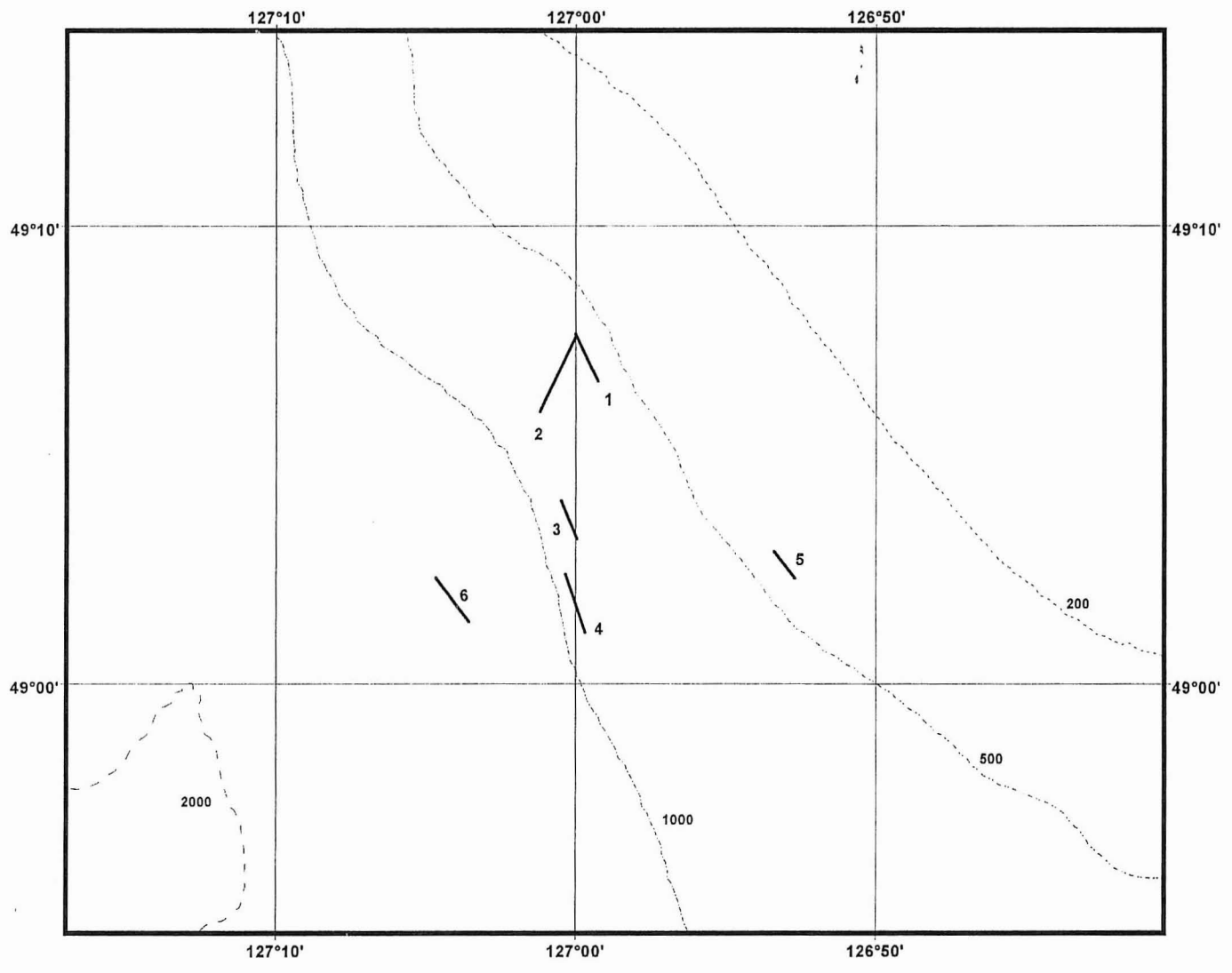


Figure 8. Trap Sets completed during the 1999 Tanner crab survey off the west coast of Vancouver Island. Depth Contours are the 200, 500, 1000 and 2000 m isobaths.

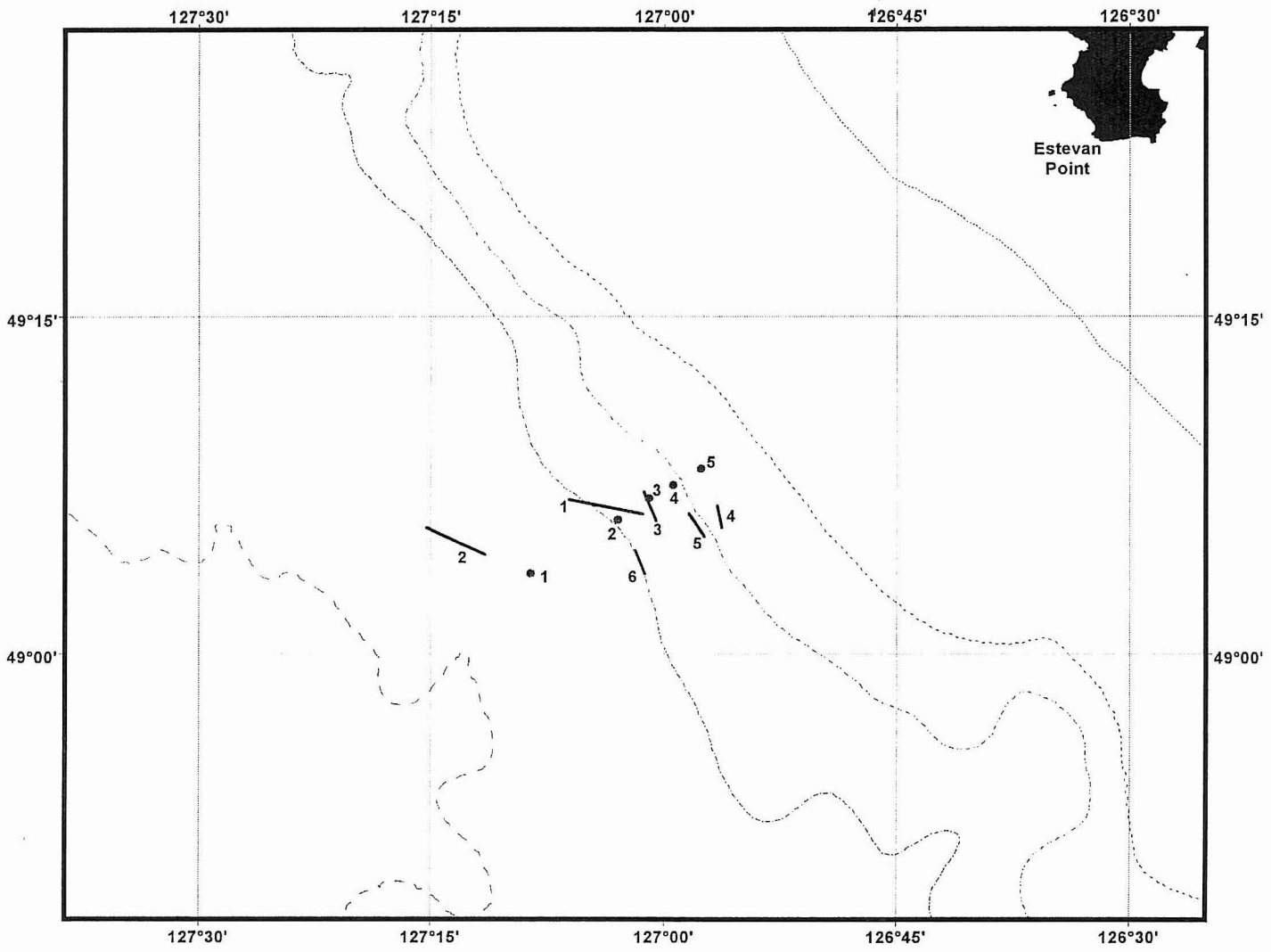


Figure 9. Oceranographic sampling conducted during the 1999 Tanner crab survey. Dots indicte the location of CTD casts, the lines represent Bongo tows, each is labeled and corresponds to the data in Tables 11 and 12. Depth contours are as labeled in Figs. 7 and 8.

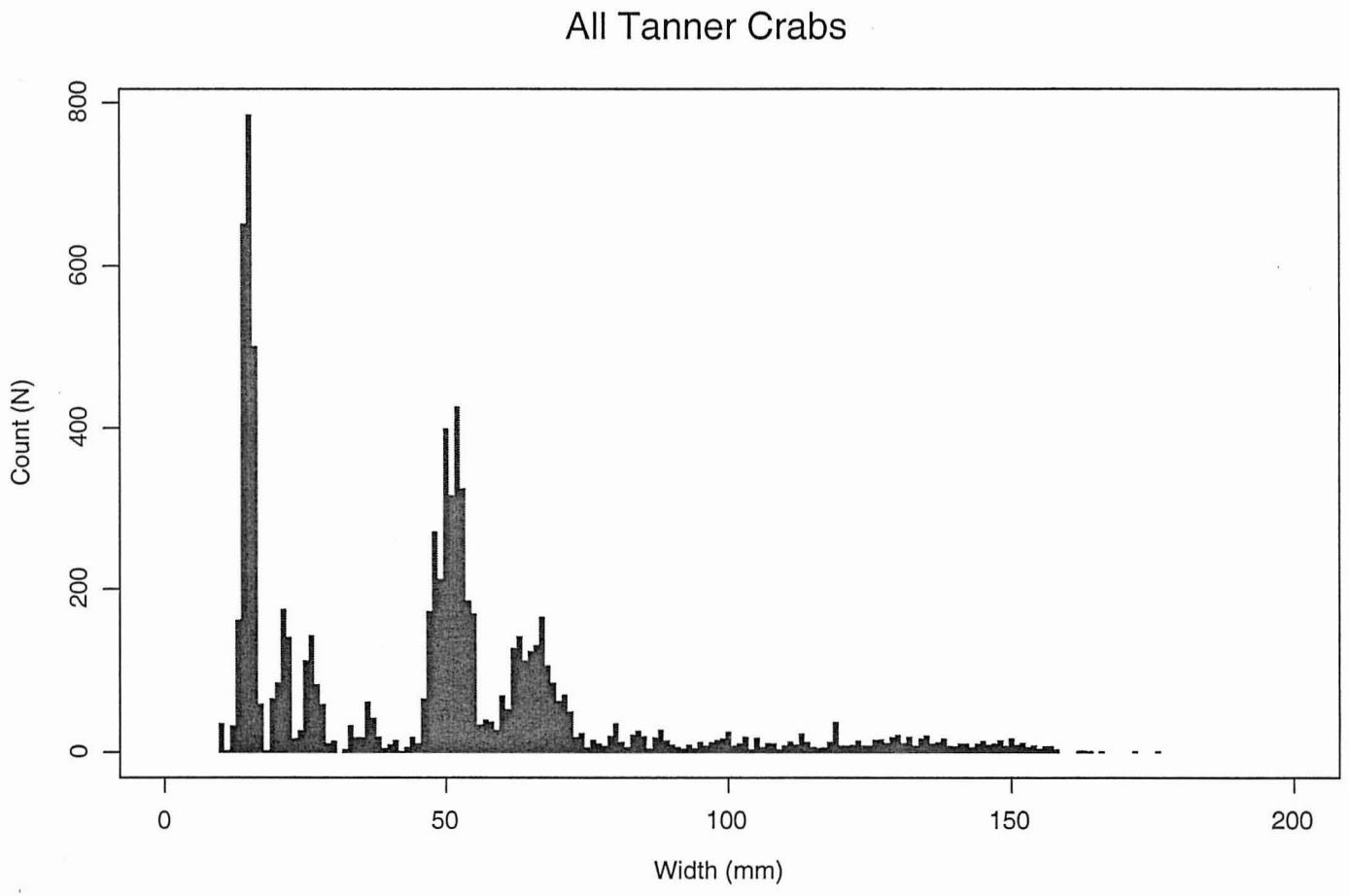


Figure 10. Width frequency histogram for all tanner crab captured during the 1999 Tanner crab trawl survey. All strata, sexes and sizes. Data has been corrected to total catch for all size classes.

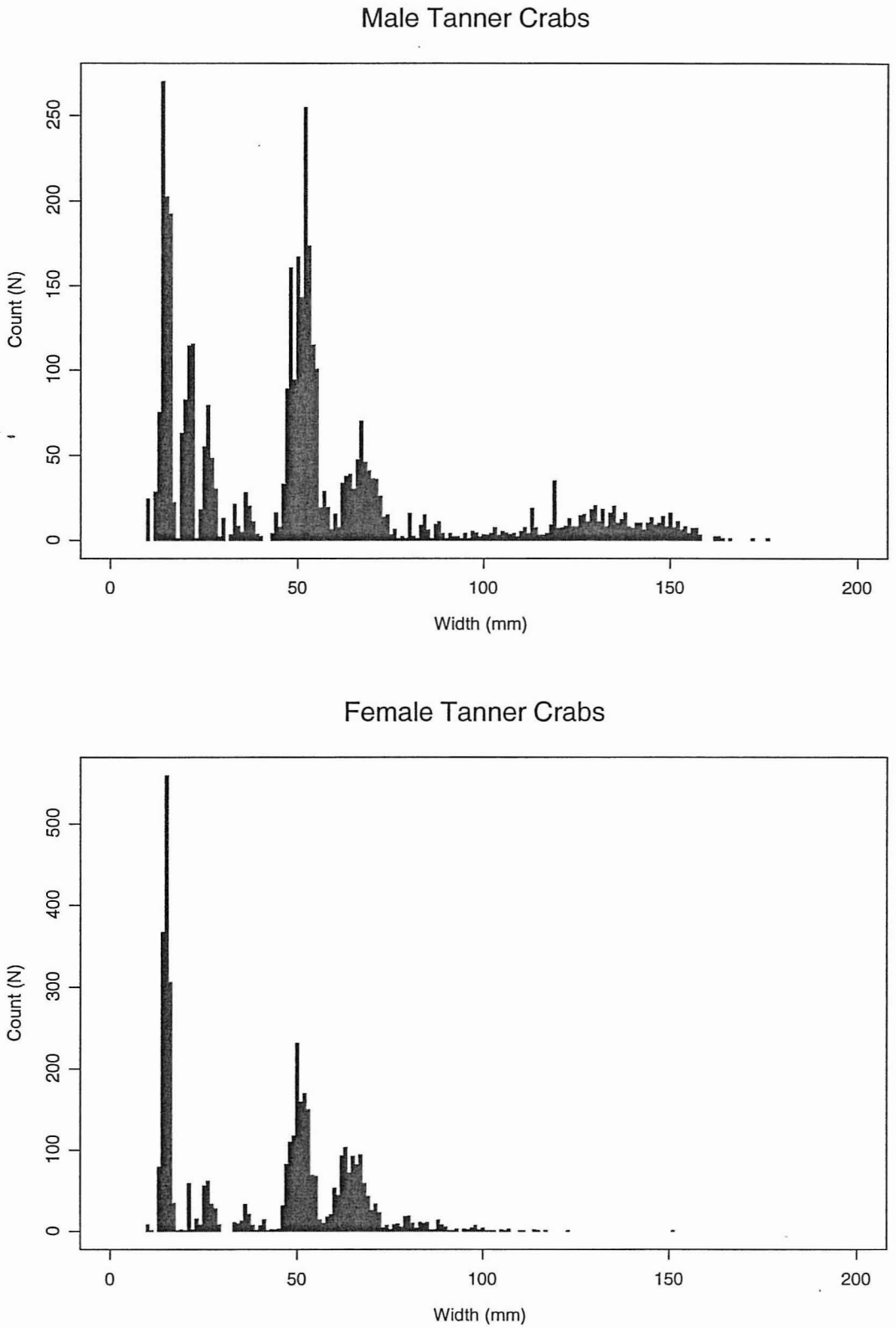


Figure 11. Width frequency histograms by sex for Tanner crab caught during the 1999 Tanner crab survey off the west coast of Vancouver Island

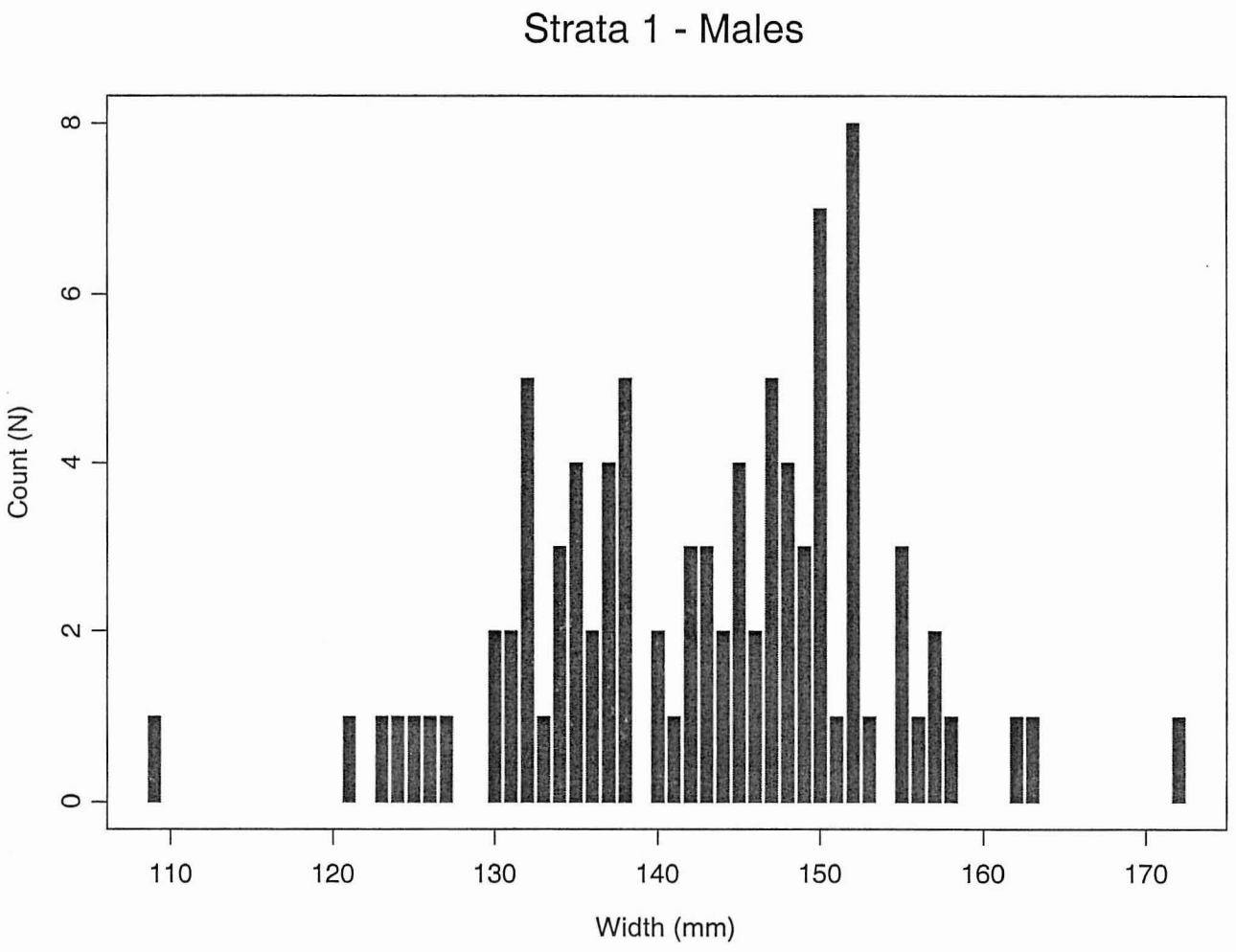


Figure 12. Width frequency histogram for Tanner crabs caught in depth strata 1, 400 – 560 m, during the 1999 Tanner crab trawl survey. Only male crabs were caught in this stratum.

