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Assessment of the Dungeness Crab Population in the Nass Estuary, 2000 and 2001

Évaluation de la population de crabe dormeur dans l'estuaire de la Nass en 2000 et en 2001

R.F. Alexander[1], W.J. Gazey[2], and I. Winther[3]

[1]LGL Limited
9768 Second Street
Sidney, BC
V8L 3Y8

[2]W.J. Gazey Research
1214 Camas Court
Victoria, BC
V8X 4R1

[3]Fisheries and Oceans Canada
Room 202, 417-2nd Street
Prince Rupert, BC
V8J 1G8

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ABSTRACT

Dungeness crabs (*Cancer magister*) were captured with traps in the Nass Estuary from June 2000 to April 2002 to monitor abundance and collect biological samples. A total of 1845 traps (264 trap sets) were fished and 20,978 crabs captured. Catches of crabs included 12,164 males and 8814 females. Of the male catch, 6343 legal- (>153 mm notch width [NW]), 5297 medium- (127-153 mm NW) and 519 small- (<127 mm NW) sized crabs were caught. A total of 5976 male crabs, 2976 in 2000 and 3000 in 2001, were anchor-tagged between May and September in three defined release areas. A total of 1679 tagged crabs were later recovered during sampling sessions and in marine (Nisga'a and commercial) fisheries. Counts of marked and unmarked crabs from observed catches (sampling and commercial-fishery patrol observations), unobserved marine catches and recoveries were used to compute a population estimate in 2000 (70,092 [CI=66,912, 73,272]) and 2001 (98,701 [CI=88,816, 108,586]) for legal-sized male Dungeness crabs. Exploitation rates of the legal-sized males in the Nass Estuary were estimated at 57% and 46% for 2000 and 2001, respectively, assuming an annual instantaneous natural mortality and tag loss rate of 1.5. Of the overall exploitation rates calculated for the Nass Estuary for 2000 and 2001, the exploitation rates for the commercial-opened area were 65% and 68%, respectively, and for the commercial-closed area 25% and 12%, respectively. A catch per effort analysis was also performed for standard trap sets conducted in the open and closed commercial areas of the Nass Estuary to test for seasonal variations in abundance and to compare with the mark-recapture results. As a result of these analyses, the commercial fishery was found not to have a negative effect on the availability of legal-sized male crabs in the closed area. In addition, the level of harvest and effort observed in this study suggests that the legal-size male Dungeness crab population is not being over exploited in the Nass Estuary.

Mark-recovery data and size frequency analysis indicated that peak moulting of male Dungeness crabs in the Nass Estuary is occurring in the spring and early summer months. Consequently, the 6-wk commercial fishery in the Nass Estuary between October and mid-November is being conducted during the period of highest percentage of hard-shelled males. This study also provided information on the female and pre-recruit male populations, vertical and horizontal distribution of crabs within the Nass Estuary, incidence of injury and embrace marks of Dungeness crabs. Information regarding individual movement of legal- and medium-sized male Dungeness crabs within the Nass Estuary was also collected from the monitoring of 30 ultrasonic-tagged crabs between August and November 2000.

RÉSUMÉ

Nous avons capturé du crabe dormeur (*Cancer magister*) au casier dans l'estuaire de la Nass de juin 2000 à avril 2002 dans le but de surveiller son abondance et de prélever des échantillons biologiques. À cette fin, nous avons mouillé un total de 1 845 casiers (264 mouillages), ce qui nous a permis de capturer 20 978 crabes, dont 12 164 mâles et 8 814 femelles. Parmi les mâles, 6 343 étaient de taille légale (largeur de la carapace à l'encoche (LCE) > 153 mm), 5 297 étaient de taille moyenne (LCE : 127-153 mm) et 519 étaient de taille petite (LCE <127 mm). De mai à septembre, nous avons apposé une marque à ancrage à un total de 5 976 mâles, soit 2 976 en 2000 et 3 000 en 2001, dans trois secteurs définis de remise à l'eau. De ces crabes étiquetés, un total de 1 679 ont été récupérés par la suite lors de sorties d'échantillonnage et dans le cadre de pêches Nisga'a et commerciale. Nous avons utilisé le nombre de crabes marqués et non marqués dans les prises en mer soumises à un contrôle (données d'échantillonnage et d'observation de la pêche commerciale), dans les prises en mer non soumises à un contrôle et dans les volumes récupérés pour faire une estimation des effectifs de mâles de taille légale dans la population en 2000 (70 092 [IC = 66 912, 73 272]) et en 2001 (98 701 [IC = 88 816, 108 586]). En supposant que le taux annuel instantané de mortalité naturelle et le taux de perte de marques s'élevaient à 1,5, nous avons estimé que les taux d'exploitation des mâles de taille légale dans l'estuaire de la Nass se situaient à 57 % et 46 % en 2000 et en 2001 respectivement. Le taux d'exploitation total dans l'estuaire de la Nass en 2000 et en 2001 se divise comme suit : 65 % et 68 % respectivement dans le secteur de pêche commerciale et 25 % et 12 % respectivement dans le secteur fermé à la pêche commerciale. Nous avons aussi fait une analyse des prises par unité d'effort de pêche provenant de mouillages normalisés de casiers effectués dans les secteurs de pêche commerciale ouverts et fermés de l'estuaire de la Nass en vue d'établir si l'abondance variait selon la saison, puis nous en avons comparé les résultats aux résultats de l'étude de marquage et de recapture. Ces analyses ont révélé que la pêche commerciale n'avait pas d'incidences négatives sur la disponibilité de crabes mâles de taille légale dans le secteur fermé. En outre, le niveau des prises et de l'effort observé lors de cette étude donne à penser que la population de crabe dormeur mâle de taille légale n'est pas surexploitée dans l'estuaire de la Nass.

Les données de marquage et de recapture et l'analyse de fréquence des tailles indiquent que, chez les mâles de l'estuaire de la Nass, le pic de la mue a lieu au printemps et au début de l'été. C'est pourquoi la pêche commerciale de six semaines autorisée dans cet estuaire d'octobre à la mi-novembre correspond à la période où le pourcentage de mâles à carapace dure est le plus élevé. La présente étude a aussi permis de recueillir des renseignements sur les effectifs de femelles et de prérecrues mâles, la distribution verticale et horizontale des crabes dans l'estuaire et l'incidence de blessures et de marques d'étreinte. Nous avons aussi recueilli de l'information sur les déplacements dans ce bassin de 30 mâles de taille légale et de taille moyenne, que nous avions surveillés entre août et novembre 2000 après les avoir munis d'une étiquette ultrasonore.

1.0 INTRODUCTION

A treaty between the Nisga'a Nation, Canada and British Columbia was reached and finalized in May 2000 (Nisga'a Final Agreement). As part of the treaty, entitlements are to be provided to the Nisga'a citizens to harvest Dungeness crab (*Cancer magister*) in the Nass marine area subject to measures necessary for conservation and legislation enacted for the purposes of public health or safety. Dungeness crab were the focus of in-depth studies to support the definition of the Nisga'a entitlement. This study examined the commercial fishery and the biological attributes of crab in the Nass River Estuary to assess crab availability to Nisga'a fishers.

The basic management objective for the Dungeness crab fishery in British Columbia is to maintain crab reproductive potential through the protection of most females and a significant portion of the mature males. A size limit of 165 mm measured across the maximum breadth of the carapace is the primary management tool. The size limit is designed to protect sexually mature male Dungeness crab for one year prior to harvest. Female Dungeness crab rarely exceed the 165 mm size limit but are further protected from the commercial fishery through a sex restriction that limits the harvest to male crab only. Legal-sized female crabs may be retained in First Nations' and recreational (sport) fisheries. Biodegradable escapement devices on traps are used to limit ghost fishing in all fisheries. Other management measures in the commercial fishery include escape holes to allow small crab out of traps, licence limitation, area licensing, trap limits, soft-shell restrictions and seasonal closures to protect soft crab (Hankin et al. 1997; Winther 2000).

Harvests of Dungeness crab are part of the Nisga'a heritage that precedes the arrival of Europeans in North America. The Nisga'a word for Dungeness crab is k'almoos. Nisga'a fishers harvest crabs from the Nass River estuary and Iceberg Bay, near the Nisga'a community, Kincolith (Gingolx; Figure 1). Fishing with crab traps was the main method of harvest by Nisga'a fishers to catch and retain 5418 crabs in 2001 and 5549 crabs in 2002 (Baxter and Stephens 2002; Baxter and Azak 2003). The Nisga'a catch from the portion of year after 10 June 2000 was 3707 crabs (Bocking et al. 2002). Catches prior to 10 June represented 48.5% of the total in 2001 and 35.5% of the total in 2002. Traps currently represent the preferred method of crab harvest by Nisga'a fishers (H. Nyce Sr., Nisga'a Lisims Government, Aiyansh, B.C., pers. comm.).

The commercial fishery for Dungeness crabs in the Nass estuary contributes between 1 and 2% to the coast-wide crab production annually. The annual commercial catch from 1990 to 2002 averaged 39 tonnes and ranged between 8 and 84 tonnes (Table 1). This represents the third largest estuarine fishery in the province next to the Fraser and Skeena crab fisheries. Other crab fisheries on the west coast of Vancouver Island and in Hecate Strait are not associated with estuaries and make up the bulk of the commercial crab catch. Approximately half of the commercial vessels licensed for Area B (the North Coast Mainland between Alaska and Cape Caution) have participated in the Nass Estuary fishery in recent years (Table 1).

First Nations have priority in the allocation of harvestable surpluses of crab in British Columbia. No priority has been defined among sport, commercial, environmental and other

sustainable uses of crab resources. To date it has not been necessary to define crab fisheries for First Nations use as allocations have been provided by excluding commercial fishing from some areas. This allows access by First Nations and recreational fishermen. Thus sport allocations have been accommodated within management actions for First Nations' access to crab fisheries. This approach was taken in the Nass Estuary. Concern was raised by Nisga'a fishers in the early 1980's regarding the availability of crabs for food, social and ceremonial requirements. Fisheries and Oceans Canada (DFO) responded with a series of management actions in the 1990's including:

1) Establishment of a 0.5 mile boundary between Nass Point and Fort Point that was closed year-round to the commercial fishery of Dungeness crabs in 1990 (Figure 1),
2) Restricting the commercial fishery to a one-month fishery from 1 to 30 September in 1990,
3) Modifying the restricted fishery to a three-month fishery (1 October to 1 December) from 1991 to 1997, and
4) Reducing the commercial fishery to a six-week fishery (1 October to 15 November) from 1997 to present.

The objectives of this study were to:

1. Conduct a catch-per-effort analysis from standard set locations to determine the effect of removals by the six-week commercial fishery on the availability of crab to Nisga'a fishers between 2000 and 2001,
2. Capture, tag and recapture male Dungeness crab for estimating seasonal and annual differences in abundance between 2000 and 2001,
3. Use the catch and recapture data to evaluate the effectiveness of the current management strategies (i.e., short seasonal fishery late in the year combined with areas that are permanently closed) in ensuring availability of crabs for First Nation and recreational fishers,
4. Collect and summarize biological information from captured crabs to assess the population of crab in the Nass estuary with respect to all harvesting activities (i.e., handling effects, availability of legal-sized crabs and future recruitment's) and compare with other crab populations, and
5. Provide results to the Nass Joint Fisheries Management Committee (JFMC) to help determine an entitlement of Dungeness crab for the Nisga'a Nation as part of the Nisga'a Final Agreement.

1.1 Study Area

The coastal marine waterways located in the Nass area extend from the most southerly end of Pearse Island in Portland Inlet to the most northerly end of Portland Canal, Hastings and Alice arms on the north coast of British Columbia. The study area for this report is defined as the easterly portion of Portland Inlet, east of Nass Point to the estuary of the Nass River including Iceberg Bay (Figure 1).

The Nass River originates in the Skeena Mountains and flows south and southwest for approximately 400 km, entering the Pacific Ocean at Portland Inlet (Figure 1). The river drains 20,500 km^2, has an average annual discharge of 813 m^3s^{-1} and ranges from 24 m^3s^{-1} to 5437 m^3s^{-1} within years (Holland 1976). The village of Kincolith (Gingolx) is situated at the intersection of the Nass River and Portland Inlet and provides a port for sea going vessels.

Dramatic changes in temperature, salinity, dissolved oxygen and water flow are known to occur in the study area due to complex interactions between tidal current, freshwater run-off, and underwater topography (Nass 1994; Ricker and McDonald 1992). Unusually strong winds that follow the predominantly north-south orientation of the valleys also influence water conditions.

1.2 Study Design

The study area was divided into three sampling areas for assessing the Dungeness crab population in the Nass estuary: (1) Kincolith, 0.5 mile commercial closure area from Nass Point to Fort Point; (2) Ripple Tongue, the area between the Nass estuary and waters east of Low Point excluding the closed area and Iceberg Bay; and (3) Iceberg Bay, the area west of Double Islet and Jaques points (Figure 1). The Kincolith, Ripple Tongue and Iceberg Bay areas represented approximately 815, 2158 and 939 hectares, respectively. Data collected from the sampling and mark-recapture portions of the study were used to assess the abundance, movement and distribution of Dungeness crabs in each of the three areas before and after the commercial fishery.

The data collected during the study were:

1. Seasonal variation in availability of crabs in the Nass estuary (measured in catch-per-effort (CPE) from each sampling trip and from mark-recapture techniques),
2. Biological data related to size, sex, shell condition and timing of soft-shelled periods (i.e., moulting) for determination of effects on availability and recruitment, and
3. Crab movements within the Nass estuary in open and closed areas, before and after the commercial fishery.

2.0 METHODS

2.1 Trap Sampling

Standard commercial traps were used in this study. The traps were circular, 105 cm in diameter and 25 cm high, with rubber-wrapped iron lower frames and stainless steel upper frames. Each trap had 2 weight bars across the bottom of 40 mm mild steel concrete reinforcement rod with one bar equipped with a sacrificial zinc anode. Average weight was 15 kg. Each trap was equipped with 2 opposing tunnels that tapered from the frame to a rectangular entrance measuring 8 cm by 23 cm. Entrances extended 15 cm into the interior of the trap were equipped with twin triggers 8 cm apart. The triggers formed a one-way passage to the interior of the trap. Trap frames were covered with stainless steel wire mesh in a diamond shaped configuration with openings 8 cm by 5 cm measured from point to point across the maximum breadth of the diamond shape. The traps were equipped with 110 mm escape ports but these

were wired closed for the duration of this study. All traps were equipped with rot cords as described in the Pacific Region 2000 Crab Management Plan (Anon. 1999). Bait was secured in the centre of the trap in a perforated 500-ml plastic jar. A combination of frozen squid and herring was used for bait.

Sampling of the three test areas occurred almost monthly from early summer to late fall in 2000 and 2001 with a minimum of 20 traps set in each area. Additional sampling occurred in the spring of 2001 and 2002. The 20 traps were fished at varying depths with 5 single traps set at shallow depths (<10 m), 10 traps set in a string at moderate depths (10-40 m), and 5 traps set in a string at deep depths (>40 m). Traps were set 20 to 30 m apart and identified by an attached, marked buoy. Traps were allowed to soak for approximately 24 hrs before being hauled on board the Nisga'a Lisims Government's vessel, M.V. *Xsgaagim Lisims*, using a hydraulic crab shiv. Once aboard, abundance and biological data were recorded. These traps were fished by the same method in the same area of each sampling period and were classified as the standard trap sets. During the study, additional traps were fished in shallow areas to capture male crabs for tagging and collecting additional data on distribution and relative abundance of male crabs in the study area. These additional trap samples were classified as non-standard sets and had variable soak times. All captured crabs were released in the same area of capture.

Location of trap sets was recorded using a Global Positioning System (GPS) onboard the M.V. Xsgaagim Lisims. The location of the first trap and last trap were recorded using latitude and longitude coordinates (to the nearest minute). Depth was also recorded for the first and last trap using an acoustic sounder.

2.2 Catches and Catch per Effort

All catch from each trap haul was identified and enumerated by species. Soak time in hours was recorded as the time between setting the traps, fished singly or in a string, and hauling the traps aboard the vessel. Since most of the traps had standard soak times of 24 hrs, we calculated catch per effort (CPE) as crabs caught per trap haul. Thus in this report, any reference to CPE is defined as the number of crabs caught per trap haul. A comparison of soak time and mean catch per trap was performed to determine any significant differences using linear regression (1-factor ANOVA) and log-linear model techniques (S.A.S. program; L. Cowen, S.F.U. Statistics Dept., pers. comm.).

The counts of legal-sized male Dungeness crabs were modelled using a log-linear model with an assumed Poisson distribution (S.A.S. program; L. Cowen, S.F.U. Statistics Dept., pers. comm.; McCullagh and Nelder, 1989, p. 193). The covariates of the model included year, location (Kincolith, Ripple, and Iceberg Bay) and treatment (i.e., opened or closed periods to the commercial fishery) as well as a treatment by location interaction:

$$(1)\quad \ln\left(E(Y_i)\right) = \beta_0 + \beta_1 year_i + \beta_2 treatment_i + \beta_3 location_i + \beta_4 (location \times treatment)_i + \ln(haul_i)$$
$$i = 1,2,...,n$$

where Y_i (counts of legal-sized males) $\sim Poisson(\lambda_i haul_i)$ and $\lambda_i haul_i$ is the expected number of crabs at count *i*. Haul_i is the number of traps hauled in a sampling period ($i = 1,2,...,n$) and is an offset variable rather than a covariate of interest that affects the response (number of legal-sized crabs) but does not have a coefficient associated with it in the model. Thus $E(Y_i) = \lambda_i * haul_i$ and $Y_1, Y_2, ... Y_n \sim$ Poisson ($\lambda_i$haul$_i$). The offset variable and the response were converted into logarithms with the assumption that the count data were Poisson distributed. The Poisson distribution was used as count data are not normally distributed and can be modelled using a log linear model where ln(E(Y_i)) is set equal to a linear model ($B_0 + B_1x_i + \ldots$). By converting the response into a logarithm, the multiplicative model becomes linear. Likelihood ratio F statistics were used to test if the commercial fishery had an effect on the CPE of legal-sized male Dungeness crabs in Kincolith and to test if there were differences in CPE between the sampling locations. Extra variability in the data was accounted for in the F statistic by estimating an over-dispersion parameter (McCullagh and Nelder, 1989, p.198).

Mean or median CPE by area, period and depth type were also statistically compared using parametric (1-factor ANOVA; Tukey) and non-parametric (Kruskal-Wallis; Median) tests of Statistix 7.0 computer program.

2.3 Biological Sampling

All Dungeness crabs that were caught in the traps were sexed, measured for carapace width (notch-to-notch [NW]), graded for shell hardness, and checked for an injured shell or body, missing legs/claws, or regenerated legs/claws. Grading for shell hardness and injury was conducted to determine the moulting stage and health condition of the crab. Sex was determined by examining the abdominal area of the crab with females having a wider and distinct abdominal plate than males. The carapace width was measured (to the nearest mm) using a stainless steel Vernier caliper. All measured male crabs were size-classified as legal (>153 mm NW), medium (127-153 mm NW) or small (<127 mm NW). We classified female crabs into the same size categories as males for comparison but referred them as large, medium or small-sized as legal retention of females is prohibited in commercial fisheries. We defined the legal-size category for male crabs based on information from Smith and Jamieson (1989) and Butler (1961) regarding recruitment of medium-sized males into commercial fisheries in BC. In those studies, medium-sized males recruited into the commercial fishery at 154 mm NW that equalled the legal size limit of 165 mm spine-to-spine carapace width. We defined the medium-size category in this study as males that would become legal size on the next moult based on a size increment of 28 mm from Smith and Jamieson (1989).

When male crabs hold females in a pre-mating embrace the spines of the female's carapace scrape distinct marks on the inside of the male's claws. Embrace marks represent pre-mating behaviour but do not necessarily indicate mating success. These embrace marks were recorded as present or absent from captured males.

Shell hardness was determined by pressing the underside of the crab shell anterior to the insertion point of the claw and adjacent to the curved portion of the suture line that extends laterally from the mouth. The following codes and criteria were used as a subjective measure of shell hardness:

1. *New Shell (#1)*: hard shell with no marks or barnacles occurring from a moult within approximately 3 months;
2. *Springy New (#2)*: soft-to-hard shell with no marks occurring from a moult within approximately 1-2 months;
3. *Crackly New (#3)*: very soft shell occurring from a recent moult, approximately 1 month;
4. *Plastic Soft (#4)*: thin, soft shell occurring from a very recent moult (within days);
5. *Moulting (#5)*: crab in the process of losing it's shell and beginning the formation of a new shell;
6. *Old Shell (#6*): hard shell that shows age greater than 3 months with various marking and possibly barnacles; and
7. *Very Old Shell (#7)*: hard shell that shows considerable age with barnacles and various marking.

We estimated the number of crabs that had moulted within a 30 d period by summing the number of crabs that were measured as soft shelled (i.e., #3, #4 and #5) on sampling trips conducted within a monthly period. The percentage of crabs that had moulted was estimated as the ratio of soft-shelled crabs to total crabs sampled in a 30 d period.

In addition to the number of legs and/or claws that were missing, the following codes were used to categorize injuries that were observed:

1. *Deformed Shell (#1)*: Recorded any deformities to the shell other than holes;
2. *Hole in Shell (#2)*: Recorded any holes in the shell other than tag losses (see below);
3. *Torn Abdomen (#3)*: Recorded any injuries to the abdomen area;
4. *Regenerated Claw (#4)*: Recorded number of claw(s) that were small and showed signs of regeneration;
5. *Regenerated Leg (#5)*: Recorded number of leg(s) that were small and showed signs of regeneration;
6. *Regenerated Both (#6)*: Recorded as a crab that had a regenerated leg(s) and regenerated claw(s);
7. *Multiple Injuries (#7)*: Recorded as crab that had multiple injuries; and
8. *Shell Disease (#8)*: Recorded as a crab that had evidence of a shell disease (i.e., decay of shell caused by some biological agent).

2.4 Tagging

We attempted to tag all healthy, "new" hard-shelled, male Dungeness crabs that were caught during sampling periods before September to allow for adequate mixing of tagged and non-tagged crabs before the start of the commercial fishery in October. Legal-sized males were primarily targeted for tagging however medium-sized males were also tagged for information regarding their relative abundance, moult timing, recruitment and distribution. Females or small-sized males were not tagged.

2.4.1 Anchor Tagging

Anchor tags were used for marking legal- and medium-sized male crabs captured during sampling activities. Information obtained from the marking program was used to assess distribution and relative abundance of male crabs in the study area. Individually numbered 5.7-cm T-bar anchor tags (Model FD-94; Floy Tag and Manufacturing Co., Seattle, WA) were inserted through the right posterior epimeral suture line of a male crab with a tagging gun (Dennison Mark II stainless steel pistol grip), taking care not to puncture internal organs. Highly visible tags were used in 2000 (blue) and 2001 (green) to increase the probability of detection when recaptured. Placing the tag at the epimeral suture line is assumed to have a high retention rate when the old shell is discarded during a moult (Smith and Jamieson 1989).

2.4.2 Ultrasonic Tagging

Ultrasonic tags were used to collect individual migration data for a portion of the male crabs captured in each of the three areas to assess movement within (and outside) the study area. The information regarding the movement of these tagged crabs, along with recapture information from other Floy-tagged crabs, was used in assessing potential tag losses for the mark-recapture model (see 2.7. Population and Exploitation Estimates). Thirty, individually acoustic-coded, ultrasonic tags were used, approximately ten in each of the three sampling areas. The ultrasonic tags (Model CAFT11_2; Lotek Engineering, Inc., Newmarket, Ontario) were 11 mm x 40 mm epoxy cylinders, weighed 8 g in air (4.3 g in water), had a battery-life expectancy of 106 d, and transmitted at a frequency of 77 KHz. Signal activation of each transmitter occurred when an attached magnet was removed that opened a micro-switch and initiated transmission of an acoustic signal. All transmitters were tested for signal output prior to release. A test of the transmitter type and tracking equipment was conducted prior to tagging and suggested that detection ranges were reasonable (audible detection within 300 m and individual coding within 200 m).

Male Dungeness crabs that were captured during sampling activities in August 2000 were ultrasonic-tagged based on size (>140 mm NW) and shell hardness. Since the ultrasonic tag would be shed during a moult, only crabs that were graded with new shells were used for tagging. Selected crabs had a small area of their shell dried with a cloth and the ultrasonic tag applied to the dried area of the shell using a pre-mixed marine epoxy (Z-Spar Splash two component epoxy putty). The epoxy was expected to fully harden within 6 hrs. Care was taken so that the transmitter label was face-up and easily identifiable. Ultrasonic-tagged crabs were also anchor-tagged. Once tagged, the crab was placed in a small recovery tote (clear with many holes in the lid) and placed in a crab trap and suspended near the capture site. Up to 5 ultrasonic tagged crabs were placed in a single crab trap. Ultrasonic-tagged crabs were recovered after sufficient recovery (and hardening) time and released back into the same location as they were captured.

2.5 Ultrasonic Tracking

Detection of ultrasonic tags was possible by using an acoustic hydrophone (Lotek Model LHP_1) that was connected to a sonic converter (Lotek model UUC-150) and attached to a VHF

telemetry receiver (Lotek Model SRX_400). The sonic converter was powered by a 12-v battery (or external power from the M.V. Xsgaagim Lisims) and converted the ultrasonic signal (77 KHz) to a VHF signal (150 MHz) for reception by the receiver.

Boat tracking surveys were conducted in a 4 m inflatable zodiac with the hydrophone and a directional baffle suspended from a 1.5 m PVC pipe mounted in a fishing rod holder that was attached to the boat's transom. The PVC pole was lowered through the rod holder effectively positioning the hydrophone 1 m below the bottom of the boat. Tracking surveys were conducted opportunistically during trap sampling activities in the fall of 2000 and covered most of the study area. Emphasis of the tracks was in shallower areas where male crabs were thought to be in greater abundance. A grid line pattern of tracking locations was established in each of the three areas using a GPS. Up to 130 tracking locations were established, separated roughly by 500 m between points, and surveyed during ultrasonic tracking sessions. Identification of individual tags began when the receiver was within 200 m from the transmitter. The location of the transmitter was determined by lowering the gain on the receiver and moving to the position where the highest power reading was attained. Once a tagged crab was located, the tag code, time, position (latitude, longitude), receiver gain setting and signal power were recorded.

2.6 Tag Recovery

Dungeness crabs that were tagged in 2000 and 2001 were recovered throughout the study area during sampling (SMP), in the Nisga'a (NF) and commercial (CF) fisheries between June 2000 and April 2002. A reward program was implemented in both tagging years to encourage fishers to return any information regarding recaptured tagged crabs during their fisheries. Public announcements were made to the Nisga'a communities and to the Area-B commercial fishermen describing the study, reward program and asking fishers to release any ultrasonic-tagged crabs that were captured in 2000. Each returned tag gave the returnee one chance of a draw for $250 in either the Nisga'a or commercial fisheries.

2.6.1 Sampling

All male Dungeness crabs were examined for presence of an anchor tag during sampling. Any recaptured tagged crabs were bio-sampled for size, shell hardness, injuries and the tag number recorded. If a tag hole was evident but the tag was missing, the recapture was recorded as a tag loss. During the tagging period in 2001, any recaptured tagged crabs that had been tagged in 2000 were re-tagged with a 2001 anchor tag.

2.6.2 Nisga'a Fishery

A non-salmon catch-monitoring program was conducted by the Nisga'a Fisheries Program in 2000 and 2001 and reported in Bocking et al. (2002) and Baxter and Stephens (2002), respectively. Anchor tags that were recovered from Dungeness crabs during harvesting activities by Nisga'a fishers were returned to a Nisga'a catch monitor who collected the tag and recorded catch information. A catch monitor was available in Kincolith (Gingolx), Greenville (Laxgalts'ap), Gitwinksihlkw and New Aiyansh (Gitlakdamix).

2.6.3 Commercial Fishery

During the 2000 commercial fishery (1 October to 15 November), participants could return tags to a charter patrol officer that operated during the first week of the fishery or directly to DFO in Prince Rupert. Commercial crab data were also provided to DFO by commercial fishers in the form of harvest logs. The Charter Patrol Association monitored the first week of the commercial fishery in 2000 and observed and recorded catch and tags recovered. In 2001, Nisga'a Fisheries monitored the first week of the commercial fishery by collecting catch and tag information from commercial vessels. Additional observations and data were collected by the Charter Patrol Association in 2001. Commercial fishery catch was derived from harvest logs. About 60% of the catch was reported in pieces, the remainder by weight. An average of 0.8 kg/crab (1.772 lbs per crab) was used to convert landings reported by weight only to an estimate of the number of crab caught. This conversion was derived from harvest log data where both weights and pieces were provided. Harvest logs were checked against fish landing slips to verify the average piece weight and to ensure catch was not missed.

2.6.4 Tag Removal Rates

For 2000 and 2001, we estimated the number of tags removed by the commercial fishery by multiplying the total estimated commercial catch in each year by the cumulative "observed" mark rate (i.e., total tags returned/sampled to total catch observed) in each year that was obtained from the commercial monitoring and sampling programs. We assumed a tag return rate of 100% in the monitored commercial fisheries, the sampling program and the Nisga'a fishery. The Nisga'a fishery was assumed to have a 100% tag return rate due to the high profile of the study, a tag reward program, the presence of a catch monitor in each Nisga'a community to collect any returned tags and the close proximity of the communities to the harvest areas. A participation (compliance or reporting) rate of returning tags by commercial fishers was estimated for 2000 and 2001 by calculating the proportion of returned tags to the total tags estimated to have been removed. Conversely, a non-reporting rate was estimated as the difference between the estimated tags removed and actual tags returned to the total estimate of tags removed.

2.7 Population and Exploitation Estimates

Population estimates were calculated for legal-sized male Dungeness crabs in 2000 and 2001 using information from tagging and tag-recovery efforts from sampling, Nisga'a and commercial fisheries. For each year, an estimate was calculated for the commercial-fishery closed (Kincolith) and open (Ripple/Iceberg) areas of the Nass Estuary. A total estimate for the Nass Estuary was the summation of the closed and open estimates. Estimates were calculated using a modified Bayesian technique for closed populations (Gazey and Staley 1986) with the following mark-recapture assumptions:

1) The marked crabs suffer the same natural and fishing mortality as the unmarked crabs.
2) All crabs in a stratum (time period and site partition), whether marked or unmarked, have the same probability of being caught.
3) Crabs do not lose their marks over the period of the study.

4) The population in the study area does not change over the period of the experiment. If mortality occurs then it can be specified independent of the mark-recapture information. Crabs can move (mix) between study sites; however, the mixing is fully determined by the history of recaptured marks, and
5) All marks are reported when crabs are recaptured. If all marks are not reported then the rate of participation (or detection of a mark) can be specified.

To minimize biases associated with assumptions (1) and (4), we estimated recruitment and associated tag losses (i.e., natural, tag-related mortality and tag recovery rates) based on tag recovery data. For each estimate, the number of tags applied was adjusted to account for natural mortality, tag loss, non-participation rate of tags returned, and a proportion of medium-size tagged crabs that would move into the legal-sized tag category as a result of moulting. Our assessment of the validity of each of these assumptions is presented below (see DISCUSSION).

In order to generate population estimates the data were organized as follows:

m_{ti} – the number of marks applied during period (trip) t in site i,
c_{ti} – the number of crab examined for marks during period t in site i,
r_{ti} – the number of recaptures in the sample c_{ti}, and
d_{ti} – the number of crab removed or killed of the recaptures r_{ti}.
y_{ti} – the number of crab removed or killed (censused, e.g., catch) during period t in site i,
T_t – the number of days from the start of the study to the middle of period t.

The number of marks applied (m_{ti}) is the sum of individual releases (legal and medium size) weighted by the probability that the crab would be of legal size at recapture defined as follows:

$$\text{Probability (Legal)} = \begin{cases} 1 & \text{if } W \geq W^* \\ \alpha & \text{if } W^* - g < W < W^* \\ 0 & \text{otherwise} \end{cases}$$

where W is measured carapace width, W^* is legal carapace width, g is the moult increment and α is the probability of moulting. In words, the mark is not counted if the crab cannot become legal in a single moult and the crab is counted as the moulting probability if the crab is of medium size but can become legal with a single moult. The crab is fully counted when of legal size. Similarly, a recapture was counted as $1/(1-\mu)$ where μ is the rate of not detecting (reporting) a mark. If all marks are reported then $\mu = 0$.

The number of marks available for recapture adjusted for movement was determined by first estimating the proportion on marks released in zone i moving to zone j (p_{ij}). Note by definition:

$$\sum_j p_{ij} = 1.$$

Assuming that the movement of marked crab is determined by the recapture history corrected for the sampling intensity then

$$(2) \qquad \hat{p}_{ij} = \frac{\dfrac{w_{ij}}{\sum_t c_{tj}}}{\sum_j \dfrac{w_{ij}}{\sum_t c_{tj}}}$$

where w_{ij} is the total number of recaptures that were released in zone i and captured in zone j over the entire study. The maximum number of releases available for recapture during day t in zone j (m^*_{tj}) is then

$$(3) \qquad m^*_{tj} = \sum_i \hat{p}_{ij} m_{ti} \ .$$

Note that the redistribution of marks, specified by equations (2) and (3), is assumed to be accomplished by the start of the next sampling interval.

The usual closed population model assumptions (e.g., Gazey and Staley 1986) may be invalidated by natural mortality and the emigration of crab from the study area. We incorporated these factors when the data were assembled for a region (more than one site). Thus, the number of marks available for recapture at the start of day t in region k (M_{tk}) consists of the releases in each of the zones corrected for removals (mortality and emigration) summed over time and into the appropriate region, i.e.,

$$(4) \qquad M_{tk} = \sum_{v=1}^{t-1} \exp\left\{\frac{(T_v - T_t)}{365} Q\right\} \sum_{j \subset k} (m^*_{vj} - d_{vj})$$

where Q is the instantaneous annual rate of removal. The number of fish examined and recaptured during day t in the k'th region (C_{tk}, R_{tk}) do not require correction (simply sum up the sites in the region), i.e.,

$$(5) \qquad C_{tk} = \sum_{j \subset k} c_{tj}$$

and

$$(6) \qquad R_{tk} = \sum_{j \subset k} r_{tj} \ .$$

Similarly, total cumulative censused removals are obtained by summing over the relevant sites and over periods up to the current period, i.e.,

$$(7) \qquad Y_{tk} = \sum_{v}^{t-1} \sum_{j \subset k} y_{tj}$$

The probability of capturing a marked crab (q_{itk}), adjusted for removals (equation 7), is then

$$(8) \qquad q_{itk} = \frac{M_{tk}}{N_{ik} \exp\left\{\frac{-T_t}{365} Q\right\} - Y_{tk}}$$

where N_{ik} is a particular population level indexed by i for the k'th region. Note that this population level is the initial population size at the start of the study and remains constant for all periods (fulfilling the closed assumption requirement). The capture probability is adjusted by the marks available and removals to reflect any changes in the population as the study progresses. The likelihood kernel for sampling with replacement is then

$$(9) \qquad P(R_{tk} | N_{ik}) \propto q_{itk}^{R_{tk}} (1 - q_{itk})^{C_{tk} - R_{tk}}$$

Bayesian procedures provided by the Gazey and Staley (1986) were then followed to form the population estimates. As recommended by Gazey and Staley an improper discrete uniform prior was used. The range of the prior was determined interactively by inspection of the posterior.

2.7.1 Population Model

The estimation of population size was accomplished with a Microsoft Excel© spreadsheet model that consists of macros coded in Visual Basic. The procedure requires the execution of two passes (macros update and estimate). First (execute macro update), the mark-recapture data are assembled by site under the selection criteria of year, legal carapace width, moult increment, probability of moulting and the rate of unreported marks specified by the user. For the second pass (execute macro estimate), the user must specify the sites to be included in the estimate (coined a region), annual instantaneous removal rate and the confidence interval percentage desired for the output. The model then assembles the adjusted mark-recapture data (equations 4 to 7) and follows Gazey and Staley (1986) using an altered replacement model (equation 9) to compute the population estimates. Output includes the posterior distribution for each sampling sequence, the Bayesian mean, standard deviation, median, mode, symmetric confidence interval and the highest probability density (HPD) interval.

Population estimates were generated for the open (Kincolith stratum) and closed (Ripple and Iceberg strata) areas to the commercial fishery using a start-date of 1 June 2000 (2000 estimate) and 1 May 2001 (2001 estimate), promotion of medium-size, tagged crabs to legal size (i.e., moulting probability) of 13.8% (2000) and 18.2% (2001), an annual instantaneous removal rate (represents natural mortality, unobserved removals and emigration) of between 1.0 and 2.0, and an undetected mark rate of 29.4% (2000) and 45.7% (2001; see RESULTS for details). Note that the two area estimates are for a mean value over the period of tag application. The total population estimate for the study area was obtained by summing the open and closed estimates. The confidence interval for the total study area estimate was calculated invoking a normal

distribution under the central limit theorem with a variance equal to the sum of the variances for the two areas.

2.7.2 Exploitation Rates

Exploitation rates of legal-sized male Dungeness crabs were calculated for the open (Ripple and Iceberg Bay) and the closed (Kincolith) areas to the commercial fishery for 2000 and 2001 by dividing the harvested catch by a range of population estimates that accounted for different annual instantaneous rates of natural mortality for each respective year.

3.0 RESULTS

3.1 Trap Sampling

A total of 264 traps sets and 1845 trap hauls were made from 15 sampling trips in the Nass Estuary between 8 June 2000 and 19 April 2002 (Table 2, Table 3). Detailed information regarding trap sets is presented in Table A - 1. Locations of the trap sets are shown in Figure 2 for 2000 trips and Figure 3 for 2001-2002 trips with individual trips shown in Appendix A (Figs. A - 1 to A - 15). Of the total traps hauled, 1195 (65%) were from standard set locations with 38%, 33%, and 29% occurring in the Kincolith, Ripple and Iceberg Bay sampling areas, respectively. The number of trap hauls from both standard and non-standard sets averaged 123 trap hauls per trip with a range between 30 (trip 7: 28-29 November 2000) and 280 (trip 9: 9-15 May 2001). The low number of traps hauled on trip 7 in 2000 was the result of poor weather conditions that enabled only the Kincolith area to be sampled and trips that had greater than 160 trap hauls per sampling trip were conducted during periods of intensive tagging of male Dungeness crabs. Standard soak times varied in the sampling areas from 14 to 34 hrs with mean soak times of 23.1 hrs (n=695, SD=3.7) and 24.8 hrs (n=500, SD=1.3) in 2000 and 2001-2002 sampling periods, respectively. Non-standard soak times varied between 6 and 29 hrs with mean soak times of 20.9 hrs (n=104, SD=1.5) and 18.6 hrs (n=546, SD=5.5) in 2000 and 2001-2002 sampling periods, respectively. Combining all three study areas, we found no significant relationship between soak time and the mean catch per trap of legal- and medium-sized male Dungeness crabs in the Nass Estuary (Figure 4, Figure 5; Log-linear model, $F=1.41$, $p=0.10$). However, significant relationships were found between soak time and the mean CPE of legal-sized male Dungeness crabs caught in Kincolith ($R^2=0.58$, $p=0.0008$) and Iceberg Bay ($R^2=0.49$, $p=0.007$) in 2001-2002 (Figure 5). Based on these relationships, significantly lower mean CPE was observed when soak times were less than 8 hrs.

3.2 Catches and Catch per Effort

3.2.1 Catches of Dungeness Crabs

A total of 20,978 Dungeness crabs were caught during sampling trips in the Nass Estuary from 8 June 2000 to 19 April 2002 (Table B - 1). Catches from standard and non-standard trap sets from the 2000 and 2001-2002 sampling periods are presented in Table 4 and Table 5, respectively. More crabs were caught in the 2001-2002 (12,339) period than 2000 (8639) period with more trap sets conducted in the 2001-2002 period. Standard sets accounted for 62% of the total catch of crabs. Of the total crabs caught during sampling, 58% (12,164) were male and

42% (8814) were female. Of the total catch, more crabs were caught in Kincolith (43%) than Ripple (33%) and Iceberg Bay (25%) areas. Of the total respective male and female catches, more males were caught in Kincolith (38%) than Ripple (32%) and Iceberg Bay (30%) and more females were caught in Kincolith (50%) than Ripple (33%) and Iceberg Bay (17%). Of the total catch of crabs, a lower proportion (51% vs. 63%) of males was observed in 2000 than 2001-2002 sampling periods and may be a result of fewer trap sets conducted in shallower water between years (see DISCUSSION).

Of the total male crabs caught and measured (12,159), 52% were legal, 44% were medium and 4% were small sized. Catches of legal, medium and small-sized male crabs for 2000 and 2001-2002 sampling periods are shown in Table 6 and Table 7, respectively. A higher proportion of legal-sized male crabs was caught in the 2000 sampling period than the 2001-2002 period (66% vs. 45%), whereas, a lower proportion of medium-sized male crabs was caught in 2000 than 2001-2002 periods (29% vs. 52%). Similar proportions of small-sized male crabs were caught between the two sampling years. Kincolith accounted for the highest total catch of legal-sized males followed by Ripple and Iceberg Bay. Iceberg Bay accounted for the highest total catch of medium and small-sized males than Kincolith and Ripple.

Of the total female crabs caught and measured (8,812), most were medium sized (73%) followed by large (14%) and small (14%) sizes. Catches by size type for female crabs in 2000 and 2001-2002 sampling periods are shown in Table 8 and Table 9, respectively. Kincolith accounted for the highest catches of all size types of females.

3.2.2 CPE of Dungeness Crabs

Mean CPE for legal-, medium- and small-sized male crabs from 2000 and 2001-2002 sampling trips are presented in Table 10 and Table 11, respectively. Median CPE values (and any outlier data) are shown in Figure 6 and Figure 7 for legal-size male crabs and Figure 8 and Figure 9 for medium-sized male crabs.

Mean CPE for large-, medium- and small-sized female crabs from 2000 and 2001-2002 sampling trips are presented in Table 12 and Table 13, respectively. Median CPE values (and any outlier data) are shown in Figure 10 and Figure 11 for female crabs.

3.2.2.1 Legal-sized Males

The overall mean CPE for legal-sized male Dungeness crabs caught in all three sampling areas in 2000 and 2001-2002 was 3.6 ± 3.5 S.D. [range between 1.4 ± 2.3 S.D. (27-31 October) and 5.0 ± 3.7 S.D. (23-28 August)] and 3.3 ± 2.9 S.D. [range between 2.4 ± 2.3 S.D. (23-24 June) and 5.0 ± 3.5 S.D. (17-19 April)], respectively (Table 10 and Table 11).

The Kincolith area had significantly higher mean CPE (2.2 ± 2.3 S.D. to 6.6 ± 4.2 S.D.) for legal-sized male crabs than the other sampled areas in standard trap sets except during the following trips: 2 (30 June to 2 July), 10 (28-31 May) and 15 (17-19 April) (ANOVA, $p<0.001$ to 0.029; Table C - 1). Other than the April sampling trip, the lower mean CPE observed in Kincolith from trips 2 and 10 were from trips that were conducted within 13-21 days of the

previous sampling trip and may be an affect of the sampling. Ripple had consistently higher mean CPE (range between 0.8 ± 1.0 S.D. and 5.1 ± 3.3 S.D.) for legal-sized males than Iceberg Bay (range between 0.5 ± 0.6 S.D. and 2.5 ± 2.3 S.D.) in standard sets in 2000 (Table C - 1). However, in 2001-2002 sampling trips, Iceberg Bay had higher mean CPE (range between 2.0 ± 1.7 S.D. and 5.3 ± 2.9 S.D.) in standard sets for all trips except trip 9 (28-31 May; Table C - 1). The higher mean CPE observed in Iceberg Bay in 2001-2002 is thought to be related to an increase of legal-sized males from the moulting of pre-recruit males in the area (see DISCUSSION).

Period differences in mean (and median) CPE for legal-sized males were observed with highest values typically in August and September and lowest values in October after the start of the commercial fishery. Significant decreases in mean CPE of legal-sized male crabs were observed in all three areas in late October 2000 (ANOVA, $p<0.001$ to 0.013) and in Iceberg Bay in October 2001-2002 sampling periods (ANOVA, $p<0.001$ to 0.31; Table C - 1). The standard sets that were conducted after the start of the 2000 commercial fishery showed a 60%, 67%, and 100% reduction in median CPE (37%, 74%, and 83% mean CPE) for legal-sized male crabs in Kincolith, Ripple and Iceberg Bay, respectively (Figure 6; Table C - 1). In October 2001, a 27%, 60% and 62% reduction in median CPE (9%, 48%, and 53% reduction in mean CPE) was observed for legal-sized male crabs in Kincolith, Ripple and Iceberg Bay, respectively (Figure 7; Table C - 1). Reductions occurring in Kincolith are thought to be related to the timing and effort of the Nisga'a fisheries and not to the commercial fishery (see DISCUSSION). With the exception of Ripple in 2000, high mean (and median) CPE for legal-sized males were observed in all areas during April sampling periods (Table C - 1). The high CPE values of legal-size males in April sampling periods are considered to be related to peak moulting of pre-recruit males into the legal-size category (see DISCUSSION).

3.2.2.2 Medium and Small Sized Males

The overall mean CPE for medium-sized male Dungeness crabs caught in all three sampling areas in 2000 and 2001-2002 was 1.6 ± 2.0 S.D. [range between 0.5 ± 0.9 S.D. (9-11 June) and 3.2 ± 2.7 S.D. (27-31 October)] and 3.9 ± 3.1 S.D. [range between 2.3 ± 1.9 S.D. (17-19 April) and 6.6 ± 3.3 S.D. (20-22 October)], respectively (Table 10 and Table 11). Median values (and any outlier data) are shown in Figure 8 and Figure 9. In 2000 sampling trips, Iceberg Bay was found to have significantly higher mean CPE for medium-sized males than Kincolith or Ripple from late June to October sampling periods (ANOVA, $p<0.001$ to 0.020, Table C - 1). Significant increases in mean (and median) CPE for medium-size males caught in standard sets was observed after July in all three areas in 2000 (ANOVA, $p<0.001$). In 2001-2002 sampling trips, Iceberg Bay was found to have significantly higher mean CPE for medium-sized males than Kincolith or Ripple from April to June and October 2001 sampling periods (ANOVA, $p<0.001$ to 0.007, Table C - 1). Kincolith had a significantly higher mean CPE for medium-sized males than Ripple from April to June, September and October 2001 sampling periods and significantly higher mean CPE than Iceberg in September (Table C - 1). Significant decreases in mean (and median) CPE for medium males caught in standard sets from all three areas was observed between the October 2001 and April 2002 sampling periods (ANOVA, $p<0.001$). No significant differences in mean CPE for medium-sized males was observed between areas in the April 2002 sampling period (ANOVA, $p=0.43$; Table C - 1). Seasonal differences in mean CPE

of medium-sized crabs are thought to be related to the moulting of small-sized crabs to medium size (i.e., increase to mean CPE) and the moulting of medium-sized crabs to legal size (i.e., decrease to mean CPE; see DISCUSSION).

The overall mean CPE for small-sized male Dungeness crabs caught in all three sampling areas in 2000 and 2001-2002 was 0.3 ± 0.9 S.D. [range between 0.1 ± 0.1 S.D. (30 June to 2 July) and 0.6 ± 1.3 S.D. (27-31 October)] and 0.3 ± 0.7 S.D. [range between 0.04 ± 0.2 S.D. (27-29 August) and 0.5 ± 1.0 S.D. (28-31 May)], respectively (Table 10 and Table 11). Small-sized male crabs were not found in high abundance in either sampling year, however, the trigger spacing in the traps did allow under-sized crabs (105 mm or less) to escape (see DISCUSSION).

3.2.2.3 Females

The overall mean CPE for large-sized female Dungeness crabs caught in all three sampling areas in 2000 and 2001-2002 was 0.9 ± 1.2 S.D. [range between 0.80 ± 1.0 S.D. (23-28 August) and 1.4 ± 1.4 S.D. (8-11 June)] and 0.4 ± 0.8 S.D. [range between 0.30 ± 0.59 S.D. (17-19 April) and 0.7 ± 0.98 S.D. (27-29 August)], respectively (Table 12 and Table 13). In 2000 sampling trips, Kincolith was found to have significantly higher mean CPE for large-sized females than Ripple or Iceberg in late July, September and October (ANOVA, $p<0.001$ to 0.017) and Ripple had significantly higher mean CPE for large-sized females than Iceberg in September ($p=0.001$; Table C - 2; Figure 10). Additional observations from the 2000 sampling periods found no significant differences in mean CPE for large-sized females between sampling periods in Kincolith, however, significant reductions in mean CPE were observed in Ripple and Iceberg between the June and October periods ($p<0.001$). In 2001-2002 sampling trips, Kincolith was found to have significantly higher mean CPE for large-sized females than Ripple or Iceberg in early May and between June and October 2001 sampling periods (ANOVA, $p<0.001$ to 0.04, Table C - 2; Figure 11). Iceberg Bay was found to have significantly higher mean CPE for large-sized females than Ripple in June, September and October 2001 sampling periods ($p=0.004$ to 0.044) but not in August (ANOVA, $p=0.006$). No significant difference in mean CPE for large-sized females was observed in the April 2002 sampling period ($p=0.96$; Table C - 2).

The overall mean CPE for medium-sized female Dungeness crabs caught in all three sampling areas in 2000 and 2001-2002 was 3.8 ± 3.4 S.D. [range between 2.9 ± 3.0 S.D. (27-31 October) and 4.9 ± 3.3 S.D. (23-26 September)] and 3.2 ± 2.9 S.D. [range between 1.9 ± 2.7 S.D. (23-24 June) and 4.8 ± 3.6 S.D. (27-29 August)], respectively (Table 12 and Table 13). Medium-sized female crabs were abundant throughout the 2000 sampling periods with generally lower mean CPE observed in October and November (Figure 10). The highest mean CPE for medium-sized females in 2000 sampling trips was observed in Kincolith (range between 3.6 and 6.6) followed by Ripple (range between 3.7 and 5.1) and Iceberg Bay (range between 0.9 and 2.6). Kincolith also had significantly higher mean CPE for medium-sized females than Ripple or Iceberg in all periods except late June 2000 ($p<0.001$; Table C - 2). Ripple was found to have significantly higher mean CPE for medium-sized females on all trips other than late June or October 2000. In 2001-2002 sampling trips, Kincolith was found to have significantly higher mean CPE for medium-sized females than Ripple or Iceberg from April to September 2001 sampling periods (ANOVA, $p<0.001$ to 0.04, Table C - 2). Ripple was found to have significantly higher mean CPE for medium-sized females than Iceberg in April, late May, and

August 2001 periods (ANOVA, $p<0.001$). No significant difference in mean CPE for medium-sized females was observed between areas in the October 2001 sampling period ($p=0.83$). However, a significant difference in mean CPE for medium-sized females was observed in the April 2002 sampling period, Kincolith had a higher mean CPE than Ripple and Iceberg and Ripple had a higher mean CPE than Iceberg (ANOVA, $p=0.001$; Table C - 2).

The overall mean CPE for small-sized female Dungeness crabs caught in all three sampling areas in 2000 and 2001-2002 was 0.5 ± 1.2 S.D. [range between 0.1 ± 0.5 S.D. (30 June to 2 July) and 1.4 ± 2.0 S.D. (23-26 September)] and 0.7 ± 1.3 S.D. [range between 0.3 ± 0.7 S.D. (20-22 October) and 1.3 ± 1.9 S.D. (27-29 August)], respectively (Table 12 and Table 13). Small-sized female crabs were found in low abundance in all areas with highest mean CPE observed in the fall months (Table 12 and Table 13).

3.2.3 Depth Stratification

Mean CPE of male and female Dungeness crab caught at shallow (3-20 m), moderate (21-45 m) and deep depths (41-75 m) are shown in Figure 12 and Figure 13 for 2000 and 2001-2002 sampling trips, respectively. Male Dungeness crabs were caught in higher abundance at shallow depths than any other depth type. Mean CPE of male crabs that were caught at shallow depths were significantly higher than mean CPE caught at moderate or deep depths on all sampling trips in 2000 (ANOVA, $p<0.001$ to 0.040; Table C - 3). In 2001-2002, mean CPE of male crabs caught at shallow depths were found to be significantly higher than mean CPE caught at moderate or deep depths in April, May and August 2001 sampling periods (ANOVA, $p<0.001$ to 0.010; Table C - 3). Female Dungeness crabs were caught in significantly higher abundance at deep depths in late June, August and October 2000 sampling periods (ANOVA, $p<0.001$ to 0.006; Table C - 3; Figure 12). In 2001-2002 sampling trips, female Dungeness crabs were caught in significantly higher abundance at deep depths in the June sampling period only (ANOVA, $p=0.004$; Table C - 3; Figure 13); however, less sampling in deeper strata occurred in 2001-2002 versus 2000. The data show that female crabs moved into shallower waters in late September 2000 and late August 2001 and may indicate timing of mating activity (see DISCUSSION).

3.2.4 Non-Dungeness Crab Catches

Catches of non-Dungeness crabs during sampling periods in 2000 included 54 Hermit crabs (*Pagurus spp*.), 40 Tanner crabs (*Chionoecetes bairdi*) and 1 starfish (*Pisaster ochraceus*). All of the Hermit crabs, two Tanner crabs and the starfish were caught in Kincolith. A total of 38 Tanner crabs was caught in Iceberg Bay. The Hermit crabs were caught in July (94%) and August (6%) sampling periods in Kincolith. The Tanner crabs were caught in similar proportions from June to October. No Tanner crabs were caught in Iceberg Bay after the commercial fishery began in October 2000.

Catches of non-Dungeness crabs during sampling periods in 2001 and 2002 included 68 Tanner crabs, 35 tritons (*Fusitriton oregonensis*), 15 sole (*Parophrys vetulus*), 1 decorator crab (*Oregonia gracilis*), 1 halibut (*Hippoglossus stenolepis*), and 1 giant Pacific Octopus (*Octopus dofleini*). Of the tanner crabs caught, 87% were captured in Iceberg Bay and 13% in Kincolith

sampling sites. Tanner crabs were only caught in April (2001 and 2002) in Kincolith and all sampling trips in Iceberg Bay. All of the sole were caught during sampling in April 2002, 73% in Ripple Tongue, 13% in Kincolith and 13% in Iceberg set locations. The decorator crab and halibut were caught in Kincolith in May and October 2001, respectively. The octopus was caught in Ripple Tongue in May 2001.

3.3 Biological Sampling

3.3.1 Size Frequency

3.3.1.1 Males:

Size frequency data for male Dungeness crabs caught on sampling trips between 8 June 2000 and 19 April 2002 are shown in Figure 14 (8 June to 28 August 2000), Figure 15 (23 September to 29 November 2000), Figure 16 (10 April to 24 June 2001), and Figure 17 (27 August 2001 to 19 April 2002).

2000 sampling trips:

The range in male size captured in Kincolith was between 108.0 mm NW and 199.0 mm NW. The percentage of legal-sized males caught in Kincolith from sampling trips ranged between 54% (trip 7; November) and 93% (trip 1; early June). Of the total legal males caught in Kincolith, 4.6% (62 of 1356) were greater than 184 mm. The range in male size captured in Ripple Tongue was between 101.0 mm NW and 206.0 mm NW. The percentage of legal-sized males caught in Ripple Tongue ranged between 16% (trip 6; October) and 88% (trip 1; early June). Of the total legal males caught in Ripple, 4.5% (52 of 1155) were greater than 184 mm. The range in male size captured in Iceberg Bay was between 110.0 mm NW and 191.0 mm NW. The percentage of legal-sized males caught in Iceberg Bay ranged between 8% (trip 6; October) to 67% (trip 2; early July). Of the total legal males caught in Iceberg in 2000, 2.4% (9 of 372) were greater than 184 mm.

Males caught in Kincolith during sampling in 2000 were found to be significantly larger than males caught in Ripple Tongue in early July (trip 2; $p=0.03$), August (trip 4; $p=0.0001$), and October (trip 6; $p=0.0001$; t-test); and significantly larger than males caught in Iceberg Bay from June to October (all trips; $p<0.05$; t-test). Males caught in Ripple Tongue during sampling were found to be significantly larger than males caught in Iceberg Bay in early June (trip 1; $p=0.003$), late July (trip 3; $p=0.0001$), August (trip 4; $p=0.008$), and September (trip 5; $p=0.0001$; t-test). The percentage of legal-sized males caught after the start of the commercial fishery in October 2000 diminished in all three sampling areas but the most substantial declines occurred in Iceberg Bay and Ripple Tongue (Figure 15).

