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Distribution of Spawning Eulachon Stocks in the Central Coast of British Columbia as Indicated by Larval Surveys

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ABSTRACT

The anadromous eulachon (*Thaleichthys pacificus*) spawns in the lower reaches of coastal rivers and streams from northern California to Alaska. Although the distribution and timing in some rivers is well known, the occurrence in other rivers is uncertain or unknown. The presence of larval eulachons in estuaries and marine waters adjacent to rivers is a strong indication that a river is used by eulachons for spawning. Some British Columbia rivers are known to have long-established runs, but the status of many other rivers is uncertain. In this report, we present data from larval surveys that confirm the presence of eulachons in central coast rivers where they were known or believed to occur. We also identify several rivers that apparently support eulachons where they were previously undocumented.

Central British Columbia mainland inlets were surveyed in 1994, 1996 and 1997 to determine distribution patterns and relative abundance. A total of 767 plankton net hauls were completed in 3 intensive surveys. Salinity-temperature, depth profiles and bathymetric distributions of larvae were also examined in some inlets. Each survey was conducted in a two week period in the spring, after larvae had hatched and had been flushed from nearby eulachon spawning rivers into adjacent estuarine and marine waters. In most inlets that have two or more eulachon-spawning rivers, the geographical distribution of larvae in estuarine and marine waters was continuous, indicating that larvae from different rivers were mixed. In some instances, the larval distributions were continuous between adjacent inlets. We suggest that this apparent mixing of young larvae may limit or preclude the potential for differentiation of spawning populations between closely adjacent rivers, or inlets. In most inlets, it appears that estuarine circulation may retain larvae. This period of retention may last for a period of several weeks or longer. In some instances, our surveys detected larvae a month or more after hatching. In general, eulachon larvae were confined to the upper brackish outflow layer that extended out from some estuaries a distance of 100 kilometres or more. We looked for larvae in some small inlets where they had not previously been described, and sometimes we found some. The presence of larvae in these inlets, indicates that eulachon spawn in some nearby streams or rivers that had not previously been known to support eulachon spawning.

We discuss the results of these surveys in the context of the availability of suitable spawning rivers for eulachons and their present status. We estimate the eulachon spawning biomass required to produce the numbers of larvae we observed, but emphasize that these are not estimates of the total spawning biomass, which we believe would be larger, perhaps by an order of magnitude or more. We use these estimates, however, to provide an approximate biomass scaling among different areas and review these estimates in the context of the available information of eulachon spawning biomass estimate for different rivers. The report concludes with a brief discussion of the recent declines in eulachon populations, their present status and recommendations.

RÉSUMÉ

L'eulakane anadrome (*Thaleichthys pacificus*) fraie dans le cours inférieur des cours d'eau côtiers, du nord de la Californie à l'Alaska. La répartition et le moment du frai sont bien connus dans certains cours d'eau, mais s'avèrent incertains ou inconnus dans d'autres. La présence d'eulakanes larvaires dans des estuaires et les eaux marines voisines de cours d'eau est un bon indice que ces derniers sont utilisés pour le frai. Certains cours d'eau de la Colombie-Britannique sont connus pour leurs remontées établies depuis longtemps, mais la situation d'un grand nombre d'autres cours d'eau est incertaine. Les auteurs présentent dans ce rapport des données tirées de relevés des larves qui confirment la présence de l'eulakane dans des cours d'eau de la côte centrale où l'on connaissait ou supposait sa présence. Plusieurs autres cours d'eau où la présence de l'eulakane n'avait pas antérieurement été documentée sont aussi décrits.

Des bras de mer de la côte centrale de la Colombie-Britannique ont fait l'objet de relevés en 1994, 1996 et 1997 dans le but de connaître le modèle de distribution et l'abondance relative de ce poisson. Au total, 767 traits au filet à plancton ont été réalisés dans le cadre de trois relevés intensifs. Dans certains bras de mer, on a aussi noté la salinité et la température, le profil de profondeur et la répartition bathymétrique des larves. Chaque relevé a été effectué au cours d'une période de deux semaines, au printemps, après l'éclosion des larves et après que celles-ci aient été entraînées des lieux de frai vers les eaux voisines des estuaires et de la mer. Dans la plupart des bras de mer où l'on compte au moins deux cours d'eau abritant des frayères, la répartition géographique des larves dans les eaux des estuaires et de la mer était continue, ce qui indique que des larves provenant de cours d'eau différents s'étaient mélangées. Dans certains cas, les distributions étaient continues entre deux bras de mer adjacents. Les auteurs suggèrent que ce mélange apparent des jeunes larves pourrait limiter ou interdire la différenciation de populations de géniteurs entre des cours d'eau ou des bras de mer voisins. Dans la plupart des bras de mer, la circulation estuarienne pourrait avoir pour effet de retenir les larves. Cette période de rétention pourrait durer plusieurs semaines, sinon plus. Dans certains cas, les relevés ont permis de déceler des larves un mois et plus après l'éclosion. De façon générale, les larves étaient confinées à la couche d'écoulement supérieure d'eau saumâtre qui, pour certains estuaires, pouvait s'étendre sur une distance pouvant dépasser 100 kilomètres. Les auteurs ont recherché des larves dans certains petits bras de mer où elles n'avaient jamais été décelées et ont pu en trouver quelques-unes. La présence de larves à ces endroits indique que des eulakanes fraient dans des cours d'eau voisins où le frai était auparavant inconnu.

Les auteurs traitent des résultats des relevés dans le contexte de la disponibilité de cours d'eau appropriés au frai des eulakanes et de leur situation actuelle. Ils ont estimé la biomasse de géniteurs nécessaire à la production du nombre de larves observées, mais soulignent qu'il ne s'agit pas d'une estimation de la biomasse totale des géniteurs qui, selon eux, serait supérieure, peut-être d'un ordre de grandeur ou plus. Ils ont cependant utilisé ces estimations pour obtenir la valeur relative approximative des biomasses dans les différentes zones et en on fait l'examen dans le contexte des estimations actuelles de la biomasse des géniteurs dans divers cours d'eau. Le rapport se termine par une brève discussion des déclins récents des populations d'eulakane, de leur situation actuelle et des recommandations.

INTRODUCTION

The distribution and relative abundance of eulachons (*Thaleichthys pacificus*) within British Columbia has not been described previously. This paper uses the distribution of larval eulachons in an attempt to identify eulachon-bearing rivers, streams and estuaries in the central coast of British Columbia. The larval distribution data are then considered in relation to the available river-specific catch data and biomass estimates, although very few data are available. The paper concludes that estuaries are particularly important for eulachons. We suggest that estuaries, and estuarine circulation are probably the main factor determining and maintaining eulachon 'stock' structure and that the estuarine habitat for larval fish may require special attention and protection – both for the future welfare of euachons and for the maintenance of ecosystems and biodiversity as part of the implementation of marine protected areas.

Most larval fish surveys conducted in British Columbia (BC) were done as a means to comment on larval dispersion and ecology (Stevenson, 1962; Barraclough, 1967; McGurk 1989; Rees, 1970). Elsewhere, larval fish surveys are routinely used as a means of estimating stock abundance (Smith and Richardson, 1977). Hay & McCarter (1991 & 1997) conducted surveys of Pacific herring larvae (*Clupea pallasi*) to comment on stock structure. The present paper examines the distribution of larval eulachons as a means of determining which rivers are used by eualchons for spawning. The surveys can determine the distribution of larval eulachons and can also determined if larval eulachon distributions overlap and mix between different eulachon spawning rivers. This paper presents the results of surveys in 1994, 1996 and 1997 that were conducted in nearly all BC mainland inlets, with emphasis on locations nearest rivers that might serve as potential eulachon spawning areas. If substantial mixing of larvae occurs among rivers, then maintenance of genetic isolation between individual spawning sites would be unlikely unless eulachon larvae possessed homing mechanisms that allowed them to imprint precisely to each river. Small, undeveloped larvae, such as those captured near rivers during the surveys, are unlikely to acquire such imprinting capabilities.

A second objective of the surveys was to assess the depth distribution of eulachon larvae at different times of the day and night along the length of an inlet. Estuarine circulation is prevalent in many BC inlets where surface currents above 100 m flow seaward and deeper currents flow landward (Thomson, 1981). Can larval eulachon distributions be explained by this oceanographic feature alone or are other factors involved? This report compares and documents the larval distribution patterns from three ichthyoplankton surveys conducted in the Johnstone Strait and central BC coast areas during the spring of 1994, 1996 and 1997.

METHODS AND MATERIALS

The first survey, in 1994 (April 25 – May 5) examined major coastal inlets from Bute Inlet in the south to Rivers Inlet in the north. This survey covered the lengths of Bute Inlet (to the mouth of the Homathko River), Loughborough Inlet, Knight Inlet (to the Klinaklini and Franklin River estuaries), Kingcome Inlet (to the Kingcome River estuary), Queen Charlotte Strait, Seymour and Belize Inlets, Smith and Rivers Inlets (to the Chuckwalla/Kilbella and Wannock River estuaries). Many interconnecting channels, smaller inlets and sounds were also surveyed. Regions surveyed are labelled 'JS' (Johnstone Strait), 'QS' (Queen Charlotte Strait) and 'RI' (Rivers Inlet) on a BC map in Figure 1.

The second survey, in 1996 (May 27 – June 7) examined the entire lengths of Douglas Channel (to the mouth of the Kitimat River) and Gardner Canal (to the mouth of the Kitlope River). Major side inlets were also examined including Kildala Arm, Gilttoyees Inlet and Foch Lagoon (also Kildala, Kemano/Wahoo and Kowesas River estuaries). The survey region is labelled 'DC' (Douglas Channel) on a BC map (Figure 1).

The third survey, in 1997 (April 14-25) examined many of the same inlets as the 1994 survey plus most of Burke Channel, Fisher Channel, Dean Channel (to the mouths of the Kimsquit & Dean Rivers), Cascade Inlet, South and North Bentinck Arms (to the Bella Coola River estuary), Mathieson Channel and Mussel and Kynoch Inlets. The regions surveyed are indicated as 'JS' (Johnstone Strait), 'RI' (Rivers Inlet) and 'BD' (Burke & Dean Channels) on a BC map (Figure 1).

OBLIQUE PLANKTON TOWS

Sampling stations were located at approximately 5.5 km intervals along various waterways covering most of BC's central mainland inlets and channels. Sampling stations were designed to examine the waters within and between major eulachon spawning areas (Figure 2) as identified by Hay et al. (1997a). Presently, we believe that there may be only about 15 major eulachon runs spawning in BC rivers. The ichthyoplankton surveys were timed several weeks after completion of major eulachon spawning activity. Samples were collected with 57-cm diameter bongo nets hauled from research vessels, *VECTOR* or *R. B. YOUNG* in deep water locations and with smaller, 19-cm diameter bongo nets hauled from smaller, 6 metre vessels in shallow water locations, often within metres of the shore. The paired plankton nets on the 57-cm and 19-cm bongo frames were 3 metres and one metre in length respectively and were made of 0.35-mm black Nitex® mesh. General Oceanic® flowmeters with low- and high-speed rotors were used to measure the volume of seawater filtered through the large and smaller bongo nets respectively. Flowmeter revolutions were recorded after each bongo net tow. Tows were usually completed in 6 minutes while the towing vessel travelled at approximately 3.5 km/hr or about 2 knots. The 57-cm bongo nets with an 86 kg weight and 25 m of cable were slowly paid-out from the primary research vessel at a rate of 0.166 m/sec and immediately recovered at the same rate (oblique tow). A maximum vertical net depth of 20 m was estimated based on a 30 - 40 ^{o} wire angle. The 19-cm bongo nets with a 15 kg weight and 20 m of cable were paid-out from Boston whalers at a rate of 0.33 m/sec and immediately raised 1 m every 15 seconds (stepped, oblique tow). The whalers were equipped with small, single speed (0.33 m/sec) electric winches and towing frames. In 1994, approximately two thirds of the stations were completed by two whalers (see 'S' or 'L' station names in Appendix Table 1) while the remaining stations were completed by the *VECTOR* ('V' station names). In 1996 and 1997, most stations were completed by the primary research vessel, however, SCOR plankton nets, equipped with flowmeters, were sometimes towed from inflatable boats or whalers to access a small number of near shore stations (see 'Z' or 'W' station names in Appendix Table 1). The recovered nets from each plankton net tow were thoroughly washed down with seawater and the plankton catches retained in both left and right net codends, were preserved separately, in 5 percent buffered seawater formaldehyde. Appendix Table 1 shows the location, date, time and depth (m) of each sampling station, the volume of seawater filtered (m^3) through each 0.35 mm-mesh net and the count of eulachon larvae from each plankton net tow conducted in 1994, 1996 and 1997.

FIXED DEPTH PLANKTON TOWS

A total of 24 pairs of 57-cm bongo net samples were collected in a series at fixed depths (0, 5, 10, 15, 20 and 35 metres) and times (0000, 0600, 1200, and 1800 hours) at station M47, near Kitimat, June 4, 1996. Twelve additional pairs of 57-cm bongo net samples were collect in a similar series at fixed depths (0, 10, 20 and 30 metres) and times (0800, 1000 and 1200 hours) near the head of Bute Inlet (stations BT1, BT3 & BT5), April 24, 1997. The nets were lowered from the ship's starboard A-frame (*VECTOR*) or stern A-frame (*R. B. YOUNG*) at the rate of 1 m/sec, maintained at a fixed depth for five minutes and then raised at 1 m/sec. Flowmeter revolutions were recorded to measure the volume of seawater filtered during each tow. The purpose of these tows was to examine the vertical distribution patterns of eulachon larvae at different times of day and night. An opening/closing net was not used during these surveys such that depth contamination of plankton catches did occur. Mixing of larvae from different depths in the sample was considered minimal, however, as the nets were raised and lowered quickly, over a shallow depth range.

HYDROGRAPHIC STATIONS

Forty-eight STD (Salinity-Temperature-Depth) casts were completed using a STD-1200 Applied Microsystems instrument® during the 1996, Kitimat/Gardner Canal survey. Many casts were completed at station M47 (near the Kitimat River estuary) at the same time fixed-depth plankton tows were conducted. STD casts were also conducted at stations positioned approximately 5.5 km apart, along the rest of Douglas channel and Gardner Canal. Fifty-one STD casts were completed during the 1997 central BC coast survey. Most of these STD's were conducted in a series of 3 to 5 casts, approximately 5.5 km apart, extending seaward from the heads of mainland inlets. STD casts were also completed at the head of Bute Inlet (Homathko River estuary) at the same time fixed-depth plankton tows were conducted. Separate temperature-salinity depth profiles were plotted for each station. Salinity profiles using multiple stations along Gardner Canal, Douglas Channel and other mainland inlets were constructed with a Systat© contour plot algorithm. No STD casts were conducted during the 1994 central BC coast survey.

LABORATORY PROCESSING

Plankton samples were transferred from 0.25 l and 1.0 l field jars to 150x20 mm glass petri dishes and counts of eulachon larvae and other larval fish were obtained from each left net sample. Larval identifications were based on descriptions and drawings in Garrison and Miller (1982) and Matarese et al. (1989). Fish larvae were sorted into 10 categories corresponding approximately to taxonomic families: Osmeridae (Eulachon, *Thaleichthys pacificus* only), Clupeidae (Pacific herring, *Clupea pallasi* only), Gadidae (undistinguished codfishes), Stichaeidae & Pholidae (pricklebacks &

gunnels), Ammodytidae (Pacific Sand Lance, *Ammodytes hexapterus* only), Hexagrammidae (greenlings & Lingcod), Cottidae, Cyclopteridae & Scorpaenidae (sculpins, snailfishes & rockfishes), Agonidae (poachers), Pleuronectidae (flatfishes), Bathylagidae (deepsea smelt, Northern Smoothtongue, *Leuroglossus stilbius schmidti* only) and an unidentified larval fish category. Direct counts of fish larvae were conducted with fine forceps under a dissecting microscope. Standard subsampling with a Folsam plankton splitter and estimation of larval numbers was required for a small number of samples that exceeded 1000 larvae. After counting, larvae were placed in sample vials for subsequent measuring, drying and weighing. A maximum of 20 undamaged eulachon larvae per left net sample were randomly selected and measured to the nearest 0.2 mm with an ocular micrometer, dissecting microscope. The total plankton contents of each right net sample were suctioned with a Buchner funnel, dried in a 100 ^{o}C oven for 18-20 hrs and weighed to the nearest 0.01 g on a electronic balance.

LARVAL FISH DENSITY AND RELATIVE ABUNDANCE ESTIMATIONS

Sampling stations in the central BC coast were partitioned geographically into five regions: (1) Johnstone Strait; (2) Queen Charlotte Strait; (3) Smith and Rivers Inlets; (4) Burke and Dean Channels and (5) Douglas Channel and Gardner Canal. Larval fish density estimates (#/m^3) were calculated at each station based on the laboratory count and the estimated volume of seawater filtered (m^3) through each plankton net tow using the following General Oceanics® formula:

$$\frac{\text{area of net opening (m}^2\text{) x flowmeter revolutions x rotor constant}}{999{,}999}$$

where: high speed rotor constant = 26,873
low speed rotor constant = 51,020

and large, 57-cm bongo net opening = 0.2544 m^2
small, 19-cm bongo net opening = 0.0283 m^2
Scor, 60-cm net opening = 0.2827 m^2

The total ocean surface area (m^2) of each region surveyed was estimated using a raster-based Geographical Information System (Compugrid©). A simple area expansion method was used to estimate the total number of larvae in the survey region for each taxonomic group. The ocean area (m^2) represented by each sampling station was determined by the quotient of the total estimated regional area (m^2) and the number of stations in the region. The total estimated number of larvae was determined for each region and year by the sum of the product of each station's represented area (m^2), sampling depth (m) and density estimate (#/m^3). Density maps of each region and year were plotted using Systat© bubble plots. The co-ordinates of each sampling station were electronically plotted on digitized, hydrographic charts with a plotting circle proportional to each of the 731 station density estimates. The total larvae estimates derived from these surveys were crude approximations (only surface waters were surveyed, 0-20 m) as limited survey time and logistics precluded more detailed techniques. Fixed depth plankton tows from these and other surveys have shown most larvae are distributed in surface waters.

The larval fish estimates do provide indications of relative abundance and distribution pattern when examined together with associated density maps.

ASSEMBLY OF EULACHON SPAWNING BIOMASS DATA FROM VARIOUS RIVERS

There are very few direct estimates of eulachon spawning biomass from any river in BC. Similarly, there is very little catch data and most of the available data were recorded informally. Regardless, for the purposes of evaluating the larval survey results, we also attempted to compile a list of known eulachon spawning rivers and any available data on (i) spawning biomass from any year and (ii) catch data from any year.

RESULTS

LARVAL EULACHON DISTRIBUTION

Eulachon spawning time varies among rivers with the Kitimat River being among the earliest (Pedersen et al., 1995) and the Fraser among the latest (Hay et al., 1997b). Consequently the time between spawning and the larval survey varied. This among-river variation affects the results because some would have had time for greater larval dispersal, and presumably, greater larval mortality. Surveys conducted early in the season (April 14-25, 1997) showed larvae distributed closer to known, eulachon spawning rivers, while surveys that were conducted late in the season (May 27-June 7, 1996, Douglas Channel-Gardner Canal) showed eulachon larvae widely distributed along the entire lengths of inlets to open ocean areas. Figures 3a-3g show detailed maps of larval eulachon densities represented by the size (areas) of each sampling station circle. A cross represents a station where no eulachon larvae were captured. Maximum larval densities are indicated below each figure. The highest recorded eulachon density (32.2 larvae/m^3) occurred at the head of Gardner Canal near the Kitlope River estuary. Eulachon larval densities decreased gradually in a seaward direction along most inlets until reaching the measuring resolution limit of the plankton nets (approximately 1 larvae per 100 m^3 of seawater filtered through the 57-cm diameter bongo net during a 6 minute tow). Eulachon (and herring) larval densities were also greater on the left sides of inlets (looking seaward) than the right sides during a 1994 survey when sampling stations were staggered along both shorelines (Figure. 3a). The Coriolis effect, which forces seawater further upstream on the left side (looking seaward) of inlets and estuaries in the northern hemisphere was thought to be exerting an influence. A larval accumulation or concentrating effect would be expected to occur on the side of the inlet with the most contracted freshwater layer and lower rate of discharge (left side looking seaward). Tidal, centrifugal forces in narrow and sinuous inlets would be expected to further distort this pattern.

Most larval eulachon were found adjacent to known, eulachon spawning rivers. The presence of eulachon larvae at the heads of some inlets surveyed, however, suggested the occurrence of eulachon spawning in nearby rivers not previously known to support eulachon spawning. A list of known and other possible eulachon spawning rivers is shown in Table 1. In some cases, there was uncertainty whether the captured larvae were recently flushed down from nearby, undocumented eulachon spawning rivers or were advected to the heads of these inlets from further distant but known eulachon spawning areas via deeper, landward currents (estuarine circulation with possible Coriolis effect).

Larval eulachon samples that were collected at the heads of these particular inlets (Loughborough Inlet, Thompson Sound, Smith, Moses and Kynoch Inlets) were comprised mostly of small, newly-hatched larvae (3.6-8.0 mm) which supported the first scenario. Significant numbers of large (8-27 mm) and small (4.4-6.6 mm) eulachon larvae were collected in other more remote inlets (Khutze and Aaltanhash Inlets) which suggested the occurrence of the latter scenario as well. Larval eulachon samples collected from these inlets are indicated with an asterisk in Appendix Table 1. Larval length frequencies are shown in Table 2a.

Larval eulachon samples collected at the heads of inlets, adjacent to known eulachon spawning rivers consisted predominantly of small, newly hatched larvae. Mean eulachon larval size (mm) generally increased at each sampling station in a seaward direction away from eulachon spawning rivers (Figure 3h). Larval eulachon collected at some stations along inlets, however, showed a wide range of larval sizes (Table 2b) indicating mixing of small, newly hatched larvae from nearby rivers (i.e. Kemano or Kowesas River flowing into Gardner Canal) with much larger larvae, from more distant rivers (i.e. Kitlope River at the head of Gardner Canal). Larval mixing was also suggested between eulachon originating in the Kimsquit and Bella Coola Rivers and between several eulachon spawning rivers in the Johnstone Strait Region. Larval length frequencies summarized by year and region are shown in Table 2c.

Very few larvae were caught in the open, ocean entrances of the inlets (i.e. Queen Charlotte Strait). Other ichthyoplankton surveys conducted later in the year, however, have captured eulachon larvae in more open ocean areas. One hundred and twenty-eight eulachon larvae, 12-34 mm in size were captured late in July and early August at 31 sampling stations located in the centre of Chatham Sound and west of Porcher Island (Figure 4) using the same bongo net gear and techniques (McCarter et al., 1986). No larval eulachon were captured during similar ichthyoplankton surveys conducted in May of 1985 or 1986 in nearshore areas around Moresby or Porcher Island (Hay & McCarter, 1991). Table 3 summarizes the total number of plankton net tows, the area surveyed (m^2), the volume of seawater filtered (m^3), the total counts of larval eulachon and herring and the total dry plankton weight (g) for each region and year.

LARVAL EULACHON RELATIVE ABUNDANCE

Estimated numbers of eulachon larvae determined by the area expansion of each measured density at each sampling station are shown in Table 4 for each region and year. Eulachon larvae were more abundant during the 1994 survey in the Johnstone Strait Region than those estimated in the same region during the 1997 survey. Rivers Inlet larval eulachon estimations were similar between the two years. Queen Charlotte Strait surveys captured few eulachon larvae. Further, this region was not covered equally between the two years to permit comparisons. A more thorough interpretation of the relative abundance of eulachon larvae between years must also consider larval distribution and larval size or age-at-capture since larger, older larvae occur in lower densities than smaller, younger larvae due to dispersion, mortality and net avoidance. The state of completion of eulachon larval flushing from rivers into inlets is another consideration. Greater larval dispersion had occurred at the time of the 1994 survey as compared to the 1997 survey and as a consequence made relative abundance comparisons difficult, if not impossible. The purpose of the surveys, however, was to improve the current understanding of larval eulachon distributions and dispersal. Relative abundance estimations were attempted only to assist in this objective.

LARVAL EULACHON DEPTH DISTRIBUTION AND CAPTURE AVOIDANCE

Most eulachon larvae were captured in surface waters between 0 and 15 metres depth. Considerably fewer larvae were caught at depths of 20-35 metres. Tables 5a and 5b shows larval eulachon density estimates and mean lengths of eulachon larvae from each fixed-depth plankton tow conducted at the head of Kitimat Arm and Bute Inlet. In general, density estimates of larval eulachon were greater near the surface waters during night plankton tows than during daytime tows. Continuous advection of pulses of larvae through the sampling areas, however, could obscure any relative pattern. Further, an opening and closing device was not installed on the bongo frame such that depth contamination upon deployment of the nets to each fixed depth, would slightly inflate larval densities at lower depths. These influences, however, were considered minimal. Deflection of larvae near the stern wash of the vessel and capture avoidance by large, developed larvae in the undisturbed, surface waters off the starboard sampling side during daylight may account for the consistently lower larval density estimates measured under those circumstances. Larval eulachon mean lengths were significantly smaller in daytime catches than night catches. Larvae sampled in surface waters were also consistently smaller than those at deeper depths. Capture avoidance of large, developed larvae is a significant factor considering eulachon larvae greater than 30 mm in length are rarely captured in bongo net gear (McCarter et al. 1986). The turbidity of seawater filtered through the nets (milky color from glacier-fed rivers) was also highly variable during the surveys. A particularly sharp border between turbid and clear water was observed midway along Gardner Canal where the canal makes a hairpin turn (Cornwall Point). Larval eulachon density estimates declined at this point and again where Gardner Canal joins Douglas Channel (Figure 3d). Most surveys, however, were conducted early in the season when larvae were small (< 15 mm) and sampled with oblique tows (0-20 m variable sampling depths) so that deflection and capture avoidance by larger larvae in the surface waters was considered insignificant. Kitimat Arm fixed-depth plankton tows were conducted late in the season (June 4) when this frequently overlooked sampling bias can have a more influential effect on fixed-depth surface samples.