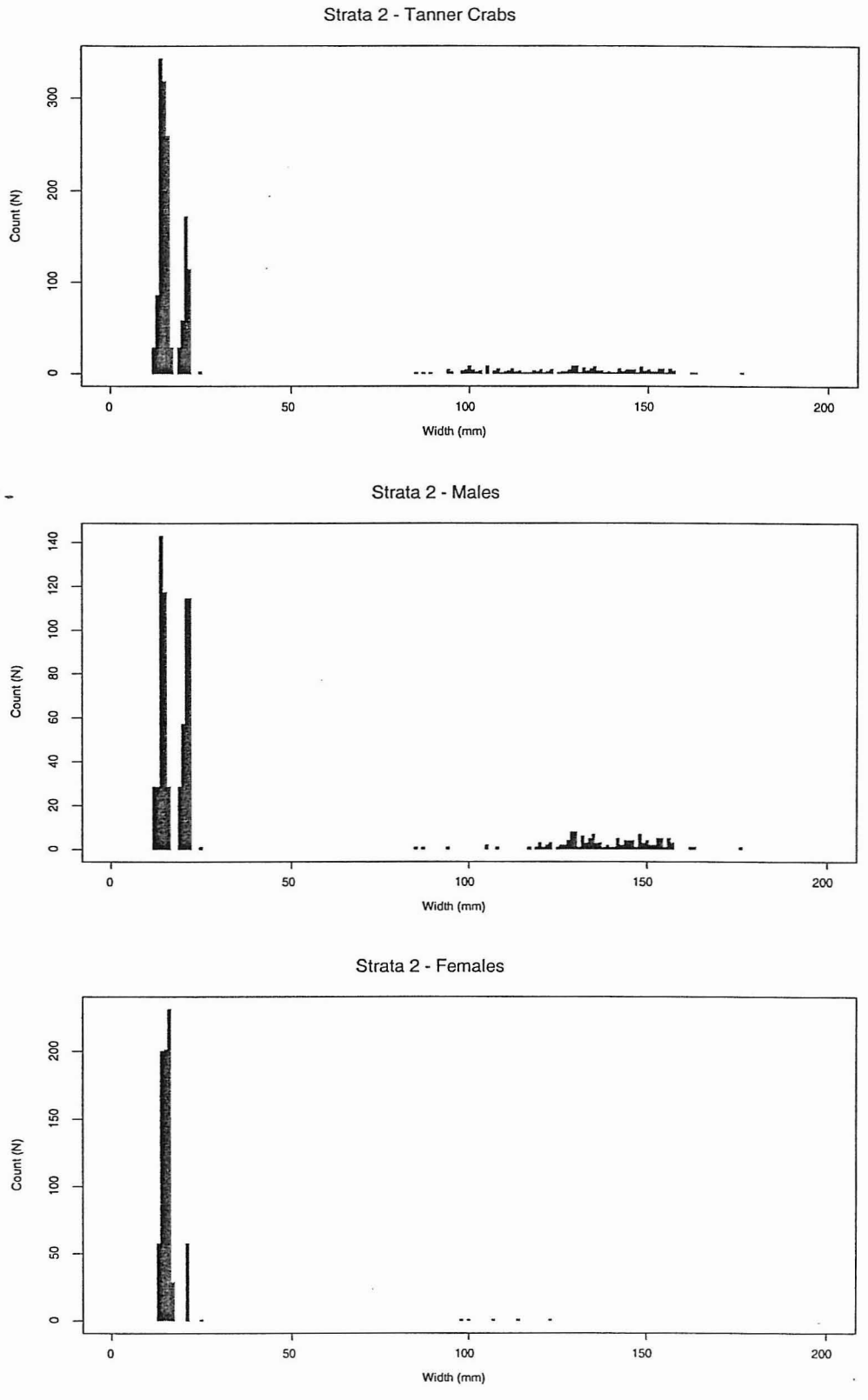


Figure 13. Width frequency histograms by sex for Tanner crab caught in survey stratum 2, 560 – 720 m, during the 1999 Tanner crab trawl survey.

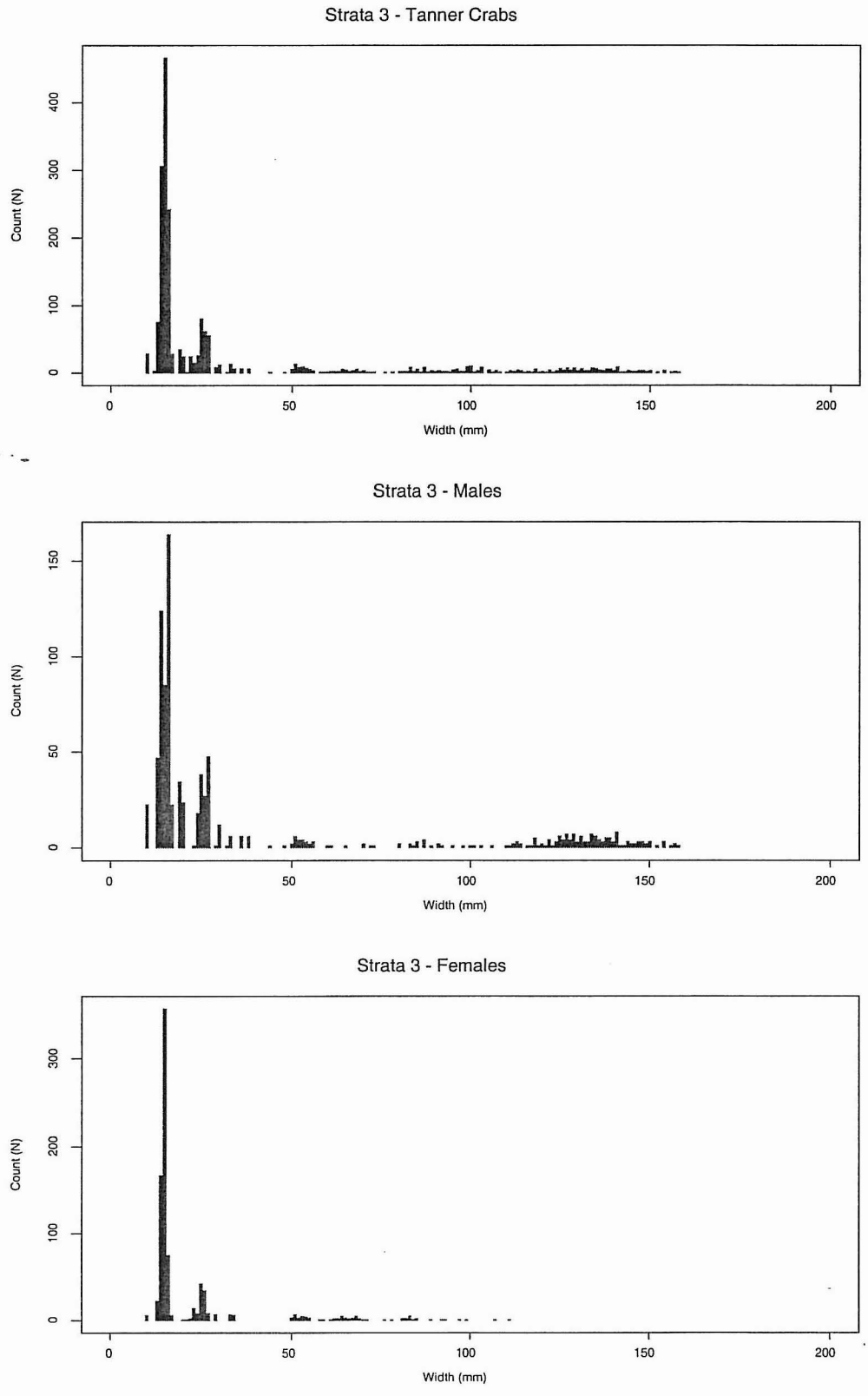


Figure 14. Width frequency histograms by sex for Tanner crab caught in survey stratum 3, 720 – 880 m, during the 1999 Tanner crab trawl survey.

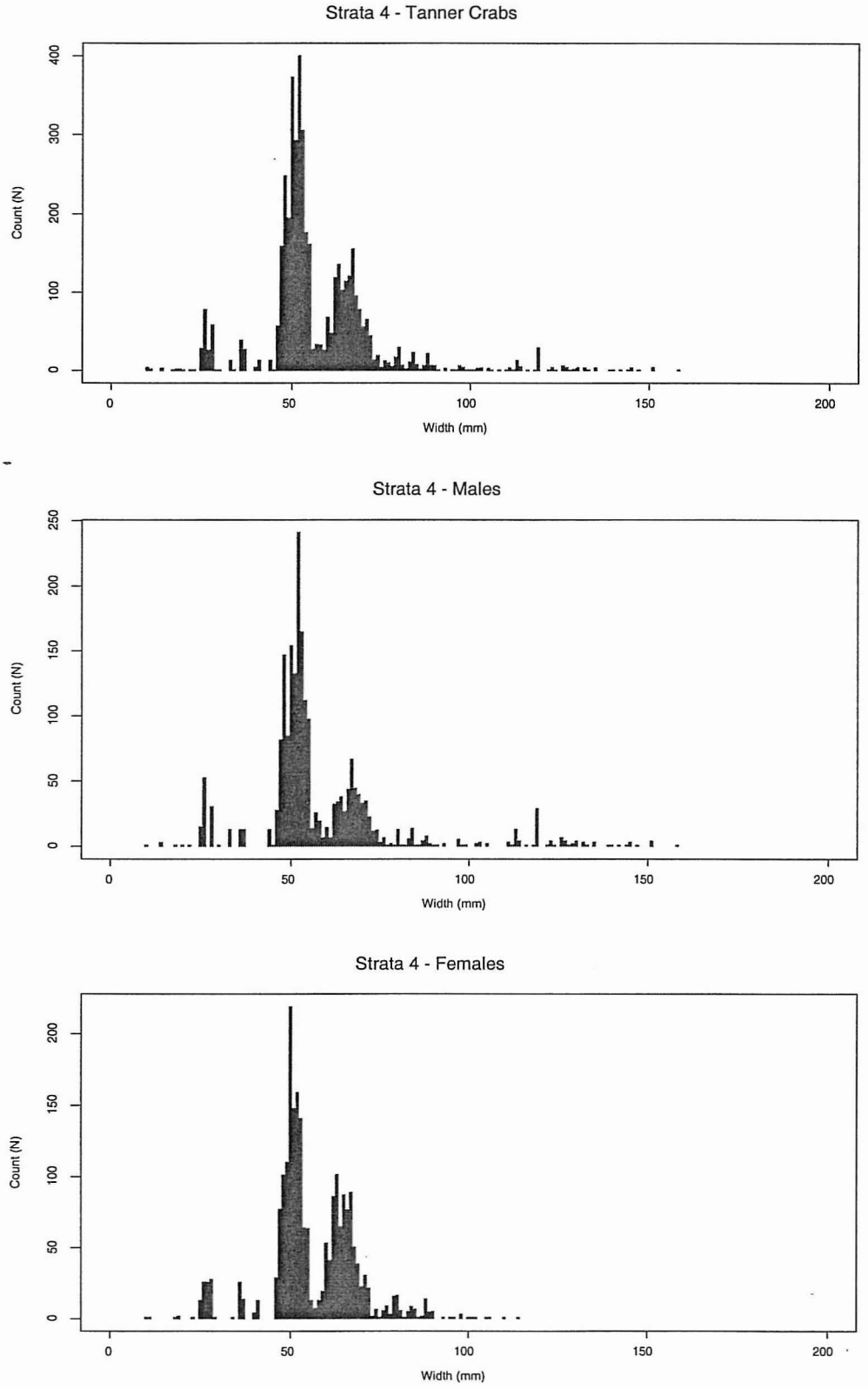


Figure 15. Width frequency histograms by sex for Tanner crab caught in survey stratum 4, 880-1040 m, during the 1999 Tanner crab trawl survey.

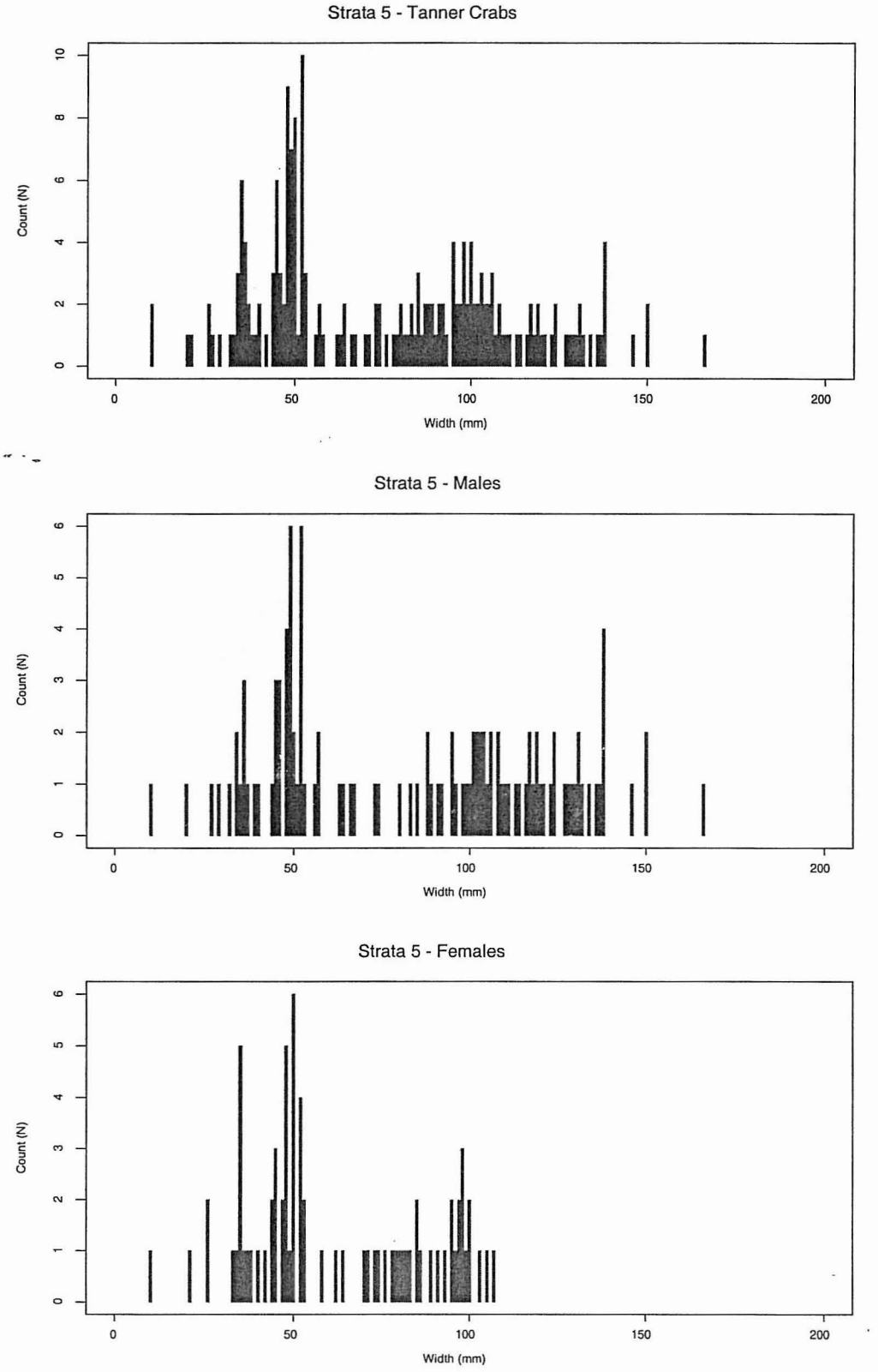


Figure 16. Width frequency histograms by sex for Tanner crab caught in survey stratum 5, 1040 – 1200 m, durng the 1999 Tanner crab trawl survey.

