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DATA RECORD ON TRAWLING AND TRAPPING EFFECTS ON HUMPBACK SHRIMP AND BYCATCH ORGANISMS IN SIMOOM SOUND AND NORTHUMBERLAND CHANNEL, BRITISH COLUMBIA

by

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ABSTRACT

Ong, S., C.D. Levings, T.F. Sutherland, G.E. Piercey, V. Keong, and R. Davis. 2002. Data record on trawling and trapping effects on humpback shrimp and bycatch organisms in Simoom Sound and Northumberland Channel, British Columbia. Can. Data Rep. Fish. Aquat. Sci. 1084: 47 p.

As part of a project investigating possible modification of marine ecosystems by shrimp trawling and trapping, we obtained information on catches of fish, shrimp, prawns, and bycatch organisms as well as weight, sex ratios, egg location and collateral damage to several species of pandalids and eualids. Focusing on the humpback shrimp (*Pandalus hypsinotus*), we assessed damage to the rostrum, carapace, abdomen, and tail fan on specimens caught by beam trawling, otter trawling, and trapping. Data are given from a preliminary study conducted in Northumberland Channel in June 2000 and more comprehensive sampling from Simoom Sound in November 2000 and February 2001.

RÉSUMÉ

Ong, S., C.D. Levings, T.F. Sutherland, G.E. Piercey, V. Keong, and R. Davis. 2002. Data record on trawling and trapping effects on humpback shrimp and bycatch organisms in Simoom Sound and Northumberland Channel, British Columbia. Can. Data Rep. Fish. Aquat. Sci. 1084: 47 p.

Dans le cadre d'un projet d'étude des modifications physiques probables des écosystèmes marins imputables à la pêche des crevettes au chalut et au casier, on a recueilli des données sur les prises de poissons et de crevettes, les prises accessoires, ainsi que le poids, la proportion relative des sexes, l'emplacement des œufs et les dommages collatéraux à plusieurs espèces de Pandalidés et d'Eualidés. On a aussi évalué les dommages causés en particulier à la crevette à front rayé (*Pandalus hypsinotus*), soit au rostre, à la carapace, à l'abdomen et à l'éventail caudal, capturée au chalut à perche, au chalut à panneaux et au casier. Sont aussi incluses dans le présent document des données recueillies dans le cadre d'une étude préliminaire réalisée dans le chenal Northumberland en juin 2000 et d'un échantillonnage plus exhaustif effectué dans le détroit de Simoom en novembre 2000 et en février 2001.

INTRODUCTION

Ocean/habitat managers and conservation groups have concerns regarding the impacts of fishing gear on benthic habitats associated with commercial fisheries. Trawling gear such as doors, rollers, and tickler chains cause physical abrasion to the seabed during the towing process. This disturbance may result in a flattening of the seabed surface, the re-sorting of sediment, the resuspension and flux (horizontal and vertical) of fine sediments, and the release of sediment-bound nutrients or contaminants. There are some specific reports on these sedimentary effects on sandy habitats on continental shelves (e.g. Prena et al. 1999), however, there are very few data (Tuck et al. 1998) from inshore fjord/inlet habitats which are characterised by very different scales of oceanographic and geological processes. In addition to physical and chemical changes, trawling has the potential for collateral damage to by-catch invertebrates (e.g. shrimp (Boutillier and Nguyen 1999), brittlestars (Hansson et al. 2000)) although damage and by-catch of fish can be reduced by the use of extruder panels in trawl nets (Richard 1999). A few studies have also been conducted on the ecological impacts of traps, mostly on the effect of ghost fishing by lost traps (Stevens et al. 2000). There has been some consideration (Smolowitz 1998) of the effects of the ground lines which typically connect multiple traps on the seabed, but no data on this topic were found in the scientific literature.

In June 2000, we initiated the first study of the impact of bottom fishing gear to be conducted in British Columbia. In this data report, we give biological data for a comparison of the collateral damage from otter trawling, beam trawling, and trap fishing. We focused on a simulated fishery for humpback shrimp (*Pandalus hypsinotus*), a species which can be caught by both trawl and trap. Information obtained in our study may be useful in deciding if trawling or trapping is the preferable method of harvesting shrimp in an ecosystem-based management system. One of the aspects of such a system would be to avoid "by-kill" or unwanted fishing mortality of undersized commercial shrimp, as well as non-commercial species.

In a preliminary survey in Northumberland Channel (June, 2000), we developed methods for assessment of trawl damage to shrimp and other invertebrates, assessed by-catch, and in collaboration with CHS (Canadian Hydrographic Service) conducted acoustic benthic surveys to investigate physical change to the seafloor. After consultation with fishers and stock assessors, and in consideration of the overall study design of the project, a relatively undisturbed area on the central coast (Simoom Sound) was chosen as the main study area. Comprehensive field experiments comparing trawling and trapping were conducted in November, 2000 and February, 2001. Three non-overlapping "lines" of benthic habitats, approximately 0.5 km long and at a depth of 60 m, were chosen for this long-term study. Anatomical damage was assessed for both commercial and by-catch shrimp. Physical damage was assessed according to four different regions of the shrimp anatomy: rostrum, carapace, abdomen, and tail fan. Samples of benthic infauna were obtained before and after trawling and trapping in the study area blocks and possible emigration or immigration of epifauna was also documented with video data. These data are reported elsewhere.

FIELD METHODS

NORTHUMBERLAND CHANNEL

June 2000

Beam Trawler A (BTA): Six trawls (BTA1 to BTA6) were sampled in Northumberland Channel on June 21, 2000, at depths ranging between 58 and 82 meters (Figure 1). Tow distances varied between 919 and 1645 meters, for 25 to 50 minutes. Table 1 and Figure 1 indicate the locations, time and length specifications of each of the six trawls. The coordinates on figure 1 were plotted on Nobeltec's Visual Navigation Suite 5.0. For all trawls, except BTA6, dGPS points were plotted every two minutes, using a hand-held Trimble ProXR. For BTA6, due to missing data points, 29 seconds separate mark 1 and 2; 6:25 separate mark 2 and 3. Table 2 and Figure 2 show a diagram of the net and its dimensions.

Once the trawls were hauled on board, catch and bycatch species were identified, counted and weighed. The different shrimp species were retained and frozen in labelled Ziploc freezer bags. The other invertebrates and fish were released once identified, counted and weighed. Species were weighed to the nearest 0.1 kg, using a KiloTech scale (Model AM 1004). Tables 3 and 4 show the catch results.

Otter Trawler A (OTA): At stations close to those used by the Beam Trawler A trawls, seven otter trawls (OTA1 to OTA8) were conducted in Northumberland Channel on June 27 and 28, 2000. The catch from haul 2 was not analyzed as the net hung up on logs. Depths of trawl lines ranged from 57 to 118 meters, while tow lengths ranged from 276 to 1215 meters, for 9 to 18 minutes. A description and diagram of the trawl tracks are shown in Table 1 and Figure 3. The OTA dGPS points were plotted, on a Trimble ProXR, every minute for all trawls except OTA8. For this trawl, due to missing data points, 36 seconds separate mark 1 and 2; 1:25 separates 2 and 3; 1:25 separates 6 and 7; 4:37 separates 8 and 9; 1:43 separates 9 and 10. See Table 2 and Figure 4 for net dimensions.

The catches were sorted by species, where this could be quickly accomplished, and counts and weights were taken. Identifiable fish and invertebrates, except for bycatch shrimp, were released. Unidentifiable specimens were put in Ziploc freezer bags and frozen for later identification in the laboratory. Tubs were used to determine a volume to weight to number relationship for each species because of the quantity of easily identifiable shrimp obtained in the catches, and time constraints for analysis of each tow. Counts and weights were extrapolated for each of the species based on these ratios. However, for OTA7 coonstripe (*Pandalus danae*) shrimp, an equivalent ratio was not determined; therefore, the volume to number to weight ratio from a similar-sized species, the sidestripe shrimp (*Pandalopsis dispar*), was used in order to extrapolate the coonstripe number and weight. Otter Trawler A catch data are presented in Tables 5 and 6. Results from a subsample of the bycatch shrimp identified in the lab can be found in Table 7.

SIMOOM SOUND

November 2000

Otter Trawler B (OTB): Six trawls (OTB1-1 to OTB3-2) were conducted on November 14, 2000 in Simoom Sound. On each of three trawl lines two replicate tows were made. Depths ranged between 55 and 68 m. Tow distances varied between 643 and 677 m, with tow times 10 to 13 minutes long. A map of the six trawls, along with their specifications can be found in Figure 5 and Table 1. Except for OTB1-1, which was plotted every two minutes, the positions were plotted every minute using dGPS readings with a 36 Furuno Navigator. Table 2 and Figure 6 present the vessel and net details.

Catches were sorted by species, and counts and weights were recorded to the nearest 0.1 kg. Individuals of each species were counted and weighed in bulk (if there was more than one individual). However, because some fish and invertebrates were caught in large quantities, a weight to number relationship was determined for them by counting and weighing just a subsample; additional counts and weights were then extrapolated. Fish and most of the shrimp were not kept; a subsample of approximately 300 pink shrimp (*Pandalus borealis eous*), and all humpback shrimp (*P. hypsinotus*), from each trawl, were frozen in labelled Ziploc freezer bags for later analysis in the lab. Care was taken to keep specimens flat to minimize damage due to handling. The results from the trawl sampling are presented in Tables 8 and 9.

Trap Vessel A (TPA): Shrimp were collected by traps set by Trap Vessel A, which was also used for otter trawling during the November 2000 investigation. About 40 traps were set on a single line within each of three lines (558 to 660 m long; depth range 62 to 75 m). An additional 20 traps were set outside each of the experimental lines, as the length of the groundrope for the trap gear exceeded the length of the lines. A lead anchor was set out when the end of the line was reached. Three trap lines were laid down twice over two days on November 15 and 16, 2000, and remained submerged for approximately 6 hours, during the day, and 17 hours overnight. Traps were baited with handfuls of cut-up herring and shiner perch, which were collected on site from the trawling experiments, and salmon fish feed pellets. The dimensions of the traps were 76.2 x 30.5 x 71.1 cm, with a stretch mesh size averaging 45.3 mm. Each trap weighed about 3 lbs (1.4 kg). The groundline rope size was $5/16^{th}$ in. (0.8 cm) hardened polyprope and was equipped with rock anchors (est. 9 kg) to hold the marker buoys.

The locations of each trap line in Simoom Sound are shown in Figures 7 and 8.

Upon retrieval, the shrimp catches were identified to species, where possible. Other fish and invertebrates were identified, counted, and released. All shrimp species were counted and weighed, then frozen on board in labelled Ziploc freezer bags. Because of space constraints, the humpback shrimp and prawns from overnight trap lines 2 and 3, however, were limited to ten individuals frozen for later analysis in the lab. Care was taken to keep specimens flat and handling damage was minimized. Shrimp from each trap were placed into separate marked bags by species. Weights were obtained using a KiloTech scale (Model AM 1004) to the nearest 0.1 kg. Species names and codes for caught fauna are given in Table 10. Soak times, trap line lengths

and depths can be found in Table 11. The results of the trapping are presented in Tables 12, 13, 14 and 15.

February 2001

Beam Trawler B (BTB): Six trawls were completed with Beam Trawler B in Simoom Sound, February 22, 2001. Two replicate tows were completed in each of three lines. Trawls were made at depths between 46 and 58 m, for 14 to 17 minutes each. Tow lengths varied between 539 and 690 m. The trawl tracks are presented in Figure 9, with data pertaining to length, times, depths and directions in Table 1. The trawl tracks were plotted using dGPS readings every minute from a hand-held Trimble ProXR. See Figure 10 and Table 2 for a diagram of the beam trawl net and data on its dimensions.

Trawl catches were sorted by species, then counted and weighed to the nearest 0.1 kg for fish, and to the nearest 1 g for invertebrates. Up to 40 specimens of each of the five shrimp species were frozen in labelled Ziploc freezer bags for later analysis in the lab, while additional individuals were released. Any unidentifiable fish were also frozen for later identification back at the laboratory. Results are reported in Tables 16 and 17. It should be noted that the throat of the trawl net from each of the six trawls held a portion of the catch that was unretrievable. These contents were approximated for counts, and weights calculated based on regression analysis.

LAB METHODS

GENERAL BIOLOGICAL OBSERVATIONS

Simoom Sound

Shrimp from Simoom Sound trawls and traps were carefully unfrozen for 1-5 hours (depending on shrimp quantity in bag), and weight, length, sex and damage of each individual was measured. The weight of individual shrimp was recorded to the nearest 0.1 g, using a Mettler PL3000 electronic balance. Because of the quantity of shrimp obtained in the trap samples, only ten individuals of the humpback shrimp from the 2nd and 3rd overnight trap lines were kept. For this reason, a ratio between number of males, females with eggs in the abdomen, females with eggs in the head, females with no eggs, and their corresponding average weights was determined to extrapolate the additional humpback shrimp and their weights (See Table 14 for traps with "*", and Table 12 for corresponding weights. Example: 2 ON 50* humpback shrimp weigh 358.8 g. Weight is based on 10 kept specimens, plus 20 extrapolated specimens).

Due to time constraints, not all shrimp samples from the traps were thawed and analyzed, but all specimens were checked to confirm identification. Individual weights, lengths and genders were not determined. As a consequence, the weights for these individuals (see Table 14 for traps with "^") are based on the same humpback shrimp relationship used above, and the equivalent sex to weight ratios for the other shrimp species. For instance, the weight of the prawns from traps with "^" are based on the sex to weight ratio of all the thawed prawns from the traps).