2001-2002 sampling trips:

The range in male size captured in Kincolith was between 101.0 mm NW and 201.0 mm NW. The percentage of legal-sized males caught in Kincolith from the sampling trips ranged between 28% (late May) and 66% (August). Of the total legal-sized males caught in Kincolith,

2.5% (32 of 1289) were greater than 184 mm NW. The range in male size captured in Ripple Tongue was between 112.0 mm NW and 189.0 mm NW. The percentage of legal-sized males caught in Ripple Tongue from the sampling trips ranged between 23% (October) and 70% (April 2002). Of the total legal-sized males caught in Ripple, 3.5% (36 of 1036) were greater than 184 mm NW. The range in male size captured in Iceberg Bay was between 80.0 mm NW and 194.0 mm NW. The percentage of legal-sized males caught in Iceberg Bay from the sampling trips ranged between 16% (October) and 76% (April 2002). Of the total legal-sized males caught in Iceberg, 1.8% (20 of 1135) were greater than 184 mm NW.

Males caught during the 2001-2002 sampling in Kincolith were found to be significantly larger than males caught in Ripple Tongue in August (trip 12; $p=0.01$) and October (trip14; $p=0.001$; t-test); and significantly larger than males caught in Iceberg Bay in May (trip 8; $p<0.0001$), June (trip 11; $p<0.0001$), August (trip 12; $p<0.0001$) and October 2001 (trip 14; $p<0.0001$; t-test). Males caught during sampling in Ripple Tongue were found to be significantly larger than males caught in Kincolith in early May (trip 9; $p<0.0001$) and September (trip 13; $p<0.0001$; t-test) 2001; and significantly larger than males caught in Iceberg Bay in May (trips 9 and 10; $p<0.0001$), and September (trip 13; $P<0.0001$; t-test) 2001. Males caught during sampling in Iceberg Bay were found to be significantly larger than males caught in Kincolith ($p<0.0001$) and Ripple Tongue ($p=0.007$; t-test) in April 2002. The percentage of legal-sized males caught in October sampling from all areas was much lower than any other sampling periods (Figure 17).

3.3.1.2 Females:

Size frequency data for female Dungeness crabs caught on sampling trips between 8 June 2000 and 19 April 2002 are shown in Figure 18 (8 June to 28 August 2000), Figure 19 (23 September to 29 November 2000), Figure 20 (10 April to 24 June 2001), and Figure 21 (27 August 2001 to 19 April 2002).

2000 sampling trips:

The range in female size captured in Kincolith was between 93.0 mm NW and 173.0 mm NW. The percentage of large-sized females caught in Kincolith from the sampling trips ranged between 13% (trip 7; November) and 25% (trip 6; October). The range in female size captured in Ripple Tongue was between 104.0 mm NW and 176.0 mm NW. The percentage of large-sized females caught in Ripple Tongue from the sampling trips ranged between 12% (trip 6; October) and 18% (trip 1; early June). The range in female size captured in Iceberg Bay was between 104.0 mm NW and 175.0 mm NW. The percentage of large-sized females caught in Iceberg Bay from the sampling trips ranged between 15% (trip 5; September) and 36% (trip1; early June).

2001-2002 sampling trips:

The range in female size captured in Kincolith was between 101.0 mm NW and 177.0 mm NW. The percentage of large-sized females caught in Kincolith from the sampling trips ranged between 5% (April 2002) and 13% (August and October). The range in female size

captured in Ripple Tongue was between 111.0 mm NW and 171.0 mm NW. The percentage of large-sized females caught in Ripple Tongue from the sampling trips ranged between 4% (October) and 15% (April 2001). The range in female size captured in Iceberg Bay was between 98.0 mm NW and 167.0 mm NW. The percentage of large-sized females caught in Iceberg Bay from the sampling trips ranged between 9% (August 2001 and April 2002) and 22% (September).

3.3.2 Shell Hardness

The proportion of hard-shelled male and female Dungeness crabs caught during sampling trips in 2000 and 2001-2002 are shown in Figure 22 and Figure 23, respectively. The numbers caught by the shell hardness categories are presented in Table D - 1 and Table D - 2 for males and Table D - 3 and Table D - 4 for females.

3.3.2.1 Males:

2000 sampling trips:

The highest proportions of hard-shelled, legal-sized male crabs that were caught in Kincolith were in October (91%, n=107)) and November (96%, n=71)) 2000 with the lowest proportion observed in early June 2000 (63%, n=169). A similar pattern was observed in Ripple Tongue where 86% (n=37) of the legal-sized male crabs caught in October were hard-shelled compared with 66% (n=58) of the males caught in early June. A different pattern was observed in Iceberg Bay where the highest proportion of hard-shelled male crabs was caught in late July (97%, n=29) and the lowest proportion was observed in late October (60%, n=15).

2001-2002 sampling trips:

The highest proportion of hard-shelled, legal-sized male crabs that were caught in Kincolith was in late September 2001 (91%, n=170)) with the lowest proportion observed in early May 2001 (36%, n=58). A similar pattern was observed in Ripple Tongue where 95% (n=61) of the legal-sized male crabs caught in September were hard-shelled compared with 38% (n=72) of the males caught in early May. A different pattern was observed in Iceberg Bay where the highest proportion of hard-shelled male crabs was caught in late August (76%, n=99) but the lowest proportion was similar as the other areas (early May; 23%, n=58).

3.3.2.2 Females:

2000 sampling trips:

The proportion of hard-shelled female Dungeness crabs caught during sampling decreased from early June (99% to100%) to November (53% to 66%) 2000 in both the Kincolith and Ripple Tongues areas. The proportion of hard-shelled female crabs caught in Iceberg Bay also declined from June (98%) to September (48%) but increased in October (75%) 2000. However, the sample sizes in Iceberg Bay were much smaller than Kincolith or Ripple Tongue areas for both male and female crabs that were caught during sampling.

2001-2002 sampling trips:

The proportion of hard-shelled female Dungeness crabs caught during sampling ranged between 77% (October 2001) and 97% (April 2002) in Kincolith. The proportion of hard-shelled female crabs caught in Ripple Tongue and Iceberg Bay ranged between 59% (October 2001) and 95% (April 2002), and 85% (October 2001) and 92% (April 2002), respectively.

3.3.3 Moulting

Evidence of moulting within a sampling month was assumed by the number of Dungeness crabs caught with a shell-hardness category of crackly new (#3) and plastic soft (#4) or were in the process of moulting (#5). Shell hardness data are provided in Table D - 1 and Table D - 2 for males and Table D - 3 and Table D - 4 for females.

3.3.3.1 Males:

2000 sampling trips:

Based on the soft-shelled definition, freshly moulted legal-sized male crabs were caught in Kincolith on all sampling trips in 2000 and ranged between 1% (October and November) and 11% (early June) of the trip's catch (Table D - 1). Freshly moulted legal-sized male crabs were also caught on all sampling trips in Ripple with a range between 1% (early July) and 10% (September) of a trip's catch. Moulted legal-sized male crabs were caught in four of six sampling trips in Iceberg Bay with a range between 2% (early July and August) and 27% (October) of the trip's catch. The highest proportion of medium-sized male Dungeness crabs caught during sampling that were estimated to have moulted within a 30-d period was 46% (23-25 July), 53% (23-26 September), and 57% (23-26 September) from Kincolith, Ripple and Iceberg Bay areas, respectively (Table D - 1).

2001-2002 sampling trips:

Legal-sized male crabs that were estimated to have moulted within a 30-d period in 2001-2002 were caught in Kincolith on all sampling trips, the proportion of the catch ranged between 4% (September) and 45% (April 2001; Table D - 2). In Ripple Tongue, the proportions of moulted legal-sized male crabs in sampled catches ranged between 5% (September) and 43% (early May 2001). In Iceberg Bay, the proportions of moulted legal-sized male crabs in sampled catches ranged between 9% (August) and 48% (April 2001). The highest proportions of medium-sized male Dungeness crabs caught during sampling that were estimated to have moulted within a 30-d period was 40%, 41% and 43% from April sampling in Kincolith, June sampling in Ripple, and September sampling in Iceberg Bay, respectively. The lowest proportions of medium-sized male Dungeness crabs caught during sampling that were estimated to have moulted was 2%, 12% and 18% from September sampling in Kincolith, August sampling in Ripple, and early May sampling in Iceberg Bay, respectively (Table D - 2).

3.3.3.2 Females:

2000 sampling trips:

The highest proportion of large-sized female Dungeness crabs caught during sampling that were estimated to have moulted within a 30-d period in 2000 was 18%, 28% and 23% from September sampling in Kincolith, October sampling in Ripple, and September sampling in Iceberg Bay, respectively (Table D - 3). The highest proportion of medium-sized female Dungeness crabs caught during sampling that were estimated to have moulted within a 30-d period was 17% (27-31 October), 16% (27-31 October), and 37% (23-26 September) from Kincolith, Ripple and Iceberg Bay areas, respectively (Table D - 3).

2001-2002 sampling trips:

The highest proportion of large-sized female Dungeness crabs caught during sampling that were estimated to have moulted within a 30-d period in 2001-2002 was 10%, 10% and 8% from October sampling in Kincolith, April sampling in Ripple, and May sampling in Iceberg Bay, respectively (Table D - 4). The highest proportion of medium-sized female Dungeness crabs caught during sampling that were estimated to have moulted within a 30-d period was 9% (late May), 24% (August), and 14% (September) from Kincolith, Ripple and Iceberg Bay areas, respectively (Table D - 4).

3.3.4 Embrace Marks

The percentage of medium- and legal-sized male Dungeness crabs caught with embrace marks in 2000 and 2001-2002 sampling trips are presented in Figure 24 and Figure 25, respectively.

2000 sampling trips:

The incidence of legal-sized male Dungeness crabs caught with embrace marks increased from June (5% to 10%) to October and November (30% to 40%) 2000 in Kincolith and Ripple Tongue sampling areas (Figure 24). Legal-sized male crabs caught in Iceberg Bay had a higher incidence of embrace marks in early June (25%) compared with the other areas but the incidence dropped in late June (5%) and increased during October sampling (30%). Medium-sized male crabs caught in Kincolith and Iceberg Bay had low incidences of embrace marks in early June (6% to 8%) and high incidences in October and November (14% to 16%). Medium-sized male crabs caught in Ripple Tongue had relatively low incidences of embrace marks between June and October (range was between 1% and 6%). A total of 14 female Dungeness crabs were caught during sampling in 2000 with eggs; 3 were caught in October and 11 were caught in November. Of the total female crabs caught with eggs, 12 were from Kincolith, 1 from Ripple and 1 from Iceberg Bay.

2001-2002 sampling trips:

The highest incidence of embrace marks for legal-sized male Dungeness crabs that were caught during sampling in 2001 and 2002 was observed in August (Kincolith [31%]) and September (Ripple [27%] and Iceberg Bay [18%]; Figure 25). The lowest incidence of embrace marks for legal-sized male Dungeness crabs was observed in April 2002 (Kincolith [8%], Ripple [3%] and Iceberg Bay [3%]). Embrace marks were also observed on medium-sized males but in generally lower proportions than legal-sized males; 7% (May) to 36% (August), 5% (May) to 14% (October), and 4% (September) to 19% (April) for Kincolith, Ripple and Iceberg catches, respectively. A total of 169 female Dungeness crabs were caught during sampling in 2001 and 2002 with eggs. Of the total egg-carrying females caught, 131, 33 and 5 were caught in Kincolith, Ripple and Iceberg Bay areas, respectively. Most (67%) of the egg-carrying females were caught in April 2001 and 2002, however, eggs were observed from females caught in May (32%) and October (1%, Kincolith only).

3.3.5 Injury Incidence

The percentage of male and female Dungeness crab caught with leg or shell injuries in 2000 and 2001-2002 sampling trips are shown in Figure 26 and Figure 27, respectively.

2000 sampling trips:

A total of 371 (8%) Dungeness male crabs were caught with an injury classification in 2000; 247 were legal-sized and 124 were medium sized. The majority (87%) of injuries of male crabs caught were classified as regenerated claws or legs. Other injuries of male crabs that were found were a hole (or holes) in the shell (10%), a deformed shell (2%), shell disease (1%) and multiple injuries (<1%). In addition to the number of male crabs caught with an injury, 401 (9%) males were caught missing one or more legs and 226 (5%) males were caught missing one or more claws. A total of 280 (7%) Dungeness female crabs were caught with an injury classification in 2000; 50 were large-sized and 230 were medium-sized. The majority (72%) of injuries of female crabs caught were also classified as regenerated claws or legs. Other injuries of female crabs that were found were shell disease (13%), a hole (or holes) in the shell (7%), a deformed shell (4%), multiple injuries (3%) and 5 female crabs that were caught were dead. In addition to the number female crabs caught with injuries, 464 (11%) females were caught missing one or more legs and 250 (6%) females were missing one or more claws. The incidence of legs or claws missing in catches of male crabs ranged between 8% and 12% for missing leg(s) and 3% and 11% for missing claw(s) between sampling trips. The incidence of legs or claws missing in catches of female crabs ranged between 7% and 16% for missing leg(s) and 5% and 10% for missing claw(s) between sampling trips.

The highest incidence of injuries observed in catches was in Iceberg Bay for both male and female crabs between 8 June and 25 July 2000 (Figure 26). The incidence of injuries observed in Iceberg Bay catches ranged between 5% and 20% for male crabs and 5% and 12% for female crabs. The incidence of injuries observed in Kincolith and Ripple catches ranged between 5% and 11% for male crabs and 3% and 10% for female crabs. Male crabs were observed to have higher incidences of injuries than female crabs in all three areas except for

early June in Kincolith and late August in Ripple and Iceberg Bay where higher incidences of injuries for female crabs were observed (Figure 26).

2001-2002 sampling trips:

A total of 504 (6%) Dungeness male crabs were caught during sampling in 2001 and 2002 with an injury classification; 196 were legal-sized and 308 were medium sized. The majority (76%) of injuries of male crabs caught were classified as regenerated claws, legs or both. Other injuries of male crabs that were found were a hole (or holes) in the shell (13%), a deformed shell (6%), multiple injuries (3%), and a torn abdomen (1%). In addition to the number of male crabs caught during sampling with an injury classification, 718 (9%) males were caught missing one or more legs and 372 (5%) males were caught missing one or more claws. Of the female Dungeness crabs caught during sampling in 2001 and 2002, 264 (6%) were caught with an injury classification, 24 were large-sized and 240 were medium-sized. The majority (74%) of injuries of female crabs caught were also classified as regenerated claws, legs or both. Other injuries of female crabs that were found were a hole (or holes) in the shell (9%), a deformed shell (6%), multiple injuries (3%) and shell disease (1%). In addition to the number female crabs caught with injuries, 302 (7%) females were caught missing one or more legs and 177 (4%) females were missing one or more claws. The incidence of legs or claws missing in catches of male crabs ranged between 8% and 13% for missing leg(s) and 4% and 6% for missing claw(s). The incidence of legs or claws missing in catches of female crabs ranged between 6% and 12% for missing leg(s) and 4% and 9% for missing claw(s).

The highest incidence of injuries observed were in catches from Iceberg Bay for both male and female crabs that were caught between 10 April 2001 and 19 April 2002 (Figure 27). The incidence of injuries observed in Iceberg Bay catches ranged between 5% and 13% for male crabs and 6% and 13% for female crabs. The incidence of injuries observed in Kincolith and Ripple catches ranged between <2% and 8% for male crabs and 2% and 10% for female crabs. Female crabs were observed to have higher incidences of injuries than male crabs in Iceberg Bay except for October 2001 and April 2002 (Figure 27). A similar incidence of injuries for male and female crabs caught in Kincolith and Ripple Tongue areas was observed.

3.4 Tagging

Tagging results are presented in Table 14 (blue Floy tags applied in 2000), Table 15 (ultrasonic tags applied in 2000) and Table 16 (green Floy tags applied in 2001).

3.4.1 Anchor Tagging

A total of 5,976 male Dungeness crabs were anchor-tagged between 8 June 2000 and 29 August 2001. Of the total tagged, 2,976 were applied in 2000, between 8 June and 26 September, with most (44%) of the tags applied in late August (Table 14). Of the total tagged in 2000, fewer tags (518) were applied in Iceberg Bay than Kincolith (1178) and Ripple (1280) due to lower numbers of legal- and medium-sized male crabs caught for tagging. Most (81%) of the tags applied in 2000 were legal size. In 2001, 3,000 tags were applied between 9 May and 29 August with peak tagging (85%) occurring in May (Table 16). Equal numbers of tags were

applied in the three study areas in 2001. Of the total male crabs tagged in 2001, 54% (1605) were legal size and 45% (1394) were medium size. One male crab that was less than 127 mm NW was tagged in Kincolith. In addition, 88 crabs tagged in 2001 were previously tagged in 2000 (86 had a blue tag and 2 had a tag hole but no tag). The two crabs missing tags were caught in May (before 2001 tagging), were medium size and may have had their tags removed during the commercial fishery in 2000 (i.e., released due to not being legal size but tag retained).

3.4.2 Ultrasonic Tagging

Of the anchor tags applied to male Dungeness crabs in August 2000, 30 were also tagged with an ultrasonic tag to assess individual movement of tagged crabs between the three strata and within the standard trap-set areas (Table 15). Of the total tagged, 10 were applied in Kincolith, 13 were applied in Ripple and 7 were applied in Iceberg Bay between 23 and 28 August. Of the Ripple tags, 3 were applied east of Jacques Pt at Nass Hr and 10 were applied north of Double Islet Point. Of the 30 tagged, 24 were legal-sized and 6 were medium-sized. Individual tagging records and release locations are provided in Table E - 1. Ultrasonic-tagged crabs were tagged between 3 and 8 minutes and held between 6 and 12 hours for hardening of the marine epoxy.

3.5 Ultrasonic Tracking

A total of 35 ultrasonic-tracking surveys were conducted in the Nass Estuary between 23 September and 28 November 2000 to locate ultrasonic-tagged Dungeness crabs (Table E - 2). Information regarding ultrasonic-tagged crabs that were tracked is provided in Table E - 3 and shown in Figure 28, Figure 29 and Figure 30 for September, October and November tracks, respectively. Limited results were obtained from the ultrasonic tagged crabs due to tracking surveys being opportunistic, limited in scope (i.e., surveys were generally less than 3 hours in duration and ranged between 2 to 6 days in each of the tracking months) and affected by rough weather conditions, especially in November. However, between 5 and 20 ultrasonic-tagged were tracked each month and revealed substantial movements of tagged crabs occurring over 30-d periods. The average distance that tagged crabs moved between their tagging and tracked location in September was 1045 m (S.D.=926 m) with maximums of 1590 m, 1680 m, 2240 m and 3770 m for Kincolith, Iceberg, Jacques Pt, and Ripple tagged crabs, respectively (Figure 28). In October, the distances were even greater, the average distance was 2163 m (S.D.=2451 m) with maximums of 1706 m, 3192 m, 5591 m and 9992 m for Kincolith, Ripple, Iceberg Bay and Jacques Pt tagged crabs, respectively (Figure 29). In November's limited surveys, one ultrasonic-tagged crab was tracked 11 km from its tagging location (Jaques Point), outside of the Nass study area in Observatory Inlet (Figure 30).

In addition to tags tracked, 9 ultrasonic-tagged crabs were caught in the Nisga'a (2, one was released) and commercial (7, two was released) fisheries. One of the ultrasonic-tagged crabs that had been reported as harvested in the commercial fishery with the anchor tag returned was released alive (with the ultrasonic tag) in the ocean at Prince Rupert. This crab was later recovered in December 2000 by a sport fisher. Four ultrasonic-tagged crabs were also captured during sampling activities. Of the 13 ultrasonic-tagged crabs recovered, 5 were tagged in Kincolith, 4 in Ripple and 4 in Iceberg Bay area. The ultrasonic-tag recoveries from Nisga'a, commercial and sampling fisheries are included with all the anchor-tagged recoveries from 2000

(Table 17) and further details of the ultrasonic recoveries and tracking results are presented in Table 18. The ultrasonic tracking results suggested little movement was occurring outside of the Nass Estuary (i.e., movement outside the study area), mixing of tagged crabs was occurring in the study area, and therefore there was no need to modify the tag-application design for the mark-recapture estimation procedure.

3.6 Tag Recovery

Of the 5976 male Dungeness crabs that were anchor-tagged in 2000 and 2001, 1679 (28%) were recovered between 12 June 2000 and 19 April 2002 in sampling (10%), Nisga'a (19%) and commercial (71%) fisheries. Recoveries of 2000 (1185) and 2001 (494) tagged male crabs are shown in Table 17 and Table 19, respectively. Of the total recoveries, 1487 were legal size and 192 were medium size when tagged. Table 20 and Table 21 show recoveries of legal-size tags and Table 22 and Table 23 show recoveries of medium-size tags separately. Distribution of tag recoveries, by release and recapture area are presented in Table 24 and Table 25 for 2000 and 2001 tagged crabs, respectively. Estimates of legal-sized male crabs that were caught in the sampling, Nisga'a and commercial fisheries in 2000 and 2001 are presented in Table 26 and Table 27, respectively. Estimates of tag removals in the sampling, Nisga'a and commercial fisheries for legal-size tag releases are presented in Table 28 and Table 29 for 2000 and 2001, respectively.

3.6.1 Sampling

A total of 170 tagged crabs were recovered during sampling from June 2000 to April 2002. Of the tags that were recovered during sampling, 36%, 14% and 50% were from Kincolith, Ripple and Iceberg Bay tagging areas, respectively. Of the total recovered, 117 were tagged in 2000 and 53 were tagged in 2001 (Table 17 and Table 19). In addition, 119 were legal size and 51 were medium size (Table 20, Table 21, Table 22, and Table 23).

A total of 11 tagged crabs that were recovered during sampling had moulted, 3 legal sized and 8 medium sized (Figure 31 and Figure 32). Evidence of moulting was based on the difference in shell carapace width between tagging and recovery that ranged between a 27 mm and 30 mm growth increment. Of the 11 moulted crabs that were recovered, 5 were from Kincolith, 1 from Ripple and 5 from Iceberg.

A total of 5,502 legal-sized male crabs were caught during sampling in 2000 and 2001 and examined for tags in determining "observed" mark rates used for estimating tag removals in the commercial fishery (Table 28 and Table 29). The incidence of marked crabs within the examined catch in 2000 and 2001 was 2.4% and 1.1%, respectively.

3.6.2 Nisga'a Fishery

A total of 322 tagged crabs were recovered in Nisga'a fisheries from June 2000 to April 2002. Of the tags that were recovered during Nisga'a fisheries, 69%, 23% and 8% were from Kincolith, Ripple and Iceberg Bay tagging areas, respectively. Of the total recovered, 254 were

tagged in 2000 and 68 were tagged in 2001 (Table 17 and Table 19). In addition, 278 were legal size and 44 were medium size (Table 20, Table 21, Table 22, and Table 23).

A minimum estimate of 6,958 legal-sized male crabs were caught in Nisga'a fisheries in 2000 and 2001 with the majority (95%) of the catch estimated to have come from the Kincolith area (Bocking et al. 2002; Baxter and Stephens 2002; Table 26 and Table 27). Of the Nisga'a crab catch in 2000, 181 tags from legal-sized, male crabs were returned; incidence of marked crabs to catch was 5.5% (Table 28). Of the Nisga'a crab catch in 2001, 51 tags from legal-sized, male crabs were returned; incidence of marked crabs to catch was 1.4% (Table 29). We estimated the participation rate of returning tags from the Nisga'a fishery to be 100% based on a higher or similar mark rate (5.5% vs. 2.8% in 2000, 1.4% vs. 1.6% in 2001) observed in the Nisga'a catch than in the observed monitored catches (patrol and sampling).

3.6.3 Commercial Fishery

A total of 1187 tagged crabs were recovered during commercial fisheries in 2000 and 2001. Of the tags that were recovered during the fisheries, 24%, 47% and 29% were from Kincolith, Ripple and Iceberg Bay tagging areas, respectively. Of the total recovered, 814 were tagged in 2000 and 373 were tagged in 2001 (Table 17 and Table 19). In addition, 1090 were legal size and 97 were medium size (Table 20, Table 21, Table 22, and Table 23).

An estimated total of 35,615 legal-sized male crabs were caught during the commercial fishery in 2000 with 67% and 33% of the catch being reported from Areas 3-12 (Ripple) and 3-18 (Iceberg Bay), respectively (Table 26). A total of 10 commercial fishing vessels reported catch from the Nass Estuary in 2000. Of the total commercial catch, 1211 legal-sized crabs were observed from five of the ten commercial fishing vessels during patrol monitoring in October 2000. Of the observed catch, 47 legal-sized, tagged crabs were recovered for an overall mark rate of 3.9% (S.D.=0.6%, range between vessels was 3.4% and 4.6%). A total of 665 tags from legal-sized male crabs were returned from non-monitored commercial catches and represented a mark rate of 1.9% (Table 28). We estimated the participation rate of legal-size tags returned from the commercial fishery in 2000 to be 70.6% based on the proportion of actual tags returned to the estimate of removed (i.e., 712 tags returned and 1009 tags estimated to have been removed, Table 28). The estimate of tags removed in 2000 was calculated by expanding the commercial catch by the observed mark rate in monitored catches (2.833%).

An estimated total of 40,885 legal-sized male crabs were caught during the commercial fishery in 2001 with 57% and 43% of the catch being reported from Areas 3-12 (Ripple) and 3-18 (Iceberg Bay), respectively (Table 27). A total of 12 commercial fishing vessels reported catch from the Nass Estuary in 2001. Of the total commercial catch, 3108 legal-sized crabs were observed from eleven of the twelve commercial fishing vessels during patrol monitoring in October 2001. Of the observed catch, 62 legal-sized, tagged crabs were recovered for an overall mark rate of 2.0% (S.D.=1.4%, range between vessels reporting more than one tag was 1.1% and 5.6%). A total of 291 tags from legal-sized male crabs were returned from non-monitored commercial catches and represented a mark rate of 0.8% (Table 29). We estimated the participation rate of legal-size tags returned from the commercial fishery in 2001 to be 54.3% based on the proportion of actual tags returned to the estimate of removed (i.e., 353 tags returned

and 650 tags estimated to have been removed, Table 29). The estimate of tags removed was calculated by expanding the commercial catch by the observed mark rate in monitored catches (1.589%).

3.7 Population and Exploitation Estimates

A range of population estimates was calculated for legal-sized male Dungeness crabs in the Nass Estuary in 2000 and 2001, assuming a range of annual instantaneous rates of natural mortality (NMR, between 1.0 and 2.0) based on the overall survivorship information from tags recovered (Table 30 and Table 31) and removal of tags in the Nisga'a and commercial fisheries (Table 20 and Table 21). We estimated the overall annual instantaneous rate of mortality of tagged, legal-sized male crabs using a procedure from Smith and Jamieson (1989) and based on the relationships observed in Figure 33 and Figure 34. These relationships suggested that the rate of mortality (or disappearance) of tagged legal-sized male crabs increased with time-at-large. These rates would account for tag loss, movement from the study area, tagging-induced mortality, natural mortality, fishery removals and a lack of participation in reporting tagged crabs. However, as pointed out by Hankin and Butler (1992), this procedure of calculating Z (i.e., from the extrapolation of the slope in Figure 33 and Figure 34) would produce a positive bias since tags were recovered before, during and after the commercial fishing season and thus the fishing effort and natural mortality rates would not remain constant over the recovery period. However, we use the value of Z as an index only in selecting a "suitable" range of natural mortality rates (see DISCUSSION).

3.7.1 2000 Estimates

We estimated the overall annual instantaneous rate of mortality of tagged, legal-sized male crabs as 3.41 (Z, Table 30) based on the relationship observed in Figure 33. A less defined relationship is observed for medium-sized, tagged male crabs as shown in Figure 33. It suggests that the rate of medium-sized male crabs also increased with time-at-large due to mortality, removals, tag loss, movement from the study area and moulting into legal size. However, we chose not to generate any estimates of mortality rates or population size for medium-size crabs due to a lack of information on medium-size catches, harvest or mortality rates, and the potential of medium-size crabs to escape traps during sampling. A range of population estimates for legal-size male crabs in 2000 is presented in Table 32 using a proportion of the value of Z as natural mortality (1.0, 1.5 and 2.0) and accounting for an estimate of the proportion of tags from medium-sized crabs that would have recruited to legal size from moulting. For male crabs that were tagged in 2000, we used a moulting rate of 13.8% for medium-size, tagged crabs based on 4 tag recoveries that had moulted from 29 that were recovered during sampling (Figure 31).

The legal-sized male Dungeness crab population estimate for 2000 ranged from 67,790 (NMR=2.0) to 72,520 (NMR=1.0; Table 32). The 95% confidence intervals ranged between 67,744 and 75,841. Estimates of legal-sized male crabs in the closed (Kincolith) and open (Ripple/Iceberg) areas to commercial fishing ranged between 14,630 and 15,492, and 53,160 and 57,028, respectively. Posterior distributions of estimates in 2000 are shown in Figure F - 1, Figure F - 2 and Figure F - 3 for NMR values of 1.0, 1.5 and 2.0, respectively.

The range of exploitation rates for legal-sized male Dungeness crabs in the Nass Estuary in 2000 was estimated between 54.6% (NMR=1.0) and 58.4% (NMR=2.0; Table 34). The ranges of the estimated exploitation rates in the closed and open areas were 24.4% to 25.9% and 59.1% to 63.5%, respectively (Table 34).

3.7.2 2001 Estimates

We estimated the overall annual instantaneous rate of mortality of tagged, legal-sized male crabs in 2001 as 3.84 (Z, Table 31) based on the relationship observed in Figure 34. The mortality rate of medium-sized, tagged male crabs is also shown for comparison in Figure 34. A range of population estimates for 2001 is presented in Table 33 using a proportion of the value of Z as natural mortality (1.0, 1.5 and 2.0) and accounting for an estimate of the proportion of tags from medium-sized crabs that would have recruited to legal size from moulting. For male crabs that were tagged in 2001, we used a moulting rate of 18.2% for medium-sized tagged crabs based on 4 tag recoveries that had moulted from 22 that were recovered during sampling (Figure 32).

The legal-sized male Dungeness crab population estimate for 2001 ranged from 93,666 (NMR=2.0) to 104,225 (NMR=1.0; Table 33). The 95% confidence intervals ranged between 84,266 and 114,634. Estimates of the legal-sized male crabs in the closed (Kincolith) and open (Ripple/Iceberg) areas to commercial fishing ranged between 36,713 and 39,949, and 56,953 and 64,276, respectively. Posterior distributions of estimates in 2001 are shown in Figure F - 4, Figure F - 5 and Figure F - 6 for NMR values of 1.0, 1.5 and 2.0, respectively.

The range of exploitation rates for legal-sized male Dungeness crabs in the Nass Estuary in 2001 was estimated between 43.9% (NMR=1.0) and 48.8% (NMR=2.0). The ranges of the estimated exploitation rates in the closed and open areas were 11.5% to 12.5% and 64.0% to 72.2%, respectively (Table 35).

4.0 DISCUSSION

4.1 Abundance Estimates

The two primary goals of this study were: 1) to determine the effect of the removal of crabs from the commercial fishery on the availability of crabs to Nisga'a fishers; and 2) evaluate the current crab management strategy of a short commercial fishery (occurring between 1 October and 15 November) combined with a closed commercial fishing area on the abundance and relative health (i.e., shell hardness and injury incidence) of the Dungeness crab population in the Nass Estuary. The fact that Dungeness crabs are not limited to the Nass Estuary presents substantial challenges to producing estimates of abundance. We have attempted to provide a benchmark of the population size of legal-sized male Dungeness by mark-recapture methodology for 2000 and 2001. In comparison of the mark-recapture results, we used a catch-per-effort analysis to index changes of abundance in standard areas over time.

4.1.1 Mark-recapture Estimate

Using mark recapture techniques, our best estimate of the legal-sized male Dungeness crab population in the Nass Estuary was 70,092 [CI=66,912, 73,272] and 98,701 [CI=88,816, 108,586] for 2000 and 2001, respectively, (Table 32, Table 33, Table 34, Table 35, and Figure 35). Biases in mark-recapture estimates can occur when the principal assumptions of the estimation procedure are violated (p. 81-82, Ricker 1975; Seber 1982). The relevant assumptions and how our study attempted to meet and/or test their validity are outlined below.

1) *The marked crabs suffer the same natural and fishing mortality as the unmarked crabs.*

Knowledge of natural mortality, survival and exploitation rates for adult crab is generally poor. Much variation in natural mortality rates (M) have been reported from limited tagging or catch-per-effort studies; 0.15 (Jow 1965), 0.22 (Botsford and Wickham 1978), 0.15-0.45 (PFMC 1979), 0.88-2.50 (Gotshall 1978) and 2.3-2.8 (Smith and Jamieson 1991). Butler and Hankin (1992) concluded, after a review of mortality rates of Dungeness crabs in BC, that natural mortality rates for male Dungeness crabs may lie in a range between 0.8 and 1.2, although lower values also were plausible. A variable range of fishing mortality (F) has also been reported; 7.9 (Jow 1965), 1.2-7.0 (Gotshall 1978), 0.8-3.2 (Methot and Botsford 1982), and 5.1-6.9 (Smith and Jamieson 1989). In this study, the relatively protracted time-at-large for the legal-sized, tagged recoveries in 2000 and 2001 indicated a moderate-to-low exploitation rate compared to other Pacific crab fisheries. Based on this information, we accounted for natural mortality, tagging-induced mortality and movement from the study area by allocating a portion of the estimated annual instantaneous rate of mortality (or disappearance) of legal-sized tagged male crabs observed in this study (Z=3.41 (2000; Table 30); Z=3.84 (2001; Table 31)). We chose 1.5 (NMF) for consistency in both years for generating our best estimate of the legal-size male Dungeness crab population in the Nass Estuary. Tag recoveries in fisheries and relative return (participation) rates were accounted separately with the history of catch and recoveries over time.

Tag loss and tagging-induced mortality are expected to be small in this study; low incidence of tag loss was detected (see below) and Smith and Jamieson (1989) found no differential mortality of tagged and untagged crabs held in a tank for several months. However, the number of tagged crab that moved from the study area and natural mortality may be significant factors in the disappearance of tagged, legal-sized crabs but are difficult to quantify. A low percentage (<1%; 3 of 5976) of tagged crabs were detected outside the study area from results of the tag-recovery program and ultrasonic tracking. There was no evidence that disease was a significant factor as only 34 of 12,164 (0.3%) male crabs that were caught had some form of disease (shell disease or deformed shell) that was visually evident. Predation may be a factor but only one giant Pacific octopus, a known predator of Dungeness crabs (High 1976), was caught during sampling in both years. Thus, we believe that the 1.5 NMF is a reasonable estimate of the annual losses of tagged crab to mortality (natural and tagging-induced) and movement from the study area, and in fact may be a very conservative estimate with respect to generating the population estimates. The difference in the population estimate of legal-sized male crabs would be approximately 3% greater and 3% lesser using a 1.0 NMF and 2.0 NMF,

respectively. The population estimates are insensitive to mortality because both marked and unmarked crabs are subject to the mortality assumptions.

2) *All crabs in a stratum (time period and site partition), whether marked or unmarked, have the same probability of being caught.*

The distribution of tag recoveries, by release and recapture area, for legal- and medium-sized male Dungeness crabs suggested that adequate mixing of tagged and untagged crabs was occurring in all three study locations in the Nass Estuary (Table 24 and Table 25). Similar types of traps were used for capturing Dungeness crabs in all tag-recovery fisheries (i.e., sampling, commercial and Nisga'a). One exception being that commercial traps had to be equipped with 110 mm escape holes. Escape holes would allow medium-sized crab to escape but would not be selective for marked or unmarked legal-sized individuals. Thus the vulnerability of tagged and untagged crab to be captured in any area or period was assumed to be the same.

3) *Crabs do not lose their marks over the period of the study.*

A high incidence of tag loss will cause mark-recapture calculations to overestimate the population. The only form of tag loss that could substantially effect our estimates of the legal-sized male Dungeness crab population would be the loss of tags in legal-sized tagged crabs through dropping out after tagging or the tag was not retained after moulting. The sampling results from this study suggest that the loss of the tag after tagging is minimal; six tagged crabs (two legal and four medium sized) were caught missing their tag but retaining the hole in their shell. The medium crabs caught missing their tags are thought to have been released without their tag after being caught in the commercial fishery. Tag loss from moulting is also thought to be low as male crabs were tagged with a "new" hard shell (i.e., post-moult) and the incidence of moulting in this study was observed to be relatively low; 2.5% (3 of 119 recoveries) for legal-sized male crabs and 16% (8 of 51 recoveries) for medium-sized male crabs. Smith and Jamieson (1989) found high tag retention rates for male Dungeness crabs that were recovered as not moulted (97%; n=126) or moulted (99%; n=130). A moulting probability factor was used in the mark-recapture model to account for moulting of medium-sized, tagged male crabs that would become legal sized.

4) *The population in the study area does not change over the period of the experiment.*

The population size of legal-sized male Dungeness crabs that were estimated in this study are for the period just before tagging commenced in 2000 (June) and 2001 (May). Since mortality, migration to and from the study site and recruitment of medium sized males to legal size, all parameters that would effect the legal-size population over time, were accounted for independently in the mark-recapture model, our estimate of the population of legal-sized male crabs is assumed to be constant over the period of the study.

5) *All marks are reported when crabs are recaptured.*

Samplers examined each crab carefully for the presence of a tag (or hole) so missing marks during sampling was unlikely. The tag reward program was well publicized to the

commercial fishery and the Nisga'a fishers. The catch monitor in Kincolith was very active in obtaining information regarding the harvest of crabs and any tags that were recovered in the Nisga'a fishery. Patrol monitoring of the commercial fishery in 2000 and 2001 observed a sub-sample of the catch and closely examined for any tagged crabs that were caught. However, we are aware of two vessels in 2000 who reported catch of Dungeness crab in the Nass Estuary but did not return any tags that were caught. Also, the ability of fishers to detect and recover tags during commercial operations was not tested directly (i.e., commercial landings were not examined for tags missed by the fishers). As a result, we corrected our population estimates by estimating the participation rate of the commercial fishers to return tags that were recovered for each year. The participation rate was estimated by expanding the total catch by the observed tag rate in the monitored catches. The participation rates of the commercial fishery to return tags was estimated at 70.6% and 54.3% for 2000 and 2001, respectively. A higher participation rate in 2000 was probably due to a higher profile of the study in the first tagging year. The participation rates presented in this study are reasonable when compared to other tagging studies. Smith and Jamieson (1989) tagged 3589 legal size male Dungeness crabs, intensively monitored the commercial fishery in Tofino and estimated a 87% compliance of tags being returned by commercial fishers.

We have corrected for all known factors that may introduce bias into the population estimates. However, estimation of the posterior distribution is conditional on (i.e., assumed known without error) these factors which are as follows: natural mortality, rate of tag loss, non-participation rate of tags returned and moulting rate. In other words, while we have corrected for perceived bias, the quoted confidence intervals are unrealistically compressed.

4.1.2 Catch per Effort

The commercial fishery was found not to have a significant effect on the availability of legal-sized crabs in the Kincolith area based on the catch information collected between 2000 and 2002 (log linear model, $F=0.06$, $p=0.81$). The estimated average effect of the commercial fishery on availability of crab in the Kincolith area was 0.92 (exp (-0.07)) times the number of crab in the closed area versus the open area (CI=0.51, 1.69). A significant reduction in mean CPE of legal-sized male Dungeness crabs was observed in Kincolith between the September and October sampling periods in 2000 (5.7 vs. 3.6) but the mean CPE in October was not significantly different than the June 2000 or late May 2001 periods (Table C - 1). Lower mean CPE were observed in Kincolith when sampling occurred twice in the same month (i.e., June 2000 and May 2001 sampling trips), however, when those trips were removed from the analysis no significant difference was observed ($F=3.09$, $p=0.139$). Possible explanations of the decrease in abundance observed in Kincolith between the September and October period in 2000 may have been related to harvesting by Nisga'a fishers (26% of the Nisga'a harvest occurred between September and October versus 12% in 2001), migration out of Kincolith or outside the sampling range. A decrease in mean CPE between the September and October sampling periods was also observed in Kincolith in 2001 but the difference was not significant. Substantial movement within the Kincolith stratum may be occurring between August and October time periods due to salmon spawning periods in the Kincolith River. Chinook (*Oncorhynchus tshawytscha*) and pink (*O. gorbuscha*) salmon migrate, spawn and carcasses wash out of the Kincolith River into the Nass Estuary in late summer and early fall. However, movements of Dungeness crabs as a result

of carcasses in the estuary have not been documented and would not be detected in this study due to the distance between the sampling sites and the mouth of the Kincolith River. The availability of additional food sources may reduce foraging by crabs or cause other changes to feeding behaviour (e.g., crabs are satiated) that make the sample traps less effective.

The Kincolith area was found to have more legal-sized male crabs than either Ripple or Iceberg areas (log linear model, $F=10.98$, $p=0.002$; ANOVA, $F=35.6$, $p<0.001$; Table C - 1). The estimated average effect of the Kincolith area versus Ripple and Iceberg areas was that Kincolith had 2.26 (exp (0.81)) times the number of legal-size crabs than the other locations (CI=1.37, 3.60). Medium-sized male Dungeness crabs were found in higher abundance in Iceberg Bay, followed by Kincolith and Ripple (ANOVA, $F=42.1$, $p<0.001$; Kruskal-Wallis, $F=38.9$, $p<0.001$; Table C - 1). Medium-sized crabs were also found to be in higher abundance in 2001 than 2000 (ANOVA, $p<0.001$). Large-sized female Dungeness crabs were found to be more abundant in Kincolith than Ripple or Iceberg (ANOVA, $F=32.1$, $p<0.001$; Kruskal-Wallis, $F=27.8$, $p<0.001$). Medium-sized females were also found to be more abundant in Kincolith, followed by Ripple and Iceberg (ANOVA, $F=132.9$, $p=0.001$; Kruskal-Wallis, $F=142.3$, $p=0.001$). Relative abundances of medium and small-sized crab are not accurately reflected by CPE in this study as the traps that were used could not adequately sample the smaller sized portions of the population. Although the escape ports were wired closed and the trap mesh was less than 8 cm across the largest opening, the triggers in the tunnel entrances were spaced such that the maximum distance diagonally across an opening was approximately 105 mm. This spacing would allow undersized crab to escape from the traps.

Male Dungeness crabs were caught in higher abundance at shallow depths (<20 m; ANOVA, $p=0.001$, Table C - 3) compared to females which were caught at deeper depths (>40 m; ANOVA, $p<0.001$, Table C - 3).

In summary, the mean (and median) CPE data collected in this study provided relative indices of abundance in each of the sampling areas over time. However, with the exception of Iceberg Bay, no significant increase in mean CPE of legal-sized male Dungeness crab was detected between 2000 and 2001 sampling periods in either the Kincolith or Ripple areas. Sampling results from Iceberg in September 2000 and 2001 showed an increase in mean CPE of legal-sized males of 48% (i.e., 2.9 ± 2.3 S.D.vs. 4.3 ± 2.2 S.D.). Results from the mark-recapture portion of this study suggested an increase in the population size of legal-sized males of 154% in Kincolith, 10% in Ripple and Iceberg combined, and 41% in the entire Nass Estuary between 2000 and 2001. Although the mean CPE did not increase between years in Kincolith and Ripple, the difference between September and October sampling periods in 2001 for all areas was much less than the same periods in 2000 (i.e., Kincolith (9% vs. 37%), Ripple (47% vs. 74%) and Iceberg (53% vs. 83%)). These results suggest a much larger population of legal-sized males in 2001 than 2000, after the start of the commercial fishery.

4.2 Harvest Rates

The harvest and mark-recapture data collected in this study were used to estimate the exploitation rates of legal-sized male Dungeness crabs in the Nass Estuary in 2000 and 2001 (Table 34 and Table 35). The harvest of legal-sized males in the commercial fishery was

estimated to account for 50.8% and 41.4% of the total population in 2000 and 2001, respectively. The harvest of legal-size males in the Nisga'a fishery was estimated to account for 5.7% and 4.9% of the total population in 2000 and 2001, respectively. Sport harvest in the Nass Estuary was negligible. Combined, this study estimated a 56.5% and 46.3% exploitation rate of legal-size male Dungeness crabs in 2000 and 2001, respectively. The Kincolith area was found to have a much lower exploitation rate than Ripple and Iceberg Bay in both years (25% in 2000 vs. 65%; 12% in 2001 vs. 68%).

Although this study found a decrease in the commercial harvest rate of legal-sized males in Ripple and Iceberg between 2000 and 2001, the removals of legal-sized crabs by the commercial fishery were relatively constant from 1997 to 2001. Approximately 30 tonnes of legal-size male crabs were harvested each year by 9 to 12 commercial boats. Harvests were much greater in 1996 and 2002 when 9 and 8 commercial vessels respectively caught over 80 tonnes of crab from the Nass Estuary (Figure 36). Catches in the commercial fishery follow a typical pattern of initial high catches followed by a steady decline. Vessels tend to leave as catches decline toward the end of October. Few vessels (1 or 2) remain at the end of the opening, 15 November. These results indicate that Ripple and Iceberg areas were saturated with fishing effort prior to the end of the six week fishing opportunity. It also suggests that a portion of the population was not available to the fishery despite intense fishing pressure. It's probable that this is a function of the short duration of the fishery. Additional evidence of legal-sized crabs escaping the commercial fishery was the percentage of crabs caught greater than 184 mm NW in each of the years (Butler 1961). Totals of 4.3% (123 of 2883) and 2.6% (88 of 2171) of the legal-size male crabs caught in the commercial-open area in 2000 and 2001, respectively, were greater than 184 mm NW.

The commercial fishery did not realise a significantly larger catch in 2001 than 2000 (Figure 36). Anecdotal information from commercial operators indicated a higher incidence of soft-shelled legal-sized crab in the 2001 fishery than previous years. Although the population increase was evident in the commercial fishery it was not ready for harvest. A much greater catch of 83 tonnes was realised in 2002. These observations along with higher incidences of undersized crab in 2001 provided evidence of the increased population that supported the large harvests in 2002. They also suggest that large harvestable surpluses might be forecasted up to a year in advance if proven necessary.

Annual exploitation rates of legal sized male Dungeness crab often exceed 90% in North American fisheries (Hankin et al. 1997). By comparison the exploitation rates observed in the Nass estuary were low-to-moderate in 2000 and 2001. Future changes in the fishery may become evident as a result of increased access to the Nass valley by a new road completed in 2003. Changes to exploitation rates are possible with the advent of new gear and increased access.

4.3 Recruitment

Based on mean CPE data, medium-sized male Dungeness crabs were caught in higher abundance in 2001 than 2000 (Table C - 1). Although sample sizes were small, the mark-recapture data suggested that medium-size tagged males had a higher incidence of moulting than

the legal-sized tagged male crabs (15.7% (4 of 51) vs. 2.5% (3 of 119)). Incidence of moulting was found to be higher in 2001 than 2000 for both medium- and legal-sized tagged crabs (18.2% vs. 13.8% for medium; 6.5% vs. 1.1% for legal). This difference in moulting pattern between legal and medium-sized male crabs was also observed in shell hardness classifications of sampled catches where different proportions of moulting occurred between size classes in both years (Table D - 1 and Table D - 2). Of the total legal-size males that were graded for shell hardness, 5.2% (150 of 2881) and 26.7% (921 of 3460) were classified as moulted in 2000 and 2001, respectively. Of the total medium-size males that were graded for shell hardness, 27.9% (353 of 1264) and 27.2% (1097 of 4032) were classified as moulted in 2000 and 2001, respectively.

The results of shell hardness grading were not used in the population model due to potential inconsistencies in determining shell hardness. A Durometer was not used to quantify shell hardness measurements. The shell hardness results do suggest that moulting (and recruitment) of medium- and legal-sized male crabs was occurring every month with defined peaks in April and May. The lowest incidence period of moulting (and recruitment) was detected in late September or early October in 2000 and 2001, except in Iceberg Bay in 2001 where the lowest incidence of moulting occurred in August.

This study found that Iceberg Bay and Kincolith area had higher abundances of small and medium-sized male crabs than the Ripple area. This suggests utilisation of different habitats within the Nass Estuary by different size classes may play an important role in the recruitment of medium-sized males to legal-size each year (Table C - 1). Recruitment of small-sized crabs to medium-sized crabs cannot be directly assessed in this study due to the limitations of the traps that were used (i.e., small and medium-sized crabs could escape the traps).

4.4 Biological Sampling

The sampling program collected biological data pertaining to shell hardness, injuries and embrace marks or eggs of Dungeness crabs in the Nass Estuary. These data support the management strategy for Dungeness crabs with respect to the timing of fisheries. Current management of the Nass Estuary crab resource includes measures designed to reduce mortalities associated with the capture of soft-shelled crabs. This study found higher incidences of hard-shelled males in late September or October and suggests that the commercial fishery is occurring at the lowest period of soft-shelled male crabs. However, the fishery occurs at or near the highest period of soft-shell female crabs, probably just after the period of the highest incidence of mating.

With the exception of Dungeness crabs caught in Iceberg between June and July 2000, between 5% and 10% of the crabs that were caught were classified as having an injury. These injuries were typically missing or regenerated legs or claws. Higher incidences of injuries were reported in Iceberg in both years. Many crab injuries are probably the result of handling in fisheries.

Embrace marks were more evident in legal-sized males than medium-sized males and occurred in higher incidence in October (2000) and August (2001). The presence of marks

provides evidence of a pre-mating embrace but does not necessarily indicate mating success. Hankin et al. (1997) found that virtually all mature females mate regardless of female size or fishing intensity on legal-sized males. The pre-mating embrace occurs prior to the female moulting and copulation takes place between the hard-shelled male and the newly moulted female (Butler 1960). Soft-shelled female Dungeness crabs were caught in highest abundance between September and October 2000 which corresponded with highest incidences of embrace marks that were observed in 2000 (Figure 24 and Table D - 3). In 2001, soft-shelled female crabs were caught in highest abundance between August and September which corresponded with the highest incidences of embrace marks (Figure 25 and Table D - 4). Female Dungeness crabs were typically found at deeper depths than males but were found in higher abundance at the shallow depth stratum in September 2000 and August 2001 (Figure 12 and Figure 13). This suggests the peak period for mating is in late summer and that a vertical migration by females occurs in preparation for breeding.

5.0 CONCLUSIONS AND RECOMMENDATIONS

We conclude, based on 2000 and 2001 results:

1. The existing commercial fishery did not have a significant negative effect on the availability of crab for the Nisga'a fishery.
2. The current management regime of a short commercial fishery late in the year combined with the area closed to commercial fishing maintained the availability of crab for Nisga'a and sport harvest by resulting in low to moderate exploitation rates on Dungeness crab.
3. Soft-shelled periods occurred in spring and early summer. Timing of the commercial fishery from 1 October to 15 November was ideal for maximizing hard-shelled catch and reducing soft-shelled injuries.
4. The Dungeness crab population in the Nass Estuary is healthy and productive.

We recommend:

1. Retaining the closed 0.5-mile boundary in the Kincolith stratum. This boundary protects Dungeness crabs in the Nass Estuary from higher exploitation and handling rates and sustains the availability of legal-sized male crabs to Nisga'a Fishers while providing commercial opportunities in the open areas.
2. Retaining the 6-week commercial fishery at the current time period, 1 October to 15 November. The short duration of the fishery contributes to the lower exploitation rate. This study found the highest percentage of hard-shelled males present during this time period and although the incidence of soft-shelled females may be high in some years it likely represents the best balance between production and handling mortalities.
3. Improving catch monitoring in crab fisheries. This analysis suffers from incomplete harvest data for commercial and Nisga'a fisheries. Sport catch data will become important to future assessments of the Nass estuary.
4. Defining a schedule of regular assessments to ensure that the crab fishery in the Nass estuary remains sustainable. This vigilance will assure that exploitation rates don't become excessive if productivity declines or fisheries change (increase).

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TABLES

Table 1. Commercial catches of Dungeness crab from the Nass Estuary, 1990-2002.

Year	Period	Commercial catch (tonnes) [1]			No. of boats	
		Area B	Nass area	% Nass	Area B	Nass area
1990	1-30 September (30 d)	275.2	7.6	2.7%	83	4
1991	1 October to 30 December (90 d)	434.8	19.0	4.4%	38	5
1992	1 October to 30 December (90 d)	418.5	30.3	7.2%	40	6
1993	1 October to 31 December (91 d)	282.2	42.8	15.2%	38	10
1994	1-25 Oct., 8 Nov. to 31 Dec. (78 d)	354.8	28.1	7.9%	35	12
1995	1 October to 31 December (91 d)	474.1	51.0	10.7%	35	9
1996	1 October to 31 December (91 d)	405.5	84.3	20.8%	28	9
1997	1 October to 15 November (46 d)	225.6	34.6	15.3%	20	12
1998	1 October to 15 November (46 d)	170.6	31.1	18.2%	20	9
1999	1 October to 15 November (46 d)	165.4	33.6	20.3%	21	9
2000	1 October to 15 November (46 d)	185.3	28.7	15.5%	19	10
2001	1 October to 15 November (46 d)	181.3	32.9	18.1%	19	12
2002	1 October to 15 November (46 d)	225.6	82.7	36.6%	19	8
Average						
1990-2002		292.2	39.0	13.3%		8.5
5 year average:						
1998-2002 average		185.6	41.8	22.5%		9.6

[1] Sources: DFO unpublished; Winther and Phillips 2002.

Table 2. Number of trap sets, hauls and effort (in hrs) to catch Dungeness crab in the Nass Estuary during sampling periods, 8 June to 29 November 2000.

Trip no.	Period of trap hauls	Kincolith			Ripple Tongue			Iceberg Bay			Total		
		No. trap sets [a]	No. trap hauls	Avg. soak hrs	No. trap sets [a]	No. trap hauls	Avg. soak hrs	No. trap sets [a]	No. trap hauls	Avg. soak hrs	No. trap sets [a]	No. trap hauls	Avg. soak hrs
Standard Locations of Trap Hauls													
1	8-11 June	6	40	20	3	20	23	3	20	25	12	80	23
2	30 June to 2 July	5	40	20				4	35	22	9	75	21
3	23-25 July	3	20	24	6	40	21	3	20	25	12	80	23
4	23-28 August	9	70	23	16	110	22	6	40	21	31	220	22
5	23-26 Sep	8	60	23	3	20	25	6	40	30	17	120	26
6	27-31 October	4	30	25	4	30	24	4	30	24	12	90	24
7	28-29 November	4	30	25							4	30	25
	sub-total	39	290	23	32	220	22	26	185	25	97	695	23
Non-standard Locations of Trap Hauls													
1	8-11 June												
2	30 June to 2 July				5	40	21	1	5	23	6	45	22
3	23-25 July	3	19	20	3	20	23				6	39	22
4	23-28 August												
5	23-26 Sep												
6	27-31 October				2	20	20				2	20	20
7	28-29 November												
	sub-total	3	19	20	10	80	21	1	5	23	14	104	21
Total Trap Hauls													
1	8-11 June	6	40	20	3	20	23	3	20	25	12	80	22
2	30 June to 2 July	5	40	20	5	40	21	5	40	22	15	120	21
3	23-25 July	6	39	22	9	60	22	3	20	25	18	119	23
4	23-28 August	9	70	23	16	110	22	6	40	21	31	220	22
5	23-26 Sep	8	60	23	3	20	25	6	40	30	17	120	26
6	27-31 October	4	30	25	6	50	23	4	30	24	14	110	24
7	28-29 November	4	30	25							4	30	25
Total (2000)		**42**	**309**	**23**	**42**	**300**	**22**	**27**	**190**	**25**	**111**	**799**	**23**

[a] A set consisted of between 5 and 10 traps set singly or in a string and hauled after a 24-hr period (standard) or variable time period (non-standard).

Table 3. Number of trap sets, hauls and effort (in hrs) to catch Dungeness crab in the Nass Estuary during sampling periods, 10 April 2001 to 19 April 2002.