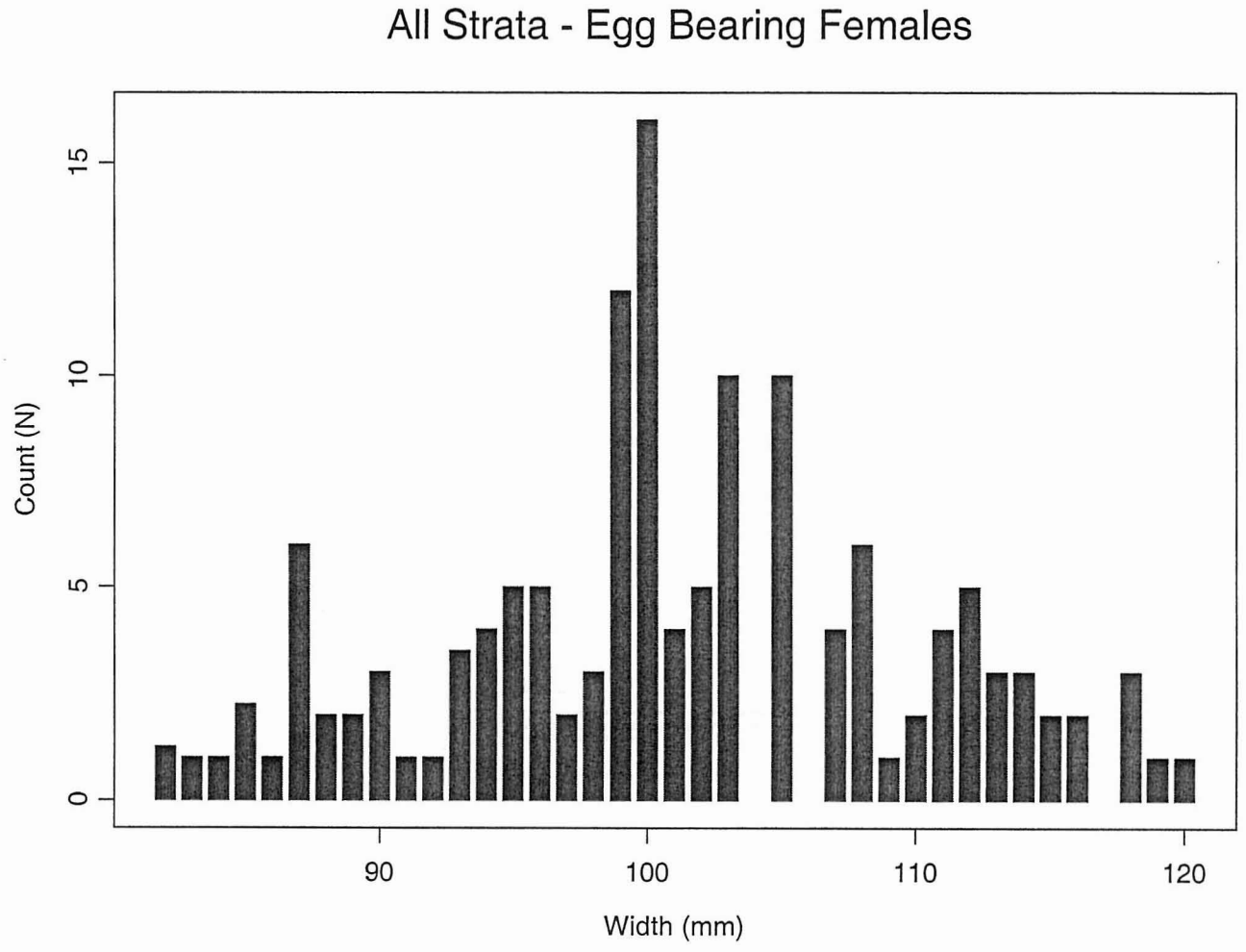
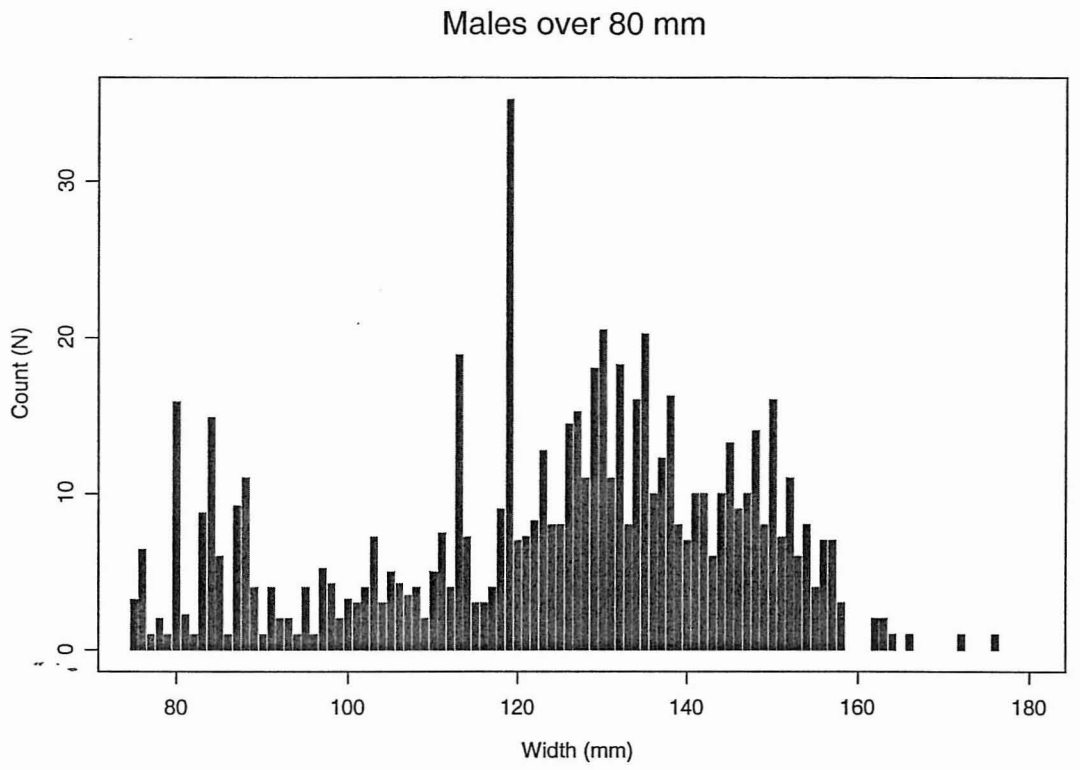


Figure 17. Width frequency histogram for ovigerous Tanner crab caught during the 1999 Tanner crab trawl survey.



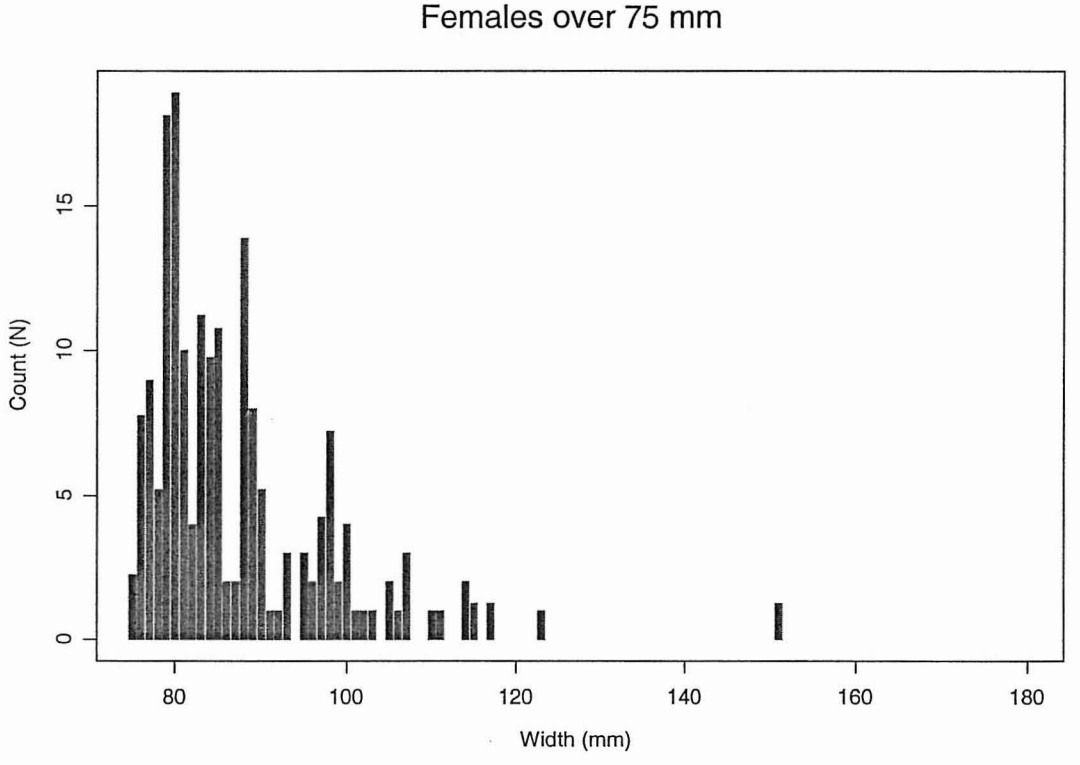


Figure 18. Width frequency histogram by sex for larger crabs caught during the 1999 Tanner crab trawl survey.

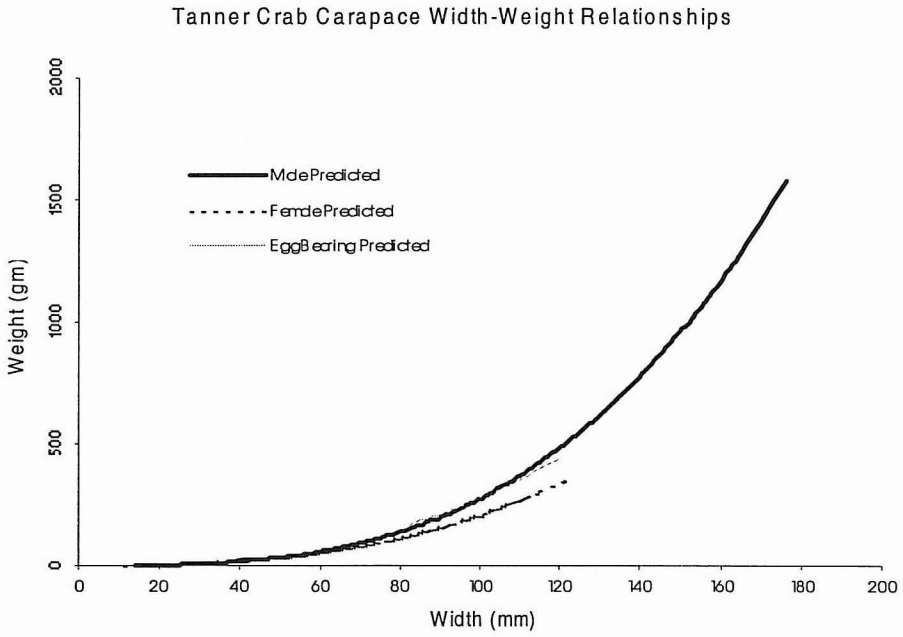


Figure 19. Carapace width-weight relationships for male, female, and ovigerous female Tanner crab. The plotted lines are the results of a least squares fit of the simple exponential growth model described in Table 10.

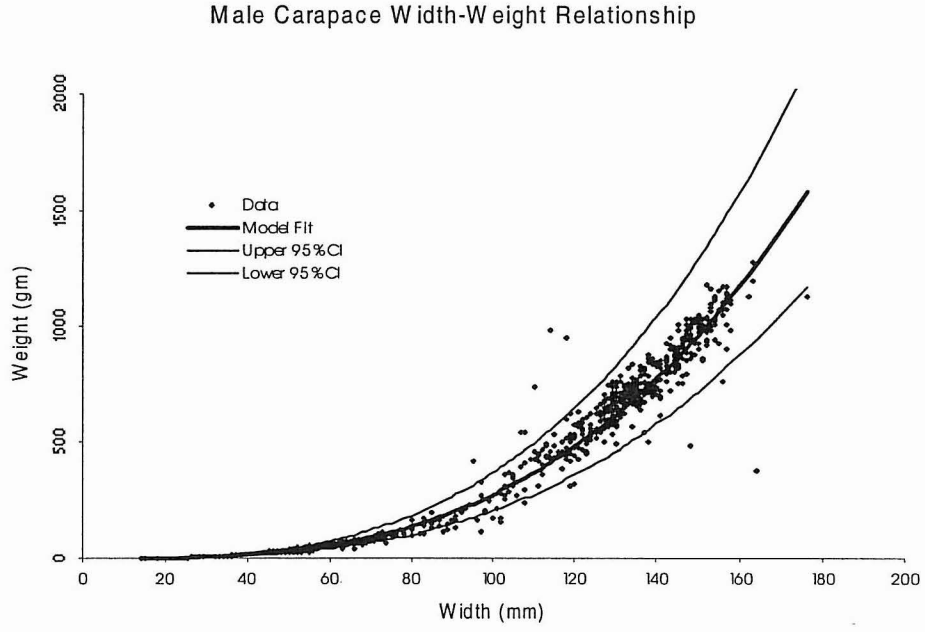


Figure 20. Carapace width-weight relationship for male Tanner crab. Data points are plotted as small diamond symbols. The heavy black line represents the results of the fitted model and the lighter lines represent the upper and lower bound of a 95 % confidence interval.

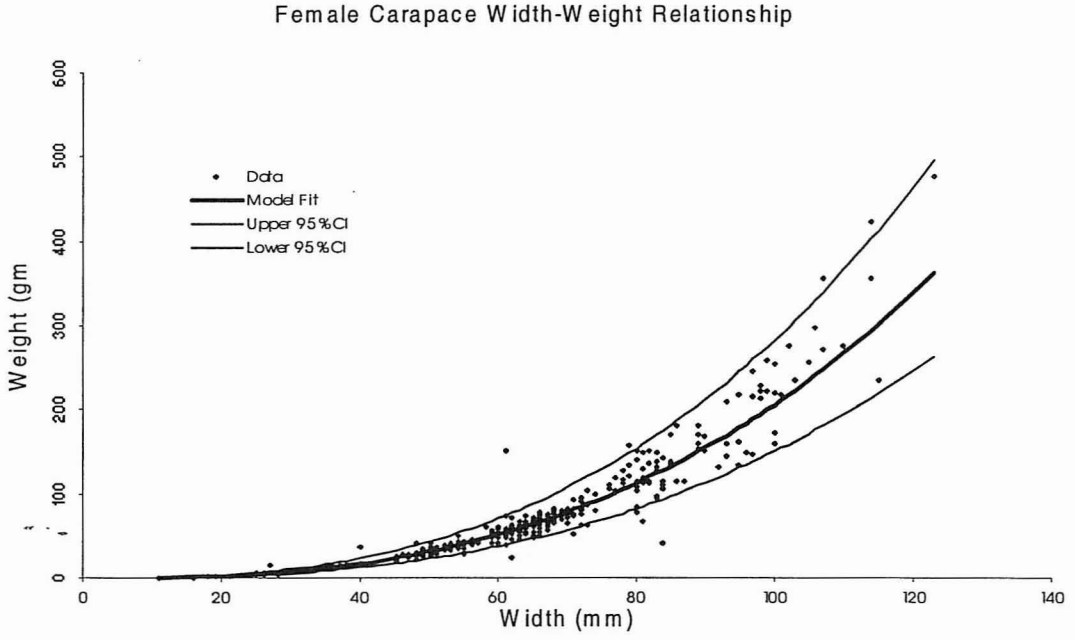


Figure 21. Carapace width-weight relationship for non-ovigerous female Tanner crab. Data points are plotted as small diamond symbols. The heavy black line represents the results of the fitted model and the lighter lines represent the upper and lower bound of a 95 % confidence interval

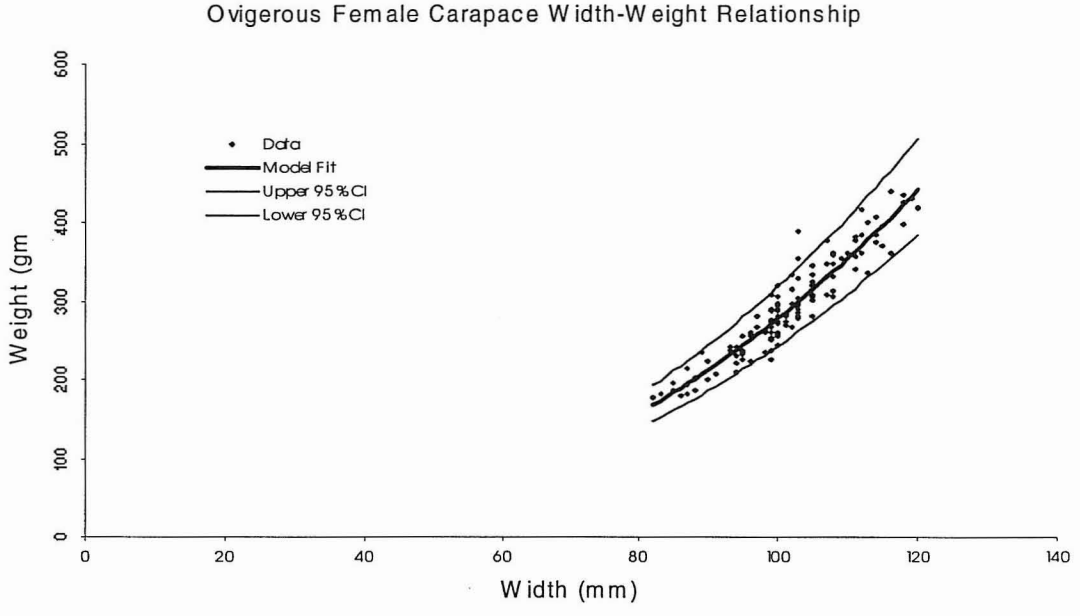


Figure 22. Carapace width-weight relationship for ovigerous female Tanner crab. Data points are plotted as small diamond symbols. The heavy black line represents the results of the fitted model and the lighter lines represent the upper and lower bound of a 95 % confidence interval.