SEAWATER TEMPERATURES AND SALINITIES

Surface seawater temperatures and salinities determined by STD casts are shown in Tables 6a and 6b for each hydrographic station. STD instrument calibration accuracy was not determined such that measurements should be interpreted as relative rather than absolute. Surface seawater temperatures were generally warmer during surveys conducted in May-June than those conducted in mid-April. Surface waters in Bute and Loughborough Inlets (casts #43-51, April 23-24) were significantly warmer than surface waters in any of the more northerly inlets measured a few days earlier. Salinity gradients were measured in most inlets, where less dense, freshwater flowed seaward along the surface, partially mixing with a more saline wedge of seawater below. Typical, temperature-salinity depth profiles measured in Gardner Canal, 2 km on either side of Chief Mathews Bay (near the Kowesas River) are shown in Figure 5a. Most depth profiles showed a sharp salinity incline at 3-8 m depth and a more gradual temperature decline at 4-15 m depth. Combined salinity profiles using 12 hydrographic stations along Gardner Canal and 15 stations along Douglas Channel are shown with contour plots (Figures 5b-5c).

EULACHON SPAWNING BIOMASS AND CATCH DATA FROM BC RIVERS

There are very few biomass estimates available, and most are available only in informal reports. In nearly all instances, these estimates are available for only a single year on the Nass, Skeena, Kitimat, Kemano, Owikeno (Wannock), Kingcome, Klinaklini and Fraser rivers. The available catch data are shown for each river, by year, from the year 1929 to 1996. For the purposes of comparison, we present data from 3 rivers, the Nass, Fraser and Columbia rivers, which were outside the sampling areas of the larval surveys. Table 7 shows catch data from the Bella Coola and Klinaklini (listed as 'Knight' because some catch may also come from the adjacent Franklin River). In addition, we present data from a biomass index estimated for offshore areas in southern BC (Hay et al., 1997a). The purpose of showing these additional data is simply to provide a perspective of the relative scale of central coast rivers relative to other rivers. We stress, however, that catch data provided only an indication of minimal spawning biomass, and can be misleading if improperly interpreted.

DISCUSSION

LARVAL SURVEYS AS INDICATORS OF SPAWNING ORIGINS

The primary objective of this work was to use larval distribution data to corroborate the existence of spawning runs in different rivers in the central coast of BC. Do the results confirm the numbers of spawning eulachon runs? The answer is a qualified yes. For most of the rivers that are known to have spawning runs, we did indeed find larvae in the adjacent marine and estuarine waters. In some instances, we found additional concentrations of larvae that appeared to originate from small rivers that were previously unknown as eulachon runs (see Table 1). The results shown in Table 1 address the basic objectives of the surveys. We confirm that some rivers are indeed used for eulachon spawning and suggest that several more, not previously known to be eulachon spawning areas, are also used for spawning as they are apparent sources of eulachon larvae.

The results of the surveys presented in this report do not examine all potential areas of the coast as possible sources of eulachon larvae. For instance, these surveys described here do not investigate potential spawning sites around the Strait of Georgia, Vancouver Island or the Queen Charlotte Islands. These areas, however, were examined during other surveys directed at describing the distribution of Pacific herring larvae (Hay and McCarter, 1997). These other surveys were conducted in April and May and found virtually no eulachon larvae in these outer areas. This reinforces the conclusion that eulachon spawning is mainly confined to coastal rivers that have a distinct spring freshet (Hay et al., 1997a).

BIOLOGICAL STATUS OF DIFFERENT EULACHON RUNS

The biological uniqueness of different eulachon populations or runs remains uncertain. Recent genetic evidence, based on mitochrondrial and micro-satellite analyses (McLean, 1999; McLean et al., 1999) indicates that there are few differences between any rivers in BC and virtually none between geographically adjacent rivers. These results agree with other approaches that examined and compared the elemental analyses of otoliths from different populations (Carolsfeld and Hay, 1999). The general (but still preliminary) conclusions from the genetic and otolith chemistry analyses is that there are few if any differences among eulachon populations. In contrast, there are a number of biological factors, which appear to indicate that there are striking differences among different populations. The most apparent is simply the geographical discontinuity of different spawning runs, different spawning times and the apparent 'homing' of each run to individual rivers. It is well established that there are biological differences among many different salmon runs (Hasler, 1966), so it is difficult to rule out the potential for similar types of variation eulachons. Perhaps the most striking apparent difference among different eulachon populations is the timing of spawning. In some rivers such as the Kitimat or Kemano, the time of spawning is relatively early, beginning in early March and in others such as the Fraser, or Klinaklini, the timing is later, beginning in late April or May. Based on concepts developed from observation of spawning of Pacific salmon, the timing of spawning runs should be biologically adapted to each river. If so, and if the same model is applied to eulachons, then each population would be adapted to each river. Therefore, until we better understand both the biological and genetic variability (or lack of it) among different eulachon populations, we are not prepared to ignore any populations differences among different rivers or estuaries.

IMPLICATIONS OF LARVAL SURVEY RESULTS FOR EULACHONS STOCKS

The distributions of larval eulachon that we describe in this report confirm that the number of spawning areas used by eulachons is limited. In those instances, however, where several rivers or streams drain into the same inlet (i.e. Klinaklini and Franklin rivers into Knight Inlet, or the Kitlope, Kemano and Kowesas rivers draining into Gardner Canal) we cannot be certain about the relative contribution of specific rivers to the numbers of larvae we observe in the adjacent estuarine or marine waters. Indeed the close proximity of different potential spawning rivers casts doubt on the capability for adjacent rivers to maintain distinct biological stocks. For instance, following the basic salmon life-history model, it is not unreasonable to assume, a priori, that eulachons may home to individual rivers. Homing, however, must be preceded by imprinting at an earlier life history stage. Salmonid imprinting may occur at several stages, and the first stage is thought to involve some form of olfactory recognition of chemical constituents in the water just after hatching. Imprinting is not thought to occur during the egg stage, presumably because of the relative impermeability of the egg capsule. Therefore, if these constraints applied to eulachons, there would be no imprinting during the 2-4 week egg incubation stage. If eulachons imprinted after hatching, they probably would have to do it rapidly, because in most instances they are rapidly advected to estuarine or marine waters. Given the flow rates in some eulachon-bearing rivers, the time of freshwater residence of newly hatched eulachon larvae would be measured in minutes or, at most, hours. This would provide very little time for larvae to imprint, compared to the much longer time (days, weeks and months of gravel residence) of salmonids. Further, eulachon larvae are only a few mg of wet weight, whereas salmonid alevins are thousands of times larger, and presumably have more biological capability (tissue and sense organs) for imprinting. Therefore, we suggest that it is unlikely that eulachons imprint during their freshwater egg and larval stages. On the other hand, our larval distribution data indicates that larvae reside in estuaries for considerable periods, weeks and perhaps months, and may be retained there by estuarine circulation. This resident time could provide an opportunity to imprint, but if so, the imprinting would be to estuarine waters and not necessarily to the water discharged from specific rivers. Therefore, we suggest that estuaries may be an important criterion for population configuration and that the numbers of different spawning runs could be determined (or limited) by the numbers of different estuaries. It also follows that annual variation in discharge volumes might lead to changes in the relative sizes of the eulachon spawning runs among rivers.

UTILITY OF LARVAL SURVEYS AS INDICATORS OF EULACHON SPAWNING RIVERS

Ichthyoplankton surveys are sensitive detectors of *small*, spawning runs, that might be missed by conventional fishing techniques (gillnet or seine nets) on adults. Substantial numbers of eulachon larvae can be caught in rivers where no (or negligible) adult spawning is observed. Further, the duration of the presence of larvae in adjacent estuaries seems to occur over a number of weeks, whereas the duration of spawning may be complete within days. A wide range of larval densities can also be measured using standard ichthyoplankton survey techniques, not only in rivers but also in estuaries, inlets and open ocean areas, during an 18-20 week period (April to August) 4 weeks after adult spawning has occurred. The basic technique is simple and requires a plankton net and a swept-volume procedure.

UTILITY OF LARVAL SURVEYS AS INDICATORS OF EULACHON SPAWNING BIOMASS

Variation in vulnerability and catchability of adults can be a problem with other assessment techniques that use seines, trawls, gillnets or traps. Ichthyoplankton catchability, however, is relatively constant, as most targets are small (< 15 mm), oceanographically dispersed and unable to avoid the nets. Fishing 'skill' usually is not a complicating factor in capturing larvae so catchability or sampling variables are minimal. For these reasons, larval samples may be better 'unbiased' estimates of the population than samples from other gear types. Variations of standard ichthyoplankton surveys are currently used to assess the abundance of Fraser River adult eulachon spawning biomass (Hay et al., 1997b). Surveys described in this report, however, were conducted primarily to assess distributions, not biomass. The main limitation of the data is that we cannot estimate the egg and larval mortality between egg deposition and larval capture. For these reasons, the estimates of total larval numbers are not a reliable index of spawning biomass. Regardless, there are some conservation concerns about eulachons and we felt it could be informative to estimate total numbers and then provide an 'approximate' estimate of the spawning biomass required to produce the estimated numbers of larvae. The conversion from larval numbers to spawning biomass uses estimates of 'relative' fecundity of about 350 eggs per gram of spawning female or about 700 eggs/g from the spawning populations (males included). Using this conversion, the biomass required to produce the larval eulachon numbers are shown in Table 8.

It is certain that these estimates of spawning biomass are severe underestimates, mainly because they assume complete survival between the time of egg deposition and egg survival. Such an assumption is unreasonable, and the total mortality during this period could easily remove most of the larvae (i.e. 90% or 99% or more). We have only a few estimates of the biomass from rivers in the central coast of BC (Table 9). An estimate was made for the Kitimat River in 1993 (Pedersen, et al., 1995) of about 23 tonnes (based on an estimate of the number of discharged larvae at 5.7×10^9 and a relative fecundity of 250 egg/g). From aerial surveys, Triton Consultants (1991) estimated a mean spawning escapement of 4.96×10^6 fish plus 1.875×10^6 fish taken in the fishery. At an approximate mean weight of about 50g/fish, the total spawning run (before catch) would have been about 340 tonnes, and this estimate was regarded as conservative because it did not include fish that entered and left the river prior to the survey, or after the survey. In 1991, eulachons may have spawned in other rivers in the Gardner Canal, such as the Kitlope and Kowesas, and their spawning biomass is unknown. Therefore, we can only guess at the total biomass but it seems probable that the upper Gardner Canal, into which drain 3 major eulachon rivers (Kemano, Kitlope and Kowesas) could support eulachon spawning populations of 500-1000 tonnes or more. If so, the 1997 estimate of spawning biomass from the larval surveys at 113 tonnes (and which includes the Kitimat and Kildala Rivers) would represent about 10-20 % of the spawning biomass in 1991. By presenting these estimates we do not mean to imply that there was a decrease in biomass between 1991 and 1997, and we do not mean to suggest that any conclusions can be drawn about larval survival. Rather, we only suggest that the numbers of larvae that we estimated in the surveys is not unreasonable relative to the rough estimates of available spawning biomass.

CENTRAL COAST EULACHON POPULATIONS COMPARED WITH OTHER POPULATIONS

The biomass estimates discussed above also can be considered relative to the available catch data (Table 7) in Knight Inlet (where usually less than 200 tonnes is taken from the Klinaklini and Franklin Rivers) and the Bella Coola River, where the catch appears to be less than 100 tons in most years. Comparison of the catch data from the central coast areas with the Fraser and Columbia Rivers show that the catches are much smaller than the Columbia and Fraser Rivers. Also, they are substantially less that the large catches in the Nass River.

Ignoring the recent (post 1990) declines in catches in the Fraser and Columbia, the relative scale of the catches between the central coast rivers and the Fraser and Columbia, may be roughly accurate – that is, the central coast rivers support much smaller eulachon populations. Probably the catch data are a rough indicator of the relative sizes of the spawning populations. If so, the sum of the biomass of all the central coast populations would constitute only a fraction of the Columbia River spawning biomass, in those years prior to the recent decline. On the other hand, the Nass River seems to support (or have supported) a relatively large eulachon spawning biomass, perhaps equal to that of the Fraser River. It is not clear if the Nass River still retains such a large spawning biomass, although the single biomass estimate made for 1983 (Appendix Figure 1 and Appendix Table 2) indicated a spawning biomass of about 1700 tonnes.

LARVAL SURVEY INFORMATION AS CONTRIBUTIONS TO THE BIOLOGY OF EULACHONS

We observe that eulachon larvae mix and distributions overlap with other eulachon larvae originating from several eulachon spawning rivers. This occurred at the head of Knight Inlet, Dean Channel and Gardner Canal. In the central coast eulachon larvae disperse and mix with other plankters in coastal areas during an 18-20 week period (April to August) 4 weeks after adult spawning has occurred. Based on modal variation in length frequency data, larvae grow from approximately 3-4 mm in size to 30-35 mm in size during this time period.

Oceanographic features measured during the surveys suggest that BOTH dispersion and retention mechanisms can be operating. Clearly there is some dispersal of larvae as they discharge from the relatively small spawning areas in rivers (probably from a spawning or egg deposition area of between 0.1 and 1.0 km^2 in most rivers to an area from 10-1000 km^2 for most larval distributions. On the other hand, larvae appear to be retained in inlets, and the larval eulachon distribution seems to be more oriented to fjords than the distribution of herring larvae, which are captured at the same time of year. Like herring larvae, however, relatively high larval eulachon densities, measured on the left sides of inlets (looking seaward), suggest an accumulation or retention effect (Coriolis effect) while larval samples collected at other stations showed a continuous dispersion effect due to estuarine outflow and wind and tidal influences (Hay and McCarter, 1997).

The larval rearing environment in BC's deep, cold and remote inlets seems to be dominated more by physical factors than biological factors. The inlets and deep fjords surveyed are known to be relatively low in overall productivity as compared to the rich, productive offshore banks and adjacent nearshore areas exposed to open ocean. Therefore, it is likely that some protection from predators is afforded in these inlets while eulachon larvae absorb their yolk sacs and gradually acquire the characteristics necessary to survive in open ocean environments. Further, the confinement of eulachon larvae to the upper layers of relatively low saline water (resulting from estuarine circulation) would eliminate most stenohaline predators (i.e. most marine fishes and invertebrate predators). As a consequence, small spawning runs of eulachon may be more sensitive to ocean climate changes particularly those that impact the freshwater discharge than, for instance, large spawning runs of herring that deposit vast numbers of progeny usually near the centers of highly productive areas.

SUMMARY AND RECOMMENDATIONS

1.) Larval surveys in the central coast of BC corroborated the occurrence of spawning runs in rivers or adjacent areas where they were believed to occur. In addition, we found evidence of eulachon spawning in a few small streams and rivers where they were not previously documented.

2.) The distribution of larval eulachons is consistent with known oceanographic factors that may affect their distribution, particularly estuarine circulation. The distribution of small eulachon larvae also has implications for understanding eulachon stock structure. We suggest that the smallest geographical area that can support a 'unique' eulachon stock is an estuary, and not necessarily a river. This suggestion is based on the observation that eulachon larvae spend very little time (minutes – hours) in rivers and substantially longer time in estuaries, as we observed from this study. The duration of larval residency in estuaries may be sufficient for geographic imprinting to occur. We suggest, therefore, that the most appropriate management unit for eulachons is the estuary, not necessarily the river. This recommendation only has application in a few instances where more than one river drains into an estuary. Specifically, we suggest that eulachons spawning in the Kitimat River may be the same population that spawn in adjacent rivers and streams at the head of Douglas Channel. Similarly, the populations spawning in the Kemano, Kitlope and Kowesas Rivers may be biologically identical, and able to switch among rivers. The same conclusions may apply to eulachon in Dean Channel, Rivers Inlet, Smith Inlet, Kingcome Inlet and Knight Inlet. If so, the total number of eulachon populations should not be listed according to the numbers of spawning rivers but by the numbers of available estuaries. This tentative conclusion is consistent with recent genetic and otolith chemistry analyses of eulachons.

3.) Larval surveys in estuarine waters provide very approximate and conservative estimates of spawning biomass. These estimates, however, indicate that central coast eulachon populations are small, with a low, total biomass. This is corroborated by a comparison of single point population biomass estimates made for certain years at different rivers, and by a comparison of catch data among different rivers, including the Fraser, Nass and Columbia Rivers, which were outside the range of the survey.

RECOMMENDATIONS

The recommendations that follow are based on results of the present paper, but are presented in the context of the recent decline of eulachons spawning runs that has occurred in a number of different systems (see Hay et al., 1997a, 1997b). The reasons for this general decline are not known and the relative severity among different areas is not clear.

1.) For the purposes of eulachon conservation in BC, eulachon populations could be identified at the level of major estuaries for each of the following rivers or systems: (1) Portland Inlet, (2) Skeena (3) head of Douglas Channel, (4) head of Gardner Canal) (5) Dean Channel, (6) Smith Inlet, (7) Rivers Inlet, (8) Kingcome Inlet, (9) Knight Inlet, (10) Bute Inlet, (11) Fraser River estuary. This recommendation would replace a 'one river-one stock' model that is implicitly assumed for most anadromous fish, but which has never been explicitly stated (or documented) for eulachons. This recommendation has several implications. Adopting the 'estuary' as the smallest common denominator for eulachon populations, changes the perspective on factors that might deleteriously impact on eulachons.

For example, industrial discharge or domestic sewage discharge into rivers would reduce the available spawning habitat within the river but the impact could be felt on a population that would be larger than that spawning only in a specific river. It follows that changes in the spawning size of single rivers (within an estuary) cannot be taken as an indicator of population change without reference to concurrent changes in adjacent rivers. This recommendation should not be interpreted as a suggestion for relaxation of management vigilance within individual rivers.

Alternatively, anthropogenic changes in an estuary could impact on the progeny derived from several rivers – even if the estuary is not immediately adjacent to the river. It follows that deleterious impacts to estuaries could affect an entire eulachon population. This recommendation should be interpreted as support for increased management concern and vigilance about anthropogenic changes in estuaries.

2.) One or more eulachon-bearing estuaries should be considered for inclusion in 'Marine Protected Areas' (i.e. Kitlope River estuary).

3.) Factors affecting eulachon larval survival in estuaries should be considered relative to future impacts. This would include activities to be avoided during spawning and larval rearing such as dredging, extensive log booming, industrial discharge (or intakes) etc.

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Table 1. List of known and possible eulachon spawning and larval dispersal areas examined during *VECTOR*, April 25 - May 5, 1994, *R. B. YOUNG*, May 27 - June 7, 1996 and *VECTOR*, April 14 - 25, 1997 ichthyoplankton surveys. River estuaries are ordered geographically, from southern to northern BC. Larval eulachon samples listed in this table are indicated by an asterisk in Appendix Table 1. Corresponding larval length frequencies are shown in Table 2a.

Known Eulachon Spawning Areas	Inlet Head & Larval Dispersal Areas
Homathko River	Bute Inlet -> Johnstone Strait
Klinaklini & Franklin Rivers	Knight Inlet -> Johnstone Strait
Kingcome River	Kingcome Inlet -> Queen Charlotte Strait
Chuckwalla/Kilbella & Wannock Rivers	Rivers Inlet -> Queen Charlotte Strait
Bella Coola River	North Bentinck Arm -> Burke Channel
Kimsquit River	Dean Channel
Kitlope River	Gardner Canal -> Verney Passage
Kowesas River	Chief Mathews Bay -> Gardner Canal
Kemano/Wahoo River	Kemano Bay -> Gardner Canal
Kildala River	Kildala Arm -> Douglas Channel
Kitimat River	Kitimat Arm -> Douglas Channel
Possible Eulachon Spawning Areas (Based **only** on larval density maps figs. 3a-3g **and** larval length frequency samples from the surveys)	Inlet Head & Larval Dispersal Areas
Stafford/Apple Rivers (Samples 167-169 in 1997)	Loughborough Inlet -> Johnstone Strait
Kakweiken River (Samples 42-43 in 1997)	Thompson Sound -> Johnstone Strait
Nekite River (Samples 57-58 in 1997)	Smith Inlet -> Queen Charlotte Strait
Clyak River (Samples 75, 79-81 in 1997)	Moses Inlet -> Rivers Inlet
Kainet or Lard Creek (Sample 154 in 1997)	Kynoch Inlet ->Mathieson Channel
Khutze River (Sample 188 in 1996)	Khutze Inlet -> Princess Royal Channel
Aaltanhash River (Sample 189 in 1996)	Aaltanhash Inlet -> Princess Royal Ch.

Table 2a. Length frequencies of 14 larval eulachon samples collected at the heads of mainland inlets near river estuaries not known to support eulachon spawning during *R. B. YOUNG*, May 27 - June 7, 1996 and *VECTOR*, April 14-25, 1997 ichthyoplankton surveys.

	1996		1997												
	Khutze & Aaltanhash		Thompson Sound		Smith Inlet		Moses Inlet				Kynoch Inlet	Loughborough Inlet			
Sample	188	189	42	43	57	58	75	79	80	81	154	167	168	169	All
larval length (mm)															
3.6	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1
3.8	0	0	0	0	0	0	0	1	1	0	0	0	0	0	2
4.0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1
4.4	1	1	0	2	1	0	0	0	0	0	0	0	0	0	5
4.6	0	2	2	2	1	2	0	0	0	0	1	1	0	0	11
4.8	0	1	0	2	0	4	0	0	0	1	0	0	0	0	8
5.0	3	0	3	7	1	1	3	1	1	2	0	0	0	0	22
5.2	0	1	2	1	0	1	0	0	1	2	1	0	0	0	9
5.4	2	1	3	1	7	2	3	0	0	0	0	0	0	0	19
5.6	0	0	3	1	2	3	1	1	0	4	1	0	0	0	16
5.8	0	0	1	2	1	3	1	0	1	2	2	0	0	1	14
6.0	0	1	3	1	1	1	3	0	1	4	0	0	0	0	15
6.2	0	1	0	0	1	1	0	1	2	2	0	0	0	1	9
6.4	0	0	1	0	2	0	0	0	2	1	0	2	0	0	8
6.6	0	1	0	0	1	1	0	0	1	0	0	0	0	2	6
6.8	0	0	0	0	1	0	0	0	0	1	0	1	1	1	5
7.0	0	0	1	0	0	0	1	1	0	0	0	3	2	1	9
7.2	1	0	0	0	0	0	0	1	0	0	0	2	3	3	10
7.4	0	0	0	0	0	0	1	1	0	0	0	2	3	4	11
7.6	0	0	0	0	0	0	1	0	0	0	0	1	2	5	9
7.8	0	0	0	1	0	0	0	0	0	0	0	3	0	0	4
8.0	0	2	0	0	0	0	1	1	0	0	0	1	4	1	10
8.2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8.4	0	1	0	0	0	0	0	0	0	0	0	1	1	1	4
8.6	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1
8.8	0	0	1	0	0	0	0	0	0	0	0	1	0	0	2
9.0	0	0	0	0	0	0	1	0	0	0	0	0	1	0	2
9.6	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1
9.8	0	1	0	0	0	0	0	0	0	0	0	0	1	0	2
10.0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1
10.2	1	1	0	0	0	0	0	0	0	0	0	0	0	0	2
10.6	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1
10.8	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1
11.2	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1
11.4	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1
12.0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	2
13.2	0	1	0	0	1	0	0	0	0	0	0	0	0	0	2
15.0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1
16.8	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1
19.2	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1
27.6	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1
All	11	20	20	20	20	19	16	10	10	20	5	20	20	20	231

Table 2b. Length frequencies of 4 larval eulachon samples (N=20) collected at the mouth of the Kemano River (midway along Gardner Canal) and 4 samples (N=20) at the mouth of the Kitlope River at the head of Gardner Canal during *R. B. YOUNG*, May 27 - June 7, 1996 ichthyoplankton survey.

	Kemano River Estuary					Kitlope River Estuary				
Sample:	46	47	48	49	All	56	57	58	68	All
larval length (mm)										
4.2	0	0	0	0	0	0	0	0	1	1
4.6	0	0	2	0	2	1	0	2	0	3
4.8	0	0	0	0	0	2	0	2	1	5
5.0	0	0	0	1	1	0	1	5	2	8
5.2	0	0	1	0	1	2	0	1	3	6
5.4	0	0	0	0	0	2	2	3	3	10
5.6	0	0	0	0	0	2	4	2	1	9
5.8	0	0	0	0	0	0	3	3	2	8
6.0	0	2	0	0	2	2	1	2	5	10
6.2	2	0	0	1	3	2	3	0	2	7
6.4	0	3	0	0	3	3	1	0	0	4
6.6	1	1	0	0	2	1	2	0	0	3
6.8	2	1	1	0	4	0	3	0	0	3
7.0	0	3	1	1	5	0	0	0	0	0
7.2	0	2	0	3	5	0	0	0	0	0
7.4	0	1	0	1	2	1	0	0	0	1
7.6	1	0	1	0	2	0	0	0	0	0
7.8	0	2	0	0	2	0	0	0	0	0
8.0	1	2	1	1	5	0	0	0	0	0
8.2	0	0	1	1	2	0	0	0	0	0
8.4	1	0	1	0	2	1	0	0	0	1
8.6	2	0	0	0	2	0	0	0	0	0
8.8	1	0	0	0	1	0	0	0	0	0
9.0	1	0	0	2	3	0	0	0	0	0
9.2	0	0	0	1	1	0	0	0	0	0
9.4	1	0	1	1	3	0	0	0	0	0
9.6	0	0	0	0	1	1	0	0	0	1
9.8	2	1	0	0	3	0	0	0	0	0
10.0	0	0	0	1	1	0	0	0	0	0
10.2	0	1	1	2	4	0	0	0	0	0
10.4	1	0	1	0	2	0	0	0	0	0
10.6	0	0	0	2	2	0	0	0	0	0
10.8	0	0	2	0	2	0	0	0	0	0
11.0	0	0	1	0	1	0	0	0	0	0
11.4	0	0	1	0	1	0	0	0	0	0
11.8	2	0	1	0	3	0	0	0	0	0
12.0	0	0	1	1	2	0	0	0	0	0
12.2	1	0	0	0	1	0	0	0	0	0
12.6	0	1	0	0	1	0	0	0	0	0
13.2	0	0	1	0	1	0	0	0	0	0
14.4	0	0	1	0	1	0	0	0	0	0
15.0	0	0	0	1	1	0	0	0	0	0
15.2	1	0	0	0	1	0	0	0	0	0
All	20	20	20	20	80	20	20	20	20	80

Table 2c. Larval eulachon length frequencies summarized by region and year. Johnstone Strait (JS), Queen Charlotte Strait (QS), Rivers Inlet (RI), Douglas Channel (DC) and Burke and Dean Channels (BD).