Trip no.	Period of trap hauls	Kincolith No. trap sets [a]	Kincolith No. trap hauls	Kincolith Avg. soak hrs	Ripple Tongue No. trap sets [a]	Ripple Tongue No. trap hauls	Ripple Tongue Avg. soak hrs	Iceberg Bay No. trap sets [a]	Iceberg Bay No. trap hauls	Iceberg Bay Avg. soak hrs	Total No. trap sets [a]	Total No. trap hauls	Total Avg. soak hrs
Standard Locations of Trap Hauls													
8	10-12 Apr	4	30	25	4	30	23	3	20	23	11	80	24
9	9-15 May	3	20	27	3	20	23	3	20	24	9	60	25
10	28-31 May	3	20	25	3	20	26	3	20	24	9	60	25
11	23-24 Jun	3	20	25	3	20	27	3	20	26	9	60	26
12	27-29 Aug	3	20	24	3	20	25	3	20	24	9	60	24
13	20-22 Sep	3	20	26	3	20	24	3	20	24	9	60	25
14	20-22 Oct	3	20	26	3	20	25	3	20	24	9	60	25
15	17-19 Apr	3	20	25	3	20	25	3	20	24	9	60	24
	sub-total	25	170	25	25	170	25	24	160	24	74	500	25
Non-standard Locations of Trap Hauls													
8	10-12 Apr							1	10	24	1	10	24
9	9-15 May	9	60	21	15	100	20	9	60	19	33	220	20
10	28-31 May	6	40	7	6	40	11	3	20	18	15	100	12
11	23-24 Jun				1	3	6	5	33	14	6	36	10
12	27-29 Aug	1	10	27	1	10	24	1	10	23	3	30	25
13	20-22 Sep	1	10	24	1	10	20	1	10	21	3	30	22
14	20-22 Oct	3	20	24	3	20	20	3	20	20	9	60	21
15	17-19 Apr	3	20	28	3	20	19	3	20	19	9	60	22
	sub-total	23	160	19	30	203	18	26	183	18	79	546	19
Total Trap Hauls													
8	10-12 Apr	4	30	25	4	30	23	4	30	23	12	90	24
9	9-15 May	12	80	22	18	120	21	12	80	20	42	280	21
10	28-31 May	9	60	13	9	60	16	6	40	21	24	160	16
11	23-24 Jun	3	20	25	4	23	22	8	53	19	15	96	21
12	27-29 Aug	4	30	25	4	30	25	4	30	24	12	90	25
13	20-22 Sep	4	30	26	4	30	23	4	30	24	12	90	24
14	20-22 Oct	6	40	25	6	40	23	6	40	22	18	120	23
15	17-19 Apr	6	40	27	6	40	22	6	40	21	18	120	23
Total (2001-2002)		**48**	**330**	**22**	**55**	**373**	**21**	**50**	**343**	**21**	**153**	**1046**	**21**
Study Total		**90**	**639**	**22**	**97**	**673**	**21**	**77**	**533**	**22**	**264**	**1845**	**22**
	Standard	64	460	24	57	390	23	50	345	24	171	1195	24
	Non-standard	26	179	19	40	283	19	27	188	19	93	650	19

[a] A set consisted of between 5 and 10 traps set singly or in a string and hauled after a 24-hr period (standard) or variable time period (non-standard).

Table 4. Number of male and female Dungeness crabs captured in the Nass Estuary during sampling periods, 8 June to 29 November 2000.

Trip no.	Period of trap hauls	Sampling Areas: Kincolith Male	Kincolith Fem.	Kincolith Total	Ripple Tongue Male	Ripple Tongue Fem.	Ripple Tongue Total	Iceberg Bay Male	Iceberg Bay Fem.	Iceberg Bay Total	Total Male	Total Fem.	Total Total
Standard Locations of Trap Hauls													
1	8-11 June	183	340	523	66	120	186	46	50	96	295	510	805
2	30 June to 2 July	102	182	284				137	129	266	239	311	550
3	23-25 July	108	153	261	117	192	309	57	38	95	282	383	665
4	23-28 August	556	418	974	821	560	1381	146	118	264	1523	1096	2619
5	23-26 Sep	431	600	1031	81	138	219	315	151	466	827	889	1716
6	27-31 October	158	283	441	81	85	166	199	67	266	438	435	873
7	28-29 November	132	182	314							132	182	314
	sub-total	1670	2158	3828	1166	1095	2261	900	553	1453	3736	3806	7542
Non-standard Locations of Trap Hauls													
1	8-11 June												
2	30 June to 2 July				302	186	488	9	19	28	311	205	516
3	23-25 July	45	103	148	157	90	247				202	193	395
4	23-28 August												
5	23-26 Sep												
6	27-31 October				142	44	186				142	44	186
7	28-29 November												
	sub-total	45	103	148	601	320	921	9	19	28	655	442	1097
Total Trap Hauls													
1	8-11 June	183	340	523	66	120	186	46	50	96	295	510	805
2	30 June to 2 July	102	182	284	302	186	488	146	148	294	550	516	1066
3	23-25 July	153	256	409	274	282	556	57	38	95	484	576	1060
4	23-28 August	556	418	974	821	560	1381	146	118	264	1523	1096	2619
5	23-26 Sep	431	600	1031	81	138	219	315	151	466	827	889	1716
6	27-31 October	158	283	441	223	129	352	199	67	266	580	479	1059
7	28-29 November	132	182	314							132	182	314
Total (2000)		**1715**	**2261**	**3976**	**1767**	**1415**	**3182**	**909**	**572**	**1481**	**4391**	**4248**	**8639**

Table 5. Number of male and female Dungeness crabs captured in the Nass Estuary during sampling periods, 10 April 2001 to 19 April 2002.

Trip no.	Period of trap hauls	Sampling Areas: Kincolith Male	Kincolith Fem.	Kincolith Total	Ripple Tongue Male	Ripple Tongue Fem.	Ripple Tongue Total	Iceberg Bay Male	Iceberg Bay Fem.	Iceberg Bay Total	Total Male	Total Fem.	Total Total
Standard Locations of Trap Hauls													
8	10-12 Apr	240	242	482	56	98	154	193	28	221	489	368	857
9	9-15 May	174	170	344	59	74	133	160	37	197	393	281	674
10	28-31 May	96	65	161	96	71	167	143	44	187	335	180	515
11	23-24 Jun	155	120	275	38	14	52	160	50	210	353	184	537
12	27-29 Aug	156	213	369	80	156	236	117	28	145	353	397	750
13	20-22 Sep	248	117	365	85	59	144	155	54	209	488	230	718
14	20-22 Oct	268	75	343	129	58	187	158	75	233	555	208	763
15	17-19 Apr	138	163	301	135	96	231	137	19	156	410	278	688
	sub-total	1475	1165	2640	678	626	1304	1223	335	1558	3376	2126	5502
Non-standard Locations of Trap Hauls													
8	10-12 Apr							76	20	96	76	20	96
9	9-15 May	554	379	933	771	421	1192	436	230	666	1761	1030	2791
10	28-31 May	265	114	379	257	168	425	257	77	334	779	359	1138
11	23-24 Jun				32	9	41	192	54	246	224	63	287
12	27-29 Aug	126	103	229	50	67	117	77	46	123	253	216	469
13	20-22 Sep	103	76	179	39	29	68	106	31	137	248	136	384
14	20-22 Oct	220	138	358	172	131	303	202	37	239	594	306	900
15	17-19 Apr	135	147	282	138	51	189	189	112	301	462	310	772
	sub-total	1403	957	2360	1459	876	2335	1535	607	2142	4397	2440	6837
Total Trap Hauls													
8	10-12 Apr	240	242	482	56	98	154	269	48	317	565	388	953
9	9-15 May	728	549	1277	830	495	1325	596	267	863	2154	1311	3465
10	28-31 May	361	179	540	353	239	592	400	121	521	1114	539	1653
11	23-24 Jun	155	120	275	70	23	93	352	104	456	577	247	824
12	27-29 Aug	282	316	598	130	223	353	194	74	268	606	613	1219
13	20-22 Sep	351	193	544	124	88	212	261	85	346	736	366	1102
14	20-22 Oct	488	213	701	301	189	490	360	112	472	1149	514	1663
15	17-19 Apr	273	310	583	273	147	420	326	131	457	872	588	1460
Total (2001-2002)		**2878**	**2122**	**5000**	**2137**	**1502**	**3639**	**2758**	**942**	**3700**	**7773**	**4566**	**12339**
Study Total		**4593**	**4383**	**8976**	**3904**	**2917**	**6821**	**3667**	**1514**	**5181**	**12164**	**8814**	**20978**
Standard		3145	3323	6468	1844	1721	3565	2123	888	3011	7112	5932	13044
Non-standard		1448	1060	2508	2060	1196	3256	1544	626	2170	5052	2882	7934

Table 6. Number of legal (>153 mm NW), medium (127-153 mm NW) and small (<127 mm NW) sized male Dungeness crabs captured in the Nass Estuary during sampling periods, 8 June to 29 November 2000.

Trip	Period of	Sampling Areas: Kincolith				Ripple Tongue				Iceberg Bay				Total			
no.	trap hauls	Legal [a]	Med.	Small	Total	Legal [b]	Med.	Small	Total	Legal [c]	Med.	Small	Total	Legal	Med.	Small	Total
Standard Locations of Trap Hauls																	
1	8-11 June	170	13	0	183	58	8	0	66	29	17	0	46	257	38	0	295
2	30 June to 2 July	86	16	0	102					89	41	6	136	175	57	6	238
3	23-25 July	99	8	0	107	103	13	1	117	30	19	7	56	232	40	8	280
4	23-28 August	461	91	4	556	565	201	55	821	84	52	10	146	1110	344	69	1523
5	23-26 Sep	344	71	16	431	61	15	5	81	116	173	26	315	521	259	47	827
6	27-31 October	107	49	2	158	25	52	3	80	15	158	26	199	147	259	31	437
7	28-29 November	71	56	5	132									71	56	5	132
	sub-total	1338	304	27	1669	812	289	64	1165	363	460	75	898	2513	1053	166	3732
Non-standard Locations of Trap Hauls																	
1	8-11 June																
2	30 June to 2 July					224	67	11	302	9	0	0	9	233	67	11	311
3	23-25 July	18	16	11	45	107	38	12	157					125	54	23	202
4	23-28 August																
5	23-26 Sep																
6	27-31 October					12	90	40	142					12	90	40	142
7	28-29 November																
	sub-total	18	16	11	45	343	195	63	601	9	0	0	9	370	211	74	655
Total Trap Hauls																	
1	8-11 June	170	13	0	183	58	8	0	66	29	17	0	46	257	38	0	295
2	30 June to 2 July	86	16	0	102	224	67	11	302	98	41	6	145	408	124	17	549
3	23-25 July	117	24	11	152	210	51	13	274	30	19	7	56	357	94	31	482
4	23-28 August	461	91	4	556	565	201	55	821	84	52	10	146	1110	344	69	1523
5	23-26 Sep	344	71	16	431	61	15	5	81	116	173	26	315	521	259	47	827
6	27-31 October	107	49	2	158	37	142	43	222	15	158	26	199	159	349	71	579
7	28-29 November	71	56	5	132									71	56	5	132
Total (2000)		**1356**	**320**	**38**	**1714**	**1155**	**484**	**127**	**1766**	**372**	**460**	**75**	**907**	**2883**	**1264**	**240**	**4387**

[a] Of the total legal sized males captured in Kincolith, 62 were greater than 184 mm NW. Of the 62 caught, 9, 3, 7, 15, 20, 2, and 6 were caught from trips 1 to 7, respectively.

[b] Of the total legal sized males captured in Ripple, 52 were greater than 184 mm NW. Of the 52 caught, 10, 9, 9, 15, 6, and 3 were caught from trips 1 to 6, respectively.

[c] Of the total legal sized males captured in Iceberg, 9 were greater than 184 mm NW. Of the 9 caught, 1, 5, 1, 1, 1 and 0 were caught from trips 1 to 6, respectively.

[d] Of the total males captured (Table 4), four males, one from Kincolith, one from Ripple, and two from Iceberg were not measured.

Table 7. Number of legal (>153 mm NW), medium (127-153 mm NW) and small (<127 mm NW) sized male Dungeness crabs captured in the Nass Estuary during sampling periods, 10 April 2001 to 19 April 2002.

Trip	Period of	Sampling Areas: Kincolith				Ripple Tongue				Iceberg Bay				Total			
no.	trap hauls	Legal [a]	Med.	Small	Total	Legal [b]	Med.	Small	Total	Legal [c]	Med.	Small	Total	Legal	Med.	Small	Total
Standard Locations of Trap Hauls																	
8	10-12 Apr	124	112	3	239	29	27	0	56	64	125	4	193	217	264	7	488
9	9-15 May	87	82	5	174	35	22	2	59	69	89	2	160	191	193	9	393
10	28-31 May	28	66	2	96	64	32	0	96	54	85	4	143	146	183	6	335
11	23-24 Jun	65	89	1	155	24	13	1	38	79	79	2	160	168	181	4	353
12	27-29 Aug	102	53	1	156	43	35	2	80	53	63	1	117	198	151	4	353
13	20-22 Sep	105	141	2	248	64	21	0	85	86	69	0	155	255	231	2	488
14	20-22 Oct	95	162	11	268	33	94	2	129	40	117	1	158	168	373	14	555
15	17-19 Apr	90	48	0	138	94	41	0	135	106	31	0	137	290	120	0	410
	sub-total	696	753	25	1474	386	285	7	678	551	658	14	1223	1633	1696	46	3375
Non-standard Locations of Trap Hauls																	
8	10-12 Apr									22	52	2	76	22	52	2	76
9	9-15 May	217	299	38	554	393	345	33	771	182	222	32	436	792	866	103	1761
10	28-31 May	72	182	11	265	76	159	22	257	98	122	37	257	246	463	70	779
11	23-24 Jun					6	21	5	32	52	111	29	192	58	132	34	224
12	27-29 Aug	84	42	0	126	21	29	0	50	33	44	0	77	138	115	0	253
13	20-22 Sep	48	55	0	103	20	19	0	39	37	65	4	106	105	139	4	248
14	20-22 Oct	99	116	5	220	37	132	3	172	19	171	12	202	155	419	20	594
15	17-19 Apr	73	62	0	135	97	41	0	138	141	48	0	189	311	151	0	462
	sub-total	593	756	54	1403	650	746	63	1459	584	835	116	1535	1827	2337	233	4397
Total Trap Hauls																	
8	10-12 Apr	124	112	3	239	29	27	0	56	86	177	6	269	239	316	9	564
9	9-15 May	304	381	43	728	428	367	35	830	251	311	34	596	983	1059	112	2154
10	28-31 May	100	248	13	361	140	191	22	353	152	207	41	400	392	646	76	1114
11	23-24 Jun	65	89	1	155	30	34	6	70	131	190	31	352	226	313	38	577
12	27-29 Aug	186	95	1	282	64	64	2	130	86	107	1	194	336	266	4	606
13	20-22 Sep	153	196	2	351	84	40	0	124	123	134	4	261	360	370	6	736
14	20-22 Oct	194	278	16	488	70	226	5	301	59	288	13	360	323	792	34	1149
15	17-19 Apr	163	110	0	273	191	82	0	273	247	79	0	326	601	271	0	872
Total (2001-2002)		**1289**	**1509**	**79**	**2877**	**1036**	**1031**	**70**	**2137**	**1135**	**1493**	**130**	**2758**	**3460**	**4033**	**279**	**7772** [d]
Study Total		**2645**	**1829**	**117**	**4591**	**2191**	**1515**	**197**	**3903**	**1507**	**1953**	**205**	**3665**	**6343**	**5297**	**519**	**12159**
Standard		2034	1057	52	3143	1198	574	71	1843	914	1118	89	2121	4146	2749	212	7107
Non-standard		611	772	65	1448	993	941	126	2060	593	835	116	1544	2197	2548	307	5052

[a] Of the total legal sized males captured in Kincolith, 37 were greater than 184 mm NW. Of the 32 caught, 9, 14, 3, 2, 5, 1, 1, and 2 were caught from trips 8 to 15, respectively.

[b] Of the total legal sized males captured in Ripple, 36 were greater than 184 mm NW. Of the 36 caught, 2, 21, 4, 1, 3, 2, 0, and 3 were caught from trips 8 to 15, respectively.

[c] Of the total legal sized males captured in Iceberg, 20 were greater than 184 mm NW. Of the 20 caught, 3, 4, 1, 4, 1, 0, 0 and 7 were caught from trips 8 to 15, respectively.

[a] Of the total males captured (Table 5), one male captured in Kincolith was not measured.

Table 8. Number of large (>153 mm NW), medium (127-153 mm NW) and small (<127 mm NW) sized female Dungeness crabs captured in the Nass Estuary during sampling periods, 8 June to 29 November 2000.

Trip no.	Period of trap hauls	Sampling Areas: Kincolith Lge	Kincolith Med.	Kincolith Small	Kincolith Total	Ripple Tongue Lge	Ripple Tongue Med.	Ripple Tongue Small	Ripple Tongue Total	Iceberg Bay Lge	Iceberg Bay Med.	Iceberg Bay Small	Iceberg Bay Total	Total [a] Lge	Total Med.	Total Small	Total Total
Standard Locations of Trap Hauls																	
1	8-11 June	68	265	7	340	22	98	0	120	18	27	5	50	108	390	12	510
2	30 June to 2 July	31	142	9	182					38	86	5	129	69	228	14	311
3	23-25 July	26	124	3	153	24	159	9	192	9	18	10	37	59	301	22	382
4	23-28 August	62	318	38	418	82	411	67	560	33	76	9	118	177	805	114	1096
5	23-26 Sep	91	385	124	600	19	101	18	138	22	103	26	151	132	589	168	889
6	27-31 October	71	170	42	283	10	61	14	85	12	48	7	67	93	279	63	435
7	28-29 November	24	126	32	182									24	126	32	182
	sub-total	373	1530	255	2158	157	830	108	1095	132	358	62	552	662	2718	425	3805
Non-standard Locations of Trap Hauls																	
1	8-11 June																
2	30 June to 2 July					24	159	3	186	8	11	0	19	32	170	3	205
3	23-25 July	22	78	3	103	21	64	5	90					43	142	8	193
4	23-28 August																
5	23-26 Sep																
6	27-31 October					6	36	2	44					6	36	2	44
7	28-29 November																
	sub-total	22	78	3	103	51	259	10	320	8	11	0	19	81	348	13	442
Total Trap Hauls																	
1	8-11 June	68	265	7	340	22	98	0	120	18	27	5	50	108	390	12	510
2	30 June to 2 July	31	142	9	182	24	159	3	186	46	97	5	148	101	398	17	516
3	23-25 July	48	202	6	256	45	223	14	282	9	18	10	37	102	443	30	575
4	23-28 August	62	318	38	418	82	411	67	560	33	76	9	118	177	805	114	1096
5	23-26 Sep	91	385	124	600	19	101	18	138	22	103	26	151	132	589	168	889
6	27-31 October	71	170	42	283	16	97	16	129	12	48	7	67	99	315	65	479
7	28-29 November	24	126	32	182									24	126	32	182
Total (2000)		**395**	**1608**	**258**	**2261**	**208**	**1089**	**118**	**1415**	**140**	**369**	**62**	**571**	**743**	**3066**	**438**	**4247**

[a] Of the total females captured (Table 4), one from Iceberg was not measured.

Table 9. Number of large (>153 mm NW), medium (127-153 mm NW) and small (<127 mm NW) sized female Dungeness crabs captured in the Nass Estuary during sampling periods, 10 April 2001 to 19 April 2002.

		Sampling Areas															
Trip	Period of	Kincolith				Ripple Tongue				Iceberg Bay				Total [a]			
no.	trap hauls	Lge	Med.	Small	Total	Lge	Med.	Small	Total	Lge	Med.	Small	Total	Lge	Med.	Small	Total
Standard Locations of Trap Hauls																	
8	10-12 Apr	22	162	58	242	15	72	11	98	4	18	6	28	41	252	75	368
9	9-15 May	30	126	14	170	6	50	18	74	6	27	4	37	42	203	36	281
10	28-31 May	8	53	4	65	7	56	8	71	15	26	3	44	30	135	15	180
11	23-24 Jun	14	91	15	120	0	13	1	14	13	33	4	50	27	137	20	184
12	27-29 Aug	25	158	30	213	12	102	42	156	7	18	3	28	44	278	75	397
13	20-22 Sep	8	85	24	117	6	45	8	59	16	35	3	54	30	165	35	230
14	20-22 Oct	21	48	6	75	6	49	3	58	20	54	1	75	47	151	10	208
15	17-19 Apr	7	126	30	163	6	79	11	96	7	11	1	19	20	216	42	278
	sub-total	135	849	181	1165	58	466	102	626	88	222	25	335	281	1537	308	2126
Non-standard Locations of Trap Hauls																	
8	10-12 Apr									4	14	2	20	4	14	2	20
9	9-15 May	26	250	103	379	33	307	80	420	28	173	29	230	87	730	212	1029
10	28-31 May	2	82	30	114	14	112	42	168	5	62	10	77	21	256	82	359
11	23-24 Jun					1	4	4	9	3	37	14	54	4	41	18	63
12	27-29 Aug	16	72	15	103	5	47	15	67	0	37	9	46	21	156	39	216
13	20-22 Sep	4	54	18	76	2	25	2	29	3	26	2	31	9	105	22	136
14	20-22 Oct	6	114	18	138	1	120	10	131	2	35	0	37	9	269	28	306
15	17-19 Apr	9	105	33	147	2	39	10	51	5	90	17	112	16	234	60	310
	sub-total	63	677	217	957	58	654	163	875	50	474	83	607	171	1805	463	2439
Total Trap Hauls																	
8	10-12 Apr	22	162	58	242	15	72	11	98	8	32	8	48	45	266	77	388
9	9-15 May	56	376	117	549	39	357	98	494	34	200	33	267	129	933	248	1310
10	28-31 May	10	135	34	179	21	168	50	239	20	88	13	121	51	391	97	539
11	23-24 Jun	14	91	15	120	1	17	5	23	16	70	18	104	31	178	38	247
12	27-29 Aug	41	230	45	316	17	149	57	223	7	55	12	74	65	434	114	613
13	20-22 Sep	12	139	42	193	8	70	10	88	19	61	5	85	39	270	57	366
14	20-22 Oct	27	162	24	213	7	169	13	189	22	89	1	112	56	420	38	514
15	17-19 Apr	16	231	63	310	8	118	21	147	12	101	18	131	36	450	102	588
Total (2001-2002)		**198**	**1526**	**398**	**2122**	**116**	**1120**	**265**	**1501**	**138**	**696**	**108**	**942**	**452**	**3342**	**771**	**4565**
Study Total		**593**	**3134**	**656**	**4383**	**324**	**2209**	**383**	**2916**	**278**	**1065**	**170**	**1513**	**1195**	**6408**	**1209**	**8812**
Standard		508	2379	436	3323	215	1296	210	1721	220	580	87	887	943	4255	733	5931
Non-standard		85	755	220	1060	109	913	173	1195	58	485	83	626	252	2153	476	2881

[a] Of the total females captured (Table 5), one female captured in Ripple was not measured.

Table 10. Mean CPE (catch per trap haul) of legal (>153 mm NW), medium (127-153 mm NW) and small (<127 mm NW) sized male Dungeness crabs captured in the Nass Estuary during sampling periods, 8 June to 29 November 2000.

Trip no.	Period of trap hauls	Sampling Areas: Kincolith Legal	Kincolith Med.	Kincolith Small	Kincolith Total	Ripple Tongue Legal	Ripple Tongue Med.	Ripple Tongue Small	Ripple Tongue Total	Iceberg Bay Legal	Iceberg Bay Med.	Iceberg Bay Small	Iceberg Bay Total	Total Legal	Total Med.	Total Small	Total Total
Standard Locations of Trap Hauls																	
1	8-11 June	4.3	0.3	0.0	4.6	2.9	0.4	0.0	3.3	1.5	0.9	0.0	2.3	3.2	0.5	0.0	3.7
2	30 June to 2 July	2.2	0.4	0.0	2.6					2.5	1.2	0.2	3.9	2.3	0.8	0.1	3.2
3	23-25 July	5.0	0.4	0.0	5.4	2.6	0.3	0.0	2.9	1.5	1.0	0.4	2.8	2.9	0.5	0.1	3.5
4	23-28 August	6.6	1.3	0.1	7.9	5.1	1.8	0.5	7.5	2.1	1.3	0.3	3.7	5.0	1.6	0.3	6.9
5	23-26 Sep	5.7	1.2	0.3	7.2	3.1	0.8	0.3	4.1	2.9	4.3	0.7	7.9	4.3	2.2	0.4	6.9
6	27-31 October	3.6	1.6	0.1	5.3	0.8	1.7	0.1	2.7	0.5	5.3	0.9	6.6	1.6	2.9	0.3	4.9
7	28-29 November	2.4	1.9	0.2	4.4									2.4	1.9	0.2	4.4
	sub-total	4.6	1.0	0.1	5.8	3.7	1.3	0.3	5.3	2.0	2.5	0.4	4.9	3.6	1.5	0.2	5.4
Non-standard Locations of Trap Hauls																	
1	8-11 June																
2	30 June to 2 July					5.6	1.7	0.3	7.6	1.8	0.0	0.0	1.8	5.2	1.5	0.2	6.9
3	23-25 July	0.9	0.8	0.6	2.4	5.4	1.9	0.6	7.9					3.2	1.4	0.6	5.2
4	23-28 August																
5	23-26 Sep																
6	27-31 October					0.6	4.5	2.0	7.1					0.6	4.5	2.0	7.1
7	28-29 November																
	sub-total	0.9	0.8	0.6	2.4	4.3	2.4	0.8	7.5	1.8	0.0	0.0	1.8	3.6	2.0	0.7	6.3
Total Trap Hauls																	
1	8-11 June	4.3	0.3	0.0	4.6	2.9	0.4	0.0	3.3	1.5	0.9	0.0	2.3	3.2	0.5	0.0	3.7
2	30 June to 2 July	2.2	0.4	0.0	2.6	5.6	1.7	0.3	7.6	2.5	1.0	0.2	3.6	3.4	1.0	0.1	4.6
3	23-25 July	3.0	0.6	0.3	3.9	3.5	0.9	0.2	4.6	1.5	1.0	0.4	2.8	3.0	0.8	0.3	4.1
4	23-28 August	6.6	1.3	0.1	7.9	5.1	1.8	0.5	7.5	2.1	1.3	0.3	3.7	5.0	1.6	0.3	6.9
5	23-26 Sep	5.7	1.2	0.3	7.2	3.1	0.8	0.3	4.1	2.9	4.3	0.7	7.9	4.3	2.2	0.4	6.9
6	27-31 October	3.6	1.6	0.1	5.3	0.7	2.8	0.9	4.4	0.5	5.3	0.9	6.6	1.4	3.2	0.6	5.3
7	28-29 November	2.4	1.9	0.2	4.4									2.4	1.9	0.2	4.4
Total (2000)		**4.4**	**1.0**	**0.1**	**5.5**	**3.9**	**1.6**	**0.4**	**5.9**	**2.0**	**2.4**	**0.4**	**4.8**	**3.6**	**1.6**	**0.3**	**5.5**

Table 11. Mean CPE (catch per trap haul) of legal (>153 mm NW), medium (127-153 mm NW) and small (<127 mm NW) sized male Dungeness crabs captured in the Nass Estuary during sampling periods, 10 April 2001 to 19 April 2002.

Trip	Period of	Sampling Areas												Total			
		Kincolith				Ripple Tongue				Iceberg Bay							
no.	trap hauls	Legal	Med.	Small	Total	Legal	Med.	Small	Total	Legal	Med.	Small	Total	Legal	Med.	Small	Total
Standard Locations of Trap Hauls																	
8	10-12 Apr	4.1	3.7	0.1	8.0	1.0	0.9	0.0	1.9	3.2	6.3	0.2	9.7	2.7	3.3	0.1	6.1
9	9-15 May	4.4	4.1	0.3	8.7	1.8	1.1	0.1	3.0	3.5	4.5	0.1	8.0	3.2	3.2	0.2	6.6
10	28-31 May	1.4	3.3	0.1	4.8	3.2	1.6	0.0	4.8	2.7	4.3	0.2	7.2	2.4	3.1	0.1	5.6
11	23-24 Jun	3.3	4.5	0.1	7.8	1.2	0.7	0.1	1.9	4.0	4.0	0.1	8.0	2.8	3.0	0.1	5.9
12	27-29 Aug	5.1	2.7	0.1	7.8	2.2	1.8	0.1	4.0	2.7	3.2	0.1	5.9	3.3	2.5	0.1	5.9
13	20-22 Sep	5.3	7.1	0.1	12.4	3.2	1.1	0.0	4.3	4.3	3.5	0.0	7.8	4.3	3.9	0.0	8.1
14	20-22 Oct	4.8	8.1	0.6	13.4	1.7	4.7	0.1	6.5	2.0	5.9	0.1	7.9	2.8	6.2	0.2	9.3
15	17-19 Apr	4.5	2.4	0.0	6.9	4.7	2.1	0.0	6.8	5.3	1.6	0.0	6.9	4.8	2.0	0.0	6.8
	sub-total	4.1	4.4	0.1	8.7	2.3	1.7	0.0	4.0	3.4	4.1	0.1	7.6	3.3	3.4	0.1	6.8
Non-standard Locations of Trap Hauls																	
8	10-12 Apr									2.2	5.2	0.2	7.6	2.2	5.2	0.2	7.6
9	9-15 May	3.6	5.0	0.6	9.2	3.9	3.5	0.3	7.7	3.0	3.7	0.5	7.3	3.6	3.9	0.5	8.0
10	28-31 May	1.8	4.6	0.3	6.6	1.9	4.0	0.6	6.4	4.9	6.1	1.9	12.9	2.5	4.6	0.7	7.8
11	23-24 Jun					2.0	7.0	1.7	10.7	1.6	3.4	0.9	5.8	1.6	3.7	0.9	6.2
12	27-29 Aug	8.4	4.2	0.0	12.6	2.1	2.9	0.0	5.0	3.3	4.4	0.0	7.7	4.6	3.8	0.0	8.4
13	20-22 Sep	4.8	5.5	0.0	10.3	2.0	1.9	0.0	3.9	3.7	6.5	0.4	10.6	3.5	4.6	0.1	8.3
14	20-22 Oct	5.0	5.8	0.3	11.0	1.9	6.6	0.2	8.6	1.0	8.6	0.6	10.1	2.6	7.0	0.3	9.9
15	17-19 Apr	3.7	3.1	0.0	6.8	4.9	2.1	0.0	6.9	7.1	2.4	0.0	9.5	5.2	2.5	0.0	7.7
	sub-total	3.7	4.7	0.3	8.8	3.2	3.7	0.3	7.2	3.2	4.6	0.6	8.4	3.3	4.3	0.4	8.1
Total Trap Hauls																	
8	10-12 Apr	4.1	3.7	0.1	8.0	1.0	0.9	0.0	1.9	2.9	5.9	0.2	9.0	2.7	3.5	0.1	6.3
9	9-15 May	3.8	4.8	0.5	9.1	3.6	3.1	0.3	6.9	3.1	3.9	0.4	7.5	3.5	3.8	0.4	7.7
10	28-31 May	1.7	4.1	0.2	6.0	2.3	3.2	0.4	5.9	3.8	5.2	1.0	10.0	2.5	4.0	0.5	7.0
11	23-24 Jun	3.3	4.5	0.1	7.8	1.3	1.5	0.3	3.0	2.5	3.6	0.6	6.6	2.4	3.3	0.4	6.0
12	27-29 Aug	6.2	3.2	0.0	9.4	2.1	2.1	0.1	4.3	2.9	3.6	0.0	6.5	3.7	3.0	0.0	6.7
13	20-22 Sep	5.1	6.5	0.1	11.7	2.8	1.3	0.0	4.1	4.1	4.5	0.1	8.7	4.0	4.1	0.1	8.2
14	20-22 Oct	4.9	7.0	0.4	12.2	1.8	5.7	0.1	7.5	1.5	7.2	0.3	9.0	2.7	6.6	0.3	9.6
15	17-19 Apr	4.1	2.8	0.0	6.8	4.8	2.1	0.0	6.8	6.2	2.0	0.0	8.2	5.0	2.3	0.0	7.3
Total (2001-2002)		**3.9**	**4.6**	**0.2**	**8.7**	**2.8**	**2.8**	**0.2**	**5.7**	**3.3**	**4.4**	**0.4**	**8.0**	**3.3**	**3.9**	**0.3**	**7.4**
Study Total		**4.1**	**2.9**	**0.2**	**7.2**	**3.3**	**2.3**	**0.3**	**5.8**	**2.8**	**3.7**	**0.4**	**6.9**	**3.4**	**2.9**	**0.3**	**6.6**
Standard		4.4	2.3	0.1	6.8	3.1	1.5	0.2	4.7	2.6	3.2	0.3	6.1	3.5	2.3	0.2	5.9
Non-standard		3.4	4.3	0.4	8.1	3.5	3.3	0.4	7.3	3.2	4.4	0.6	8.2	3.4	3.9	0.5	7.8

Table 12. Mean CPE (catch per trap haul) of large (>153 mm NW), medium (127-153 mm NW) and small (<127 mm NW) sized female Dungeness crabs captured in the Nass Estuary during sampling periods, 8 June to 29 November 2000.

Trip	Period of	Sampling Areas: Kincolith				Ripple Tongue				Iceberg Bay				Total			
no.	trap hauls	Lge	Med.	Small	Total	Lge	Med.	Small	Total	Lge	Med.	Small	Total	Lge	Med.	Small	Total
Standard Locations of Trap Hauls																	
1	8-11 June	1.7	6.6	0.2	8.5	1.1	4.9	0.0	6.0	0.9	1.4	0.3	2.5	1.4	4.9	0.2	6.4
2	30 June to 2 July	0.8	3.6	0.2	4.6					1.1	2.5	0.1	3.7	0.9	3.0	0.2	4.1
3	23-25 July	1.3	6.2	0.2	7.7	0.6	4.0	0.2	4.8	0.5	0.9	0.5	1.9	0.7	3.8	0.3	4.8
4	23-28 August	0.9	4.5	0.5	6.0	0.7	3.7	0.6	5.1	0.8	1.9	0.2	3.0	0.8	3.7	0.5	5.0
5	23-26 Sep	1.5	6.4	2.1	10.0	1.0	5.1	0.9	6.9	0.6	2.6	0.7	3.8	1.1	4.9	1.4	7.4
6	27-31 October	2.4	5.7	1.4	9.4	0.3	2.0	0.5	2.8	0.4	1.6	0.2	2.2	1.0	3.1	0.7	4.8
7	28-29 November	0.8	4.2	1.1	6.1									0.8	4.2	1.1	6.1
	sub-total	1.3	5.3	0.9	7.4	0.7	3.8	0.5	5.0	0.7	1.9	0.3	3.0	1.0	3.9	0.6	5.5
Non-standard Locations of Trap Hauls																	
1	8-11 June																
2	30 June to 2 July					0.6	4.0	0.1	4.7	1.6	2.2	0.0	3.8	0.7	3.8	0.1	4.6
3	23-25 July	1.2	4.1	0.2	5.4	1.1	3.2	0.3	4.5					1.1	3.6	0.2	4.9
4	23-28 August																
5	23-26 Sep																
6	27-31 October					0.3	1.8	0.1	2.2					0.3	1.8	0.1	2.2
7	28-29 November																
	sub-total	1.2	4.1	0.2	5.4	0.6	3.2	0.1	4.0	1.6	2.2	0.0	3.8	0.8	3.3	0.1	4.3
Total Trap Hauls																	
1	8-11 June	1.7	6.6	0.2	8.5	1.1	4.9	0.0	6.0	0.9	1.4	0.3	2.5	1.4	4.9	0.2	6.4
2	30 June to 2 July	0.8	3.6	0.2	4.6	0.6	4.0	0.1	4.7	1.2	2.4	0.1	3.7	0.8	3.3	0.1	4.3
3	23-25 July	1.2	5.2	0.2	6.6	0.8	3.7	0.2	4.7	0.5	0.9	0.5	1.9	0.9	3.7	0.3	4.8
4	23-28 August	0.9	4.5	0.5	6.0	0.7	3.7	0.6	5.1	0.8	1.9	0.2	3.0	0.8	3.7	0.5	5.0
5	23-26 Sep	1.5	6.4	2.1	10.0	1.0	5.1	0.9	6.9	0.6	2.6	0.7	3.8	1.1	4.9	1.4	7.4
6	27-31 October	2.4	5.7	1.4	9.4	0.3	1.9	0.3	2.6	0.4	1.6	0.2	2.2	0.9	2.9	0.6	4.4
7	28-29 November	0.8	4.2	1.1	6.1									0.8	4.2	1.1	6.1
Total (2000)		**1.3**	**5.2**	**0.8**	**7.3**	**0.7**	**3.6**	**0.4**	**4.7**	**0.7**	**1.9**	**0.3**	**3.0**	**0.9**	**3.8**	**0.5**	**5.3**

Table 13. Mean CPE (catch per trap haul) of large (>153 mm NW), medium (127-153 mm NW) and small (<127 mm NW) sized female Dungeness crabs captured in the Nass Estuary during sampling periods, 10 April 2001 to 19 April 2002.

Trip	Period of	Sampling Areas												Total			
		Kincolith				Ripple Tongue				Iceberg Bay							
no.	trap hauls	Lge	Med.	Small	Total	Lge	Med.	Small	Total	Lge	Med.	Small	Total	Lge	Med.	Small	Total
Standard Locations of Trap Hauls																	
8	10-12 Apr	0.7	5.4	1.9	8.1	0.5	2.4	0.4	3.3	0.2	0.9	0.3	9.7	0.5	3.2	0.9	4.6
9	9-15 May	1.5	6.3	0.7	8.5	0.3	2.5	0.9	3.7	0.3	1.4	0.2	8.0	0.7	3.4	0.6	4.7
10	28-31 May	0.4	2.7	0.2	3.3	0.4	2.8	0.4	3.6	0.8	1.3	0.2	7.2	0.5	2.3	0.3	3.0
11	23-24 Jun	0.7	4.6	0.8	6.0	0.0	0.7	0.1	0.7	0.7	1.7	0.2	8.0	0.5	2.3	0.3	3.1
12	27-29 Aug	1.3	7.9	1.5	10.7	0.6	5.1	2.1	7.8	0.4	0.9	0.2	5.9	0.7	4.6	1.3	6.6
13	20-22 Sep	0.4	4.3	1.2	5.9	0.3	2.3	0.4	3.0	0.8	1.8	0.2	7.8	0.5	2.8	0.6	3.8
14	20-22 Oct	1.1	2.4	0.3	3.8	0.3	2.5	0.2	2.9	1.0	2.7	0.1	7.9	0.8	2.5	0.2	3.5
15	17-19 Apr	0.4	6.3	1.5	8.2	0.3	4.0	0.6	4.8	0.4	0.6	0.1	6.9	0.3	3.6	0.7	4.6
	sub-total	0.8	5.0	1.1	6.9	0.3	2.7	0.6	3.7	0.6	1.4	0.2	2.1	0.6	3.1	0.6	4.3
Non-standard Locations of Trap Hauls																	
8	10-12 Apr									0.4	1.4	0.2	2.0	0.4	1.4	0.2	2.0
9	9-15 May	0.4	4.2	1.7	6.3	0.3	3.1	0.8	4.2	0.5	2.9	0.5	3.8	0.4	3.3	1.0	4.7
10	28-31 May	0.1	2.1	0.8	2.9	0.4	2.8	1.1	4.2	0.3	3.1	0.5	3.9	0.2	2.6	0.8	3.6
11	23-24 Jun					0.3	1.3	1.3	3.0	0.1	1.1	0.4	1.6	0.1	1.1	0.5	1.8
12	27-29 Aug	1.6	7.2	1.5	10.3	0.5	4.7	1.5	6.7	0.0	3.7	0.9	4.6	0.7	5.2	1.3	7.2
13	20-22 Sep	0.4	5.4	1.8	7.6	0.2	2.5	0.2	2.9	0.3	2.6	0.2	3.1	0.3	3.5	0.7	4.5
14	20-22 Oct	0.3	5.7	0.9	6.9	0.1	6.0	0.5	6.6	0.1	1.8	0.0	1.9	0.2	4.5	0.5	5.1
15	17-19 Apr	0.5	5.3	1.7	7.4	0.1	2.0	0.5	2.6	0.3	4.5	0.9	5.6	0.3	3.9	1.0	5.2
	sub-total	0.4	4.2	1.4	6.0	0.3	3.2	0.8	4.3	0.3	2.6	0.5	3.3	0.3	3.3	0.8	4.5
Total Trap Hauls																	
8	10-12 Apr	0.7	5.4	1.9	8.1	0.5	2.4	0.4	3.3	0.3	1.1	0.3	1.6	0.5	3.0	0.9	4.3
9	9-15 May	0.7	4.7	1.5	6.9	0.3	3.0	0.8	4.1	0.4	2.5	0.4	3.3	0.5	3.3	0.9	4.7
10	28-31 May	0.2	2.3	0.6	3.0	0.4	2.8	0.8	4.0	0.5	2.2	0.3	3.0	0.3	2.4	0.6	3.4
11	23-24 Jun	0.7	4.6	0.8	6.0	0.0	0.7	0.2	1.0	0.3	1.3	0.3	2.0	0.3	1.9	0.4	2.6
12	27-29 Aug	1.4	7.7	1.5	10.5	0.6	5.0	1.9	7.4	0.2	1.8	0.4	2.5	0.7	4.8	1.3	6.8
13	20-22 Sep	0.4	4.6	1.4	6.4	0.3	2.3	0.3	2.9	0.6	2.0	0.2	2.8	0.4	3.0	0.6	4.1
14	20-22 Oct	0.7	4.1	0.6	5.3	0.2	4.2	0.3	4.7	0.6	2.2	0.0	2.8	0.5	3.5	0.3	4.3
15	17-19 Apr	0.4	5.8	1.6	7.8	0.2	3.0	0.5	3.7	0.3	2.5	0.5	3.3	0.3	3.8	0.9	4.9
Total (2001-2002)		**0.6**	**4.6**	**1.2**	**6.4**	**0.3**	**3.0**	**0.7**	**4.0**	**0.4**	**2.0**	**0.3**	**2.7**	**0.4**	**3.2**	**0.7**	**4.4**
Study Total		**0.9**	**4.9**	**1.0**	**6.9**	**0.5**	**3.3**	**0.6**	**4.3**	**0.5**	**2.0**	**0.3**	**2.8**	**0.6**	**3.5**	**0.7**	**4.8**
Standard		1.1	5.2	0.9	7.2	0.6	3.3	0.5	4.4	0.6	1.7	0.3	2.6	0.8	3.6	0.6	5.0
Non-standard		0.5	4.2	1.2	5.9	0.4	3.2	0.6	4.2	0.3	2.6	0.4	3.3	0.4	3.3	0.7	4.4

Table 14. Number of legal (>153 mm NW), medium (127-153 mm NW) and small (<127 mm NW) sized male Dungeness crabs that were anchor-tagged in the Nass Estuary during sampling periods, 8 June to 29 November 2000.

Trip	Period of	Sampling Areas												Total			
		Kincolith				Ripple Tongue				Iceberg Bay							
no.	trap hauls	Legal	Med.	Small	Total	Legal	Med.	Small	Total	Legal	Med.	Small	Total	Legal	Med.	Small	Total
Standard Locations of Trap Hauls																	
1	8-11 June	129	9	0	138	56	8	0	64	29	12	0	41	214	29	0	243
2	30 June to 2 July	86	16	0	102					83	35	0	118	169	51	0	220
3	23-25 July	98	8	0	106	103	10	0	113	28	8	0	36	229	26	0	255
4	23-28 August	452	76	0	528	561	121	0	682	72	32	0	104	1085	229	0	1314
5	23-26 Sep	250	32	0	282	0	0	0	0	96	115	0	211	346	147	0	493
	sub-total	1015	141	0	1156	720	139	0	859	308	202	0	510	2043	482	0	2525
Non-standard Locations of Trap Hauls																	
1	8-11 June																
2	30 June to 2 July					223	59	0	282	8	0	0	8	231	59	0	290
3	23-25 July	18	4	0	22	106	33	0	139					124	37	0	161
4	23-28 August																
5	23-26 Sep																
	sub-total	18	4	0	22	329	92	0	421	8	0	0	8	355	96	0	451
Total Trap Hauls																	
1	8-11 June	129	9	0	138	56	8	0	64	29	12	0	41	214	29	0	243
2	30 June to 2 July	86	16	0	102	223	59	0	282	91	35	0	126	400	110	0	510
3	23-25 July	116	12	0	128	209	43	0	252	28	8	0	36	353	63	0	416
4	23-28 August	452	76	0	528	561	121	0	682	72	32	0	104	1085	229	0	1314
5	23-26 Sep	250	32	0	282	0	0	0	0	96	115	0	211	346	147	0	493
Total (2000)		**1033**	**145**	**0**	**1178**	**1049**	**231**	**0**	**1280**	**316**	**202**	**0**	**518**	**2398**	**578**	**0**	**2976**

Table 15. Number of legal (>153 mm NW) and medium (127-153 mm NW) sized male Dungeness crabs that were ultrasonic-tagged in the Nass Estuary between 23 and 28 August 2000.

Trip no.	Period of trap hauls	Sampling Areas: Kincolith Legal	Kincolith Med.	Kincolith Total	Ripple Tongue Legal	Ripple Tongue Med.	Ripple Tongue Total	Iceberg Bay Legal	Iceberg Bay Med.	Iceberg Bay Total	Total Legal	Total Med.	Total Total
Standard Locations of Trap Hauls													
1	8-11 June			0			0			0	0	0	0
2	30 June to 2 July			0						0	0	0	0
3	23-25 July			0			0			0	0	0	0
4	23-28 August	9	1	10	10	3	13	5	2	7	24	6	30
5	23-26 Sep			0			0			0	0	0	0
	sub-total	9	1	10	10	3	13	5	2	7	24	6	30

Table 16. Number of legal (>153 mm NW), medium (127-153 mm NW) and small (<127 mm NW) sized male Dungeness crabs that were anchor-tagged in the Nass Estuary between 9 May and 29 August 2001.

Trip no.	Period of trap hauls	Sampling Areas: Kincolith Legal	Kincolith Med.	Kincolith Small	Kincolith Total	Ripple Tongue Legal	Ripple Tongue Med.	Ripple Tongue Small	Ripple Tongue Total	Iceberg Bay Legal	Iceberg Bay Med.	Iceberg Bay Small	Iceberg Bay Total	Total Legal	Total Med.	Total Small	Total Total
Standard Locations of Trap Hauls																	
9	9-15 May	87	63	0	150	35	15	0	50	69	73	0	142	191	151	0	342
10	28-31 May	27	53	0	80	61	25	0	86	53	71	0	124	141	149	0	290
11	23-24 Jun	60	75	0	135	24	10	0	34	70	55	0	125	154	140	0	294
12	27-29 Aug	23	13	1	37	6	0	0	6	0	0	0	0	29	13	1	43
	sub-total	197	204	1	402	126	50	0	176	192	199	0	391	515	453	1	969
Non-standard Locations of Trap Hauls																	
9	9-15 May	216	179	0	395	393	253	0	646	182	155	0	337	791	587	0	1378
10	28-31 May	71	132	0	203	75	90	0	165	96	72	0	168	242	294	0	536
11	23-24 Jun					6	7	0	13	51	53	0	104	57	60	0	117
12	27-29 Aug	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	sub-total	287	311	0	598	474	350	0	824	329	280	0	609	1090	941	0	2031
Total Trap Hauls																	
9	9-15 May	303	242	0	545	428	268	0	696	251	228	0	479	982	738	0	1720
10	28-31 May	98	185	0	283	136	115	0	251	149	143	0	292	383	443	0	826
11	23-24 Jun	60	75	0	135	30	17	0	47	121	108	0	229	211	200	0	411
12	27-29 Aug	23	13	1	37	6	0	0	6	0	0	0	0	29	13	1	43
Total (2001)		**484**	**515**	**1**	**1000**	**600**	**400**	**0**	**1000**	**521**	**479**	**0**	**1000**	**1605**	**1394**	**1**	**3000**
Study Total		**1517**	**660**	**1**	**2178**	**1649**	**631**	**0**	**2280**	**837**	**681**	**0**	**1518**	**4003**	**1972**	**1**	**5976**

Table 17. Numbers of male Dungeness crabs that were anchor-tagged in 2000 and recovered by release area between 8 June 2000 and 19 April 2002.

	Release area																			
	Kincolith					Ripple Tongue					Iceberg					All Areas				
	No.	Recovered during [a]				No.	Recovered during [a]				No.	Recovered during [a]				No.	Recovered during [a]			
Period	tagged	SMP	NF	CF	Tot.	tagged	SMP	NF	CF	Tot.	tagged	SMP	NF	CF	Tot.	tagged	SMP	NF	CF	Tot.
2000																				
8-11 Jun	138				0	64				0	41				0	243	0	0	0	0
12-29 Jun			1		1			0		0			0		0		0	1	0	1
30 Jun - 2 Jul	102		0		0	282		0		0	126	3	0		3	510	3	0	0	3
3 Jul - 22 Jul			0		0			1		1			0		0		0	1	0	1
23-25 Jul	128	1	0		1	252	1	0		1	36	2	0		2	416	4	0	0	4
26 Jul - 22 Aug			3		3			3		3			0		0		0	6	0	6
23 Aug - 28 Au	528	5	3		8	682	4	0		4	104	12	0		12	1314	21	3	0	24
29 Aug - 22 Sep			9		9			6		6			0		0		0	15	0	15
23-26 Sep	282	10	0		10		2	0		2	211	24	0		24	493	36	0	0	36
27 Sep - 26 Oct			61	110	171			12	185	197			2	75	77		0	75	370	445
27-31 Oct		5	4	12	21		1	0	70	71		7	0	88	95		13	4	170	187
1-27 Nov			24	47	71			1	151	152			0	23	23		0	25	221	246
28 Nov - 31 Dec		5	0		5			0		0			0		0		5	0	0	5
2001																				
1 Jan - 9 Apr			53		53			10		10			0		0		0	63	0	63
10-12 Apr		3	4		7		1	0		1		2	0		2		6	4	0	10
13 Apr - 8 May			22		22			6		6			1		1		0	29	0	29
9-15 May		9	0		9			0		0		5	0		5		14	0	0	14
16-27 May			4		4			5		5			0		0		0	9	0	9
28-31 May		2	1		3		2	1		3		2	2		4		6	4	0	10
1-22 Jun			1		1			1		1			0		0		0	2	0	2
23-24 Jun		1	0		1			0		0		1	0		1		2	0	0	2
25 Jun - 26 Aug			3		3			3		3			0		0		0	6	0	6
27-29 Aug		3	0		3			0		0			0		0		3	0	0	3
30 Aug - 19 Sep			0		0			1		1			0		0		0	1	0	1
20-22 Sep		1	0		1			0		0			0		0		1	0	0	1
23 Sep - 19 Oct			0	10	10			0	20	20			1	12	13		0	1	42	43
20-22 Oct			0	1	1		1	0	1	2		2	0		2		3	0	2	5
23 Oct - 31 Dec			1	5	6			0	4	4			1		1		0	2	9	11
																	0	0	0	
2002																				
1 Jan - 19 Apr			2		2			1		1			0		0		0	3	0	3
Total	**1178**	**45**	**196**	**185**	**426**	**1280**	**12**	**51**	**431**	**494**	**518**	**60**	**7**	**198**	**265**	**2976**	**117**	**254**	**814**	**1185**

[a] NF and CF refer to the Nisga'a fishery (year round) and commercial fishery (1 Oct - 15 Nov), respectively.

Table 18. Numbers of male Dungeness crabs that were ultrasonic-tagged in 2000 and recovered by release area between 23 August 2000 and 31 December 2001.

	Release area																					
	Kincolith						Ripple Tongue						Iceberg						All Areas			
	No.	Recovered during [a]					No.	Recovered during [a]					No.	Recovered during [a]					No.	Recovered during [a]				
Period	tagged	Track	SMP	NF	CF	Tot.	tagged	Track	SMP	NF	CF	Tot.	tagged	Track	SMP	NF	CF	Tot.	tagged	Track	SMP	NF	CF	Tot.
2000																								
23 Aug - 28 Aug	10					0	13					0	7					0	30	0	0	0	0	0
29 Aug - 22 Sep				1		1						0						0		0	0	1	0	1
23-26 Sep		8	2			10		7				7		5	1			6		20	3	0	0	23
27 Sep - 26 Oct					1	1					2	2					2	2		0	0	0	5	5
27-31 Oct		5				5		11				11		4				4		20	0	0	0	20
1-27 Nov				1		1						0						0		0	0	1	0	1
28 Nov - 31 Dec		4				4		1				1						0		5	0	0	0	5
2001																								
1 Jan - 9 Apr						0						0						0		0	0	0	0	0
10-12 Apr						0						0						0		0	0	0	0	0
13 Apr - 8 May						0						0						0		0	0	0	0	0
9-15 May						0						0			1			1		0	1	0	0	1
16-27 May						0						0						0		0	0	0	0	0
28-31 May						0						0						0		0	0	0	0	0
1-22 Jun						0						0						0		0	0	0	0	0
23-24 Jun						0						0						0		0	0	0	0	0
25 Jun - 26 Aug						0						0						0		0	0	0	0	0
27-29 Aug						0						0						0		0	0	0	0	0
30 Aug - 19 Sep						0						0						0		0	0	0	0	0
20-22 Sep						0						0						0		0	0	0	0	0
23 Sep - 19 Oct						0					2	2						0		0	0	0	2	2
20-22 Oct						0						0						0		0	0	0	0	0
23 Oct - 31 Dec						0						0						0		0	0	0	0	0
Total	**10**	**17**	**2**	**2**	**1**	**22**	**13**	**19**	**0**	**0**	**4**	**23**	**7**	**9**	**2**	**0**	**2**	**13**	**30**	**45**	**4**	**2**	**7**	**58**

[a] NF and CF refer to the Nisga'a fishery (year round) and commercial fishery (1 Oct - 15 Nov), respectively.

Table 19. Numbers of male Dungeness crabs that were anchor-tagged in 2001 and recovered by release area between 9 May 2001 and 19 April 2002.

	Release area																			
	Kincolith					Ripple Tongue					Iceberg					All Areas				
	No.	Recovered during [a]				No.	Recovered during [a]				No.	Recovered during [a]				No.	Recovered during [a]			
Period	tagged	SMP	NF	CF	Tot.	tagged	SMP	NF	CF	Tot.	tagged	SMP	NF	CF	Tot.	tagged	SMP	NF	CF	Tot.
2001																				
9-15 May	545	1	0	0	1	696	0	0	0	0	479	0	1	0	1	1720	1	1	0	2
16-27 May		0	7	0	7		0	0	0	0		0	0	0	0		0	7	0	7
28-31 May	283	4	0	0	4	251	3	2	0	5	292	5	0	0	5	826	12	2	0	14
1-22 Jun		0	4	0	4		0	1	0	1		0	1	0	1		0	6	0	6
23-24 Jun	135	4	0	0	4	47	1	0	0	1	229	7	0	0	7	411	12	0	0	12
25 Jun - 26 Aug		0	5	0	5		0	8	0	8		0	7	0	7		0	20	0	20
27-29 Aug	37	4	0	0	4	6	1	0	0	1	0	2	0	0	2	43	7	0	0	7
30 Aug - 19 Sep		0	7	0	7		0	2	0	2		0	4	0	4		0	13	0	13
20-22 Sep		2	0	0	2		4	0	0	4		2	0	0	2		8	0	0	8
23 Sep - 19 Oct		0	1	56	57		0	4	87	91		0	3	108	111		0	8	251	259
20-22 Oct		0	0	22	22		0	2	22	24		4	0	21	25		4	2	65	71
23 Oct - 31 Dec		0	1	22	23		0	2	15	17		0	1	20	21		0	4	57	61
																	0	0	0	
2002																				
1 Jan - 19 Apr		2	2	0	4		2	2	0	4		5	1	0	6		9	5	0	14
Total	**1000**	**17**	**27**	**100**	**144**	**1000**	**11**	**23**	**124**	**158**	**1000**	**25**	**18**	**149**	**192**	**3000**	**53**	**68**	**373**	**494**
Study Total (2000 & 2001 tags)	**2178**	**62**	**223**	**285**	**570**	**2280**	**23**	**74**	**555**	**652**	**1518**	**85**	**25**	**347**	**457**	**5976**	**170**	**322**	**1187**	**1679**

[a] NF and CF refer to the Nisga'a fishery (year round) and commercial fishery (1 Oct - 15 Nov), respectively.