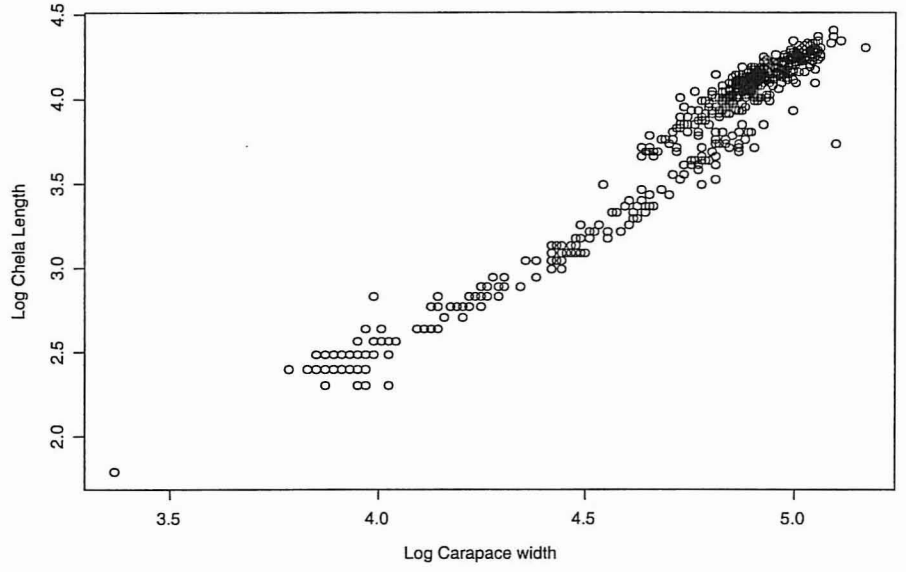


Figure 23. Plot of log chelae length on log carapace width. Clearly distinct is the separation of morphometrically mature from morphometrically immature individuals. Mophometrically mature males being represented the cloud of data points in the upper right hand corner of the plot.

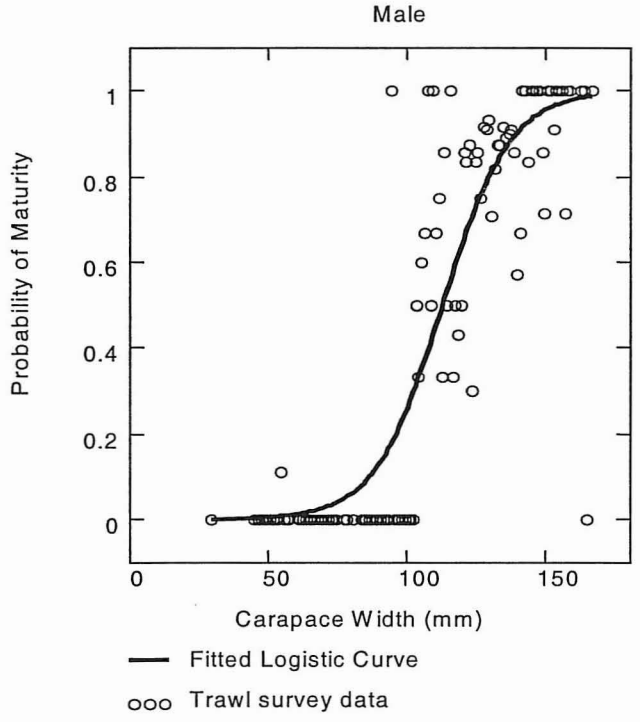


Figure 24. Male maturity ogive, plotting the proportion of male crabs in each 1 mm size increment that were mature and a logistic curve fitted to the data. From the logistic model the size at 50 % maturity is 112 mm.

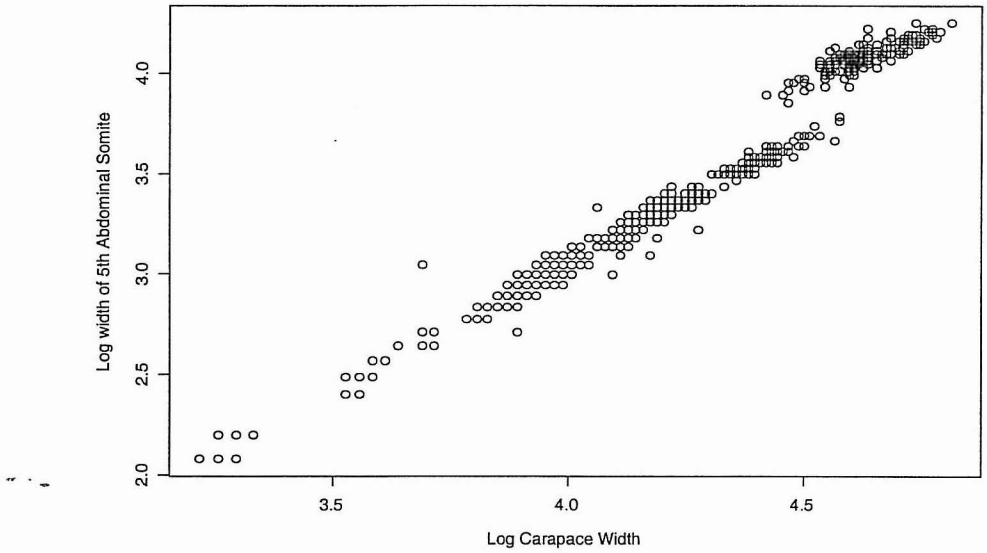


Figure 25. Plot of log of 5th obdominal somite width on log carapace width. As with males there is a clear distinction between morphometrically mature and immature idividuals. With mature females forming the cloud of data points in the upper right hand corner of the plot.

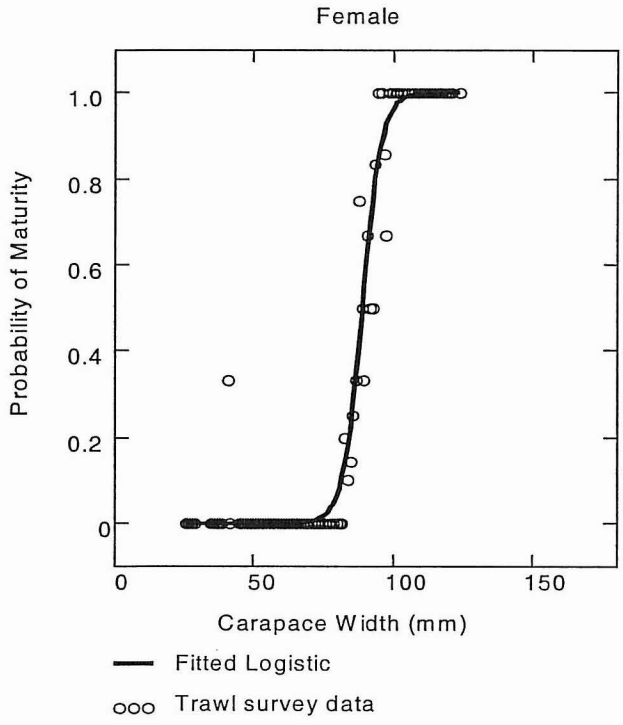
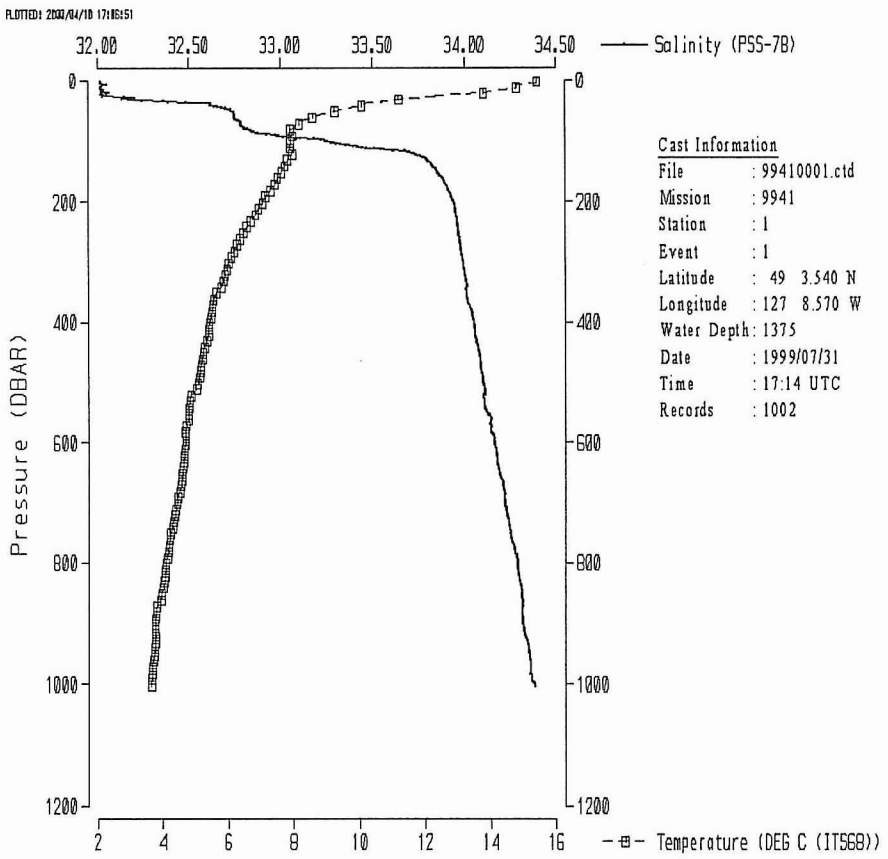


Figure 26. Female maturity ogive, plotting the proportion of female crabs in each 1 mm size increment that were mature and a logistic curve fitted to the data. From the logistic model the size at 50 % maturity is 88 mm.



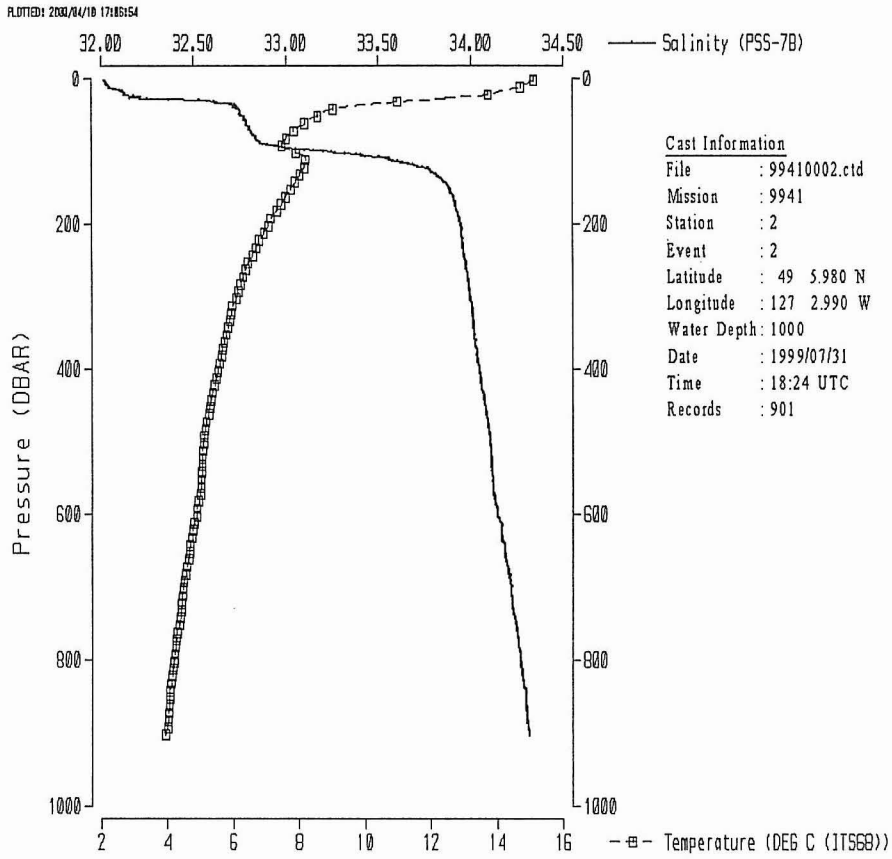
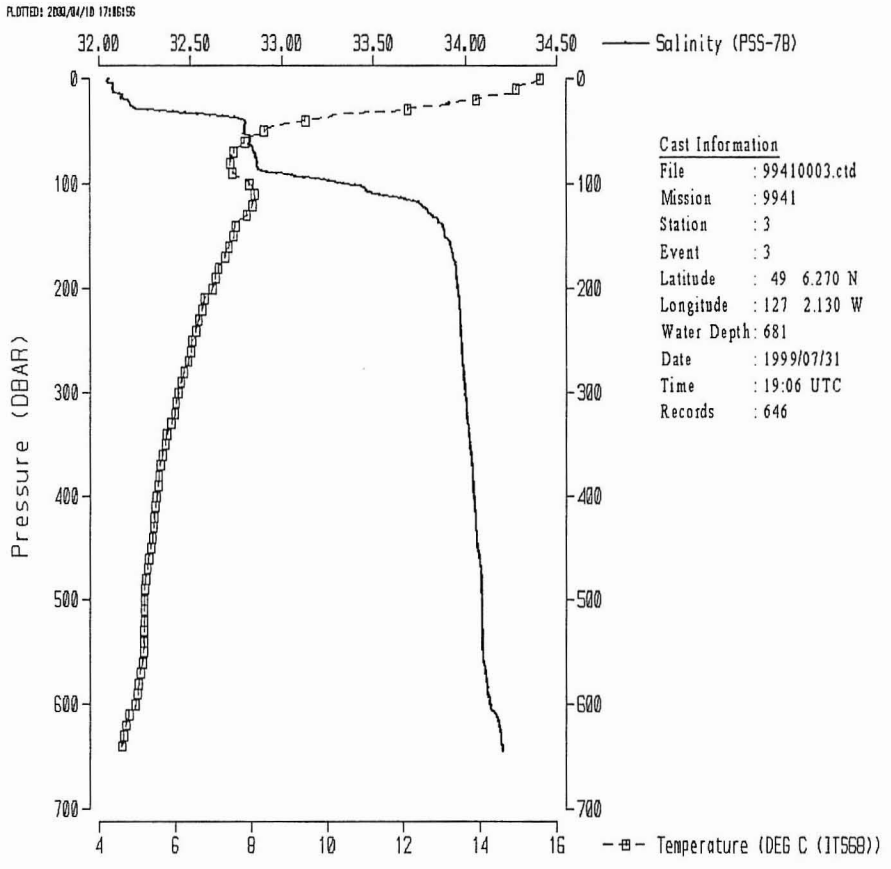


Figure 27. Cast Profiles for CTD casts performed during the 1999 Tanner crab Trawl Survey off the west coast of Vancouver Island. Casts proceed from deep to shallow.



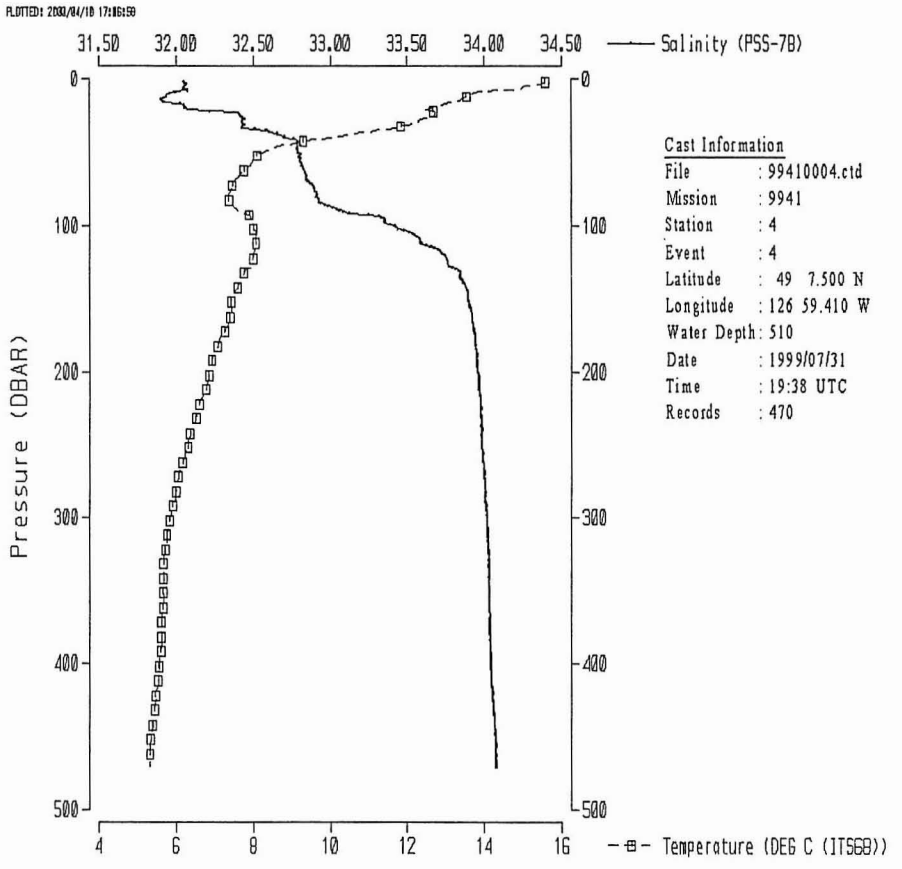


Figure 27 (cont'd)

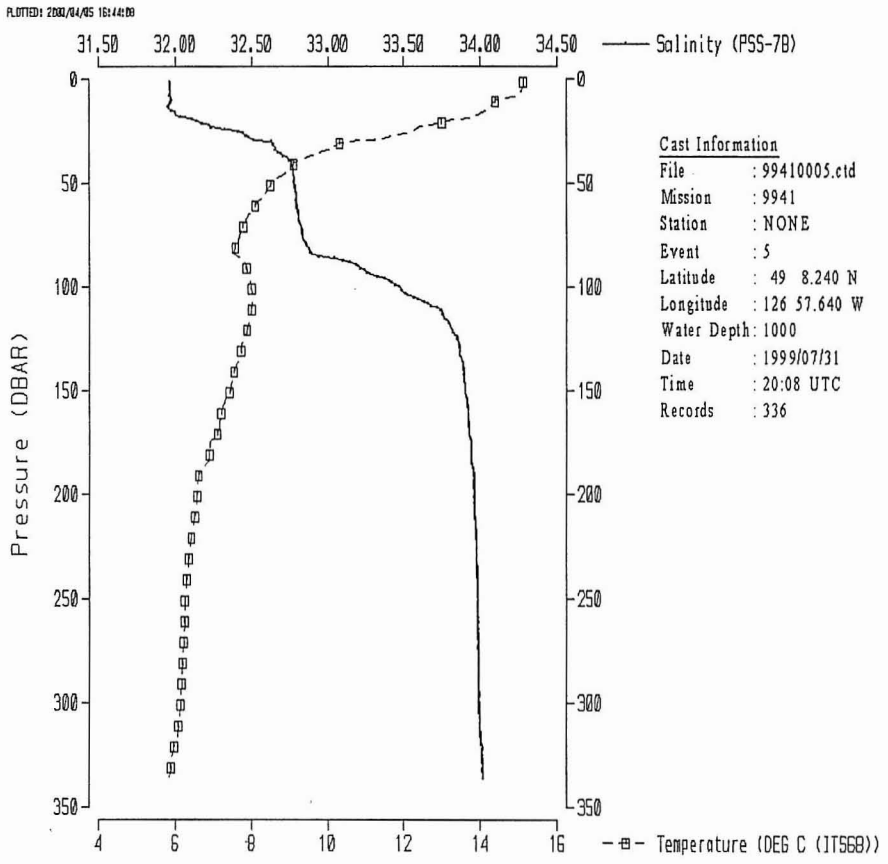


Figure 27 (cont'd)

APPENDICES

Appendix 1. Sex Codes

Blank = did not check

0 = Don't know

1 = male

3 = female

4 = female with a complete batch of eggs *i.e.* are not in the process of hatching. Egg clutch fullness is a separate observation. Also record egg colour.