Year:	1994				1996	1997			
Region: Larval length (mm)	JS	QS	RI	ALL	DC	JS	RI	BD	ALL
3.0	1	0	0	1	0	0	0	0	0
3.2	0	0	0	0	1	1	0	0	1
3.6	1	0	0	1	2	0	1	0	1
3.8	1	0	0	1	4	0	2	0	2
4.0	3	0	0	3	5	0	1	0	1
4.2	1	0	0	1	7	0	0	0	0
4.4	2	0	0	2	21	6	2	1	9
4.6	9	0	0	9	34	9	3	1	13
4.8	2	0	3	5	31	9	12	0	21
5.0	14	0	1	15	63	19	14	0	33
5.2	17	0	2	19	98	12	11	4	27
5.4	27	0	5	32	99	11	18	0	29
5.6	45	0	1	46	81	23	12	3	38
5.8	47	0	4	51	71	17	15	5	37
6.0	55	0	2	57	116	34	15	11	60
6.2	69	0	6	75	82	17	7	3	27
6.4	54	0	2	56	86	26	7	9	42
6.6	57	0	3	60	52	27	7	8	42
6.8	46	1	4	51	58	29	4	8	41
7.0	45	0	10	55	42	36	4	2	42
7.2	28	0	9	37	37	23	1	3	27
7.4	22	1	6	29	25	31	2	3	36
7.6	23	0	2	25	24	27	2	1	30
7.8	11	0	3	14	14	31	1	0	32
8.0	25	1	3	29	41	53	3	0	56
8.2	19	0	2	21	34	20	0	1	21
8.4	21	1	3	25	40	21	1	1	23
8.6	15	0	6	21	29	16	2	0	18
8.8	18	0	2	20	36	28	1	1	30
9.0	14	0	1	15	42	13	1	2	16
9.2	17	0	7	24	23	11	0	1	12
9.4	14	0	2	16	21	12	2	0	14
9.6	14	0	1	15	22	11	0	1	12
9.8	17	0	1	18	13	11	0	0	11
10.0	6	0	1	7	29	6	0	0	6
10.2	15	0	2	17	21	6	1	0	7
10.4	12	0	4	16	25	2	1	0	3
10.6	5	1	1	7	24	9	0	0	9
10.8	13	1	2	16	23	8	0	0	8
11.0	5	1	1	7	22	10	0	0	10
11.2	4	0	2	6	24	6	0	0	6
11.4	6	0	2	8	19	7	0	0	7
11.6	9	0	1	10	22	6	0	0	6
11.8	10	0	2	12	27	4	0	0	4
12.0	14	0	0	14	26	8	0	0	8

12.2	6	0	1	7	17	1	0	0	1
12.4	10	0	0	10	22	7	0	0	7
12.6	3	0	1	4	16	2	0	0	2
12.8	8	0	2	10	12	2	0	0	2
13.0	4	0	0	4	18	5	1	0	6
13.2	4	0	2	6	14	7	1	0	8
13.4	4	0	0	4	5	5	0	0	5
13.6	6	0	1	7	13	5	0	0	5

Table 2c (Cont'd.) Larval eulachon length frequencies summarized by region and year. Johnstone Strait (JS), Queen Charlotte Strait (QS), Rivers Inlet (RI), Douglas Channel (DC) and Burke and Dean Channels (BD).

Year:	1994				1996	1997			
Region: Larval length (mm)	JS	QS	RI	ALL	DC	JS	RI	BD	ALL
13.8	5	1	0	6	4	0	0	0	0
14.0	4	0	0	4	9	1	0	0	1
14.2	3	0	0	3	4	2	0	0	2
14.4	1	0	0	1	7	2	0	0	2
14.6	2	0	0	2	7	1	0	0	1
14.8	3	0	0	3	8	0	0	0	0
15.0	2	0	0	2	11	1	0	0	1
15.2	0	0	0	0	10	3	0	0	3
15.4	0	0	0	0	7	0	0	0	0
15.6	0	0	0	0	6	0	0	0	0
15.8	0	0	0	0	6	3	0	0	3
16.0	1	0	0	0	3	0	0	0	0
16.2	1	0	0	1	3	0	0	0	0
16.4	0	0	0	0	3	0	0	0	0
16.6	0	0	0	0	4	0	0	0	0
16.8	1	0	0	1	3	0	0	0	0
17.0	0	0	0	0	3	0	0	0	0
17.2	0	0	0	0	2	0	0	0	0
17.4	0	0	0	0	2	0	0	0	0
17.6	0	0	0	0	2	0	0	0	0
17.8	0	0	0	0	5	0	0	0	0
18.0	0	0	0	0	2	0	0	0	0
18.2	0	0	0	0	1	0	0	0	0
18.4	0	0	0	0	3	1	0	0	1
18.8	0	0	0	0	1	0	0	0	0
19.0	0	0	0	0	2	0	0	0	0
19.2	0	0	0	0	3	1	0	0	1
19.6	0	0	0	0	3	0	0	0	0
19.8	0	0	0	0	2	0	0	0	0
20.0	0	0	0	0	3	0	0	0	0
20.6	0	0	0	0	1	0	0	0	0
21.0	0	0	0	0	1	0	0	0	0
21.2	0	0	0	0	2	0	0	0	0
21.6	0	0	0	0	1	0	0	0	0
21.8	0	0	0	0	1	0	0	0	0
22.0	0	0	0	0	1	0	0	0	0
22.6	0	0	0	0	2	0	0	0	0
23.8	0	0	0	0	2	0	0	0	0
24.0	0	0	0	0	2	0	0	0	0
24.2	0	0	0	0	2	0	0	0	0
24.4	0	0	0	0	1	0	0	0	0
24.6	0	0	0	0	1	0	0	0	0
25.4	0	0	0	0	1	0	0	0	0
25.6	0	0	0	0	1	0	0	0	0
26.2	0	0	0	0	1	0	0	0	0
26.4	0	0	0	0	1	0	0	0	0
26.8	0	0	0	0	1	0	0	0	0
27.6	0	0	0	0	1	0	0	0	0
27.8	0	0	0	0	2	0	0	0	0

28.2	0	0	0	0	1	0	0	0	0
29.0	0	0	0	0	2	0	0	0	0
30.0	0	0	0	0	2	0	0	0	0
30.6	0	0	0	0	1	0	0	0	0
31.0	0	0	0	0	1	0	0	0	0
TOTAL	921	8	116	1045	1894	705	155	69	929

Table 3. Total area surveyed (m^2) and volume of seawater filtered (m^3), using 19-cm and 57-cm diameter bongo nets. Total counts of eulachon and herring larvae (from left net) and total plankton dry weight (from right net) for each region and year during *VECTOR*, April 25 - May 5, 1994, *R. B. YOUNG*, May 27 - June 7, 1996 and *VECTOR*, April 14 - 25, 1997 ichthyoplankton surveys. Fixed-depth plankton net tows are excluded.

Survey Date:	Apr 25-May 5, 1994			Apr 14-25, 1997			May 27-Jun 7, 1996
Survey Area:	Johnstone Strait	Queen Charlotte Strait	Smith & Rivers Inlets	Johnstone Strait	Smith & Rivers Inlets	Burke & Dean Channels	Douglas Channel & Gardner Canal
Ocean Surface Area (m^2)	1.76E+09	3.59E+09	6.30E+08	1.22E+09	3.58E+08	1.06E+09	1.75 E+09
Total Volume of Seawater Filtered (m^3)	7,244	8,311	3,101	6,418	1,198	4,942	16,542
Total Eulachon Larvae Counted	**6,174**	**8**	**219**	**3,383**	**314**	**251**	**23,778**
Total Herring Larvae Counted	**1,099**	**309**	**5,618**	**2,626**	**3,108**	**1,822**	**792**
Total Dry Weight of Plankton (g)	**64.0**	**194.4**	**237.4**	**264.1**	**57.7**	**512.9**	**418.2**
Total Number of Sampling Stations (fixed-depth tows excluded)	**172**	**119**	**88**	**83**	**25**	**79**	**165**

Table 4. Estimates of the number of fish larvae (scientific notation) in each region and year using a simple area expansion method during *VECTOR*, April 25 - May 5, 1994, *R. B. YOUNG*, May 27 – June 7, 1996 and *VECTOR*, April 14 – 25, 1997 ichthyoplankton surveys. Only surface waters (0-20 m depth) were examined during the surveys.

Survey Date:	Apr 25-May 5, 1994			Apr 14-25, 1997			May 27-Jun 7, 1996
Survey Region:	Johnstone Strait	Queen Charlotte Strait	Smith & Rivers Inlets	Johnstone Strait	Smith & Rivers Inlets	Burke & Dean Channels	Douglas Channel & Gardner Canal
Ocean Surface Area (m^2)	1.76E+09	3.59E+09	6.30E+08	1.22E+09	3.58E+08	1.06E+09	1.75 E+09
Larval Fish Taxonomic Group:							
Eulachon	**3.76E+10**	**2.33E+08**	**1.70E+09**	**1.69E+10**	**2.26E+09**	**1.31E+09**	**3.94E+10**
Herring	9.07E+09	1.80E+10	4.43E+10	1.28E+10	3.43E+10	1.07E+10	2.15E+09
Codfishes	-	-	-	2.65E+09	9.69E+08	1.40E+10	3.25E+09
Prickle/Gunnels	1.57E+06	5.76E+06	1.74E+07	8.29E+08	3.65E+08	2.24E+08	8.83E+08
Sandlance	1.70E+08	1.67E+09	3.17E+07	4.92E+08	4.28E+08	1.95E+08	1.69E+07
Lingcod	-	-	-	1.13E+07	7.98E+06	1.70E+07	3.19E+07
Sculpins	-	-	-	6.83E+09	1.83E+09	1.86E+09	3.76E+09
Poachers	-	-	-	3.60E+07	9.46E+06	3.13E+07	6.84E+07
Flatfishes	-	8.90E+08	6.91E+07	4.75E+09	7.91E+08	1.82E+09	1.10E+09
Deepsea smelts	1.32E+09	2.77E+08	5.31E+07	2.64E+09	1.08E+08	1.23E+10	2.99E+09
Unclassified	1.47E+10	1.20E+10	3.84E+09	3.44E+08	5.21E+08	7.70E+08	1.95E+09

Table 5a. Counts of eulachon larvae, eulachon density estimates (#/m^3) and mean larval eulachon length measurements (mm) from each fixed-depth plankton tow conducted from the *R. B. YOUNG*, June 4, 1996 at station M47 in Kitimat Arm.

Sample Number	Station Name	Time (PDT)	Depth (m)	Volume seawater filtered (m^3)	Larval Eulachon Count	Larval eulachon density (#/m^3)	Mean length (mm)	Number of larvae measured
141	M47	0615	0	67.8	74	1.09	7.23	20
142	M47	0625	5	99.6	149	1.50	5.77	20
143	M47	0635	10	74.0	19	0.26	7.18	19
144	M47	0645	15	32.1	0	0.00	-	0
145	M47	0700	20	66.0	1	0.02	-	0
146	M47	0715	35	85.0	2	0.02	-	0
156	M47	1205	0	88.1	42	0.48	5.57	20
157	M47	1215	5	100.5	217	2.16	6.07	20
158	M47	1225	10	86.4	10	0.16	7.68	10
159	M47	1240	15	66.9	12	0.18	5.67	12
160	M47	1255	20	95.9	8	0.08	6.80	8
161	M47	1305	35	139.9	5	0.04	10.96	5
166	M47	1805	0	99.4	47	0.47	5.62	20
167	M47	1815	5	106.5	49	0.46	5.82	20
168	M47	1830	10	75.1	21	0.28	5.42	21
169	M47	1845	15	71.8	17	0.24	8.25	17
170	M47	1900	20	90.3	8	0.09	10.90	8
171	M47	1915	35	118.1	7	0.06	8.69	7
178	M47	0015	0	79.6	240	3.02	6.81	20
179	M47	0025	5	95.8	67	0.70	16.87	20
180	M47	0035	10	93.2	12	0.13	18.13	12
181	M47	0050	15	96.4	10	0.10	18.76	10
182	M47	0100	20	88.2	8	0.09	12.48	8
183	M47	0110	35	100.7	9	0.09	9.91	9

Table 5b. Counts of eulachon larvae, eulachon density estimates (#/m^3) and mean larval eulachon length measurements (mm) of each fixed-depth plankton tow conducted from the *VECTOR*, April 24, 1997 at stations BT1-BT5 at the head of Bute Inlet.

Sample Number	Station Name	Time (PDT)	Depth (m)	Volume seawater filtered (m^3)	Larval Eulachon Count	Larval eulachon density (#/m^3)	Mean length (mm)	Number of larvae measured
173	BT1-0	0805	0	76.3	0	0.00	-	0
174	BT1-10	0820	10	79.9	162	2.03	6.75	20
175	BT1-20	0835	20	81.3	72	0.89	7.10	20
176	BT1-30	0845	30	88.6	88	0.99	7.06	20
179	BT3-0	0950	0	66.1	6	0.09	5.60	6
180	BT3-10	1000	10	33.0	163	4.94	8.78	20
181	BT3-20	1015	20	88.4	147	1.66	10.54	20
182	BT3-30	1025	30	71.8	92	1.28	9.92	20
185	BT5-0	1207	0	57.3	2	0.04	-	0
186	BT5-10	1221	10	26.5	94	3.55	7.92	20
187	BT5-20	1237	20	54.9	39	0.71	11.35	20
188	BT5-30	1248	30	103.9	75	0.73	10.95	20

Table 6a. Surface temperature and salinity measurements taken by STD-12 instrument #424 at hydrographic stations during *R. B. YOUNG*, May 27 – June 7, 1996, Kitimat/Gardner Canal ichthyoplankton survey.

Station Name	Latitude (deg min)	Longitude (deg min)	Date	Time	Max depth (m)	Surface salin (o/oo)	Surface temp (oC)	STD Cast number
G37	53 21.8	128 1.1	960601	1015	25	3.0	9.4	1
G38	53 24.7	128 4.6	960601	1050	25	4.3	11.1	2
G39	53 27.8	128 9.0	960601	1125	25	3.4	12.2	3
G40	53 27.6	128 16.2	960601	1205	25	3.1	10.6	4
G41	53 29.0	128 20.9	960601	1310	25	4.0	10.6	5
G42	53 26.3	128 28.4	960601	1435	25	6.9	11.3	6
G43	53 28.9	128 38.3	960601	1530	25	9.3	12.9	7
G44	53 32.0	128 45.5	960601	1610	25	8.5	13.1	8
G45	53 34.8	128 50.0	960601	1645	25	14.7	13.1	9
G46	53 32.9	128 52.6	960601	1705	25	20.7	12.5	10
G47	53 33.2	128 59.3	960601	1755	25	15.9	13.5	11
G48	53 31.0	128 58.9	960601	1820	25	25.8	10.6	12
G49	53 27.2	128 57.8	960601	1855	25	26.7	11.4	13
S1	53 27.1	128 57.1	960602	0900	25	26.8	10.6	14
S4	53 18.6	128 55.2	960602	1000	25	26.3	13.0	15
S7	53 17.5	129 7.0	960602	1105	25	27.2	11.1	16
S10	53 10.0	129 6.0	960602	1210	25	27.3	12.4	17
S13	53 5.7	129 11.9	960602	1325	25	28.5	10.3	18
S16	53 7.2	129 20.6	960602	1440	25	27.0	12.3	19
S19	53 13.1	129 24.7	960602	1615	25	28.3	11.0	20
M25	53 22.2	129 11.8	960603	1005	25	23.0	12.9	21
M28	53 25.7	129 12.3	960603	1110	25	21.2	13.7	22
M30	53 31.1	129 12.4	960603	1200	25	21.0	13.2	23
M32	53 36.2	129 12.7	960603	1255	25	18.4	14.5	24
M33	53 38.7	129 10.8	960603	1333	25	21.3	13.1	25
M34	53 40.1	129 7.6	960603	1400	25	26.3	10.2	26
M36	53 43.9	129 2.2	960603	1500	25	14.3	15.8	27
M37	53 52.8	128 58.9	960603	1625	25	10.0	11.7	28
M38	53 50.0	128 58.3	960603	1700	25	12.3	13.0	29
M40	53 44.9	128 58.5	960603	1755	25	15.3	15.5	30
M41	53 46.4	128 55.2	960603	1825	25	14.7	15.4	31
M42	53 47.9	128 51.8	960603	1855	25	20.9	14.7	32
M43	53 49.7	128 48.6	960603	1930	25	13.7	15.7	33
M44	53 51.7	128 46.4	960603	1950	25	9.4	15.3	34
M45	53 54.0	128 44.1	960603	2020	25	13.7	14.6	35
M46	53 56.0	128 41.8	960603	2045	25	9.7	14.8	36
M47	53 58.5	128 40.4	960603	2115	25	7.8	13.2	37
M47	53 58.5	128 40.4	960604	0645	25	4.6	10.4	38
K1C	53 59.0	128 40.4	960604	0815	25	5.8	9.5	39
K2C	53 58.4	128 40.4	960604	0900	25	5.8	11.0	40
K3C	53 57.8	128 40.6	960604	0940	25	9.2	12.4	41
M47	53 58.5	128 40.4	960604	1240	25	3.8	9.9	42
K4C	53 57.1	128 40.7	960604	1405	25	7.7	12.4	43
M47	53 58.5	128 40.4	960604	1845	25	4.8	10.9	44
K5C	53 56.3	128 41.6	960604	2005	25	8.7	14.0	45
K6C	53 55.7	128 42.0	960604	2050	25	10.3	14.9	46
M47	53 58.5	128 40.4	960604	0050	25	2.5	8.4	47
W3	53 6.0	128 27.1	960605	0915	25	16.2	8.7	48

Table 6b. Surface temperature and salinity measurements taken by STD-12 instrument #458 at hydrographic stations during ***VECTOR***, April 14-25, 1997 central BC coast, ichthyoplankton survey.

Station Name	Latitude (deg min)	Longitude (deg min)	Date	Time	Max depth (m)	Surface salin (o/oo)	Surface temp (oC)	STD Cast number
K1STD1	51 04.0	125 36.7	970415	0810	25	12.2	9.3	1
K3STD2	51 01.6	125 34.5	970415	0855	25	11.8	8.8	2
K4STD3	50 58.6	125 33.6	970415	0925	25	19.7	9.4	3
K6STD4	50 53.0	125 33.7	970415	1025	25	22.1	9.6	4
K8STD5	50 49.8	125 40.3	970415	1120	25	22.3	9.3	5
K10STD6	50 45.6	125 39.7	970415	1250	25	24.0	9.2	6
K12STD7	50 51.4	125 46.6	970415	1350	25	28.6	7.6	7
T18STD8	50 53.2	126 20.9	970416	1615	25	23.2	6.9	8
T19STD9	50 53.0	126 15.9	970416	1655	25	7.2	5.2	9
T20STD10	50 55.3	126 12.2	970416	1750	25	8.7	6.0	10
T21STD11	50 57.3	126 30.3	970416	1900	25	8.3	7.3	11
T22STD12	50 59.9	126 31.0	970416	1920	25	20.1	6.7	12
T23STD13	51 01.3	126 31.2	970416	1950	25	7.3	6.0	13
S1STD14	51 11.2	126 39.6	970417	1055	25	0.1	8.3	14
S2STD15	51 08.4	126 40.7	970417	1120	25	5.4	6.7	15
S3STD16	51 06.2	126 44.2	970417	1235	25	7.7	8.8	16
SM1STD17	51 21.2	127 04.9	970418	0750	25	26.1	7.7	17
SM2STD18	51 22.2	127 07.2	970418	0810	25	6.1	5.2	18
SM3STD19	51 20.2	127 10.3	970418	0835	25	12.4	6.1	19
R11STD20	51 39.5	127 24.5	970418	1910	25	19.2	8.4	20
R12STD21	51 41.4	127 20.8	970418	1940	25	5.9	7.7	21
R13STD22	51 40.4	127 16.6	970418	2020	25	8.1	7.4	22
B17STD23	52 19.0	127 59.9	970419	1755	25	21.2	8.8	23
B18STD24	52 21.3	127 56.8	970419	1825	25	13.4	8.9	24
B19STD25	52 22.3	127 52.6	970419	1850	25	11.4	9.2	25
B20STD26	52 23.1	127 48.2	970419	1920	25	13.4	8.5	26
D20STD27	52 52.1	127 03.8	970420	0755	25	2.6	8.1	27
D19STD28	52 49.8	126 59.3	970420	0825	25	3.5	8.2	28
D18STD29	52 45.9	126 58.4	970420	0900	25	6.2	7.8	29
D17STD30	52 43.1	126 56.3	970420	0930	25	6.6	7.6	30
D16STD31	52 40.7	126 59.2	970420	1000	25	7.3	7.9	31
D15STD32	52 38.2	127 01.8	970420	1030	25	8.2	7.8	32
D4STD33	52 09.4	127 50.2	970420	1630	25	17.2	9.4	33
D3STD34	52 07.2	127 46.9	970420	1735	25	17.1	9.9	34
D2STD35	52 04.8	127 44.2	970420	1800	25	16.6	9.2	35
D1STD36	52 02.3	127 41.6	970420	1835	25	21.6	8.5	36
F1STD37	52 36.0	127 37.2	970421	0750	25	14.1	6.9	37
F2STD38	52 33.2	127 35.0	970421	0823	25	13.8	7.1	38
F3STD39	52 30.9	127 32.0	970421	0848	25	19.1	8.0	39
M3STD40	52 51.0	128 08.2	970422	0839	25	26.7	6.9	40
M2STD41	52 54.0	128 07.8	970422	0908	25	24.5	6.6	41
M1STD42	52 54.7	127 03.0	970422	0938	25	26.4	6.9	42
L7STD43	50 31.8	125 32.5	970423	1450	25	15.6	12.4	43
L8STD44	50 40.4	125 30.2	970423	1525	25	17.9	11.0	44
L9STD45	50 42.3	125 27.1	970423	1600	25	8.8	11.9	45
BT1STD46	50 54.3	124 49.6	970424	0900	25	10.3	10.5	46
BT2STD47	50 52.1	124 51.6	970424	0925	25	11.3	10.6	47

BT3STD48	50 49.8	124 53.2	970424	1040	25	16.4	11.1	48
BT4STD49	50 48.8	124 57.0	970424	1100	25	15.0	10.7	49
BT5STD50	50 46.5	124 55.3	970424	1300	25	16.5	11.4	50
BT6STD51	50 44.6	124 52.6	970424	1319	25	17.1	11.8	51

Table 7. Summary of available catch data from BC Rivers, as well as an 'offshore index' estimated from analyses of eulachon densities captured in a time series of data collected during offshore shrimp surveys (Hay et al., 1997). Only the Bella Coola and Knight Inlet rivers were assessed during the larval surveys.