Table 20. Numbers of legal-sized male Dungeness crabs that were anchor-tagged in 2000 and recovered by release area between 8 June 2000 and 19 April 2002.

	Release area																			
	Kincolith					Ripple Tongue					Iceberg					All Areas				
	No.	Recovered during [a]				No.	Recovered during [a]				No.	Recovered during [a]				No.	Recovered during [a]			
Period	tagged	SMP	NF	CF	Tot.	tagged	SMP	NF	CF	Tot.	tagged	SMP	NF	CF	Tot.	tagged	SMP	NF	CF	Tot.
2000																				
8-11 Jun	129				0	56				0	29				0	214	0	0	0	0
12-29 Jun		0	1	0	1		0	0	0	0		0	0	0	0		0	1	0	1
30 Jun - 2 Jul	86	0	0	0	0	223	0	0	0	0	91	2	0	0	2	400	2	0	0	2
3 Jul - 22 Jul		0	0	0	0		0	1	0	1		0	0	0	0		0	1	0	1
23-25 Jul	116	1	0	0	1	209	0	0	0	0	28	2	0	0	2	353	3	0	0	3
26 Jul - 22 Aug		0	3	0	3		0	3	0	3		0	0	0	0		0	6	0	6
23 Aug - 28 Aug	452	5	3	0	8	561	4	0	0	4	72	12	0	0	12	1085	21	3	0	24
29 Aug - 22 Sep		0	9	0	9		0	5	0	5		0	0	0	0		0	14	0	14
23-26 Sep	250	10	0	0	10	0	2	0	0	2	96	19	0	0	19	346	31	0	0	31
27 Sep - 26 Oct		0	58	109	167		0	11	178	189		0	2	71	73		0	71	358	429
27-31 Oct		4	4	12	20		1	0	60	61		2	0	71	73		7	4	143	154
1-27 Nov		0	22	46	68		0	1	144	145		0	0	21	21		0	23	211	234
28 Nov - 31 Dec		4	0	0	4		0	0	0	0		0	0	0	0		4	0	0	4
2001																				
1 Jan - 9 Apr		0	48	0	48		0	10	0	10		0	0	1	1		0	58	1	59
10-12 Apr		1	4	0	5		0	0	0	0		0	0	0	0		1	4	0	5
13 Apr - 8 May		0	19	0	19		0	6	0	6		0	1	0	1		0	26	0	26
9-15 May		8	0	0	8		0	0	0	0		2	0	0	2		10	0	0	10
16-27 May		0	3	0	3		0	5	0	5		0	0	0	0		0	8	0	8
28-31 May		2	1	0	3		1	1	0	2		0	0	0	0		3	2	0	5
1-22 Jun		0	1	0	1		0	1	0	1		0	0	0	0		0	2	0	2
23-24 Jun		1	0	0	1		0	0	0	0		0	0	0	0		1	0	0	1
25 Jun - 26 Aug		0	1	0	1		0	1	0	1		0	0	0	0		0	2	0	2
27-29 Aug		2 [b]	0	0	2		0	0	0	0		0	0	0	0		2 [b]	0	0	2
30 Aug - 19 Sep		0	0	0	0		0	0	0	0		0	0	0	0		0	0	0	0
20-22 Sep		1	0	0	1		0	0	0	0		0	0	0	0		1	0	0	1
23 Sep - 19 Oct		0	0	5	5		0	0	7	7		0	0	6	6		0	0	18	18
20-22 Oct		0	0	0	0		1	0	1	2		1	0	0	1		2	0	1	3
23 Oct - 31 Dec		0	1	4	5		0	0	1	1		0	1	0	1		0	2	5	7
																	0	0	0	
2002																				
1 Jan - 19 Apr		0	0	0	0		0	0	0	0		0	0	0	0		0	0	0	0
Total	**1033**	**39**	**178**	**176**	**393**	**1049**	**9**	**45**	**391**	**445**	**316**	**40**	**4**	**170**	**214**	**2398**	**88**	**227**	**737**	**1052**

[a] NF and CF refer to the Nisga'a fishery (year round) and commercial fishery (1 Oct - 15 Nov), respectively.

[b] 1 recovered crab had moulted.

Table 21. Numbers of legal-sized male Dungeness crabs that were anchor-tagged in 2001 and recovered by release area between 9 May 2001 and 19 April 2002**.**

	Release area																			
	Kincolith					Ripple Tongue					Iceberg					All Areas				
	No.	Recovered during [a]				No.	Recovered during [a]				No.	Recovered during [a]				No.	Recovered during [a]			
Period	tagged	SMP	NF	CF	Tot.	tagged	SMP	NF	CF	Tot.	tagged	SMP	NF	CF	Tot.	tagged	SMP	NF	CF	Tot.
2001																				
9-15 May	303	0	0	0	0	428	0	0	0	0	251	0	1	0	1	982	0	1	0	1
16-27 May		0	7	0	7		0	0	0	0		0	0	0	0	0	0	7	0	7
28-31 May	98	3	0	0	3	136	3	1	0	4	149	3	0	0	3	383	9	1	0	10
1-22 Jun		0	3	0	3		0	1	0	1		0	1	0	1	0	0	5	0	5
23-24 Jun	60	3	0	0	3	30	1	0	0	1	121	2	0	0	2	211	6	0	0	6
25 Jun - 26 Aug		0	5	0	5		0	6	0	6		0	6	0	6	0	0	17	0	17
27-29 Aug	23	4	0	0	4	6	0	0	0	0	0	2	0	0	2	29	6	0	0	6
30 Aug - 19 Sep		0	5	0	5		0	1	0	1		0	1	0	1		0	7	0	7
20-22 Sep		2 [b]	0	0	2		4	0	0	4		2	0	0	2		8 [b]	0	0	8
23 Sep - 19 Oct		0	0	55	55		0	4	84	88		0	3	99	102		0	7	238	245
20-22 Oct		0	0	20	20		0	1	22	23		0	0	20	20		0	1	62	63
23 Oct - 31 Dec		0	1	20	21		0	1	15	16		0	1	18	19		0	3	53	56
																	0	0	0	
2002																				
1 Jan - 19 Apr		2 [b]	1	0	3		0	0	0	0		0	1	0	1		2 [b]	2	0	4
Total	**484**	**14** [b]	**22**	**95**	**131**	**600**	**8**	**15**	**121**	**144**	**521**	**9**	**14**	**137**	**160**	**1605**	**31** [b]	**51**	**353**	**435**
Study Total (2000 & 2001 tags)	**1517**	**53**	**200**	**271**	**524**	**1649**	**17**	**60**	**512**	**589**	**837**	**49**	**18**	**307**	**374**	**4003**	**119**	**278**	**1090**	**1487**

[a] NF and CF refer to the Nisga'a fishery (year round) and commercial fishery (1 Oct - 15 Nov), respectively.

[b] Two crab recoveries (one from 20-22 Sep 2001 period and one from 17-19 Apr 2002 period) from Kincolith had moulted.

Table 22. Numbers of medium-sized male Dungeness crabs that were anchor-tagged in 2000 and recovered by release area between 8 June 2000 and 19 April 2002.

	Release area																			
	Kincolith					Ripple Tongue					Iceberg					All Areas				
	No.	Recovered during [a]				No.	Recovered during [a]				No.	Recovered during [a]				No.	Recovered during [a]			
Period	tagged	SMP	NF	CF	Tot.	tagged	SMP	NF	CF	Tot.	tagged	SMP	NF	CF	Tot.	tagged	SMP	NF	CF	Tot.
2000																				
8-11 Jun	9				0	8				0	12				0	29	0	0	0	0
12-29 Jun		0	0	0	0		0	0	0	0		0	0	0	0		0	0	0	0
30 Jun - 2 Jul	16	0	0	0	0	59	0	0	0	0	35	1	0	0	1	110	1	0	0	1
3 Jul - 22 Jul		0	0	0	0		0	0	0	0		0	0	0	0		0	0	0	0
23-25 Jul	12	0	0	0	0	43	1	0	0	1	8	0	0	0	0	63	1	0	0	1
26 Jul - 22 Aug		0	0	0	0		0	0	0	0		0	0	0	0		0	0	0	0
23 Aug - 28 Aug	76	0	0	0	0	121	0	0	0	0	32	0	0	0	0	229	0	0	0	0
29 Aug - 22 Sep		0	0	0	0		0	1	0	1		0	0	0	0		0	1	0	1
23-26 Sep	32	0	0	0	0	0	0	0	0	0	115	5 [b]	0	0	5	147	5 [b]	0	0	5
27 Sep - 26 Oct		0	3	1	4		0	1	7	8		0	0	4	4		0	4	12	16
27-31 Oct		1	0	0	1		0	0	10	10		5	0	17	22		6	0	27	33
1-27 Nov		0	2	1	3		0	0	7	7		0	0	1	1		0	2	9	11
28 Nov - 31 Dec		1	0	0	1		0	0	0	0		0	0	0	0		1	0	0	1
2001																				
1 Jan - 9 Apr		0	5	0	5		0	0	0	0		0	0	0	0		0	5	0	5
10-12 Apr		2	0	0	2		1 [c]	0	0	1		2	0	0	2		5 [c]	0	0	5
13 Apr - 8 May		0	3	0	3		0	0	0	0		0	0	0	0		0	3	0	3
9-15 May		1 [d]	0	0	1		0	0	0	0		3 [d]	0	0	3		4 [d]	0	0	4
16-27 May		0	1	0	1		0	0	0	0		0	0	0	0		0	1	0	1
28-31 May		0	0	0	0		1	0	0	1		2	2	0	4		3	2	0	5
1-22 Jun		0	0	0	0		0	0	0	0		0	0	0	0		0	0	0	0
23-24 Jun		0	0	0	0		0	0	0	0		1	0	0	1		1	0	0	1
25 Jun - 26 Aug		0	2	0	2		0	2	0	2		0	0	0	0		0	4	0	4
27-29 Aug		1	0	0	1		0	0	0	0		0	0	0	0		1	0	0	1
30 Aug - 19 Sep		0	0	0	0		0	1	0	1		0	0	0	0		0	1	0	1
20-22 Sep		0	0	0	0		0	0	0	0		0	0	0	0		0	0	0	0
23 Sep - 19 Oct		0	0	5	5		0	0	13	13		0	1	6	7		0	1	24	25
20-22 Oct		0	0	1	1		0	0	0	0		1	0	0	1		1	0	1	2
23 Oct - 31 Dec		0	0	1	1		0	0	3	3		0	0	0	0		0	0	4	4
																	0	0	0	
2002																				
1 Jan - 20 Apr		0	2	0	2		0	1	0	1		0	0	0	0		0	3	0	3
Total	**145**	**6**	**18**	**9**	**33**	**231**	**3**	**6**	**40**	**49**	**202**	**20**	**3**	**28**	**51**	**578**	**29**	**27**	**77**	**133**

[a] NF and CF refer to the Nisga'a fishery (year round) and commercial fishery (1 Oct - 15 Nov), respectively.

[b] One crab recovery from Iceberg had moulted.

[c] One crab recovery from Ripple had moulted.

[d] Two crab recoveries, one from Kincolith and one from Iceberg, had moulted.

Table 23. Numbers of medium-sized male Dungeness crabs that were anchor-tagged in 2001 and recovered by release area between 9 May 2001 and 20 April 2002.

	Release area																			
	Kincolith					Ripple Tongue					Iceberg					All Areas				
	No.	Recovered during [a]				No.	Recovered during [a]				No.	Recovered during [a]				No.	Recovered during [a]			
Period	tagged	SMP	NF	CF	Tot.	tagged	SMP	NF	CF	Tot.	tagged	SMP	NF	CF	Tot.	tagged	SMP	NF	CF	Tot.
2001																				
9-15 May	242	1	0	0	1	268	0	0	0	0	228	0	0	0	0	738	1	0	0	1
16-27 May		0	0	0	0		0	0	0	0		0	0	0	0	0	0	0	0	0
28-31 May	185	1	0	0	1	115	0	1	0	1	143	2	0	0	2	443	3	1	0	4
1-22 Jun		0	1	0	1		0	0	0	0		0	0	0	0	0	0	1	0	1
23-24 Jun	75	1	0	0	1	17	0	0	0	0	108	5	0	0	5	200	6	0	0	6
25 Jun - 26 Aug		0	0	0	0		0	2	0	2		0	1	0	1	0	0	3	0	3
27-29 Aug	13	0	0	0	0	0	1	0	0	1	0	0	0	0	0	13	1	0	0	1
30 Aug - 19 Sep		0	2	0	2		0	1	0	1		0	3	0	3		0	6	0	6
20-22 Sep		0	0	0	0		0	0	0	0		0	0	0	0		0	0	0	0
23 Sep - 19 Oct		0	1	1	2		0	0	3	3		0	0	10	10		0	1	14	15
20-22 Oct		0	0	2	2		0	1	0	1		4	0	1	5		4	1	3	8
23 Oct - 31 Dec		0	0	1	1		0	1	0	1		0	0	2	2		0	1	3	4
2002																				
1 Jan - 19 Apr		0	1	0	1		2	2	0	4		5 [b]	0	0	5		7 [b]	3	0	10
Total	**515**	**3**	**5**	**4**	**12**	**400**	**3**	**8**	**3**	**14**	**479**	**16** [b]	**4**	**13**	**33**	**1394**	**22** [b]	**17**	**20**	**59**
Study Total (2000 & 2001 tags)	**660**	**9**	**23**	**13**	**45**	**631**	**6**	**14**	**43**	**63**	**681**	**36**	**7**	**41**	**84**	**1972**	**51**	**44**	**97**	**192**

[a] NF and CF refer to the Nisga'a fishery (year round) and commercial fishery (1 Oct - 15 Nov), respectively.

[b] Four crab recoveries from 17-19 April 2002 sampling period in Iceberg had moulted.

Table 24. Distribution of tag recoveries, by release and recapture area, for legal-sized and medium-sized male Dungeness crabs that were tagged in 2000 in the Nass Estuary, June 2000 to April 2002.

	Legal-sized males				Medium-sized males			
Release site	Recapture site				Recapture site			
From/to	Kincolith	Ripple	Iceberg	Total	Kincolith	Ripple	Iceberg	Total
Kincolith	217	172	4	393	24	7	2	33
Ripple	48	395	2	445	7	39	3	49
Iceberg	5	166	43	214	3	23	25	51
Total	270	733	49	1052	34	69	30	133
Proportion: [a]								
Kincolith	55.2%	43.8%	1.0%	100%	72.7%	21.2%	6.1%	100%
Ripple	10.8%	88.8%	0.4%	100%	14.3%	79.6%	6.1%	100%
Iceberg	2.3%	77.6%	20.1%	100%	5.9%	45.1%	49.0%	100%
Total	25.7%	69.7%	4.7%	100%	25.6%	51.9%	22.6%	100%

[a] Proportions represent the distribution of tag recoveries and not the distributions of the crab population as capture effort was not equal among sites.

Table 25. Distribution of tag recoveries, by release and recapture area, for legal-sized and medium-sized male Dungeness crabs that were tagged in 2001 in the Nass Estuary, May 2001 to April 2002.

	Legal-sized males				Medium-sized males			
Release site	Recapture site				Recapture site			
From/to	Kincolith	Ripple	Iceberg	Total	Kincolith	Ripple	Iceberg	Total
Kincolith	37	86	8	131	8	4		12
Ripple	21	98	25	144	10	3	1	14
Iceberg	17	92	51	160	6	6	21	33
Total	75	276	84	435	24	13	22	59
Proportion: [a]								
Kincolith	28.2%	65.6%	6.1%	100%	66.7%	33.3%	0.0%	100%
Ripple	14.6%	68.1%	17.4%	100%	71.4%	21.4%	7.1%	100%
Iceberg	10.6%	57.5%	31.9%	100%	18.2%	18.2%	63.6%	100%
Total	17.2%	63.4%	19.3%	100%	40.7%	22.0%	37.3%	100%

[a] Proportions represent the distribution of tag recoveries and not the distributions of the crab population as capture effort was not equal among sites.

Table 26. Estimates of legal-sized male Dungeness crabs that were caught in the commercial, Nisga'a and sampling fisheries between 8 June and 31 December 2000.

	Fishery															
	Commercial [a]				Nisga'a [b]				Sampling				Total			
Period	Kin	Ripple	Ice	Total	Kin	Ripple	Ice	Total	Kin	Ripple	Ice	Total	Kin	Ripple	Ice	Total
8-11 Jun	0	0	0	0	286	15	0	301	170	58	29	257	456	73	29	558
12-29 Jun	0	0	0	0	178	9	0	187	0	0	0	0	178	9	0	187
30 Jun - 2 Jul	0	0	0	0	116	6	0	122	86	224	98	408	202	230	98	530
3 Jul - 22 Jul	0	0	0	0	99	5	0	104	0	0	0	0	99	5	0	104
23-25 Jul	0	0	0	0	0	0	0	0	117	210	30	357	117	210	30	357
26 Jul - 22 Aug	0	0	0	0	543	29	0	572	0	0	0	0	543	29	0	572
23 Aug - 28 Aug	0	0	0	0	157	8	0	165	461	565	84	1110	618	573	84	1275
29 Aug - 22 Sep	0	0	0	0	240	13	0	253	0	0	0	0	240	13	0	253
23-26 Sep	0	0	0	0	39	2	0	41	344	61	116	521	383	63	116	562
27 Sep - 26 Oct	0	5807	12001	17808	587	31	0	618	0	0	0	0	587	5838	12001	18426
27-31 Oct	0	2323	4800	7123	236	12	0	248	107	37	15	159	343	2372	4815	7530
1-27 Nov	0	3484	7200	10685	623	33	0	656	0	0	0	0	623	3517	7200	11341
28 Nov - 31 Dec	0	0	0	0	0	0	0	0	71	0	0	71	71	0	0	71
Total	**0**	**11614**	**24001**	**35615**	**3104**	**163**	**0**	**3267**	**1356**	**1155**	**372**	**2883**	**4460**	**12932**	**24373**	**41765**

[a] Of the commercial catches reported from harvest logs in 2001, weights that were reported in pounds were converted into pieces using a factor 1.772 lbs per crab.

[b] Catches are from Bocking et al. (2002) and were proportioned by area using 95% to Kincolith and 5% to Ripple.

Table 27. Estimates of legal-sized male Dungeness crabs that were caught in the commercial, Nisga'a and sampling fisheries between 9 May and 31 December 2001.

	Fishery															
	Commercial [a]				Nisga'a [b]				Sampling				Total			
Period	Kin	Rip	Ice	Total	Kin	Rip	Ice	Total	Kin	Rip	Ice	Total	Kin	Rip	Ice	Total
9-15 May	0	0	0	0	206	11	0	217	304	428	251	983	510	439	251	1200
16-27 May	0	0	0	0	374	20	0	394	0	0	0	0	374	20	0	394
28-31 May	0	0	0	0	0	0	0	0	100	160	131	391	100	160	131	391
1-22 Jun	0	0	0	0	544	29	0	573	0	0	0	0	544	29	0	573
23-24 Jun	0	0	0	0	190	10	0	200	65	30	131	226	255	40	131	426
25 Jun - 26 Aug	0	0	0	0	1101	58	0	1159	0	0	0	0	1101	58	0	1159
27-29 Aug	0	0	0	0	0	0	0	0	186	64	86	336	186	64	86	336
30 Aug - 19 Sep	0	0	0	0	321	17	0	338	0	0	0	0	321	17	0	338
20-22 Sep	0	0	0	0	14	1	0	15	153	84	123	360	167	85	123	375
23 Sep - 19 Oct	0	15806	11996	27802	381	20	0	401	0	0	0	0	381	15826	11996	28203
20-22 Oct	0	3951	2999	6950	57	3	0	60	194	70	59	323	251	4024	3058	7333
23 Oct - 31 Dec	0	3487	2646	6133	317	17	0	334	0	0	0	0	317	3503	2646	6467
Total	**0**	**23244**	**17641**	**40885**	**3506**	**185**	**0**	**3691**	**1002**	**836**	**781**	**2619**	**4508**	**24265**	**18422**	**47195**

[a] Of the commercial catches reported from harvest logs in 2001, weights that were reported in pounds were converted into pieces using a factor 1.772 lbs per crab.

[b] Catches are from Baxter and Stephens (2002) and were proportioned by area using 95% to Kincolith and 5% to Ripple.

Table 28. Estimates of tag removals (tagged in 2000) in commercial and Nisga'a fisheries for legal-sized male Dungeness crabs between 8 June and 31 December 2000.

		Non-Monitored			Monitored				Estimated
Fishery	Total catch	Tags returned	Estimated Catch	% tags	Tags returned[a]	Obs. Catch	% tags	Obs. return rate (%) [b]	Tags Removed[c]
Commercial	35615	665	34404	1.9%	47	1211	3.9%	100.0%	1009
Nisga'a	3267	181	3267	5.5%					181
Sampling	2883				69	2883	2.4%	100.0%	
Total	**41765**	**846**	**37671**	**2.2%**	**116**	**4094**	**2.8%**	**100.0%**	**1190**

[a] Tags were returned during the commercial monitoring and Nisga'a sampling programs.

[b] Observed return rate was assumed to be 100%.

[c] Estimated tags removed=Total catch (by fishery) x Total %tags returned in the monitored programs (2.833%).

Table 29. Estimates of tag removals (tagged in 2001) in commercial and Nisga'a fisheries for legal-sized male Dungeness crabs between 9 May and 31 December 2001.

		Non-Monitored			Monitored				Estimated
Fishery	Total catch	Tags returned	Estimated Catch	% tags	Tags returned[a]	Obs. Catch	% tags	Obs. return rate (%) [b]	Tags Removed[c]
Commercial	40885	291	37777	0.8%	62	3108	2.0%	100.0%	650
Nisga'a	3691	51	3691	1.4%					51
Sampling	2619				29	2619	1.1%	100.0%	
Total	**47195**	**342**	**41468**	**0.8%**	**91**	**5727**	**1.6%**	**100.0%**	**701**

[a] Tags were returned during the commercial monitoring and Nisga'a sampling programs.

[b] Observed return rate was assumed to be 100%.

[c] Estimated tags removed=Total catch (by fishery) x Total %tags returned in the monitored programs (1.589%).

Table 30. Summary of survivorship of legal-sized male crabs that were tagged in 2000 and recovered in Nisga'a and commercial fisheries between 8 June 2000 and 20 April 2002.

	Release Area																			
	Kincolith					Ripple					Iceberg					Total				
Release Period	No. tagged (M)	Recoveries (R)	% Recovered	Mean days at large (T)	Instantaneous Annual Mortality Rate (Z) [a]	No. tagged (M)	Recoveries (R)	% Recovered	Mean days at large (T)	Instantaneous Annual Mortality Rate (Z) [a]	No. tagged (M)	Recoveries (R)	% Recovered	Mean days at large (T)	Instantaneous Annual Mortality Rate (Z) [a]	No. tagged (M)	Recoveries (R)	% Recovered	Mean days at large (T)	Instantaneous Annual Mortality Rate (Z) [a]
8-11 June	129	40	31.0	149.0	2.87	56	11	19.6	162.6	3.65	29	15	51.7	195.5	1.23	214	66	30.8	161.8	2.65
30 June to 2 July	86	40	46.5	131.2	2.13	223	77	34.5	131.3	2.96	91	53	58.2	116.7	1.69	400	170	42.5	126.7	2.46
23-25 July	116	33	28.4	128.0	3.58	209	87	41.6	104.3	3.07	28	15	53.6	108.7	2.10	353	135	38.2	110.6	3.17
23-28 August	452	160	35.4	97.9	3.87	561	261	46.5	75.9	3.68	72	39	54.2	81.3	2.75	1085	460	42.4	84.0	3.73
23-26 Sep	249	81	32.5	77.3	5.30						96	52	54.2	36.1	6.21	345	133	38.6	61.2	5.69
Total	**1032**	**354**	**34.3**	**105.5**	**3.70**	**1049**	**436**	**41.6**	**93.6**	**3.42**	**316**	**174**	**55.1**	**90.8**	**2.40**	**2397**	**964**	**40.2**	**97.5**	**3.41**

[a] Annual Mortality Estimate=-ln(R/M)*(365/T). Source: Smith and Jamieson (1989).

Table 31. Summary of survivorship of legal-sized male crabs that were tagged in 2001 and recovered in Nisga'a and commercial fisheries between 9 May 2001 and 20 April 2002.

	Release Area																			
	Kincolith					Ripple					Iceberg					Total				
Release Period	No. tagged (M)	Recoveries (R)	% Recovered	Mean days at large (T)	Instantaneous Annual Mortality Rate (Z) [a]	No. tagged (M)	Recoveries (R)	% Recovered	Mean days at large (T)	Instantaneous Annual Mortality Rate (Z) [a]	No. tagged (M)	Recoveries (R)	% Recovered	Mean days at large (T)	Instantaneous Annual Mortality Rate (Z) [a]	No. tagged (M)	Recoveries (R)	% Recovered	Mean days at large (T)	Instantaneous Annual Mortality Rate (Z) [a]
9-15 May	303	76	25.1	136.6	3.70	428	89	20.8	145.0	3.95	251	71	28.3	141.0	3.27	982	236	24.0	141.1	3.69
28-31 May	98	17	17.3	127.2	5.03	136	34	25.0	133.1	3.80	148	44	29.7	136.5	3.24	382	95	24.9	133.6	3.80
23-24 Jun	60	14	23.3	106.3	5.00	30	9	30.0	116.8	3.76	121	34	28.1	109.2	4.24	211	57	27.0	109.7	4.36
27-29 Aug	23	9	39.1	45.0	7.61	6	4	66.7	46.8	3.17						29	13	44.8	45.5	6.43
Total	**484**	**116**	**24.0**	**124.5**	**4.19**	**600**	**136**	**22.7**	**137.3**	**3.95**	**520**	**149**	**28.7**	**132.4**	**3.45**	**1604**	**401**	**25.0**	**131.8**	**3.84**

[a] Annual Mortality Estimate=-ln(R/M)*(365/T). Source: Smith and Jamieson (1989).

Table 32. Estimates of the population size of legal-sized male Dungeness crabs in the Nass Estuary, 2000.

Best estimates are bolded.

Area	Marks released (M)	% of total marks	Catch (C)	Tags recov. (R)	Est. of non-return rate (%) [a]	Range of population estimates using natural mortality rates (NMR) [b]					
						NMR (1.0)		NMR (1.5)		NMR (2.0)	
						Estimate	95% CI	Estimate	95% CI	Estimate	95% CI
Kincolith	1033	43.1	4,460	393	0.0	15,492	13300-17900	**15,050**	13000-17400	14,630	12600-16900
Ripple/Iceberg	1365	56.9	37,305	659	29.4	57,028	54600-59600	**55,042**	52700-57400	53,160	50900-55400
Total	2398	100.0	41,765	1052	25.0	72,520	69199-75841	**70,092**	66912-73272	67,790	64744-70836

[a] Non-participation estimate for Ripple/Iceberg (%)=1-(712 [CF tags returned]/1009[estimated removed; Table 28]).

[b] A natural mortality rate accounts for all tag losses (i.e., movement from the study area, tag loss, tagging-induced mortality and natural mortality) other than fishing mortalities.

Table 33. Estimates of the population size of legal-sized male Dungeness crabs in the Nass Estuary, 2001.

Best estimates are bolded.

Area	Marks released (M)	% of total marks	Catch (C)	Tags recov. (R)	Est. of non-return rate (%) [a]	Range of population estimates using natural mortality rates (NMR) [b]					
						NMR (1.0)		NMR (1.5)		NMR (2.0)	
						Estimate	95% CI	Estimate	95% CI	Estimate	95% CI
Kincolith	484	30.2	4,508	131	0.0	39,949	31500-50600	**38,278**	30200-48500	36,713	29000-46500
Ripple/Iceberg	1120	69.8	42,687	304	45.7	64,276	60200-68700	**60,423**	56700-64400	56,953	53500-60600
Total	1604	100.0	47,195	435	42.3	104,225	93816-114634	**98,701**	88816-108586	93,666	84266-103066

[a] Non-participation estimate (%)=1-(353 [CF tags returned]/650[estimated removed; Table 29]).

[b] A natural mortality rate accounts for all tag losses (i.e., movement from the study area, tag loss, tagging-induced mortality and natural mortality) other than fishing mortalities.

Table 34. Estimates of exploitation rates of legal-sized male Dungeness crabs in the Nass Estuary, 2000.
Best estimates are bolded.

	Estimate of catch [a]			Estimate of population [b]			Estimate of exploitation rate		
Area	Comm.	Nisga'a	Total	NMR (1.0)	NMR (1.5)	NMR (2.0)	NMR (1.0)	NMR (1.5)	NMR (2.0)
Kincolith	0	3,785	3,785	15,492	**15,050**	14,630	24.4	**25.1**	25.9
Ripple/Iceberg	35,615	199	35,814	57,028	**55,042**	53,160	62.8	**65.1**	67.4
Total	35,615	3,984	39,599	72,520	**70,092**	67,790	54.6	**56.5**	58.4

[a] Commercial catch is from Table 26. Nisga'a catch includes all catch from June 2000 to April 2001 (Bocking et al. 2002).

[b] Estimates of population are from Table 32 using natural mortality rates between 1.0 and 2.0.

Table 35. Estimates of exploitation rates of legal-sized male Dungeness crabs in the Nass Estuary, 2001.
Best estimates are bolded.

	Estimate of total catch [a]			Estimate of population [b]			Estimate of exploitation rate		
Area	Comm.	Nisga'a	Total	NMR (1.0)	NMR (1.5)	NMR (2.0)	NMR (1.0)	NMR (1.5)	NMR (2.0)
Kincolith	0	4,597	4,597	39,949	**38,278**	36,713	11.5	**12.0**	12.5
Ripple/Iceberg	40,885	242	41,127	64,276	**60,423**	56,953	64.0	**68.1**	72.2
Total	40,885	4,839	45,724	104,225	**98,701**	93,666	43.9	**46.3**	48.8

[a] Commercial catch is from Table 27. Nisga'a catch includes all catch from May 2001 to April 2002 (Baxter and Stephens 2002).

[b] Estimates of population are from Table 33 using natural mortality rates between 1.0 and 2.0.

FIGURES

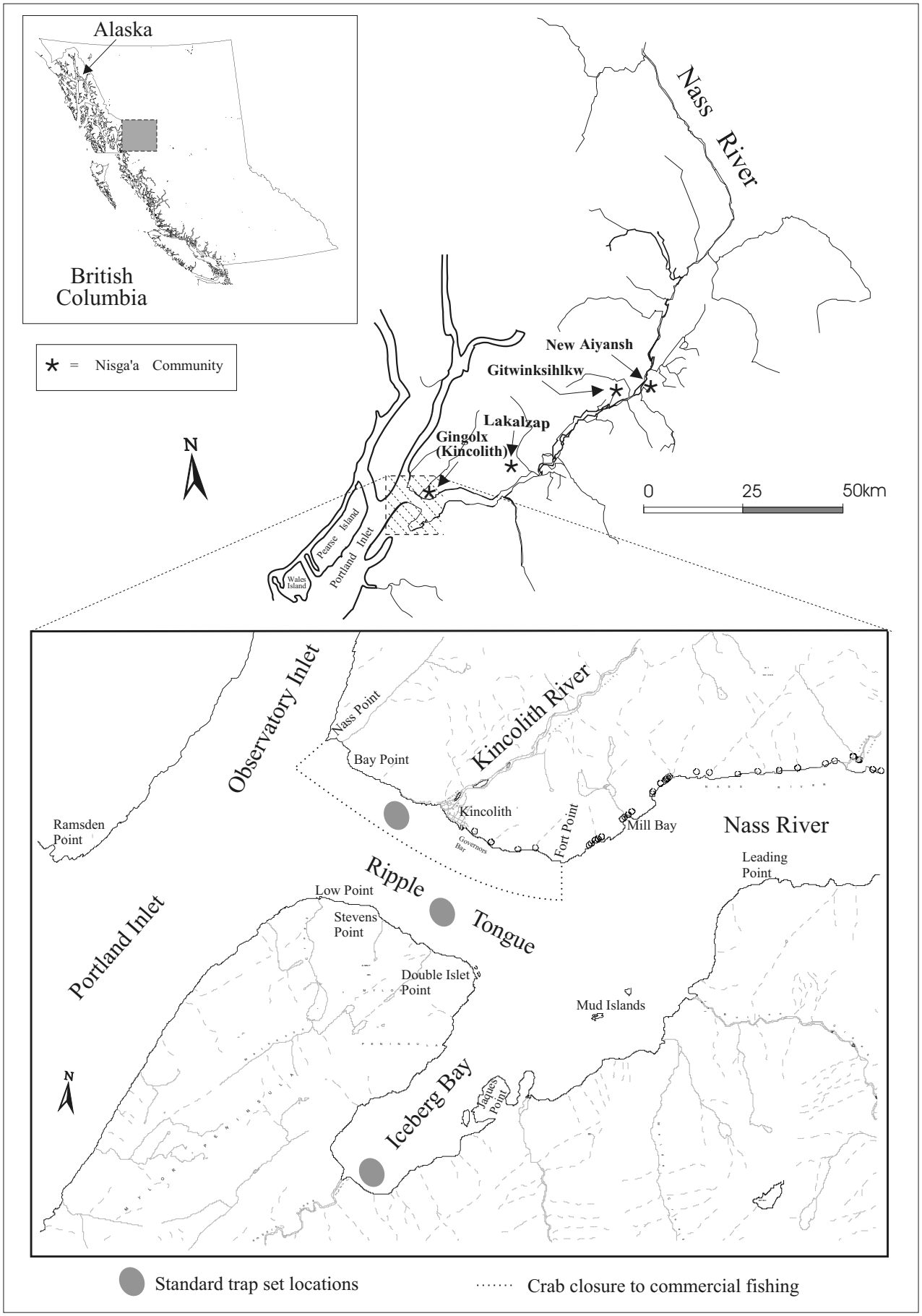


Figure 1. The Nass watershed and estuary showing Nass communities and locations of standard trap sets for capturing Dungeness crabs.

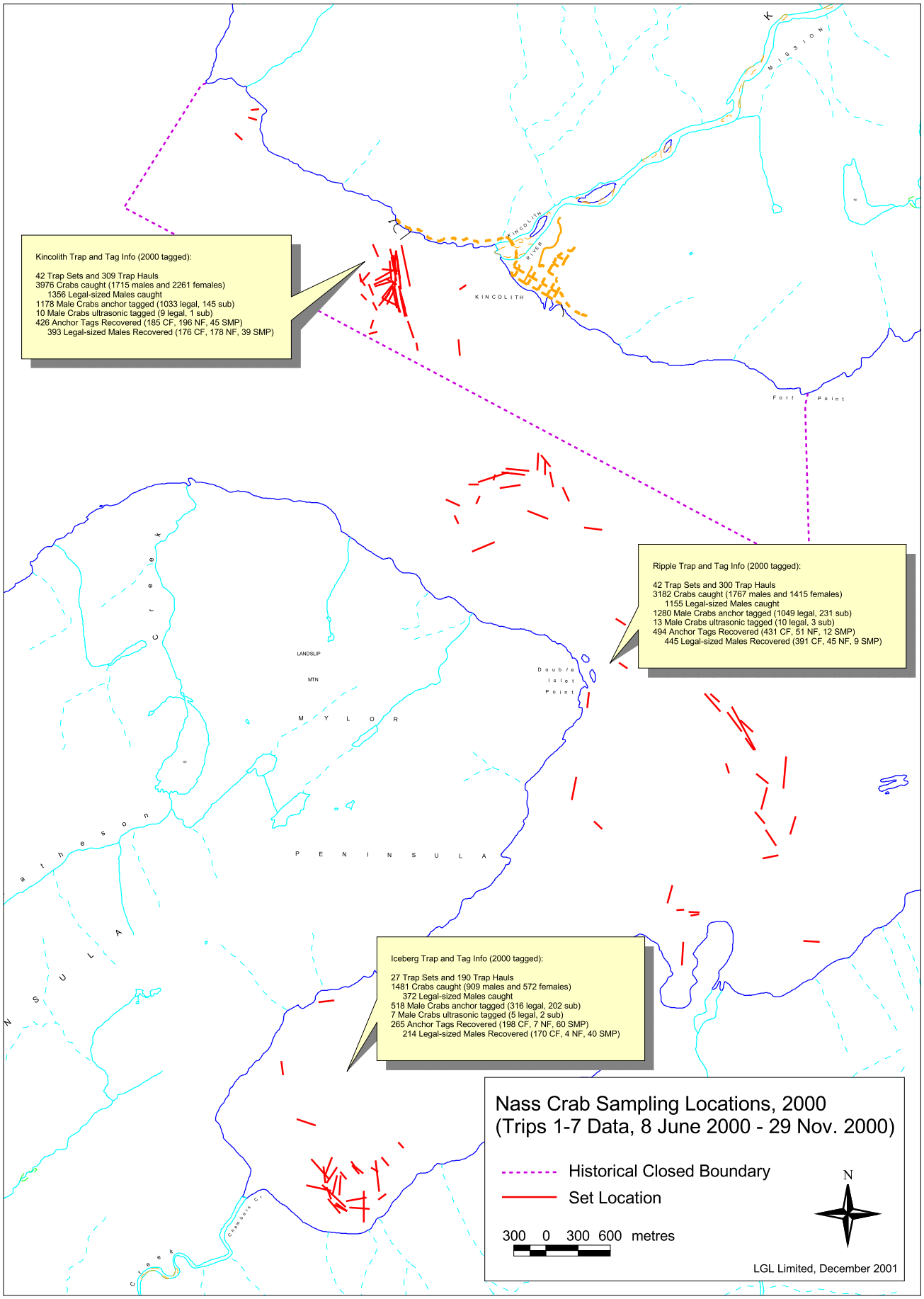


Figure 2. Locations of trap sets for capturing Dungeness Crabs in the Nass Estuary from 8 June 2000 to 29 November 2000.

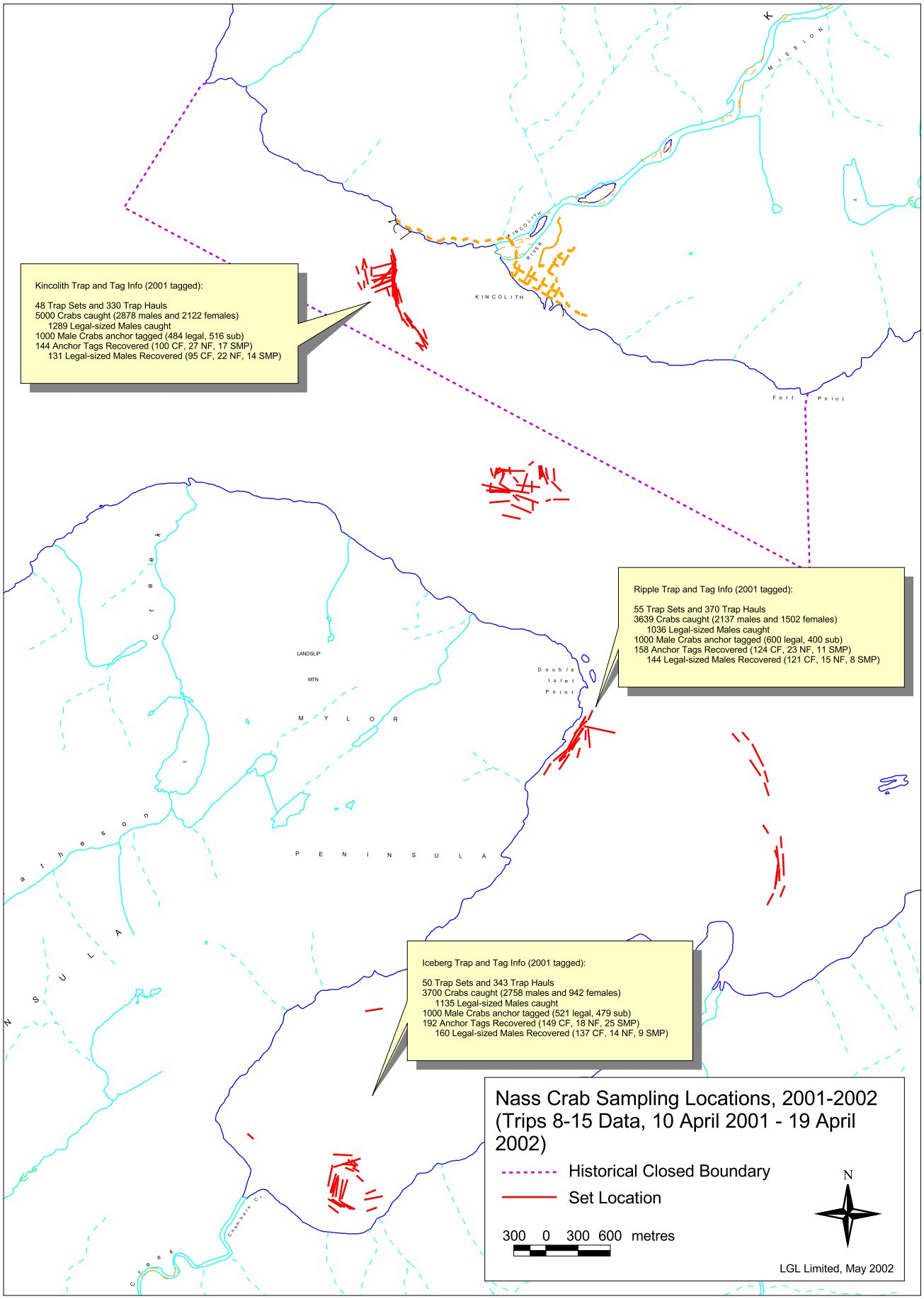


Figure 3. Locations of trap sets for capturing Dungeness Crabs in the Nass Estuary from 10 April 2001 to 19 April 2002.

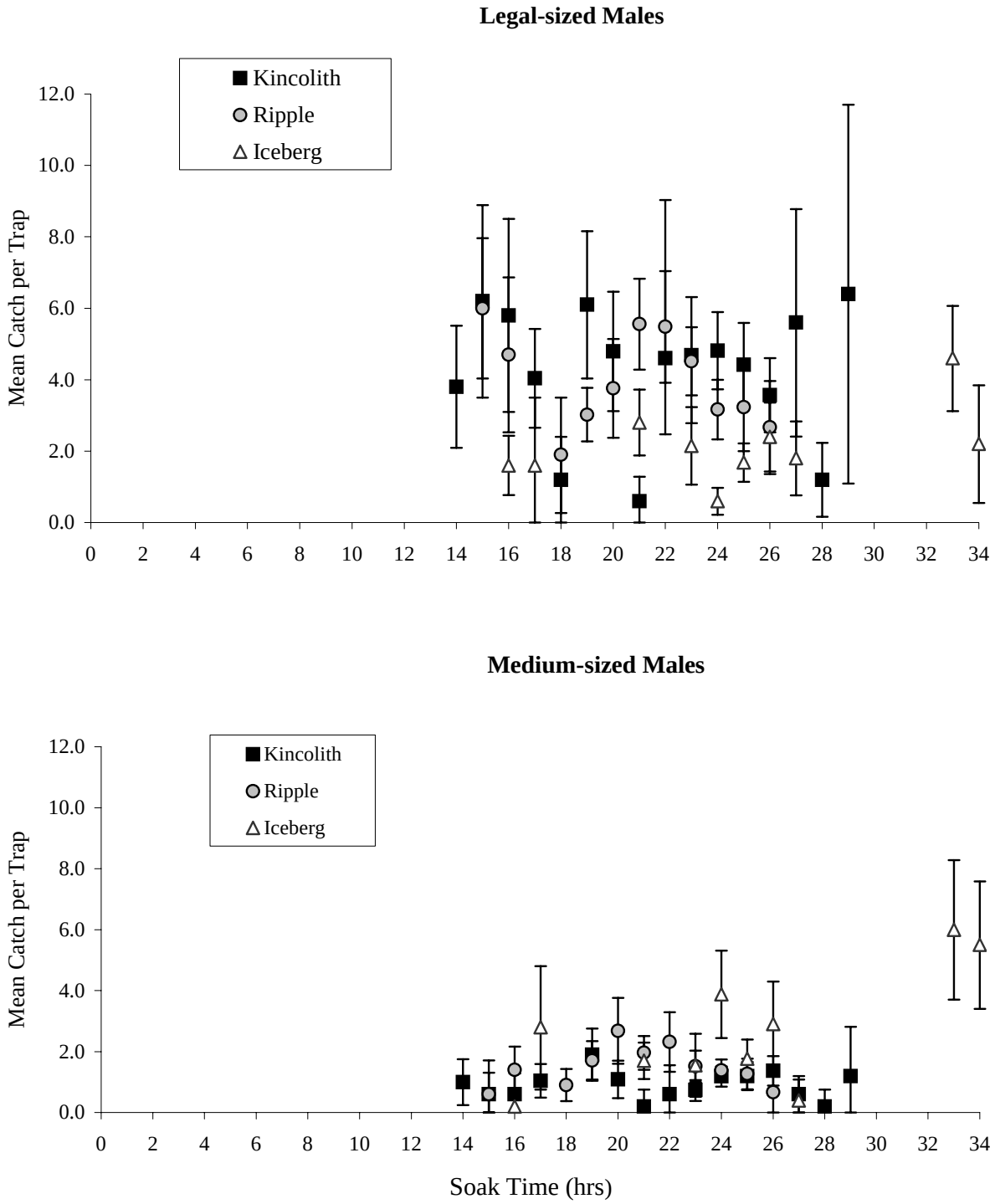


Figure 4. Relationship between soak time (hrs) of traps and catch per trap of legal- and medium-sized male Dungeness crabs in the Nass Estuary, 8 June to 29 November 2000.

Error bars depict 95% confidence levels.

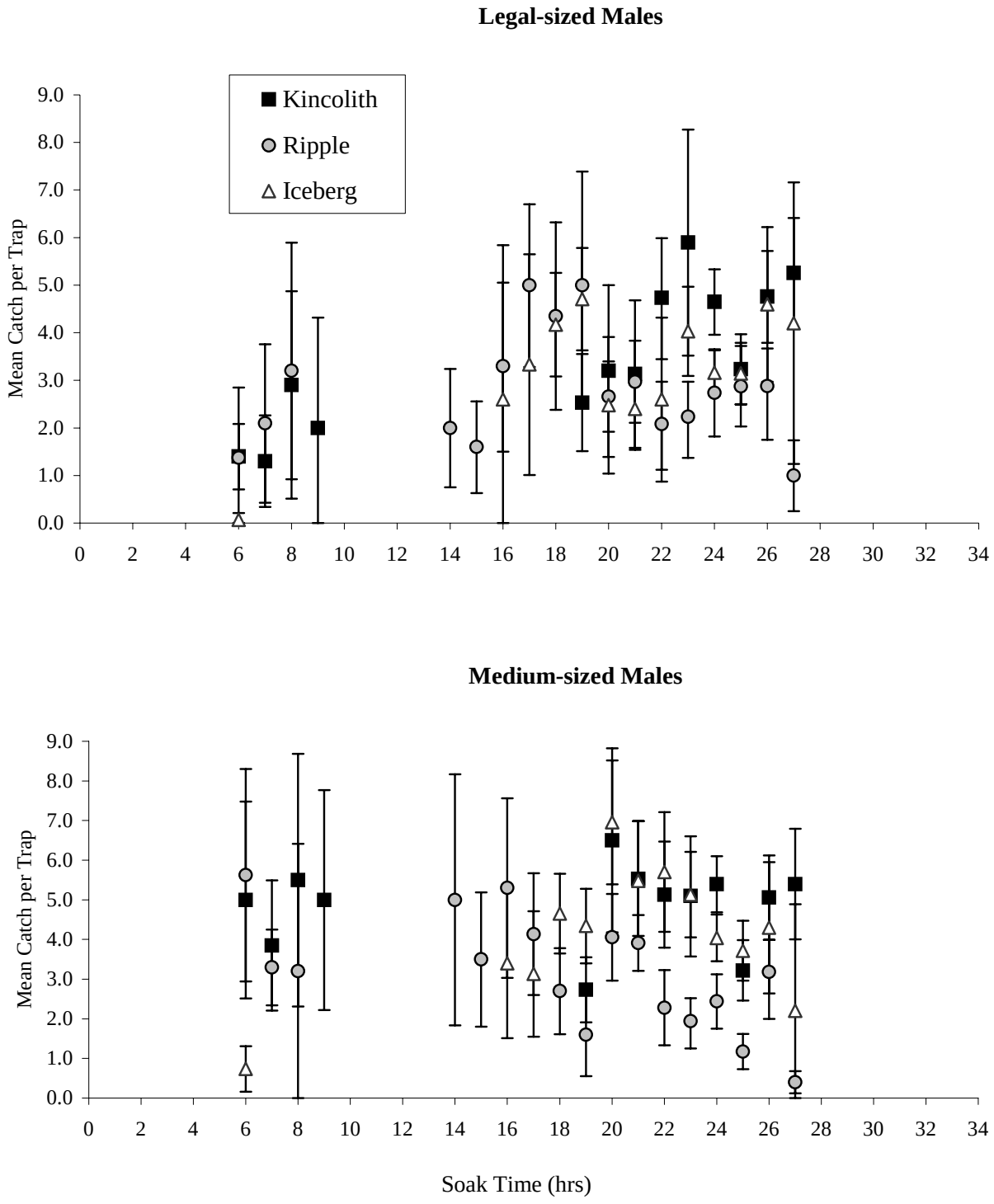


Figure 5. Relationship between soak time (hrs) of traps and catch per trap of legal- and medium-sized male Dungeness crabs in the Nass Estuary, 10 April 2001 to 19 April 2002.

Error bars depict 95% confidence levels.

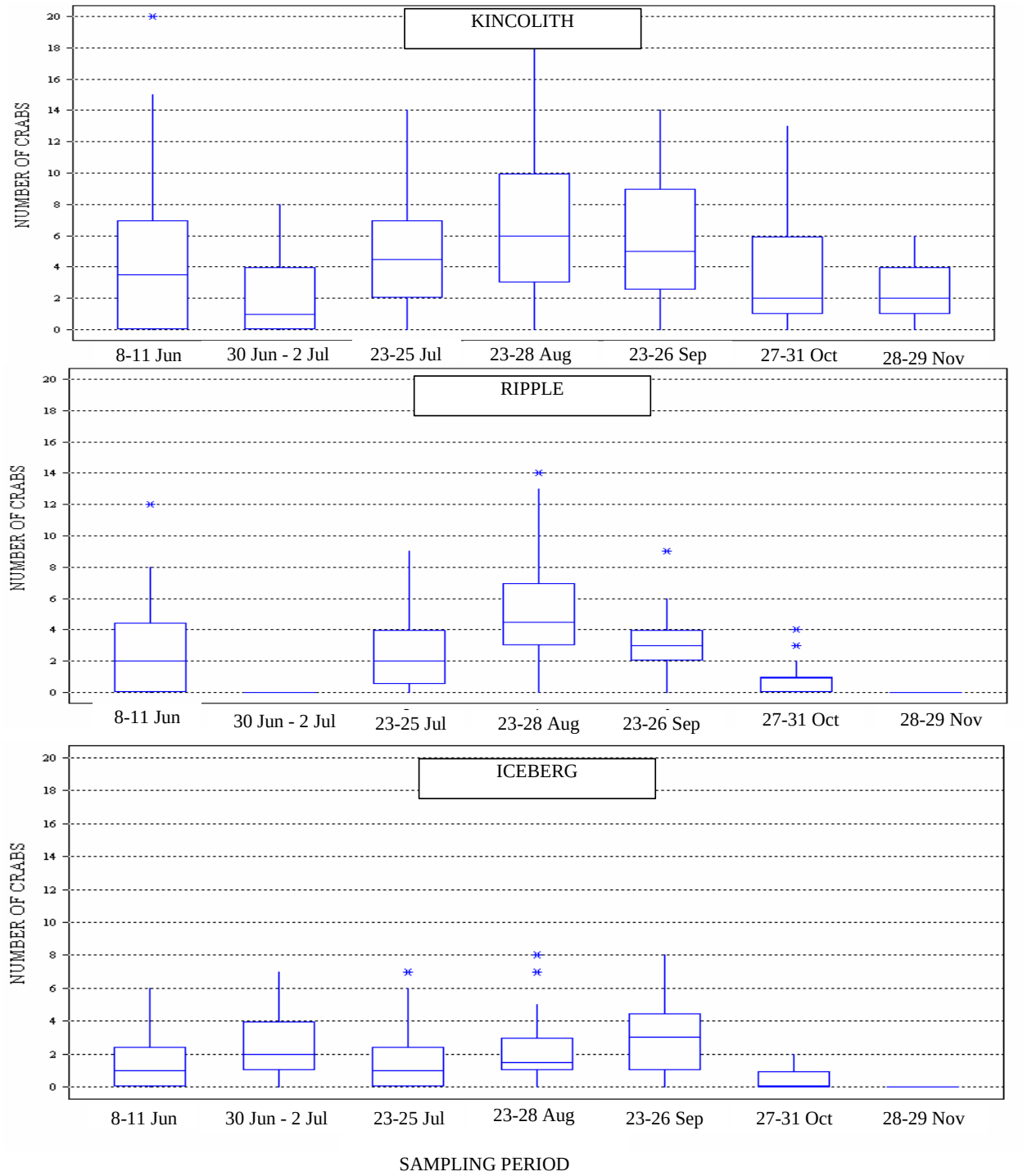


Figure 6. Box and whisker plots of the number of legal-sized male Dungeness crabs caught in traps from standard sets in the Nass estuary, 8 June to 29 November 2000.

A box encloses middle 50% of the number caught, the line bisecting the box represents the median number caught, and the whiskers show the range of the quartiles. Outlier points were identified by STATISTIX as possible (star) and probable (circle) outliers.

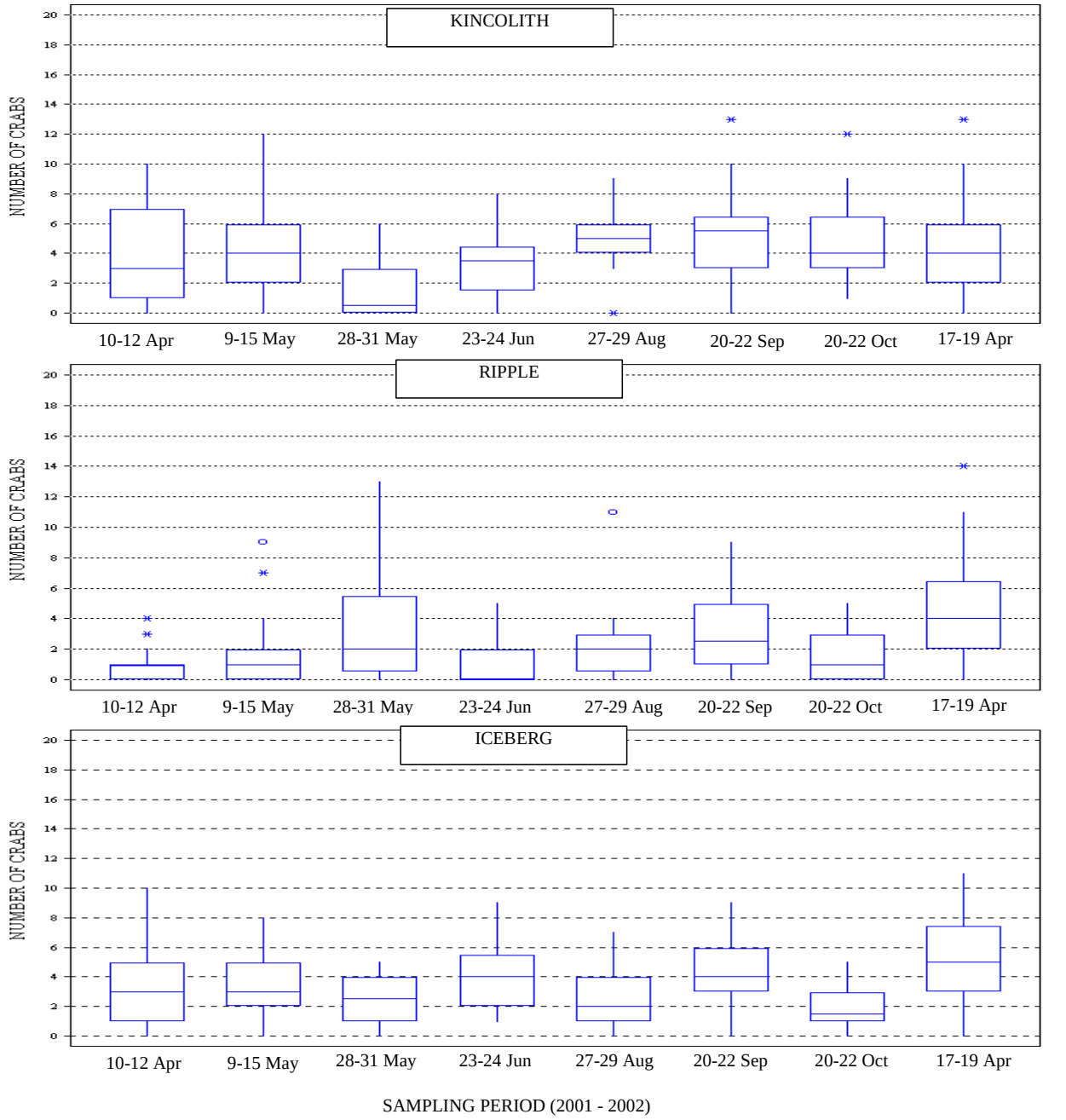


Figure 7. Box and whisker plots of the number of legal-sized male Dungeness crabs caught in traps from standard sets in the Nass estuary, 10 April 2001 to 19 April 2002.