5 = female which has just released her eggs or is in the process of releasing her eggs - (an incomplete, dark brown egg mass - some eggs must still adhere to pleopods to qualify).

6 = hermaphrodite. Not observed in deepwater Tanners *as yet*.

Egg Color codes

1 = yellow, newly extruded egg mass

2 = orange, dark orange coloration, this clutch is maturing.

3 = red, this color is attained at about the same time the eye spots start forming so look for very small black dots that indicate eye formation in the developing embryo.

4 = brown, the egg mass is brown because the eyes on the embryos are very large and when combined with the red egg coor the egg clutch appears brown.

5 = black, this clutch should be in the process of hatching, eyes are fully formed and the embryo within the egg is recognizable as a zoea or larval crab

6 = decomposing, this egg clutch was not fertilized, or is diseased and will not be hatching! This is unlikely to occur in Chionoecetes crabs due to their internal fertilization.

Appendix 2. Shell condition codes.

1 = new hard shell – crab has moulted within the last year and carapace is fully hardened. Little sign of wear on tips of walking legs or claw teeth. Claws may begin to show ivory coloration at tips, however there is little fouling or abrasion observed.

2 = new shell hardening – walking legs can be bent with moderate pressure. Claw may be deformed with pressure from the thumbnail. No wear on tips of walking legs or claw teeth. Little fouling or abrasion observed.

3 = new shell soft – shell plastic and easily deformed - walking legs are easily bent, claws easily deformed. No sign of abrasion or wear. No fouling. Grasping marks on females are usually not observed

4 = plastic soft - newly moulted. Shell feels like soft leather. These crabs are too soft to crawl out of water, likely in very poor shape after capture by trawl. Very easily damaged.

5 = moulting - old shell which is splitting and is actually in process of moult. Suture (joint line between upper and lower halves of the shell) must be opening at time of observation. Fairly rare - this phase lasts less than 3 days.

6 = old shell - always show claw wear and usually epiphytes, for example: barnacle encrustation, tube worms, bryozoans, leech cocoons or other fouling growth. Lesions on shell and walking legs may show blackening; tips of walking legs worn; tips of claws broken or ivory coloured, teeth on claw blunted, spines on shell worn or broken. Female crabs frequently show grasping marks on legs. Crab is otherwise vigorous. Used to designate crabs which have not moulted for 1 year or more but which appear lively and likely to carry on for a bit. Typically the shell will be hard, although prior to a moult the shell will soften so the hardness cannot be taken as a reliable indicator.

7 = really old, barnacle encrusted shell, extreme shell and claw wear; claw tips frequently broken, females typically show missing appendages and old mating marks which have worn through legs; may have shell disease; tips of walking legs may be black or rotting off. These crabs always appear lethargic and moribund. The crab probably has not moulted for 4 or more years. Unlikely to live long - crab is in terminal moult and shows other signs of senescence

8 = not sure - can't determine weather it is an old shell or a new shell. Shell shows signs of wear, especially on cusps and tips of claws, but the crab is still relatively clean and vigorous. Takes the guesswork out of old/new shell dilemma

9 = moulted shell - the new (larger) crab may or may not be present. If the moult and the new crab can be linked, then it is a moulted pair - before and after. We need this info. Record the data as if they were 2 separate crabs one after the other. In the observation column enter 1 (moulting pair) for both crabs. The moulted shell will be **shell 9**; the new crab will be **shell 4**.

Appendix 3. Injury codes

(Do not record injuries that occure during capture or sampling.)

1 = deformed carapace - occurs at time of moult – often misshapen, dented or rounded shell which hardens in this configuration – cannot obtain an accurate width measurement however do the best you can.

2 = hole or crack in carapace (healed).

3 = torn or missing telson (especially important for females as a missing telson may prohibit successful retention of the egg mass) Usually indicates rough handling of discarded females during egg incubation stage. The condition is rare in males.

4 = regenerating claw or claws - smaller limb is present which will require another moult or more to completely regenerate to full size.

5 = regenerating leg(s)

6 = regenerating claw(s) and leg(s)

7 = multiple injuries - more than 1 injury code

8 = shell disease – See observation codes below to record disease details. Diseases may include:

1. Torch – Chitinolastic bacterial infection, black spots on legs, claws and underside of shell and at the site of any shell injury.
2. Black mat fungus – Carapace is covered in black tarry fungal uncrustation
3. Bitter lymph disease – Crab looks washed out and greenish particularly on the ventral surface

9 = dead - Record cause of death in comments if obvious. Measure the crab anyway - even if sex is not apparent (due to missing body parts). Determine if the shell is a actually from a dead crab and not a moult.

Appendix 4. Other codes.

Missing Limbs: Only record missing limbs that show a healed scar

Claws – record 1 or 2 missing – which side doesn't matter

Legs - 1 – 8 missing – which leg on which side is not important at this time.

Observation Codes

Used to record something about an individual crab not recorded elsewhere.

1 = Moulting pair. - before and after shell size. Record them one after the other for the pair - order is not important. Obviously the larger one will be the live, soft crab (shell 4). Record the moulted shell as **shell condition 9**.

2 = Mating pair - record as above only if male crab is actually grasping the female by the legs. It is unlikely this will be observed by the time the trawl reaches the surface – but just in case!

3 = Limb-bud forming - a fleshy miniature limb extruded from a lost limb sometime before a moult takes place. The bud indicates the crab is planning to moult as opposed to skip moulting. If 1 lost limb shows a bud, all other lost limbs will also show a bud unless limb loss was very recent. Record the limb as regenerating (4, 5 or 6 in the **Injury** column) as well as **3** in the **Observation** column.

4 = Marks on female - caused by the male crab grasping the female near the base of her walking legs and carrying her around prior to mating. The marks are noticeable as scratches or abraded areas on the female's legs. Mating marks do not necessarily indicate breeding and lack thereof does not necessarily imply that the crab is unbred. Typically a crab with mating marks will have an old shell or a very hard new one. Soft crabs seldom show mating marks due to the pliable condition of the shell.

5 = Tangled in man-made debris – i.e. fishing line, fish netting, rope strands, 6 pack rings etc. Put something in remarks as well.

6 = Torch – This is not uncommon, especially in old crabs. Caused by a chitin-eating bacterium, normally associated with injury to shell or appendages. Code also as **8** in the **Injury** column. "Biological Field Techniques for Chionoecetes Crabs" manual (p53, 56)

7 = Bitter lymph Syndrome – We have not identified it in our samples so far – be aware that it could be present. Bag and tag any crab you think shows this condition. Code also as **8** in the **Injury** column. "Biological Field Techniques for Chionoecetes Crabs" manual (p53 - 54)

9 = Black mat fungus — Bag and tag any specimens you think exhibit this. Code also as **8** in the **Injury** column. "Biological Field Techniques for Chionoecetes Crabs" manual (p 55).

Appendix 5. Fishing locations and catch information For all trawl sets from the 1999 Tanner crab survey off the west coast of Vancouver Island. Time is expressed on a 24-hour clock, depths are in meters, latitudes and longitudes are in degrees, decimal-minutes, direction in degrees, duration in minutes and distance and speed in knots and nautical miles. Catch weights are in kilograms, N is the number of animals if counted and Estimate indictes whether the recorded values are estimated from sub-samples or actual. Trace indicates weights less than approximately 0.1 kg or 100 g.

Set :	1	**Date:**	7/22	**Set :**	2	**Date:**	7/23
Transect :	1	**Strata:**	1	**Transect :**	2	**Strata:**	2
Stat area:	124	**Sub area:**	4	**Stat area:**	125	**Sub area:**	5
	Start		**Finish**		**Start**		**Finish**
Time:	15:49		16:5	**Time:**	6:34		7:16
Depth:	458		462	**Depth:**	661		625
Latitude:	49 4.386		49 3.826	**Latitude:**	49 4.754		49 6.336
Longitude	126 56.33		126 55.805	**Longitude**	126 59.424		127 0.315
Direction:	146	**Duration**	16	**Direction:**	340	**Duration**	42
Distance:	0.7	**Speed:**	2.60	**Distance:**	1.7	**Speed:**	2.33

Species	**Weight(Kg)**	**N**	**Estimate**
Crab			
Chionoecetes tanneri	0.90	1	-
Shrimp			
Pasiphaea pacifica	5.00		-
Mollusc			
Berryteuthis magister	Trace	1	-
Onychoteuthis	Trace	1	-
Echinoderm			
Holothuroidea	0.06		-
Ophiurae	Trace		-
Groundfish			
Sebastes borealis	21.70		-
Anoplopoma fimbria	16.00		-
Sebastolobus alascanus	9.70		-
Microstomus pacificus	7.40		-
Merluccius productus	4.10		-
Atheresthes stomias	2.70		-
Antimora microlepis	1.10		-
Lycodes diapterus	0.70		-
Sebastes malostomus	Trace	3	-
Lycodapus fierasfer	Trace		-
Bathypelagic Fish			
Stenobrachius leucopsarus	Trace	20	-
Chauliodus macouni	Trace	1	-
Poromitra crassiceps	Trace	1	-
Notolepis rissoi	Trace	1	-
Other Inverts.			
Scyphozoa	7.50		-
Actiniaria	1.40		-
Aphrodita	Trace		-

Species	**Weight(Kg)**	**N**	**Estimate**
Crab			
Chionoecetes tanneri	7.40		-
Mollusc			
Berryteuthis magister	2.20	2	-
Benthoctopus	1.20	1	-
Groundfish			
Anoplopoma fimbria	120.50		-
Sebastolobus alascanus	52.60		-
Sebastolobus altivelis	19.50		-
Coryphaenoides filifer	11.40		-
Raja rhina	11.00	2	-
Lycodes diapterus	7.50		-
Antimora microlepis	6.10		-
Microstomus pacificus	4.10	6	-
Albatrossia pectoralis	3.90	3	-
Apristurus brunneus	3.70	15	-
Bothrocara brunneum	1.60	3	-
Eptatretus deani	0.60	6	-
Careproctus melanurus	0.50	9	-
Lampetra tridentata	0.40	1	-
Agonidae	Trace		-
Bathypelagic Fish			
Stenobrachius leucopsarus	0.90		-
Chauliodus macouni	0.20		-
Oneirodes bulbosus	0.10		-
Diaphus theta	Trace		-
Tactostoma macropus	Trace	1	-

Appendix 5 (cont'd)

Set :	3	**Date:**	7/23	**Set :**	4	**Date:**	7/23
Transect :	1	**Strata:**	3	**Transect :**	2	**Strata:**	4
Stat area:	125	**Sub area:**	5	**Stat area:**	125	**Sub area:**	5
	Start		**Finish**		**Start**		**Finish**
Time:	8:38		9:21	**Time:**	11:0		11:49
Depth:	782		780	**Depth:**	960		750
Latitude:	49 3.78		49 2.502	**Latitude:**	49 4.004		49 5.648
Longitude	127 0.118		126 58.475	**Longitude**	127 0.925		127 1.031
Direction:	145	**Duration**	43	**Direction:**	0	**Duration**	49
Distance:	1.8	**Speed:**	2.50	**Distance:**	1.7	**Speed:**	2.10

Species	**Weight(Kg)**	**N**	**Estimate**
Crab			
Chionoecetes tanneri	1.30		-
Mollusc			
Cephalopoda	Trace	6	-
Groundfish			
Anoplopoma fimbria	61.90		-
Sebastolobus altivelis	44.00		-
Sebastolobus alascanus	19.60		-
Coryphaenoides filifer	17.50		-
Antimora microlepis	8.90		-
Microstomus pacificus	2.90	3	-
Apristurus brunneus	2.35		-
Bothrocara brunneum	2.00	5	-
Lycodes diapterus	0.61		-
Albatrossia pectoralis	0.40		-
Bathyagonus nigripinnis	0.11		-
Lycodapus fierasfer	0.10		-
Talismania bifurcata	Trace	1	-
Lycodapus mandibularis	Trace	1	-
Derepodichthys alepidotus	Trace	1	-
Careproctus melanurus	Trace	1	-
Bathypelagic Fish			
Stenobrachius leucopsarus	2.31		-
Bathylagus milleri	0.42		-
Tactostoma macropus	0.27	5	-
Chauliodus macouni	0.14		-
Nemichthyidae	Trace	3	-
Sagamichthys abei	Trace	1	-
Benthalbella dentata	Trace	1	-
Notolepis rissoi	Trace	1	-
Tarletonbeania crenularis	Trace	5	-
Aristostomias scintillans	Trace	1	-

Species	**Weight(Kg)**	**N**	**Estimate**
Crab			
Chionoecetes tanneri	106.35		-
Shrimp			
Notostomus japonicus	Trace		-
Mollusc			
Berryteuthis magister	1.04		-
Nudibranchiata	0.30		-
Groundfish			
Sebastolobus altivelis	129.63		-
Anoplopoma fimbria	82.94		-
Albatrossia pectoralis	50.20		-
Sebastolobus alascanus	16.04		-
Eptatretus deani	7.66		-
Coryphaenoides filifer	7.29		-
Embassichthys bathybius	6.27		-
Bothrocara brunneum	6.16		-
Antimora microlepis	2.84		-
Talismania bifurcata	2.50		-
Apristurus brunneus	0.97		-
Lycodapus fierasfer	0.52		-
Careproctus melanurus	0.49		-
Alepocephalidae	0.30		-
Derepodichthys alepidotus	Trace	1	-
Lampetra tridentata	Trace	2	-
Bathypelagic Fish			
Stenobrachius leucopsarus	0.40		-
Bathylagus milleri	Trace	6	-
Tactostoma macropus	Trace	1	-
Sagamichthys abei	Trace	1	-
Other Inverts.			
Actiniaria	Trace		-

Appendix 5 (cont'd)

Set :	5	**Date:**	7/23	**Set :**	6	**Date:**	7/23
Transect :	1	**Strata:**	5	**Transect :**	3	**Strata:**	5
Stat area:	125	**Sub area:**	5	**Stat area:**	125	**Sub area:**	5
	Start		**Finish**		**Start**		**Finish**
Time:	13:20		14:3	**Time:**	16:5		16:49
Depth:	1150		1190	**Depth:**	1120		1180
Latitude:	49 1.019		48 59.448	**Latitude:**	49 6.703		49 7.909
Longitude	127 1.431		127 0.535	**Longitude**	127 7.372		127 9.252
Direction:	159	**Duration**	43	**Direction:**	315	**Duration**	44
Distance:	1.7	**Speed:**	2.40	**Distance:**	1.8	**Speed:**	2.30

Species	**Weight(Kg)**	**N**	**Estimate**
Crab			
Chionoecetes tanneri	14.70		-
Shrimp			
Pasiphaea tarda	Trace		-
Parapasiphae	Trace		-
Acanthephyra curtirostris	Trace		-
Eualus macrophthalmus	Trace	20	-
Mysidacea	Trace		-
Notostomus japonicus	Trace		-
Echinoderm			
Euryalae	Trace		-
Groundfish			
Coryphaenoides filifer	194.80		-
Sebastolobinae	110.90		-
Albatrossia pectoralis	65.30		-
Anoplopoma fimbria	23.90		-
Antimora microlepis	7.10		-
Bothrocara brunneum	6.80		-
Eptatretus deani	2.40		-
Embassichthys bathybius	2.10		-
Lycodapus fierasfer	1.00		-
Lycenchelys crotalina	0.30		-
Derepodichthys alepidotus	0.10		-
Lampetra tridentata	Trace		-
Bathypelagic Fish			
Chauliodus macouni	6.40		-
Bathylagus milleri	1.60		-
Stenobrachius leucopsarus	0.90		-
Sagamichthys abei	0.60		-
Tactostoma macropus	0.14		-
Poromitra crassiceps	0.10		-
Aristostomias scintillans	Trace		-
Nemichthyidae	Trace		-
Other Inverts.			
Actiniaria	11.00		-
Scyphozoa	Trace		-

Species	**Weight(Kg)**	**N**	**Estimate**
Crab			
Chionoecetes tanneri	16.60		-
Chionoecetes angulatus	1.60		-
Shrimp			
Mysidacea	Trace		-
Parapasiphae sulcatifrons	Trace		-
Notostomus japonicus	Trace		-
Mollusc			
Nudibranchiata	Trace		-
Echinoderm			
Asteroidea	6.50		-
Groundfish			
Sebastolobus altivelis	261.00		Yes
Coryphaenoides filifer	208.40		-
Albatrossia pectoralis	83.50		-
Sebastolobus alascanus	80.00		Yes
Anoplopoma fimbria	58.30		-
Bothrocara brunneum	9.50		-
Embassichthys bathybius	9.00		-
Antimora microlepis	8.90		-
Alepocephalidae	6.00		-
Lycenchelys crotalina	2.80		-
Eptatretus deani	2.20		-
Apristurus brunneus	1.50		-
Lycodapus fierasfer	1.27		-
Talismania bifurcata	0.60		-
Derepodichthys alepidotus	0.50		-
Careproctus melanurus	0.20		-
Bathypelagic Fish			
Bathylagus milleri	2.90		-
Stenobrachius leucopsarus	2.70		-
Chauliodus macouni	0.30		-
Tactostoma macropus	0.20		-
Nemichthyidae	Trace		-
Tarletonbeania crenularis	Trace		-
Poromitra crassiceps	Trace		-
Other Inverts.			
Actiniaria	46.80		-
Aphrodita	0.13		-