Year	Nass (tons)	Bella Coola (tons)	Knight (tons)	Fraser (tonnes)	Columbia (tonnes)	Offshore Index (tonnes)
1929	450	*	*	*	*	*
1930	45	*	*	*	*	*
1938	*	*	*	*	473.91	*
1939	*	*	*	*	1407.45	*
1940	*	*	*	*	1401.14	*
1941	*	*	*	50.14	1150.82	*
1942	*	*	*	152.74	1220.91	*
1943	*	*	*	154.79	1807.86	*
1944	80	*	*	65.70	1031.14	*
1945	*	*	*	73.87	2599.68	*
1946	*	*	*	115.71	1489.09	*
1947	*	*	135.0	231.10	702.23	*
1948	*	*	*	112.80	1806.41	*
1949	*	*	70.0	102.70	1515.27	*
1950	*	*	100.0	36.20	673.86	*
1951	*	*	20.0	189.30	689.50	*
1952	*	*	27.5	421.00	579.50	*
1953	2250	*	*	158.60	777.73	*
1954	1750	5.5	*	151.60	856.50	*
1955	*	*	*	238.80	1016.86	*
1956	575	62.0	*	235.50	765.41	*
1957	267	*	20.0	33.20	717.73	*
1958	260	*	*	92.10	1189.27	*
1959	250	*	45.0	132.00	798.23	*
1960	300	*	60.0	84.00	532.82	*
1961	350	*	*	216.90	478.32	*
1962	450	*	70.0	178.20	669.82	*
1963	300	*	*	159.30	489.59	*
1964	*	*	*	105.50	382.64	*
1965	20	*	100.0	87.80	413.95	*
1966	66	20.0	*	101.90	467.41	*
1967	35	20.0	100.0	86.80	454.91	*
1968	415	20.0	100.0	46.00	430.68	*
1969	260	20.0	80.0	29.80	497.14	*
1970	250	20.0	40.0	71.70	538.14	*
1971	200	20.0	20.0	34.50	807.59	*
1972	300	20.0	50.0	53.20	747.05	*
1973	200	20.0	40.0	53.10	1106.55	302.44
1974	*	*	*	75.30	1073.55	*
1975	*	*	*	27.70	944.55	675.60
1976	*	*	*	36.70	1397.73	1148.97
1977	*	*	50.0	32.20	796.82	2529.70
1978	300	*	*	38.60	1218.18	1400.55
1979	*	*	*	22.30	525.91	1133.08
1980	*	*	*	24.40	1505.00	1211.34
1981	*	*	*	21.20	760.00	625.11
1982	*	*	*	13.70	1004.55	2395.76
1983	239	*	*	10.80	1240.91	238.64
1984	*	*	*	11.80	226.36	*
1985	*	*	*	29.20	926.36	1681.27
1986	*	*	*	49.60	1745.00	*
1987	*	*	*	19.30	861.36	1868.32

1988	*	*	*	39.50	1303.64	2090.93
1989	105	*	*	18.70	1394.09	1272.36
1990	8	*	*	19.90	1265.45	1643.17
1991	*	*	*	12.30	1340.91	1667.85
1992	*	*	*	19.60	1670.00	2600.20
1993	*	*	*	8.70	233.64	424.60
1994	*	*	*	6.10	19.55	91.78
1995	*	*	*	15.50	200.20	190.62
1996	135	*	*	63.20	26.60	729.81

Table 8. Estimates of the spawning biomass required to produce the numbers of eulachon larvae estimated in Table 4. The number of larvae (scientific notation) in each region and year using a simple area expansion method during *VECTOR*, April 25 - May 5, 1994, *R. B. YOUNG*, May 27 – June 7, 1996 and *VECTOR*, April 14 – 25, 1997 ichthyoplankton surveys. Only surface waters (0-20 m depth) were examined during the surveys.

Survey Date:	Apr 25-May 5, 1994			Apr 14-25, 1997			May 27-Jun 7, 1996
Survey Region:	Johnstone Strait	Queen Charlotte Strait	Smith & Rivers Inlets	Johnstone Strait	Smith & Rivers Inlets	Burke & Dean Channels	Douglas Channel & Gardner Canal
Ocean Surface Area (m^2)	1.76E+09	3.59E+09	6.30E+08	1.22E+09	3.58E+08	1.06E+09	1.75 E+09
Estimated number of Eulachon larvae	**3.76E+10**	**2.33E+08**	**1.70E+09**	**1.69E+10**	**2.26E+09**	**1.31E+09**	**3.94E+10**
Estimated Eulachon spawning biomass (tonnes)	**107.43**	**0.66**	**4.86**	**48.28**	**6.46**	**3.74**	**112.57**

Table 9. List of eulachon spawning biomass estimates for different rivers in BC, showing the source(s) of information. Catch data (shown in detail in Table 7) is summarized here.

River	Period/Year	Biomass	Catch	Source
Nass	early 1900's		500 tons/y	(Nisga'a Fisheries and Nortec 1990)
Years of maximal catch				
	1929		4500 tons	Stacey MS 1996
	1953		2250 tons	Stacey MS 1996
	1954		3500 tons	Stacey MS 1996
	1970-71		150-200 tons	Langer et al 1977:135-180 mt)
	1983		239 mt	Orr 1984 MS
	1989		105 t	(Nisga'a Fisheries and Nortec MS 1990)
	1990		8 tons	(Nisga'a Fisheries and Nortec MS 1990)
	1996		135 t	(1998 Eulachon Research Council notes)
	1983	1700 mt		Orr 1984 MS and this report (Appendix Table 2)
Skeena	1997	3 mt (known to be low)		(1998 Eulachon Research Council notes)
Kitimat	1993	23 mt		Pedersen et al. 1995
Kemano	1990	342 mt*	~120 tonnes	Triton MS 1990
Kemano	1991	83 mt*	~ 70 tonnes	Triton MS 1991
Kitlope				
Kowesas				
Kildala				
Homathko River				
Klinaklini	1996	~120 mt	50-100 tons	Berry MS 1996, 1998 Eulachon Research Council Notes
Franklin				
Kingcome	1997	14 mt		1998 Eulachon Research Council Notes
Wannock	1997	nil		1998 Eulachon Research Council Notes
Chuckwalla				
Kilbella				
Bella Coola			10-62 tonnes	Stacey MS 1996
Kimsquit				
Fraser	<1950		100-500 tons	Ricker et al. 1954
Fraser	>1990's	50-1700 mt	20-30 tonnes	Hay et al. 1997b

* estimates in tonnes were made by dividing the estimated number of individuals (provided in source) by a median wt of 50 g (provided by source).

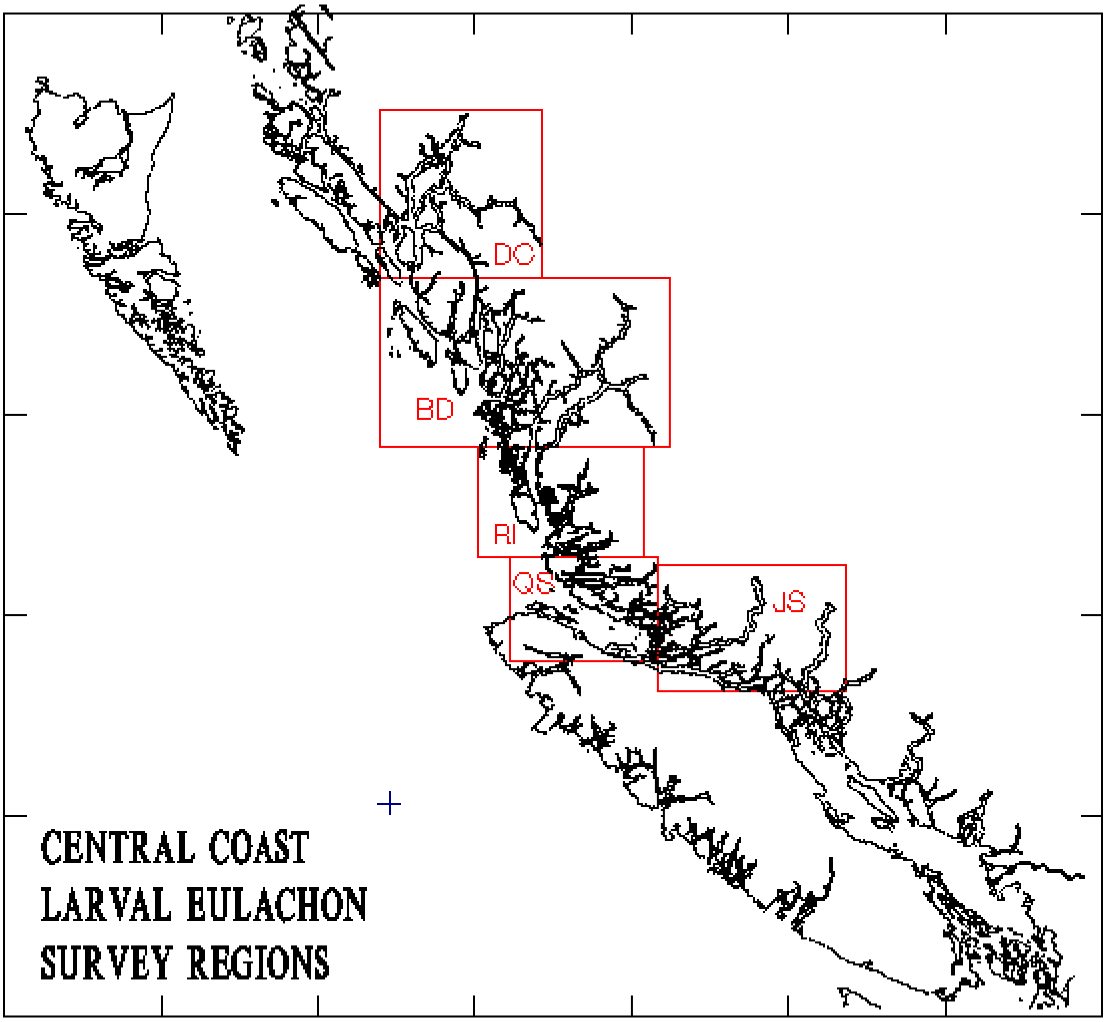


Fig. 1. Larval eulachon regions examined during VECTOR, April 25 - May 5, 1994, R. B. YOUNG, May 27 – June 7, 1996 and VECTOR, April 14 – 25, 1997 ichthyoplankton surveys. Johnstone Strait (JS), Queen Charlotte Strait (QS), Rivers Inlet (RI), Burke & Dean Channels (BD) and Douglas Channel (DC).

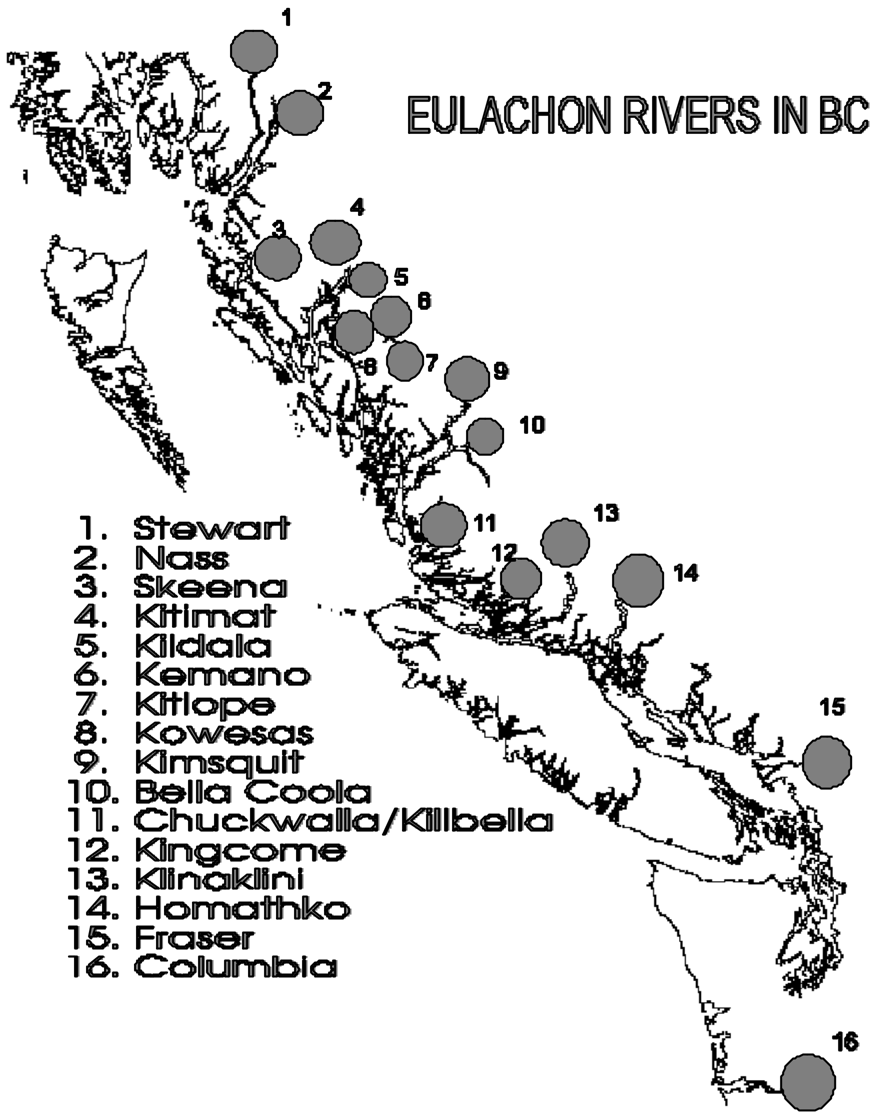


Fig. 2. Major eulachon spawning areas in British Columbia (DFO, 1999)

Fig. 3a. **Larval eulachon** density map of the Johnstone Strait Region (JS) during April 25 – May 5, 1994 (Maximum density = 21.3 larvae/m3). A cross indicates a station where no eulachon larvae were captured.

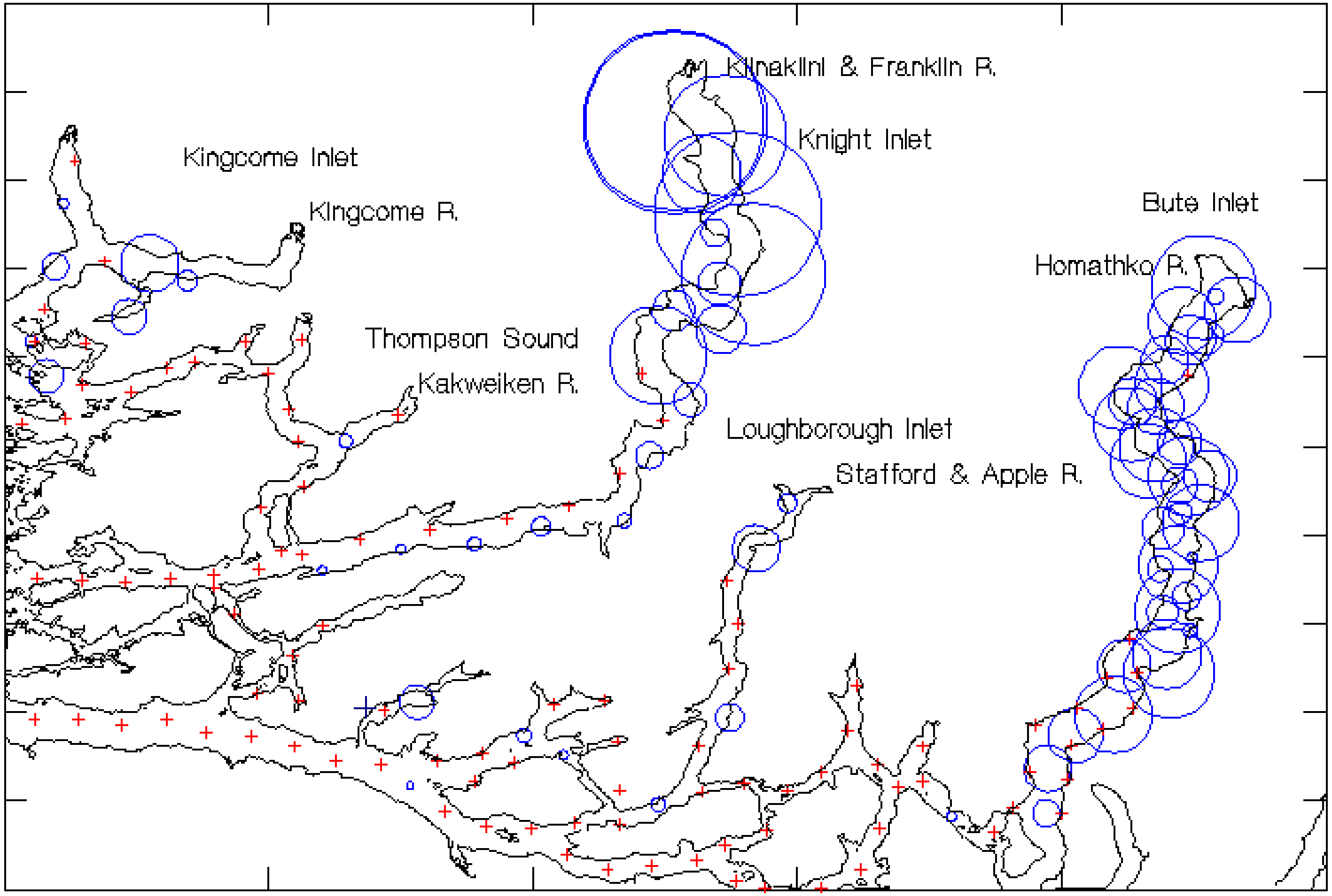


Fig. 3b. **Larval eulachon** density map of the Queen Charlotte Strait Region (QS) during April 25 – May 5, 1994 (Maximum density = 0.1 larvae/m3). A cross indicates a station where no eulachon larvae were captured.

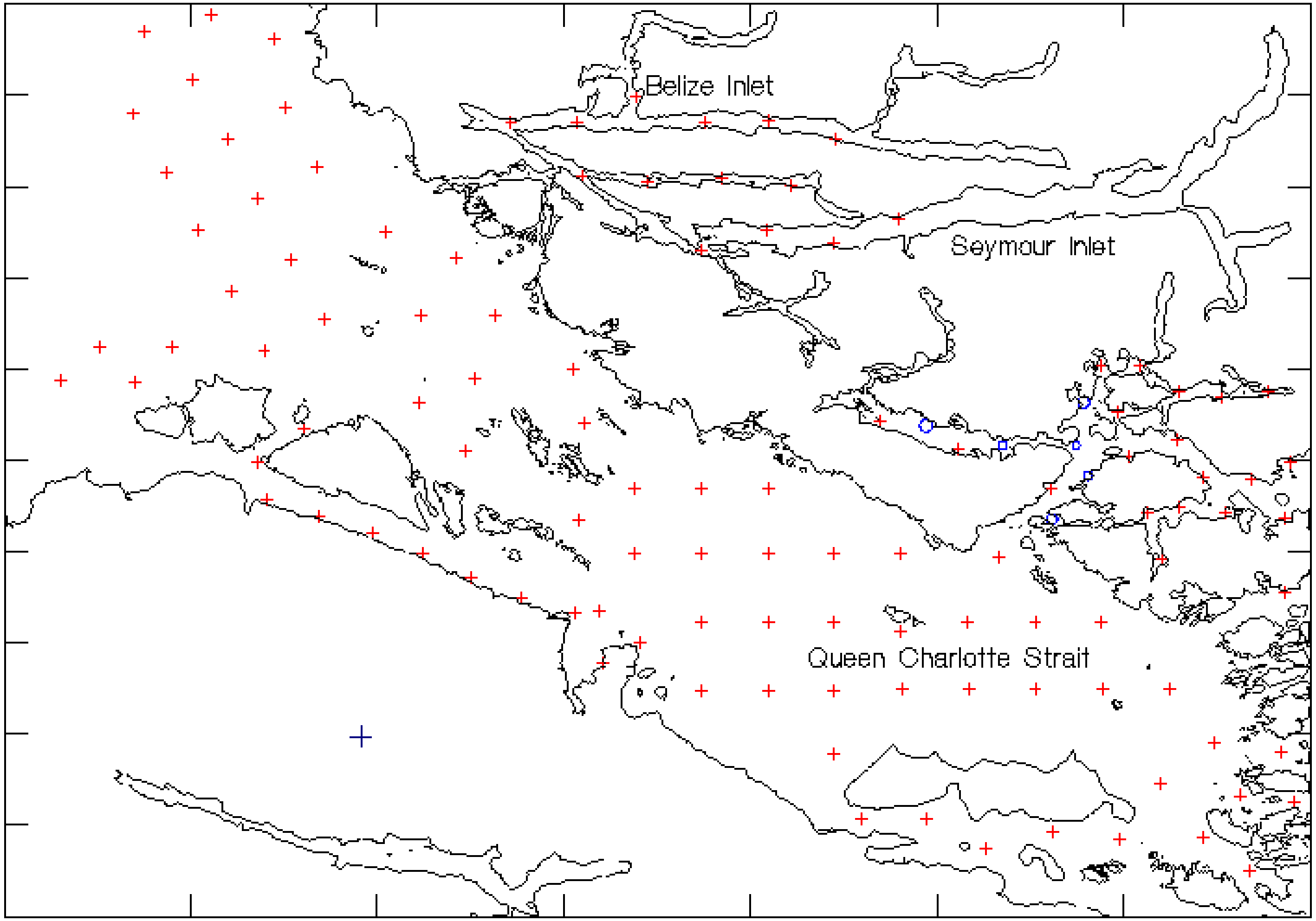


Fig. 3c. **Larval eulachon** density map of the Rivers Inlet Region (RI) during April 25 – May 5, 1994 (Maximum density = 4.0 larvae/m3). A cross indicates a station where no eulachon larvae were captured.

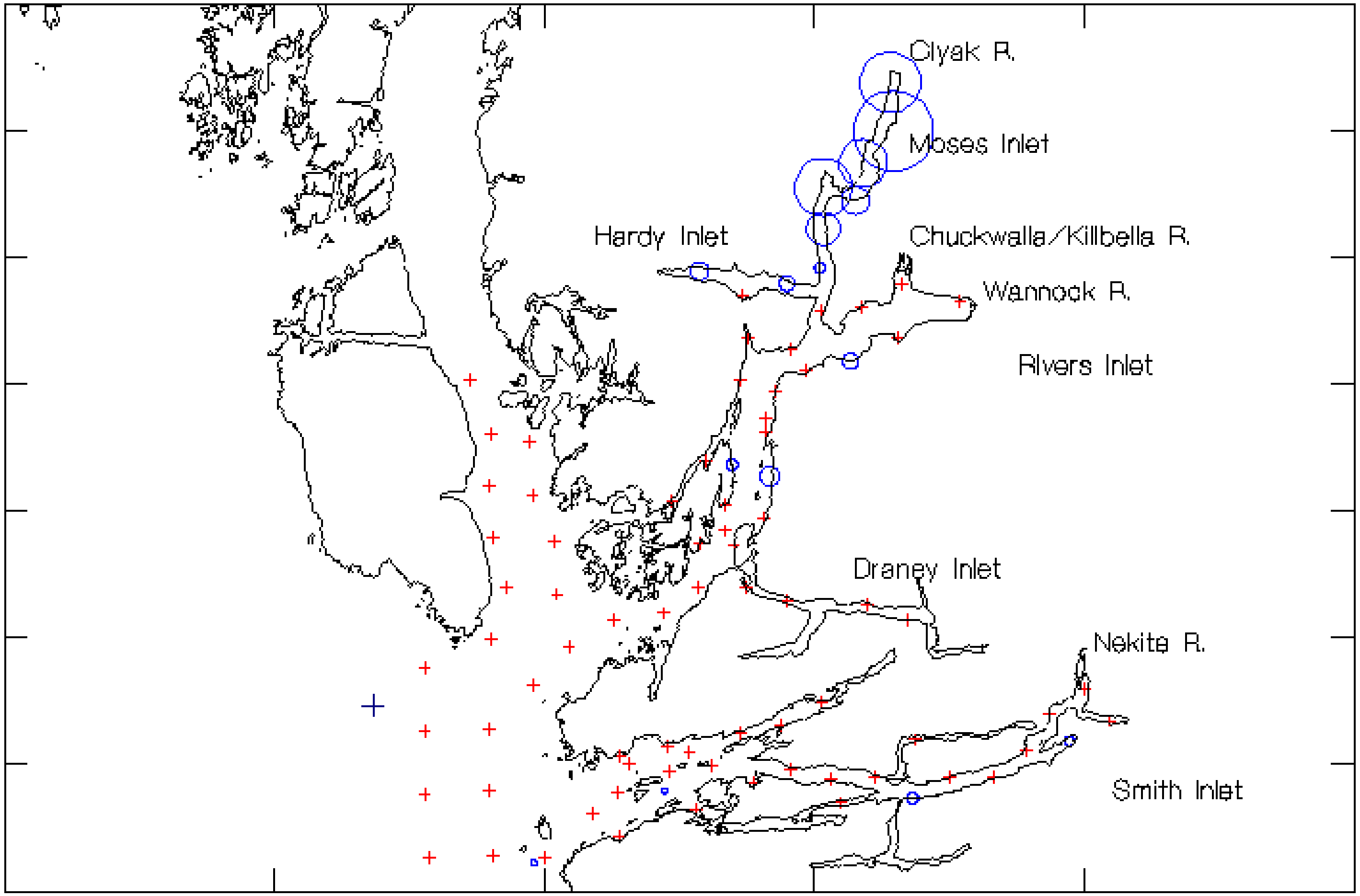


Fig. 3d. **Larval eulachon** density map of the Douglas Channel Region (DC) during May 27 – June 7, 1996 (Maximum density = 32.2 larvae/m3). A cross indicates a station where no eulachon larvae were captured.