On thawed shrimp, lengths were recorded to the nearest millimetre, using manual or electronic vernier calipers. Carapace length, from the posterior-most part of the orbit to the posterior middorsal margin, and total length, from the tip of the rostrum to the tip of the telson, were measured. After obtaining the total lengths for approximately 100 humpback shrimp individuals of both sexes, the relationship between carapace length and total length was determined. A regression line and equation were obtained and used to extrapolate the total length of subsequent individuals (females n=94, r^2=0.90; males n=79, r^2=0.92) (Figure 11). Several humpback shrimp individuals from the Beam Trawler B hauls were in a transitional stage, from male to female phases; their total lengths were calculated based on the male carapace length to total length relationship.

Sexing was accomplished by noting the presence of eggs in the head or abdomen, or by examination of the endopods of the second pleopods. In males, an appendix masculina and an appendix interna branch off from the endopods. Females, however, lack the former process and have only the appendix interna branching from the endopod. In the transitional stage, the appendix masculina of the second pleopod has degenerated in size and lost most of its spicules. The locations for sex determination are given in Figure 12.

Northumberland Channel

A proportion of the shrimp found in the bycatch subsamples from Otter Trawler A were unfrozen and observed for species identification, counts and weights. Time constraints did not allow for all shrimp to be examined.

DAMAGE ASSESSMENT

Simoom Sound

A table was constructed to delineate the principle body parts in the four major regions of the shrimp body, as shown in Butler (1980). The body parts chosen for damage analysis were those that would likely be required for the survival of a shrimp if it were to be released. Each body part was given a score from 0 to 1.0, with zero being a missing body part, and 1.0 representing a fully intact body part, with interim scores representing varying levels of damage. Table 18 describes the codes and damage scores used for each of the body regions. A figure depicting the particular body parts and their accompanying functions are presented in Figure 12 and Table 19. It should be noted that, due to time constraints, the majority of the damage scores were keyed directly into the tables on the computer (i.e. there are no rough data sheets).

Up to twenty humpback shrimp from each of the Otter Trawler B and Beam Trawler B hauls conducted in Simoom Sound were analyzed for damage, according to the four major body regions: the rostrum, carapace, abdomen and tail fan (high resolution damage description) (see Table 18). A few individuals of other shrimp species found in the beam trawls were also analyzed for damage according to the same methods. A list of the common and scientific names with codes for shrimp from both the traps and trawls is provided in Table 20. Additional humpback shrimp and other species caught by otter and beam trawls were observed only for length, weight, sex and egg location. Results are presented in Tables 21 to 25.

The shrimp species caught by trap from the six trap lines set in Simoom Sound were analyzed for damage according to the same scoring method used for the trawls (Table 18). Except for trap line 2, the humpback shrimp analyzed for damage came from at least ten of the traps that were located within the trap lines, and some of the traps extending outside of the experimental lines. The shrimp collected from every trap located within trap line 2 were examined. The shrimp from all the remaining traps, within and out of the experimental lines, were solely identified to determine counts.

From each trap analyzed, six humpback shrimp were examined; three for physical damage to the rostrum, carapace, abdomen and tailfan (high resolution damage description), and three for damage to all regions except the abdomen (low resolution damage description). The other shrimp species (*Pandalus borealis eous, P. platyceros, Eualus suckleyi*) were assessed for damage at high resolution, but because of time constraints some of the individuals were examined only for length, weight, sex and egg location. Tables 26 to 28 show the trap results.

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Table 1: Lengths, times, depths and directions of trawling in Northumberland Channel and Simoom Sound.

Trawl Code	Date(s)	Start Position	Stop Position	Length (m)	Time Period (min)	Actual Time (PST)	Depth Range (m)	Direction of Tow (°Mag)
BTA1	21 Jun 00	49 08.815 N, 123 50.441 W	49 08.533 N, 123 49.872 W	1053	25	07:50 - 08:15	58 - 76	128
BTA2	21 Jun 00	49 08.779 N, 123 50.388 W	49 08.582 N, 123 49.862 W	1289	34	09:11 - 09:45	60 - 73	121
BTA3	21 Jun 00	49 08.798 N, 123 50.452 W	49 08.518 N, 123 49.877 W	1527	36	10:31 - 11:07	61 - 74	127
BTA4	21 Jun 00	49 08.544 N, 123 49.994 W	49 08.853 N, 123 50.641 W	1645	50	12:00 - 12:50	59 - 75	307
BTA5	21 Jun 00	49 08.650 N, 123 50.153 W	49 08.853 N, 123 50.669 W	941	34	14:13 - 14:47	71 - 79	301
BTA6	21 Jun 00	49 08.679 N, 123 50.097W	49 08.910 N, 123 50.750 W	919	42	15:45 - 16:27	63 - 82	295
OTA1	27 Jun 00	49 09.361 N, 123 51.789 W	49 09.014 N, 123 51.299 W	881	16	09:47 - 10:03	105 - 118	137
OTA3	27 Jun 00	49 09.214 N, 123 51.580 W	49 09.024 N, 123 51.259 W	526	9	12:56 - 13:05	102 - 112	132
OTA4	27 Jun 00	49 09.257 N, 123 51.560 W	49 09.366 N, 123 51.704 W	276	5	15:23 - 15:28	104 - 104	317
OTA5	27 Jun 00	49 09.337 N, 123 51.761 W	49 09.003 N, 123 51.260W	869	13	15:52 - 16:05	104 - 118	137
OTA6	28 Jun 00	49 08.753 N, 123 50.007 W	49 08.632 N, 123 49.587 W	601	9	08:17 - 08:26	57 - 60	113
OTA7	28 Jun 00	49 08.707 N, 123 50.188 W	49 08.484 N, 123 49.465 W	972	15	09:14 - 09:29	59 - 67	115
OTA8	28 Jun 00	49 08.777 N, 123 50.430 W	49 08.499 N, 123 49.523 W	1215	18	10:43 - 11:01	64 - 71	115
OTB1-1	14 Nov 00	50 51.152 N, 126 29.407 W	50 50.986 N, 126 28.921 W	693	10	08:52 - 09:02	58 - 62	118
OTB1-2	14 Nov 00	50 51.146 N, 126 29.433 W	50 50.991 N, 126 28.931 W	654	10	10:10 - 10:20	58 - 62	116
OTB2-1	14 Nov 00	50 51.076 N, 126 29.460 W	50 50.936 N, 126 28.961 W	652	12	11:36 - 11:48	56 - 66	114
OTB2-2	14 Nov 00	50 51.079 N, 126 29.463 W	50 50.929 N, 126 28.940 W	674	12	13:30 - 13:42	58 - 66	114
OTB3-1	14 Nov 00	50 51.008 N, 126 29.520 W	50 50.861 N, 126 28.990 W	678	13	14:30 - 14:43	56 - 68	114
OTB3-2	14 Nov 00	50 51.001 N, 126 29.500 W	50 50.863 N, 126 28.995 W	644	12	15:26 - 15:38	56 - 66	113
BTB1-1	22 Feb 01	50 51.345 N, 126 29.906 W	50 51.233 N, 126 29.518 W	513	15	10:13 - 10:28	52 - 57	114
BTB1-2	22 Feb 01	50 51.368 N, 126 29.928 W	50 51.214 N, 126 29.528 W	557	16	11:46 - 12:02	53 - 58	121
BTB2-1	22 Feb 01	50 51.317 N, 126 29.969 W	50 51.169 N, 126 29.557 W	560	16	13:48 - 14:04	51 -57	120
BTB2-2	22 Feb 01	50 51.338 N, 126 29.995 W	50 51.180 N, 126 29.557 W	610	16	15:02 - 15:18	50 - 56	120
BTB3-1	22 Feb 01	50 51.244 N, 126 30.081 W	50 51.073 N, 126 29.622 W	676	17	16:04 - 16:21	47 - 55	120
BTB3-2	22 Feb 01	50 51.260 N, 126 30.030 W	50 51.072 N, 126 29.627 W	660	17	17:09 - 17:26	46 - 53	127

Table 2: Data on trawling vessels and gear used

Vessel Name	Boat Len (m)	Horse-power	Headline/ Footrope (m)	Net Len (m)	Wt of Trawl Doors (kg)	Bridle Len (m)	Beam Len (m)	Mesh Size of Net (mm)*	Tickler Chain	Comments, Extruder Type
BTA	10.4	210	14.5 / 15.4	30.5	n/a	16.8	14.3	1.5"(5)	n/a	Soft type 14' long, 3.2' high
OTA	16.8	171	17.7 / 17.7	38.2	318	27.4	n/a	1.5"(5)	yes	Rigid type 25' long, 4-5' high
OTB, TPA	15.2	220	23.8 / 30.5	36.8	303 ea	27.4	n/a	T:6"(1)/3"(2)/ 1.5"(3) B:3"(4)/1.5" (3)	no	Rigid type 25' long, 4-5' high
BTB	11.0	185	14.0 / 16.5	26.5	n/a	22.0	14.0	T and B: 1.5"(3)/1.75" (2)	n/a	Rigid type 23.5' long, 5' high

* Numbers in brackets refer to number of sections with the particular mesh size, starting with the front section of the net.
T indicates top side of net; B indicates bottom

Table 3: Counts of fish and invertebrates caught by Beam Trawler A, Northumberland Channel, June 21, 2000. (- indicates not caught. The jellyfish counts in hauls 1,2, 3 and 4 are estimates)

		BTA1	BTA2	BTA3	BTA4	BTA5	BTA6
Common Name	Species	Haul 1	Haul 2	Haul 3	Haul 4	Haul 5	Haul 6
Shrimp							
Sidestripe	*Pandalopsis dispar*	-	-	-	10	1	4
Coonstripe	*Pandalus danae*	-	-	1	5	6	-
Smooth pink	*Pandalus jordani*	34	10	14	25	23	3
Prawn	*Pandalus platyceros*	25	38	109	396	383	163
Yellow-leg pandalid	*Pandalus tridens*	-	-	3	2	3	-
Horned	*Paracrangon echinata*	-	-	1	-	-	-
Crabs							
Redclaw	*Chorilia longipes*	-	-	-	-	1	-
Decorator	*Oregonia gracilis*	-	-	-	-	1	-
Dungeness	*Cancer magister*	-	-	-	1	1	-
Graceful kelp	*Pugettia gracilis*	-	-	-	-	1	-
Squat lobster	*Munida quadrispina*	-	-	-	-	-	3
Flatfish							
Pacific Sanddab	*Citharichthys sordidus*	-	-	1	1	-	-
English Sole	*Pleuronectes vetulus*	-	-	-	2	6	-
Rex Sole	*Errex zachirus*	-	-	-	1	6	-
Rock Sole	*Pleuronectes bilineatus*	-	-	-	1	-	-
Slender Sole	*Eopsetta exilis*	-	-	-	12	10	-
Selachii							
Dogfish	*Squalus acanthias*	-	-	-	-	-	5
Spotted Ratfish	*Hydrolagus colliei*	4	-	8	153	64	6
Roundfish							
Pacific Herring	*Clupea pallasi*	-	-	-	-	-	2
Plainfin Midshipman	*Porichthys notatus*	1	-	1	-	1	-
Walleye Pollock	*Theragra chalcogramma*	-	-	-	18	2	-
Padded Sculpin	*Artedius fenestralis*	-	1	-	-	-	-
Threadfin Sculpin	*Icelinus filamentosus*	1	-	-	1	-	-
Threespine Stickleback	*Gasterosteus aculeatus*	-	-	3	-	-	-
Sturgeon Poacher	*Agonus acipenserinus*	-	-	-	3	2	1
Pacific Tomcod	*Microgadus proximus*	-	-	-	-	-	2
Rockfish							
Greenstriped	*Sebastes elongatus*	-	-	-	3	2	-
Quillback	*Sebastes maliger*	-	-	-	1	-	-
Invertebrates		-	-	-	-	-	-
Jellyfish	*Scyphozoa*	30	5	5	10	-	-
Hydroid	*Hydrozoa*	1	-	-	-	some	-
Mottled seastar	*Evasterias troschelii*	-	-	-	-	1	-
Tunicate	*Styela*	-	-	1	-	-	-
Bryozoan	Gymnolaemata	-	-	some	some	-	-
Stubby Squid	*Rossia pacifica*	-	-	1	8	1	-
	Totals	96	54	148	653	515	189

Table 4: Weight of fish and invertebrates caught by Beam Trawler A, Northumberland Channel, June 21, 2000 (kg). (- indicates not caught. *indicates weight obtained by extrapolating from average weights in other tows. For species with weights <0.1, not enough information was available for estimation. n.w. indicates weight not obtained)