Appendix 5 (cont'd)

Set :	7	**Date:**	7/24	**Set :**	8	**Date:**	7/24
Transect :	3	**Strata:**	5	**Transect :**	3	**Strata:**	4
Stat area:	125	**Sub area:**	5	**Stat area:**	125	**Sub area:**	5
	Start		**Finish**		**Start**		**Finish**
Time:	6:46		7:31	**Time:**	9:1		9:48
Depth:	1160		1126	**Depth:**	933		965
Latitude:	49 7.28		49 8.271	**Latitude:**	49 7.57		49 6.668
Longitude	127 8.08		127 9.958	**Longitude**	127 6.325		127 3.766
Direction:	313	**Duration**	45	**Direction:**	120	**Duration**	47
Distance:	1.9	**Speed:**	2.50	**Distance:**	2.0	**Speed:**	2.50

Species	**Weight(Kg)**	**N**	**Estimate**
Crab			
Chionoecetes tanneri	5.10		-
Chionoecetes angulatus	1.90	6	-
Shrimp			
Eualus biunguis	1.00		-
Pasiphaea tarda	Trace	1	-
Crangon dalli	Trace	1	-
Notostomus japonicus	Trace	3	-
Parapasiphae sulcatifrons	Trace	11	-
Mollusc			
Gastropoda	Trace		-
Gonatus	Trace		-
Vampyroteuthidae	Trace		-
Benthoctopus robustus	Trace		-
Echinoderm			
Asteroidea	0.40		-
Groundfish			
Coryphaenoides acrolepis	140.00		-
Sebastolobus altivelis	95.30		-
Albatrossia pectoralis	40.70		-
Anoplopoma fimbria	24.00		-
Antimora microlepis	5.40		-
Bothrocara brunneum	2.30		-
Alepocephalidae	1.30		-
Lycodapus fierasfer	0.80		-
Lycodes diapterus	0.50		-
Derepodichthys alepidotus	0.40		-
Lycenchelys crotalina	0.20		-
Talismania bifurcata	0.10	5	-
Embassichthys bathybius	Trace	1	-
Bathypelagic Fish			
Bathylagus milleri	2.60		-
Stenobrachius leucopsarus	2.20		-
Chauliodus macouni	0.40		-
Poromitra crassiceps	0.10	4	-
Avocettina infans	Trace		-
Tarletonbeania crenularis	Trace		-
Tactostoma macropus	Trace		-
Other Inverts.			
Actiniaria	11.90		-
Polychaeta	Trace	3	-
Aphrodita	Trace	1	-
Isopoda	Trace		-

Species	**Weight(Kg)**	**N**	**Estimate**
Crab			
Chionoecetes tanneri	6.61		-
Shrimp			
Notostomus japonicus	Trace		-
Eualus macrophthalmus	Trace		-
Sergestes similis	Trace		-
Hymenodora frontalis	Trace		-
Acanthephyra curtirostris	Trace		-
Mollusc			
Vampyroteuthidae	Trace		-
Nudibranchiata	Trace		-
Echinoderm			
Asteroidea	0.70		-
Holothuroidea	Trace		-
Groundfish			
Sebastolobus altivelis	54.30		Yes
Sebastolobus alascanus	37.80		Yes
Anoplopoma fimbria	37.60		-
Albatrossia pectoralis	8.10		-
Lycodapus fierasfer	6.70		-
Alepocephalidae	6.50		-
Coryphaenoides acrolepis	5.60		-
Antimora microlepis	1.80		-
Bothrocara brunneum	1.50		-
Embassichthys bathybius	1.20		-
Talismania bifurcata	1.10		-
Lycenchelys crotalina	0.50	5	-
Eptatretus deani	0.50	4	-
Bathyagonus nigripinnis	Trace		-
Derepodichthys alepidotus	Trace		-
Bathypelagic Fish			
Stenobrachius leucopsarus	2.20		-
Bathylagus milleri	1.40		-
Anotopterus pharao	0.20		-
Tactostoma macropus	0.20		-
Tarletonbeania crenularis	Trace		-
Chauliodus macouni	Trace		-
Sagamichthys abei	Trace		-
Poromitra crassiceps	Trace		-
Nemichthyidae	Trace		-
Other Inverts.			
Actiniaria	Trace		-

Appendix 5 (cont'd)

Set :	9	**Date:**	7/24	**Set :**	10	**Date:**	7/24
Transect :	3	**Strata:**	3	**Transect :**	3	**Strata:**	2
Stat area:	125	**Sub area:**	5	**Stat area:**	125	**Sub area:**	5
	Start		**Finish**		**Start**		**Finish**
Time:	10:44		11:30	**Time:**	12:52		13:35
Depth:	800		850	**Depth:**	654		680
Latitude:	49 8.508		49 9.452	**Latitude:**	49 9.481		49 8.123
Longitude	127 5.499		127 7.619	**Longitude**	127 4.459		127 2.124
Direction:	299	**Duration**	46	**Direction:**	130	**Duration**	43
Distance:	1.8	**Speed:**	2.30	**Distance:**	2.1	**Speed:**	2.90

Species	**Weight(Kg)**	**N**	**Estimate**
Crab			
Chionoecetes tanneri	8.90		-
Lithodes couesi	0.50		-
Munida quadrispina	Trace	15	-
Shrimp			
Notostomus japonicus	Trace	2	-
Echinoderm			
Ophiurae	1.50		-
Crinodea	Trace		-
Groundfish			
Anoplopoma fimbria	126.60		-
Sebastolobus altivelis	88.60		Yes
Sebastolobus alascanus	62.00		Yes
Microstomus pacificus	26.20		-
Coryphaenoides acrolepis	12.30		-
Albatrossia pectoralis	9.00		-
Apristurus brunneus	3.10		-
Antimora microlepis	3.10		-
Alepocephalidae	2.20		-
Embassichthys bathybius	1.90		-
Eptatretus deani	0.50		-
Lycenchelys crotalina	0.40		-
Careproctus melanurus	0.20		-
Bothrocara brunneum	0.20		-
Derepodichthys alepidotus	0.10		-
Bathyagonus nigripinnis	Trace		-
Bathypelagic Fish			
Stenobrachius leucopsarus	0.50		-
Tactostoma macropus	0.50		-
Bathylagus milleri	0.40		-
Poromitra crassiceps	Trace		-
Tarletonbeania crenularis	Trace		-
Anotopterus pharao	Trace		-
Chauliodus macouni	Trace		-
Nemichthyidae	Trace		-
Nanensia candida	Trace		-

Species	**Weight(Kg)**	**N**	**Estimate**
Crab			
Chionoecetes tanneri	15.90		-
Shrimp			
Pasiphaea pacifica	1.84		Yes
Mollusc			
Berryteuthis magister	15.20		-
Gastropoda	1.19		Yes
Cephalopoda	0.92		Yes
Echinoderm			
Asteroidea	0.92		Yes
Ophiurae	0.92		Yes
Holothuroidea	0.92		Yes
Echinacea	0.46		Yes
Hippasteria spinosa	0.10		-
Groundfish			
Anoplopoma fimbria	330.30		-
Microstomus pacificus	55.20		-
Sebastolobus alascanus	39.90		Yes
Sebastolobus altivelis	17.40		Yes
Antimora microlepis	17.40		-
Lycodes diapterus	14.00		-
Coryphaenoides acrolepis	8.22		-
Apristurus brunneus	7.10		-
Albatrossia pectoralis	5.90		-
Bothrocara brunneum	3.50		-
Lycodapus fierasfer	0.92		Yes
Eptatretus deani	0.50		-
Careproctus melanurus	0.30		-
Bathypelagic Fish			
Icosteidae	50.00		-
Chauliodus macouni	0.92		Yes
Stenobrachius leucopsarus	0.70		-
Tactostoma macropus	Trace		-
Oneirodes bulbosus	Trace		-
Sagamichthys abei	Trace		-
Tarletonbeania crenularis	Trace		-
Other Inverts.			
Scyphozoa	0.92		Yes

Appendix 5 (cont'd)

Set :	11	**Date:**	7/24	**Set :**	12	**Date:**	7/24
Transect :	3	**Strata:**	1	**Transect :**	2	**Strata:**	1
Stat area:	125	**Sub area:**	5	**Stat area:**	125	**Sub area:**	5
	Start		**Finish**		**Start**		**Finish**
Time:	14:45		15:25	**Time:**	16:17		17:0
Depth:	428		534	**Depth:**	423		450
Latitude:	49 10.642		49 8.969	**Latitude:**	49 7.685		49 5.674
Longitude	127 2.648		127 1.101	**Longitude**	126 58.133		126 56.876
Direction:	146	**Duration**	40	**Direction:**	157	**Duration**	43
Distance:	2.1	**Speed:**	2.80	**Distance:**	2.2	**Speed:**	3.00

Species	**Weight(Kg)**	**N**	**Estimate**
Crab			
Chionoecetes tanneri	0.00		-
Shrimp			
Pasiphaea pacifica	1.70		-
Eualus macrophthalmus	0.20		-
Pandalopsis dispar	Trace		-
Mollusc			
Berryteuthis magister	4.00		-
Gastropoda	0.20		-
Teuthoidea	0.10		-
Groundfish			
Anoplopoma fimbria	188.00		-
Microstomus pacificus	101.00		-
Sebastes aleutianus	85.70		-
Atheresthes stomias	38.70		-
Sebastolobus alascanus	29.10		-
Errex zachirus	11.30		-
Sebastes malostomus	6.30		-
Lycodes cortezianus	5.70		-
Merluccius productus	4.70		-
Sebastes borealis	3.30		-
Hydrolagus colliei	2.40		-
Lycodes diapterus	2.20		-
Antimora microlepis	1.50		-
Raja rhina	1.00		-
Sebastes alutus	0.60		-
Bathyraja interrupta	0.50		-
Squalus acanthias	Trace		-
Derepodichthys alepidotus	Trace		-
Bathypelagic Fish			
Tarletonbeania crenularis	Trace		-
Stenobrachius leucopsarus	Trace		-
Other Inverts.			
Actiniaria	0.70		-
Isopoda	Trace		-
Aphrodita	Trace		-

Species	**Weight(Kg)**	**N**	**Estimate**
Crab			
Chionoecetes tanneri	1.00	1	-
Shrimp			
Pasiphaea pacifica	1.81		Yes
Pandalopsis dispar	0.30		-
Eualus macrophthalmus	0.15		Yes
Mollusc			
Berryteuthis magister	5.70		-
Gastropoda	0.60		Yes
Echinoderm			
Ophiurae	0.60		Yes
Holothuroidea	Trace		-
Groundfish			
Sebastes aleutianus	130.60		-
Anoplopoma fimbria	108.80		-
Sebastolobinae	44.40		-
Microstomus pacificus	25.80		-
Atheresthes stomias	13.20		-
Merluccius productus	10.80		-
Errex zachirus	7.50		-
Raja rhina	2.50		-
Sebastes aurora	2.00		-
Sebastes alutus	1.30		-
Squalus acanthias	0.70		-
Lycodes diapterus	0.70		-
Antimora microlepis	0.50		-
Lycodes cortezianus	0.40		-
Bathypelagic Fish			
Stenobrachius leucopsarus	Trace		-
Other Inverts.			
Actiniaria	3.40		-
Aphrodita	0.15		Yes
Isopoda	0.15		Yes
Misc.			
Unidentified organic matter	1.21		Yes

Appendix 5 (cont'd)

Set :	13	**Date:**	7/24	**Set :**	14	**Date:**	7/25
Transect :	1	**Strata:**	1	**Transect :**	1	**Strata:**	2
Stat area:	125	**Sub area:**	5	**Stat area:**	124	**Sub area:**	4
	Start		**Finish**		**Start**		**Finish**
Time:	17:42		18:20	**Time:**	7:2		7:43
Depth:	490		560	**Depth:**	654		680
Latitude:	49 3.706		49 1.754	**Latitude:**	49 3.246		49 1.395
Longitude	126 56.055		126 54.994	**Longitude**	126 58.218		126 56.936
Direction:	159	**Duration**	38	**Direction:**	158	**Duration**	41
Distance:	2.1	**Speed:**	3.30	**Distance:**	2.0	**Speed:**	2.90

Species	**Weight(Kg)**	**N**	**Estimate**
Crab			
Chionoecetes tanneri	0.90		-
Shrimp			
Pasiphaea pacifica	11.30		Yes
Eualus macrophthalmus	0.32		Yes
Mollusc			
Cephalopoda	0.94		Yes
Berryteuthis magister	0.90		-
Echinoderm			
Asteroidea	1.00		-
Groundfish			
Anoplopoma fimbria	69.00		-
Sebastolobus alascanus	18.80		-
Microstomus pacificus	15.30		-
Atheresthes stomias	8.50		-
Lycodes diapterus	2.00		-
Antimora microlepis	1.90		-
Merluccius productus	1.70		-
Apristurus brunneus	1.40		-
Lycodes cortezianus	1.30		-
Bathyraja interrupta	0.90		-
Lampetra tridentata	0.10		-
Bathypelagic Fish			
Stenobrachius leucopsarus	0.94		Yes
Tarletonbeania crenularis	0.09		Yes
Chauliodus macouni	0.09		Yes
Other Inverts.			
Scyphozoa	1.89		Yes
Actiniaria	1.00		-
Misc.			
Unidentified organic matter	0.94		-

Species	**Weight(Kg)**	**N**	**Estimate**
Crab			
Chionoecetes tanneri	7.80		-
Shrimp			
Eualus macrophthalmus	1.50		-
Notostomus japonicus	Trace		-
Mollusc			
Berryteuthis magister	2.00	2	-
Echinoderm			
Ophiurae	6.50		-
Asteroidea	0.50		-
Euryalae	Trace		-
Groundfish			
Anoplopoma fimbria	135.90		-
Sebastolobus alascanus	28.20		-
Coryphaenoides acrolepis	23.50		-
Microstomus pacificus	20.60		-
Antimora microlepis	19.90		-
Sebastolobus altivelis	15.50		-
Lycodes diapterus	11.30		-
Albatrossia pectoralis	9.30		-
Apristurus brunneus	6.20		-
Bothrocara brunneum	2.70		-
Eptatretus deani	2.20		-
Careproctus melanurus	0.40	5	-
Lycodapus fierasfer	Trace	10	-
Bathyagonus nigripinnis	Trace		-
Bathypelagic Fish			
Stenobrachius leucopsarus	1.70		-
Chauliodus macouni	0.60		-
Bathylagus milleri	0.60		-
Tactostoma macropus	0.20	6	-
Sagamichthys abei	Trace	1	-
Nemichthys scolopaceus	Trace	1	-
Bathylagus pacificus	Trace	1	-
Argyropelecus sladeni	Trace	1	-
Tarletonbeania crenularis	Trace	5	-
Scopelosaurus harryi	Trace	1	-
Other Inverts.			
Pennatulacea	Trace		-
Aphrodita	Trace		-

Appendix 5 (cont'd)

Set :	15	**Date:**	7/25	**Set :**	16	**Date:**	7/25
Transect :	1	**Strata:**	4	**Transect :**	1	**Strata:**	6
Stat area:	125	**Sub area:**	5	**Stat area:**	124	**Sub area:**	4
	Start		**Finish**		**Start**		**Finish**
Time:	8:55		9:37	**Time:**	12:26		13:13
Depth:	980		913	**Depth:**	1255		1348
Latitude:	49 1.623		49 3.62	**Latitude:**	49 0.208		48 59.375
Longitude	127 0.267		127 0.77	**Longitude**	127 2.06		127 0.698
Direction:	351	**Duration**	42	**Direction:**	132	**Duration**	47
Distance:	2.0	**Speed:**	2.80	**Distance:**	1.3	**Speed:**	1.60

Species	**Weight(Kg)**	**N**	**Estimate**
Crab			
Chionoecetes tanneri	21.00	-	
Shrimp			
Pasiphaea tarda	Trace	-	
Hymenodora frontalis	Trace	-	
Systellaspis braueri	Trace	-	
Notostomus japonicus	Trace	-	
Sergia tenuiremis	Trace	-	
Sergestes similis	Trace	-	
Mollusc			
Gastropoda	0.30	-	
Groundfish			
Sebastolobus altivelis	103.30	-	
Sebastolobus alascanus	20.20	-	
Albatrossia pectoralis	19.60	-	
Anoplopoma fimbria	19.20	-	
Coryphaenoides acrolepis	15.44	-	
Talismania bifurcata	12.10	-	
Lycodapus fierasfer	3.74	-	
Antimora microlepis	3.50	-	
Eptatretus deani	3.50	-	
Bothrocara brunneum	1.34	-	
Apristurus brunneus	1.30	-	
Alepocephalidae	0.80	-	
Careproctus melanurus	0.30	-	
Lycodes cortezianus	0.20	-	
Bathypelagic Fish			
Stenobrachius leucopsarus	3.92	Yes	
Chauliodus macouni	1.31	Yes	
Bathylagus milleri	0.87	Yes	
Tarletonbeania crenularis	0.04	Yes	
Diaphus theta	0.04	Yes	
Nanensia candida	0.04	Yes	
Other Inverts.			
Actiniaria	Trace	-	

Species	**Weight(Kg)**	**N**	**Estimate**
Crab			
Chionoecetes tanneri	15.00	-	
Pagurus splendescens	Trace	-	
Munida quadrispina	Trace	-	
Shrimp			
Notostomus japonicus	Trace	-	
Acanthephyra curtirostris	Trace	-	
Pasiphaea tarda	Trace	-	
Eualus macrophthalmus	Trace	-	
Eualus biunguis	Trace	-	
Mollusc			
Benthoctopus robustus	0.50	-	
Gastropoda	0.30	-	
Echinoderm			
Asteroidea	1.30	-	
Groundfish			
Albatrossia pectoralis	78.20	-	
Coryphaenoides acrolepis	42.40	-	
Sebastolobus altivelis	21.10	-	
Antimora microlepis	7.70	-	
Embassichthys bathybius	2.80	-	
Anoplopoma fimbria	2.50	-	
Bothrocara remigerum	1.00	-	
Bothrocara brunneum	0.90	-	
Careproctus melanurus	0.10	-	
Lycodapus fierasfer	0.10	-	
Bathyraja interrupta	Trace	-	
Bathypelagic Fish			
Chauliodus macouni	0.30	-	
Bathylagus milleri	0.20	-	
Stenobrachius leucopsarus	0.20	-	
Poromitra crassiceps	Trace	-	
Other Inverts.			
Actiniaria	12.70	-	
Aphrodita	Trace	-	