A box encloses middle 50% of the number caught, the line bisecting the box represents the median number caught, and the whiskers show the range of the quartiles. Outlier points were identified by STATISTIX as possible (star) and probable (circle) outliers.

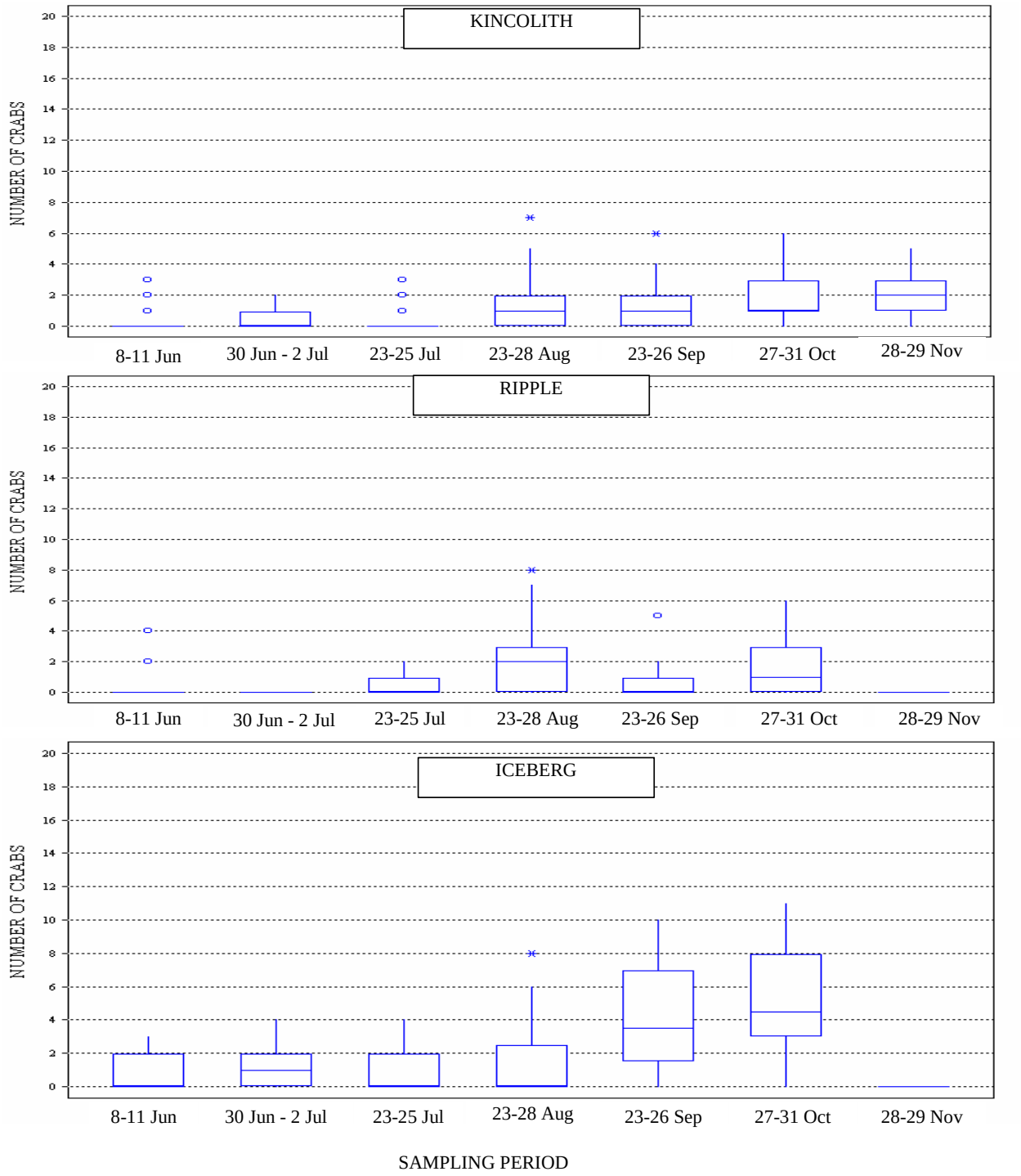


Figure 8. Box and whisker plots of the number of medium-sized male Dungeness crabs caught in traps from standard sets in the Nass estuary, 8 June to 29 November 2000.

A box encloses middle 50% of the number caught, the line bisecting the box represents the median number caught, and the whiskers show the range of the quartiles. Outlier points were identified by STATISTIX as possible (star) and probable (circle) outliers.

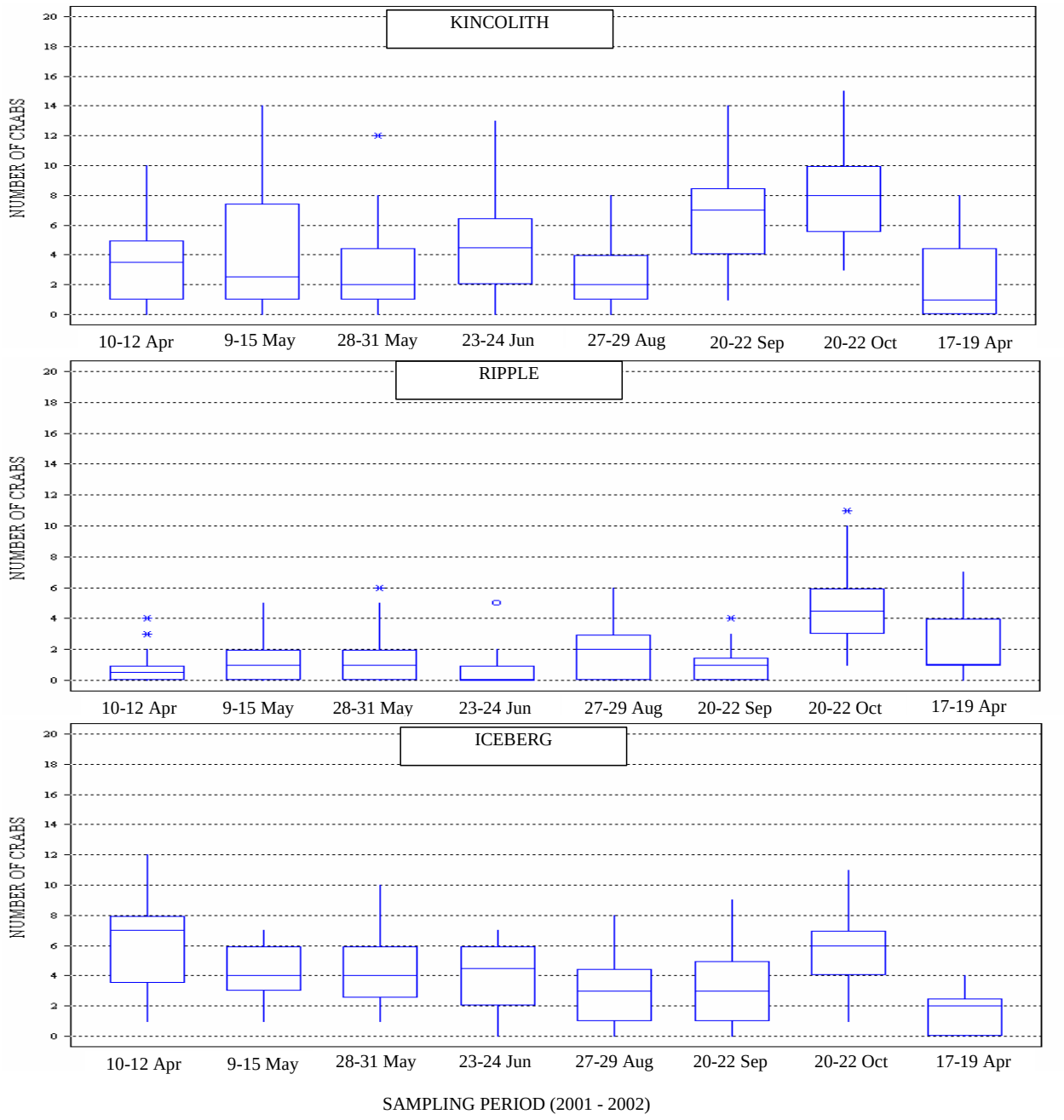


Figure 9. Box and whisker plots of the number of medium-sized male Dungeness crabs caught in traps from standard sets in the Nass estuary, 10 April 2001 to 19 April 2002.

A box encloses middle 50% of the number caught, the line bisecting the box represents the median number caught, and the whiskers show the range of the quartiles. Outlier points were identified by STATISTIX as possible (star) and probable (circle) outliers.

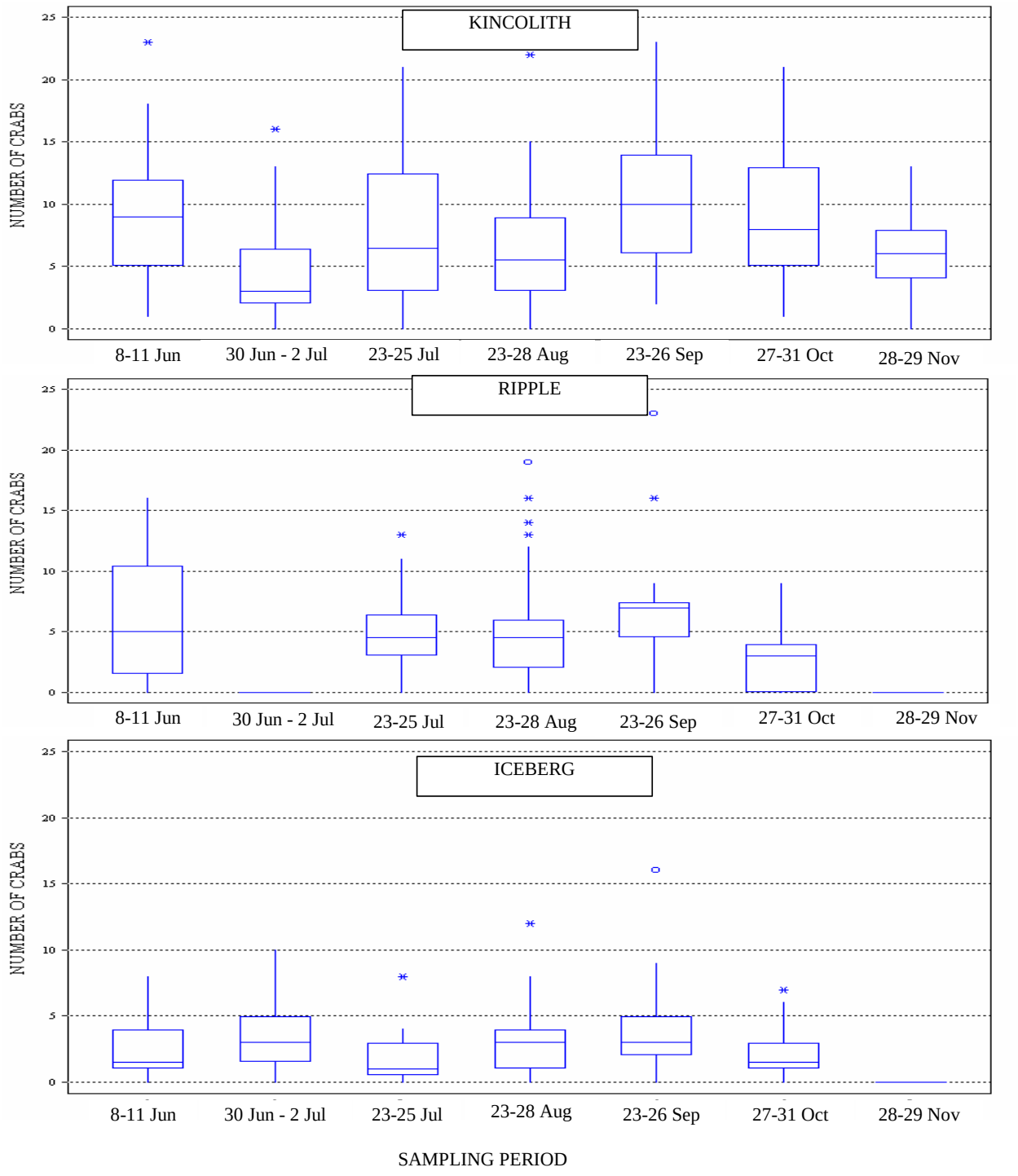


Figure 10. Box and whisker plots of the number of female Dungeness crabs caught in traps from standard sets in the Nass estuary, 8 June to 29 November 2000.

A box encloses middle 50% of the number caught, the line bisecting the box represents the median number caught, and the whiskers show the range of the quartiles. Outlier points were identified by STATISTIX as possible (star) and probable (circle) outliers.

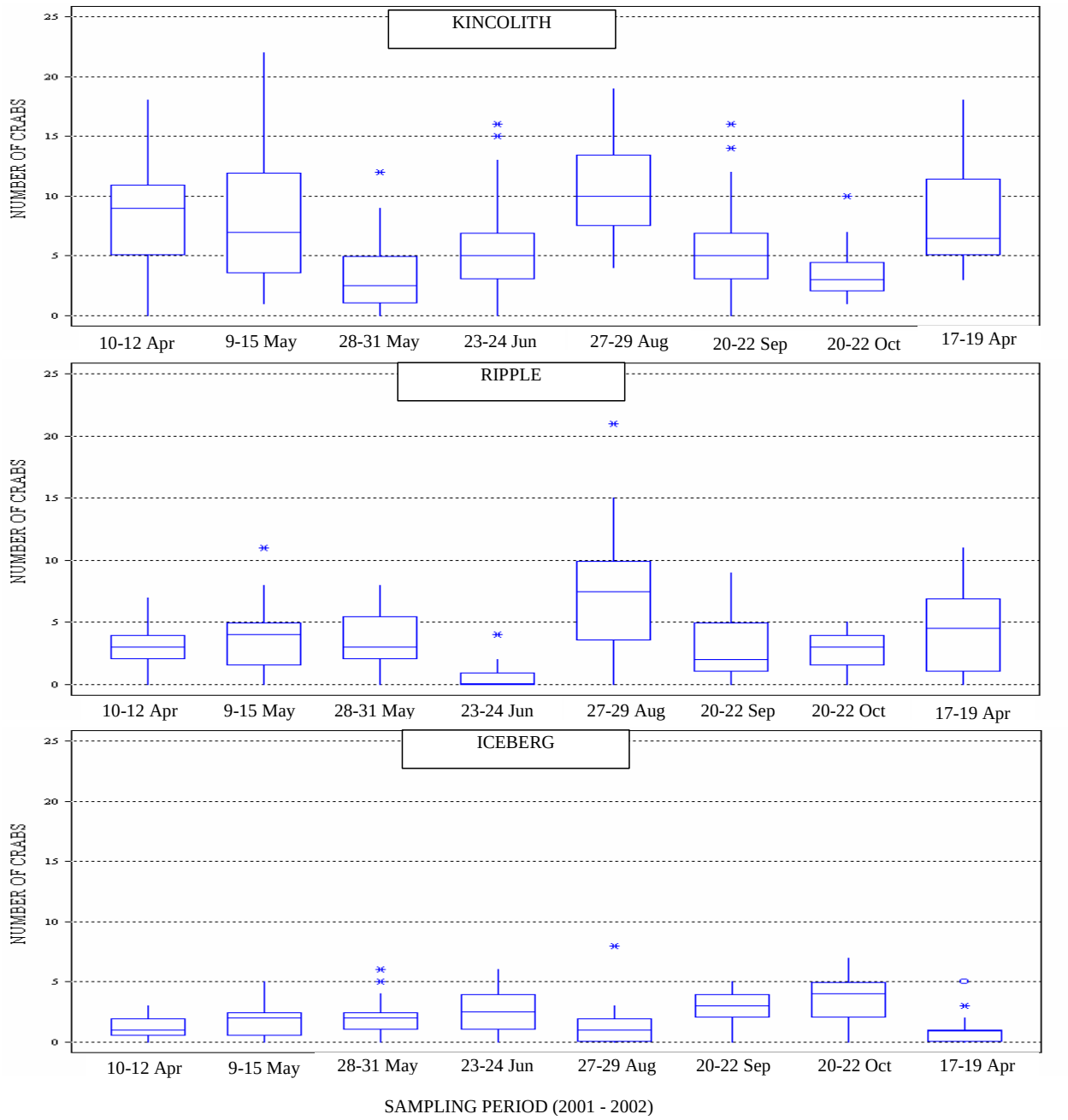


Figure 11. Box and whisker plots of the number of female Dungeness crabs caught in traps from standard sets in the Nass estuary, 10 April 2001 to 19 April 2002.

A box encloses middle 50% of the number caught, the line bisecting the box represents the median number caught, and the whiskers show the range of the quartiles. Outlier points were identified by STATISTIX as possible (star) and probable (circle) outliers.

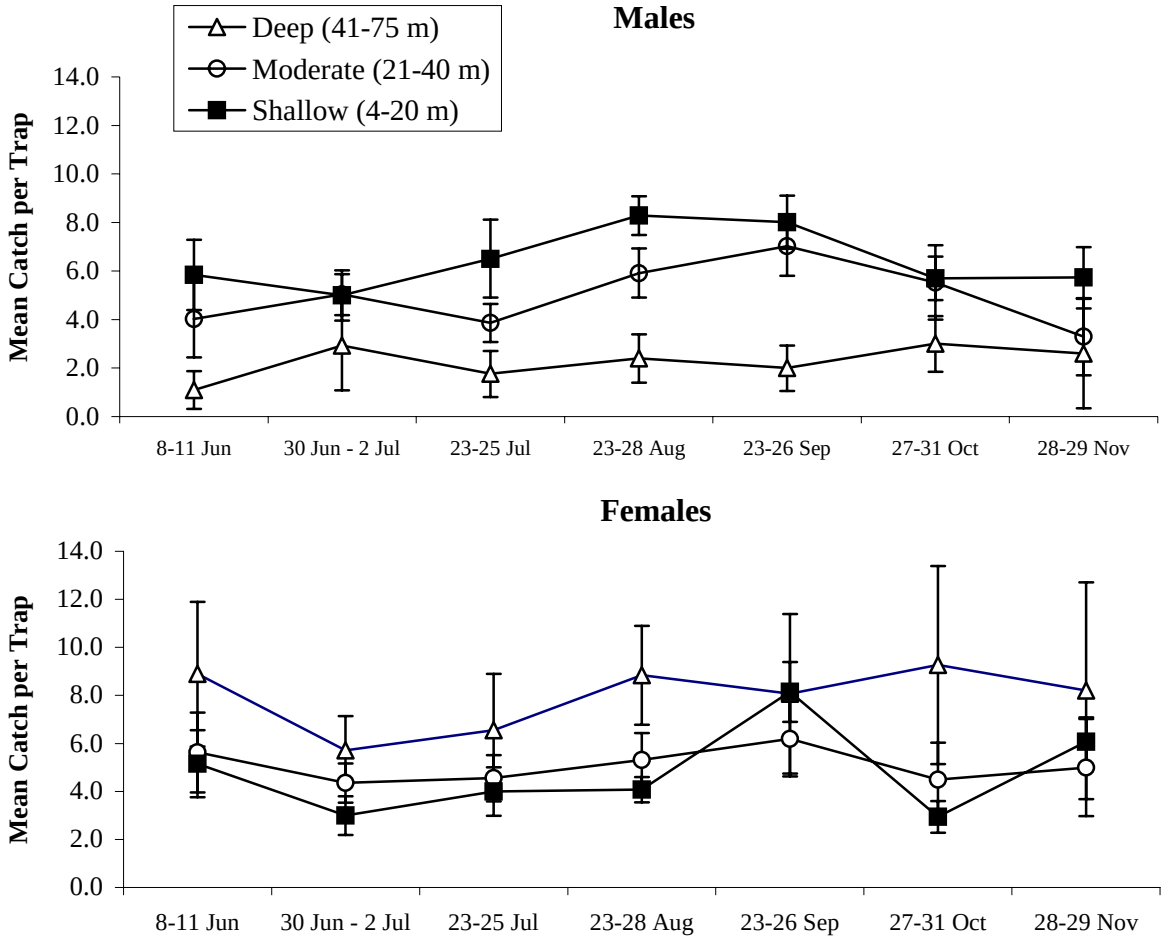


Figure 12. Mean catch per trap of male and female Dungeness crab caught at shallow, moderate and deep depths in the Nass Estuary, 8 June to 29 November 2000.

Error bars depict 95% confidence levels.

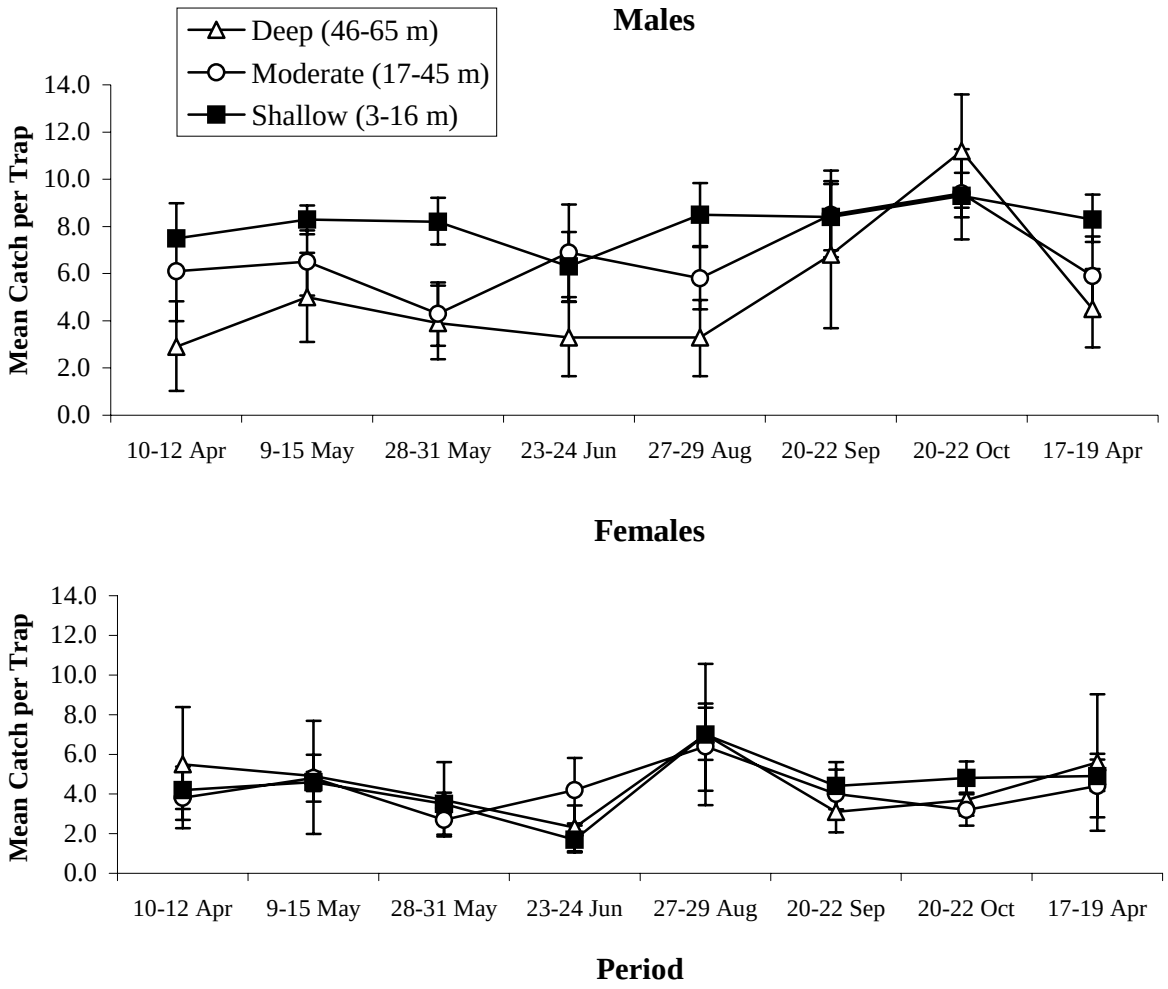


Figure 13. Mean catch per trap of male and female Dungeness crab caught at shallow, moderate and deep depths in the Nass Estuary, 10 April 2001 to 19 April 2002.

Error bars depict 95% confidence levels.

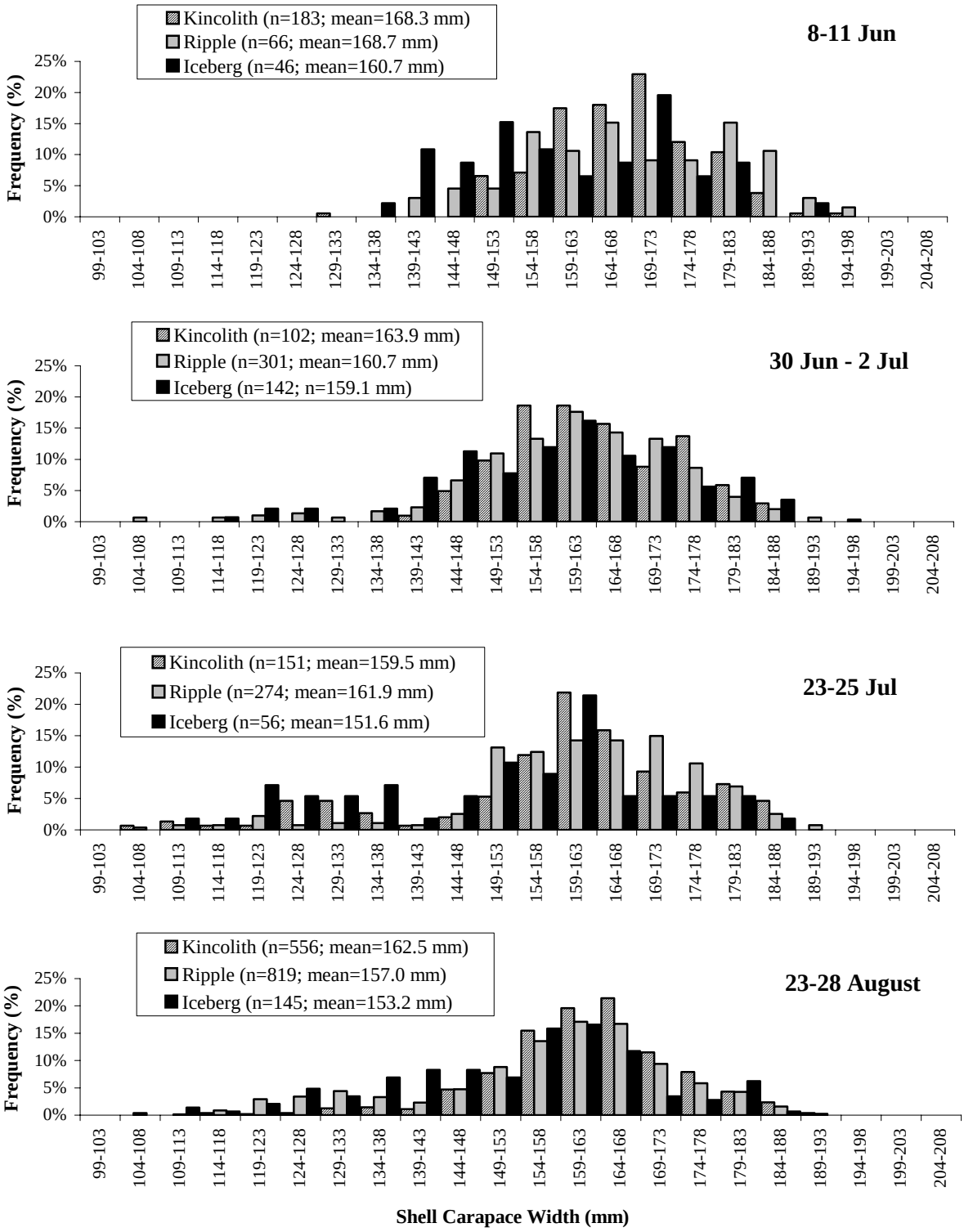


Figure 14. The frequency of shell carapace widths for male Dungeness crab caught in the Nass Estuary between 8 June and 28 August 2000.

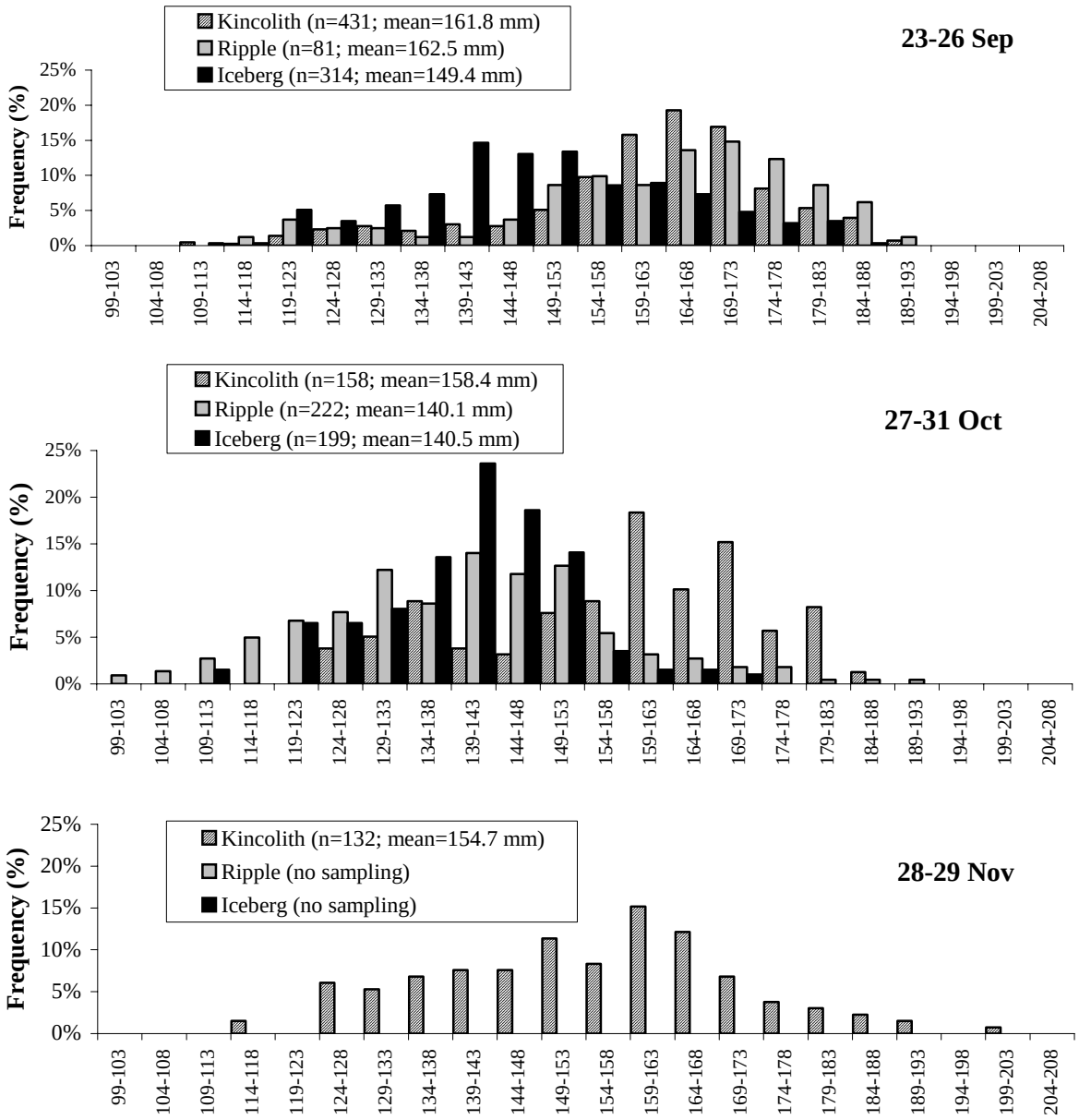


Figure 15. The frequency of shell carapace widths for male Dungeness crab caught in the Nass Estuary between 23 September and 29 November 2000.

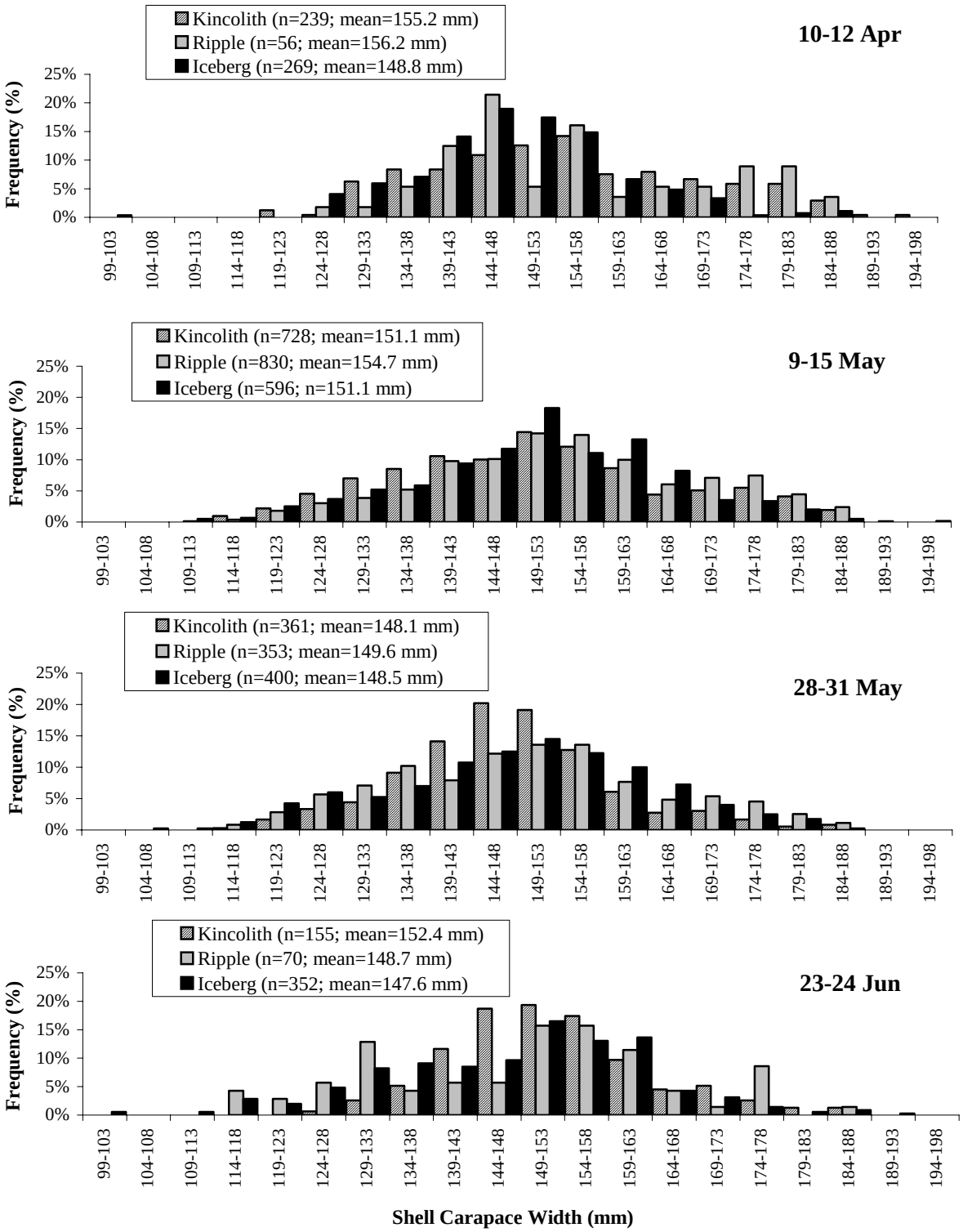


Figure 16. The frequency of shell carapace widths for male Dungeness crab caught in the Nass Estuary between 10 April and 24 June 2001.

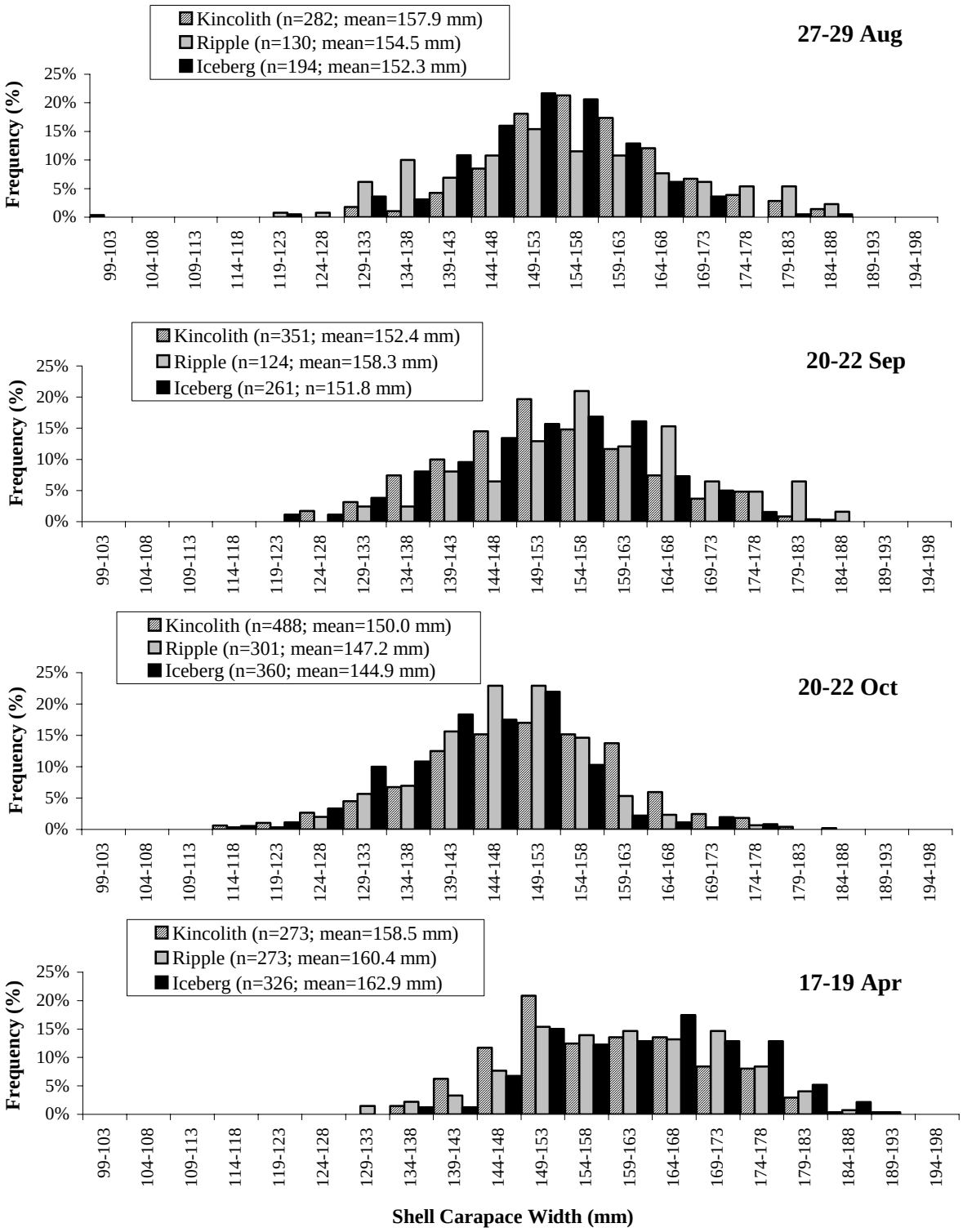


Figure 17. The frequency of shell carapace widths for male Dungeness crab caught in the Nass Estuary between 27 August 2001 and 19 April 2002.

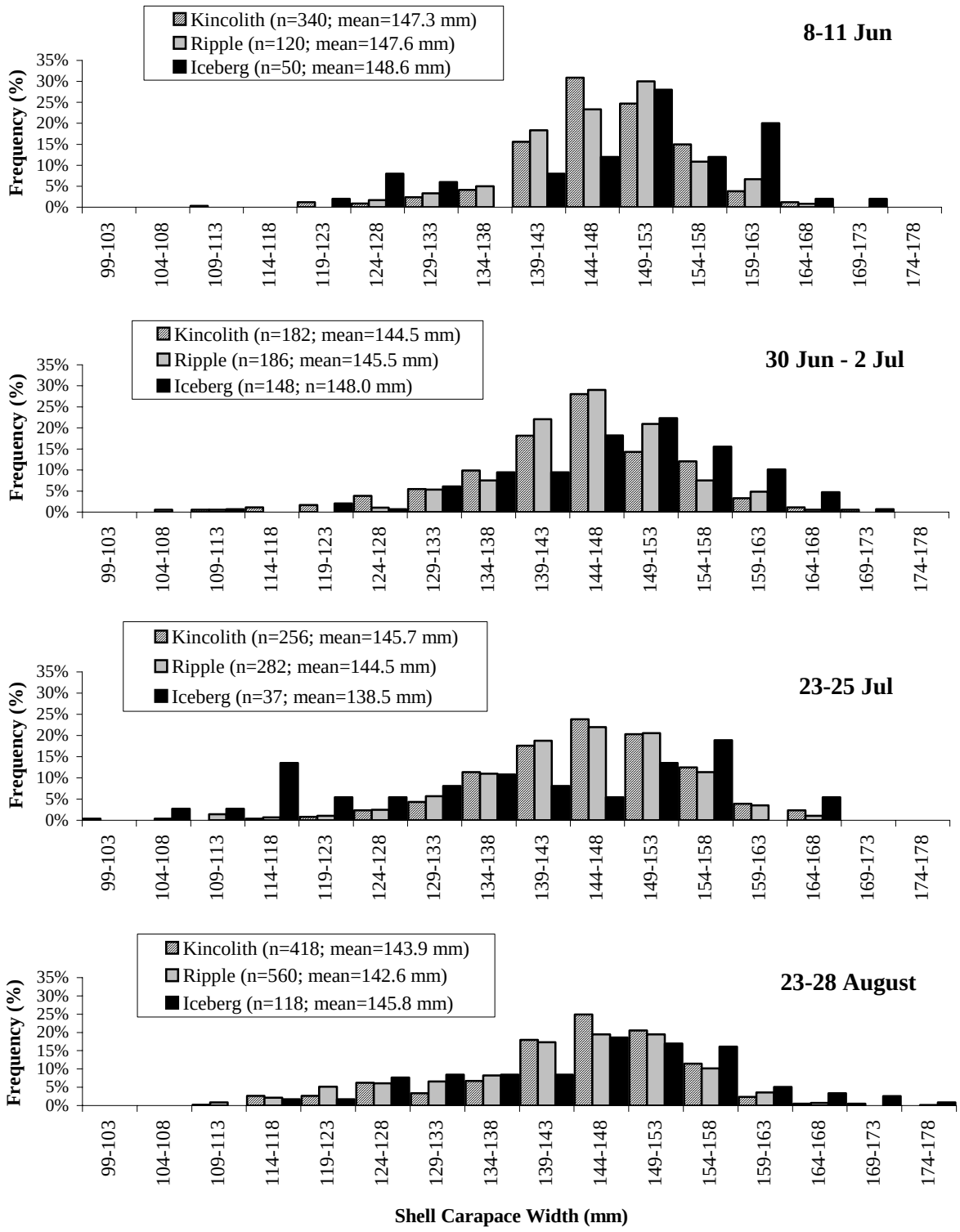


Figure 18. The frequency of shell carapace widths for female Dungeness crab caught in the Nass Estuary between 8 June and 28 August 2000.

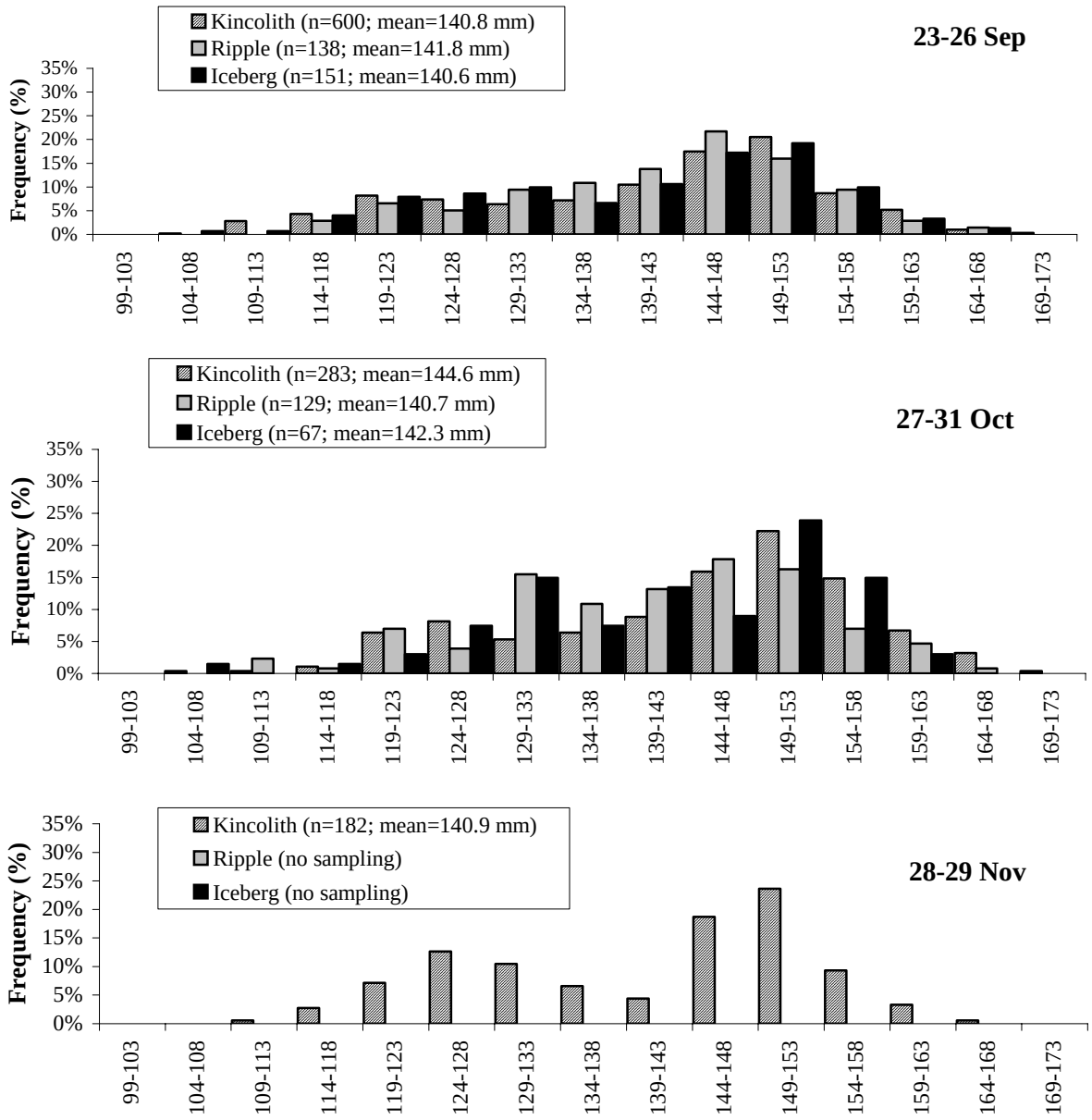


Figure 19. The frequency of shell carapace widths for female Dungeness crab caught in the Nass Estuary between 23 September and 29 November 2000.

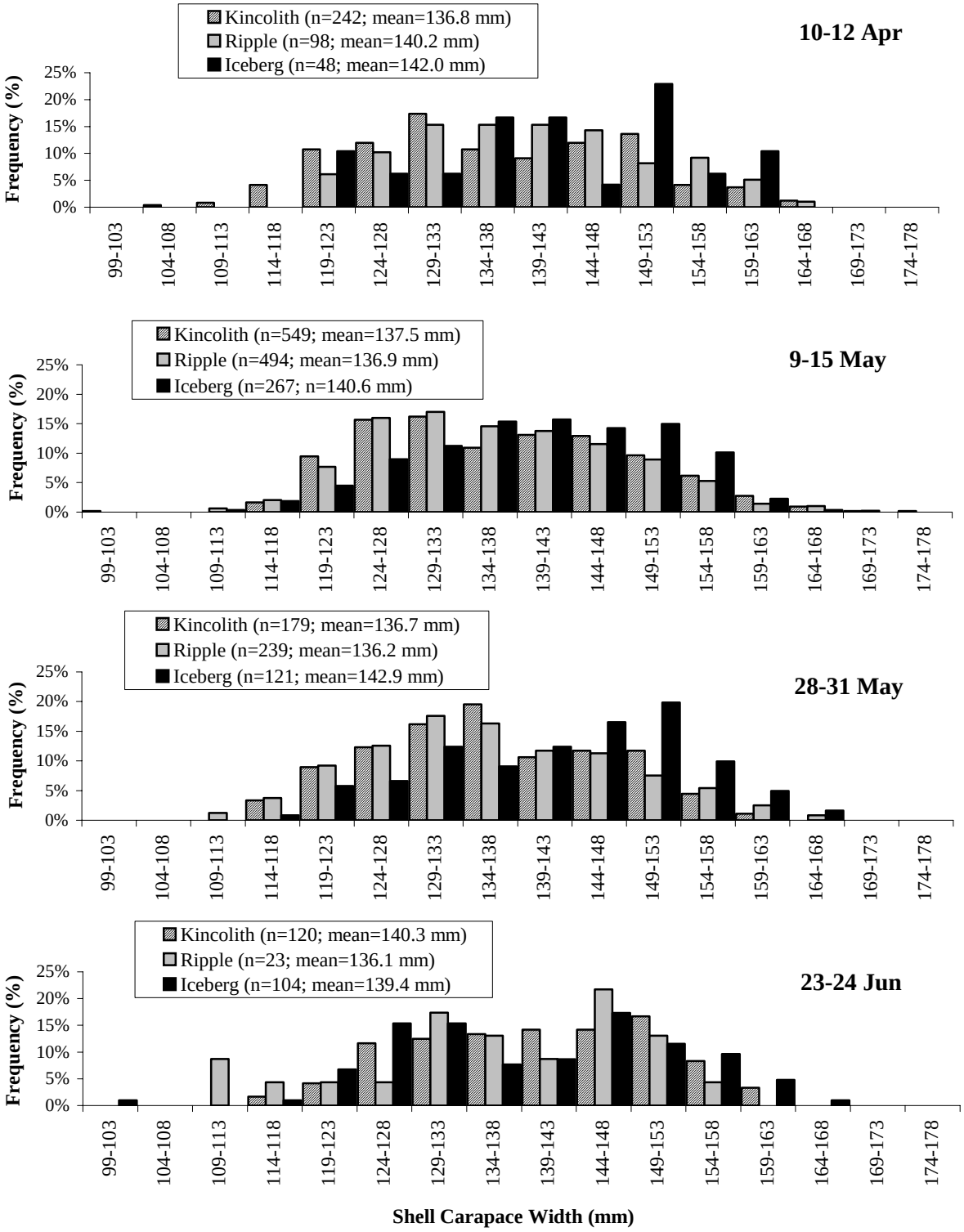


Figure 20. The frequency of shell carapace widths for female Dungeness crab caught in the Nass Estuary between 10 April and 24 June 2001.

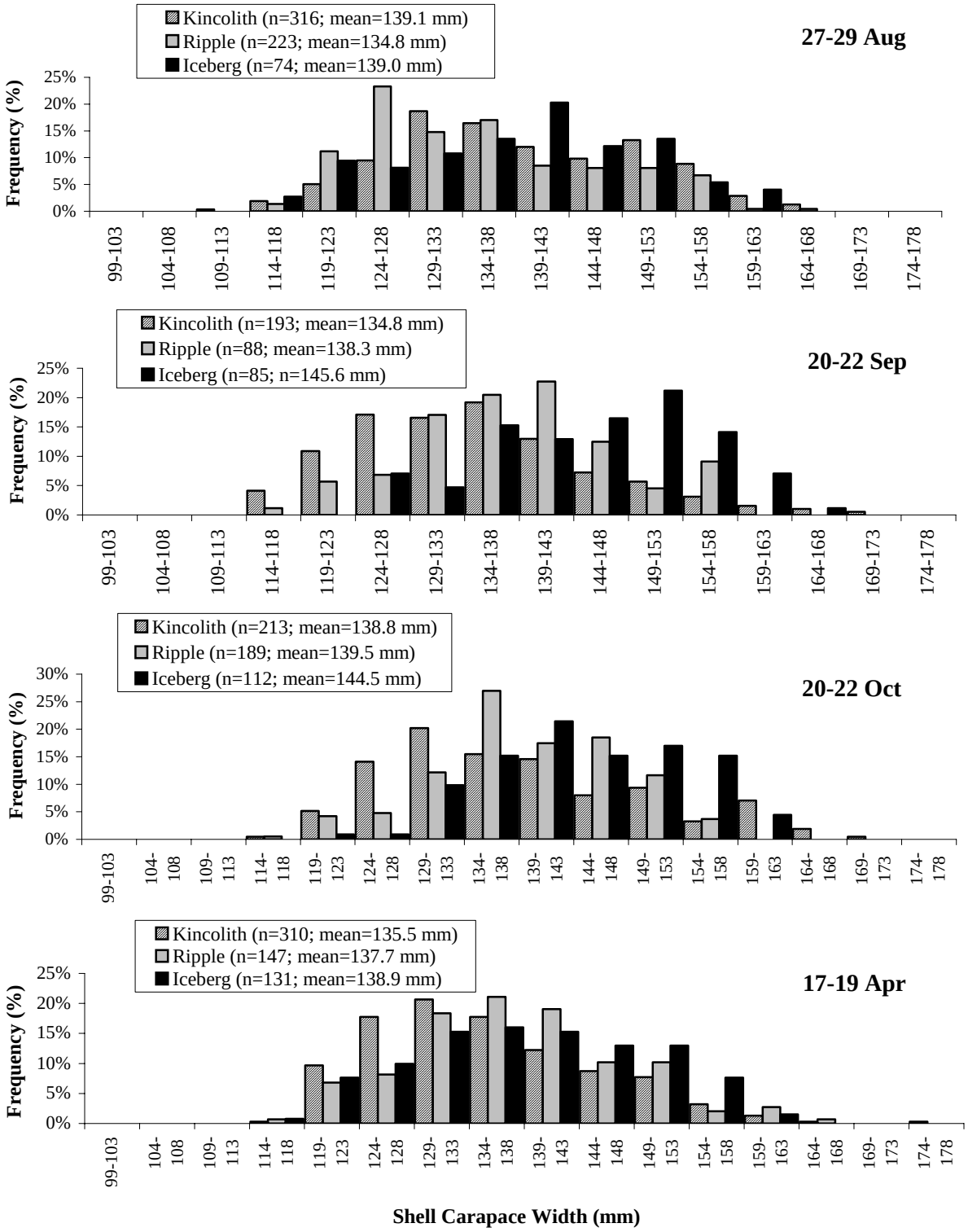


Figure 21. The frequency of shell carapace widths for female Dungeness crab caught in the Nass Estuary between 27 August 2001 and 19 April 2002.