		BTA1	BTA2	BTA3	BTA4	BTA5	BTA6
Common Name	Species	Haul 1	Haul 2	Haul 3	Haul 4	Haul 5	Haul 6
Shrimp							
Sidestripe	*Pandalopsis dispar*	-	-	-	0.2	<0.1	0.1*
Coonstripe	*Pandalus danae*	-	-	<0.1	0.2	<0.1	-
Smooth pink	*Pandalus jordani*	0.2	0.1*	0.3	0.2	0.3	0.0*
Prawn	*Pandalus platyceros*	1.0	1.3	3.3	8.5	10.7	3.5
Yellow-leg pandalid	*Pandalus tridens*	-	-	<0.1	<0.1	<0.1	-
Horned	*Paracrangon echinata*	-	-	<0.1	-	-	-
Crabs							
Redclaw	*Chorilia longipes*	-	-	-	-	<0.1	-
Decorator	*Oregonia gracilis*	-	-	-	-	<0.1	-
Dungeness	*Cancer magister*	-	-	-	0.5	0.5	-
Graceful kelp	*Pugettia gracilis*	-	-	-	-	<0.1	-
Squat lobster	*Munida quadrispina*	-	-	-	-	-	<0.1
Flatfish							
Pacific Sanddab	*Citharichthys sordidus*	-	-	<0.1	0.3	-	-
English Sole	*Pleuronectes vetulus*	-	-	-	0.1	0.7	-
Rex Sole	*Errex zachirus*	-	-	-	0.1	0.4	-
Rock Sole	*Pleuronectes bilineatus*	-	-	-	0.1	-	-
Slender Sole	*Eopsetta exilis*	-	-	-	0.8	0.5	-
Selachii							
Dogfish	*Squalus acanthias*	-	-	-	-	-	3.6
Spotted Ratfish	*Hydrolagus colliei*	0.4	-	0.8	21.1	6.4	1.8
Roundfish							
Pacific Herring	*Clupea pallasi*	-	-	-	-	-	0.3
Plainfin Midshipman	*Porichthys notatus*	<0.1	-	<0.1	-	<0.1	-
Walleye Pollock	*Theragra chalcogramma*	-	-	-	1.0	<0.1	-
Padded Sculpin	*Artedius fenestralis*	-	n.w.	-	-	-	-
Threadfin Sculpin	*Icelinus filamentosus*	<0.1	-	-	<0.1	-	-
Threespine Stickleback	*Gasterosteus aculeatus*	-	-	<0.1	-	-	-
Sturgeon Poacher	*Agonus acipenserinus*	-	-	-	1.0	<0.1	<0.1
Pacific Tomcod	*Microgadus proximus*	-	-	-	-	-	<0.1
Rockfish							
Greenstriped	*Sebastes elongatus*	-	-	-	0.5	0.4	-
Quillback	*Sebastes maliger*	-	-	-	0.2	-	-
Invertebrates		-					
Jellyfish	Scyphozoa	n.w.	n.w.	n.w.	n.w.	-	-
Hydroid	Hydrozoa	n.w.	-	-	-	n.w.	-
Mottled seastar	*Evasterias troschelii*	-	-	-	-	<0.1	-
Tunicate	*Styela*	-	-	n.w.	-	-	-
Bryozoan	Gymnolaemata	-	-	n.w.	n.w.	-	-
Stubby Squid	*Rossia pacifica*	-	-	<0.1	0.4	<0.1	-
	Totals	1.6	1.5	4.4	35.2	19.9	9.3

Table 5: Counts of fish and invertebrates caught by Otter Trawler A, Northumberland Channel, June 27-28, 2000, excluding non-commercial shrimp by-catch given in Table 7. (n.s. indicates no sample. Haul 2 not analyzed. [1] Partial catch; log caught in net. - indicates not caught. The 5 ribbon worms in OTA7 are an estimate.)

		OTA1	OTA2	OTA3	OTA4	OTA5	OTA6	OTA7	OTA8[1]
Common Name	Species	Haul 1	Haul 2	Haul 3	Haul 4	Haul 5	Haul 6	Haul 7	Haul 8

Data can be found on a diskette 1 at the back of this report, pages 48-49.

Table 6: Weight (kg) of fish and invertebrates caught by Otter Trawler A, Northumberland Channel, June 27-28, 2000, excluding non-commercial shrimp bycatch given in Table 7. (n.s. indicates no sample. Haul 2 not analyzed. [1]Partial catch; log caught in net. - indicates not caught. n.w. indicates weight not obtained)

		OTA1	OTA2	OTA3	OTA4	OTA5	OTA6	OTA7	OTA8[1]
Common Name	Species	Haul 1	Haul 2	Haul 3	Haul 4	Haul 5	Haul 6	Haul 7	Haul 8

Data can be found on a diskette 1 at the back of this report, pages 50-51.

Table 7: A proportion of shrimp found in bycatch subsamples from Otter Trawler A, Northumberland Channel, June 27-28, 2000. (- indicates not caught)

		OTA1	OTA3	OTA4	OTA5	OTA6	OTA7	OTA8
Common Name	Scientific Name	Haul 1	Haul 3	Haul 4	Haul 5	Haul 6	Haul 7	Haul 8
Common two-spined crangon	*Crangon communis*	110	91	28	-	-	10	1
Beaked eualid	*Eualus avinus*	-	1	2	2	-	-	-
Deepsea eualid	*E. binguis*	-	-	-	-	-	1	1
Short-scaled eualid	*E. suckleyi*	-	3	-	1	-	-	-
Stiletto coastal shrimp	*Heptacarpus stylus*	1	-	-	-	-	-	-
Slender coastal	*H. tenuissimus*	-	-	-	-	-	1	-
Three-spined coastal	*H. tridens*	1	-	-	-	-	2	-
Sidestripe	*Pandalopsis dispar*	7	1	-	1	-	-	-
Horned	*Paracrangon echinata*	-	-	-	-	-	8	-
Humpback	*Pandalus hypsinotus*	2	-	-	-	-	-	1
Smooth pink	*P. jordani*	1	2	1	-	-	1	-
Rough patch shrimp	*P. stenolepis*	-	-	-	-	-	8	-
Yellow-leg pandalid	*P. tridens*	1	2	-	4	-	-	-
Slender-bladed	*Spirontocaris holmesi*	86	79	9	102	-	1	-
Dana's bladed	*S. lamellicornis*	1	-	-	-	-	-	2
Snyder's bladed	*S. snyderi*	-	-	1	-	-	-	-
	Pandalus sp.	-	-	-	-	-	2	-
	unidentifiable	-	-	-	-	-	1	-
	Totals	210	179	41	110	0	35	5

Table 8: Counts of fish and invertebrates caught in by Otter Trawler B, Simoom Sound, November 14, 2000. (- indicates not caught)

		OTB1-1	OTB1-2	OTB2-1	OTB2-2	OTB3-1	OTB3-2
Common Name	Species	Haul 1	Haul 2	Haul 3	Haul 4	Haul 5	Haul 6
Shrimp							
Humpback	*Pandalus hypsinotus*	7	67	103	28	19	22
Spiny pink	*Pandalus borealis eous*	3980	5657	8708	5130	4841	8216
Common two-spined crangon	*Crangon communis*	1	-	-	1	1	1
Flatfish							
Flathead Sole	*Hippoglossoides elassodon*	-	1	-	-	-	1
Roundfish							
Pacific Herring	*Clupea pallasi*	285	133	275	250	99	333
Walleye Pollock	*Theragra chalcogramma*	2	1	2	-	-	-
Prickleback	Stichaeidae	-	1		-	-	-
Shiner Perch	*Cymatogaster aggregata*	57	153	478	29	13	137
Pacific Tomcod	*Microgadus proximus*	-	1	1	-	-	-
Sandlance	*Ammodytes hexapterus*	1	8	-	-	-	-
Invertebrates							
Squid	*Loligo opalescens*	1	1	-	-	-	-
Flatworm	Turbellaria	-	-	-	-	-	1
	Totals	4334	6023	9567	5438	4973	8711

Table 9: Weight (kg) of fish and invertebrates caught by Otter Trawler B, Simoom Sound, November 14, 2000. (- indicates not caught. n.w. indicates weight not obtained)

		OTB1-1	OTB1-2	OTB2-1	OTB2-2	OTB3-1	OTB3-2
Common Name	Species	Haul 1	Haul 2	Haul 3	Haul 4	Haul 5	Haul 6
Shrimp							
Humpback	*Pandalus hypsinotus*	0.1	0.4	0.7	0.4	0.2	0.2
Spiny pink	*Pandalus borealis eous*	12.9	16.5	31.1	17.1	13.4	23.4
Common two-spined crangon	*Crangon communis*	<0.1	-	-	<0.1	<0.1	<0.1
Flatfish							
Flathead Sole	*Hippoglossoides elassodon*	-	<0.1	-	-	-	<0.1
Roundfish							
Pacific Herring	*Clupea pallasi*	3.4	1.5	3.3	3	1.1	3.7
Walleye Pollock	*Theragra chalcogramma*	<0.1	<0.1	<0.1	-	-	-
Prickleback	Stichaeidae	-	<0.1	-	-	-	-
Shiner Perch	*Cymatogaster aggregata*	1	2.9	8.3	0.4	0.2	2.1
Pacific Tomcod	*Microgadus proximus*	-	<0.1	<0.1	-	-	-
Sandlance	*Ammodytes hexapterus*	<0.1	<0.1	-	-	-	-
Invertebrates							
Squid	*Loligo opalescens*	<0.1	<0.1	-	-	-	-
Flatworm	Turbellaria (class)	-	-	-	-	-	n.w.
	Totals	17.5	21.3	43.4	20.9	14.9	29.4

Table 10: Common and scientific names and species codes for fish and invertebrates in Tables 12 to 15.

Group	Common Name	Scientific Name	Species Code
INVERTEBRATES	Spiny pink Shrimp	*Pandalus borealis eous*	PBO
	Humpback Shrimp	*P. hypsinotus*	PHY
	Prawn	*P. platyceros*	PPL
	Short-scaled Eualid	*Eualus suckleyi*	ESU
	Commom two-spined crangon	*Crangon communis*	CCO
	Dungeness Crab	*Cancer magister*	DC
	Decorator Crab	Majidae (Family)	DE
	Hermit Crab	Paguridae (Family)	HC
	Red Rock Crab	*Cancer productus*	RC
	Spider Crab	Majidae (Family)	SC
	Squat Lobster	*Munida quadrispina*	SL
	Tanner Crab	*Chionoecetes bairdi*	TC
	Polychaete	Polychaeta (Class)	PO
	Sunflower Star	*Pycnopodia helianthoides*	PY
	Vermilion Star	*Mediaster aequalis*	VS
FISH	Black Cod	*Anoplopoma fimbria*	BC
	Cabezon	*Scorpaenichthys marmoratus*	CB
	Flathead Sole	*Hippoglossoides elassodon*	FS
	Quillback Rockfish	*Sebastes maliger*	QR
	Shiner Perch	*Cymatogaster aggregata*	SP
	Staghorn Sculpin	*Leptocottus armatus*	SS
	Wolfeel	*Anarrhichthys ocellatus*	WE
	Dwarf Wrymouth	*Lyconectes aleutensis*	WR

Table 11: Dates, soak times, lengths and depths of trap sampling in Simoom Sound. (ON indicates overnight trap lines. The lat/long coordinates were determined with dGPS)

Trap Line	Date(s)	Start Position	Stop Position	Length (m)	Soak Time (hrs)	Actual Time (PST)	Depth Range (m)
1	15 Nov 00	50 50.983 N, 126 28.879 W	50 50.859 N, 126 28.396 W	610	6:09	08:01 - 14:10	62.2
2	15 Nov 00	50 50.931 N, 126 28.953 W	50 50.791 N, 126 28.435 W	660	6:26	09:14 - 15:40	62.2 - 65.1
3	15 Nov 00	50 50.729 N, 126 28.521 W	50 50.849 N, 126 28.969 W	574	6:46	10:29 - 17:15	64.1 - 73.2
1 ON	15-16 Nov 00	50 50.981 N, 126 28.870 W	50 50.859 N, 126 28.385 W	611	17:15	15:13 - 08:28	64.1 - 65.9
2 ON	15-16 Nov 00	50 50.921 N, 126 28.916 W	50 50.785 N, 126 28.411 W	643	17:25	16:36 - 10:01	64.1 - 67.7
3 ON	15-16 Nov 00	50 50.734 N, 126 28.520 W	50 50.845 N, 126 28.963 W	558	17:34	18:11 - 11:45	65.9 - 75.0

Table 12: Counts of fish and invertebrates from Trap Vessel A samples, Simoom Sound, Nov 15-16, 2000. (Refer to Table 10 for species names. - indicates not caught. ON indicates overnight traps)

	Species Code																					
Trap	PHY	PPL	PBO	ESU	CCO	DC	DE	HC	RC	SC	SL	TC	PO	PY	VS	BC	CB	FS	QR	SP	SS	WE	WR

Data can be found on a diskette 1 at the back of this report, pages 52-60.

Table 13: Summary of totals of counts of fish and invertebrates from Trap Vessel A samples, Simoom Sound, November 15-16, 2000. "Within" refers to traps located within the experimental lines. "Outside" refers to traps located out of the experimental lines. (Refer to Table 1 for species names)

Trap	No. of	Species Code																					
Line	Traps	PHY	PPL	PBO	ESU	CCO	DC	DE	HC	RC	SC	SL	TC	PO	PY	VS	BC	CB	FS	QR	SP	SS	WE	WR
1																								
Within	39	406	1	2	1	0	1	2	0	0	0	0	1	0	1	0	1	0	0	0	4	1	1	1
Outside	22	159	14	0	0	0	14	10	0	1	0	0	0	0	5	0	0	0	0	0	0	0	0	0
1 ON																								
Within	42	691	8	4	110	1	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	1	0	3
Outside	20	119	44	0	3	0	10	9	0	0	5	0	7	0	1	0	0	0	0	0	0	0	0	0
2																								
Within	27	561	0	8	7	0	0	0	0	0	0	0	0	0	1	0	1	1	0	0	1	0	0	0
Outside	33	152	170	0	0	0	3	41	0	3	0	1	0	0	2	1	0	0	0	4	0	0	0	0
2 ON																								
Within	41	656	32	17	356	0	0	0	0	0	0	0	1	0	2	0	0	0	0	0	0	0	0	3
Outside	22	32	230	1	3	0	1	12	3	1	25	0	0	0	4	0	0	0	0	0	0	0	0	0
3																								
Within	34	612	9	16	20	0	0	0	0	0	0	0	0	0	2	0	1	0	0	0	2	0	0	0
Outside	26	121	192	2	0	0	3	15	1	1	1	0	0	0	2	0	0	0	0	0	0	0	0	1
3 ON																								
Within	35	431	12	9	327	0	0	0	0	0	1	0	0	0	3	0	1	0	1	0	2	0	0	1
Outside	27	448	13	3	189	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0

Table 14: Weight (g) of shrimp from Trap Vessel A samples, Simoom Sound, November, 15-16, 2000. (- indicates not caught. ON indicates overnight traps. Traps with ^ and * are estimates; see Lab Methods. There is no trap 1-35)

	Species Code				
Trap	PHY	PPL	PBO	ESU	Total

Data can be found on a diskette 1 at the back of this report, pages 61-69.