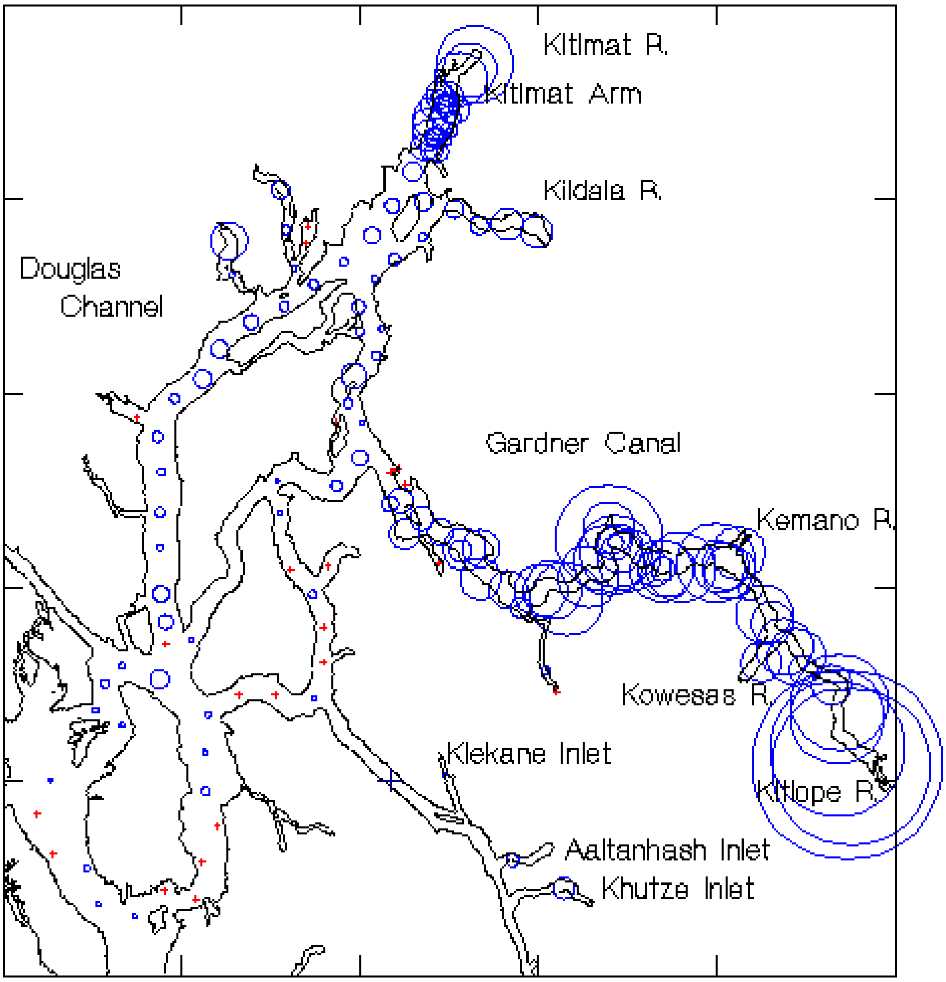


Fig. 3e. **Larval eulachon** density map of the Johnstone Strait Region (JS) during April 14 – 25, 1997 (Maximum density = 6.5 larvae/m3). A cross indicates a station where no eulachon larvae were captured.

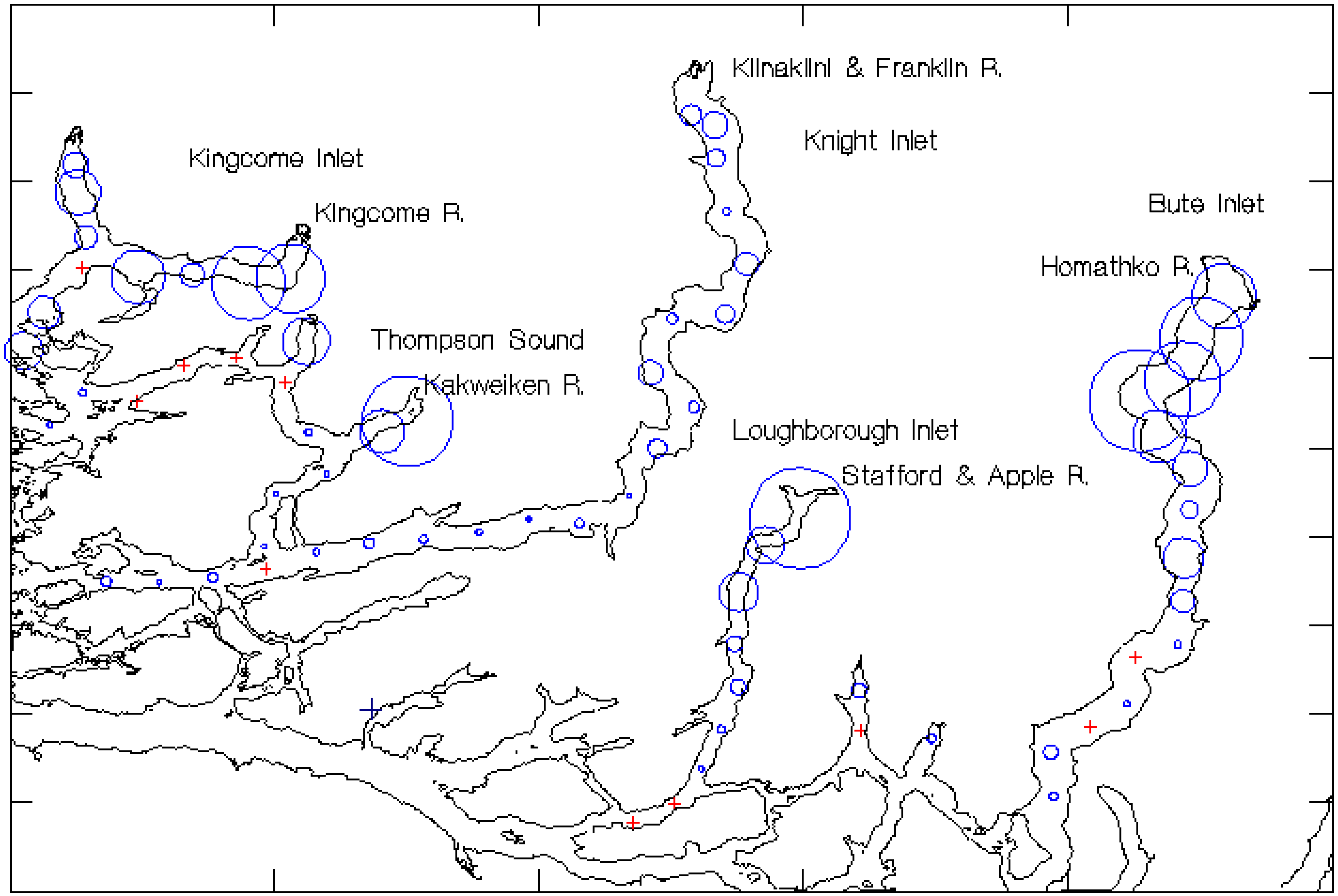


Fig. 3f. **Larval eulachon** density map of the Rivers Inlet Region (RI) during April 14 – 25, 1997 (Maximum density = 3.6 larvae/m3). A cross indicates a station where no eulachon larvae were captured.

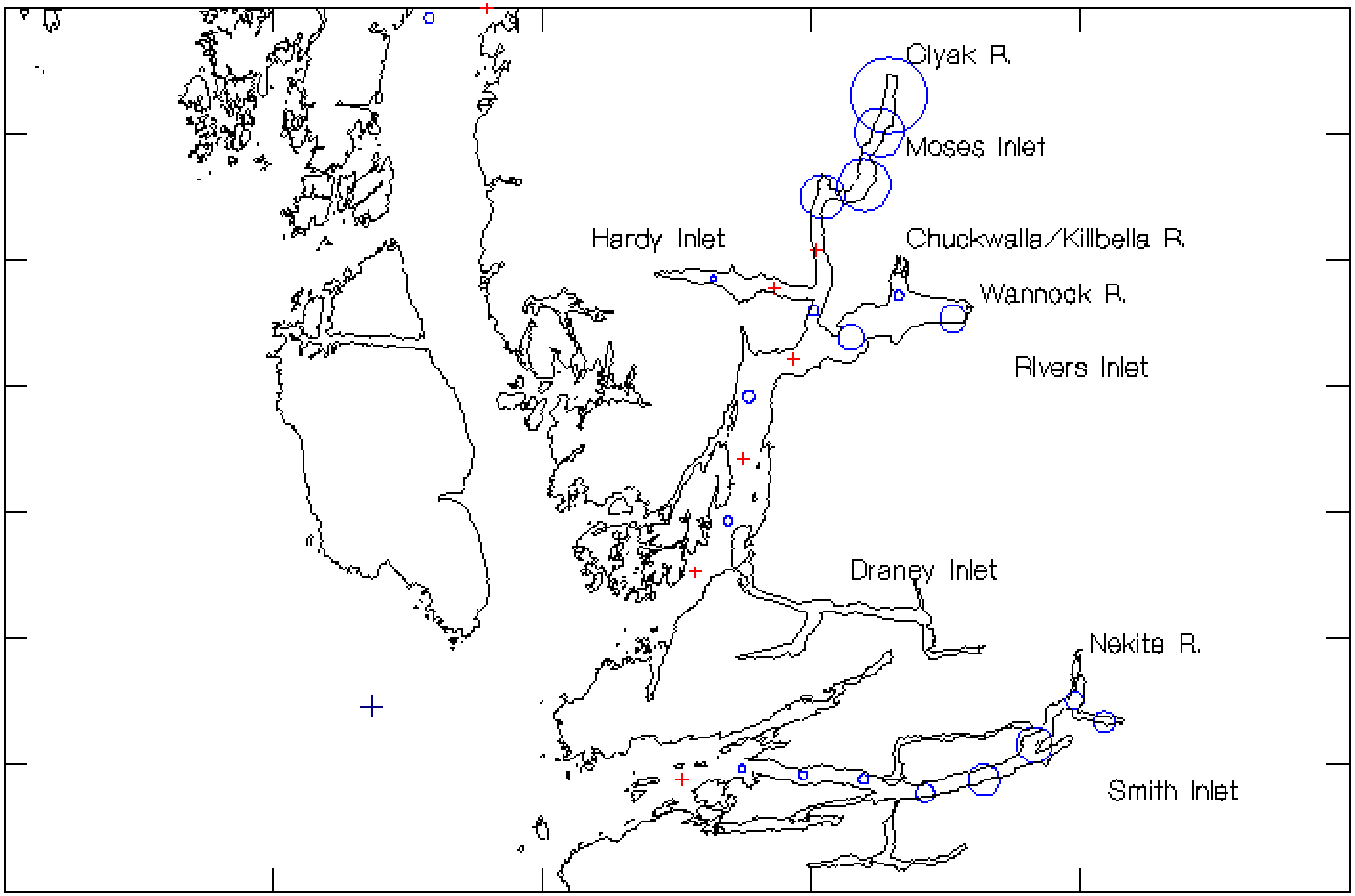


Fig. 3g. **Larval eulachon** density map of the Burke and Dean Channel Region (BD) during April 14 – 25, 1997 (Maximum density = 1.4 larvae/m3). A cross indicates a station where no eulachon larvae were captured.

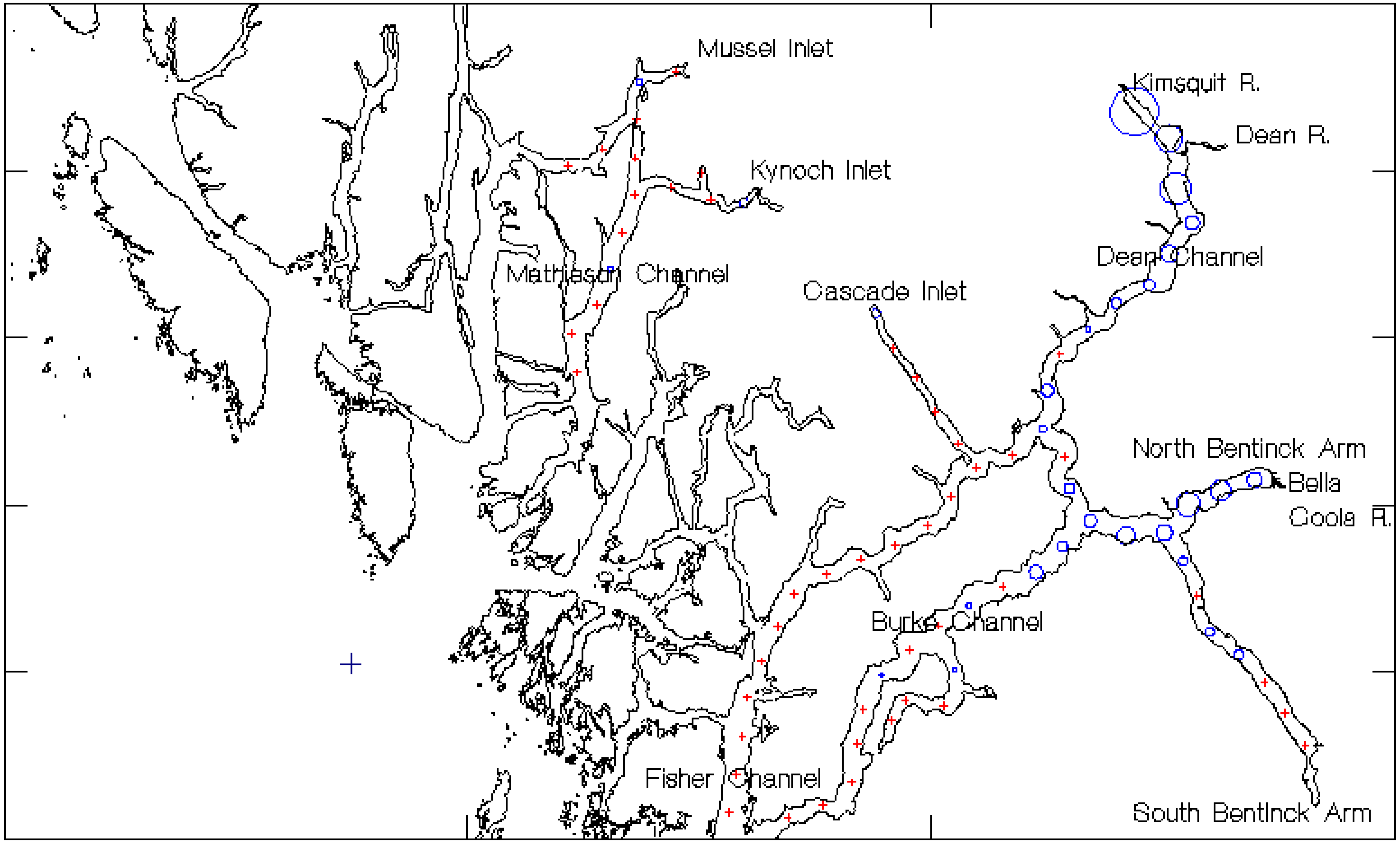


Fig. 3h. Larval eulachon mean lengths (N=20) are represented by the size of a triangle at each sampling station along Gardner Canal (May 27 – June 7, 1996). Mean lengths ranged from 5.2 mm at the head of Gardner Canal near the Kitlope River estuary to 12.1 mm where Gardner Canal joins Douglas.Channel. A small dot or cross indicates a station where less than 20 eulachon larvae were captured.

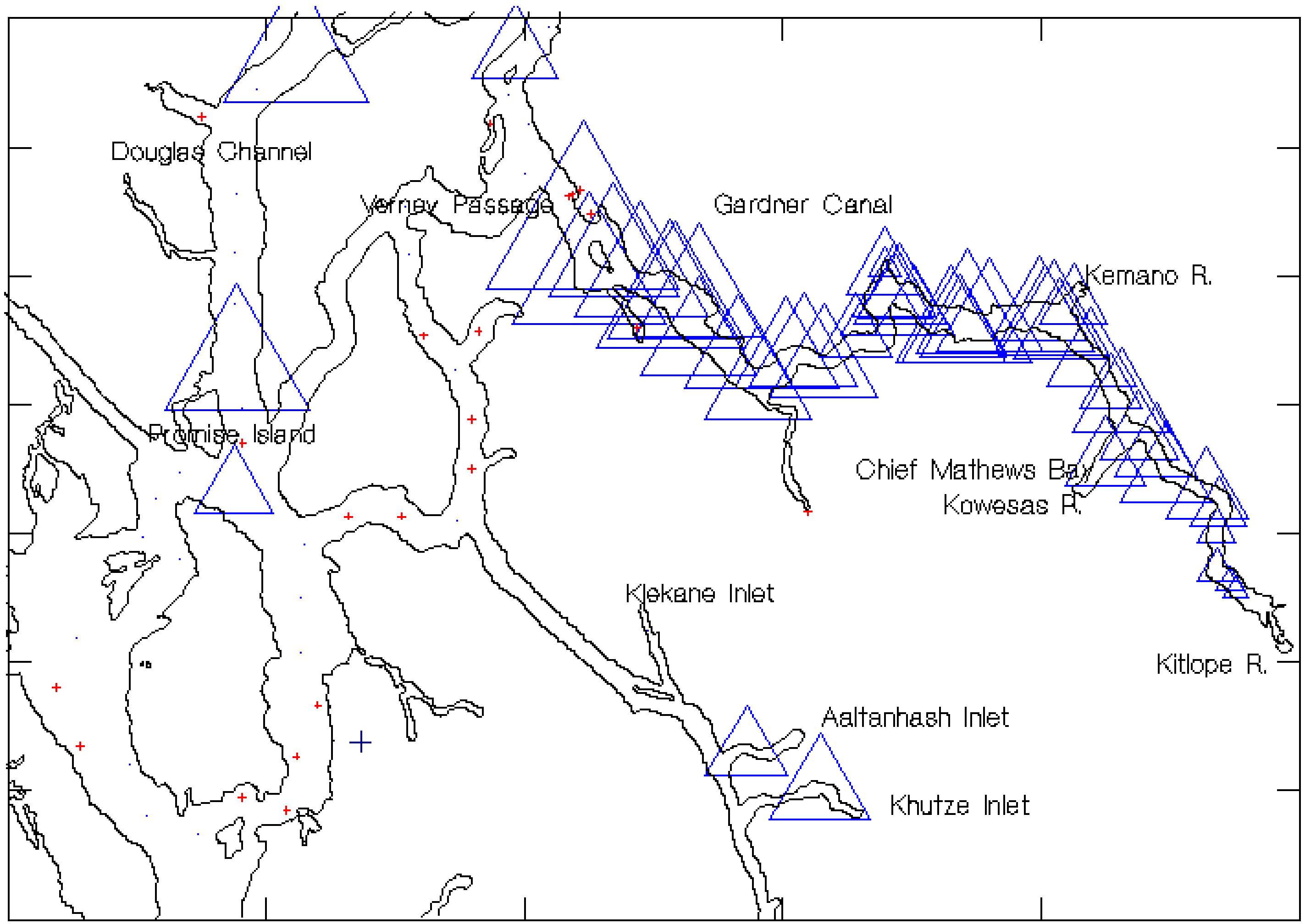


Fig. 4. **Larval eulachon** density map of Hecate Strait during G.B. REED cruise, July 22-August 8, 1985. Larval eulachon 12-34 mm in size were captured at 31 sampling stations (Maximum density = 0.14 larvae/m3). A cross indicates a station where no eulachon larvae were captured.

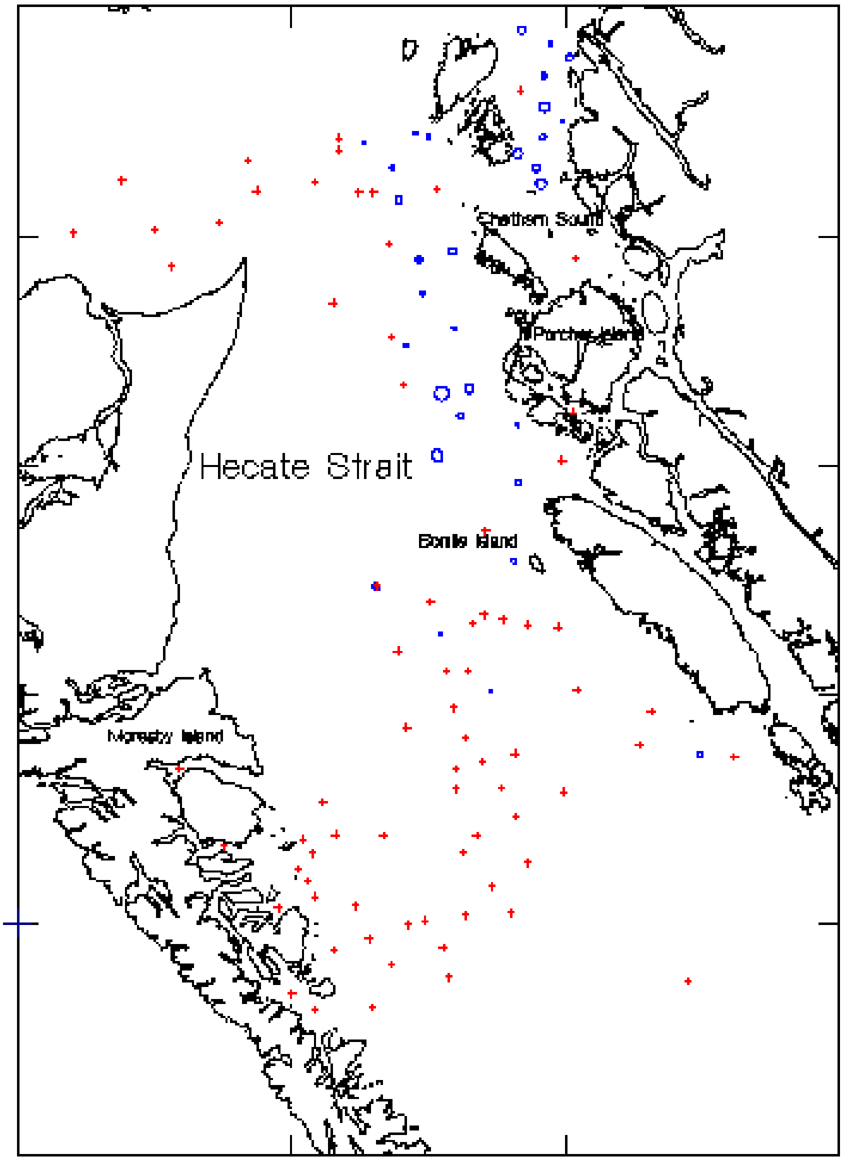


Fig. 5a. **Temperature-salinity depth profiles** of the first two STD casts in Gardner Canal conducted 2 km east (cast #1) and west (cast #2) of Chief Mathews Bay. Most depth profiles showed a sharp salinity incline at 3-8 m depth and a more gradual temperature decline at 4-15 m depth.

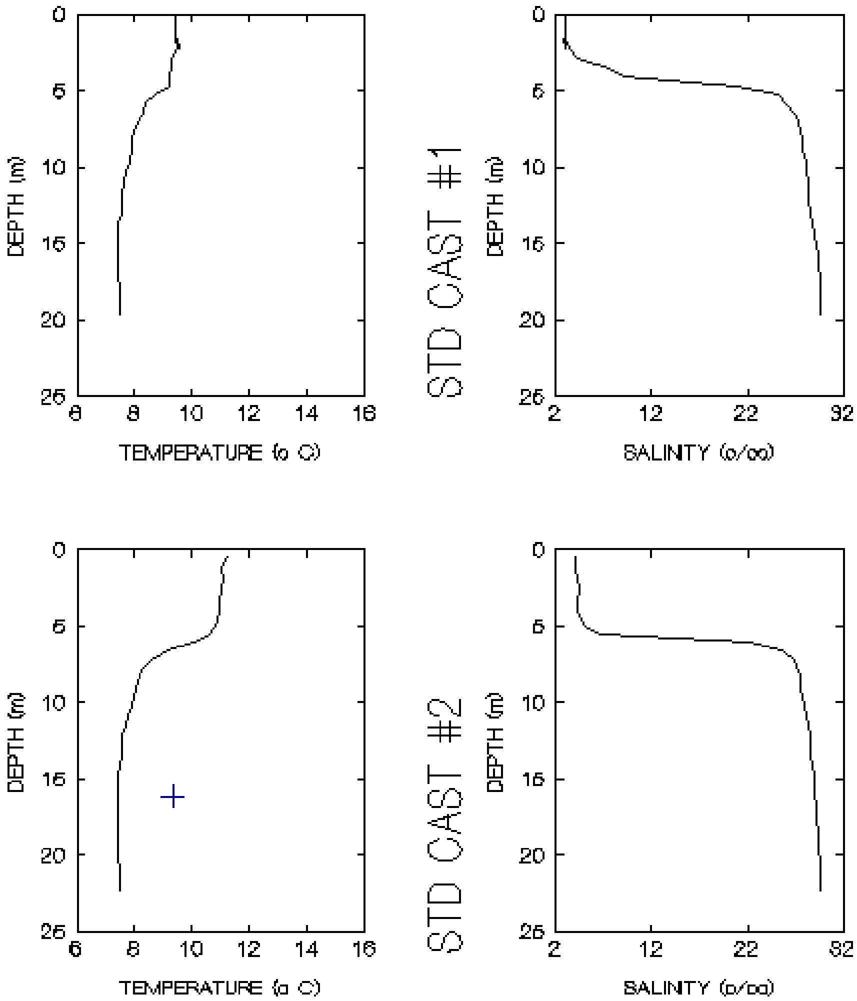


Fig. 5b. **Salinity profile** (0/oo) of Gardner Canal using 12 hydrographic sampling stations (STD cast numbers 1-12 are on the x-axis, see Table 6a). The left side of the profile is located near Chief Mathews Bay near the head of Gardner Canal and the right side is in Verney Passage where Gardner Canal joins Douglas Channel. Battery problems prevented STD measurements closer to the head of Gardner Canal (Kitlope River).