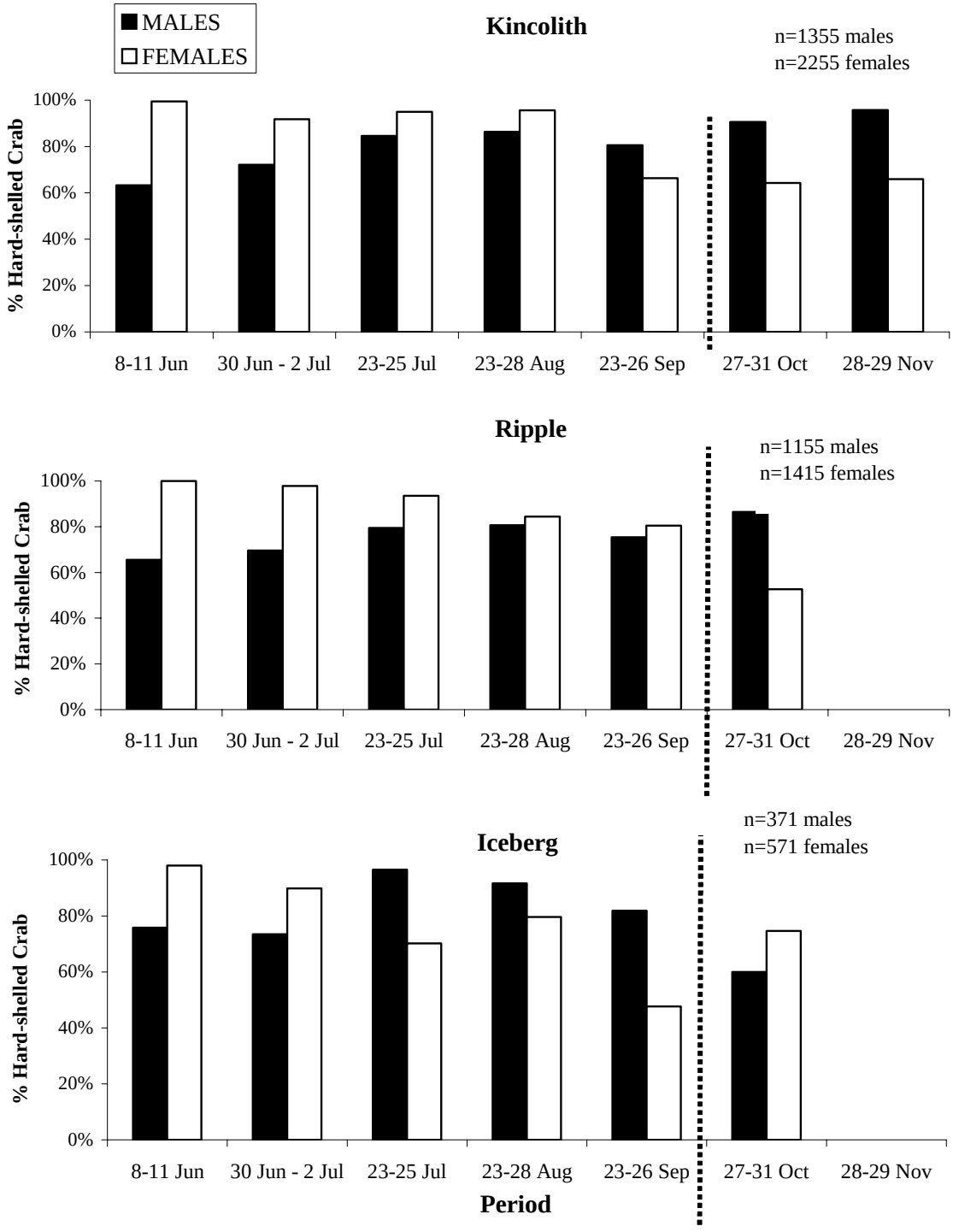


Figure 22. The proportion of hard-shelled male (legal size only) and female Dungeness crab caught in the Nass Estuary between 8 June and 29 November 2000.

Periods before the dashed line represent proportions before commercial fishery.

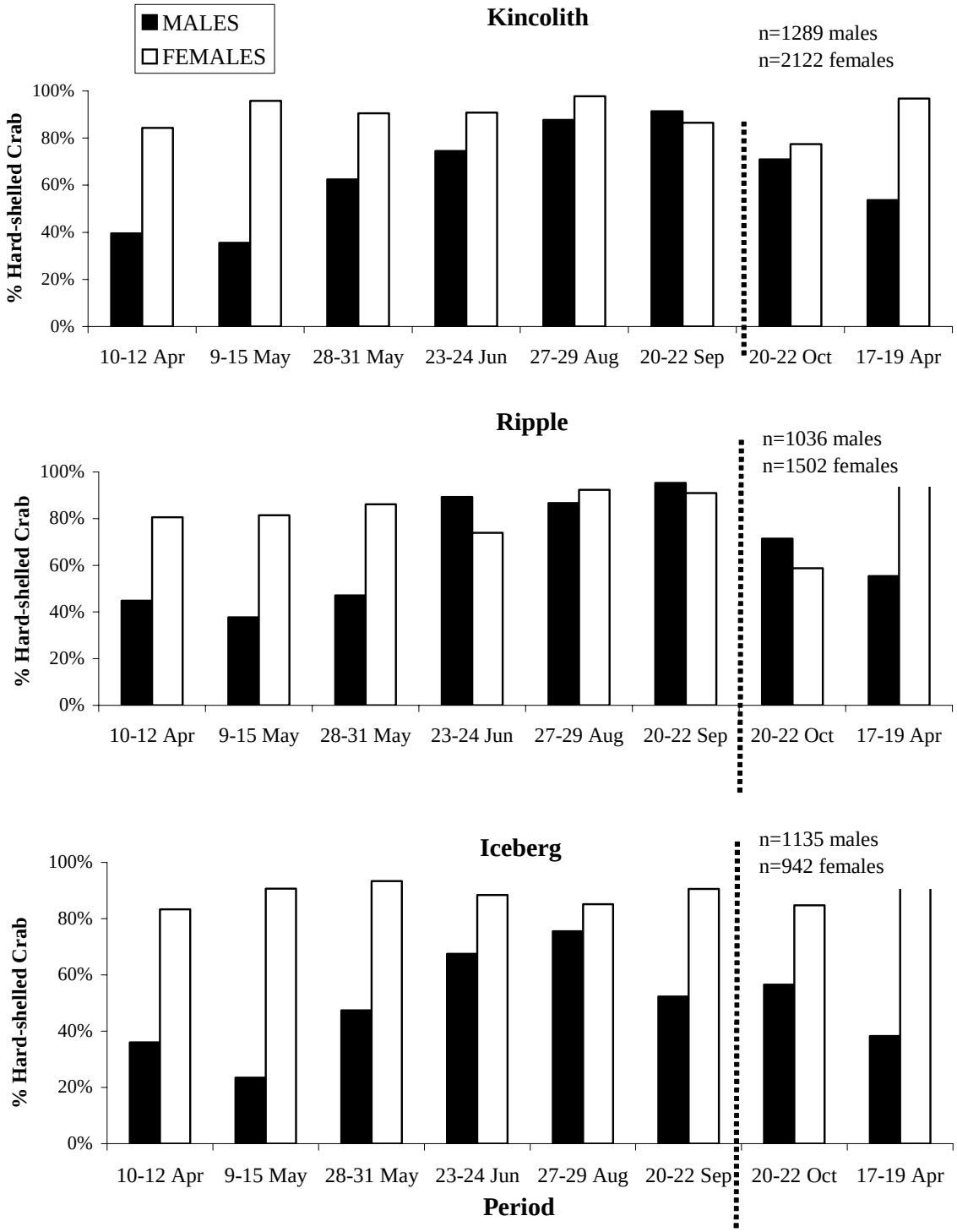


Figure 23. The proportion of hard-shelled male (legal size only) and female Dungeness crab caught in the Nass Estuary between 10 April 2001 and 19 April 2002.

Periods before the dashed line represent proportions before commercial fishery.

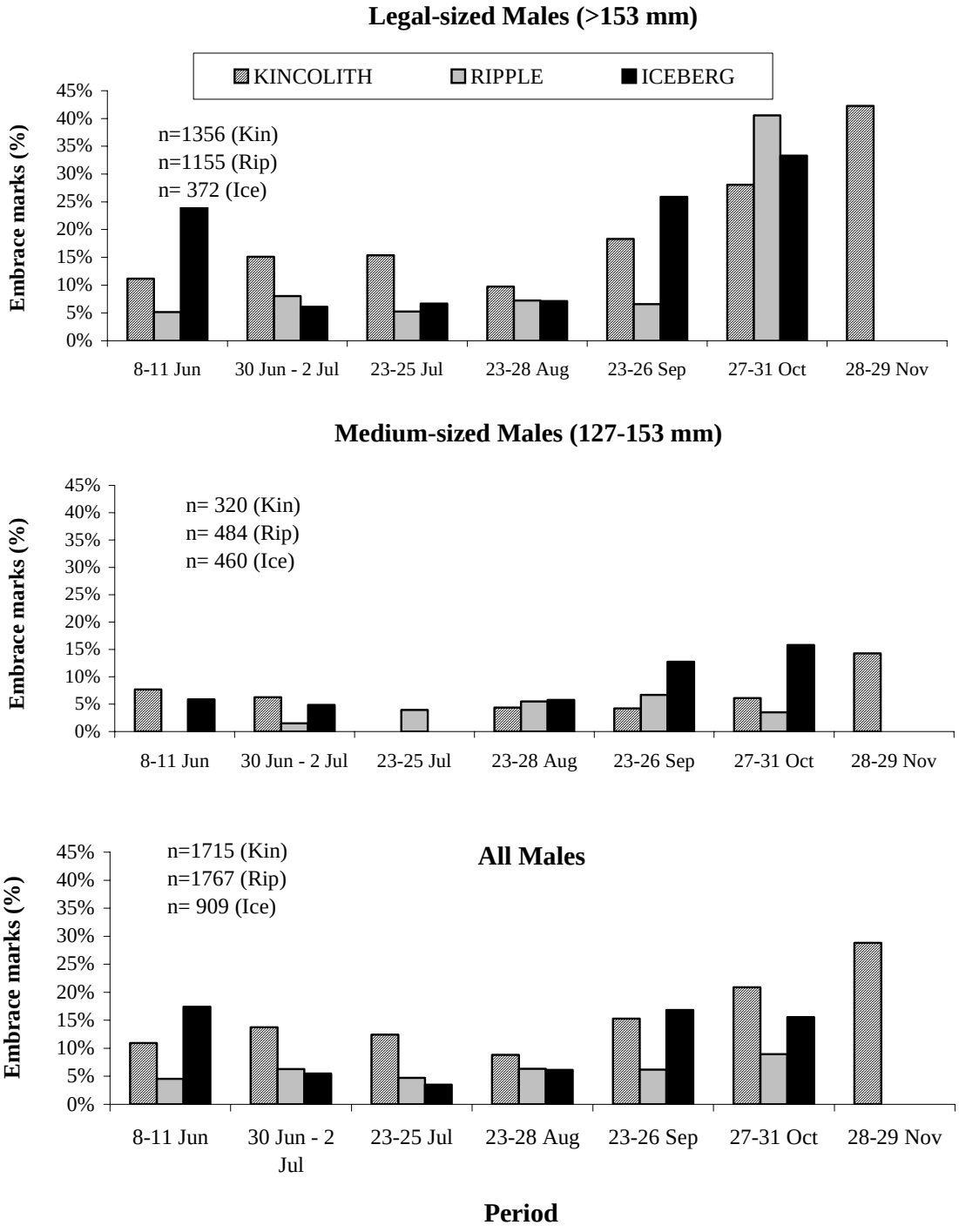


Figure 24. The percentage of medium and legal-sized male Dungeness crabs caught with embrace marks in the Nass estuary, 8 June to 29 November 2000.

Periods before the dashed line represent proportions before commercial fishery.

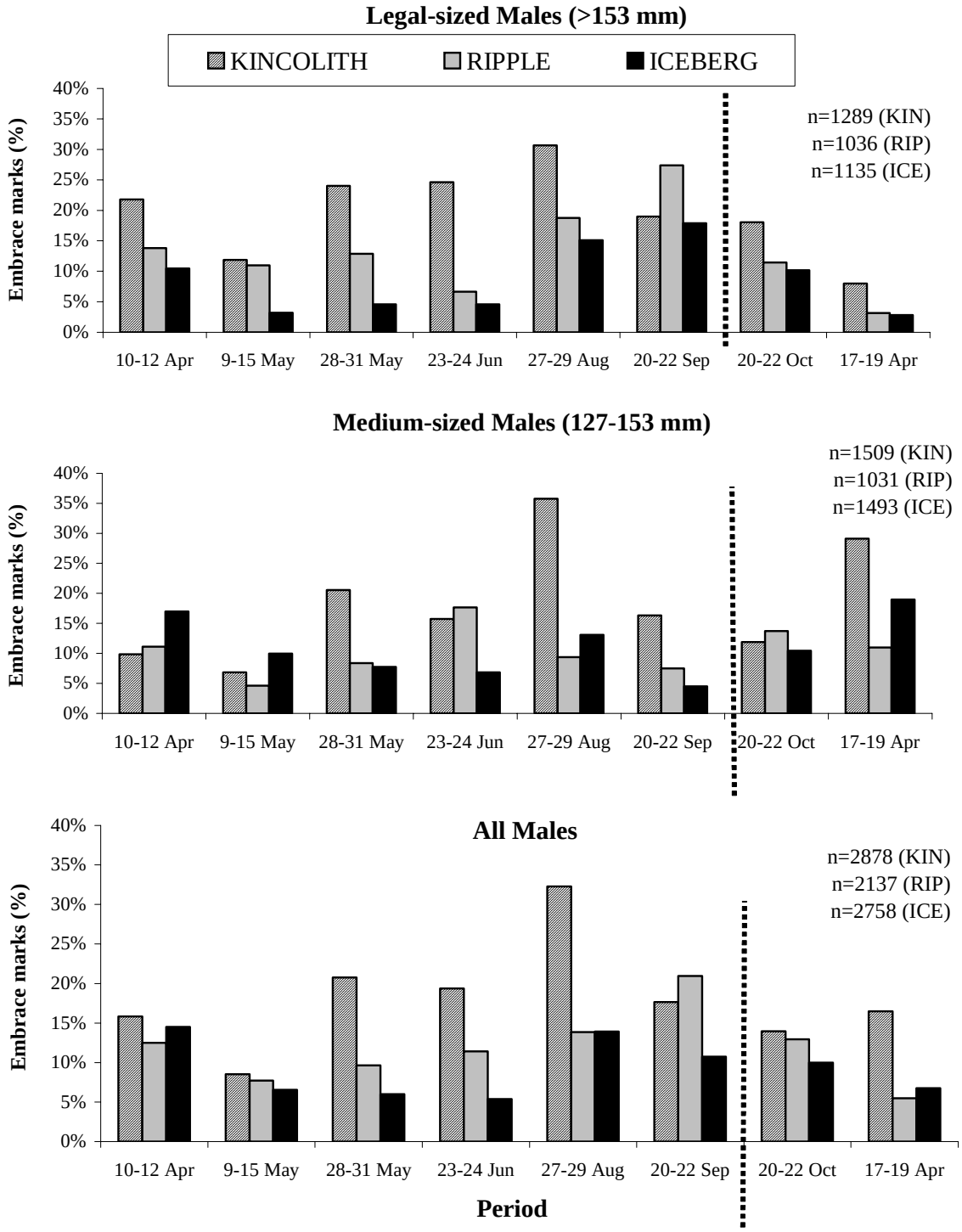


Figure 25. The percentage of medium and legal-sized male Dungeness crabs caught with embrace marks in the Nass estuary, 10 April 2001 to 19 April 2002.

Periods before the dashed line represent proportions before commercial fishery.

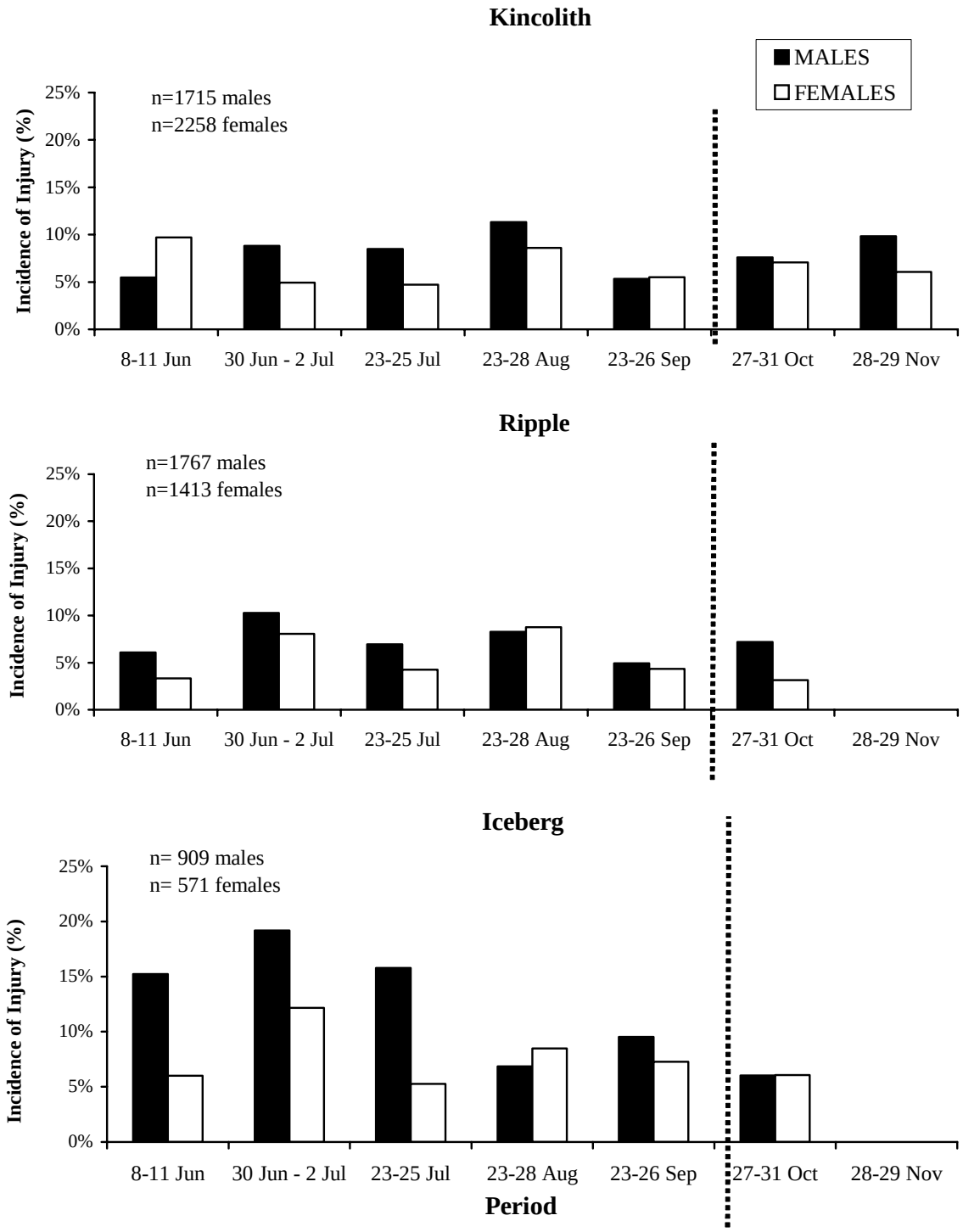


Figure 26. Percentage of male and female Dungeness crab caught in the Nass Estuary with leg or shell injuries, 8 June to 29 November 2000.

Periods before the dashed line represent proportions before commercial fishery.

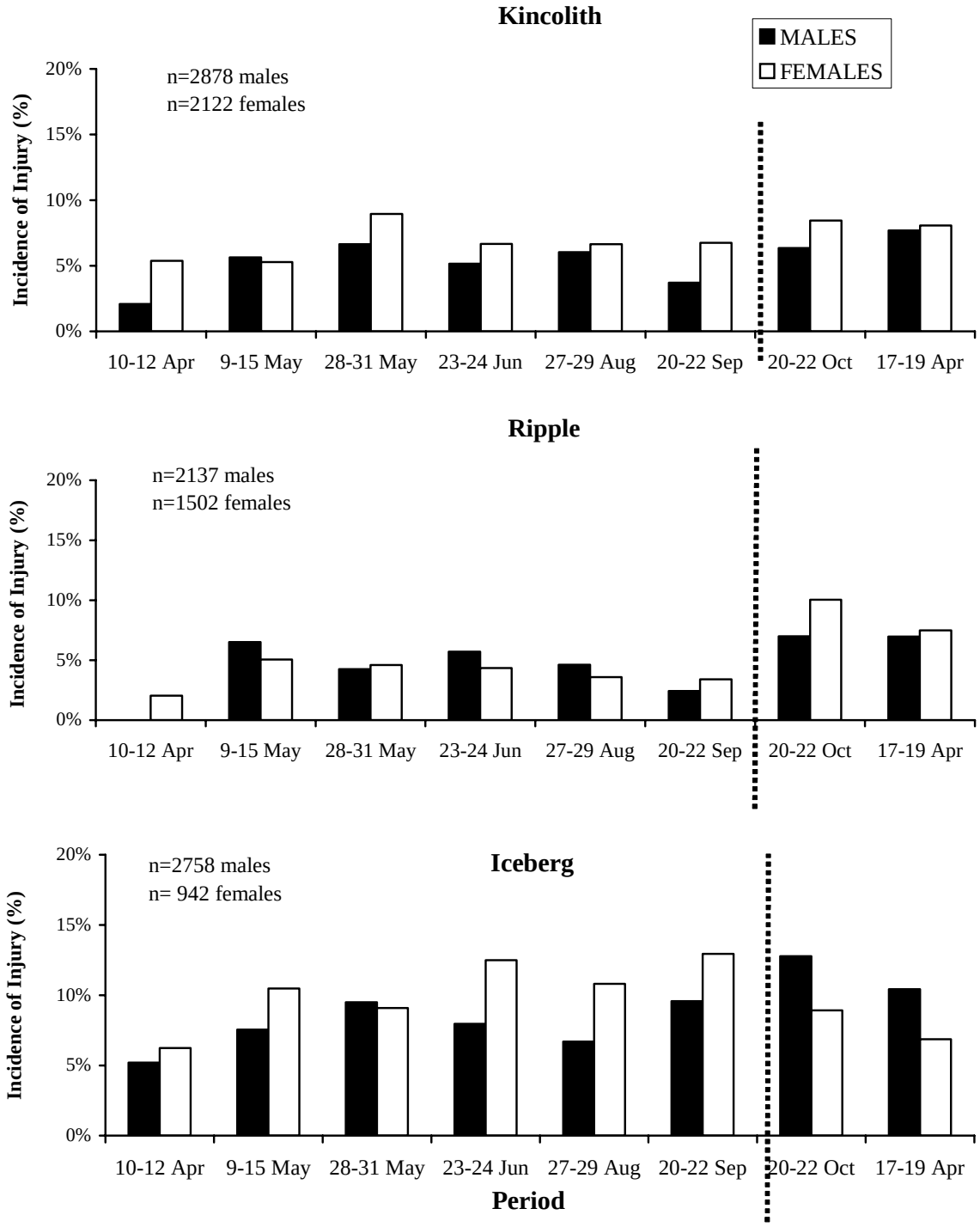


Figure 27. Percentage of male and female Dungeness crab caught in the Nass Estuary with leg or shell injuries, 10 April 2001 to 19 April 2002.

Periods before the dashed line represent proportions before commercial fishery.

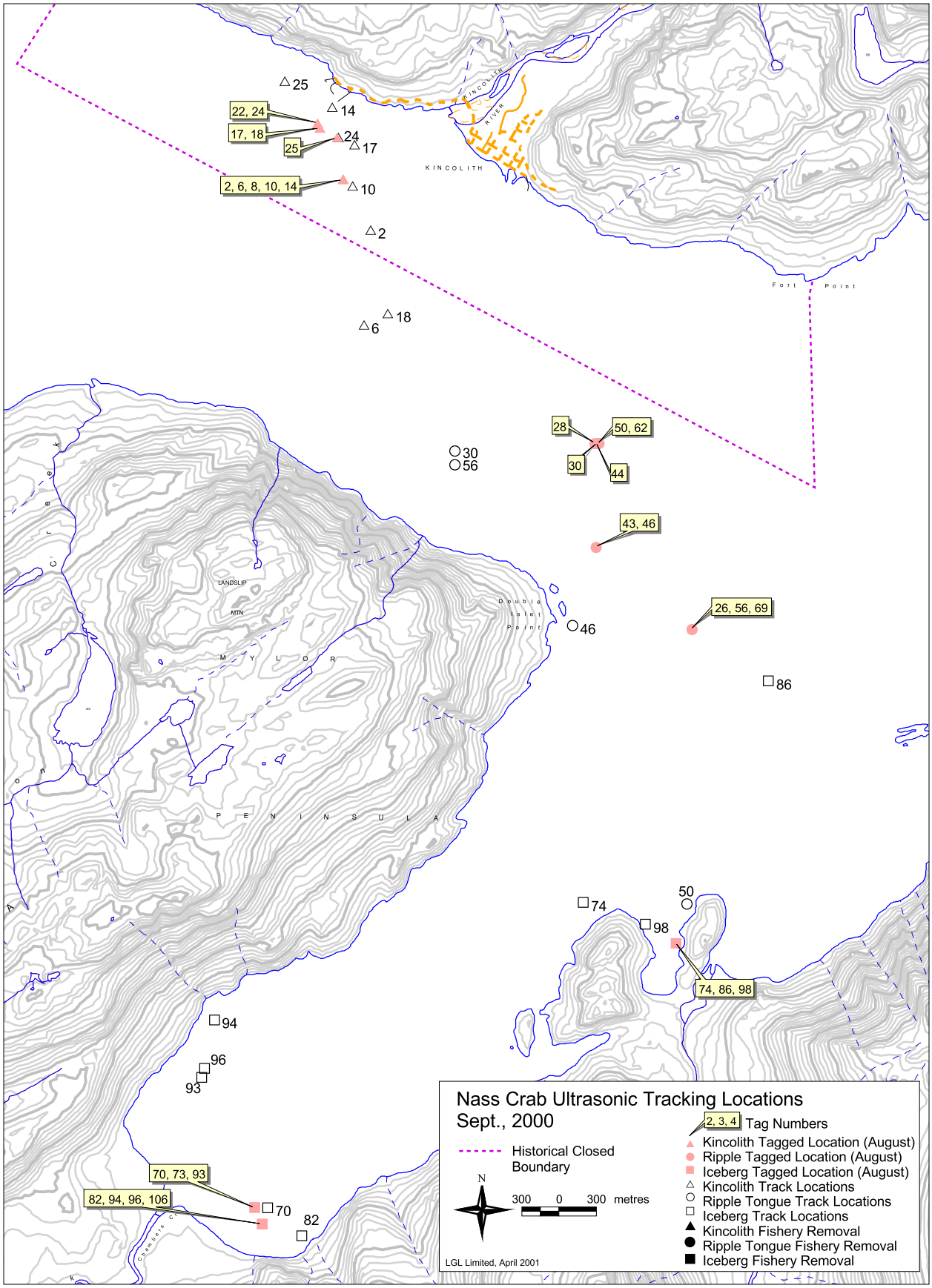


Figure 28. Locations of ultrasonic-tagged Dungeness Crab tracked between 22 and 25 September 2000.

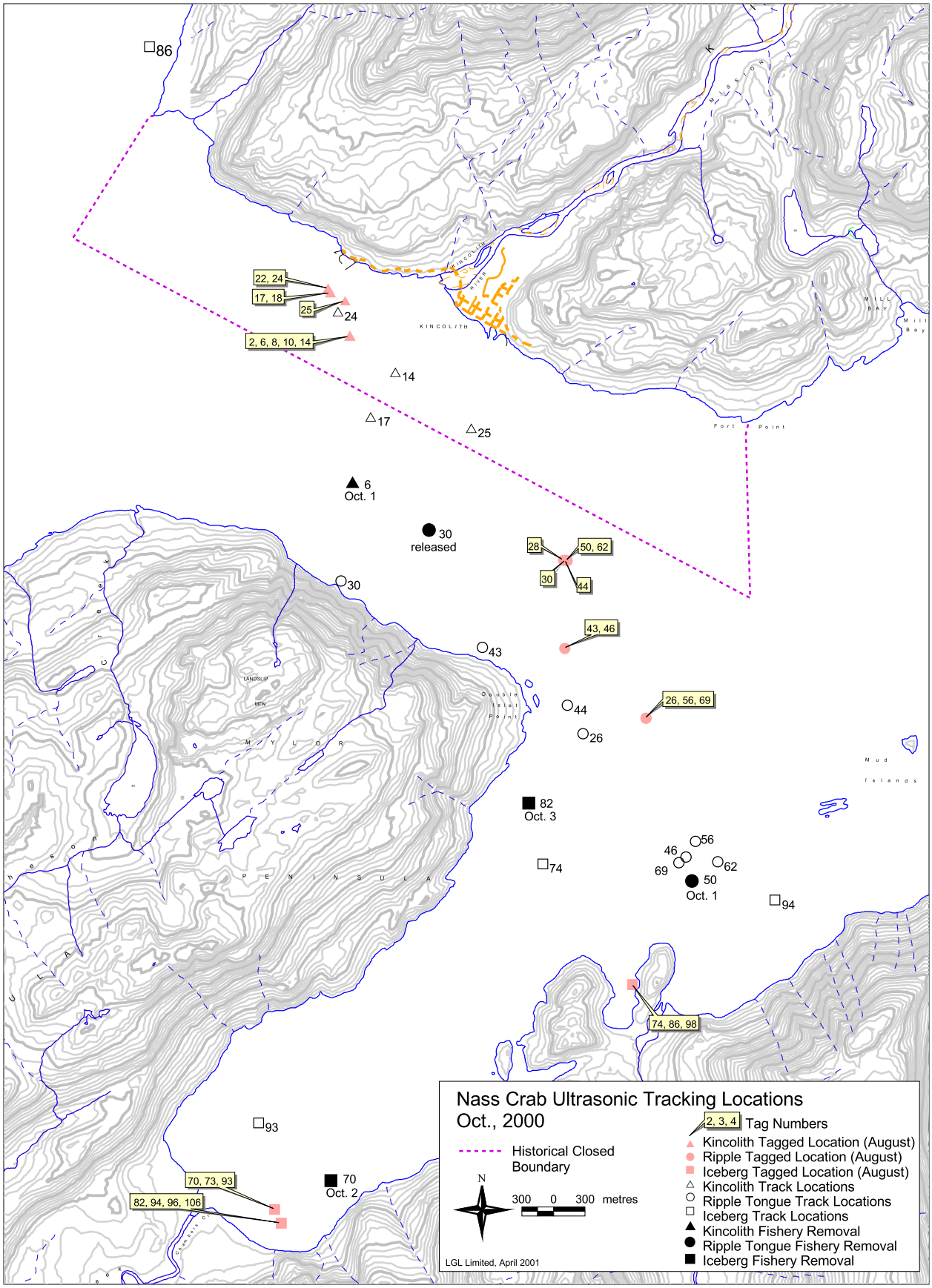


Figure 29. Locations of ultrasonic-tagged Dungeness Crab tracked between 24 and 30 October 2000.

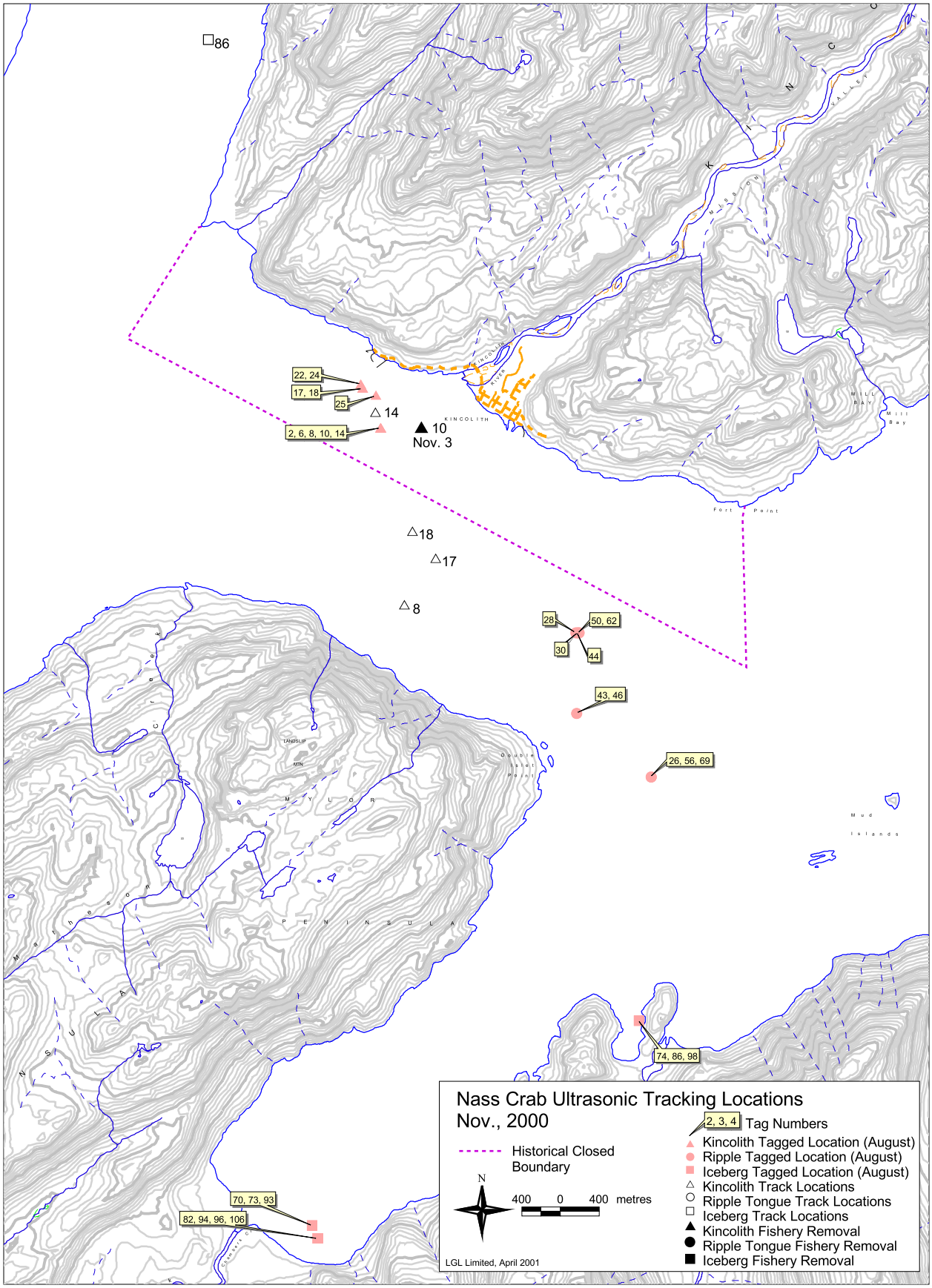


Figure 30. Locations of ultrasonic-tagged Dungeness Crab tracked between 27 and 28 November 2000.

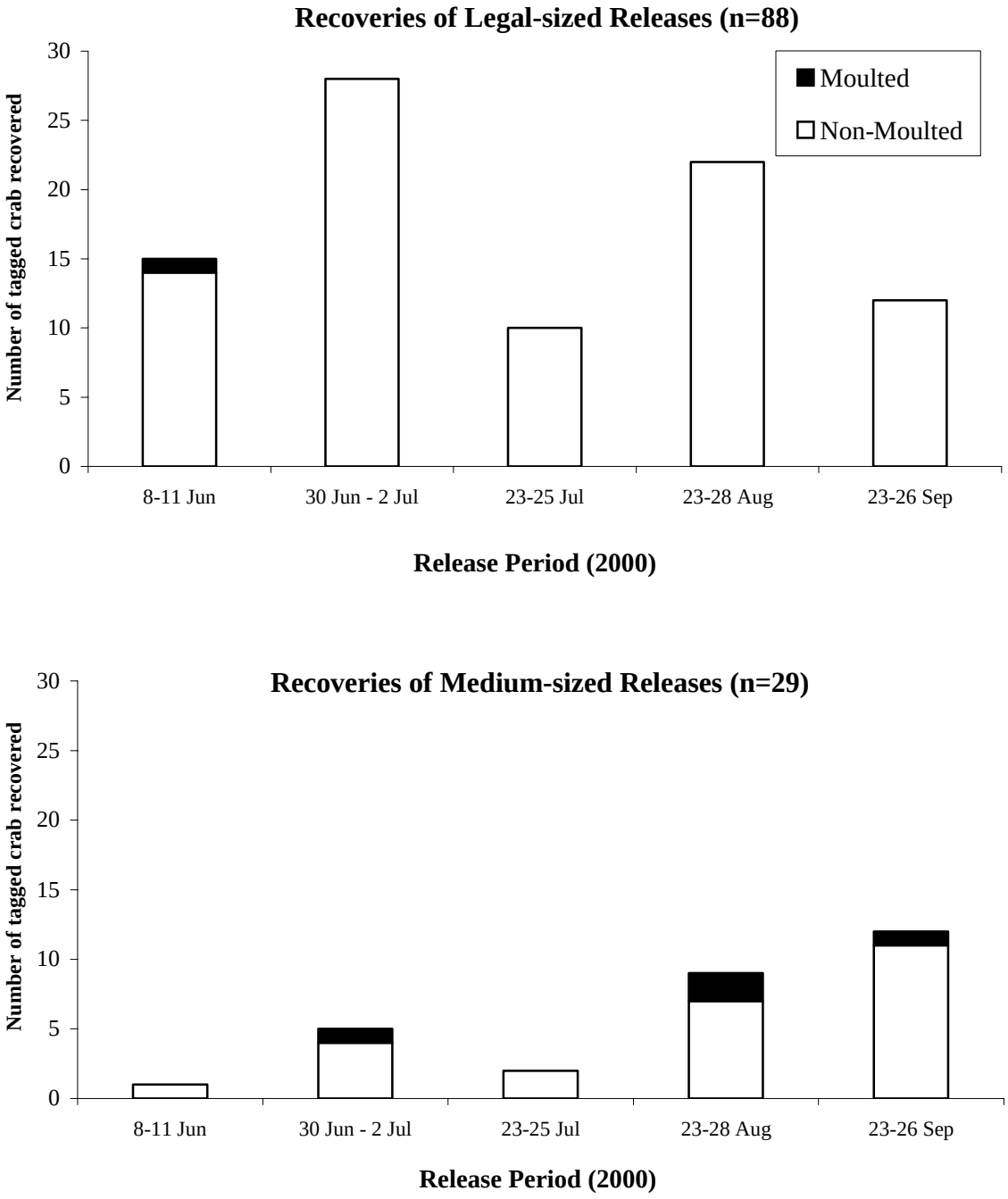


Figure 31. Numbers of moulted and non-moulted legal- and medium-sized male Dungeness crabs that were tagged in 2000 and recovered during sampling periods, 8 June 2000 to 19 April 2002.

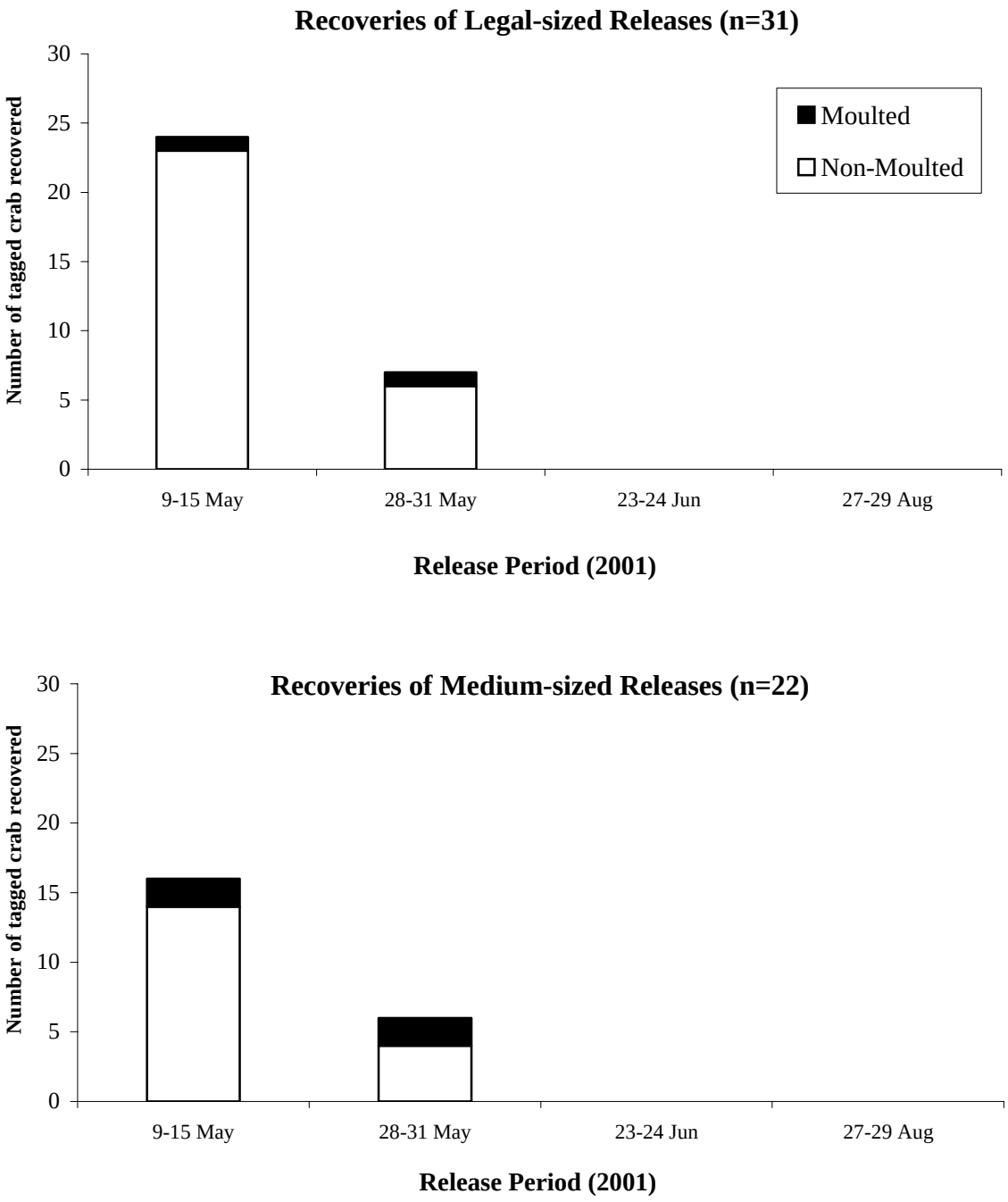


Figure 32. Numbers of moulted and non-moulted legal- and medium-sized male Dungeness crabs that were tagged in 2001 and recovered during sampling periods, 9 May 2001 to 19 April 2002.

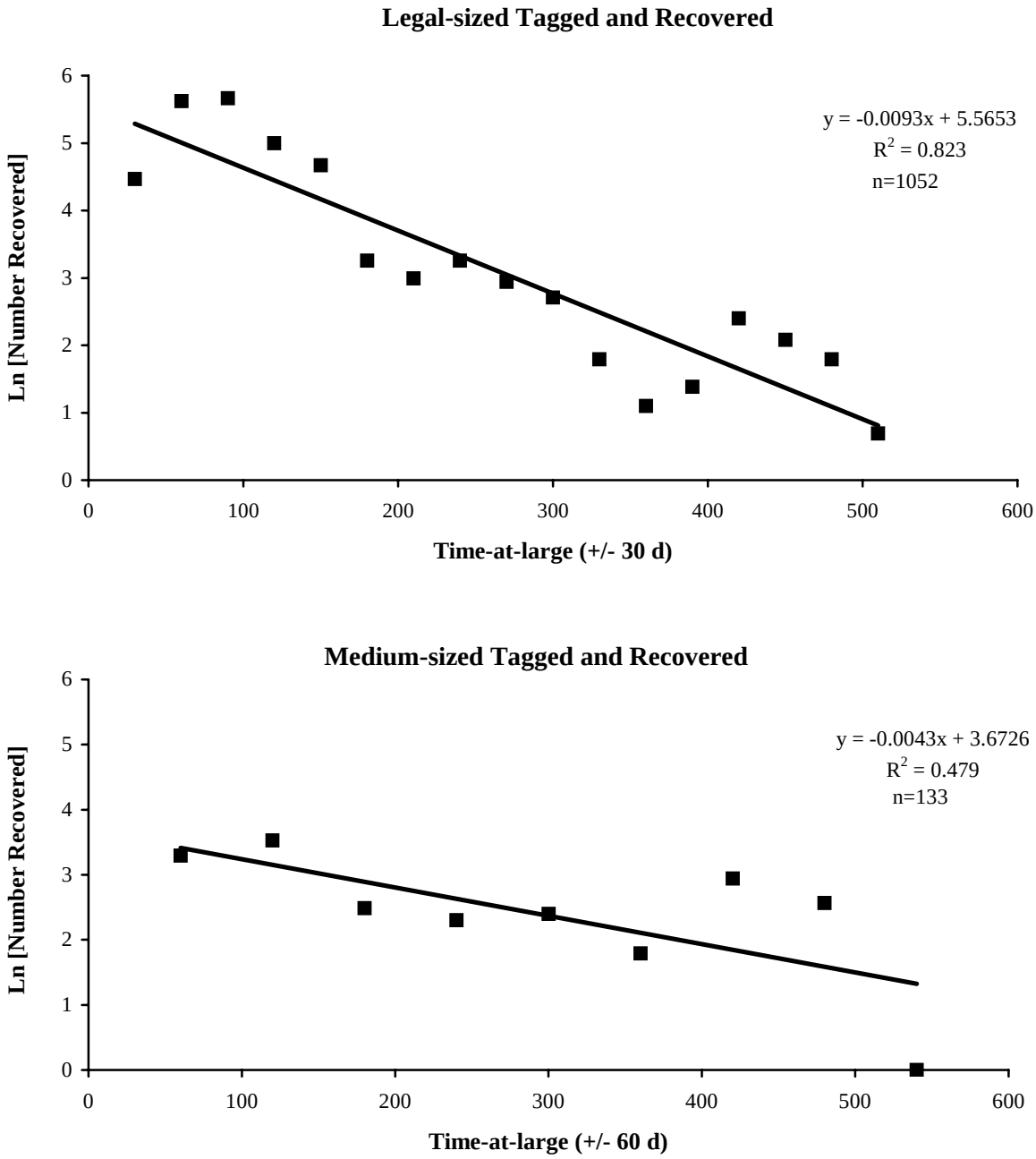


Figure 33. Linear regressions of recoveries over time for legal- and medium-sized crabs that were tagged in the Nass Estuary in 2000.

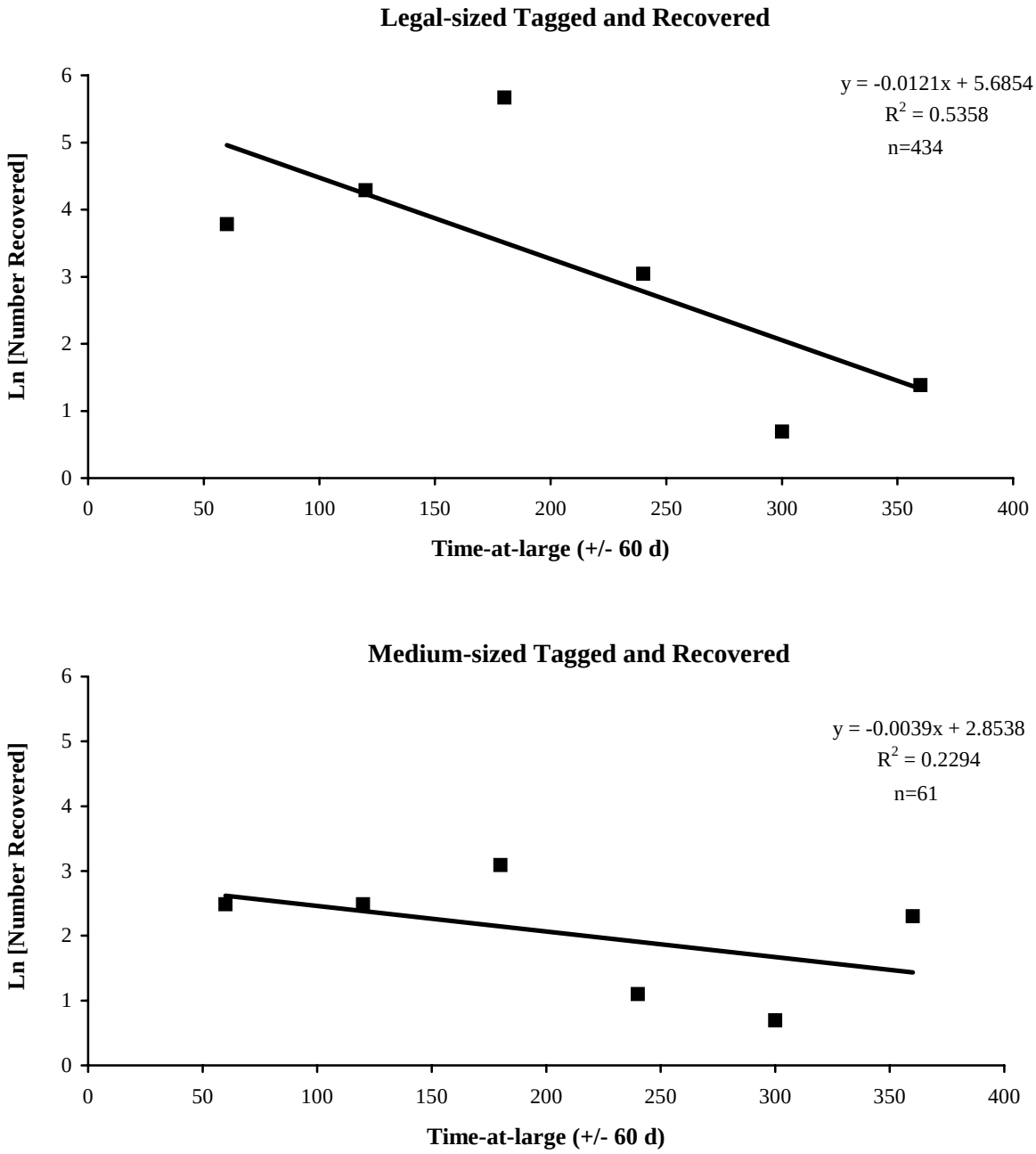


Figure 34. Linear regressions of recoveries over time for legal- and medium-sized crabs that were tagged in the Nass Estuary in 2001.

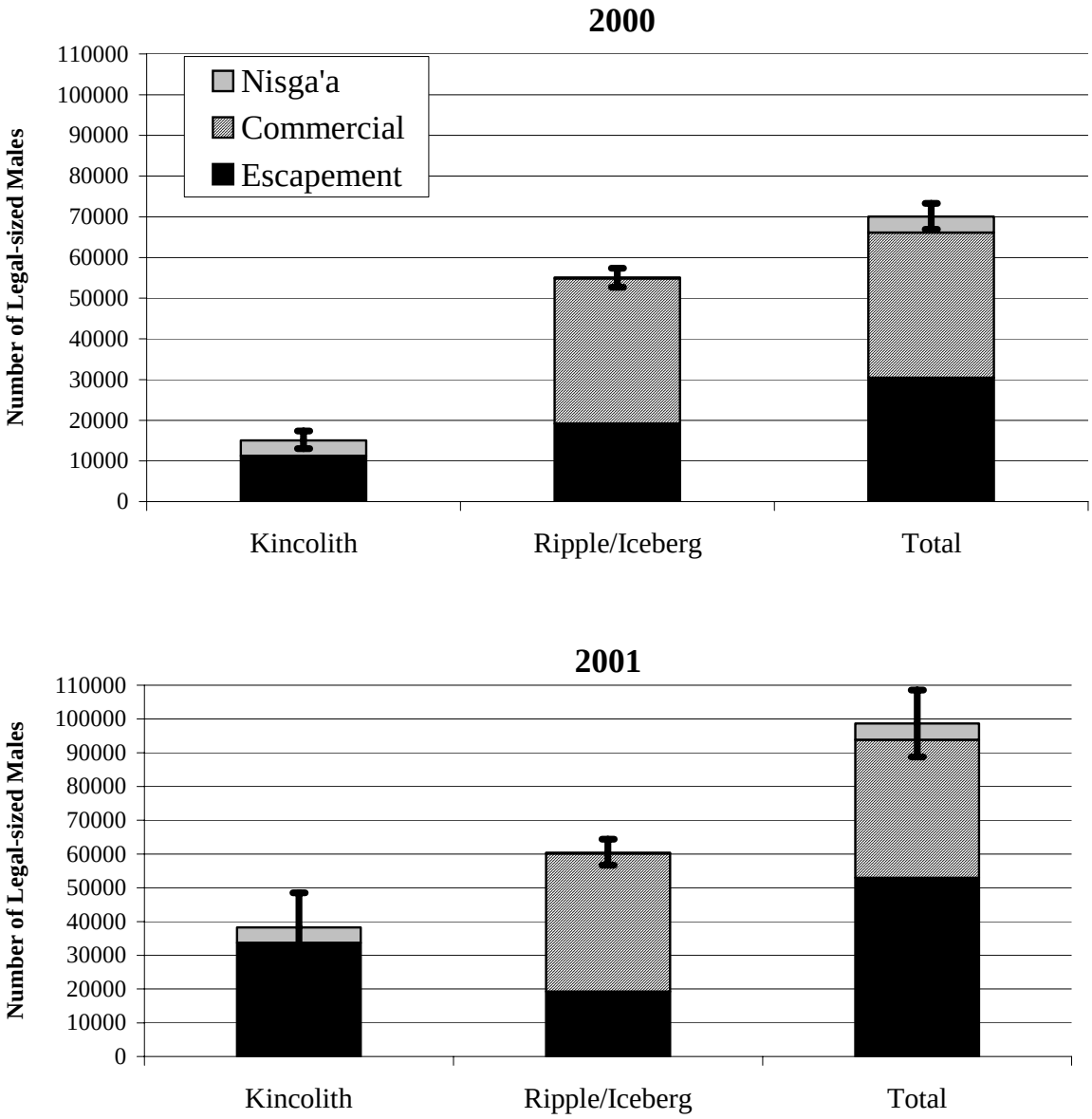


Figure 35. Best estimates of the 2000 and 2001 catch and escapement for legal-sized male Dungeness crabs in the Nass Estuary.

Error bars depict 95% confidence levels.