Table 15: Summary of shrimp weights (kg) from Trap Vessel A samples, Simoom Sound, November 15-16, 2000. "Within line" refers to traps located within the experimental lines. "Out of line" refers to traps located out of the experimental lines. (Refer to Table 1 for species names)

Trap Line	No. of traps	PHY	PPL	PBO	ESU	Total
1						
Within line	39	4.5	0.0	0.0	0.0	4.5
Out of line	22	1.8	0.4	-	-	2.1
1 ON						
Within line	42	8.2	0.2	0.0	0.2	8.5
Out of line	20	1.7	1.2	-	0.0	2.9
2						
Within line	27	6.9	-	0.0	0.0	7.0
Out of line	33	1.7	4.6	-	-	6.3
2 ON						
Within line	41	7.5	0.9	0.1	0.6	9.0
Out of line	22	0.4	6.3	-	-	6.6
3						
Within line	34	7.2	0.2	0.1	0.0	7.6
Out of line	26	1.3	5.2	0.0	0.0	6.5
3 ON						
Within line	35	5.3	0.3	0.0	0.5	6.3
Out of line	27	5.0	0.3	0.0	0.3	5.6

Table 16: Counts of fish and invertebrates caught by Beam Trawler B, Simoom Sound, February 22, 2001. (* indicates estimates of total because some specimens were caught in the throat of the net. - indicates not caught)

		BTB1-1	BTB1-2	BTB2-1	BTB2-2	BTB3-1	BTB3-2
Common Name	Species	Haul 1	Haul 2	Haul 3	Haul 4	Haul 5	Haul 6
Shrimp							
Humpback	*Pandalus hypsinotus*	93*	405*	336	517*	544*	855*
Spiny pink	*Pandalus borealis eous*	101*	154	4	3	10	7
Common two-spined crangon	*Crangon communis*	29	58*	33	31	14	26
Ridged crangon	*Crangon dalli*	1	-	-	-	-	-
Short-scaled eualid	*Eualus suckleyi*	1	-	-	-	-	-
Flatfish							
English Sole	*Pleuronectes vetulus*	-	-	1	-	-	1
Flathead sole	*Hippoglossoides elassodon*	16	11	32	19	38	38
Rock Sole	*Pleuronectes bilineatus*	-	-	1	-	1	1
Arrowtooth Flounder	*Atheresthes stomias*	-	-	-	-	-	1
Selachii							
Spiny Dogfish	*Squalus acanthias*	-	-	-	-	1	-
Spotted Ratfish	*Hydrolagus colliei*	10	13	8	4	10	7
Longnose Skate	*Raja rhina*	-	-	-	-	-	1
Roundfish							
Blackbelly Eelpout	*Lycodopsis pacifica*	1	-	1	1	-	2
Lingcod	*Ophiodon elongatus*	1	-	-	-	-	-
Walleye Pollock	*Theragra chalcogramma*	-	1	3		-	-
Shiner Perch	*Cymatogaster aggregata*	1	9	32	25	7	7
Showy Snailfish	*Liparis pulchellus*	-	-	1	-	-	-
Northern Smoothtongue	*Leuroglossus schmidti*	-	-	-	1	-	-
Invertebrates							
Clams	Bivalvia	-	-	-	-	1	2
Stubby Squid	*Rossia pacifica*	-	-	-	-	-	1
	Totals	254	651	452	601	626	949

Table 17: Weight of fish and invertebrates caught by Beam Trawler B, Simoom Sound, February 22, 2001; in kg. (*Weights are based on those counts that are estimates in Table 16. - indicates not caught. n.w. indicates weight not obtained)

		BTB1-1	BTB1-2	BTB2-1	BTB2-2	BTB3-1	BTB3-2
Common Name	Species	Haul 1	Haul 2	Haul 3	Haul 4	Haul 5	Haul 6
Shrimp							
Humpback	*Pandalus hypsinotus*	0.6*	3.2*	2.3	3.3*	3.7*	6.3*
Spiny pink	*Pandalus borealis eous*	0.2*	0.2	<0.1	<0.1	<0.1	<0.1
Common two-spined crangon	*Crangon communis*	0.1	0.1*	0.1	0.1	<0.1	0.1
Ridged crangon	*Crangon dalli*	<0.1	-	-	-	-	-
Short-scaled eualid	*Eualus suckleyi*	<0.1	-	-	-	-	-
Flatfish							
English Sole	*Pleuronectes vetulus*	-	-	0.1	-	-	<0.1
Flathead sole	*Hippoglossoides elassodon*	1.1*	0.2*	0.5	0.4	0.8	1.1
Rock Sole	*Pleuronectes bilineatus*	-	-	0.3	-	0.2	0.2
Arrowtooth Flounder	*Atheresthes stomias*	-	-	-	-	-	0.1
Selachii							
Spiny Dogfish	*Squalus acanthias*	-	-	-	-	1.8	-
Spotted Ratfish	*Hydrolagus colliei*	5.8*	7.1	4.8	2.5	6.6	4.8
Longnose Skate	*Raja rhina*	-	-	-	-	-	1.8
Roundfish							
Blackbelly Eelpout	*Lycodopsis pacifica*	<0.1	-	<0.1	<0.1	-	<0.1
Lingcod	*Ophiodon elongatus*	n.w	-	-	-	-	-
Walleye Pollock	*Theragra chalcogramma*	-	<0.1	0.1	-	-	-
Shiner Perch	*Cymatogaster aggregata*	n.w.	0.1	0.2	0.2	0.1	<0.1
Showy Snailfish	*Liparis pulchellus*	-	-	0.1	-	-	-
Northern Smoothtongue	*Leuroglossus schmidti*	-	-	-	<0.1	-	-
Invertebrates		-					
Clams	Bivalvia	-	-	-	-	n.w.	<0.1
Stubby Squid	*Rossia pacifica*	-	-	-	-	-	n.w.
	Totals	7.8	10.8	8.4	6.5	13.3	14.4

Table 18: Shrimp codes and accompanying scores for damage regions categorized in Tables 21, 23 and 26.

Region	Code	Body Part	Damage Score
Rostrum	R1	rostrum	0=completely broken off 0.5=some damage 1.0=intact
	R2	eye stalk and cornea (R)	0=completely broken off 0.5=some damage 1.0=intact
	R3	eye stalk and cornea (L)	0=completely broken off 0.5=some damage 1.0=intact
	R4	antennae 1 (L)	0=completely broken off 0.5=some damage 1.0=intact
	R5	antennae 1 (R)	0=completely broken off 0.5=some damage 1.0=intact
	R6	antennae 2 (L)	0=completely broken off 0.5=some damage 1.0=intact
	R7	antennae 2 (R)	0=completely broken off 0.5=some damage 1.0=intact
	R8	antennal scale (L)	0=completely broken off 0.5=some damage 1.0=intact
	R9	antennal scale (R)	0=completely broken off 0.5=some damage 1.0=intact
Carapace	C1	3rd maxilliped (L)	0=completely broken off 0.5=some damage 1.0=intact
	C2	3rd maxilliped (R)	0=completely broken off 0.5=some damage 1.0=intact
	C3	pereiopod I (L)	The following scores apply to all pereiopods:
	C4	pereiopod I (R)	0=broken off below (bob) coxa 0.1=bob basis
	C5	pereiopod II (L)	0.2=bob ischium 0.3=bob merus 0.4=bob carpus
	C6	pereiopod II (R)	0.5=bob propodus 0.6=damaged chela
	C7	pereiopod III (L)	0.7=broken off chela 0.8=broken off exopod
	C8	pereiopod III (R)	0.9=broken off epipod 1.0=intact
	C9	pereiopod IV (L)	"
	C10	pereiopod IV (R)	"
	C11	pereiopod V (L)	"
	C12	pereiopod V (R)	"
	C13	carapace itself	0.5=some damage 1.0=intact
Abdomen	A1	somites I-VI	0.5=some damage 1.0=intact
	A2	pleurons I-V	0.5=some damage 1.0=intact
	A3	pleopods I (L and R)	0.5=some damage 1.0=intact
	A4	pleopods II (L and R)	0.5=some damage 1.0=intact
	A5	pleopods III (L and R)	0.5=some damage 1.0=intact
	A6	pleopods IV (L and R)	0.5=some damage 1.0=intact
	A7	pleopods V (L and R)	0.5=some damage 1.0=intact
Tail Fan	T1	telson	0=completely broken off 0.5=some damage 1.0=intact
	T2	uropods (L)	0=both broken off 0.5=some damage 1.0=intact
	T3	uropods (R)	0=both broken off 0.5=some damage 1.0=intact

Table 19: Functions of body parts chosen for analysis in damage assessment of trap, otter and beam trawl shrimp caught in Simoom Sound. From Butler (1980) and Jensen (1995).

Region	Body Part	Function
Rostrum	Rostrum	The 'head spine' that helps deter small predators.
	Antennae 1 (antennules)	Detect waterborne smells.
	Antennae 2	For touch and to detect approaching predators.
	Antennal scales	Provide stability while swimming.
Carapace	3rd Maxilliped	Holds food while pieces are pulled off with claws; used when sparring with other shrimps.
	Pereiopod I	If chelate, it is used to catch small prey.
	Pereiopod II	Chelate leg with articulated carpus for grooming and retrieving scraps of food.
	Pereiopods III to V	Walking legs. Pereiopod V may have brushes used for grooming and cleaning eggs.
Abdomen	Abdomen (somites and pleurons)	With tail fan, the strong muscles are used for fast backward swimming (in escape response).
	Pleopods	For forward swimming, and to brood eggs.
Tail Fan	Telson	Bears the anus. Involved in backward swimming.
	Uropods	Involved in backward swimming.

Table 20: Common and scientific names and species codes of shrimp analyzed for damage in Tables 21 to 28.

Family	Common Name	Scientific Name	Species Code
PANDALIDAE	Spiny Pink Shrimp	*Pandalus borealis eous*	PBO
	Humpback Shrimp	*P. hypsinotus*	PHY
	Prawn	*P. platyceros*	PPL
CRANGONIDAE	Common Two-spined Crangon	*Crangon communis*	CCO
	Ridged Crangon	*C. dalli*	CDI
HIPPOLYTIDAE	Short-scaled Eualid	*Eualus suckleyi*	ESU

Table 21: Length, weight, sex and damage scores of up to twenty humpback shrimp caught in each haul by Otter Trawler B, Simoom Sound, November 14, 2000. (* indicates total length was obtained by extrapolation using a total length to carapace length regression relationship. See Figure 11. - indicates specimen analyzed at low resolution i.e. abdomen not analyzed)

Haul			Total					Rostrum Damage									Carapace Damage													Abdomen Damage							Tail Fan Damage		
OTB	Species	Carapace Len (mm)	Len (mm)	Wt (g)	Sex	Eggs	Egg Location	R1	R2	R3	R4	R5	R6	R7	R8	R9	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13	A1	A2	A3	A4	A5	A6	A7	T1	T2	T3

Data can be found on a diskette 1 at the back of this report, pages 70-72.

Table 22: Length, weight, sex and egg location of humpback shrimp not analyzed for damage caught by Otter Trawler B, Simoom Sound, November 14, 2000.

Trawl OTB	Carapace Len (mm)	Wt (g)	Sex	Eggs	Egg Location

Data can be found on a diskette 1 at the back of this report, pages 73-76.

Table 23: Length, weight, sex and damage scores of twenty humpback shrimp caught in each haul by Beam Trawler B, Simoom Sound, February 22, 2001. (* indicates total length was obtained by extrapolation using a total length to carapace length regression relationship. See Figure 11. - indicates specimen analyzed at low resolution i.e. abdomen not analyzed for damage. U indicates length undeterminable due to damage.)

								Rostrum Damage									Carapace Damage													Abdomen Damage							Tail Fan Damage		
Haul BTB	Species	Carapace Len (mm)	Total Len (mm)	Wt (g)	Sex	Eggs	Egg Location	R1	R2	R3	R4	R5	R6	R7	R8	R9	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13	A1	A2	A3	A4	A5	A6	A7	T1	T2	T3

Data can be found on a diskette 1 at the back of this report, pages 77-80.

Table 24: Length, weight, sex and egg location of humpback shrimp not analyzed for damage caught by Beam Trawler B, Simoom Sound, February 22, 2001. (* indicates total length obtained by extrapolation using a total length to carapace length regression relationship. See Figure 11. - indicates data undeterminable as either rostrum or telson and uropods broken.)

Trawl BTB	Carapace Len (mm)	Total Len (mm)	Wt (g)	Sex	Eggs	Egg Location, Comments
1 - 1	23.8	114.8*	8.8	F	Y	abdomen
1 - 1	23.2	112.2*	9.0	F	Y	abdomen
1 - 1	27.8	132.4*	16.9	F	Y	abdomen
1 - 1	26.4	126.2*	15.3	F	Y	abdomen
1 - 1	22.8	110.4*	8.7	F	Y	abdomen
1 - 1	22.7	110.0*	8.5	F	Y	abdomen
1 - 1	23.7	114.4*	10.2	F	Y	abdomen
1 - 1	22.5	111.2*	7.0	T	n/a	n/a
1 - 1	-	-	5.1	T	n/a	n/a, damaged carapace
1 - 1	17.7	88.7*	3.9	T	n/a	n/a, damaged carapace
1 - 1	15.9	80.2*	2.5	T	n/a	n/a
1 - 1	14.7	74.6*	2.5	T	n/a	n/a
1 - 1	15.1	76.5*	2.3	T	n/a	n/a
1 - 1	-	-	4.7	T	n/a	n/a, damaged carapace & abdomen

Table 25: Length, weight, sex and egg location of shrimp species not analyzed for damage caught by Beam Trawler B, Simoom Sound, February 22, 2001. (- indicates length undeterminable as either rostrum or telson and uropods broken.)