Appendix 5 (cont'd)

Set :	17	**Date:**	7/26	**Set :**	18	**Date:**	7/26
Transect :	2	**Strata:**	2	**Transect :**	2	**Strata:**	3
Stat area:	125	**Sub area:**	6	**Stat area:**	125	**Sub area:**	5
	Start		**Finish**		**Start**		**Finish**
Time:	6:32		7:12	**Time:**	8:22		9:4
Depth:	520		547	**Depth:**	712		750
Latitude:	49 7.162		49 5.189	**Latitude:**	49 6.172		49 7.98
Longitude	126 59.535		126 58.515	**Longitude**	127 1.036		127 2.354
Direction:	162	**Duration**	40	**Direction:**	320	**Duration**	42
Distance:	2.1	**Speed:**	3.10	**Distance:**	2.4	**Speed:**	3.40

Species	**Weight(Kg)**	**N**	**Estimate**
Crab			
Chionoecetes tanneri	0.00		-
Shrimp			
Pasiphaea pacifica	3.70		-
Eualus macrophthalmus	0.10	100	-
Mysidacea	Trace		-
Sergestes similis	Trace		-
Notostomus japonicus		5	-
Mollusc			
Berryteuthis magister	3.70	3	-
Gastropoda	Trace		-
Gonatus	Trace	4	-
Groundfish			
Anoplopoma fimbria	58.20		-
Microstomus pacificus	23.40		-
Albatrossia pectoralis	19.80		-
Sebastolobus alascanus	13.40		-
Lycodes diapterus	6.10		-
Antimora microlepis	4.60		-
Apristurus brunneus	4.50		-
Raja rhina	3.10		-
Sebastes borealis	1.20		-
Careproctus melanurus	Trace		-
Coryphaenoides acrolepis	Trace		-
Bathyagonus nigripinnis	Trace	1	-
Bathypelagic Fish			
Stenobrachius leucopsarus	1.00		-
Chauliodus macouni	0.20		-
Tactostoma macropus	Trace	6	-
Melamphaes lugubris	Trace	1	-
Benthalbella dentata	Trace	1	-
Sagamichthys abei	Trace	6	-
Notolepis rissoi	Trace	6	-
Tarletonbeania crenularis	Trace	6	-
Other Inverts.			
Actiniaria	0.30		-
Scyphozoa	Trace	5	-

Species	**Weight(Kg)**	**N**	**Estimate**
Crab			
Chionoecetes tanneri	8.76	1120	-
Shrimp			
Eualus	0.30		-
Notostomus japonicus	Trace	7	-
Hymenodora frontalis	Trace	10	-
Mysidacea	Trace		-
Mollusc			
Berryteuthis magister	2.80		-
Gonatus	Trace	7	-
Echinoderm			
Ophiurae	Trace		-
Groundfish			
Anoplopoma fimbria	97.20		-
Sebastolobus altivelis	62.67		Yes
Sebastolobus alascanus	41.00		-
Microstomus pacificus	14.50		-
Coryphaenoides acrolepis	9.85		Yes
Albatrossia pectoralis	9.50		-
Antimora microlepis	8.30		-
Lycodes diapterus	6.20		Yes
Bothrocara brunneum	3.90		-
Eptatretus deani	3.40		-
Apristurus brunneus	2.80		-
Embassichthys bathybius	0.80		-
Lycodapus fierasfer	0.62		Yes
Alepocephalidae	0.60		-
Bathyagonus nigripinnis	0.07		Yes
Bathypelagic Fish			
Stenobrachius leucopsarus	2.98		Yes
Chauliodus macouni	1.11		Yes
Bathylagus milleri	1.11		Yes
Tarletonbeania crenularis	0.07		Yes
Other Inverts.			
Actiniaria	Trace		-
Scyphozoa	Trace		-
Misc.			
Unidentified organic matter	4.00		-

Appendix 5 (cont'd)

Set :	19	**Date:**	7/26	**Set :**	20	**Date:**	7/26
Transect :	4	**Strata:**	4	**Transect :**	4	**Strata:**	3
Stat area:	125	**Sub area:**	5	**Stat area:**	125	**Sub area:**	5
	Start		**Finish**		**Start**		**Finish**
Time:	10:35		11:2	**Time:**	13:30		13:57
Depth:	927		900	**Depth:**	701		749
Latitude:	49 14.124		49 14.754	**Latitude:**	49 13.817		49 12.875
Longitude	127 9.173		127 9.758	**Longitude**	127 7.831		127 7.051
Direction:	323	**Duration**	27	**Direction:**	150	**Duration**	27
Distance:	0.6	**Speed:**	1.30	**Distance:**	1.1	**Speed:**	2.40

Species	**Weight(Kg)**	**N**	**Estimate**
Crab			
Chionoecetes tanneri	2.11	4	Yes
Shrimp			
Pasiphaea pacifica	0.13		-
Mysidacea	Trace		-
Eualus macrophthalmus	Trace		-
Mollusc			
Berryteuthis magister	1.00	1	-
Groundfish			
Anoplopoma fimbria	101.40		-
Sebastolobus altivelis	52.45		-
Sebastolobus alascanus	29.10		-
Microstomus pacificus	12.80		-
Coryphaenoides acrolepis	12.40		-
Albatrossia pectoralis	6.60		-
Bothrocara brunneum	2.07		-
Antimora microlepis	1.55		-
Eptatretus deani	1.20		-
Lycodes diapterus	0.80		-
Lycenchelys crotalina	0.30		-
Lycodapus fierasfer	0.30		-
Apristurus brunneus	0.30		-
Bathyagonus nigripinnis	Trace		-
Talismania bifurcata	Trace		-
Derepodichthys alepidotus	Trace		-
Lycodapus mandibularis	Trace	1	-
Bathypelagic Fish			
Stenobrachius leucopsarus	1.35		-
Chauliodus macouni	0.08		-
Tactostoma macropus	0.07		-
Nemichthyidae	Trace	1	-
Bathylagus milleri	Trace		-
Tarletonbeania crenularis	Trace		-
Other Inverts.			
Isopoda	Trace		-

Species	**Weight(Kg)**	**N**	**Estimate**
Crab			
Chionoecetes tanneri	18.90	10	-
Shrimp			
Pasiphaea pacifica	1.40		-
Eualus macrophthalmus	0.19		-
Mysidacea	Trace		-
Mollusc			
Gastropoda	1.50		-
Berryteuthis magister	1.00	3	-
Gonatus	Trace	5	-
Echinoderm			
Asteroidea	2.60		-
Groundfish			
Anoplopoma fimbria	148.40		-
Sebastolobus altivelis	54.30		-
Microstomus pacificus	34.70		-
Sebastolobus alascanus	32.20		-
Lycodes diapterus	8.30		-
Bothrocara brunneum	6.90		-
Coryphaenoides acrolepis	3.32		-
Merluccius productus	2.84		-
Antimora microlepis	2.30		-
Albatrossia pectoralis	1.84		-
Eptatretus deani	0.87		-
Apristurus brunneus	0.40		-
Careproctus melanurus	0.30		-
Agonidae	0.20		-
Lycodapus fierasfer	0.14		-
Derepodichthys alepidotus	Trace	2	-
Bathypelagic Fish			
Stenobrachius leucopsarus	2.50		-
Chauliodus macouni	0.18		-
Bathylagus milleri	0.10		-
Tarletonbeania crenularis	0.05		-
Argyropelecus sladeni	Trace	1	-
Other Inverts.			
Actiniaria	Trace		-

Appendix 5 (cont'd)

Set :	21	**Date:**	7/26	**Set :**	22	**Date:**	7/27
Transect :	4	**Strata:**	2	**Transect :**	4	**Strata:**	5
Stat area:	125	**Sub area:**	5	**Stat area:**	125	**Sub area:**	5
	Start		**Finish**		**Start**		**Finish**
Time:	15:9		15:39	**Time:**	7:8		7:53
Depth:	480		650	**Depth:**	1179		1393
Latitude:	49 13.539		49 12.407	**Latitude:**	49 14.99		49 13.488
Longitude	127 6.239		127 5.214	**Longitude**	127 12.672		127 10.712
Direction:	147	**Duration**	30	**Direction:**	138	**Duration**	45
Distance:	1.4	**Speed:**	2.80	**Distance:**	2.0	**Speed:**	2.60

Species	**Weight(Kg)**	**N**	**Estimate**
Crab			
Chionoecetes tanneri	6.20		-
Shrimp			
Eualus macrophthalmus	Trace		-
Sergestes similis	Trace		-
Pasiphaea pacifica	Trace		-
Nɵtostomus japonicus	Trace		-
Mollusc			
Berryteuthis magister	Trace		-
Gonatus	Trace		-
Gastropoda	Trace		-
Echinoderm			
Asteroidea	1.30		-
Echinacea	0.30		-
Groundfish			
Anoplopoma fimbria	132.50		-
Microstomus pacificus	77.00		-
Albatrossia pectoralis	66.20		-
Sebastolobus alascanus	44.50		-
Sebastolobus altivelis	36.00		-
Raja rhina	15.40		-
Sebastes borealis	11.80		-
Antimora microlepis	7.50		-
Lycodes diapterus	5.70		-
Merluccius productus	3.40		-
Apristurus brunneus	2.50		-
Bothrocara brunneum	1.00		-
Careproctus melanurus	0.90		-
Coryphaenoides acrolepis	0.60		-
Lampetra tridentata	0.36		-
Eptatretus deani	Trace	1	-
Other Inverts.			
Scyphozoa	3.30		Yes
Misc.			
Unidentified organic matter	6.20		-

Species	**Weight(Kg)**	**N**	**Estimate**
Crab			
Chionoecetes tanneri	0.00		-
Mollusc			
Gastropoda	0.15		-
Echinoderm			
Asteroidea	0.17		-
Groundfish			
Raja rhina	7.60		-
Sebastolobus alascanus	4.00		-
Coryphaenoides acrolepis	2.90		-
Sebastolobus altivelis	0.40		-
Talismania bifurcata	0.20		-
Bathypelagic Fish			
Stenobrachius leucopsarus	6.20		-
Bathylagus milleri	3.40		-
Chauliodus macouni	0.75		-
Tactostoma macropus	0.30		-
Sagamichthys abei	Trace		-
Nanensia candida	Trace		-
Tarletonbeania crenularis	Trace		-
Benthalbella dentata	Trace		-
Other Inverts.			
Scyphozoa	3.00		-

Appendix 5 (cont'd)

Set :	23	**Date:**	7/27	**Set :**	24	**Date:**	7/27
Transect :	6	**Strata:**	4	**Transect :**	6	**Strata:**	2
Stat area:	125	**Sub area:**	5	**Stat area:**	125	**Sub area:**	5
	Start		**Finish**		**Start**		**Finish**
Time:	9:22		9:50	**Time:**	11:10		11:55
Depth:	925		930	**Depth:**	560		660
Latitude:	49 18.114		49 18.521	**Latitude:**	49 20.01		49 22.054
Longitude	127 14.411		127 15.138	**Longitude**	127 13.9		127 16.871
Direction:	320	**Duration**	28	**Direction:**	316	**Duration**	45
Distance:	0.6	**Speed:**	1.20	**Distance:**	2.3	**Speed:**	3.00

Species	**Weight(Kg)**	**N**	**Estimate**
Crab			
Chionoecetes tanneri	0.50	-	
Mollusc			
Gastropoda	1.50	-	
Echinoderm			
Asteroidea	0.50	-	
Groundfish			
Sebastolobus altivelis	23.80	-	
Sebastolobus alascanus	12.90	-	
Anoplopoma fimbria	4.10	-	
Albatrossia pectoralis	2.90	-	
Microstomus pacificus	1.60	-	
Apristurus brunneus	0.80	-	
Merluccius productus	0.70	-	
Eptatretus stouti	0.60	-	
Lycenchelys crotalina	0.50	-	
Coryphaenoides acrolepis	0.30	-	
Antimora microlepis	0.10	-	
Lycodapus fierasfer	Trace	-	
Derepodichthys alepidotus	Trace	-	
Bathypelagic Fish			
Stenobrachius leucopsarus	2.30	-	
Chauliodus macouni	0.50	-	
Bathylagus milleri	0.20	-	
Tactostoma macropus	0.10	-	
Tarletonbeania crenularis	Trace	-	
Aristostomias scintillans	Trace	-	

Species	**Weight(Kg)**	**N**	**Estimate**
Crab			
Chionoecetes tanneri	3.20	-	
Shrimp			
Pasiphaea pacifica	0.26	-	
Mollusc			
Berryteuthis magister	27.20	-	
Gastropoda	0.80	-	
Echinoderm			
Ophiurae	13.08	-	
Asteroidea	3.00	-	
Groundfish			
Anoplopoma fimbria	313.20	-	
Microstomus pacificus	248.60	-	
Sebastolobus alascanus	66.70	-	
Raja rhina	18.60	-	
Antimora microlepis	17.40	-	
Albatrossia pectoralis	14.10	-	
Lycodes diapterus	8.30	-	
Atheresthes stomias	7.20	-	
Merluccius productus	5.10	-	
Bothrocara brunneum	4.80	-	
Apristurus brunneus	1.90	-	
Coryphaenoides acrolepis	0.85	-	
Careproctus melanurus	0.82	-	
Bathyagonus nigripinnis	Trace	-	
Eptatretus stouti	Trace	-	
Lycodapus fierasfer	Trace	-	
Bathypelagic Fish			
Stenobrachius leucopsarus	0.89	-	
Chauliodus macouni	0.20	-	
Tactostoma macropus	Trace	-	
Nemichthys scolopaceus	Trace	-	
Other Inverts.			
Actiniaria	Trace	-	
Misc.			
Unidentified organic matter	0.12	-	

Appendix 5 (cont'd)

Set :	25	**Date:**	7/27	**Set :**	26	**Date:**	7/27
Transect :	6	**Strata:**	1	**Transect :**	6	**Strata:**	3
Stat area:	125	**Sub area:**	5	**Stat area:**	125	**Sub area:**	5
	Start		**Finish**		**Start**		**Finish**
Time:	13:2		13:42	**Time:**	15:3		15:45
Depth:	484		530	**Depth:**	828		940
Latitude:	49 20.757		49 22.296	**Latitude:**	49 21.621		49 20.5
Longitude	127 14.294		127 16.349	**Longitude**	127 18.388		127 16.856
Direction:	320	**Duration**	40	**Direction:**	147	**Duration**	42
Distance:	2.2	**Speed:**	3.30	**Distance:**	1.9	**Speed:**	2.70

Species	**Weight(Kg)**	**N**	**Estimate**
Crab			
Chionoecetes tanneri	2.20	4	-
Shrimp			
Pasiphaea pacifica	10.50		Yes
Eualus macrophthalmus	0.04		-
Mollusc			
Berryteuthis magister	5.00		-
Gastropoda	0.85		-
Cephalopoda	0.31		Yes
Teuthoidea	Trace		-
Echinoderm			
Ophiurae	2.06		Yes
Groundfish			
Microstomus pacificus	157.80		-
Anoplopoma fimbria	134.80		-
Atheresthes stomias	33.90		-
Sebastes borealis	27.10		-
Sebastolobus alascanus	24.00		-
Raja rhina	16.20		-
Sebastolobus altivelis	9.50		-
Antimora microlepis	7.80		-
Merluccius productus	5.40		-
Sebastes aleutianus	4.30		-
Lycodes diapterus	2.70		-
Eptatretus deani	0.80		-
Bathypelagic Fish			
Icosteidae	34.10		-
Stenobrachius leucopsarus	0.20		-
Other Inverts.			
Actiniaria	8.73		-
Misc.			
Unknown fish	0.62		Yes

Species	**Weight(Kg)**	**N**	**Estimate**
Crab			
Chionoecetes tanneri	0.00		-
Shrimp			
Pasiphaea pacifica	2.84		Yes
Hymenodora frontalis	Trace		-
Eualus macrophthalmus	Trace		-
Notostomus japonicus	Trace		-
Sergestes similis	Trace		-
Mollusc			
Teuthoidea	0.25		Yes
Echinoderm			
Ophiurae	0.33		Yes
Groundfish			
Microstomus pacificus	5.60		-
Raja rhina	4.40		-
Merluccius productus	0.50		-
Lycodapus fierasfer	0.07		-
Bothrocara brunneum	0.05		-
Lycodes diapterus	Trace		-
Sebastolobus altivelis	Trace		-
Antimora microlepis	Trace		-
Bathypelagic Fish			
Stenobrachius leucopsarus	1.67		-
Bathylagus milleri	0.50		-
Chauliodus macouni	0.30		-
Malacosteidae	0.10		-
Scopelosaurus harryi	0.09		-
Bathylagus pacificus	Trace		-
Tarletonbeania crenularis	Trace		-
Other Inverts.			
Scyphozoa	3.76		Yes
Misc.			
Unidentified organic matter	0.83		Yes

Appendix 5 (cont'd)

Set :	27	**Date:**	7/27	**Set :**	28	**Date:**	7/28
Transect :	4	**Strata:**	1	**Transect :**	0	**Strata:**	1
Stat area:	125	**Sub area:**	5	**Stat area:**	125	**Sub area:**	5
	Start		**Finish**		**Start**		**Finish**
Time:	17:0		17:39	**Time:**	6:39		7:12
Depth:	480		598	**Depth:**	550		530
Latitude:	49 15.645		49 14.576	**Latitude:**	48 59.335		49 0.365
Longitude	127 8.886		127 6.517	**Longitude**	126 50.278		126 52.141
Direction:	122	**Duration**	39	**Direction:**	300	**Duration**	33
Distance:	2.6	**Speed:**	3.90	**Distance:**	1.6	**Speed:**	2.90