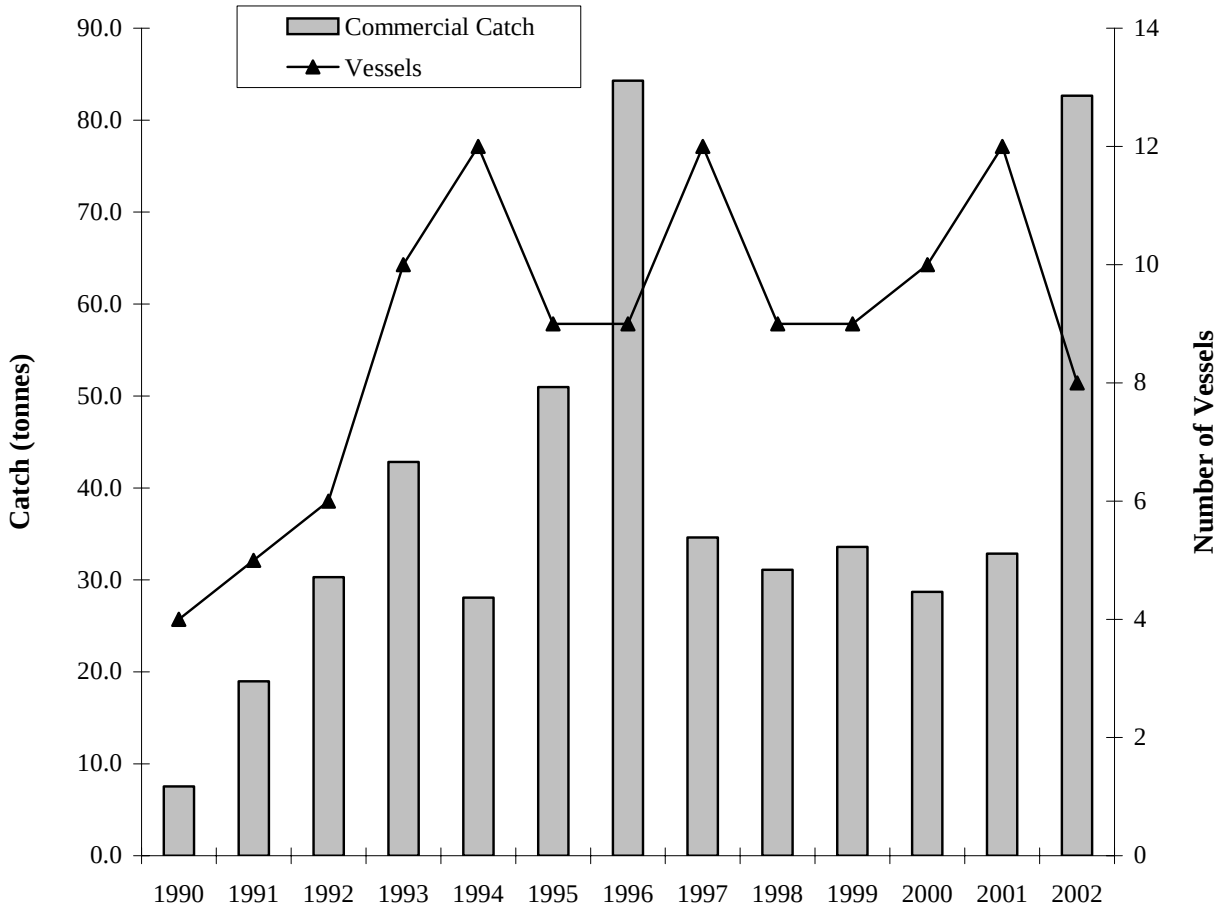


Figure 36. Commercial catches (in tonnes) of legal-sized male Dungeness crabs and numbers of vessels operated in the Nass Estuary from 1990 to 2002.

Source from DFO unpublished (2003) and Winther and Phillips (2002).

APPENDIX A

Set data for the Nass Dungeness crab sampling program, 2000-2002.

Table A - 1. Set data collected during the Nass Dungeness crab sampling program, 8 June 2000 to 19 April 2002.

SET#	TRAP HAUL DATE	TRIP NO.	LOCATION (1=Kin, 2=Rip, 3=Ice)	SET TYPE (S=stand., N=non-stand)	DEPTHTYPE (1=S, 2=M, 3=D)	MINDEPTH	MAXDEPTH	FISHMETH (S=single; G=groundline)	SOAK(HRS)	TRAP SPACING	NO. OF TRAPS IN STRINGS	NO. OF TRAPS SAMPLED	PORT (O=OPEN; X=CLOSED)	LatStartDeg	LatStartMinDec	LongStartDeg	LongStartMinDec	LatEndDeg	LatEndMinDec	LongEndDeg	LongEndMinDec
1	08-Jun-00	1	1	S	1	5	7	S	15	25	0	5	O	54	59.8	129	58.6	54	59.7	129	58.7
2	08-Jun-00	1	1	S	2	7	47	G	20	30	10	10	O	54	59.6	129	58.7	54	59.5	129	58.7
3	08-Jun-00	1	1	S	3	50	53	G	18	24	5	5	O	54	59.6	129	58.9	54	59.7	129	58.9
4	09-Jun-00	1	2	S	1	5	8	S	24	30	0	5	X	54	58.7	129	57.3	54	58.7	129	57.3
5	09-Jun-00	1	2	S	2	10	25	G	23	30	10	10	X	54	58.7	129	57.3	54	58.6	129	57.9
6	09-Jun-00	1	2	S	3	50	60	G	22	24	5	5	X	54	58.5	129	58.1	54	58.5	129	58.2
7	10-Jun-00	1	3	S	1	5	5	S	25	30	0	5	X	54	54.9	129	59.0	54	55.0	129	59.1
8	10-Jun-00	1	3	S	3	40	50	G	25	24	5	5	X	54	55.1	129	59.0	54	55.1	129	59.0
9	10-Jun-00	1	3	S	2	18	35	G	25	30	10	10	X	54	55.1	129	59.1	54	55.2	129	59.3
10	11-Jun-00	1	1	S	1	4	5	S	22	30	0	5	X	54	59.8	129	58.6	54	59.6	129	58.6
11	11-Jun-00	1	1	S	2	10	34	G	24	30	10	10	X	54	59.6	129	58.7	54	59.5	129	58.7
12	11-Jun-00	1	1	S	3	46	47	G	23	24	5	5	X	54	59.5	129	58.8	54	59.6	129	58.9
13	30-Jun-00	2	3	S	1	6	7	S	21	40	0	10	X	54	55.0	129	59.0	54	55.1	129	59.2
14	30-Jun-00	2	3	S	2	10	35	G	21	30	10	10	X	54	55.1	129	59.1	54	55.2	129	59.1
15	30-Jun-00	2	3	N	3	50	60	G	23	23	5	5	X	54	55.6	129	59.5	54	58.6	129	59.6
16	30-Jun-00	2	3	S	2	15	43	G	23	30	10	10	X	54	55.4	129	59.4	54	55.4	129	59.2
17	30-Jun-00	2	3	S	3	71	71	G	24	24	5	5	X	54	55.3	129	58.5	54	55.3	129	58.5
18	01-Jul-00	2	2	E	1	6	8	S	21	40	0	10	X	54	57.5	129	55.6	54	57.3	129	55.4
19	01-Jul-00	2	2	E	2	10	18	G	19	30	10	10	X	54	57.1	129	55.3	54	57.0	129	55.4
20	01-Jul-00	2	2	N	2	17	44	G	20	30	10	10	X	54	56.6	129	56.1	54	56.5	129	56.2
21	01-Jul-00	2	2	N	3	62	67	G	21	24	5	5	X	54	56.5	129	56.1	54	56.5	129	56.0
22	01-Jul-00	2	2	N	2	22	23	G	22	24	5	5	X	54	56.9	129	56.8	54	56.9	129	56.8
23	02-Jul-00	2	1	S	1	5	6	S	23	50	0	10	X	54	59.8	129	58.6	54	59.6	129	58.5
24	02-Jul-00	2	1	S	2	10	35	G	17	30	10	10	X	54	59.6	129	58.6	54	59.6	129	58.7
25	02-Jul-00	2	1	S	2	12	41	G	23	30	10	10	X	54	59.6	129	58.7	54	59.5	129	58.8
26	02-Jul-00	2	1	S	3	53	59	G	18	24	5	5	X	54	59.4	129	58.8	54	59.4	129	58.9
27	02-Jul-00	2	1	S	3	52	62	G	17	24	5	5	X	54	59.4	128	58.8	54	59.4	129	58.9
28	23-Jul-00	3	1	S	1	4	6	S	24	30	0	5	X	54	59.6	129	58.6	54	59.5	129	58.6
29	23-Jul-00	3	1	S	3	40	42	G	25	24	5	5	X	54	59.5	129	58.8	54	59.5	129	58.8
30	23-Jul-00	3	1	S	2	10	34	G	24	30	10	10	X	54	59.5	129	58.6	54	59.5	129	58.8
31	23-Jul-00	3	1	N	1	4	4	G	20	40	0	4	X	55	0.5	129	59.9	55	0.5	129	59.0
32	23-Jul-00	3	1	N	2	15	47	G	20	30	10	10	X	55	0.4	129	60.0	55	0.4	129	59.1
33	23-Jul-00	3	1	N	3	50	50	G	21	24	5	5	X	55	0.4	130	0.1	55	0.3	130	0.0
34	24-Jul-00	3	2	S	1	5	6	S	23	40	0	5	X	54	58.8	129	57.4	54	58.7	129	57.4
35	24-Jul-00	3	2	S	2	10	45	G	23	30	10	10	X	54	58.7	129	57.5	54	58.7	129	57.7
36	24-Jul-00	3	2	S	3	45	75	G	24	24	5	5	X	54	58.6	129	57.6	54	58.6	129	58.0

Table A-1. Con't.

SET#	TRAP HAUL DATE	TRIP NO.	LOCATION (1=Kin, 2=Rip, 3=Ice)	SET TYPE (S=stand., N=non-stand)	DEPTHTYPE (1=S, 2=M, 3=D)	MINDEPTH	MAXDEPTH	FISHMETH (S=single; G=groundline)	SOAK(HRS)	TRAP SPACING	NO. OF TRAPS IN STRINGS	NO. OF TRAPS SAMPLED	PORT (O=OPEN; X=CLOSED)	LatStartDeg	LatStartMinDec	LongStartDeg	LongStartMinDec	LatEndDeg	LatEndMinDec	LongEndDeg	LongEndMinDec
37	24-Jul-00	3	2	E	1	4	4	S	23	40	0	5	X	54	57.4	129	55.6	54	57.4	129	55.5
38	24-Jul-00	3	2	E	2	10	28	G	23	30	10	10	X	54	56.8	129	55.2	54	56.7	129	55.4
39	24-Jul-00	3	2	N	3	60	70	G	24	24	5	5	X	54	56.5	129	56.0	54	56.4	129	55.1
40	25-Jul-00	3	3	S	1	5	6	S	25	40	0	5	X	54	55.0	129	58.9	54	55.0	129	58.0
41	25-Jul-00	3	3	S	2	12	38	G	25	30	10	10	X	54	55.0	129	59.0	54	55.1	129	59.0
42	25-Jul-00	3	3	S	3	55	55	G	25	24	5	5	X	54	55.1	129	58.9	54	55.2	129	58.9
43	25-Jul-00	3	2	S	1	4	5	S	18	40	0	5	X	54	57.6	129	56.9	54	57.5	129	56.9
44	25-Jul-00	3	2	S	2	21	25	G	19	30	10	10	X	54	57.0	129	57.0	54	57.1	129	57.0
45	25-Jul-00	3	2	S	2	38	40	G	19	24	5	5	X	54	57.7	129	56.6	54	57.7	129	56.6
46	23-Aug-00	4	1	S	1	4	5	S	25	30	0	10	X	54	59.7	129	58.6	54	59.6	129	58.6
47	23-Aug-00	4	1	S	2	11	38	G	27	24	10	10	X	54	59.7	129	58.7	54	59.6	129	58.8
48	23-Aug-00	4	1	S	1	8	8	G	23	24	10	10	X	54	59.6	129	58.6	54	59.4	129	58.6
49	23-Aug-00	4	1	S	3	60	60	G	26	30	5	5	X	54	59.6	129	58.0	54	59.6	129	58.1
50	23-Aug-00	4	1	S	2	21	22	G	29	30	5	5	X	54	59.3	129	58.1	54	59.0	129	58.0
51	24-Aug-00	4	2	S	1	6	20	S	25	30	0	5	X	54	58.7	129	57.3	54	58.6	129	57.2
52	24-Aug-00	4	2	S	1	7	20	G	25	30	10	10	X	54	58.3	129	57.7	54	58.3	129	57.9
53	24-Aug-00	4	2	S	3	50	55	G	26	30	5	5	X	54	58.4	129	58.1	54	58.4	129	58.1
54	24-Aug-00	4	2	S	1	9	10	G	19	24	10	10	X	54	58.4	129	56.8	54	58.4	129	57.0
55	24-Aug-00	4	1	S	1	9	11	G	16	24	5	5	X	54	59.5	129	58.6	54	59.5	129	58.6
56	24-Aug-00	4	1	S	2	35	36	G	28	30	5	5	X	54	59.7	129	58.8	54	59.8	129	58.8
57	25-Aug-00	4	3	S	1	4	5	S	24	30	0	5	X	54	56.0	129	60.0	54	56.0	129	59.1
58	25-Aug-00	4	3	S	2	10	38	G	25	24	10	10	X	54	55.0	129	59.1	54	55.1	129	60.0
59	25-Aug-00	4	3	S	3	52	57	G	27	30	5	5	X	54	55.1	129	58.8	54	55.2	129	58.9
60	25-Aug-00	4	2	S	1	5	6	S	15	30	0	5	X	54	57.9	129	56.6	54	57.9	129	56.7
61	25-Aug-00	4	2	S	1	10	10	G	16	24	10	10	X	54	57.6	129	55.9	54	57.5	129	55.7
62	25-Aug-00	4	2	S	2	20	22	G	18	30	5	5	X	54	57.2	129	55.7	54	57.2	129	55.7
63	26-Aug-00	4	2	S	1	5	5	S	22	30	0	5	X	54	56.3	129	55.0	54	56.3	129	54.1
64	26-Aug-00	4	2	S	1	6	11	G	24	30	10	10	X	54	56.2	129	56.1	54	56.3	129	56.0
65	26-Aug-00	4	2	S	3	70	70	G	25	30	5	5	X	54	56.5	129	55.9	54	56.4	129	56.0
66	26-Aug-00	4	3	S	1	5	6	S	17	30	0	5	X	54	55.2	129	59.2	54	55.1	129	59.1
67	26-Aug-00	4	3	S	2	22	22	G	16	30	10	10	X	54	55.0	129	58.7	54	56.0	129	58.8
68	26-Aug-00	4	3	S	3	60	60	G	16	30	5	5	X	54	55.2	129	58.6	54	55.2	129	58.7
69	27-Aug-00	4	2	S	1	6	7	S	22	30	0	5	X	54	56.9	129	55.1	54	57.0	129	55.1
70	27-Aug-00	4	2	S	1	7	8	G	23	30	10	10	X	54	58.0	129	55.1	54	57.1	129	55.2
71	27-Aug-00	4	2	S	1	9	16	G	24	30	5	5	X	54	57.1	129	55.3	54	57.2	129	55.4
72	27-Aug-00	4	2	S	1	6	6	S	20	30	0	5	X	54	57.3	129	55.5	54	57.3	129	55.5
73	27-Aug-00	4	2	S	1	6	6	G	21	30	10	10	X	54	57.4	129	55.6	54	57.5	129	55.7

Table A-1. Con't.

SET#	TRAP HAUL DATE	TRIP NO.	LOCATION (1=Kin, 2=Rip, 3=Ice)	SET TYPE (S=stand., N=non-stand)	DEPTHTYPE (1=S, 2=M, 3=D)	MINDEPTH	MAXDEPTH	FISHMETH (S=single; G=groundline)	SOAK(HRS)	TRAP SPACING	NO. OF TRAPS IN STRINGS	NO. OF TRAPS SAMPLED	PORT (O=OPEN; X=CLOSED)	LatStartDeg	LatStartMinDec	LongStartDeg	LongStartMinDec	LatEndDeg	LatEndMinDec	LongEndDeg	LongEndMinDec
74	27-Aug-00	4	2	S	1	5	5	G	22	30	5	5	X	54	57.5	129	55.8	54	57.6	129	55.8
75	28-Aug-00	4	1	S	2	11	18	G	19	24	10	10	X	54	59.6	129	58.6	54	59.6	129	58.7
76	28-Aug-00	4	1	S	2	12	13	G	17	24	10	10	X	54	59.5	129	58.6	54	59.5	129	58.6
77	23-Sep-00	5	3	S	1	5	5	S	26	30	0	5	X	54	54.9	129	59.0	54	55.0	129	59.1
78	23-Sep-00	5	3	S	1	6	6	S	34	30	0	5	X	54	55.0	129	59.1	54	55.1	129	59.1
79	23-Sep-00	5	3	S	2	10	37	G	26	30	10	10	X	54	55.1	129	59.1	54	55.2	129	59.0
80	23-Sep-00	5	3	S	2	15	23	G	33	30	10	10	X	54	55.0	129	59.0	54	55.0	129	58.8
81	23-Sep-00	5	3	S	2	18	20	G	34	24	5	5	X	54	55.0	129	58.6	54	55.0	129	58.7
82	23-Sep-00	5	3	S	3	50	60	G	26	24	5	5	X	54	55.1	129	58.7	54	55.2	129	58.7
83	24-Sep-00	5	2	S	1	6	6	S	26	30	0	5	X	54	58.8	129	57.3	54	58.7	129	57.3
84	24-Sep-00	5	2	S	2	9	41	G	24	30	10	10	X	54	58.7	129	57.4	54	58.7	129	57.7
85	24-Sep-00	5	2	S	3	58	58	G	26	24	5	5	X	54	58.7	129	57.7	54	58.6	129	57.8
86	25-Sep-00	5	1	S	1	6	6	S	24	30	0	5	X	54	59.8	129	58.7	54	59.7	129	58.6
87	25-Sep-00	5	1	S	2	10	40	G	25	30	10	10	X	54	59.6	129	58.7	54	59.6	129	58.8
88	25-Sep-00	5	1	S	3	50	60	G	26	24	5	5	X	54	59.6	129	58.9	54	59.6	129	59.0
89	25-Sep-00	5	1	S	1	6	6	S	24	30	0	5	X	54	59.5	129	58.6	54	59.4	129	58.5
90	25-Sep-00	5	1	S	1	10	15	G	25	30	10	10	X	54	59.4	129	58.5	54	59.3	129	58.5
91	25-Sep-00	5	1	S	1	14	14	G	26	24	5	5	X	54	59.3	129	58.5	54	59.3	129	58.4
92	26-Sep-00	5	1	S	1	12	12	G	20	30	10	10	X	54	59.7	129	58.7	54	59.6	129	58.6
93	26-Sep-00	5	1	S	1	9	15	G	14	30	10	10	X	54	59.6	129	58.6	54	59.5	129	58.6
94	27-Oct-00	6	1	S	1	3	4	S	24	30	0	5	X	54	59.8	129	59.6	54	59.7	129	58.6
95	27-Oct-00	6	1	S	2	7	35	G	24	30	10	10	X	54	59.6	129	58.6	54	59.5	129	58.8
96	27-Oct-00	6	1	S	3	52	52	G	25	30	5	5	X	54	59.5	129	58.9	54	59.6	129	58.9
97	27-Oct-00	6	1	S	1	13	16	G	26	30	10	10	X	54	59.6	129	58.7	54	59.7	129	58.7
98	29-Oct-00	6	2	S	1	6	6	S	24	30	0	5	X	54	58.6	129	57.2	54	58.5	129	57.1
99	29-Oct-00	6	2	S	2	9	40	G	24	30	10	10	X	54	58.6	129	57.5	54	58.6	129	57.7
100	29-Oct-00	6	2	S	3	60	60	G	24	24	5	5	X	54	58.5	129	57.9	54	58.5	129	57.9
101	29-Oct-00	6	2	S	1	6	6	G	25	30	10	10	X	54	58.4	129	57.3	54	58.5	129	57.5
102	30-Oct-00	6	3	S	1	5	5	S	23	30	0	5	X	54	54.9	129	59.0	54	55.0	129	59.1
103	30-Oct-00	6	3	S	2	9	30	G	24	30	10	10	X	54	55.0	129	59.1	54	55.1	129	59.0
104	30-Oct-00	6	3	S	3	55	55	G	24	30	5	5	X	54	55.2	129	58.9	54	55.1	129	58.9
105	30-Oct-00	6	3	S	1	16	16	G	25	30	10	10	X	54	54.0	129	58.6	54	55.0	129	58.8
106	31-Oct-00	6	2	E	1	10	10	G	19	30	10	10	X	54	56.8	129	55.2	54	56.9	129	55.3
107	31-Oct-00	6	2	E	2	19	19	G	20	30	10	10	X	54	56.9	129	55.3	54	57.0	129	55.4
108	28-Nov-00	7	1	S	1	5	6	S	24	30	0	5	X	54	59.8	129	58.7	54	59.7	129	58.6
109	28-Nov-00	7	1	S	2	10	40	G	24	30	10	10	X	54	59.6	129	58.7	54	59.6	129	58.8
110	28-Nov-00	7	1	S	3	55	60	G	25	24	5	5	X	54	59.6	129	58.9	54	59.7	129	59.0

Table A-1. Con't.

SET#	TRAP HAUL DATE	TRIP NO.	LOCATION (1=Kin, 2=Rip, 3=Ice)	SET TYPE (S=stand., N=non-stand)	DEPTHTYPE (1=S, 2=M, 3=D)	MINDEPTH	MAXDEPTH	FISHMETH (S=single; G=groundline)	SOAK(HRS)	TRAP SPACING	NO. OF TRAPS IN STRINGS	NO. OF TRAPS SAMPLED	PORT (O=OPEN; X=CLOSED)	LatStartDeg	LatStartMinDec	LongStartDeg	LongStartMinDec	LatEndDeg	LatEndMinDec	LongEndDeg	LongEndMinDec
111	28-Nov-00	7	1	S	1	13	13	G	26	30	10	10	X	54	59.6	129	58.7	54	59.5	129	58.6
116	10-Apr-01	8	1	S	1	4	5	S	24	30	0	5	X	54	59.8	129	58.7	54	59.7	129	58.6
117	10-Apr-01	8	1	S	2	10	40	G	25	30	10	10	X	54	59.6	129	58.7	54	59.6	129	58.9
118	10-Apr-01	8	1	S	3	50	50	G	26	24	5	5	X	54	59.7	129	59.0	54	59.7	129	59.0
119	10-Apr-01	8	1	S	1	6	8	G	26	30	10	10	X	54	59.5	129	58.6	54	59.6	129	58.6
120	11-Apr-01	8	2	S	1	8	9	S	21	30	0	5	X	54	58.7	129	57.4	54	58.6	129	57.3
121	11-Apr-01	8	2	S	1	10	10	G	23	30	10	9	X	54	58.5	129	57.5	54	58.6	129	57.6
122	11-Apr-01	8	2	S	2	11	40	G	22	30	10	10	X	54	58.6	129	57.6	54	58.6	129	57.7
123	11-Apr-01	8	2	S	3	60	65	G	24	24	5	5	X	54	58.6	129	57.8	54	58.7	129	57.8
124	12-Apr-01	8	3	S	1	5	5	S	22	30	0	5	X	54	54.9	129	59.0	54	55.0	129	59.1
125	12-Apr-01	8	3	S	2	7	37	G	23	30	10	10	X	54	55.1	129	59.1	54	55.2	129	59.1
126	12-Apr-01	8	3	S	3	50	55	G	24	24	5	5	X	54	55.2	129	60.0	54	55.2	129	59.9
127	12-Apr-01	8	3	N	1	8	10	G	24	30	10	10	X	54	56.0	129	58.7	54	55.9	129	58.8
128	09-May-01	9	1	S	1	7	7	S	26	30	0	5	X	54	59.7	129	58.7	54	59.6	129	58.7
129	09-May-01	9	1	S	2	10	40	G	27	30	10	10	X	54	59.6	129	58.7	54	59.6	129	58.8
130	09-May-01	9	1	S	3	50	58	G	29	24	5	5	X	54	59.6	129	58.9	54	59.6	129	59.0
131	09-May-01	9	1	N	1	8	8	S	20	30	0	5	X	54	59.6	129	58.6	54	59.5	129	58.6
132	09-May-01	9	1	N	1	10	15	G	22	30	10	10	X	54	59.5	129	58.6	54	59.4	129	58.5
133	09-May-01	9	1	N	1	11	11	G	23	24	5	5	X	54	59.3	129	58.4	54	59.4	129	58.4
134	10-May-01	9	2	S	1	8	8	S	22	30	0	5	X	54	58.7	129	57.2	54	58.6	129	57.2
135	10-May-01	9	2	S	2	11	40	G	23	30	10	10	X	54	58.6	129	57.6	54	58.6	129	57.8
136	10-May-01	9	2	S	3	50	50	G	24	24	5	5	X	54	58.6	129	57.7	54	58.7	129	57.7
137	10-May-01	9	2	N	1	10	10	S	17	30	0	5	X	54	58.7	129	57.4	54	58.7	129	57.5
138	10-May-01	9	2	N	1	11	11	G	18	30	10	10	X	54	58.7	129	57.5	54	58.6	129	57.5
139	10-May-01	9	2	N	2	35	35	G	19	24	5	5	X	54	58.7	129	57.6	54	58.7	129	57.6
140	11-May-01	9	2	N	1	12	12	S	16	30	0	5	X	54	56.6	129	55.2	54	56.7	129	55.2
141	11-May-01	9	2	N	1	12	12	G	17	30	10	10	X	54	56.7	129	55.2	54	56.8	129	55.2
142	11-May-01	9	2	N	2	20	20	G	18	24	5	5	X	54	56.9	129	55.3	54	56.9	129	55.4
143	11-May-01	9	2	N	1	10	10	S	21	30	0	5	X	54	57.1	129	55.3	54	57.1	129	55.4
144	11-May-01	9	2	N	1	12	12	G	21	30	10	10	X	54	57.2	129	55.4	54	57.2	129	55.5
145	11-May-01	9	2	N	1	15	15	G	22	24	5	5	X	54	57.3	129	55.6	54	57.4	129	55.6
146	12-May-01	9	3	S	1	7	7	S	23	30	0	5	X	54	54.9	129	58.9	54	55.0	129	59.0
147	12-May-01	9	3	S	2	10	35	G	24	30	10	10	X	54	55.0	129	59.1	54	55.1	129	59.0
148	12-May-01	9	3	S	3	55	55	G	25	24	5	5	X	54	55.2	129	58.9	54	55.2	129	58.9
149	12-May-01	9	3	N	1	10	10	S	16	30	0	5	X	54	55.0	129	58.7	54	54.9	129	58.8
150	12-May-01	9	3	N	2	20	20	G	17	30	10	10	X	54	55.0	129	58.6	54	55.0	129	58.8
151	12-May-01	9	3	N	3	30	30	G	18	24	5	5	X	54	55.0	129	58.8	54	55.0	129	58.7

Table A-1. Con't.

SET#	TRAP HAUL DATE	TRIP NO.	LOCATION (1=Kin, 2=Rip, 3=Ice)	SET TYPE (S=stand., N=non-stand)	DEPTHTYPE (1=S, 2=M, 3=D)	MINDEPTH	MAXDEPTH	FISHMETH (S=single; G=groundline)	SOAK(HRS)	TRAP SPACING	NO. OF TRAPS IN STRINGS	NO. OF TRAPS SAMPLED	PORT (O=OPEN; X=CLOSED)	LatStartDeg	LatStartMinDec	LongStartDeg	LongStartMinDec	LatEndDeg	LatEndMinDec	LongEndDeg	LongEndMinDec
152	13-May-01	9	3	N	1	10	10	S	18	30	0	5	X	54	57.3	129	57.0	54	57.3	129	57.0
153	13-May-01	9	3	N	1	10	15	G	18	30	10	10	X	54	57.3	129	57.1	54	57.2	129	57.2
154	13-May-01	9	3	N	1	15	15	G	19	24	5	5	X	54	57.3	129	57.0	54	57.2	129	57.0
155	13-May-01	9	3	N	1	8	8	S	20	30	0	5	X	54	57.5	129	56.9	54	57.4	129	56.9
156	13-May-01	9	3	N	1	12	15	G	21	30	10	10	X	54	57.4	129	56.9	54	57.3	129	56.9
157	13-May-01	9	3	N	1	12	12	G	22	24	5	5	X	54	57.3	129	56.9	54	57.4	129	56.9
158	14-May-01	9	2	N	1	6	7	S	20	30	0	5	X	54	58.6	129	57.4	54	58.6	129	57.4
159	14-May-01	9	2	N	1	8	8	G	21	30	10	10	X	54	58.6	129	57.4	54	58.6	129	57.6
160	14-May-01	9	2	N	2	8	30	G	22	24	5	5	X	54	58.6	129	57.5	54	58.6	129	57.6
161	14-May-01	9	2	N	1	8	8	S	24	30	0	5	X	54	58.5	129	57.4	54	58.5	129	57.4
162	14-May-01	9	2	N	1	7	7	G	23	30	10	10	X	54	58.5	129	57.4	54	58.5	129	57.6
163	14-May-01	9	2	N	1	8	8	G	23	24	5	5	X	54	58.5	129	57.4	54	58.5	129	44.5
164	15-May-01	9	1	N	1	10	10	S	19	30	0	5	X	54	59.7	129	58.7	54	59.6	129	58.7
165	15-May-01	9	1	N	1	10	10	G	19	30	10	10	X	54	59.6	129	58.7	54	59.5	129	58.6
166	15-May-01	9	1	N	1	15	15	G	20	24	5	5	X	54	59.5	129	58.6	54	59.4	129	58.6
167	15-May-01	9	1	N	1	11	11	S	21	30	0	5	X	54	59.4	129	58.5	54	59.4	129	58.5
168	15-May-01	9	1	N	1	9	12	G	21	30	10	10	X	54	59.4	129	58.4	54	59.3	129	58.4
169	15-May-01	9	1	N	1	11	11	G	22	24	5	5	X	54	59.3	129	58.4	54	59.3	129	58.4
170	28-May-01	10	3	N	1	6	6	S	17	30	0	5	X	54	57.4	129	57.0	54	57.4	129	57.0
171	28-May-01	10	3	N	1	12	12	G	18	30	10	10	X	54	57.3	129	57.0	54	57.3	129	57.1
172	28-May-01	10	3	N	1	13	13	G	19	24	5	5	X	54	57.2	129	57.1	54	57.2	129	57.2
173	29-May-01	10	3	S	1	6	6	S	24	30	0	5	X	54	55.0	129	59.0	54	55.0	129	59.1
174	29-May-01	10	3	S	2	10	30	G	24	30	10	10	X	54	55.1	129	59.1	54	55.2	129	59.1
175	29-May-01	10	3	S	3	50	50	G	25	24	5	5	X	54	55.2	129	60.0	54	55.2	129	58.9
176	28-May-01	10	2	N	1	6	6	S	6	30	0	5	X	54	56.5	129	55.3	54	56.6	129	55.3
177	28-May-01	10	2	N	1	8	8	G	7	30	10	10	X	54	56.6	129	55.3	54	56.7	129	55.2
178	28-May-01	10	2	N	1	9	9	G	8	24	5	5	X	54	56.7	129	55.2	54	56.8	129	55.3
179	29-May-01	10	2	N	1	9	9	S	14	30	0	5	X	54	57.1	129	55.3	54	57.2	129	55.4
180	29-May-01	10	2	N	1	9	9	G	15	30	10	10	X	54	57.2	129	55.4	54	57.3	129	55.5
181	29-May-01	10	2	N	1	8	8	G	16	24	5	5	X	54	57.3	129	55.5	54	57.4	129	55.6
182	29-May-01	10	1	N	1	9	9	S	6	30	0	5	X	54	59.8	129	58.7	54	59.7	129	58.7
183	29-May-01	10	1	N	1	10	12	G	7	30	10	10	X	54	59.7	129	58.7	54	59.5	129	58.7
184	29-May-01	10	1	N	2	25	25	G	7	24	5	5	X	54	59.5	129	58.7	54	59.6	129	58.7
185	29-May-01	10	1	N	1	7	7	S	7	30	0	5	X	54	59.5	129	58.6	54	59.4	129	58.5
186	29-May-01	10	1	N	1	10	10	G	8	30	10	10	X	54	59.4	129	58.5	54	59.3	129	58.4
187	29-May-01	10	1	N	1	12	12	G	9	24	5	5	X	54	59.3	129	58.4	54	59.3	129	58.5
188	31-May-01	10	1	S	1	8	8	S	24	30	0	5	X	54	59.7	129	58.7	54	59.7	129	58.6

Table A-1. Con't.

SET#	TRAP HAUL DATE	TRIP NO.	LOCATION (1=Kin, 2=Rip, 3=Ice)	SET TYPE (S=stand., N=non-stand)	DEPTHTYPE (1=S, 2=M, 3=D)	MINDEPTH	MAXDEPTH	FISHMETH (S=single; G=groundline)	SOAK(HRS)	TRAP SPACING	NO. OF TRAPS IN STRINGS	NO. OF TRAPS SAMPLED	PORT (O=OPEN; X=CLOSED)	LatStartDeg	LatStartMinDec	LongStartDeg	LongStartMinDec	LatEndDeg	LatEndMinDec	LongEndDeg	LongEndMinDec
189	31-May-01	10	1	S	2	10	40	G	25	30	10	10	X	54	59.6	129	58.7	54	59.6	129	58.8
190	31-May-01	10	1	S	3	50	50	G	25	24	5	5	X	54	59.6	129	58.9	54	59.7	129	58.9
191	31-May-01	10	2	S	1	8	8	S	26	30	0	5	X	54	58.7	129	57.4	54	58.6	129	57.4
192	31-May-01	10	2	S	2	10	40	G	26	30	10	10	X	54	58.6	129	57.6	54	58.6	129	57.8
193	31-May-01	10	2	S	3	50	55	G	27	24	5	5	X	54	58.7	129	57.8	54	58.7	129	57.7
194	23-Jun-01	11	1	S	1	6	6	S	24	24	0	5	X	54	59.7	129	58.7	54	59.7	129	58.6
195	23-Jun-01	11	1	S	2	8	42	G	25	30	10	10	X	54	59.6	129	58.7	54	59.6	129	58.9
196	23-Jun-01	11	1	S	3	50	50	G	26	24	5	5	X	54	59.6	129	58.9	54	59.7	129	58.9
197	23-Jun-01	11	2	S	1	4	4	S	26	30	0	3	X	54	58.7	129	57.3	54	58.6	129	57.3
198	23-Jun-01	11	2	S	2	8	42	G	27	30	10	10	X	54	58.6	129	57.6	54	58.6	129	57.9
199	23-Jun-01	11	2	S	3	55	55	G	27	24	5	5	X	54	58.7	129	57.3	54	58.7	129	57.7
200	24-Jun-01	11	3	S	1	5	5	S	25	30	0	5	X	54	54.9	129	58.9	54	55.0	129	59.0
201	24-Jun-01	11	3	S	2	10	42	G	26	30	10	10	X	54	55.0	129	59.0	54	55.1	129	59.0
202	24-Jun-01	11	3	S	3	50	50	G	27	24	5	5	X	54	55.1	129	58.9	54	55.1	129	58.8
203	24-Jun-01	11	3	N	1	7	7	S	19	30	0	3	X	54	57.4	129	56.9	54	57.4	129	56.9
204	24-Jun-01	11	3	N	1	9	9	G	19	30	10	10	X	54	57.4	129	57.0	54	57.3	129	57.0
205	24-Jun-01	11	3	N	1	10	12	G	20	24	5	5	X	54	57.3	129	57.1	54	57.2	129	57.2
206	24-Jun-01	11	3	N	1	6	6	G	6	30	10	10	X	54	57.3	129	57.0	54	57.2	129	57.2
207	24-Jun-01	11	3	N	1	7	7	G	6	24	5	5	X	54	57.2	129	57.2	54	57.1	129	57.3
208	24-Jun-01	11	2	N	1	4	4	S	6	30	0	3	X	54	56.3	129	55.2	54	56.8	129	55.2
209	27-Aug-01	12	1	S	1	9	9	S	24	30	0	5	X	54	59.7	129	58.6	54	59.7	129	58.7
210	27-Aug-01	12	1	S	2	10	45	G	24	30	10	10	X	54	59.7	129	58.6	54	59.6	129	58.8
211	27-Aug-01	12	1	S	3	50	50	G	25	24	5	5	X	54	59.7	129	58.9	54	59.7	129	58.9
212	27-Aug-01	12	1	N	1	14	14	G	27	30	10	10	X	54	59.6	129	58.7	54	59.6	129	58.6
213	28-Aug-01	12	2	S	1	7	7	S	24	30	0	5	X	54	58.7	129	57.4	54	58.7	129	57.4
214	28-Aug-01	12	2	S	2	11	40	G	25	30	10	10	X	54	58.6	129	57.6	54	58.6	129	57.8
215	28-Aug-01	12	2	S	3	50	50	G	25	24	5	5	X	54	58.7	129	57.7	54	58.7	129	57.7
216	28-Aug-01	12	2	N	1	5	5	G	24	30	10	10	X	54	58.5	129	57.7	54	58.4	129	57.5
217	29-Aug-01	12	3	N	1	7	8	G	23	30	10	10	X	54	57.4	129	56.9	54	57.3	129	56.0
218	29-Aug-01	12	3	S	1	7	7	S	24	30	0	5	X	54	55.0	129	59.0	54	55.0	129	59.1
219	29-Aug-01	12	3	S	2	9	35	G	25	30	10	10	X	54	55.0	129	59.1	54	55.1	129	59.0
220	29-Aug-01	12	3	S	3	55	60	G	24	24	5	5	X	54	55.2	129	59.3	54	55.2	129	58.9
221	20-Sep-01	13	1	S	1	6	6	S	25	30	0	5	X	54	59.8	129	58.7	54	59.7	129	58.7
222	20-Sep-01	13	1	S	2	9	36	G	26	30	10	10	X	54	59.7	129	58.7	54	59.6	129	58.8
223	20-Sep-01	13	1	S	3	45	45	G	27	24	5	5	X	54	59.6	129	58.9	54	59.7	129	58.9
224	20-Sep-01	13	1	N	1	12	12	G	24	30	10	10	X	54	59.7	129	58.7	54	59.5	129	58.7
225	21-Sep-01	13	2	S	1	4	4	S	24	30	0	5	X	54	58.7	129	57.4	54	58.6	129	57.3

Table A-1. Con't.

SET#	TRAP HAUL DATE	TRIP NO.	LOCATION (1=Kin, 2=Rip, 3=Ice)	SET TYPE (S=stand., N=non-stand)	DEPTHTYPE (1=S, 2=M, 3=D)	MINDEPTH	MAXDEPTH	FISHMETH (S=single; G=groundline)	SOAK(HRS)	TRAP SPACING	NO. OF TRAPS IN STRINGS	NO. OF TRAPS SAMPLED	PORT (O=OPEN; X=CLOSED)	LatStartDeg	LatStartMinDec	LongStartDeg	LongStartMinDec	LatEndDeg	LatEndMinDec	LongEndDeg	LongEndMinDec
226	21-Sep-01	13	2	S	2	7	40	G	25	30	10	10	X	54	58.5	129	57.6	54	58.5	129	57.8
227	21-Sep-01	13	2	S	3	45	45	G	24	24	5	5	X	54	58.6	129	57.8	54	58.6	129	57.8
228	21-Sep-01	13	2	N	1	8	8	G	20	30	10	10	X	54	58.6	129	57.6	54	58.5	129	57.4
229	22-Sep-01	13	3	S	1	4	4	S	24	30	0	5	X	54	55.0	129	59.0	54	55.0	129	59.1
230	22-Sep-01	13	3	S	2	7	30	G	24	30	10	10	X	54	55.0	129	59.1	54	55.1	129	59.1
231	22-Sep-01	13	3	S	3	50	50	G	25	24	5	5	X	54	55.2	129	59.0	54	55.2	129	58.9
232	22-Sep-01	13	3	N	1	6	6	G	21	30	10	10	X	54	57.4	129	56.9	54	57.3	129	57.1
233	20-Oct-01	14	1	S	1	4	7	S	25	30	0	5	X	54	59.8	129	58.7	54	59.7	129	58.7
234	20-Oct-01	14	1	S	2	8	40	G	26	30	10	10	X	54	59.7	129	58.7	54	59.7	129	58.8
235	20-Oct-01	14	1	S	3	45	45	G	27	24	5	5	X	54	59.7	129	58.9	54	59.7	129	58.9
236	20-Oct-01	14	1	N	1	6	6	S	23	30	0	5	X	54	59.6	129	58.6	54	59.5	129	58.6
237	20-Oct-01	14	1	N	1	9	10	G	24	30	10	10	X	54	59.7	129	58.7	54	59.6	129	58.7
238	20-Oct-01	14	1	N	1	10	10	G	24	24	5	5	X	54	59.5	129	58.6	54	59.5	129	58.6
239	21-Oct-01	14	2	S	1	4	5	S	24	30	0	5	X	54	58.7	129	57.3	54	58.6	129	57.3
240	21-Oct-01	14	2	S	2	7	30	G	26	30	10	10	X	54	58.6	129	57.4	54	58.6	129	57.6
241	21-Oct-01	14	2	S	3	45	45	G	26	24	5	5	X	54	58.6	129	57.7	54	58.7	129	57.7
242	21-Oct-01	14	2	N	1	5	5	S	20	30	0	5	X	54	56.5	129	55.2	54	56.6	129	55.2
243	21-Oct-01	14	2	N	1	5	8	G	20	30	10	10	X	54	56.7	129	55.2	54	56.8	129	55.2
244	21-Oct-01	14	2	N	1	6	6	G	21	24	5	5	X	54	56.8	129	55.2	54	56.9	129	55.2
245	22-Oct-01	14	3	S	1	4	4	S	24	30	0	5	X	54	55.0	129	59.0	54	55.0	129	59.1
246	22-Oct-01	14	3	S	2	9	35	G	24	30	10	10	X	54	55.0	129	59.1	54	55.1	129	59.0
247	22-Oct-01	14	3	S	3	50	50	G	25	24	5	5	X	54	55.2	129	59.0	54	55.1	129	58.9
248	22-Oct-01	14	3	N	1	6	6	S	20	30	0	5	X	54	57.4	129	56.9	54	57.4	129	57.0
249	22-Oct-01	14	3	N	1	5	10	G	20	30	10	10	X	54	57.4	129	57.0	54	57.3	129	57.1
250	22-Oct-01	14	3	N	1	10	13	G	21	24	5	5	X	54	57.3	129	57.1	54	57.2	129	57.2
251	17-Apr-02	15	1	S	1	6	6	S	24	30	0	5	X	54	59.8	129	58.7	54	59.7	129	58.6
252	17-Apr-02	15	1	S	2	10	38	G	25	30	10	10	X	54	59.7	129	58.7	54	59.6	129	58.8
253	17-Apr-02	15	1	S	3	50	54	G	26	24	5	5	X	54	59.6	129	58.9	54	59.6	129	58.9
254	17-Apr-02	15	1	N	1	5	5	S	27	30	5	5	X	54	59.7	129	58.6	54	59.6	129	58.7
255	17-Apr-02	15	1	N	1	12	13	G	28	30	10	10	X	54	59.6	129	58.7	54	59.5	129	58.6
256	17-Apr-02	15	1	N	1	15	16	G	29	24	5	5	X	54	59.4	129	58.6	54	59.4	129	58.5
257	18-Apr-02	15	2	S	1	4	4	S	24	30	0	5	X	54	58.7	129	57.3	54	58.7	129	57.3
258	18-Apr-02	15	2	S	2	8	41	G	25	30	10	10	X	54	58.7	129	57.5	54	58.7	129	57.7
259	18-Apr-02	15	2	S	3	50	50	G	25	24	5	5	X	54	58.6	129	57.8	54	58.7	129	57.7
260	18-Apr-02	15	2	N	1	6	6	S	20	30	0	5	X	54	58.6	129	57.3	54	58.6	129	57.2
261	18-Apr-02	15	2	N	1	7	7	G	19	30	10	10	X	54	58.5	129	57.1	54	58.5	129	57.2
262	18-Apr-02	15	2	N	1	7	7	G	18	24	5	5	X	54	58.5	129	57.3	54	58.5	129	57.3

Table A-1. Con't.

SET#	TRAP HAUL DATE	TRIP NO.	LOCATION (1=Kin, 2=Rip, 3=Ice)	SET TYPE (S=stand., N=non-stand)	DEPTHTYPE (1=S, 2=M, 3=D)	MINDEPTH	MAXDEPTH	FISHMETH (S=single; G=groundline)	SOAK(HRS)	TRAP SPACING	NO. OF TRAPS IN STRINGS	NO. OF TRAPS SAMPLED	PORT (O=OPEN; X=CLOSED)	LatStartDeg	LatStartMinDec	LongStartDeg	LongStartMinDec	LatEndDeg	LatEndMinDec	LongEndDeg	LongEndMinDec
263	19-Apr-02	15	3	S	1	8	8	S	23	30	0	5	X	54	54.9	129	58.9	54	55.0	129	59.0
264	19-Apr-02	15	3	S	2	8	38	G	24	30	10	10	X	54	55.0	129	59.0	54	55.1	129	59.0
265	19-Apr-02	15	3	S	3	50	50	G	24	24	5	5	X	54	55.2	129	58.9	54	55.1	129	58.9
266	19-Apr-02	15	3	N	1	3	3	G	18	30	0	5	X	54	57.4	129	56.9	54	57.4	129	57.0
267	19-Apr-02	15	3	N	1	5	6	G	19	30	10	10	X	54	57.4	129	56.9	54	57.3	129	57.1
268	19-Apr-02	15	3	N	1	8	10	G	19	24	5	5	X	54	57.3	129	57.1	54	57.2	129	57.2

Note: No set data for sets 112-115.

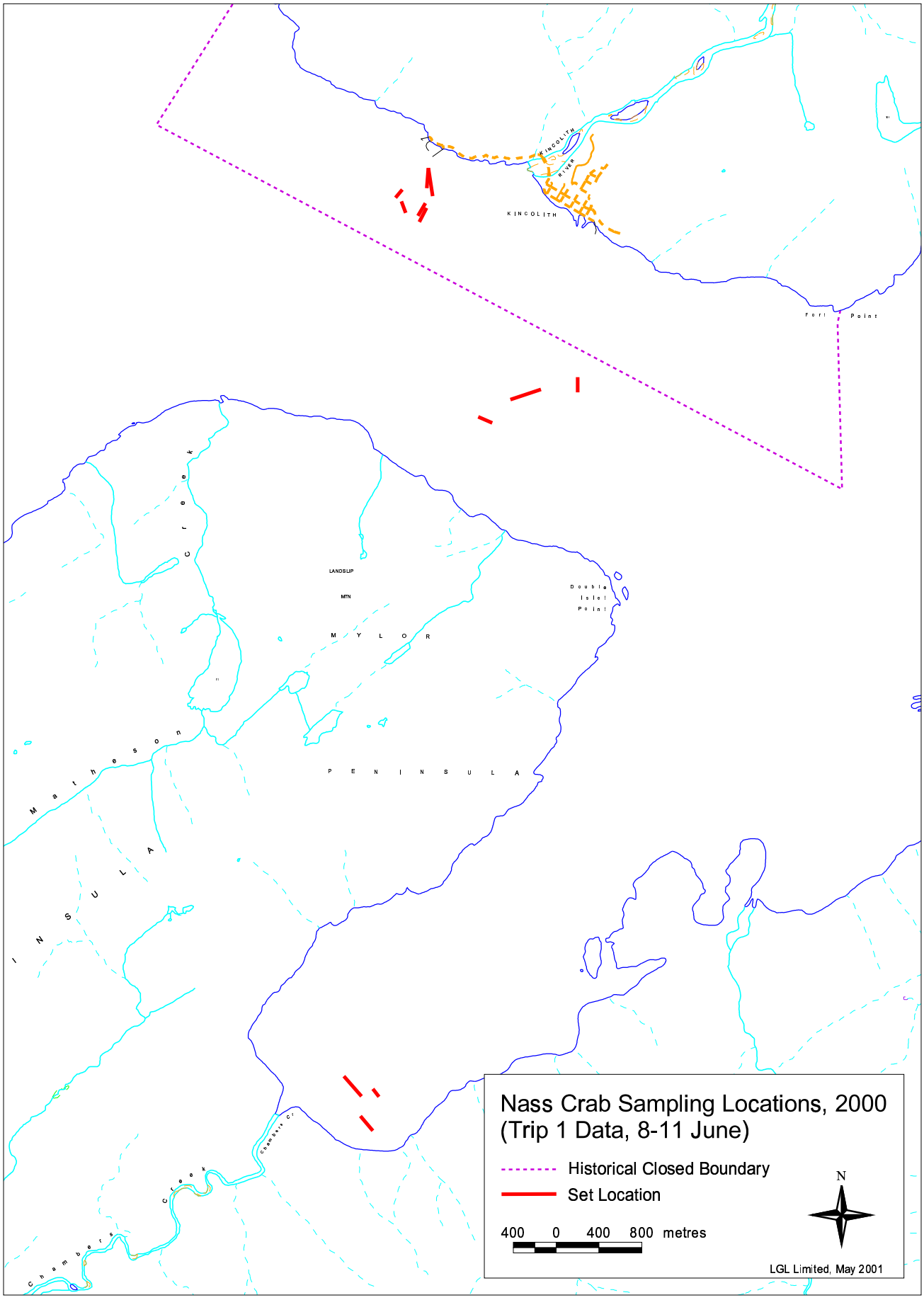


Figure A - 1. Locations of trap sets for capturing Dungeness Crabs in the Nass Estuary from 8 - 11 June 2000.

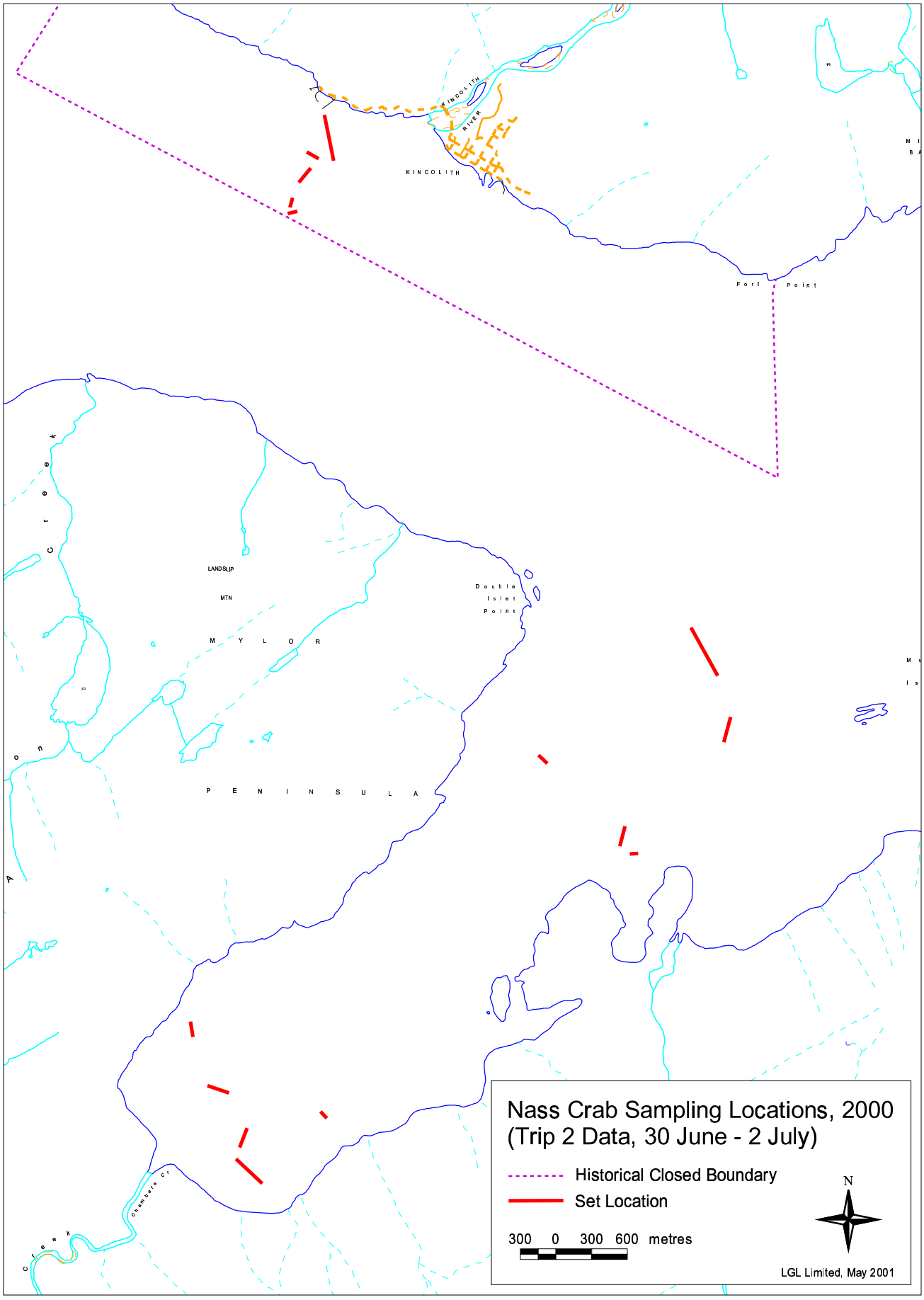


Figure A - 2. Locations of trap sets for capturing Dungeness Crabs in the Nass Estuary from 30 June - 2 July 2000.

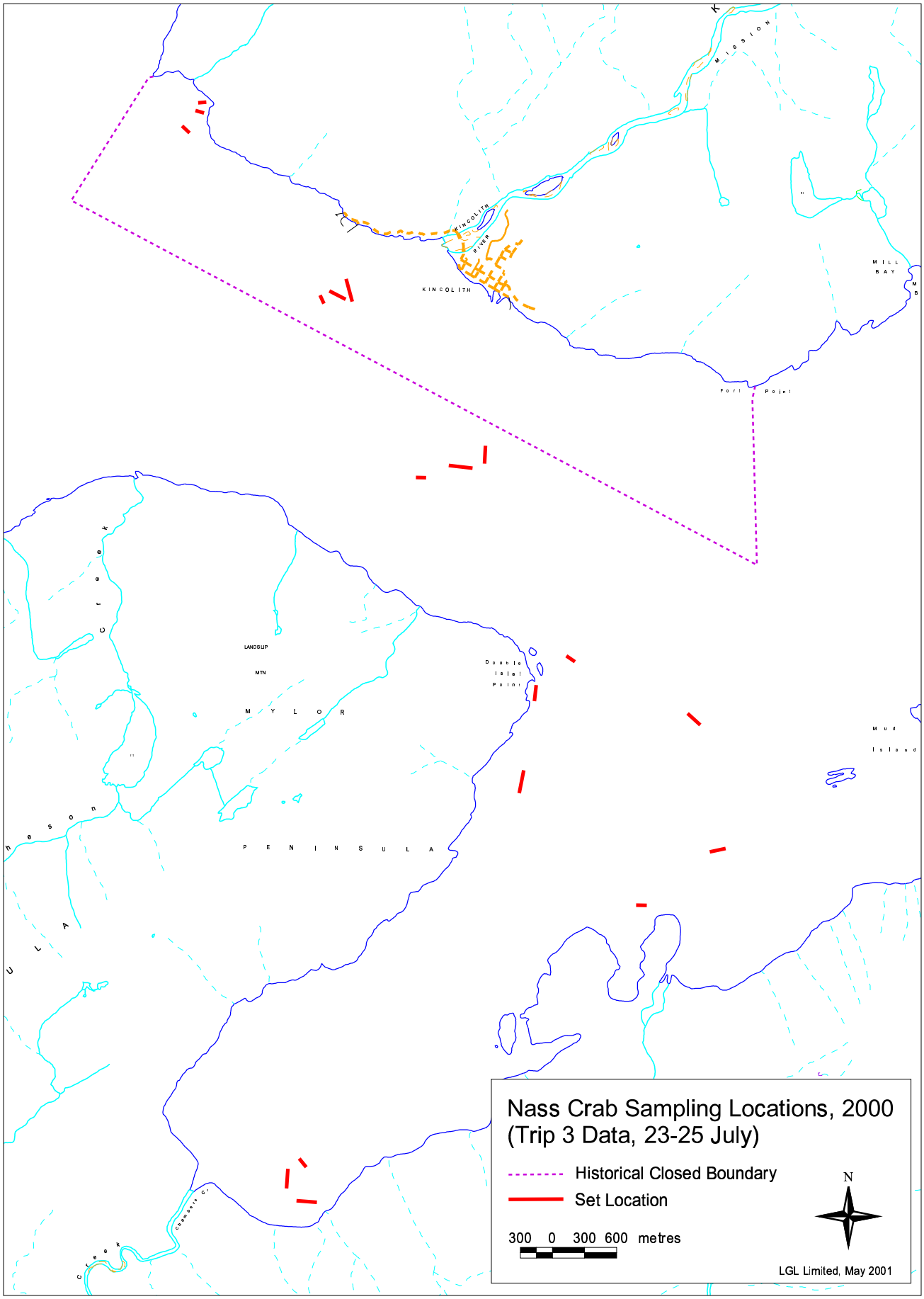


Figure A - 3. Locations of trap sets for capturing Dungeness Crabs in the Nass Estuary from 23 - 25 July 2000.