Trawl BTB	Species	Carapace Len (mm)	Total Len (mm)	Wt (g)	Sex	Eggs	Egg Location, Comments
1 - 1	PBO	14.6	-	1.8	F	N	n/a, rostrum tip missing
1 - 1	PBO	14.6	81.0	1.9	F	N	n/a
1 - 1	PBO	14.8	76.2	2.1	F	N	n/a
1 - 1	PBO	13.9	73.1	1.6	F	N	n/a
1 - 1	PBO	9.7	54.2	0.6	F	N	n/a
1 - 1	PBO	9.8	58.7	0.6	F	N	n/a
1 - 1	PBO	13.9	72.2	1.4	F	N	n/a
1 - 1	PBO	10.1	55.4	0.6	F	N	n/a
1 - 1	PBO	15.9	83.5	2.2	F	N	n/a
1 - 1	PBO	15.2	81.6	2.0	F	N	n/a
1 - 1	PBO	13.4	76.1	1.5	F	N	n/a
1 - 1	PBO	14.3	-	1.8	F	N	n/a, rostrum tip missing
1 - 1	PBO	13.3	76.9	1.3	F	N	n/a
1 - 1	PBO	14.6	74.7	1.9	F	N	n/a
1 - 1	PBO	14.9	80.7	2.0	F	N	n/a
1 - 1	PBO	14.7	75.5	1.7	F	N	n/a
1 - 1	PBO	15.2	82.9	2.2	F	N	n/a
1 - 1	PBO	13.8	75.2	1.4	F	N	n/a
1 - 1	PBO	14.1	73.2	1.6	F	N	n/a
1 - 1	PBO	14.5	77.9	1.8	F	N	n/a
1 - 1	CCO	9.6	46.9	1.1	F	Y	abdomen
1 - 1	CCO	10.0	48.5	1.3	F	Y	abdomen
1 - 1	CCO	8.7	41.1	0.7	F	N	n/a
1 - 1	CCO	9.8	46.8	1.2	F	Y	abdomen
1 - 1	CCO	12.2	57.2	1.9	F	N	n/a
1 - 1	CCO	13.7	64.1	2.6	F	Y	abdomen
1 - 1	CCO	9.7	47.2	1.0	F	N	n/a
1 - 1	CCO	13.8	64.5	2.6	F	N	n/a
1 - 1	CCO	9.9	46.0	0.9	F	N	n/a
1 - 1	CCO	13.4	64.8	2.9	F	Y	abdomen
1 - 1	CCO	10.5	50.8	1.2	F	N	n/a
1 - 1	CCO	10.9	52.9	1.8	F	Y	abdomen
1 - 1	CCO	9.1	43.9	0.8	F	N	n/a
1 - 1	CCO	12.2	58.2	2.2	F	Y	abdomen
1 - 1	CCO	13.8	63.8	2.6	F	N	n/a
1 - 1	CCO	10.4	48.4	1.1	F	N	n/a
1 - 1	CCO	12.1	56.3	1.7	F	N	n/a
1 - 1	CCO	12.1	56.0	1.9	F	N	n/a
1 - 1	CCO	10.3	50.4	1.3	F	Y	abdomen
1 - 1	CCO	12.2	56.6	1.8	F	N	n/a
1 - 1	CCO	11.2	53.0	1.5	F	Y	abdomen

Table 26: Length, weight, sex and damage scores of shrimp caught by Trap Vessel A on trap lines 1-3, Simoom Sound, November 15-16, 2000. (* indicates total length obtained by extrapolation using a total length to carapace length regression relationship. See Figure 11. - indicates specimen analyzed at low resolution i.e. abdomen not analyzed. U indicates length undeterminable due to damage.)

								Rostrum Damage									Carapace Damage													Abdomen Damage							Tail Fan Damage		
Trap	Species	Carapace Len (mm)	Total Len (mm)	Wt (g)	Sex	Eggs	Egg Location	R1	R2	R3	R4	R5	R6	R7	R8	R9	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13	A1	A2	A3	A4	A5	A6	A7	T1	T2	T3

Data can be found on a diskette 2 at the back of this report, pages 81-102.

Table 27: Length, weight, sex and egg location of humpback shrimp not analyzed for damage caught by Trap Vessel A, Simoom Sound, November 15-16, 2000. (* indicates total length obtained by extrapolation using a total length to carapace length regression relationship. See Figure 11. - indicates data not obtained.)

Trap	Carapace Length (mm)	Total Length (mm)	Wt (g)	Sex	Eggs	Egg Location

Data can be found on a diskette 1 at the back of this report, pages 103-121.

Table 28: Length, weight, sex and egg location of shrimp species not analyzed for damage caught by Trap Vessel A, Simoom Sound, November 15-16, 2000. (- indicates data undeterminable as either rostrum or telson and uropods broken off.)

Trap	Species	Carapace Len (mm)	Total Len (mm)	Wt (g)	Sex	Eggs	Egg Location, Comments

Data can be found on a diskette 1 at the back of this report, pages 122-124.

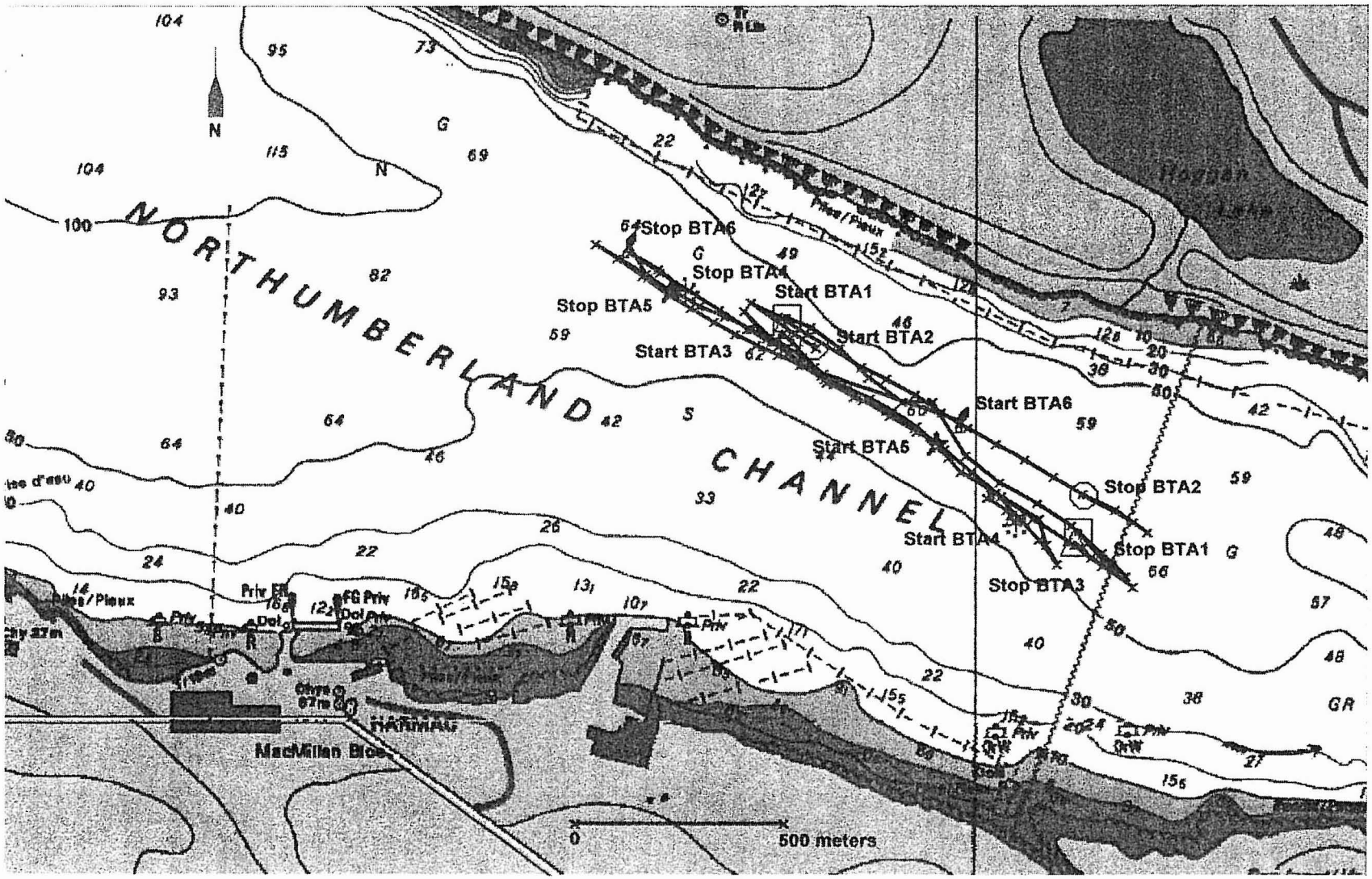


Fig. 1. Map of Northumberland Channel and the six beam trawls made by Beam Trawler A (BTA), June 21, 2000. Start position is where towing started. Stop position is where the net lifted off the bottom. Position of "Stop BTA2" is 49 08.582 N, 123 49.862 W. Direction of arrow is magnetic north. Base map from CHS Chart 3463.