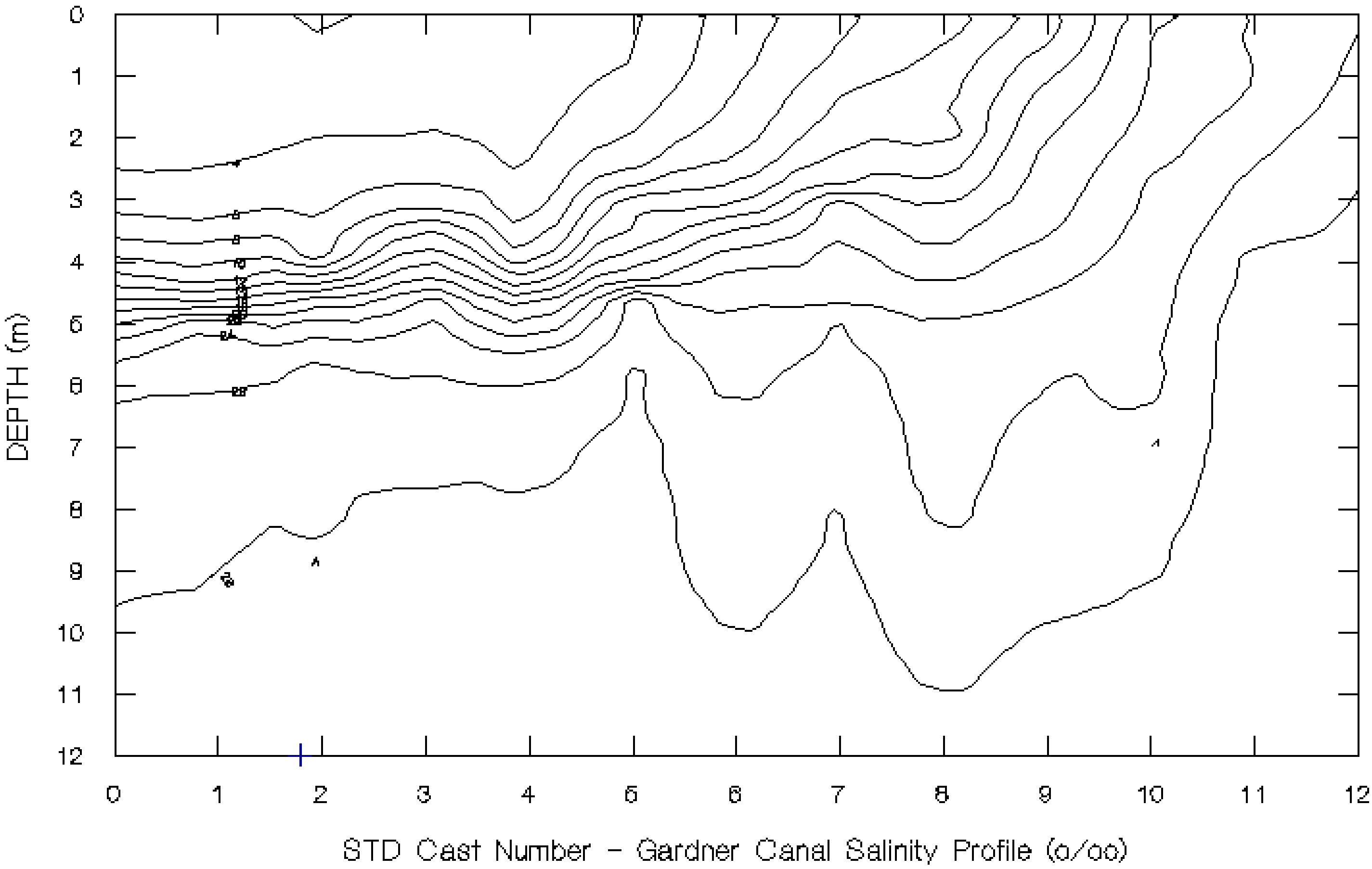
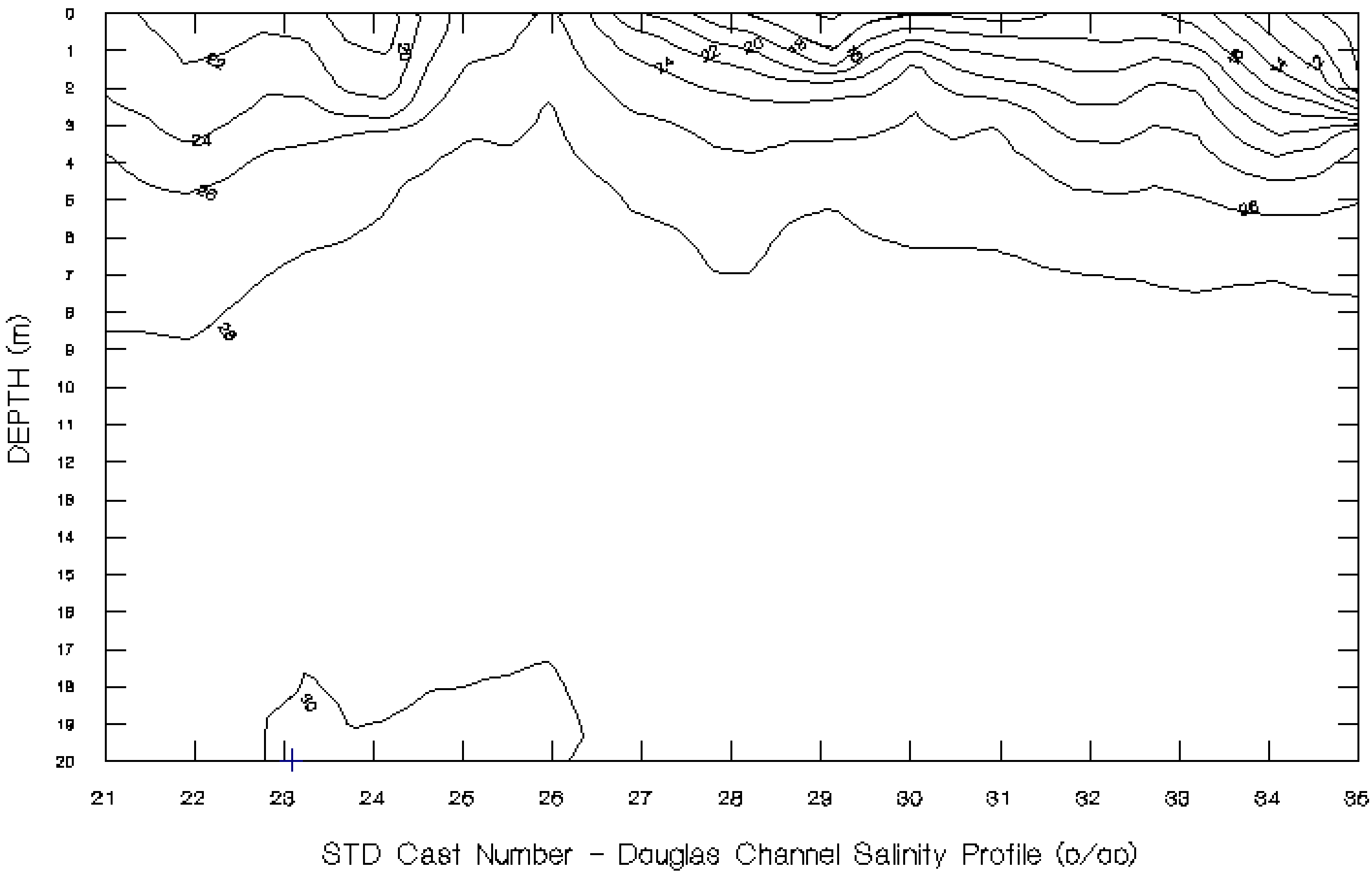


Fig. 5c. **Salinity profile** (0/oo) of Douglas Channel using 15 hydrographic sampling stations (STD cast numbers 21-35 are on the x-axis, see Table 6a). The left side of the profile is located at Promise Island near the entrance to Douglas Channel and the right side of the profile is near Kitimat at the head of Douglas Channel.



Appendix Table 1. List of plankton net tows conducted by the VECTOR, April 25 - May 5, 1994, R. B. YOUNG, May 27 – June 7, 1996 and VECTOR, April 14 – 25, 1997. ‘DOY’ refers to the Julian Date or Day-of-year, ‘Depth’ indicates the vertical depth of the net in metres, ‘Gear’ indicates whether a 19-cm bongo (0), 57-cm bongo (1) or 60-cm diameter SCOR net (3) was used, ‘Type’ indicates whether the tow was oblique (0) or fixed depth (3), ‘VOLFILT’ is the measured volume of seawater (m^3) filtered through a single net and ‘COUNT’ is the number of larval eulachons counted from a single net.

SAMPLE	STATION	LAT	LONG	TIME	DOY	Year	Depth	Gear	Type	VOLFILT	COUNT
1	S2	50.8917	-124.798	900	116	94	20	0	0	21.334	59
2	S4	50.8633	-124.845	920	116	94	20	0	0	4.987	4
3	S6	50.8233	-124.87	940	116	94	20	0	0	13.92	0
4	S8	50.8017	-124.918	1000	116	94	20	0	0	13.275	26
5	S10	50.7667	-124.883	1015	116	94	20	0	0	8.449	10
6	S12	50.7367	-124.838	1035	116	94	20	0	0	19.033	32
7	S14	50.6967	-124.852	1100	116	94	20	0	0	14.092	53
8	S16	50.6567	-124.865	1200	116	94	20	0	0	14.135	1
9	S18	50.6233	-124.873	1220	116	94	20	0	0	18.873	9
10	S20	50.59	-124.868	1235	116	94	20	0	0	8.047	1
11	S22	50.56	-124.898	1250	116	94	20	0	0	17.26	89
12	S24	50.55	-124.947	1310	116	94	20	0	0	16.726	0
13	S26	50.5167	-124.953	1330	116	94	20	0	0	18.422	0
14	S28	50.4983	-124.997	1350	116	94	20	0	0	23.071	0
15	S30	50.4833	-125.042	1410	116	94	20	0	0	12.064	0
16	S32	50.4517	-125.048	1430	116	94	20	0	0	25.954	0
17	S34	50.42	-125.058	1445	116	94	20	0	0	10.551	0
18	S36	50.4033	-125.158	820	117	94	20	0	0	15.909	0
19	S38	50.4183	-125.22	840	117	94	20	0	0	15.743	1
20	S40	50.45	-125.263	900	117	94	20	0	0	15.27	0
21	S44	50.4417	-125.463	940	117	94	20	0	0	26.663	0
22	S46	50.405	-125.493	1000	117	94	20	0	0	9.124	0
23	S48	50.39	-125.553	1020	117	94	20	0	0	15.991	0
24	S50	50.5117	-125.547	1100	117	94	20	0	0	5.995	3
25	S52	50.595	-125.533	1130	117	94	20	0	0	4.631	0
26	S54	50.67	-125.508	1200	117	94	20	0	0	11.433	16
27	S60	50.43	-125.652	1440	117	94	20	0	0	15.742	2
28	S62	50.4117	-125.775	1500	117	94	20	0	0	19.039	0
29	S64	50.475	-125.792	1520	117	94	20	0	0	17.425	1
30	S66	50.52	-125.805	1545	117	94	20	0	0	11.37	0
31	S68	50.5233	-125.732	1610	117	94	20	0	0	9.775	0
32	S70	50.4667	-125.865	1640	117	94	20	0	0	17.905	0
33	S72	50.45	-125.923	1700	117	94	20	0	0	15.281	0
34	S74A	50.5267	-126.008	830	118	94	20	0	0	7.995	6
35	S76	50.5233	-126.182	925	118	94	20	0	0	20.239	0
36	S78	50.5933	-126.148	950	118	94	20	0	0	18.037	0
37	S80	50.6283	-126.307	1020	118	94	20	0	0	19.902	0
38	S82	50.645	-126.148	1105	118	94	20	0	0	20.055	1
39	S84	50.665	-126.032	1130	118	94	20	0	0	18.363	1
40	S86	50.67	-125.923	1230	118	94	20	0	0	17.618	2
41	S88	50.6867	-125.825	1245	118	94	20	0	0	17.484	4
42	S90	50.6917	-125.702	1310	118	94	20	0	0	16.4	2
43	S92	50.7533	-125.665	1330	118	94	20	0	0	23.789	11
SAMPLE	STATION	LAT	LONG	TIME	DOY	Year	Depth	Gear	Type	VOLFILT	COUNT
44	S94	50.805	-125.605	1345	118	94	20	0	0	22.833	16
45	S96	50.8533	-125.652	1405	118	94	20	0	0	12.139	74
46	S98	50.8717	-125.56	1430	118	94	20	0	0	19.281	29
47	S100	50.9333	-125.512	1510	118	94	20	0	0	17.637	227
48	S102	50.9917	-125.535	1530	118	94	20	0	0	21.631	379
49	S104	51.0583	-125.553	1550	118	94	20	0	0	23.531	222
50	S105	51.0783	-125.628	1610	118	94	20	0	0	22.949	463
51	S108	50.7217	-126.175	930	119	94	20	0	0	15.279	0
52	S110	50.7867	-126.037	1000	119	94	20	0	0	15.101	0
53	S112	50.7917	-126.197	1020	119	94	20	0	0	16.27	0
54	S114	50.8567	-126.178	1040	119	94	20	0	0	12.115	0
55	S116	50.83	-126.377	1110	119	94	20	0	0	18.825	0
56	S118	50.815	-126.503	1130	119	94	20	0	0	20.133	0

57	S120	50.7833	-126.528	1150	119	94	20	0	0	28.134	0
58	S122	50.7867	-126.647	1210	119	94	20	0	0	13.44	0
59	S124	50.8533	-126.498	1320	119	94	20	0	0	18.49	0
60	S126	50.855	-126.573	1350	119	94	20	0	0	19.857	0
61	S128	50.885	-126.557	1415	119	94	20	0	0	18.311	0
62	S130	50.9283	-126.468	1435	119	94	20	0	0	17.121	0
63	S132	50.8817	-126.433	1510	119	94	20	0	0	26.684	21
64	S134	50.9133	-126.347	1540	119	94	20	0	0	11.75	3
65	S129	50.9333	-126.402	1550	119	94	20	0	0	26.914	57
66	S148	50.8867	-126.83	840	120	94	20	0	0	4.299	0
67	S146	50.8717	-126.743	900	120	94	20	0	0	19.969	0
68	S140	50.8417	-126.647	920	120	94	20	0	0	19.395	0
69	S142	50.845	-126.717	940	120	94	20	0	0	17.791	0
70	S144	50.845	-126.808	1000	120	94	20	0	0	7.62	0
71	S152	50.895	-126.892	1045	120	94	20	0	0	29.346	1
72	S154	50.9267	-126.883	1100	120	94	20	0	0	12.523	1
73	S156	50.9533	-126.817	1120	120	94	20	0	0	20.222	0
74	S158	50.93	-126.72	1145	120	94	20	0	0	12.503	0
75	S160	50.895	-126.978	1330	120	94	20	0	0	19.694	1
76	S162	50.91	-127.068	1350	120	94	20	0	0	19.938	2
77	S150	50.8417	-126.92	1510	120	94	20	0	0	29.009	2
78	S164	50.735	-127.448	820	121	94	20	0	0	2.711	0
79	S170	50.7717	-127.48	900	121	94	20	0	0	13.756	0
80	S172	50.7983	-127.602	915	121	94	20	0	0	17.867	0
81	S174	50.83	-127.718	940	121	94	20	0	0	23.125	0
82	S176	50.855	-127.842	1010	121	94	20	0	0	23.341	0
83	S178	50.9067	-127.798	1100	121	94	20	0	0	20.526	0
84	S186	51.2817	-127.612	820	122	94	20	0	0	6.974	0
85	S188	51.3033	-127.538	840	122	94	20	0	0	17.829	0
86	S190	51.305	-127.438	900	122	94	20	0	0	16.571	0
87	S192	51.2867	-127.427	930	122	94	20	0	0	24.922	0
88	S194	51.2917	-127.333	945	122	94	20	0	0	13.007	1
89	S196	51.3067	-127.23	1000	122	94	20	0	0	16.073	0
90	S198	51.3367	-127.132	1030	122	94	20	0	0	16.178	1
91	S200	51.3517	-127.08	1100	122	94	20	0	0	18.511	0
92	S202	51.3483	-127.502	1245	122	94	20	0	0	20.716	0
93	S204	51.3417	-127.555	1305	122	94	20	0	0	16.569	0
94	S206	51.3117	-127.645	1330	122	94	20	0	0	14.021	0
95	S208	51.26	-127.71	1345	122	94	20	0	0	16.384	0
96	S210	51.49	-127.563	820	123	94	20	0	0	7.806	0
SAMPLE	STATION	LAT	LONG	TIME	DOY	Year	Depth	Gear	Type	VOLFILT	COUNT
97	S212	51.5117	-127.525	845	123	94	20	0	0	15.517	0
98	S214	51.5467	-127.517	905	123	94	20	0	0	8.543	2
99	S216	51.58	-127.522	925	123	94	20	0	0	12.303	0
100	S218	51.6117	-127.51	945	123	94	20	0	0	22.23	0
101	S220	51.6283	-127.47	1000	123	94	20	0	0	8.388	0
102	S222	51.6367	-127.413	1020	123	94	20	0	0	13.403	2
103	S224	51.6533	-127.352	1040	123	94	20	0	0	10.293	0
104	S226	51.6833	-127.272	1100	123	94	20	0	0	28.81	0
105	S228	51.675	-127.452	1220	123	94	20	0	0	12.356	0
106	S230	51.7433	-127.448	1245	123	94	20	0	0	14.46	10
107	S232	51.765	-127.407	1300	123	94	20	0	0	19.104	9
108	S234	51.825	-127.358	1320	123	94	20	0	0	23.52	93
109	S236	51.6867	-127.552	1430	123	94	20	0	0	15.762	0
110	S238	51.59	-127.522	1505	123	94	20	0	0	12.43	0
111	S240	51.525	-127.642	1600	123	94	20	0	0	7.255	0
112	S242	51.4467	-127.495	1645	123	94	20	0	0	21.279	0
113	S246	51.4317	-127.34	845	124	94	20	0	0	8.328	0
114	S248	51.0367	-127.332	900	124	94	20	0	0	8.124	0
115	S250	51.0517	-127.255	915	124	94	20	0	0	11.491	0
116	S252	51.0417	-127.177	930	124	94	20	0	0	8.995	0
117	S254	51.06	-127.1	950	124	94	20	0	0	11.237	0
118	S260	51.1317	-127.252	1130	124	94	20	0	0	17.271	0
119	S258	51.15	-127.407	1150	124	94	20	0	0	15.943	0
120	S256	51.13	-127.555	1320	124	94	20	0	0	15.53	0
121	L1	50.9167	-124.848	920	116	94	20	0	0	14.247	98
122	L3	50.8817	-124.88	936	116	94	20	0	0	22.072	63
123	L5	50.8433	-124.905	1000	116	94	20	0	0	17.775	25
124	L7	50.8217	-124.97	1020	116	94	20	0	0	16.416	72

125	L9	50.7867	-124.955	1037	116	94	20	0	0	19.933	68
126	L11	50.7533	-124.93	1055	116	94	20	0	0	19.569	69
127	L13	50.7267	-124.883	1114	116	94	20	0	0	13.062	11
128	L15	50.6883	-124.908	1203	116	94	20	0	0	16.59	19
129	L17	50.6483	-124.912	1223	116	94	20	0	0	19.469	8
130	L19	50.61	-124.908	1243	116	94	20	0	0	18.604	12
131	L21	50.5817	-124.958	1304	116	94	20	0	0	20.79	0
132	L23	50.545	-124.99	1325	116	94	20	0	0	19.806	0
133	L25	50.5167	-125.035	1345	116	94	20	0	0	20.817	0
134	L27	50.5017	-125.097	1415	116	94	20	0	0	18.503	0
135	L29	50.4583	-125.105	1439	116	94	20	0	0	17.918	0
136	L31	50.425	-125.13	1457	116	94	20	0	0	15.633	0
137	L41	50.465	-125.33	829	117	94	20	0	0	16.783	0
138	L37	50.5383	-125.36	854	117	94	20	0	0	13.986	0
139	L39	50.4967	-125.373	913	117	94	20	0	0	8.044	0
140	L43	50.4583	-125.413	937	117	94	20	0	0	39.654	0
141	L45	50.4483	-125.527	1005	117	94	20	0	0	20.371	0
142	L47	50.44	-125.587	1025	117	94	20	0	0	16.878	0
143	L49	50.4817	-125.593	1050	117	94	20	0	0	4.597	0
144	L51	50.5533	-125.548	1114	117	94	20	0	0	4.573	0
145	L53	50.635	-125.55	1142	117	94	20	0	0	9.455	0
146	L55	50.7083	-125.462	1216	117	94	20	0	0	13.767	3
147	L61	50.41	-125.708	1445	117	94	20	0	0	15.177	0
148	L63	50.4417	-125.71	1510	117	94	20	0	0	15.724	0
149	L65	50.4867	-125.713	1537	117	94	20	0	0	8.395	0
SAMPLE	STATION	LAT	LONG	TIME	DOY	Year	Depth	Gear	Type	VOLFILT	COUNT
150	L67	50.4933	-125.85	1608	117	94	20	0	0	15.889	2
151	L69	50.475	-125.912	1638	117	94	20	0	0	14.145	0
152	L71	50.4683	-125.977	1706	117	94	20	0	0	16.431	0
153	L73A	50.515	-126.057	831	118	94	10	0	0	11.31	0
154	L75	50.5317	-126.243	921	118	94	20	0	0	16.515	0
155	L77	50.565	-126.192	943	118	94	20	0	0	17.187	0
156	L79	50.6033	-126.277	1009	118	94	20	0	0	18.254	0
157	L81	50.6617	-126.208	1107	118	94	20	0	0	19.035	0
158	L83	50.6733	-126.093	1132	118	94	20	0	0	20.598	0
159	L85	50.6817	-125.988	1228	118	94	20	0	0	16.862	0
160	L87	50.6917	-125.875	1249	118	94	20	0	0	14.15	0
161	L89	50.7033	-125.783	1310	118	94	20	0	0	17.37	0
162	L91	50.7333	-125.71	1331	118	94	20	0	0	15.32	0
163	L93	50.7817	-125.645	1357	118	94	20	0	0	18.726	0
164	L95	50.825	-125.677	1417	118	94	20	0	0	19.933	0
165	L97	50.8883	-125.63	1442	118	94	20	0	0	18.085	20
166	L99	50.9133	-125.562	1506	118	94	20	0	0	18.84	22
167	L101	50.9583	-125.568	1527	118	94	20	0	0	18.546	9
168	L103	51.0183	-125.588	1550	118	94	20	0	0	18.06	71
169	L105	51.0783	-125.628	1612	118	94	20	0	0	19.474	415
170	L107	50.7017	-126.238	923	119	94	20	0	0	15.665	0
171	L109	50.765	-126.113	953	119	94	20	0	0	18.356	2
172	L111	50.7633	-126.183	1012	119	94	20	0	0	11.707	0
173	L113	50.825	-126.228	1039	119	94	20	0	0	11.577	0
174	L115	50.855	-126.262	1058	119	94	20	0	0	12.825	0
175	L117	50.835	-126.335	1119	119	94	20	0	0	15.653	0
176	L119	50.8083	-126.43	1144	119	94	20	0	0	15.564	0
177	L121	50.7783	-126.59	1321	119	94	20	0	0	17.511	0
178	L123	50.8267	-126.555	1348	119	94	20	0	0	16.384	12
179	L125	50.8817	-126.64	1413	119	94	20	0	0	21.354	0
180	L127	50.9267	-126.542	1439	119	94	20	0	0	16.128	7
181	L136	50.8567	-126.577	1504	119	94	20	0	0	11.109	1
182	L137	51.0217	-126.512	1527	119	94	20	0	0	18.277	0
183	L135	50.9833	-126.53	1547	119	94	20	0	0	15.725	1
184	L141	50.87	-126.687	859	120	94	20	0	0	18.098	0
185	L145	50.8117	-126.79	928	120	94	20	0	0	15.518	0
186	L143	50.85	-126.77	950	120	94	20	0	0	14.773	0
187	L147	50.8983	-126.773	950	120	94	20	0	0	19.285	0
188	L153	50.9183	-126.842	1050	120	94	20	0	0	17.532	0
189	L157	50.9333	-126.772	1113	120	94	20	0	0	17.425	0
190	L159	50.9333	-126.667	1135	120	94	20	0	0	19.697	0
191	L155	50.9533	-126.863	1303	120	94	20	0	0	19.682	0
192	L163	50.9117	-127.122	1347	120	94	20	0	0	13.02	0