Species	**Weight(Kg)**	**N**	**Estimate**
Crab			
Chionoecetes tanneri	1.50		-
Shrimp			
Pasiphaea pacifica	8.37		Yes
Eualus macrophthalmus	0.11		Yes
Pandalus montagui tridens	Trace		-
Mollusc			
Berryteuthis magister	4.00		-
Gastropoda	0.10		-
Gonatus	Trace		-
Echinoderm			
Ophiurae	0.48		Yes
Asteroidea	0.10		-
Groundfish			
Microstomus pacificus	64.40		-
Albatrossia pectoralis	44.80		-
Anoplopoma fimbria	41.00		-
Apristurus brunneus	38.00		-
Raja rhina	12.70		-
Sebastolobus alascanus	12.20		-
Sebastolobus altivelis	4.20		-
Lycodes diapterus	2.80		-
Antimora microlepis	2.50		-
Merluccius productus	1.70	3	-
Bothrocara brunneum	1.00	1	-
Errex zachirus	0.90	2	-
Embassichthys bathybius	0.60	1	-
Careproctus melanurus	0.30		-
Bathyagonus nigripinnis	Trace	1	-
Coryphaenoides acrolepis	Trace	2	-
Bathypelagic Fish			
Stenobrachius leucopsarus	0.50		-
Myctophidae	0.11		Yes
Chauliodus macouni	0.10		-
Nemichthyidae	Trace	1	-
Sagamichthys abei	Trace	1	-
Tactostoma macropus	Trace		-
Other Inverts.			
Scyphozoa	1.21		Yes
Actiniaria	0.45		-
Aphrodita	Trace		-
Misc.			
Unidentified organic matter	1.09		Yes

Species	**Weight(Kg)**	**N**	**Estimate**
Crab			
Chionoecetes tanneri	1.00	1	-
Shrimp			
Pasiphaea pacifica	3.64		Yes
Eualus macrophthalmus	0.29		Yes
Sergestes similis	0.06		Yes
Mollusc			
Gastropoda	0.30		-
Echinoderm			
Ophiurae	0.29		Yes
Echinacea	0.06		Yes
Holothuroidea	0.06		Yes
Groundfish			
Anoplopoma fimbria	81.30		-
Sebastolobus altivelis	12.90		-
Raja rhina	11.90		-
Sebastolobus alascanus	7.90		-
Antimora microlepis	4.90		-
Lycodes diapterus	2.60		-
Albatrossia pectoralis	2.60		-
Apristurus brunneus	1.00		-
Merluccius productus	0.50		-
Coryphaenoides acrolepis	0.30		-
Careproctus melanurus	Trace		-
Bathypelagic Fish			
Stenobrachius leucopsarus	1.80		-
Chauliodus macouni	Trace		-
Scopelosaurus harryi	Trace		-
Tarletonbeania crenularis	Trace		-
Nemichthyidae	Trace		-
Notolepis rissoi	Trace		-
Other Inverts.			
Scyphozoa	0.47		Yes
Misc.			
Unidentified organic matter	1.65		Yes
Unknown fish	0.06		Yes

Appendix 5 (cont'd)

Set :	29	**Date:**	7/28	**Set :**	30	**Date:**	7/28
Transect :	0	**Strata:**	2	**Transect :**	0	**Strata:**	3
Stat area:	124	**Sub area:**	2	**Stat area:**	124	**Sub area:**	2
	Start		**Finish**		**Start**		**Finish**
Time:	8:15		8:55	**Time:**	9:56		10:36
Depth:	653		680	**Depth:**	756		742
Latitude:	48 59.684		48 58.578	**Latitude:**	48 58.231		48 59.346
Longitude	126 53.261		126 51.052	**Longitude**	126 52.504		126 54.704
Direction:	126	**Duration**	40	**Direction:**	310	**Duration**	40
Distance:	1.7	**Speed:**	2.50	**Distance:**	1.9	**Speed:**	2.80

Species	Weight(Kg)	N	Estimate
Crab			
Chionoecetes tanneri	5.30		-
Shrimp			
Eualus macrophthalmus	1.20		Yes
Pasiphaea pacifica	0.56		Yes
Notostomus japonicus	Trace	4	-
Mollusc			
Gastropoda	0.80		-
Echinoderm			
Ophiurae	0.07		Yes
Groundfish			
Anoplopoma fimbria	169.70		-
Microstomus pacificus	31.80		-
Sebastolobus altivelis	24.10		-
Sebastolobus alascanus	24.10		-
Antimora microlepis	13.10		-
Coryphaenoides acrolepis	5.70		-
Lycodes diapterus	5.40		-
Raja rhina	5.10		-
Apristurus brunneus	3.80		-
Albatrossia pectoralis	2.90		-
Eptatretus deani	0.20		-
Bathypelagic Fish			
Stenobrachius leucopsarus	1.10		-
Bathylagus milleri	0.42		-
Chauliodus macouni	0.30		-
Notolepis rissoi	Trace		-
Nemichthyidae	Trace		-
Other Inverts.			
Scyphozoa	1.48		Yes
Actiniaria	0.07		Yes
Misc.			
Unidentified organic matter	1.41		Yes

Species	Weight(Kg)	N	Estimate
Crab			
Chionoecetes tanneri	11.00	100	-
Shrimp			
Eualus macrophthalmus	0.30		-
Hymenodora frontalis	Trace		-
Notostomus japonicus	Trace		-
Mollusc			
Gastropoda	Trace		-
Echinoderm			
Ophiurae	0.30		-
Asteroidea	0.20		-
Groundfish			
Anoplopoma fimbria	111.60		-
Sebastolobus altivelis	84.80		-
Sebastolobus alascanus	36.50		-
Coryphaenoides acrolepis	11.90		-
Antimora microlepis	9.10		-
Microstomus pacificus	8.60		-
Albatrossia pectoralis	4.20		-
Lycodes diapterus	3.70		-
Apristurus brunneus	1.40		-
Eptatretus deani	0.80		-
Merluccius productus	0.70		-
Bathyagonus nigripinnis	0.10		-
Lycodapus fierasfer	Trace		-
Careproctus melanurus	Trace		-
Bathypelagic Fish			
Bathylagus milleri	1.50		-
Chauliodus macouni	0.90		-
Tactostoma macropus	0.30		-
Stenobrachius leucopsarus	Trace		-
Oneirodidae	Trace		-
Tarletonbeania crenularis	Trace		-
Benthalbella dentata	Trace		-
Sagamichthys abei	Trace		-
Argyropelecus sladeni	Trace		-
Nemichthyidae	Trace		-
Other Inverts.			
Scyphozoa	0.73		-

Appendix 5 (cont'd)

Set :	31	**Date:**	7/28	**Set :**	32	**Date:**	7/28
Transect :	0	**Strata:**	4	**Transect :**	0	**Strata:**	5
Stat area:	124	**Sub area:**	2	**Stat area:**	124	**Sub area:**	2
	Start		**Finish**		**Start**		**Finish**
Time:	12:31		13:15	**Time:**	14:38		15:23
Depth:	905		920	**Depth:**	1022		1044
Latitude:	48 58.721		48 57.485	**Latitude:**	48 56.306		48 57.713
Longitude	126 57.699		126 56.519	**Longitude**	126 58.001		126 58.591
Direction:	147	**Duration**	44	**Direction:**	342	**Duration**	45
Distance:	1.5	**Speed:**	2.00	**Distance:**	1.4	**Speed:**	1.80

Species	**Weight(Kg)**	**N**	**Estimate**
Crab			
Chionoecetes tanneri	11.64		-
Mollusc			
Cephalopoda	0.16		-
Echinoderm			
Asteroidea	0.70		-
Groundfish			
Sebastolobus altivelis	118.90		-
Sebastolobus alascanus	27.40		-
Anoplopoma fimbria	27.30		-
Coryphaenoides acrolepis	20.00		-
Albatrossia pectoralis	6.60		-
Embassichthys bathybius	3.40		-
Antimora microlepis	3.30		-
Eptatretus deani	3.00		-
Bothrocara brunneum	2.00		-
Apristurus brunneus	1.34		-
Talismania bifurcata	1.22		-
Microstomus pacificus	1.00		-
Lycodes diapterus	1.00		-
Alepocephalidae	0.50		-
Lycodapus fierasfer	0.10		-
Careproctus melanurus	0.10		-
Derepodichthys alepidotus	0.07		-
Bathypelagic Fish			
Stenobrachius leucopsarus	1.75		-
Bathylagus milleri	0.80		-
Chauliodus macouni	0.60		-
Tactostoma macropus	0.35		-
Nemichthyidae	0.12		-
Benthalbella dentata	0.10		-
Scopelosaurus harryi	0.06		-
Nanensia candida	Trace		-
Tarletonbeania crenularis	Trace		-
Melamphaidae	Trace		-
Argyropelecus sladeni	Trace		-

Species	**Weight(Kg)**	**N**	**Estimate**
Crab			
Chionoecetes tanneri	9.90		-
Mollusc			
Gastropoda	0.30		-
Gonatus	Trace		-
Echinoderm			
Asteroidea	1.40		-
Holothuroidea	0.20		-
Groundfish			
Sebastolobus altivelis	138.00		-
Anoplopoma fimbria	33.60		-
Albatrossia pectoralis	28.20		-
Sebastolobus alascanus	18.00		-
Coryphaenoides acrolepis	17.40		-
Bothrocara brunneum	11.70		-
Embassichthys bathybius	7.20		-
Antimora microlepis	2.70		-
Lycenchelys crotalina	2.50		-
Eptatretus deani	2.20		-
Alepocephalidae	1.40		-
Talismania bifurcata	0.40		-
Careproctus melanurus	0.20		-
Lycodapus fierasfer	0.05	3	-
Bathypelagic Fish			
Stenobrachius leucopsarus	0.30		-
Bathylagus milleri	0.30		-
Chauliodus macouni	0.20		-
Nemichthyidae	Trace		-
Tactostoma macropus	Trace	6	-
Poromitra crassiceps	Trace	4	-
Other Inverts.			
Actiniaria	2.20		-

Appendix 5 (cont'd)

Set :	33	**Date:**	7/29	**Set :**	34	**Date:**	7/29
Transect :	7	**Strata:**	5	**Transect :**	7	**Strata:**	3
Stat area:	124	**Sub area:**	2	**Stat area:**	126	**Sub area:**	2
	Start		**Finish**		**Start**		**Finish**
Time:	7:51		8:12	**Time:**	9:28		9:32
Depth:	983		829	**Depth:**	753		753
Latitude:	49 35.179		49 34.449	**Latitude:**	49 35.332		49 35.6
Longitude	127 42.928		127 42.299	**Longitude**	127 41.744		127 41
Direction:	153	**Duration**	21	**Direction:**	0	**Duration**	4
Distance:	1.8	**Speed:**	2.30	**Distance:**	0.0	**Speed:**	0.00

Species	**Weight(Kg)**	**N Estimate**	**Species**	**Weight(Kg)**	**N Estimate**
Crab			**Crab**		
Chionoecetes tanneri	1.80	-	*Chionoecetes tanneri*	0.00	-
Shrimp					
Bentheogennema borealis	Trace	-			
Notostomus japonicus	Trace	-			
Acanthephyra curtirostris	Trace	-			
Eualus macrophthalmus	Trace	-			
Hymenodora frontalis	Trace	-			
Mollusc					
Gastropoda	0.50	-			
Nudibranchiata	Trace	-			
Echinoderm					
Asteroidea	0.90	-			
Holothuroidea	Trace	-			
Groundfish					
Coryphaenoides acrolepis	93.00	-			
Sebastolobus altivelis	78.90	-			
Sebastolobus alascanus	12.40	-			
Anoplopoma fimbria	11.90	-			
Albatrossia pectoralis	8.10	-			
Alepocephalidae	4.60	-			
Antimora microlepis	1.80	-			
Bothrocara brunneum	1.30	-			
Embassichthys bathybius	0.90	-			
Lycodapus fierasfer	0.60	-			
Eptatretus deani	0.50	-			
Merluccius productus	0.50	-			
Lycenchelys crotalina	Trace	-			
Bathypelagic Fish					
Stenobrachius leucopsarus	3.10	-			
Bathylagus milleri	0.50	-			
Chauliodus macouni	0.50	-			
Tactostoma macropus	0.10	-			
Scopelosaurus harryi	0.10	-			
Tarletonbeania crenularis	Trace	-			
Benthalbella dentata	Trace	-			
Bathylagus pacificus	Trace	-			
Nanensia candida	Trace	-			
Nemichthyidae	Trace	-			
Argyropelecus sladeni	Trace	-			
Poromitra crassiceps	Trace	-			
Other Inverts.					
Actiniaria	0.50	-			
Isopoda	Trace	-			

Appendix 6. Species list, and tows in which they occurred, for gastropods and bivalves captured during the 1999 Tanner crab assessment survey off the west coast of Vancouver Island, July 21 – August 3. Not all samples have been processed consequently this is only a partial list.

Species	Tow Number
Bivalves	
Dermatomya tenuiconcha	5,6,15,16,32
Malletia faba	5,6,15,16,32
Nuculana conceptionis	16,23
Vesicomya ovalis	6
Nucula tenuis	16
Delectopecten vancouverensis	20
Idas washingtonius	24
Asheonothaerus (Genus)	32
Gastropods	
Neptunea amianta	2,3,4,5,6,12,14,15,16,18,20,21,23,32,33
Bathybembix bairdii	2,4,5,6,12,14,15,18,19,20, 21,23,33
Colus halli	4,5,15,16,18,20, 32
Mohnia frielei	2,3,4,5,15,18
Buccinium (Genus)	5,6,15,16, 32
Natica clausa	3,6,18,32
Boreotrophon (Genus)	16,32
Fusitriton oregonensis	12
Colus jordani	12
Soleriella nuda	12
Polinices nanus	12
Cancellaria (Genus)	21
Lepeta (Genus)	24

Appendix 7. Fishing locations and catch information from all trap sets from the 1999 Tanner crab survey off the west coast of Vancouver Island. Time is expressed on a 24-hour clock, depths are in meters, latitudes and longitudes are in degrees, decimal-minutes, direction in degrees, duration in minutes and distance and speed in knots and nautical miles. Catch weights are in kilograms, N is the number of animals if counted and Estimate indictes whether the recorded values are estimated from sub-samples or actual. Trace indicates weights less than approximately 0.1 kg or 100 g.

Set	1	**Date**	7/30	**Set**	2	**Date**	7/30
Transect	0	**Strata**	1	**Transect**	0	**Strata**	2
Stat area	125	**Sub area**	5	**Stat area**	125	**Sub area**	5
	Start		**Finish**		**Start**		**Finish**
Time	14:20		9:22	**Time**	16:28		13:3
Depth	525		513	**Depth**	770		700
Latitude	49 7.658		49 6.619	**Latitude**	49 5.957		49 7.58
Longitud	127 0.016		126 59.273	**Longitud**	127 1.215		127 0.016
Duration	19:02	**Distance**	1.0	**Duration**	20:35	**Distance**	1.0
Direction	325			**Direction**	140		

Catch

Species	**Weight(kg**	**N**	**Estimate**
Crab			
Chionoecetes tanneri	72.90	80	-
Mollusc			
Gastropoda		8	-
Echinoderm			
Holothuroidea		9	-
Echinacea		1	-
Other Inverts.			
Actiniaria		2	-

Catch

Species	**Weight(kg**	**N**	**Estimate**
Crab			
Chionoecetes tanneri	88.80	150	-
Mollusc			
Gastropoda		3	-
Echinoderm			
Ophiurae		4	-
Solaster borealis		5	-

Appendix 7 (cont'd)

Set	3	**Date**	7/31	**Set**	4	**Date**	7/31
Transect	0	**Strata**	3	**Transect**	0	**Strata**	4
Stat area	125	**Sub area**	5	**Stat area**	124	**Sub area**	4
	Start		**Finish**		**Start**		**Finish**
Time	11:19		8:52	**Time**	15:0		12:20
Depth	824		829	**Depth**	939		939
Latitude	49 3.176		49 4.012	**Latitude**	49 1.123		49 2.4
Longitud	126 59.968		127 0.491	**Longitud**	126 59.691		127 0.35
Duration	21:33	**Distance**	1.0	**Duration**	21:20	**Distance**	1.0
Direction	330			**Direction**	155		

Catch

Species	**Weight(kg**	**N**	**Estimate**
Crab			
Chionoecetes tanneri	81.77	198	-
Mollusc			
Gastropoda		2	-
Echinoderm			
Ophiurae	0.10		-
Solaster borealis		2	-
Groundfish			
Anoplopoma fimbria	3.20		-

Catch

Species	**Weight(kg**	**N**	**Estimate**
Crab			
Chionoecetes tanneri	100.60	1377	-
Mollusc			
Gastropoda		2	-

Appendix 7 (cont'd)

Set	5	**Date**	8/1	**Set**	6	**Date**	8/1
Transect	0	**Strata**	1	**Transect**	0	**Strata**	6
Stat area	124	**Sub area**	4	**Stat area**	125	**Sub area**	5
	Start		**Finish**		**Start**		**Finish**
Time	11:5		10:20	**Time**	14:40		6:32
Depth	400		400	**Depth**	1370		1360
Latitude	49 2.895		49 2.316	**Latitude**	49 2.323		49 1.354
Longitud	126 53.394		126 52.706	**Longitud**	127 4.659		127 3.563
Duration	23:15	**Distance**	1.0	**Duration**	15:52	**Distance**	
Direction	325			**Direction**			

Catch

Species	**Weight(kg**	**N**	**Estimate**
Crab			
Chionoecetes tanneri	1.30	2	-
Echinoderm			
Ctenodiscus		2	-
Groundfish			
Anoplopoma fimbria	100.30	46	-

Catch

Species	**Weight(kg**	**N**	**Estimate**
Crab			
Chionoecetes	11.81	23	-
Echinoderm			
Euryalae		6	-
Ophiurae		1	-
Ctenodiscus		2	-
Groundfish			
Anoplopoma fimbria	3.50	1	-
Coryphaenoides	0.80	1	-
Other Inverts.			
Scyphozoa		2	-