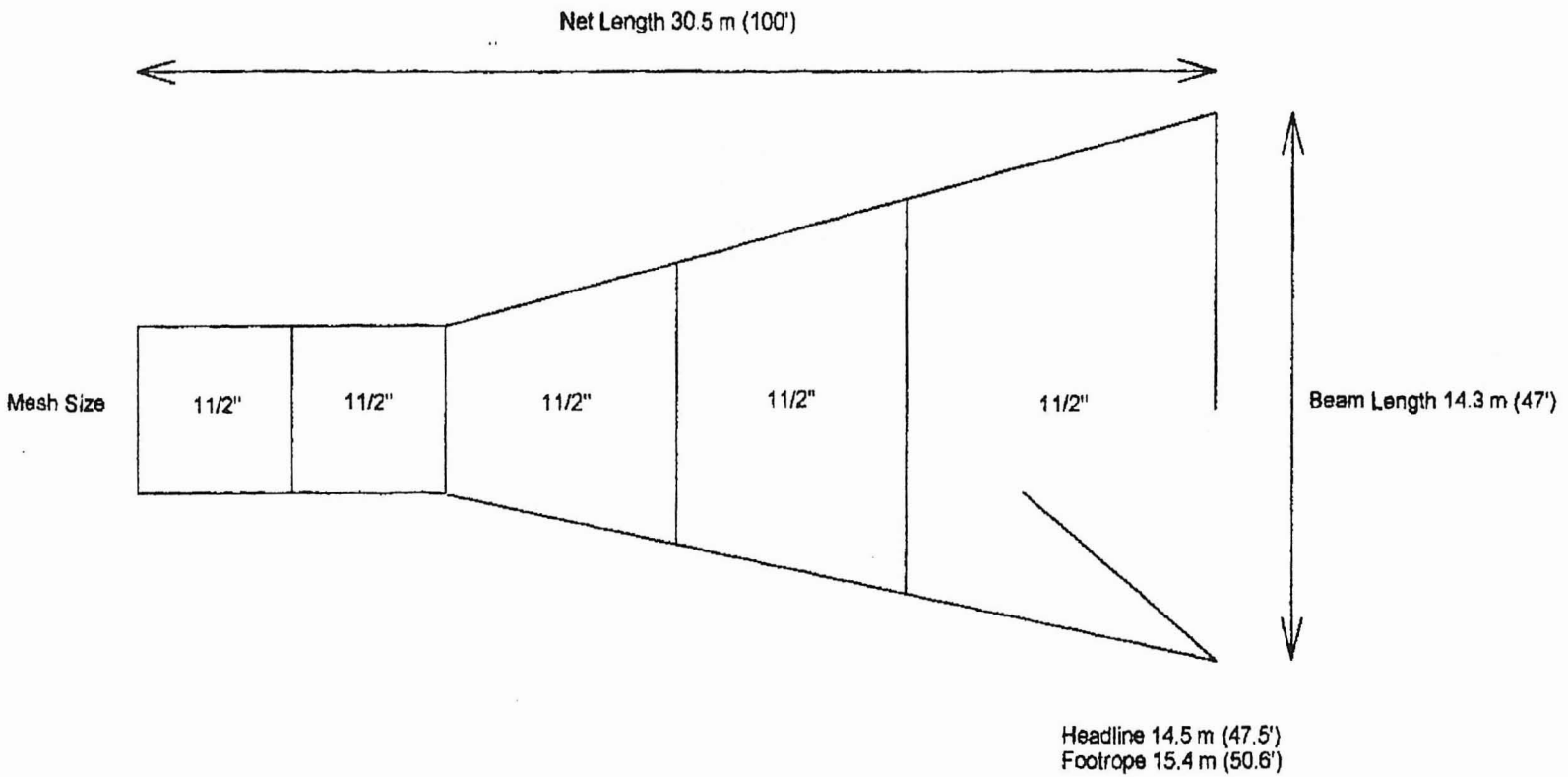


Fig. 2. Plan for beam trawl used on Beam Trawler A

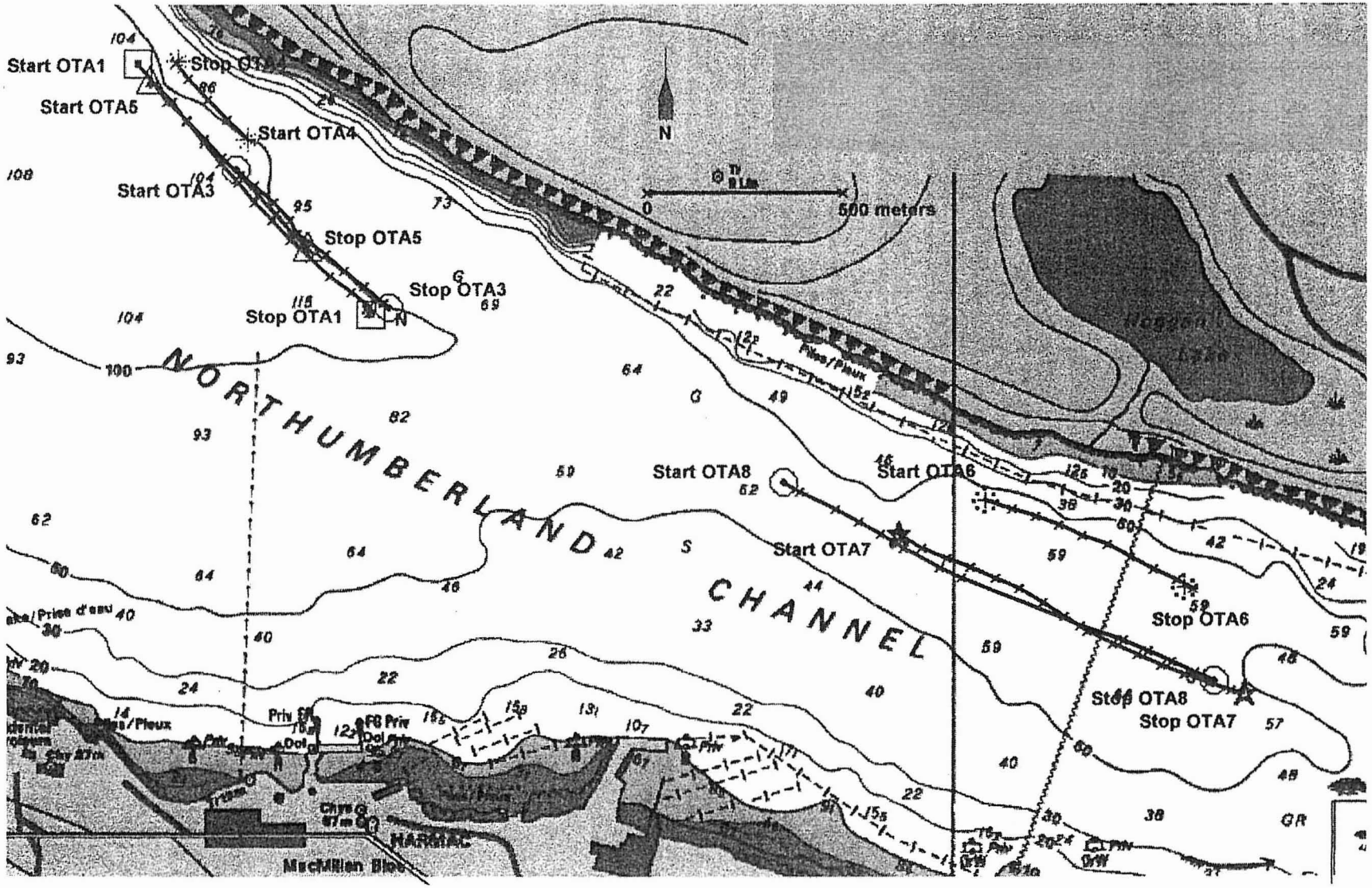


Fig. 3. Map of Northumberland Channel and the seven otter trawls made by Otter Trawler A (OTA), June 27 and 28, 2000. Start position is where towing started. Stop position is where the net lifted off the bottom. Position of "Start OTA1" is 49 09.361 N, 123 51.789 W. Direction of arrow is magnetic north. Base map from CHS Chart 3463.

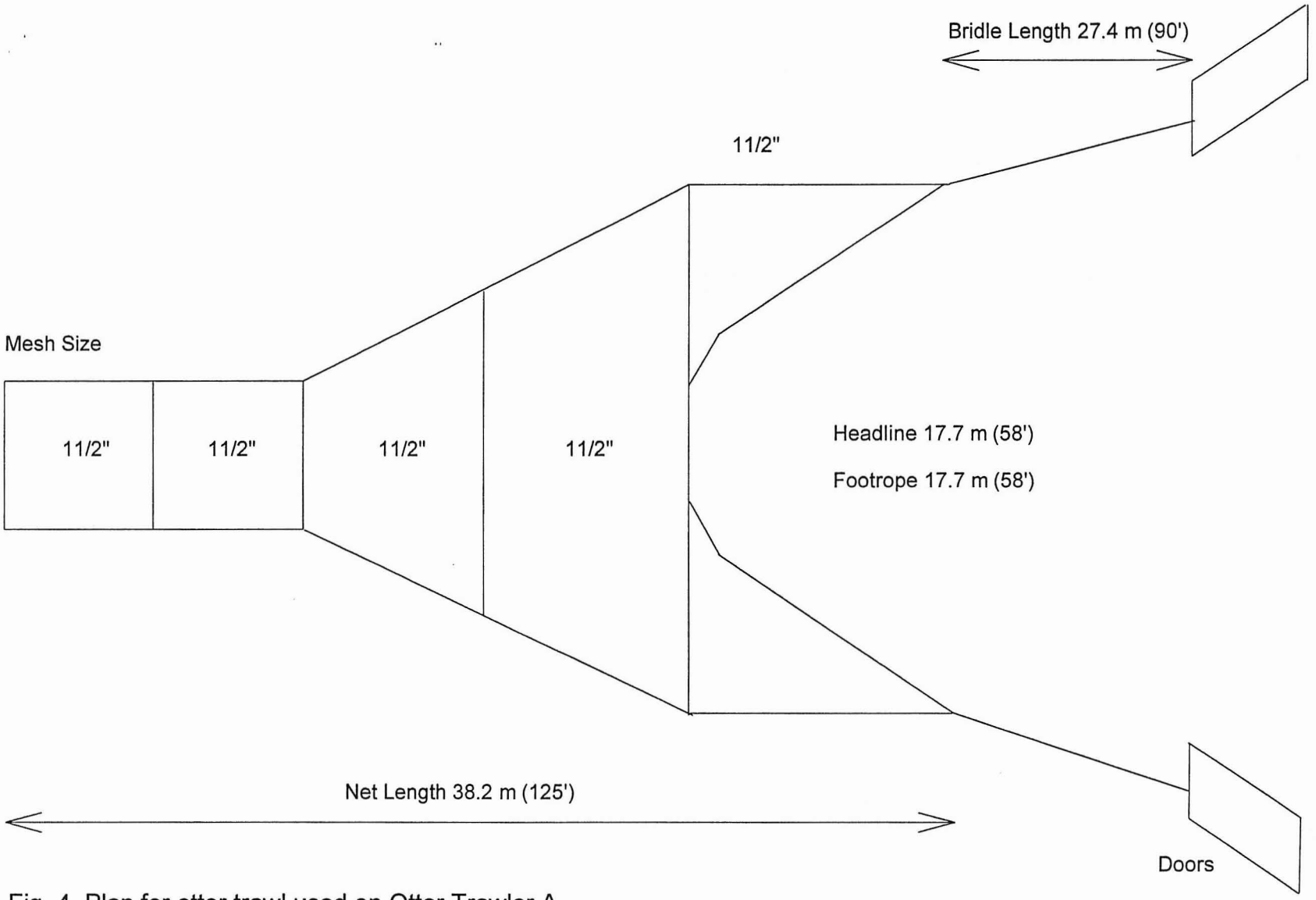


Fig. 4. Plan for otter trawl used on Otter Trawler A

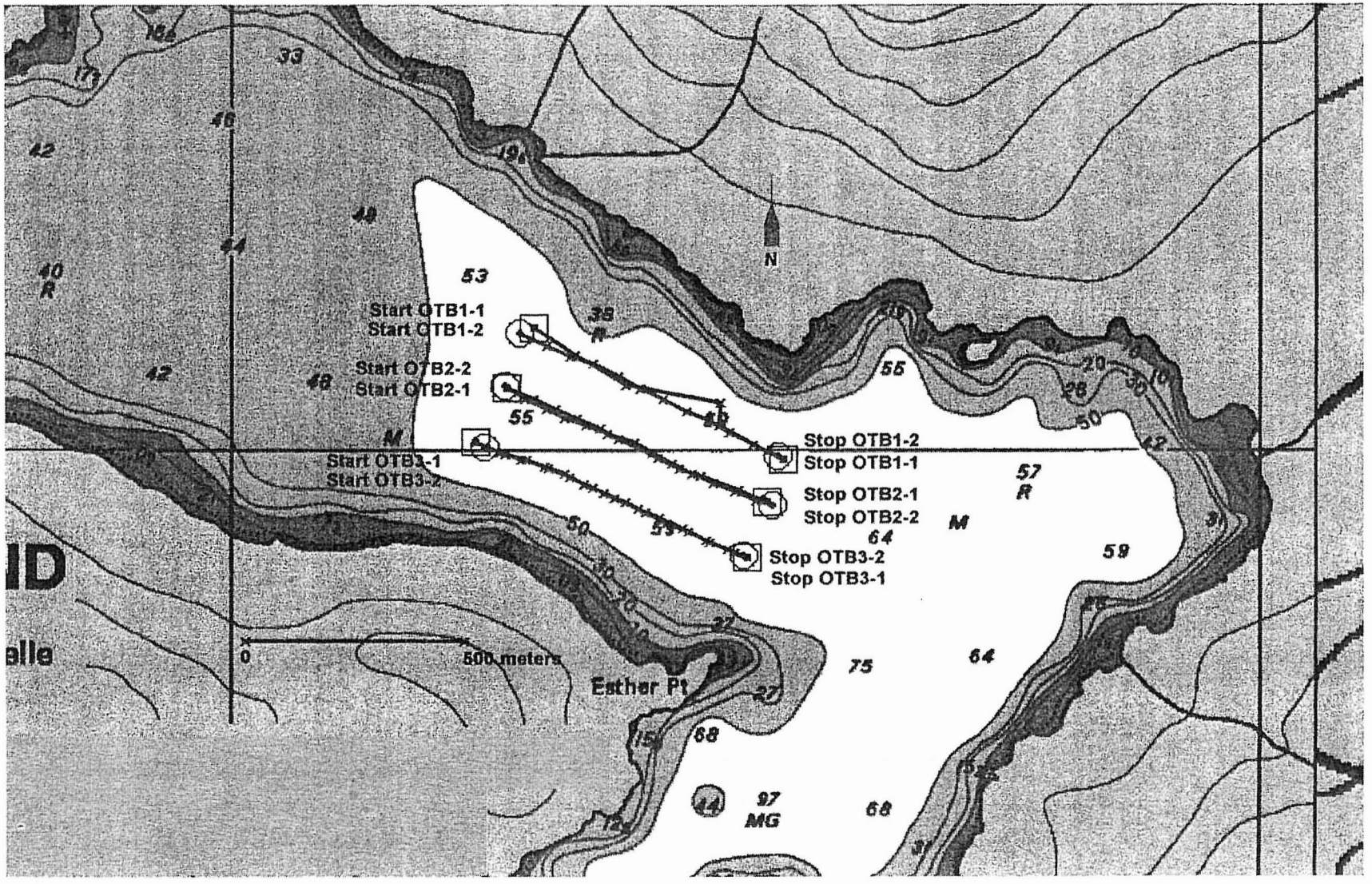


Fig. 5. Map of Simoom Sound and the two replicate otter trawls made by Otter Trawler B (OTB) in each of the three trawl lines, November 14, 2000. Start position is where towing started. Stop position is where the net lifted off the bottom. Position at cross-mark at left is 50 51.001 N, 126 29.994 W. Direction of arrow is magnetic north. Base map from CHS Chart 3515.