193	L161	50.8917	-127.03	1405	120	94	20	0	0	16.143	0
194	L149	50.8733	-126.878	1502	120	94	20	0	0	19.183	1
195	L151	50.8633	-126.922	1518	120	94	20	0	0	19.261	0
196	L165	50.75	-127.403	832	121	94	20	0	0	13.912	0
197	L171	50.7833	-127.543	909	121	94	20	0	0	16.298	0
198	L173	50.815	-127.658	934	121	94	20	0	0	14.75	0
199	L175	50.8433	-127.78	957	121	94	20	0	0	13.289	0
200	L179	50.8817	-127.852	1050	121	94	20	0	0	14.194	0
201	L187	51.3167	-127.592	818	122	94	20	0	0	14.49	0
202	L189	51.3133	-127.49	838	122	94	20	0	0	12.793	0
SAMPLE	STATION	LAT	LONG	TIME	DOY	Year	Depth	Gear	Type	VOLFILT	COUNT
203	L191	51.3067	-127.382	903	122	94	20	0	0	12.283	0
204	L193	51.3367	-127.33	925	122	94	20	0	0	12.581	0
205	L195	51.3067	-127.285	951	122	94	20	0	0	11.889	0
206	L197	51.3283	-127.187	1012	122	94	20	0	0	11.906	0
207	L199	51.3567	-127.157	1034	122	94	20	0	0	13.628	0
208	L201	51.3767	-127.112	1051	122	94	20	0	0	11.925	0
209	L203	51.3667	-127.45	1253	122	94	20	0	0	16.698	0
210	L205	51.3317	-127.648	1324	122	94	20	0	0	13.958	0
211	L207	51.3233	-127.71	1342	122	94	20	0	0	14.391	0
212	L209	51.295	-127.712	1401	122	94	20	0	0	10.228	0
213	L211	51.4917	-127.607	827	123	94	20	0	0	8.728	0
214	L213	51.5217	-127.575	855	123	94	20	0	0	13.871	0
215	L215	51.555	-127.565	917	123	94	20	0	0	12.923	1
216	L217	51.62	-127.555	942	123	94	20	0	0	12.351	0
217	L219	51.6533	-127.545	958	123	94	20	0	0	7.338	0
218	L221	51.645	-127.49	1020	123	94	20	0	0	12.157	0
219	L223	51.6783	-127.4	1039	123	94	20	0	0	13.119	0
220	L225	51.6967	-127.348	1056	123	94	20	0	0	11.656	0
221	L227	51.71	-127.453	1230	123	94	20	0	0	15.261	1
222	L229	51.7783	-127.448	1250	123	94	20	0	0	15.593	32
223	L231	51.7967	-127.397	1310	123	94	20	0	0	14.961	21
224	L233	51.8617	-127.362	1330	123	94	20	0	0	16.032	36
225	L235	51.6983	-127.495	1428	123	94	20	0	0	14.014	2
226	L237	51.7083	-127.607	1454	123	94	20	0	0	14.971	3
227	L239	51.5567	-127.598	1554	123	94	20	0	0	6.3	0
228	L241	51.4567	-127.547	1640	123	94	10	0	0	8.798	0
229	L245	51.4433	-127.392	1705	123	94	20	0	0	14.63	0
230	L247	51.0917	-127.472	837	124	94	20	0	0	6.485	0
231	L249	51.0867	-127.395	856	124	94	20	0	0	7.529	0
232	L251	51.09	-127.308	914	124	94	20	0	0	7.919	0
233	L253	51.085	-127.227	932	124	94	20	0	0	10.411	0
234	L261	51.1183	-127.175	1133	124	94	20	0	0	13.46	0
235	L259	51.13	-127.328	1205	124	94	20	0	0	17.705	0
236	L257	51.13	-127.478	1231	124	94	20	0	0	13.535	0
237	V1	50.8983	-124.83	910	116	94	20	1	0	63.794	11
238	V2	50.8617	-124.867	935	116	94	20	1	0	87.754	137
239	V3	50.8233	-124.895	957	116	94	20	1	0	65.274	218
240	V4	50.805	-124.952	1032	116	94	20	1	0	72.711	102
241	V5	50.7683	-124.918	1105	116	94	20	1	0	100.345	351
242	V6	50.74	-124.87	1141	116	94	20	1	0	119.424	480
243	V7	50.7	-124.882	1233	116	94	20	1	0	71.27	23
244	V8	50.6583	-124.885	1256	116	94	20	1	0	85.509	331
245	V9	50.6167	-124.887	1321	116	94	20	1	0	86.69	400
246	V10	50.575	-124.902	1346	116	94	20	1	0	101.357	310
247	V11	50.5617	-124.965	1406	116	94	20	1	0	112.753	201
248	V12	50.52	-124.98	1432	116	94	20	1	0	104.991	394
249	V13	50.4983	-125.037	1454	116	94	20	1	0	87.326	164
250	V14	50.4667	-125.078	1519	116	94	20	1	0	98.787	137
251	V15	50.4233	-125.08	1544	116	94	20	1	0	161.582	75
252	V16	50.4817	-125.263	828	117	94	20	1	0	113.168	0
253	V17	50.445	-125.298	851	117	94	20	1	0	86.028	0
254	V18	50.4067	-125.327	913	117	94	20	1	0	111.494	0
255	V19	50.3683	-125.353	935	117	94	20	1	0	135.921	0
SAMPLE	STATION	LAT	LONG	TIME	DOY	Year	Depth	Gear	Type	VOLFILT	COUNT
256	V20	50.3517	-125.413	1207	117	94	20	1	0	107.989	0
257	V21	50.3517	-125.495	1235	117	94	20	1	0	129.912	0
258	V22	50.3583	-125.537	1256	117	94	20	1	0	106.951	0
259	V23	50.3767	-125.595	1320	117	94	20	1	0	64.404	0

260	V24	50.3717	-125.662	1343	117	94	20	1	0	108.275	0
261	V25	50.3683	-125.727	1407	117	94	20	1	0	112.714	0
262	V26	50.3817	-125.788	1440	117	94	20	1	0	94.075	0
263	V27	50.4067	-125.84	1520	117	94	20	1	0	109.326	0
264	V28	50.4083	-125.907	1552	117	94	20	1	0	214.266	0
265	V29	50.4217	-125.967	1631	117	94	20	1	0	248.57	0
266	V30	50.4467	-126.018	1653	117	94	20	1	0	158.7	5
267	V31	50.465	-126.062	827	118	94	20	1	0	108.716	0
268	V32	50.4683	-126.127	847	118	94	20	1	0	81.472	0
269	V33	50.4817	-126.19	905	118	94	20	1	0	88.455	0
270	V34	50.4917	-126.253	926	118	94	20	1	0	112.078	0
271	V35	50.495	-126.318	947	118	94	20	1	0	109.365	0
272	V36	50.5067	-126.378	1010	118	94	20	1	0	116.945	0
273	V37	50.5017	-126.443	1031	118	94	20	1	0	111.429	0
274	V38	50.5067	-126.508	1052	118	94	20	1	0	104.251	0
275	V39	50.5067	-126.573	1113	118	94	20	1	0	102.953	0
276	V40	50.52	-126.635	1132	118	94	20	1	0	113.142	0
277	V41	50.5833	-126.688	1214	118	94	20	1	0	123.578	0
278	V42	50.6083	-126.742	1238	118	94	20	1	0	102.343	0
279	V43	50.6383	-126.7	1306	118	94	20	1	0	91.441	0
280	V44	50.6333	-126.635	1326	118	94	20	1	0	101.344	0
281	V45	50.6367	-126.568	1344	118	94	20	1	0	114.518	0
282	V46	50.635	-126.503	1404	118	94	20	1	0	98.268	0
283	V47	50.6333	-126.438	1424	118	94	20	1	0	130.094	0
284	V48	50.6367	-126.373	1446	118	94	20	1	0	115.868	0
285	V49	50.64	-126.307	1511	118	94	20	1	0	125.525	0
286	V50	50.645	-126.242	1532	118	94	20	1	0	146.344	0
287	V51	50.6583	-126.178	1557	118	94	20	1	0	164.204	0
288	V52	50.67	-126.652	926	119	94	20	1	0	110.494	0
289	V53	50.6767	-126.73	953	119	94	20	1	0	118.672	0
290	V54	50.6467	-126.792	1021	119	94	20	1	0	112.208	0
291	V55	50.6067	-126.84	1056	119	94	20	1	0	133.884	0
292	V56	50.6117	-126.92	1121	119	94	20	1	0	107.678	0
293	V57	50.6	-126.997	1145	119	94	20	1	0	93.232	0
294	V58	50.6217	-127.067	1209	119	94	20	1	0	119.152	0
295	V59	50.6217	-127.145	1231	119	94	20	1	0	109.716	0
296	V60	50.6683	-127.177	1306	119	94	20	1	0	114.323	0
297	V61	50.715	-127.177	1330	119	94	20	1	0	88.027	0
298	V62	50.7167	-127.097	1353	119	94	20	1	0	116.024	0
299	V63	50.7167	-127.018	1419	119	94	20	1	0	110.222	0
300	V64	50.7167	-126.94	1446	119	94	20	1	0	109.469	0
301	V65	50.7167	-126.86	1510	119	94	20	1	0	114.44	0
302	V66	50.7167	-126.782	1534	119	94	20	1	0	122.332	0
303	V67	50.765	-126.862	1608	119	94	20	1	0	101.578	0
304	V68	50.765	-126.94	1633	119	94	20	1	0	84.587	0
305	V69	50.8133	-126.982	900	120	94	20	1	0	101.305	0
306	V70	50.765	-127.02	924	120	94	20	1	0	105.303	0
307	V71	50.7583	-127.098	951	120	94	20	1	0	112.948	0
308	V72	50.765	-127.177	1011	120	94	20	1	0	113.83	0
SAMPLE	STATION	LAT	LONG	TIME	DOY	Year	Depth	Gear	Type	VOLFILT	COUNT
309	V73	50.765	-127.253	1033	120	94	20	1	0	116.374	0
310	V74	50.715	-127.253	1056	120	94	20	1	0	137.725	0
311	V75	50.715	-127.332	1121	120	94	20	1	0	107.496	0
312	V76	50.765	-127.332	1144	120	94	20	1	0	114.765	0
313	V77	50.815	-127.332	1219	120	94	20	1	0	109.638	0
314	V78	50.815	-127.41	1241	120	94	20	1	0	97.113	0
315	V79	50.8633	-127.332	1311	120	94	20	1	0	112.221	0
316	V80	50.8633	-127.253	1337	120	94	20	1	0	110.858	0
317	V81	50.815	-127.253	1400	120	94	20	1	0	117.711	0
318	V82	50.815	-127.177	1425	120	94	20	1	0	124.603	0
319	V83	50.815	-127.098	1450	120	94	20	1	0	113.454	0
320	V84	50.7733	-127.452	845	121	94	20	1	0	99.955	0
321	V85	50.84	-127.475	920	121	94	20	1	0	145.513	0
322	V86	50.8633	-127.41	951	121	94	20	1	0	105.848	0
323	V87	50.91	-127.468	1023	121	94	20	1	0	98.93	0
324	V88	50.95	-127.482	1043	121	94	20	1	0	105.692	0
325	V89	50.9433	-127.597	1112	121	94	20	1	0	116.063	0
326	V90	50.925	-127.662	1316	121	94	20	1	0	126.485	0
327	V91	50.89	-127.608	1346	121	94	20	1	0	110.482	0

328	V92	50.99	-127.66	1434	121	94	20	1	0	108.937	0
329	V93	50.99	-127.573	1458	121	94	20	1	0	114.518	0
330	V94	51.0317	-127.62	1527	121	94	20	1	0	120.943	0
331	V95	51.05	-127.703	1602	121	94	20	1	0	107.769	0
332	V96	51.0983	-127.782	1640	121	94	20	1	0	128.757	0
333	V97	51.1417	-127.82	1709	121	94	20	1	0	118.049	0
334	V98	51.1917	-127.833	1734	121	94	20	1	0	134.221	0
335	V99	51.24	-127.82	828	122	94	20	1	0	137.193	3
336	V100	51.2967	-127.652	854	122	94	20	1	0	103.81	2
337	V101	51.3267	-127.62	918	122	94	20	1	0	105.277	0
338	V102	51.3183	-127.698	941	122	94	20	1	0	95.464	0
339	V103	51.2783	-127.745	1008	122	94	20	1	0	84.6	0
340	V104	51.2433	-127.807	1032	122	94	20	1	0	95.919	0
341	V105	51.21	-127.908	1102	122	94	20	1	0	77.059	0
342	V106	51.1617	-127.93	1126	122	94	20	1	0	90.597	0
343	V107	51.1183	-127.888	1151	122	94	20	1	0	129.042	0
344	V108	51.075	-127.852	1218	122	94	20	1	0	116.322	0
345	V109	51.0517	-127.923	1242	122	94	20	1	0	118.139	0
346	V110	51.0933	-127.96	1306	122	94	20	1	0	122.397	0
347	V111	51.1367	-127.998	1332	122	94	20	1	0	100.409	0
348	V112	51.1967	-127.985	1403	122	94	20	1	0	72.4	0
349	V113	51.2433	-127.953	1433	122	94	20	1	0	83.783	0
350	V114	51.245	-127.873	1458	122	94	20	1	0	67.948	0
351	V115	51.2933	-127.96	1530	122	94	20	1	0	89.247	0
352	V116	51.2967	-127.878	1556	122	94	20	1	0	89.195	0
353	V117	51.5017	-127.575	902	123	94	20	1	0	50.36	0
354	V118	51.4567	-127.608	921	123	94	20	1	0	41.093	0
355	V119	51.4367	-127.653	941	123	94	20	1	0	35.369	0
356	V120	51.4317	-127.718	1001	123	94	20	1	0	47.635	0
357	V121	51.41	-127.775	1022	123	94	20	1	0	51.645	0
358	V122	51.38	-127.82	1044	123	94	20	1	0	87.949	0
359	V123	51.345	-127.878	1107	123	94	20	1	0	61.484	0
360	V124	51.3433	-127.96	1130	123	94	20	1	0	60.926	0
361	V125	51.3933	-127.96	1157	123	94	20	1	0	69.934	0
SAMPLE	STATION	LAT	LONG	TIME	DOY	Year	Depth	Gear	Type	VOLFILT	COUNT
362	V126	51.4167	-127.875	1228	123	94	20	1	0	85.12	0
363	V127	51.4567	-127.855	1250	123	94	20	1	0	73.84	0
364	V128	51.4967	-127.872	1331	123	94	20	1	0	100.163	0
365	V129	51.5367	-127.877	1352	123	94	20	1	0	96.723	0
366	V130	51.5783	-127.875	1415	123	94	20	1	0	98.761	0
367	V131	51.62	-127.902	1436	123	94	20	1	0	89.403	0
368	V132	51.5717	-127.825	1508	123	94	20	1	0	71.387	0
369	V133	51.53	-127.822	1530	123	94	20	1	0	74.814	0
370	V134	51.4933	-127.793	1552	123	94	20	1	0	52.476	0
371	V135	51.4517	-127.79	1612	123	94	20	1	0	70.777	0
372	V136	51.03	-127.813	911	124	94	20	1	0	101.876	0
373	V137	51.0067	-127.883	937	124	94	20	1	0	120.268	0
374	V138	50.9667	-127.953	1003	124	94	20	1	0	96.373	0
375	V139	50.9667	-128.037	1029	124	94	20	1	0	101.707	0
376	V140	50.9417	-128.083	1054	124	94	20	1	0	104.732	0
377	V141	50.94	-127.997	1120	124	94	20	1	0	104.109	0
378	V142	50.9633	-127.845	1203	124	94	20	1	0	105.03	0
379	V143	50.9867	-127.775	1229	124	94	20	1	0	118.762	0
1	Y1	53.975	-128.673	840	151	96	20	1	0	53.346	0
2	Y2	53.975	-128.673	850	151	96	30	1	0	121.735	0
3	Y3	53.975	-128.673	900	151	96	1	1	0	135.402	0
4	Y4	53.9883	-128.668	920	151	96	20	1	0	190.422	0
5	Y5	53.9833	-128.658	940	151	96	20	1	0	167.812	0
6	Y6	53.9783	-128.675	1005	151	96	20	1	0	189.345	0
7	Y7	53.9617	-128.702	1030	151	96	20	1	0	182.18	0
8	Y8	53.935	-128.693	1055	151	96	20	1	0	139.179	0
9	Y9	53.915	-128.742	1120	151	96	20	1	0	120.515	0
10	Y10	53.9117	-128.693	1225	151	96	20	1	0	134.364	0
11	Y11	53.9667	-128.662	1255	151	96	20	1	0	156.26	0
12	Y12	53.9	-128.737	1420	151	96	20	1	0	136.622	16
13	Y13	53.8667	-128.715	1450	151	96	20	1	0	86.469	26
14	Y14	53.8583	-128.657	1520	151	96	20	1	0	105.458	31
15	Y15	53.84	-128.61	1540	151	96	20	1	0	152.717	45
16	Y16	53.8433	-128.557	1600	151	96	20	1	0	110.469	98

17	Y17	53.835	-128.503	1630	151	96	20	1	0	79.305	69
18	Y18	53.825	-128.717	1740	151	96	20	1	0	119.71	7
19	Y19	53.8017	-128.77	1810	151	96	20	1	0	157.623	19
20	Y20	53.7783	-128.805	1840	151	96	20	1	0	207.088	9
21	Y22	53.7483	-128.835	1905	151	96	20	1	0	90	14
22	Y23	53.7233	-128.792	1935	151	96	20	1	0	135.363	4
23	Y24	53.72	-128.833	1955	151	96	20	1	0	147.72	10
24	Y25	53.6933	-128.802	2025	151	96	20	1	0	142.164	11
25	Y26	53.6733	-128.845	2100	151	96	20	1	0	128.121	70
26	Y27	53.64	-128.855	2130	151	96	20	1	0	131.69	11
27	Y28	53.6183	-128.878	830	152	96	20	1	0	65.417	0
28	Y29	53.6183	-128.828	855	152	96	20	1	0	65.936	1
29	G1	53.5617	-128.777	955	152	96	20	1	0	112.987	0
30	G2	53.5283	-128.777	1020	152	96	20	1	0	91.233	19
31	G4	53.4967	-128.75	1050	152	96	20	1	0	61.964	51
32	G5	53.5133	-128.718	1120	152	96	20	1	0	83.718	42
33	G6	53.4983	-128.683	1150	152	96	20	1	0	105.342	62
34	G8	53.4767	-128.645	1210	152	96	20	1	0	114.739	49
35	G9	53.4817	-128.607	1240	152	96	20	1	0	139.088	170
SAMPLE	STATION	LAT	LONG	TIME	DOY	Year	Depth	Gear	Type	VOLFILT	COUNT
36	G10	53.4483	-128.608	1305	152	96	20	1	0	162.179	238
37	G11	53.4367	-128.557	1330	152	96	20	1	0	165.995	209
38	G12	53.4133	-128.532	1400	152	96	20	1	0	186.489	68
39	G14	53.4367	-128.495	1425	152	96	20	1	0	100.033	242
40	G15	53.43	-128.447	1440	152	96	20	1	0	129.159	611
41	G16	53.4533	-128.407	1505	152	96	20	1	0	101.006	334
42	G17	53.4733	-128.368	1525	152	96	20	1	0	107.198	472
43	G19	53.4717	-128.33	1545	152	96	20	1	0	99.734	335
44	G20	53.4583	-128.283	1615	152	96	20	1	0	124.162	127
45	G21	53.465	-128.233	1630	152	96	20	1	0	134.13	572
46	G22	53.4717	-128.168	1700	152	96	20	1	0	137.725	760
47	G23	53.4783	-128.125	1750	152	96	20	1	0	97.087	236
48	G24	53.4633	-128.162	1810	152	96	20	1	0	130.379	303
49	G25	53.4567	-128.142	1830	152	96	20	1	0	131.794	314
50	G26	53.435	-128.102	1850	152	96	20	1	0	151.73	77
51	G27	53.4	-128.063	1910	152	96	20	1	0	138.92	216
52	G28	53.355	-128.083	2000	152	96	20	1	0	115.712	161
53	G29	53.375	-128.04	2020	152	96	20	1	0	105.952	299
54	G30	53.345	-128.005	2040	152	96	20	1	0	125.083	93
55	G31	53.33	-127.952	2100	152	96	20	1	0	109.313	153
56	G32	53.3017	-127.94	2120	152	96	20	1	0	137.946	1088
57	G33	53.2717	-127.94	2140	152	96	20	1	0	119.619	1930
58	G34	53.255	-127.915	2150	152	96	20	1	0	134.481	3010
59	G1Z	53.5633	-128.772	955	152	96	1	3	0	23.999	0
60	CRIZ	53.5667	-128.762	1025	152	96	1	3	0	29.833	0
61	CRIIZ	53.5667	-128.762	1040	152	96	1	3	0	20.504	0
62	G3Z	53.5483	-128.748	1120	152	96	1	3	0	37.985	0
63	G7Z	53.46	-128.687	1300	152	96	5	3	0	46.045	0
64	G13Z	53.3417	-128.487	1410	152	96	3	3	0	35.653	2
65	G13Z	53.3167	-128.467	1435	152	96	1	3	0	71.64	0
66	G18Z	53.5067	-128.368	1525	152	96	1	3	0	101.222	242
67	G18Z	53.5033	-128.368	1540	152	96	10	3	0	58.824	594
68	G35	53.2617	-127.922	920	153	96	20	1	0	116.154	3744
69	G36	53.3183	-127.937	945	153	96	20	1	0	129.38	1067
70	G37	53.3633	-128.018	1015	153	96	20	1	0	131.911	388
71	G38	53.4117	-128.077	1050	153	96	20	1	0	104.667	303
72	G39	53.4633	-128.15	1125	153	96	20	1	0	98.709	191
73	G40	53.46	-128.27	1205	153	96	20	1	0	123.526	411
74	G40	53.4567	-128.267	1220	153	96	0	1	0	124.227	59
75	G40	53.4617	-128.262	1230	153	96	10	1	0	78.734	210
76	G41	53.4833	-128.348	1310	153	96	20	1	0	97.93	189
77	G41	53.485	-128.355	1325	153	96	0	1	0	72.776	14
78	G41	53.4833	-128.355	1335	153	96	5	1	0	84.795	391
79	G41	53.4867	-128.357	1345	153	96	10	1	0	83.471	82
80	G42	53.4383	-128.473	1435	153	96	20	1	0	110.676	322
81	G43	53.4817	-128.638	1530	153	96	20	1	0	85.107	136
82	G44	53.5333	-128.758	1610	153	96	20	1	0	86.236	47
83	G45	53.58	-128.833	1645	153	96	20	1	0	62.276	13
84	G46	53.5483	-128.877	1705	153	96	20	1	0	53.995	6

85	G47	53.5533	-128.988	1755	153	96	20	1	0	100.968	1
86	G48	53.5167	-128.982	1820	153	96	20	1	0	50.166	1
87	G49	53.4533	-128.963	1855	153	96	20	1	0	55.176	0
88	G50	53.4567	-128.893	1930	153	96	20	1	0	54.929	0
SAMPLE	STATION	LAT	LONG	TIME	DOY	Year	Depth	Gear	Type	VOLFILT	COUNT
89	S1	53.4267	-128.922	900	154	96	20	1	0	57.214	3
90	S2	53.3883	-128.902	920	154	96	20	1	0	63.963	0
91	S3	53.35	-128.902	935	154	96	20	1	0	70.414	0
92	S4	53.31	-128.92	1000	154	96	20	1	0	70.284	1
93	S5	53.3133	-128.992	1025	154	96	20	1	0	62.587	0
94	S6	53.3133	-129.06	1045	154	96	20	1	0	62.47	0
95	S7	53.2917	-129.117	1105	154	96	20	1	0	86.119	3
96	S8	53.25	-129.123	1130	154	96	20	1	0	43.313	1
97	S9	53.2067	-129.122	1150	154	96	20	1	0	78.915	5
98	S10	53.1667	-129.1	1210	154	96	20	1	0	108.145	0
99	S11	53.1267	-129.128	1235	154	96	20	1	0	66.767	0
100	S12	53.085	-129.14	1300	154	96	20	1	0	103.473	0
101	S13	53.095	-129.198	1325	154	96	20	1	0	97.723	0
102	S14	53.0667	-129.255	1350	154	96	20	1	0	74.269	1
103	S15	53.08	-129.322	1415	154	96	20	1	0	86.288	1
104	S16	53.12	-129.343	1440	154	96	20	1	0	85.872	3
105	S17	53.135	-129.407	1525	154	96	20	1	0	114.817	0
106	S18	53.18	-129.437	1550	154	96	20	1	0	76.942	0
107	S19	53.2183	-129.412	1615	154	96	20	1	0	99.034	1
108	M20	53.28	-129.278	820	155	96	20	1	0	98.852	2
109	M21	53.2967	-129.327	850	155	96	20	1	0	96.334	3
110	M22	53.3267	-129.31	910	155	96	20	1	0	72.815	5
111	M23	53.3467	-129.278	925	155	96	20	1	0	94.647	3
112	M24	53.3333	-129.208	950	155	96	20	1	0	80.758	26
113	M25	53.37	-129.197	1005	155	96	20	1	0	89.935	0
114	M26	53.375	-129.148	1035	155	96	20	1	0	70.946	1
115	M27	53.3967	-129.197	1055	155	96	20	1	0	74.892	14
116	M28	53.4283	-129.205	1110	155	96	20	1	0	87.002	20
117	M29	53.4783	-129.207	1140	155	96	20	1	0	100.383	4
118	M30	53.5183	-129.207	1200	155	96	20	1	0	81.083	6
119	M31	53.5633	-129.205	1230	155	96	20	1	0	60.783	3
120	M32	53.6033	-129.212	1255	155	96	20	1	0	118.464	12
121	M33	53.645	-129.18	1333	155	96	20	1	0	98.527	8
122	M34	53.6683	-129.127	1400	155	96	20	1	0	101.72	29
123	M35	53.7017	-129.095	1425	155	96	20	1	0	100.461	27
124	M36	53.7317	-129.037	1500	155	96	20	1	0	111.494	22
125	M37	53.88	-128.982	1625	155	96	20	1	0	96.996	28
126	M38	53.8333	-128.972	1700	155	96	20	1	0	101.85	7
127	M39	53.79	-128.957	1730	155	96	20	1	0	80.421	2
128	M40	53.7483	-128.975	1755	155	96	20	1	0	86.742	7
129	M41	53.7733	-128.92	1825	155	96	20	1	0	101.123	8
130	M42	53.7983	-128.863	1855	155	96	20	1	0	91.661	6
131	M43	53.8283	-128.81	1930	155	96	20	1	0	74.308	18
132	M44	53.8617	-128.773	1950	155	96	20	1	0	66.429	13
133	M45	53.9	-128.735	2020	155	96	20	1	0	86.366	27
134	M46	53.9383	-128.692	2045	155	96	20	1	0	119.866	50
135	M47	53.975	-128.673	2115	155	96	20	1	0	105.342	24
136	Z1	53.6233	-129.25	1335	155	96	10	3	0	68.874	0
137	Z2	53.7833	-129.072	1430	155	96	10	3	0	33.252	1
138	Z3	53.825	-129.078	1455	155	96	10	3	0	12.581	15
139	Z4	53.8167	-128.935	1540	155	96	10	3	0	18.939	0
140	Z5	53.8367	-128.93	1555	155	96	10	3	0	20.048	0
141	M47	53.975	-128.673	615	156	96	0	1	3	67.753	74
SAMPLE	STATION	LAT	LONG	TIME	DOY	Year	Depth	Gear	Type	VOLFILT	COUNT
142	M47	53.975	-128.673	625	156	96	5	1	3	99.618	149
143	M47	53.975	-128.673	635	156	96	10	1	3	73.983	19
144	M47	53.975	-128.673	645	156	96	15	1	3	32.072	0
145	M47	53.975	-128.673	700	156	96	20	1	3	66.014	1
146	M47	53.975	-128.673	715	156	96	35	1	3	85.029	2
147	K1W	53.9867	-128.685	800	156	96	20	1	0	101.149	66
148	K1C	53.985	-128.67	815	156	96	20	1	0	122.033	109
149	K1E	53.9833	-128.657	830	156	96	20	1	0	112.61	6
150	K2E	53.9717	-128.657	840	156	96	20	1	0	112.351	91
151	K2C	53.975	-128.673	900	156	96	20	1	0	106.536	47