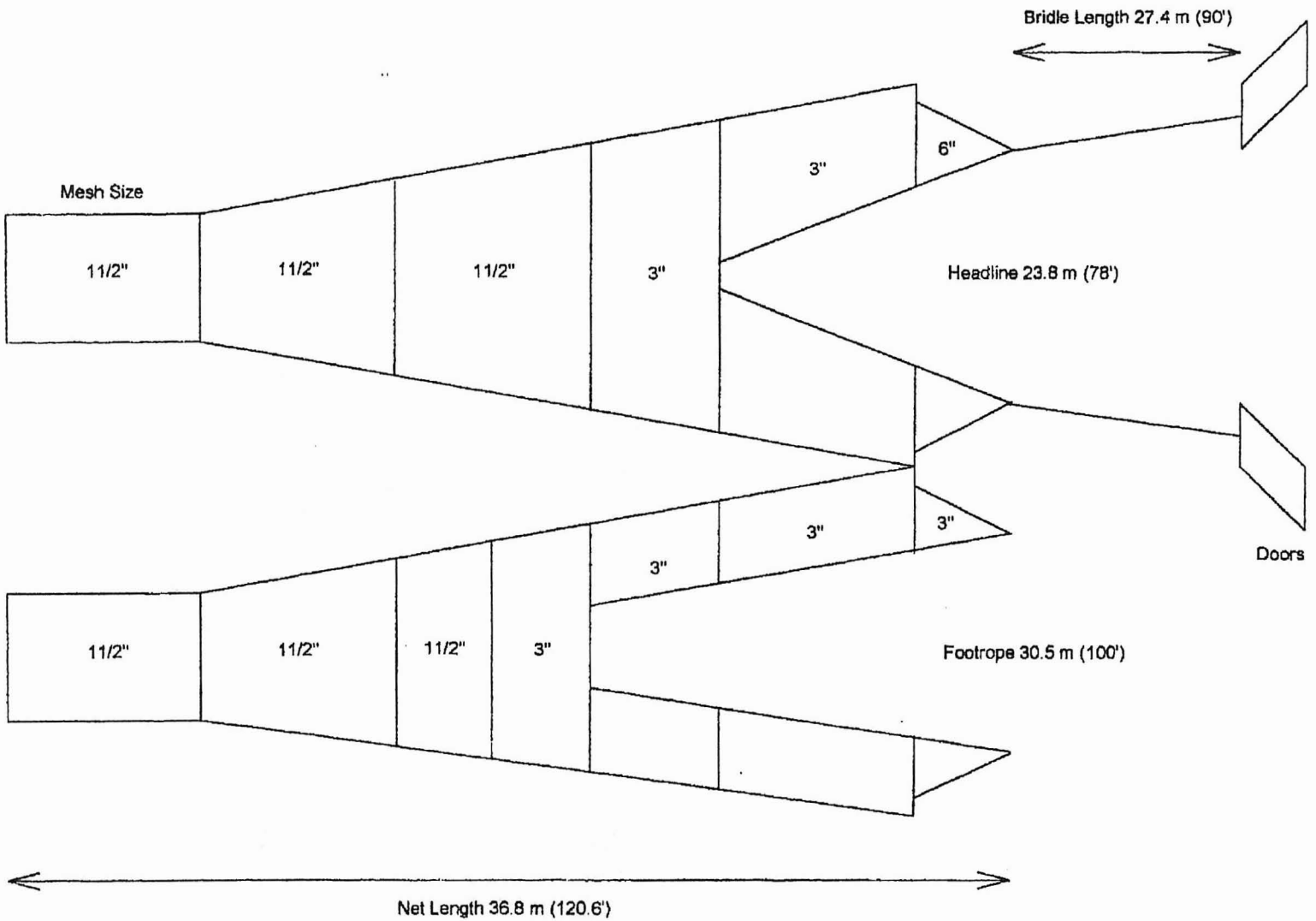


Fig. 6. Plan for otter trawl used on Otter Trawler B

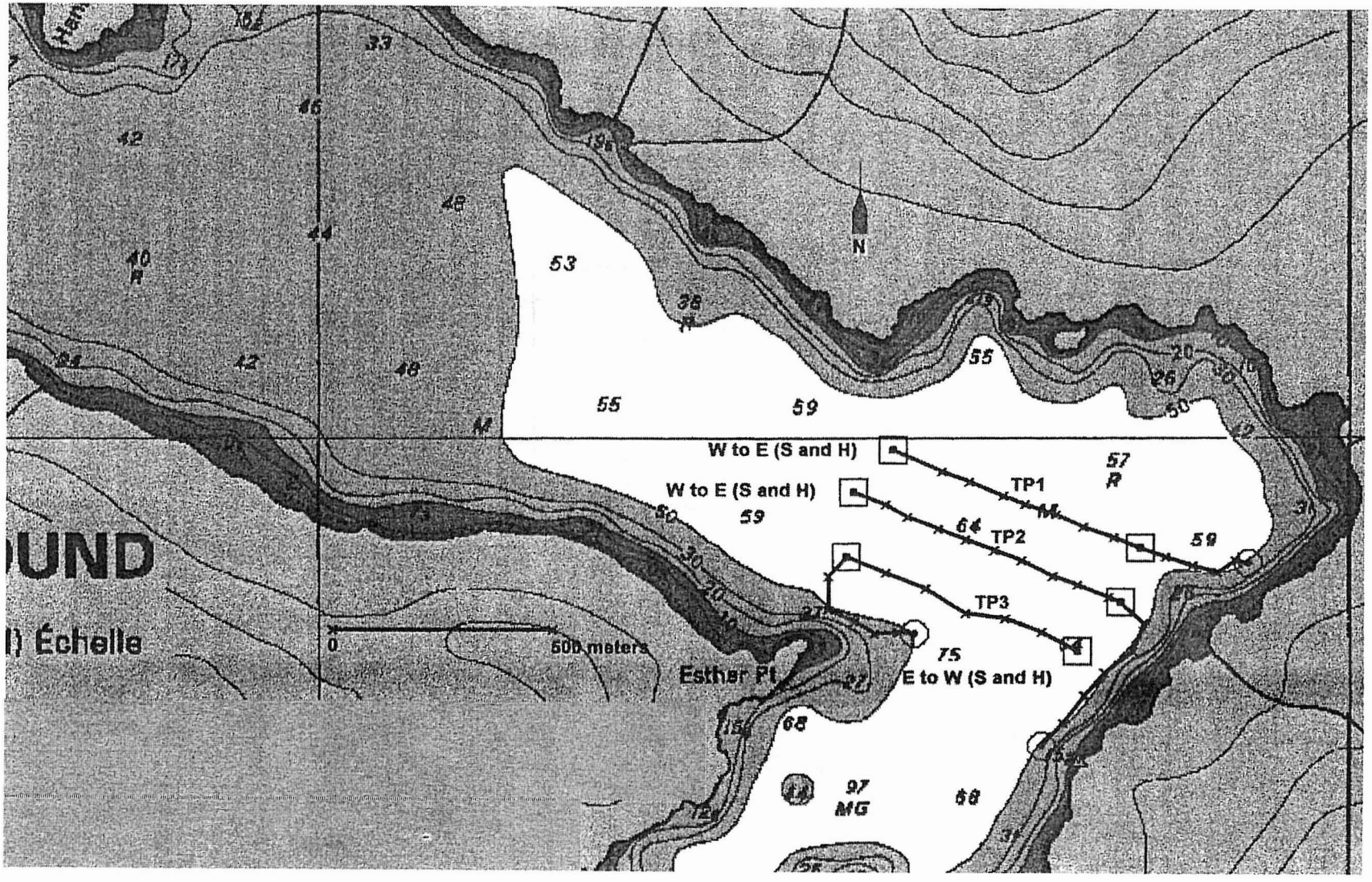


Fig. 7. Map of Simoom Sound showing the half-day trap lines, set for about 6 h, November 15, 2000. Traps set within the lines are shown from square to square. Extensions out of the lines are shown from second square to circle. (S) indicates direction traps were set. (H) indicates direction traps were hauled. Position at cross-mark at left is 50 51.001 N, 126 29.994 W. Direction of arrow is magnetic north. Base map from CHS Chart 3515.

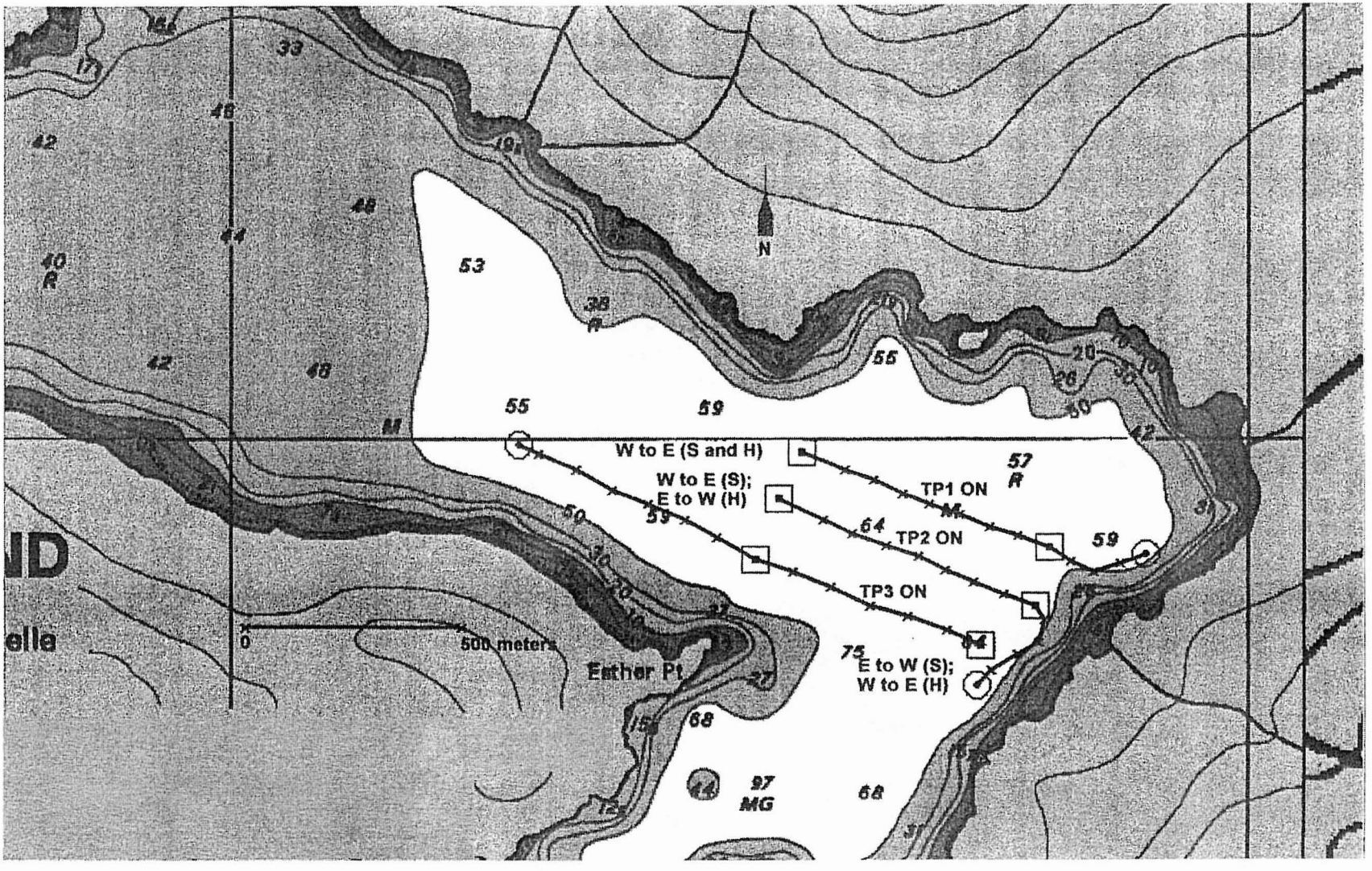


Fig. 8. Map of Simoom Sound showing the overnight (ON) trap lines, set for about 17 h, November 15-16, 2000. Traps set within the lines are shown from square to square. Extensions out of the lines are shown from second square to circle. (S) indicates direction traps were set. (H) indicates direction traps were hauled. Position at cross-mark at left is 50 51.001 N, 126 29.994 W. Direction of arrow is magnetic north. Base map from CHS Chart 3515.

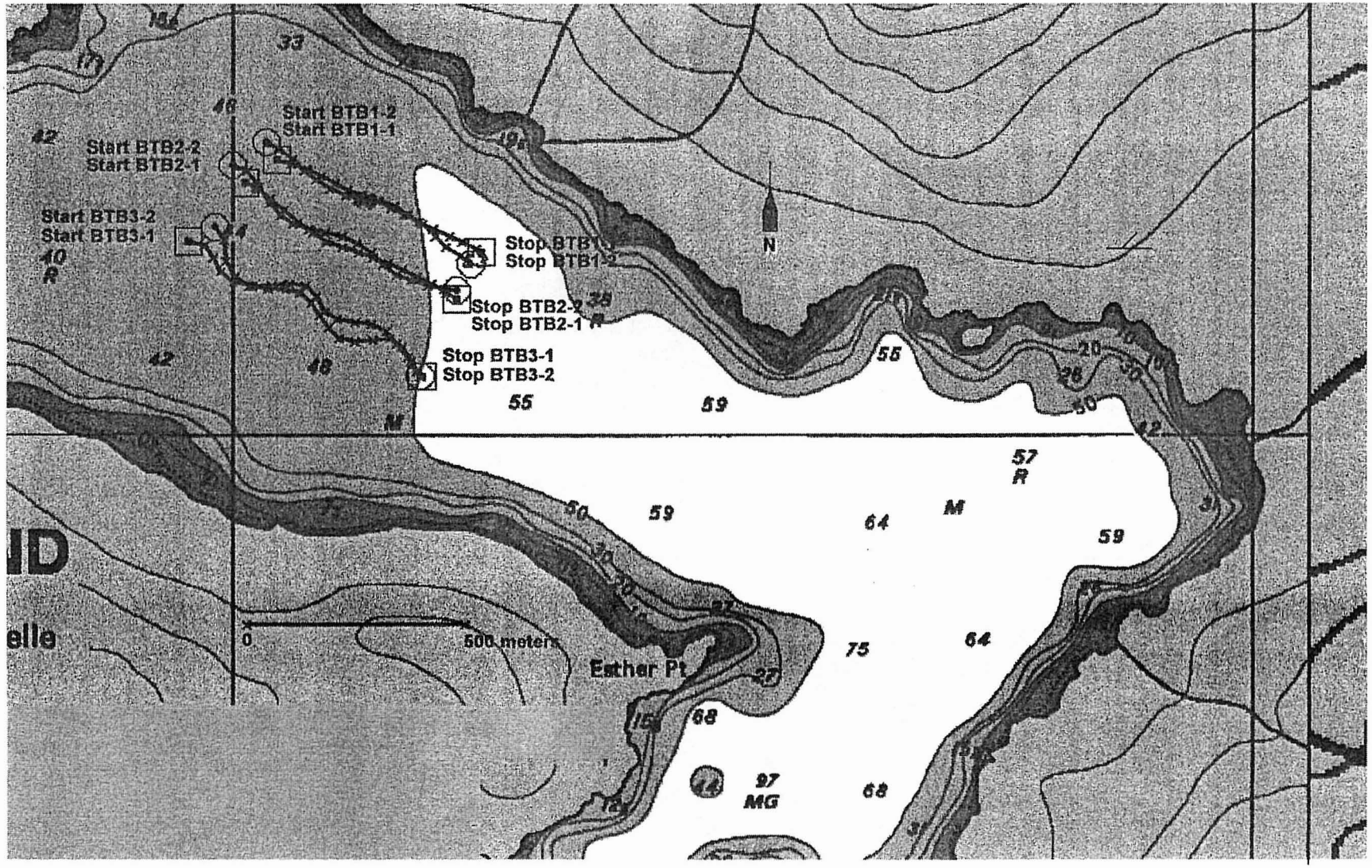


Fig. 9. Map of Simoom Sound and the two replicate beam trawls made by Beam Trawler B (BTB) in each of the three trawl lines, February 22, 2001. Start position is where towing started. Stop position is where the net lifted off the bottom. Position at cross-mark at left is 50 51.001 N, 126 29.994 W. Direction of arrow is magnetic north. Base map from CHS Chart 3515.

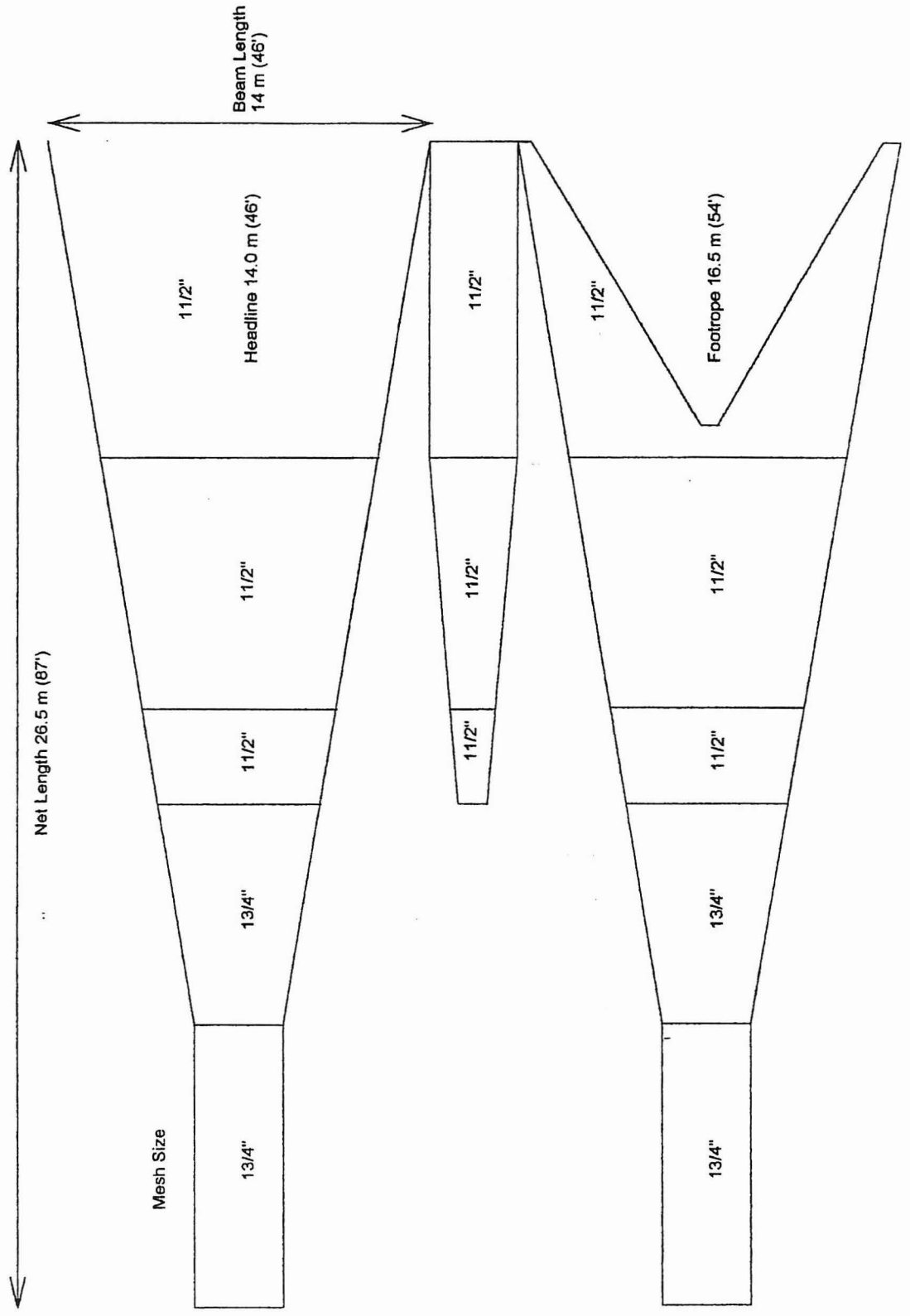
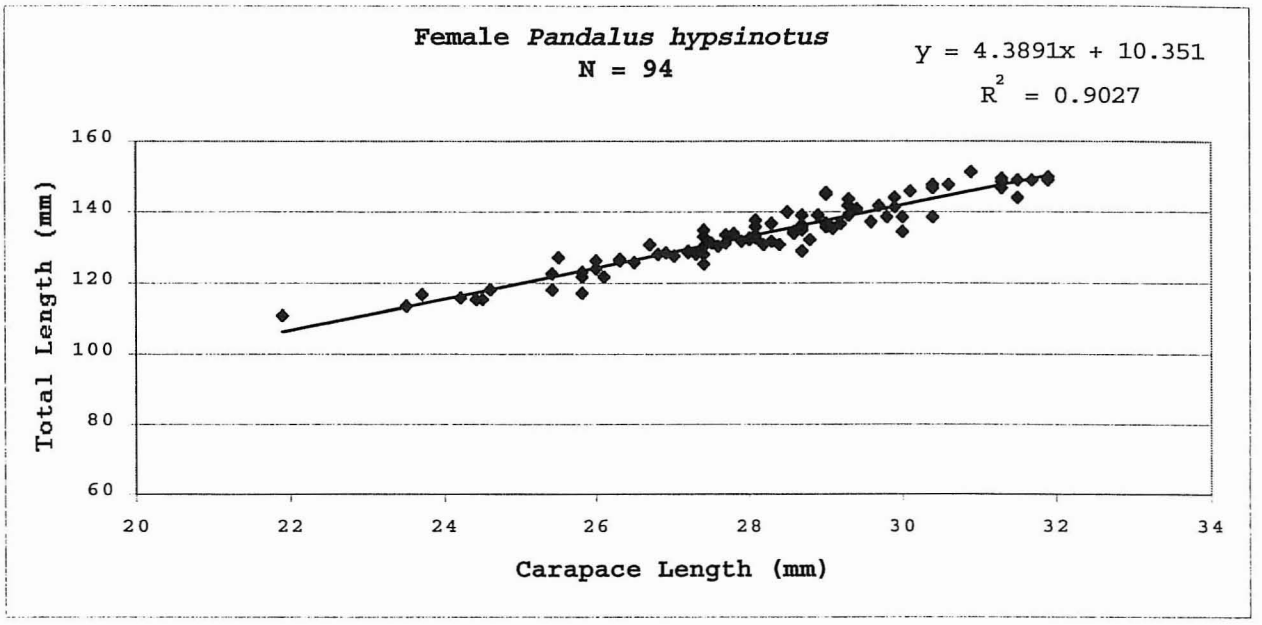


Fig. 10. Plan for beam trawl used on Beam Trawler B



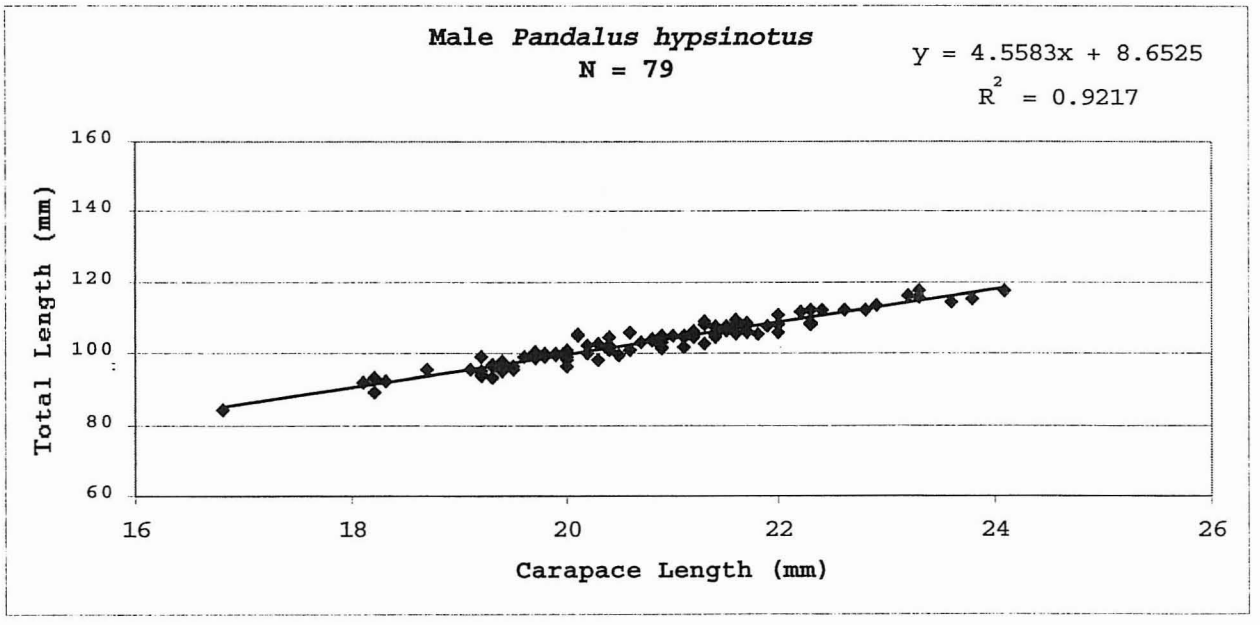


Fig. 11. Regression lines for relationship of carapace length to total length of humpback shrimp from Simoom Sound otter trawls. y= total length, tip of rostrum to tip of telson x= carapace length, base of eyestalk to the posterior mid-dorsal edge.

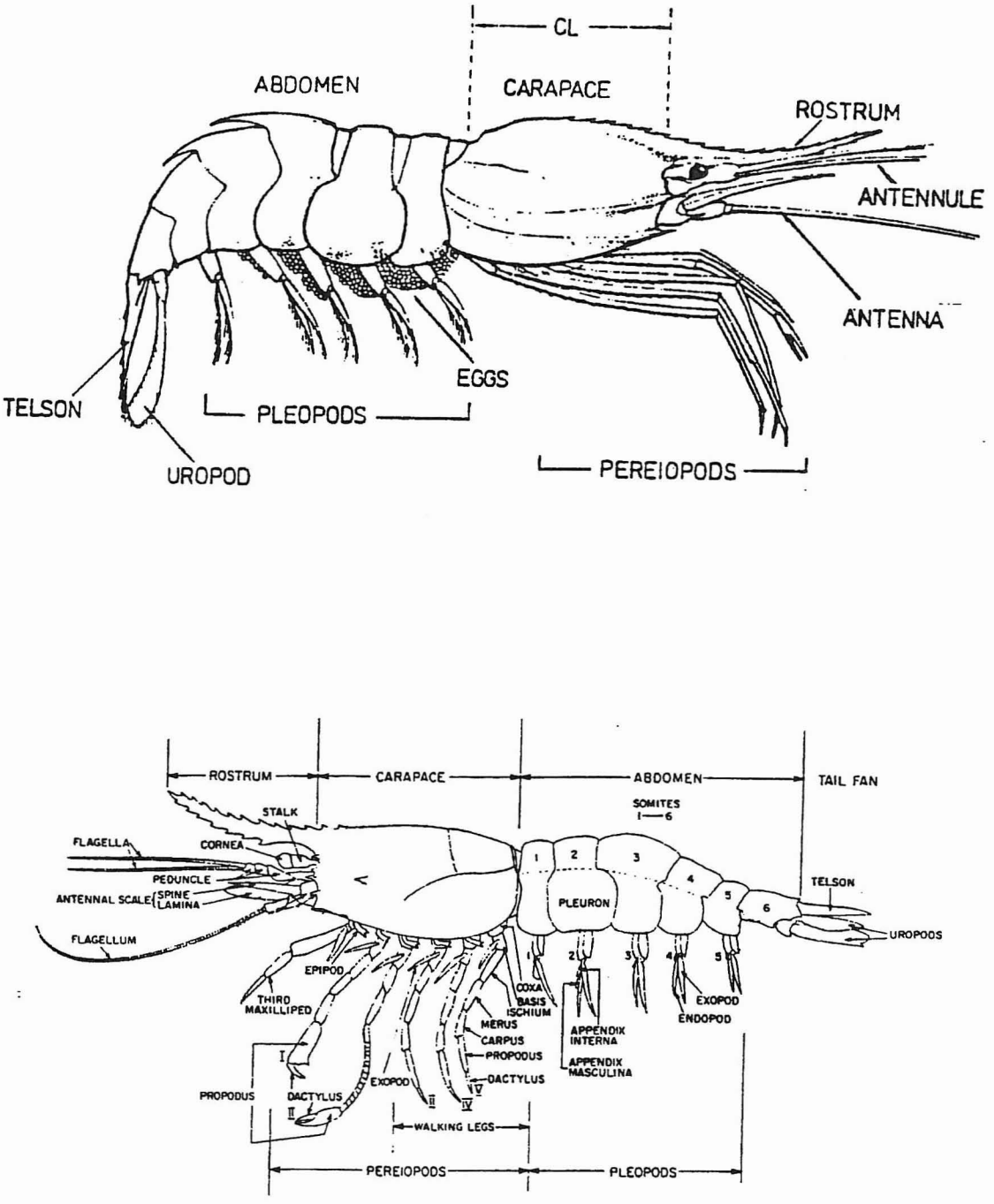


Fig.12. Generalized shrimp diagrams illustrating the following: i. Eggs in the abdomen. ii). Endopod of second pleopod showing position of appendix interna (of males and females) and appendix masculina (of males). iii). Principle body parts used in damage assessment. NOTE: eggs can also be found as a small mass within the carapace. From King, 1986 and Butler, 1980, respectively.