152	K2W	53.9767	-128.692	915	156	96	20	1	0	109.495	86
153	K3W	53.9633	-128.695	930	156	96	20	1	0	114.492	173
154	K3C	53.9617	-128.677	940	156	96	20	1	0	108.262	60
155	K3E	53.96	-128.66	955	156	96	20	1	0	103.187	23
156	M47	53.975	-128.673	1205	156	96	0	1	3	88.118	42
157	M47	53.975	-128.673	1215	156	96	5	1	3	100.487	217
158	M47	53.975	-128.673	1225	156	96	10	1	3	86.418	10
159	M47	53.975	-128.673	1240	156	96	15	1	3	66.857	12
160	M47	53.975	-128.673	1255	156	96	20	1	3	95.931	8
161	M47	53.975	-128.673	1305	156	96	35	1	3	139.88	5
162	M47	53.975	-128.673	1320	156	96	35	1	0	114.362	30
163	K4W	53.9533	-128.702	1345	156	96	20	1	0	113.571	137
164	K4C	53.95	-128.683	1405	156	96	20	1	0	102.265	25
165	K4E	53.9467	-128.667	1420	156	96	20	1	0	125.07	31
166	M47	53.975	-128.673	1805	156	96	0	1	3	99.397	47
167	M47	53.975	-128.673	1815	156	96	5	1	3	106.445	49
168	M47	53.975	-128.673	1830	156	96	10	1	3	75.099	21
169	M47	53.975	-128.673	1845	156	96	15	1	3	71.829	17
170	M47	53.975	-128.673	1900	156	96	20	1	3	90.272	8
171	M47	53.975	-128.673	1915	156	96	35	1	3	118.062	7
172	K5W	53.9417	-128.707	1950	156	96	20	1	0	122.28	101
173	K5C	53.9383	-128.692	2005	156	96	20	1	0	150.562	42
174	K5E	53.935	-128.675	2025	156	96	20	1	0	124.902	19
175	K6E	53.9233	-128.69	2040	156	96	20	1	0	87.819	41
176	K6C	53.925	-128.7	2050	156	96	20	1	0	107.886	51
177	K6W	53.9283	-128.713	2105	156	96	20	1	0	136.986	89
178	M47	53.975	-128.673	15	156	96	0	1	3	79.603	240
179	M47	53.975	-128.673	25	156	96	5	1	3	95.815	67
180	M47	53.975	-128.673	35	156	96	10	1	3	93.18	12
181	M47	53.975	-128.673	50	156	96	15	1	3	96.438	10
182	M47	53.975	-128.673	100	156	96	20	1	3	88.222	8
183	M47	53.975	-128.673	110	156	96	35	1	3	100.669	9
184	MB1	54.0283	-128.618	1505	156	96	1	3	0	96.983	512
185	MB2	54.0183	-128.628	1520	156	96	1	3	0	114.715	295
186	MB3	54.0083	-128.645	1540	156	96	1	3	0	77.474	196
187	W1	53.225	-128.675	720	157	96	20	1	0	69.622	1
*188	W2	53.13	-128.547	820	157	96	20	1	0	76.384	*11
*189	W3	53.1	-128.452	915	157	96	20	1	0	79.227	*31
1	K1STD1	51.0667	-125.612	810	105	97	20	1	0	85.081	23
2	K2	51.0583	-125.577	830	105	97	20	1	0	71.971	31
3	K3STD2	51.0267	-125.575	855	105	97	20	1	0	61.043	12
4	K4STD3	50.9767	-125.56	925	105	97	20	1	0	33.163	1
5	K5	50.93	-125.53	950	105	97	20	1	0	24.207	8
SAMPLE	STATION	LAT	LONG	TIME	DOY	Year	Depth	Gear	Type	VOLFILT	COUNT
6	K6STD4	50.8833	-125.562	1025	105	97	20	1	0	90.259	19
7	K7	50.8783	-125.64	1055	105	97	20	1	0	95.893	7
8	K8STD5	50.83	-125.672	1120	105	97	20	1	0	92.064	36
9	K9	50.7967	-125.608	1220	105	97	20	1	0	109.028	8
10	K10STD6	50.76	-125.662	1250	105	97	20	1	0	81.953	17
11	K11	50.715	-125.703	1320	105	97	20	1	0	112.883	1
12	K12STD7	50.69	-125.777	1350	105	97	20	1	0	116.854	6
13	K13	50.6933	-125.852	1420	105	97	20	1	0	152.288	2
14	K14	50.6817	-125.925	1445	105	97	20	1	0	79.409	2
15	K15	50.675	-126.007	1515	105	97	20	1	0	94.802	4
16	K16	50.6717	-126.087	1540	105	97	20	1	0	136.376	9
17	K17	50.6633	-126.165	1605	105	97	20	1	0	110.793	3
18	T1	50.6367	-126.475	715	106	97	20	1	0	73.256	5
19	T2	50.635	-126.397	810	106	97	20	1	0	64.3	1
20	T3	50.64	-126.318	835	106	97	20	1	0	72.114	4
21	T4	50.6467	-126.24	900	106	97	20	1	0	74.905	0
22	T5	50.6683	-126.242	920	106	97	20	1	0	56.902	1
23	T6	50.7167	-126.225	945	106	97	20	1	0	87.443	1
24	T7	50.735	-126.15	1010	106	97	20	1	0	70.245	1
25	T8	50.7733	-126.177	1031	106	97	20	1	0	58.654	2
26	T9	50.8183	-126.21	1100	106	97	20	1	0	44.935	0
27	T10	50.8417	-126.282	1210	106	97	20	1	0	64.612	0
28	T11	50.8333	-126.36	1235	106	97	20	1	0	100.448	0
29	T12	50.8017	-126.43	1305	106	97	20	1	0	93.738	0
30	T13	50.81	-126.51	1330	106	97	20	1	0	66.624	2

31	T14	50.8517	-126.597	1405	106	97	20	1	0	72.607	66
32	T15	50.8867	-126.567	1438	106	97	20	1	0	94.815	61
33	T16	50.9233	-126.51	1515	106	97	20	1	0	88.741	0
34	T17	50.9217	-126.428	1550	106	97	20	1	0	93.167	169
35	T18STD8	50.92	-126.348	1615	106	97	20	1	0	70.323	25
36	T19STD9	50.9183	-126.265	1655	106	97	20	1	0	74.437	253
37	T20STD10	50.9217	-126.203	1750	106	97	20	1	0	82.524	247
38	T21STD11	50.955	-126.505	1900	106	97	20	1	0	75.645	25
39	T22STD12	50.9983	-126.517	1920	106	97	20	1	0	88.572	113
40	T23STD13	51.0217	-126.52	1950	106	97	20	1	0	107.444	44
41	W1	50.8617	-126.18	1230	106	97	10	3	0	16.873	24
*42	W2	50.7933	-126.03	1315	106	97	10	3	0	28.869	*148
*43	W3	50.7783	-126.068	1325	106	97	10	3	0	18.955	*23
44	W4	50.78	-126.558	1415	106	97	10	3	0	50.163	1
45	S1STD14	51.1867	-126.66	1055	107	97	20	1	0	108.976	1
46	S2STD15	51.14	-126.678	1120	107	97	20	1	0	119.567	0
47	S3STD16	51.1033	-126.737	1235	107	97	20	1	0	142.087	0
48	S4	51.07	-126.795	1315	107	97	20	1	0	112.273	0
49	S5	51.07	-126.875	1355	107	97	20	1	0	105.316	0
50	S6	51.0667	-126.953	1430	107	97	20	1	0	108.002	0
51	S7	51.065	-127.037	1510	107	97	20	1	0	114.479	0
52	S8	51.055	-127.097	1535	107	97	20	1	0	129.029	0
53	S9	51.0483	-127.193	1615	107	97	20	1	0	138.634	0
54	S10	51.05	-127.273	1645	107	97	20	1	0	103.992	0
55	W5	51.0067	-126.703	1300	107	97	10	3	0	66.185	0
56	W6	51.0517	-126.653	1340	107	97	10	3	0	53.658	0
*57	SM1STD17	51.3533	-127.082	750	108	97	20	1	0	99.838	*28
*58	SM2STD18	51.37	-127.12	810	108	97	20	1	0	95.503	*19
SAMPLE	STATION	LAT	LONG	TIME	DOY	Year	Depth	Gear	Type	VOLFILT	COUNT
59	SM3STD19	51.3367	-127.172	835	108	97	20	1	0	115.582	90
60	SM4	51.3083	-127.237	905	108	97	20	1	0	91.454	55
61	SM5	51.2967	-127.313	945	108	97	20	1	0	94.945	20
62	SM6	51.3067	-127.392	1005	108	97	20	1	0	89.455	5
63	SM7	51.31	-127.47	1035	108	97	20	1	0	97.476	4
64	SM8	51.315	-127.548	1100	108	97	20	1	0	91.596	3
65	SM9	51.305	-127.625	1125	108	97	20	1	0	98.151	0
66	R1	51.47	-127.608	1330	108	97	20	1	0	31.488	0
67	R2	51.5117	-127.567	1355	108	97	20	1	0	23.116	1
68	R3	51.56	-127.548	1420	108	97	20	1	0	21.637	0
69	R4	51.61	-127.54	1445	108	97	20	1	0	12.876	1
70	R5	51.6383	-127.483	1510	108	97	20	1	0	24.661	0
71	R6	51.6783	-127.457	1530	108	97	20	1	0	13.745	1
72	R9	51.695	-127.507	1555	108	97	20	1	0	23.35	0
73	R10	51.7033	-127.585	1620	108	97	20	1	0	49.647	1
74	R7	51.725	-127.453	1740	108	97	20	1	0	8.476	0
*75	R8	51.7717	-127.445	1810	108	97	20	1	0	13.421	*16
76	R11STD20	51.6583	-127.408	1910	108	97	20	1	0	17.665	7
77	R12STD21	51.69	-127.347	1940	108	97	20	1	0	35.914	2
78	R13STD22	51.6733	-127.277	2020	108	97	20	1	0	27.075	12
*79	W9	51.7817	-127.392	1800	108	97	10	3	0	5.766	*10
*80	W8	51.8233	-127.372	1820	108	97	10	3	0	6.852	*10
*81	W7	51.855	-127.36	1840	108	97	10	3	0	8.098	*29
82	B1	51.91	-127.952	753	109	97	20	1	0	34.227	2
83	B2	51.9167	-127.877	815	109	97	20	1	0	96.684	0
84	B3	51.9433	-127.81	843	109	97	20	1	0	137.998	0
85	B4	51.96	-127.735	905	109	97	20	1	0	97.826	0
86	B5	51.99	-127.673	935	109	97	20	1	0	106.575	0
87	B6	52.04	-127.662	1005	109	97	20	1	0	121.722	0
88	B7	52.085	-127.647	1030	109	97	20	1	0	130.418	0
89	B8	52.13	-127.608	1055	109	97	20	1	0	111.935	1
90	B9	52.1617	-127.548	1125	109	97	20	1	0	79.461	0
91	W10	52.1367	-127.45	1213	109	97	20	1	0	85.782	1
92	W11	52.09	-127.473	1239	109	97	20	1	0	79.473	0
93	W12	52.0967	-127.557	1307	109	97	20	1	0	78.98	0
94	W13	52.07	-127.587	1339	109	97	20	1	0	99.553	0
95	B10	52.1933	-127.485	1500	109	97	20	1	0	81.044	0
96	B11	52.22	-127.42	1530	109	97	20	1	0	55.124	1
97	B12	52.2433	-127.347	1605	109	97	20	1	0	33.305	0
98	B13	52.265	-127.275	1630	109	97	20	1	0	45.467	5

99	B14	52.2983	-127.218	1655	109	97	20	1	0	44.221	3
100	B17STD23	52.3167	-126.998	1755	109	97	20	1	0	30.437	5
101	B18STD24	52.355	-126.947	1825	109	97	20	1	0	50.322	18
102	B19STD25	52.3717	-126.877	1850	109	97	20	1	0	58.641	15
103	B20STD26	52.385	-126.803	1920	109	97	20	1	0	77.656	10
104	D20STD27	52.8683	-127.063	755	110	97	20	1	0	44.169	63
105	D19STD28	52.83	-126.988	825	110	97	20	1	0	45.973	20
106	D18STD29	52.765	-126.973	900	110	97	20	1	0	87.339	53
107	D17STD30	52.7183	-126.938	930	110	97	20	1	0	46.986	6
108	D16STD31	52.6783	-126.987	1000	110	97	20	1	0	57.915	10
109	D15STD32	52.6367	-127.03	1030	110	97	20	1	0	41.924	3
110	D14	52.6133	-127.102	1100	110	97	20	1	0	55.254	4
111	D13	52.5783	-127.162	1125	110	97	20	1	0	62.925	1
SAMPLE	STATION	LAT	LONG	TIME	DOY	Year	Depth	Gear	Type	VOLFILT	COUNT
112	D12	52.545	-127.223	1210	110	97	20	1	0	41.418	0
113	D11	52.5	-127.25	1240	110	97	20	1	0	55.981	5
114	D10	52.45	-127.26	1300	110	97	20	1	0	68.013	2
115	D9	52.4133	-127.212	1325	110	97	20	1	0	36.472	0
116	D8	52.3733	-127.203	1355	110	97	20	1	0	29.463	2
117	D7	52.2783	-126.957	1415	110	97	20	1	0	59.835	3
118	D6	52.2317	-126.927	1440	110	97	20	1	0	41.599	0
119	B15	52.3317	-127.158	1515	110	97	20	1	0	29.113	3
120	B16	52.3133	-127.08	1540	110	97	20	1	0	10.487	2
121	D5	52.1867	-126.9	1605	110	97	20	1	0	21.52	1
122	D4STD33	52.1567	-126.837	1630	110	97	20	1	0	16.964	1
123	D3STD34	52.12	-126.782	1735	110	97	20	1	0	39.886	0
124	D2STD35	52.08	-126.737	1800	110	97	20	1	0	21.312	0
125	D1STD36	52.0383	-126.693	1835	110	97	20	1	0	43.819	0
126	F1STD37	52.6	-127.62	750	111	97	20	1	0	94.011	4
127	F2STD38	52.5533	-127.583	823	111	97	20	1	0	110.209	0
128	F3STD39	52.515	-127.533	848	111	97	20	1	0	105.952	0
129	F4	52.4717	-127.492	915	111	97	20	1	0	110.3	0
130	F5	52.43	-127.443	939	111	97	20	1	0	90.143	0
131	F6	52.415	-127.327	1015	111	97	20	1	0	69.972	0
132	F7	52.3983	-127.403	1040	111	97	20	1	0	99.034	0
133	F8	52.3617	-127.458	1120	111	97	20	1	0	106.328	0
134	F9	52.3233	-127.508	1205	111	97	20	1	0	77.306	0
135	F10	52.2983	-127.58	1235	111	97	20	1	0	55.617	0
136	F11	52.28	-127.653	1300	111	97	20	1	0	77.475	0
137	F12	52.26	-127.728	1325	111	97	20	1	0	48.336	0
138	F13	52.235	-127.798	1350	111	97	20	1	0	56.02	0
139	F14	52.1917	-127.833	1410	111	97	20	1	0	62.431	0
140	F15	52.1467	-127.867	1435	111	97	20	1	0	63.729	0
141	F16	52.1	-127.898	1500	111	97	20	1	0	52.801	0
142	F17	52.05	-127.908	1530	111	97	20	1	0	40.301	0
143	F18	52	-127.922	1600	111	97	20	1	0	56.824	0
144	F19	51.9517	-127.937	1620	111	97	20	1	0	36.472	0
145	M5	52.79	-128.283	748	112	97	20	1	0	53.112	0
146	M4	52.8117	-128.208	813	112	97	20	1	0	49.893	0
147	M3STD40	52.85	-128.137	839	112	97	20	1	0	47.155	0
148	M2STD41	52.9	-128.13	908	112	97	20	1	0	44.649	1
149	M1STD42	52.9117	-128.05	938	112	97	20	1	0	65.248	0
150	M6	52.8	-128.138	1040	112	97	20	1	0	39.198	0
151	M7	52.7517	-128.14	1105	112	97	20	1	0	33.409	0
152	M8	52.7617	-128.062	1130	112	97	20	1	0	20.702	0
153	M9	52.745	-127.977	1207	112	97	20	1	0	15.511	0
*154	M10	52.7433	-127.905	1235	112	97	20	1	0	97.502	*5
155	M11	52.78	-127.995	1320	112	97	20	1	0	23.96	0
156	M12	52.7033	-128.168	1425	112	97	20	1	0	48.284	0
157	M13	52.6567	-128.192	1450	112	97	20	1	0	51.49	1
158	M14	52.61	-128.222	1515	112	97	20	1	0	83.99	0
159	M15	52.5717	-128.277	1535	112	97	20	1	0	90.714	0
160	M16	52.5217	-128.263	1600	112	97	20	1	0	68.389	0
161	L1	50.4133	-125.698	1230	113	97	20	1	0	83.393	0
162	L2	50.43	-125.637	1255	113	97	20	1	0	90.415	0
163	L3	50.4633	-125.597	1320	113	97	20	1	0	62.392	1
164	L4	50.5	-125.568	1345	113	97	20	1	0	78.214	3
SAMPLE	STATION	LAT	LONG	TIME	DOY	Year	Depth	Gear	Type	VOLFILT	COUNT
165	L5	50.54	-125.543	1405	113	97	20	1	0	94.66	14

166	L6	50.58	-125.548	1430	113	97	20	1	0	63.729	10
*167	L7STD43	50.63	-125.542	1450	113	97	20	1	0	82.744	*79
*168	L8STD44	50.6733	-125.503	1525	113	97	20	1	0	76.579	*69
*169	L9STD45	50.705	-125.452	1600	113	97	20	1	0	80.823	*519
170	W15	50.5367	-125.365	1345	113	97	20	3	0	31.763	4
171	W14	50.4983	-125.362	1410	113	97	20	3	0	11.479	0
172	W16	50.4917	-125.258	1440	113	97	20	3	0	62.136	3
173	BT1-0	50.905	-124.827	805	114	97	0	1	3	76.255	0
174	BT1-10	50.905	-124.827	820	114	97	10	1	3	79.889	162
175	BT1-20	50.905	-124.827	835	114	97	20	1	3	81.252	72
176	BT1-30	50.905	-124.827	845	114	97	30	1	3	88.585	88
177	BT1STD46	50.905	-124.827	900	114	97	20	1	0	74.814	198
178	BT2STD47	50.8683	-124.86	925	114	97	20	1	0	78.591	346
179	BT3-0	50.83	-124.887	950	114	97	0	1	3	66.079	6
180	BT3-10	50.83	-124.887	1000	114	97	10	1	3	33.033	163
181	BT3-20	50.83	-124.887	1015	114	97	20	1	3	88.351	147
182	BT3-30	50.83	-124.887	1025	114	97	30	1	3	71.764	92
183	BT3STD48	50.83	-124.887	1040	114	97	20	1	0	49.776	181
184	BT4STD49	50.8133	-124.95	1100	114	97	20	1	0	61.276	401
185	BT5-0	50.775	-124.922	1207	114	97	0	1	3	57.279	2
186	BT5-10	50.775	-124.922	1221	114	97	10	1	3	26.478	94
187	BT5-20	50.775	-124.922	1237	114	97	20	1	3	54.864	39
188	BT5-30	50.775	-124.922	1248	114	97	30	1	3	103.927	75
189	BT5STD50	50.775	-124.922	1300	114	97	20	1	0	28.931	50
190	BT6STD51	50.7433	-124.877	1319	114	97	20	1	0	36.953	29
191	BT7	50.7033	-124.877	1342	114	97	20	1	0	43.52	8
192	BT8	50.6617	-124.887	1405	114	97	20	1	0	38.406	40
193	BT9	50.62	-124.887	1427	114	97	20	1	0	23.973	8
194	BT10	50.5783	-124.895	1446	114	97	20	1	0	59.991	2
195	BT11	50.565	-124.957	1514	114	97	20	1	0	74.308	0
196	BT12	50.5233	-124.97	1534	114	97	20	1	0	87.884	2
197	BT13	50.5017	-125.025	1557	114	97	20	1	0	58.745	0
198	BT14	50.48	-125.082	1620	114	97	20	1	0	50.672	6
199	BT15	50.4383	-125.078	1640	114	97	20	1	0	89.74	4

Appendix Table 2. Estimation of the spawning biomass of Nass River eulachons, based on data from Orr, 1984. The first 2 colums show the month and day of sampling, which is converted to a 'DOY' (Day of the year) in the third column. The fourth column shows the mean larval density on the days sampled. This density was extrapolated to represent each of the days as indicated in the fifth column. The river discharge volume (m^3/sec) is converted to daily discharge (m3/day). The spawning biomass per day (tonnes) is estimated as the product of (i) the daily river discharge (m^3/day) (ii) the mean larval density (iii) a conversion factor that relates larval production to required spawning biomass. This conversion is based on a relative fecundity of 350 eggs/gm of spawning fish (both sexes). Cumulative biomass (tonnes) is shown in the last column. See Hay et al., 1997b for more detail.

Month	Day	DOY	Mean Density (lar/m3)	Extrapol. Density (lar/m3)	River Discharge (m3/sec)	Daily Discharge (m3/day)	Estimated Numbers of Outdrift larva	Spawning Biomass (tonnes)	Cumulative Biomass (tonnes)
April	28	118	10.89	10.89	903	78019200	8.49629E+08	2.428	2.43
*	29	119	*	10.89	903	78019200	8.49629E+08	2.428	4.86
*	30	120	*	10.89	903	78019200	8.49629E+08	2.428	7.28
May	1	121	9.09	9.09	1060	91584000	8.32499E+08	2.379	9.66
*	2	122	*	9.09	1060	91584000	8.32499E+08	2.379	12.04
*	3	123	*	9.09	1060	91584000	8.32499E+08	2.379	14.42
*	4	124	*	9.09	1060	91584000	8.32499E+08	2.379	16.80
*	5	125	*	9.09	1060	91584000	8.32499E+08	2.379	19.18
*	6	126	*	9.09	1060	91584000	8.32499E+08	2.379	21.55
*	7	127	*	9.09	1060	91584000	8.32499E+08	2.379	23.93
*	8	128	*	9.09	1060	91584000	8.32499E+08	2.379	26.31
*	9	129	78.60	78.60	1040	89856000	7.06268E+09	20.179	46.49
*	10	130	*	78.60	1040	89856000	7.06268E+09	20.179	66.67
*	11	131	*	78.60	1040	89856000	7.06268E+09	20.179	86.85
*	12	132	*	78.60	1040	89856000	7.06268E+09	20.179	107.03
*	13	133	*	78.60	1040	89856000	7.06268E+09	20.179	127.21
*	14	134	*	78.60	1040	89856000	7.06268E+09	20.179	147.39
*	15	135	*	78.60	1040	89856000	7.06268E+09	20.179	167.56
*	16	136	297.20	297.20	1070	92448000	2.74755E+10	78.502	246.07
*	17	137	*	297.20	1070	92448000	2.74755E+10	78.502	324.57
*	18	138	*	297.20	1070	92448000	2.74755E+10	78.502	403.07
*	19	139	*	297.20	1070	92448000	2.74755E+10	78.502	481.57
*	20	140	*	297.20	1070	92448000	2.74755E+10	78.502	560.07
*	21	141	*	297.20	1070	92448000	2.74755E+10	78.502	638.57
*	22	142	*	297.20	1070	92448000	2.74755E+10	78.502	717.08
*	23	143	337.60	337.60	1230	106272000	3.58774E+10	102.507	819.58
*	24	144	*	337.60	1230	106272000	3.58774E+10	102.507	922.09
*	25	145	*	337.60	1230	106272000	3.58774E+10	102.507	1024.60
*	26	146	*	337.60	1230	106272000	3.58774E+10	102.507	1127.10
*	27	147	*	337.60	1230	106272000	3.58774E+10	102.507	1229.61
*	28	148	*	337.60	1230	106272000	3.58774E+10	102.507	1332.12
*	29	149	*	337.60	1230	106272000	3.58774E+10	102.507	1434.62
*	30	150	*	337.60	1230	106272000	3.58774E+10	102.507	1537.13
*	31	151	*	337.60	1230	106272000	3.58774E+10	102.507	1639.64
June	1	152	*	56.40	1230	106272000	5.99374E+09	17.125	1656.76
*	2	153	*	56.40	1230	106272000	5.99374E+09	17.125	1673.89
*	3	154	*	56.40	1230	106272000	5.99374E+09	17.125	1691.01
*	4	155	*	56.40	1230	106272000	5.99374E+09	17.125	1708.14
*	5	156	*	56.40	1230	106272000	5.99374E+09	17.125	1725.26
*	6	157	*	56.40	1230	106272000	5.99374E+09	17.125	1742.39
*	7	158	*	56.40	1230	106272000	5.99374E+09	17.125	1759.51
*	8	159	56.40	56.40	1440	124416000	7.01706E+09	20.049	1779.56

Appendix Figure 1. The estimated river discharge, larval density and eulachon spawning biomass in the Nass River in 1983, based on data from Orr 1984. (a) the mean discharge in m^3/second. (b) the mean larval density (n/m^3), (c) the estimated biomass in tonnes. The estimates are intended to be only approximate.