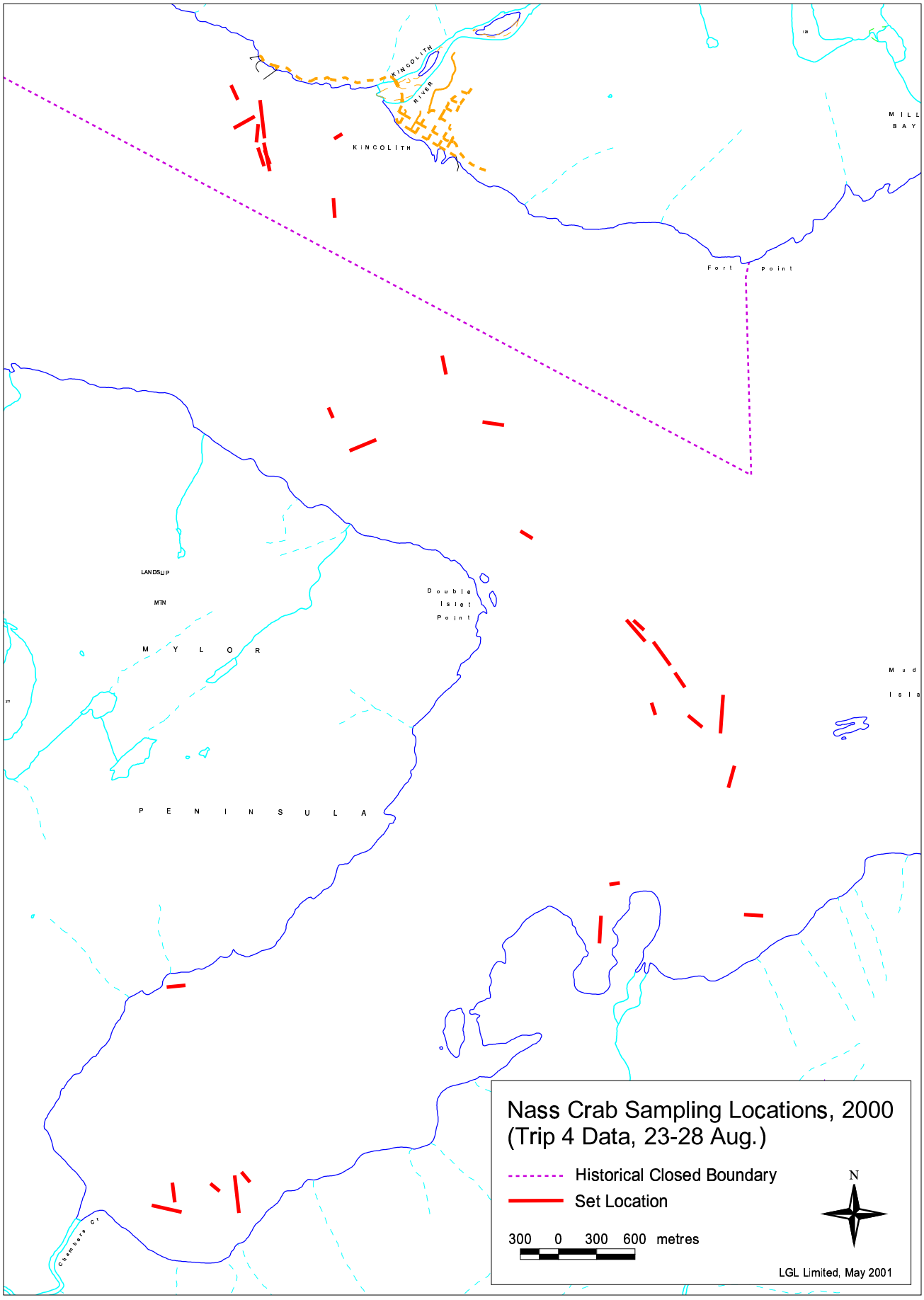


Figure A - 4. Locations of trap sets for capturing Dungeness Crabs in the Nass Estuary from 23 - 28 Aug. 2000.

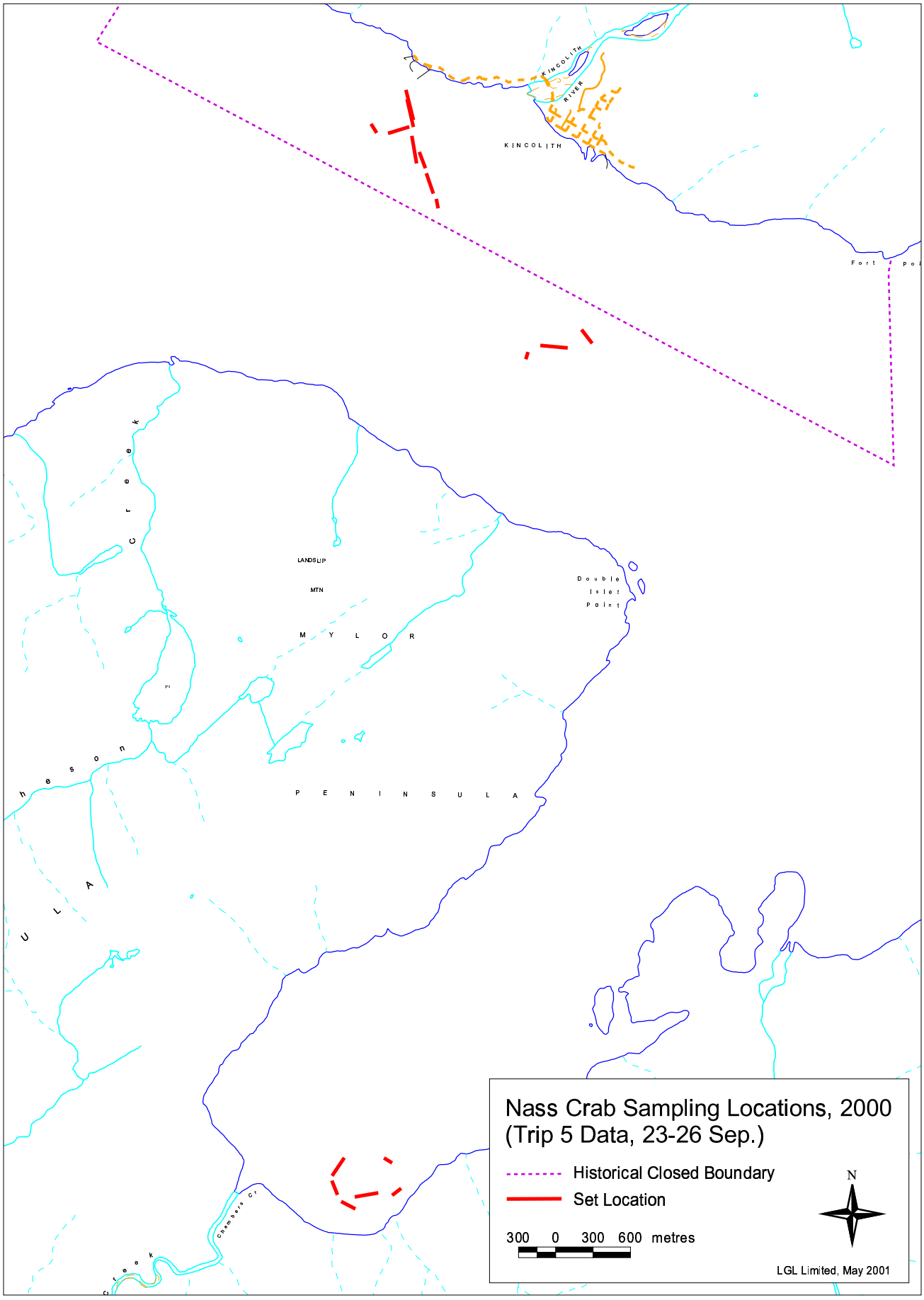


Figure A - 5. Locations of trap sets for capturing Dungeness Crabs in the Nass Estuary from 23 - 26 Sept. 2000.

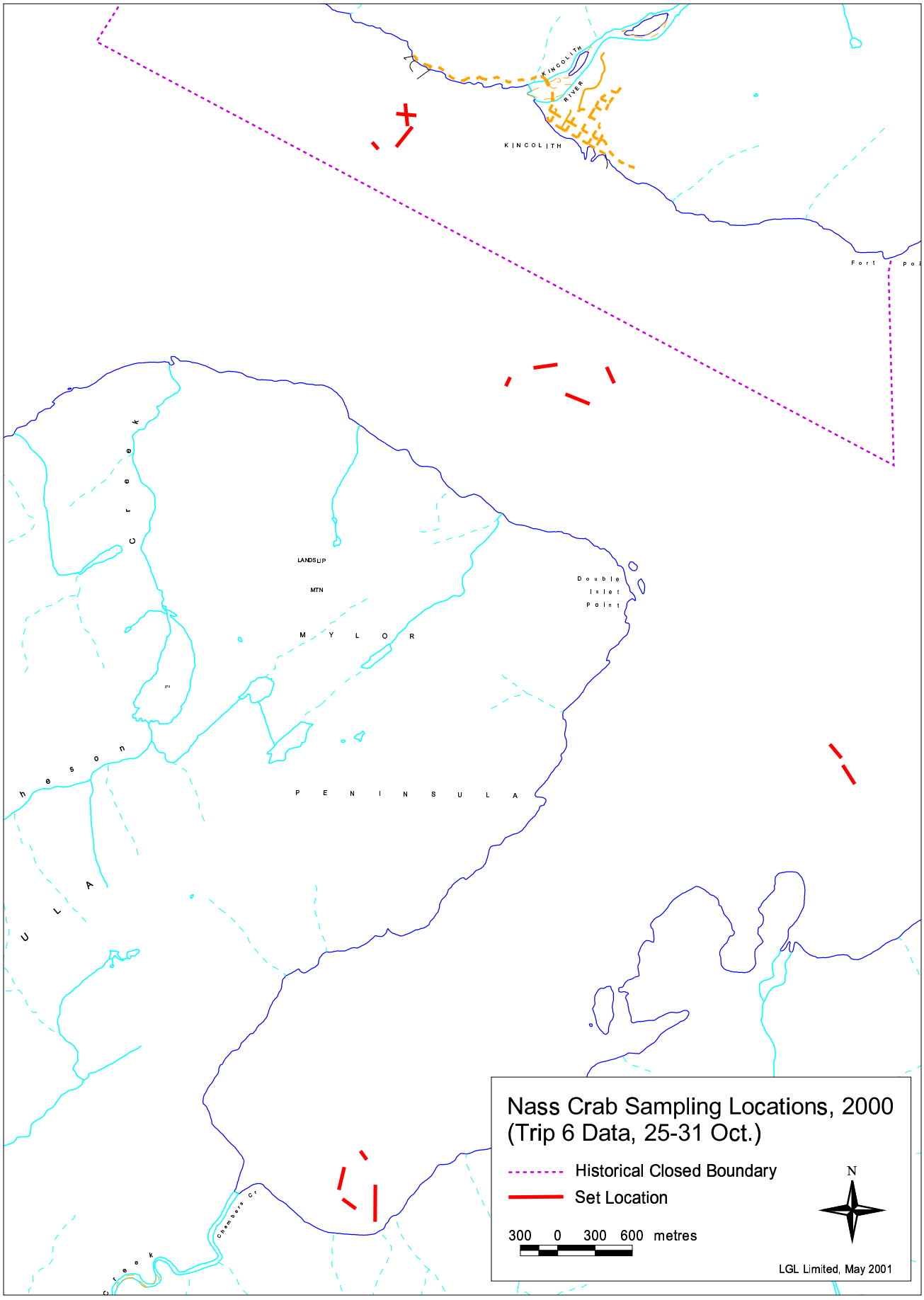


Figure A - 6. Locations of trap sets for capturing Dungeness Crabs in the Nass Estuary from 25 - 31 Oct. 2000.

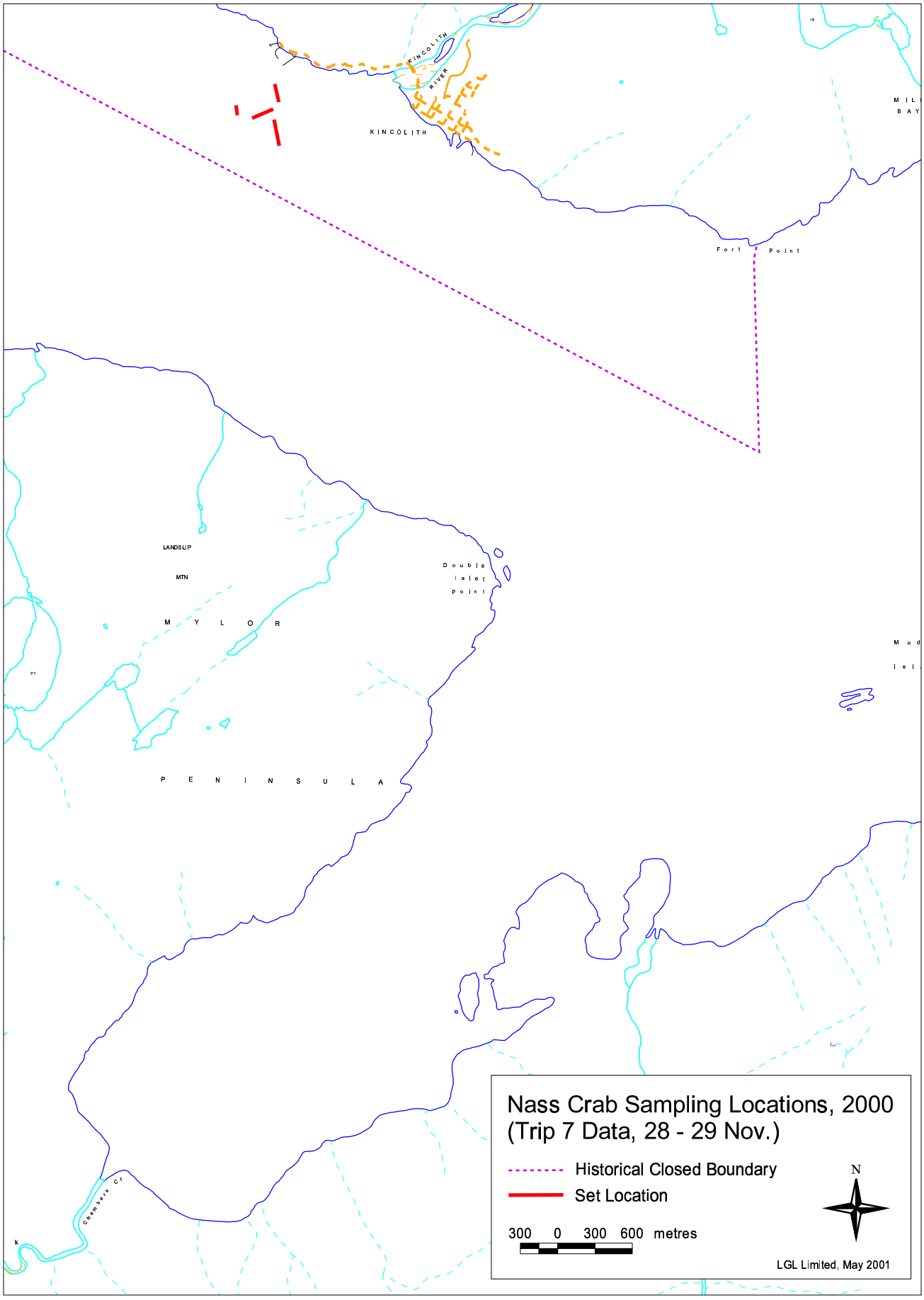


Figure A - 7. Locations of trap sets for capturing Dungeness Crabs in the Nass Estuary from 28 - 29 Nov. 2000.

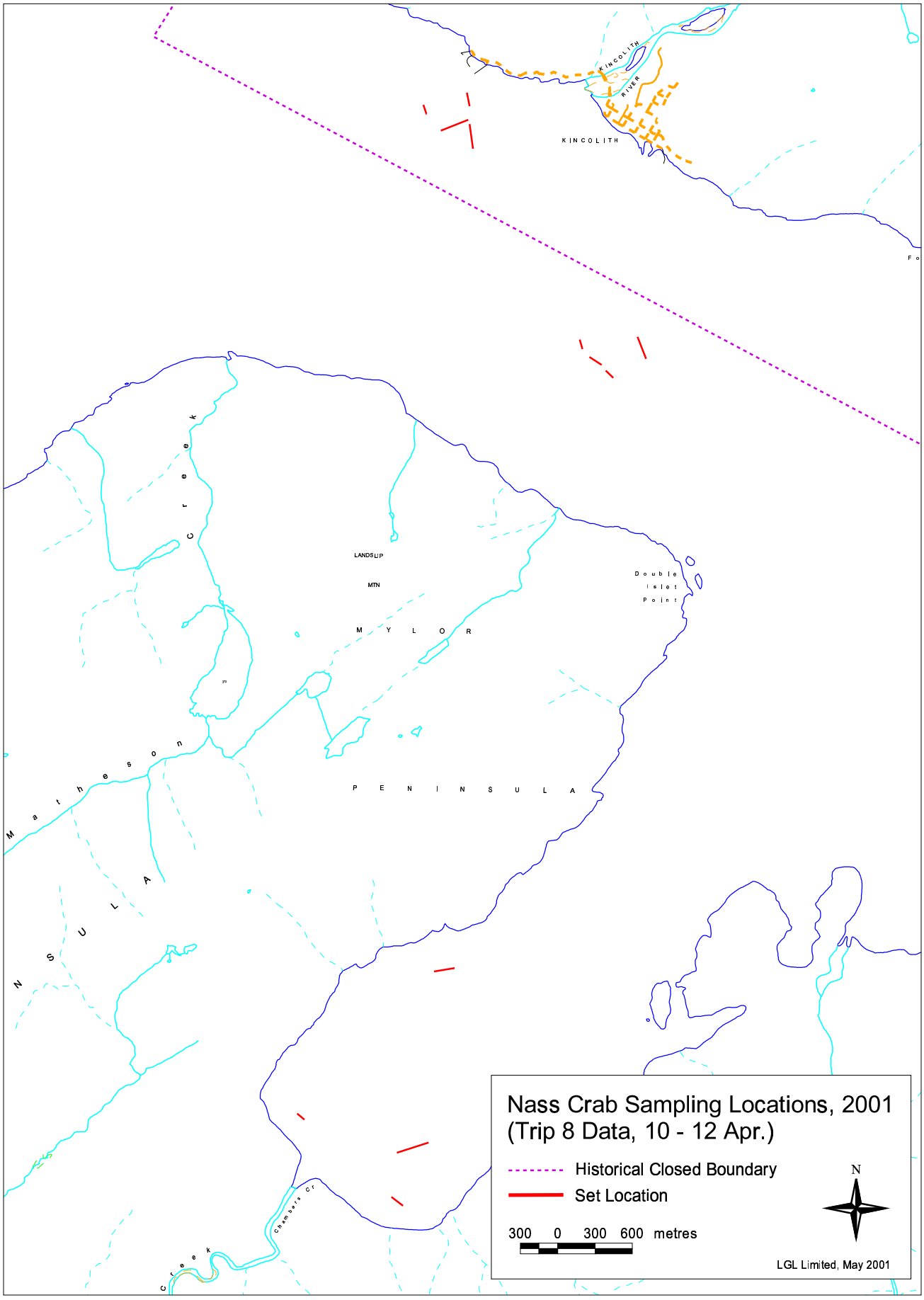


Figure A - 8. Locations of trap sets for capturing Dungeness Crabs in the Nass Estuary from 10 - 12 Apr. 2001.

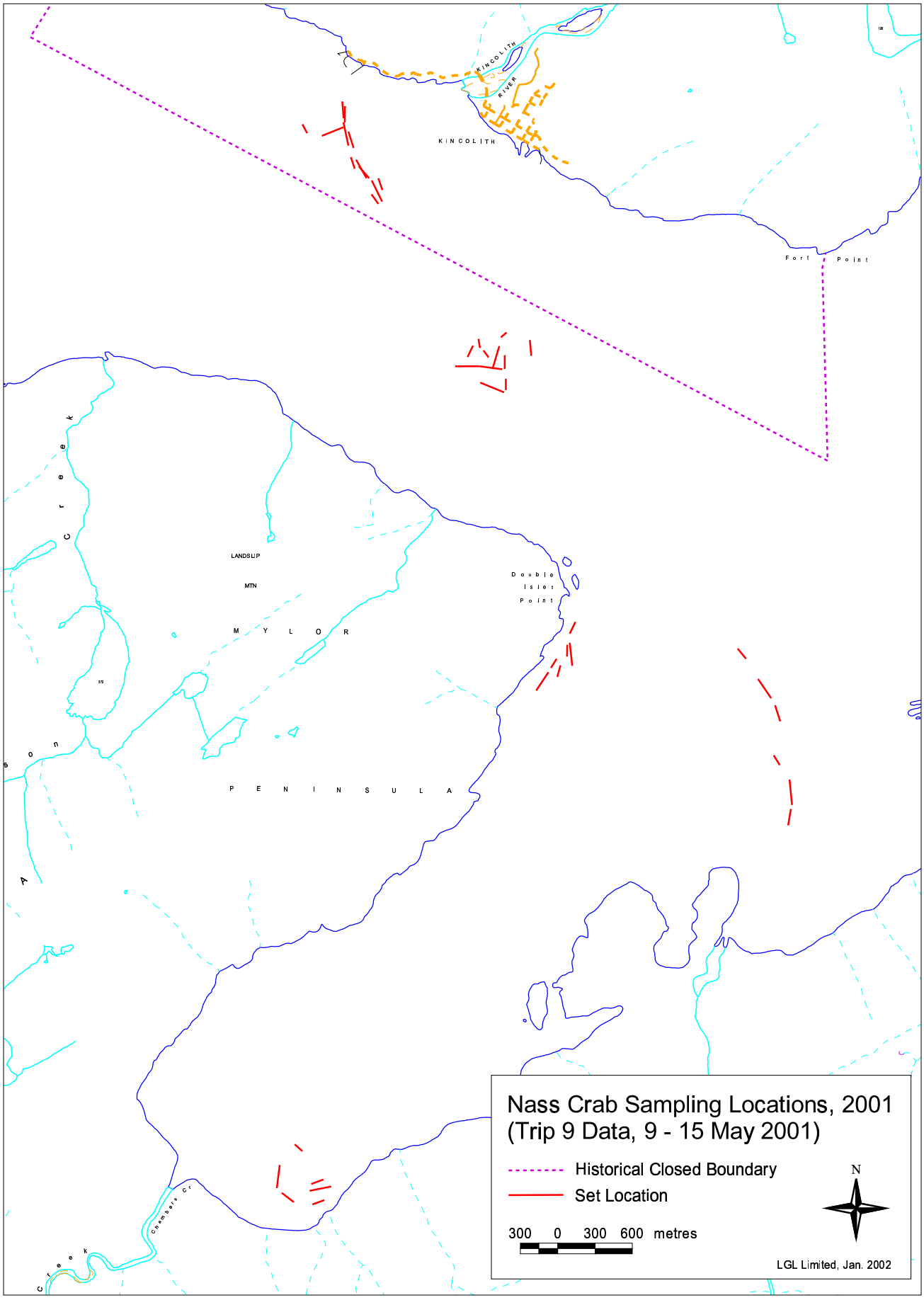


Figure A - 9. Locations of trap sets for capturing Dungeness Crabs in the Nass Estuary from 9 - 15 May 2001.

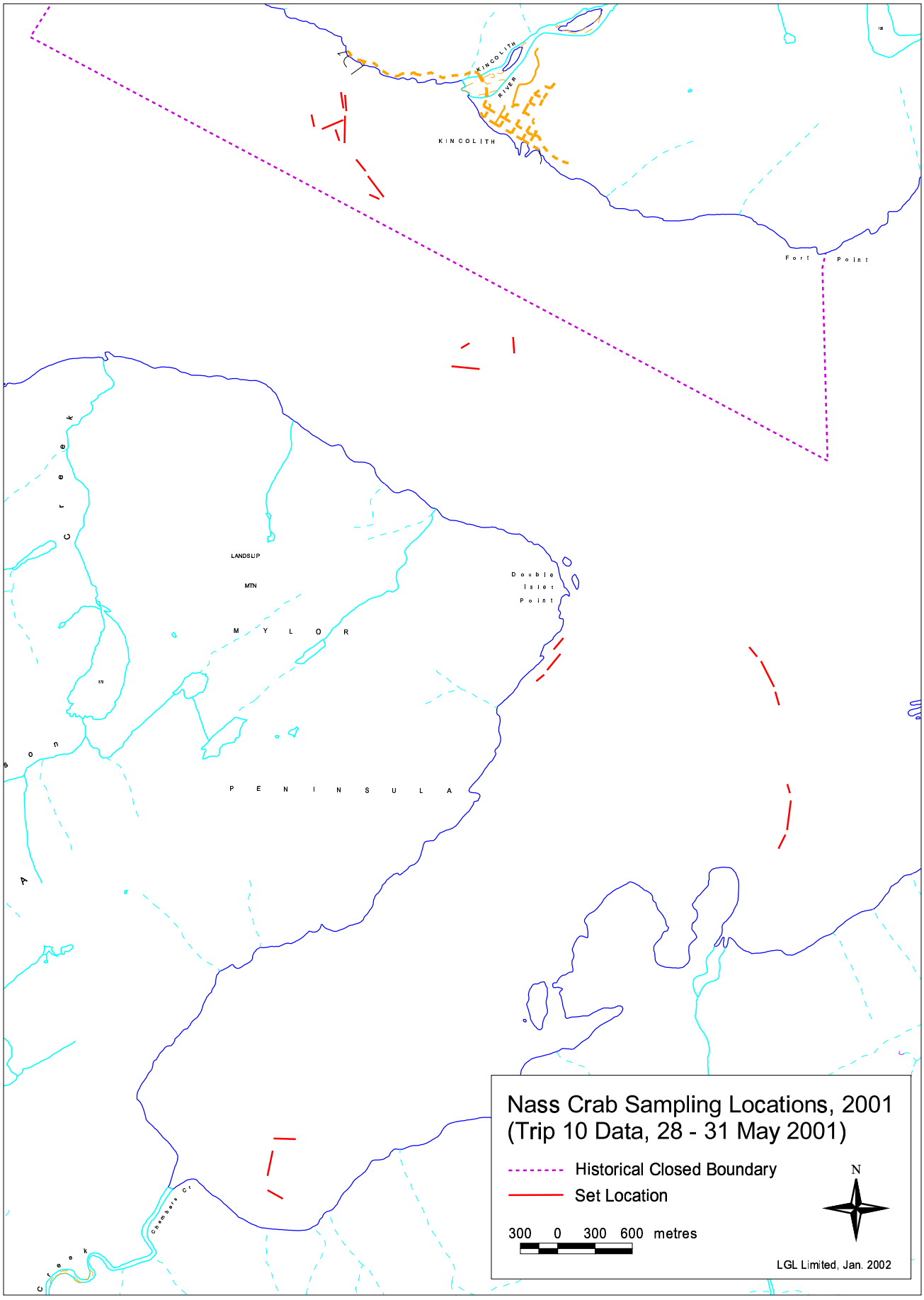


Figure A - 10. Locations of trap sets for capturing Dungeness Crabs in the Nass Estuary from 28 - 31 May 2001.

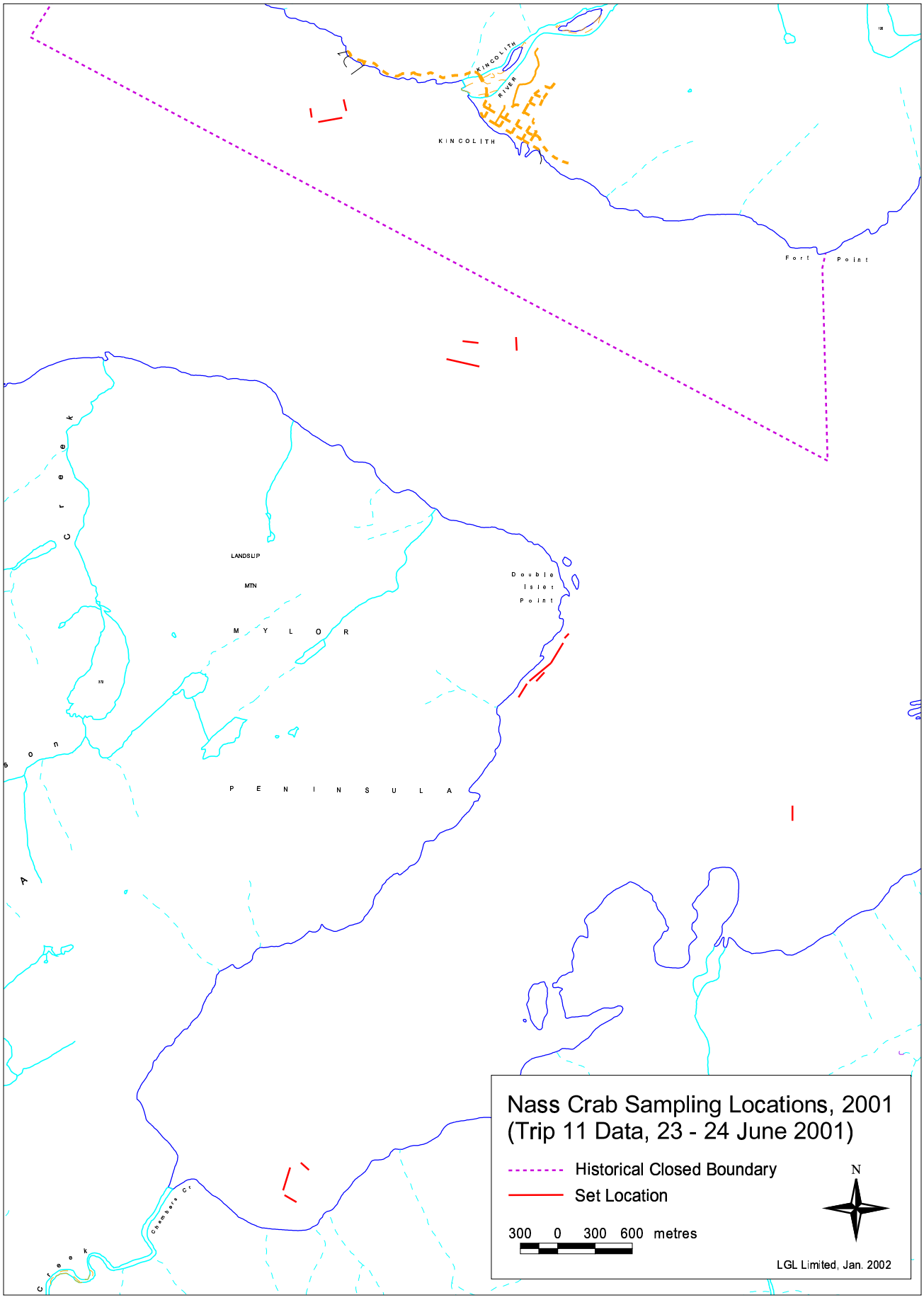


Figure A - 11. Locations of trap sets for capturing Dungeness Crabs in the Nass Estuary from 23 - 24 June 2001.

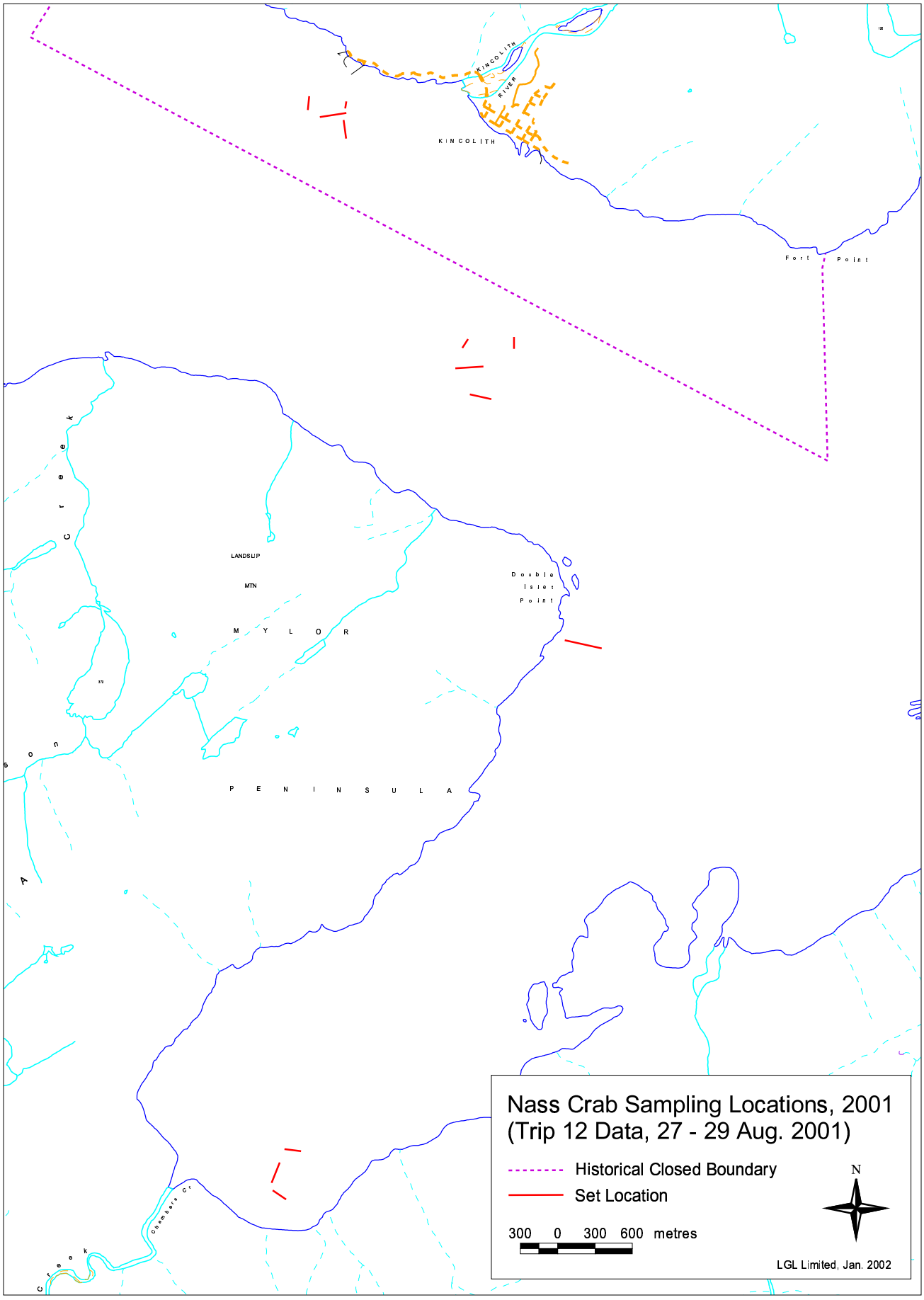


Figure A - 12. Locations of trap sets for capturing Dungeness Crabs in the Nass Estuary from 27 - 29 Aug. 2001.

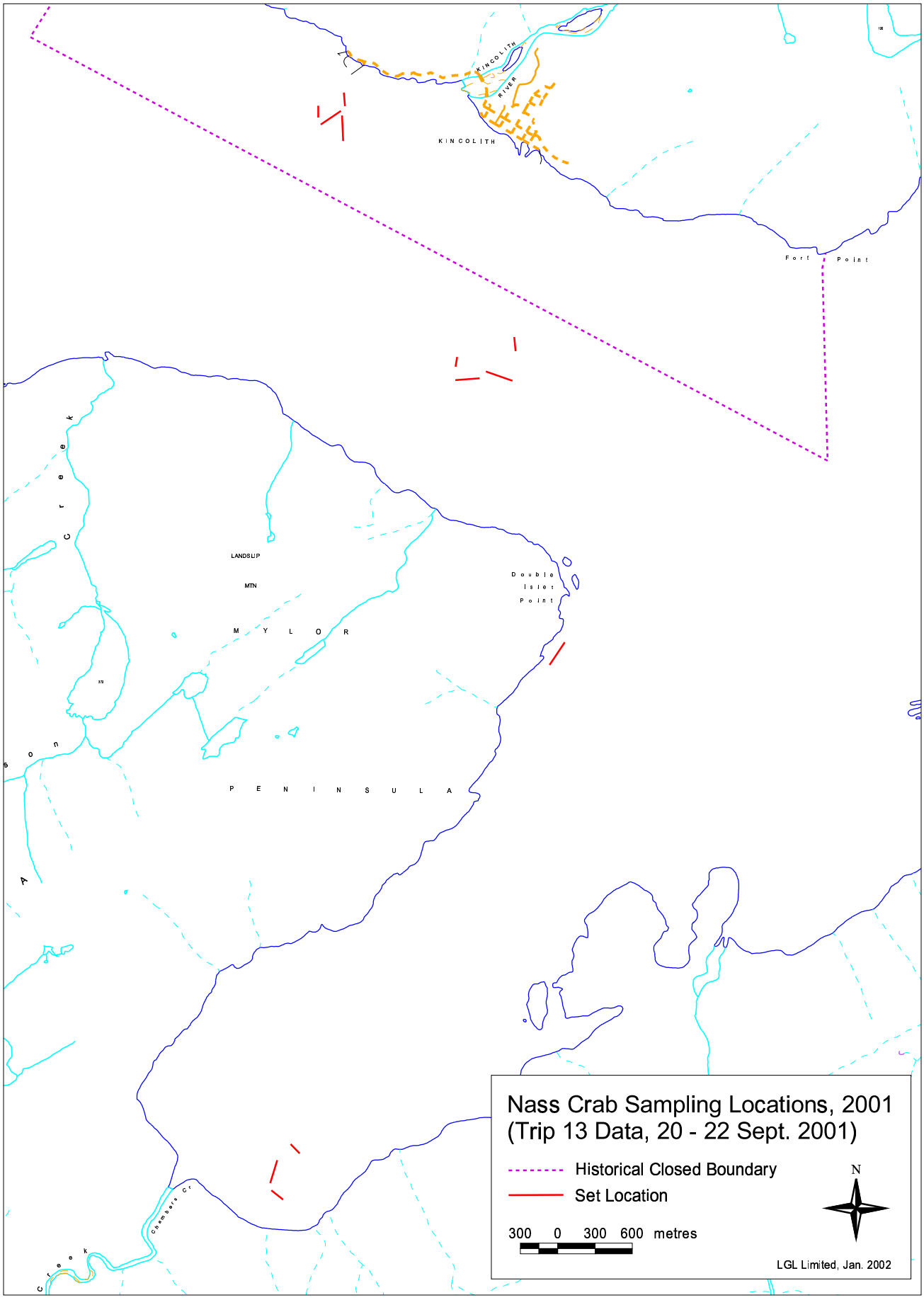


Figure A - 13. Locations of trap sets for capturing Dungeness Crabs in the Nass Estuary from 20 - 22 Sept. 2001.

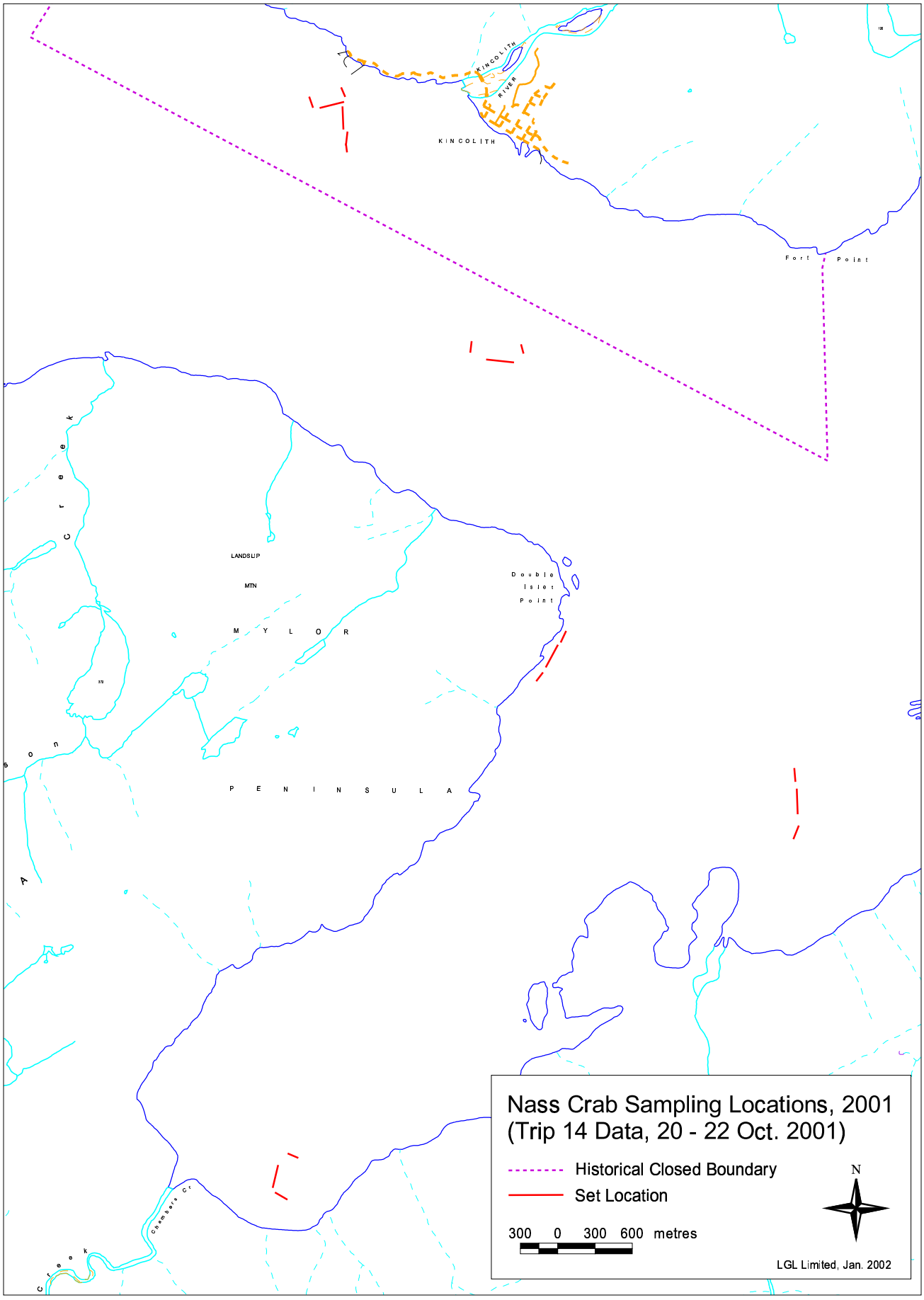


Figure A - 14. Locations of trap sets for capturing Dungeness Crabs in the Nass Estuary from 20 - 22 Oct. 2001.

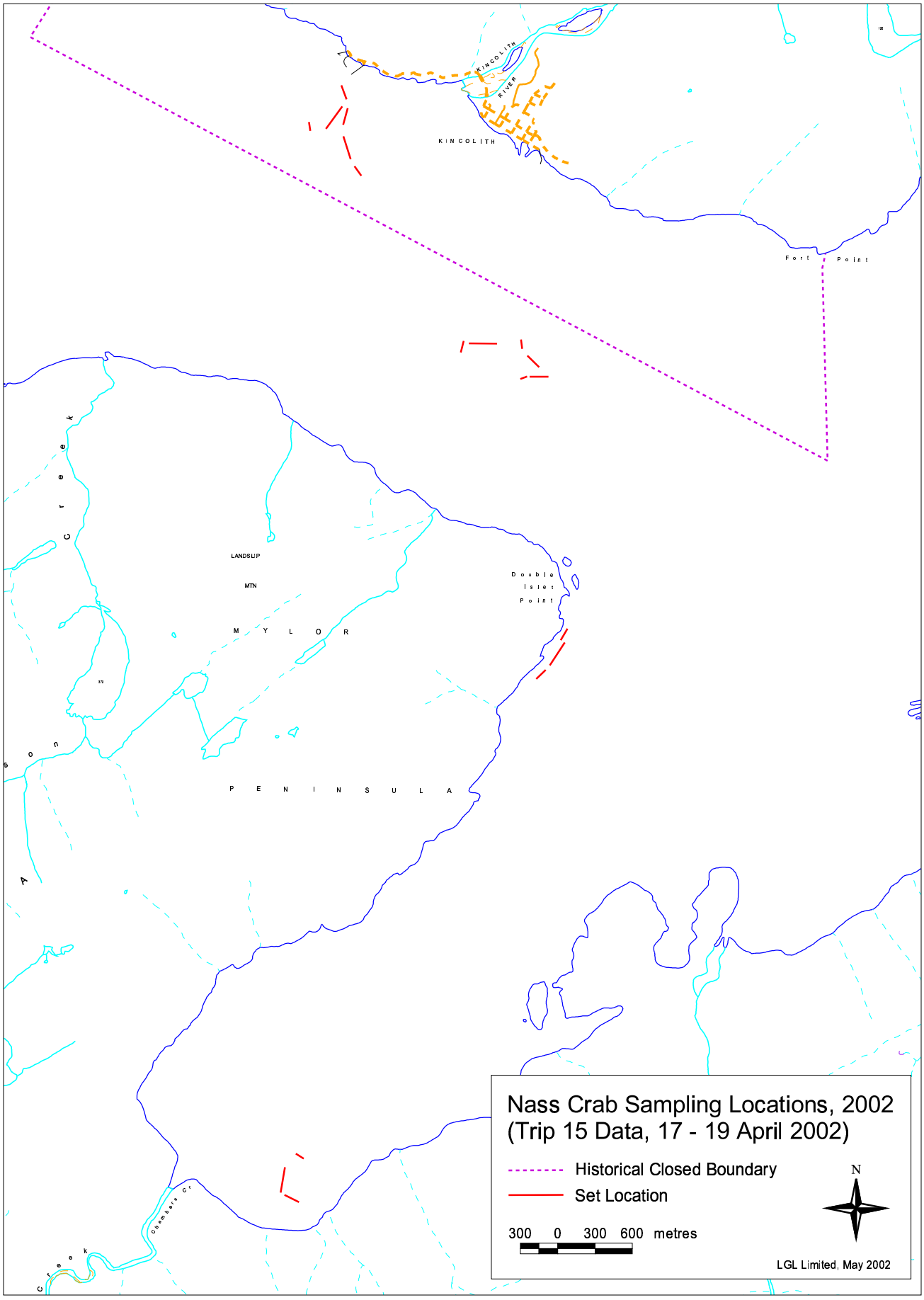


Figure A - 15. Locations of trap sets for capturing Dungeness Crabs in the Nass Estuary from 17 - 19 April 2002.

APPENDIX B

Catch data for the Nass Dungeness crab sampling program, 2000-2002.

Table B - 1. Catch and tag data collected during the Nass Dungeness crab sampling program, 8 June 2000 to 19 April 2002.

SET#	TRAP HAUL DATE	TRIP NO.	LOCATION (1=Kin, 2=Rip, 3=Ice)	SET TYPE (S=stand., N=non-stand)	NO. OF TRAPS SAMPLED	Male_Legal_Catch	Male_Medium_Catch	Male_Small_Catch	Male_Total Catch	Male_Tagged	Male_Tag_Recaps	Female_Large_Catch	Female_Medium_Catch	Female_Small_Catch	Female_Total Catch
1	08-Jun-00	1	1	S	5	31	3	0	34	0	0	6	12	1	19
2	08-Jun-00	1	1	S	10	56	2	0	58	56	0	19	69	0	88
3	08-Jun-00	1	1	S	5	8	0	0	8	0	0	12	26	1	39
4	09-Jun-00	1	2	S	5	31	8	0	39	38	0	0	16	0	16
5	09-Jun-00	1	2	S	10	21	0	0	21	20	0	14	22	0	36
6	09-Jun-00	1	2	S	5	6	0	0	6	6	0	8	60	0	68
7	10-Jun-00	1	3	S	5	4	8	0	12	11	0	9	15	5	29
8	10-Jun-00	1	3	S	5	0	0	0	0	0	0	2	0	0	2
9	10-Jun-00	1	3	S	10	25	9	0	34	30	0	7	12	0	19
10	11-Jun-00	1	1	S	5	23	3	0	26	25	0	3	29	2	34
11	11-Jun-00	1	1	S	10	43	5	0	48	48	0	15	65	2	82
12	11-Jun-00	1	1	S	5	9	0	0	9	9	0	13	64	1	78
13	30-Jun-00	2	3	S	10	14	15	4	33	25	2	9	33	3	45
14	30-Jun-00	2	3	S	10	42	19	2	64	57	0	14	31	1	46
15	30-Jun-00	2	3	N	5	9	0	0	9	8	0	8	11	0	19
16	30-Jun-00	2	3	S	10	32	7	0	39	36	1	6	16	1	23
17	30-Jun-00	2	3	S	5	1	0	0	1	0	0	9	6	0	15
18	01-Jul-00	2	2	E	10	40	25	7	72	60	0	2	23	2	27
19	01-Jul-00	2	2	E	10	47	25	2	74	71	0	7	50	1	58
20	01-Jul-00	2	2	N	10	59	7	2	68	66	0	10	37	0	47
21	01-Jul-00	2	2	N	5	49	6	0	55	52	0	2	25	0	27
22	01-Jul-00	2	2	N	5	29	4	0	33	33	0	3	24	0	27
23	02-Jul-00	2	1	S	10	36	9	0	45	45	0	5	11	2	18
24	02-Jul-00	2	1	S	10	23	4	0	27	27	0	3	22	0	25
25	02-Jul-00	2	1	S	10	19	3	0	22	22	0	7	49	1	57
26	02-Jul-00	2	1	S	5	4	0	0	4	4	0	6	22	4	32
27	02-Jul-00	2	1	S	5	4	0	0	4	4	0	10	38	2	50
28	23-Jul-00	3	1	S	5	49	8	0	58	57	1	4	5	0	9
29	23-Jul-00	3	1	S	5	12	0	0	12	11	0	12	51	2	65
30	23-Jul-00	3	1	S	10	38	0	0	38	38	0	10	68	1	79
31	23-Jul-00	3	1	N	4	4	14	10	28	6	0	2	6	2	10
32	23-Jul-00	3	1	N	10	11	1	1	13	12	0	12	38	1	51
33	23-Jul-00	3	1	N	5	3	1	0	4	4	0	8	34	0	42
34	24-Jul-00	3	2	S	5	26	4	0	30	29	0	1	22	4	27
35	24-Jul-00	3	2	S	10	17	0	0	17	17	0	10	44	1	55
36	24-Jul-00	3	2	S	5	4	0	0	4	4	0	1	2	0	3
37	24-Jul-00	3	2	E	5	26	9	12	47	31	0	2	11	4	17
38	24-Jul-00	3	2	E	10	62	25	0	87	85	1	8	21	0	29
39	24-Jul-00	3	2	N	5	19	4	0	23	23	0	11	32	1	44
40	25-Jul-00	3	3	S	5	5	7	7	19	6	0	3	6	9	18
41	25-Jul-00	3	3	S	10	25	12	0	37	30	2	3	6	1	10
42	25-Jul-00	3	3	S	5	0	0	0	1	0	0	3	6	0	10
43	25-Jul-00	3	2	S	5	3	3	1	7	6	0	6	25	4	35
44	25-Jul-00	3	2	S	10	30	3	0	33	33	0	2	49	0	51

Table B-1. Con't.

SET#	TRAP HAUL DATE	TRIP NO.	LOCATION (1=Kin, 2=Rip, 3=Ice)	SET TYPE (S=stand., N=non-stand)	NO. OF TRAPS SAMPLED	Male_Legal_Catch	Male_Medium_Catch	Male_Small_Catch	Male_Total Catch	Male_Tagged	Male_Tag_Recaps	Female_Large_Catch	Female_Medium_Catch	Female_Small_Catch	Female_Total Catch
45	25-Jul-00	3	2	S	5	23	3	0	26	24	0	4	17	0	21
46	23-Aug-00	4	1	S	10	89	20	2	111	108	0	8	32	4	44
47	23-Aug-00	4	1	S	10	56	6	0	62	62	0	17	85	2	104
48	23-Aug-00	4	1	S	10	100	14	0	114	110	2	3	31	5	39
49	23-Aug-00	4	1	S	5	14	0	0	14	12	2	10	45	2	57
50	23-Aug-00	4	1	S	5	32	6	1	39	32	3	6	22	1	29
51	24-Aug-00	4	2	S	5	34	8	0	42	40	0	6	10	2	18
52	24-Aug-00	4	2	S	10	30	8	11	49	32	0	3	33	15	51
53	24-Aug-00	4	2	S	5	7	2	0	9	9	0	6	42	12	60
54	24-Aug-00	4	2	S	10	32	5	0	37	37	0	4	7	0	11
55	24-Aug-00	4	1	S	5	29	3	0	32	31	1	0	8	1	9
56	24-Aug-00	4	1	S	5	6	1	0	7	7	0	3	13	1	17
57	25-Aug-00	4	3	S	5	8	18	8	34	15	0	6	18	5	29
58	25-Aug-00	4	3	S	10	35	15	0	50	44	3	13	15	0	28
59	25-Aug-00	4	3	S	5	9	2	0	11	10	1	8	20	0	28
60	25-Aug-00	4	2	S	5	30	3	1	34	33	0	2	21	2	25
61	25-Aug-00	4	2	S	10	47	14	1	62	52	1	9	54	6	69
62	25-Aug-00	4	2	S	5	16	6	2	24	20	0	3	31	5	39
63	26-Aug-00	4	2	S	5	33	23	6	62	40	0	2	3	2	7
64	26-Aug-00	4	2	S	10	53	20	4	77	68	0	5	33	5	43
65	26-Aug-00	4	2	S	5	23	2	0	25	25	0	11	53	2	66
66	26-Aug-00	4	3	S	5	8	14	2	24	16	0	0	9	4	13
67	26-Aug-00	4	3	S	10	23	3	0	26	18	8	4	6	0	10
68	26-Aug-00	4	3	S	5	1	0	0	1	1	0	2	8	0	10
69	27-Aug-00	4	2	S	5	50	21	3	74	66	0	2	9	0	11
70	27-Aug-00	4	2	S	10	74	38	15	127	97	0	6	21	4	31
71	27-Aug-00	4	2	S	5	40	12	2	54	44	0	8	36	5	49
72	27-Aug-00	4	2	S	5	27	11	4	42	33	0	4	12	1	17
73	27-Aug-00	4	2	S	10	50	18	3	71	60	0	7	28	3	38
74	27-Aug-00	4	2	S	5	19	10	3	32	26	0	4	18	3	25
75	28-Aug-00	4	1	S	10	61	19	0	80	76	0	8	29	12	49
76	28-Aug-00	4	1	S	10	74	22	1	97	90	0	7	53	10	70
77	23-Sep-00	5	3	S	5	5	17	6	28	14	2	0	5	4	9
78	23-Sep-00	5	3	S	5	2	35	4	41	22	1	7	21	6	34
79	23-Sep-00	5	3	S	10	33	40	6	79	59	6	4	25	9	38
80	23-Sep-00	5	3	S	10	46	60	7	113	75	10	3	20	3	26
81	23-Sep-00	5	3	S	5	20	20	3	43	31	4	3	15	4	22
82	23-Sep-00	5	3	S	5	10	1	0	11	10	1	5	17	0	22
83	24-Sep-00	5	2	S	5	21	8	2	31	0	0	2	18	6	26
84	24-Sep-00	5	2	S	10	28	7	3	38	0	0	12	65	11	88
85	24-Sep-00	5	2	S	5	12	0	0	12	0	0	5	18	1	24
86	25-Sep-00	5	1	S	5	44	9	2	55	49	2	2	19	4	25
87	25-Sep-00	5	1	S	10	32	9	2	43	31	2	17	77	11	105
88	25-Sep-00	5	1	S	5	4	2	1	7	6	0	11	45	19	75
89	25-Sep-00	5	1	S	5	42	5	2	49	46	0	5	33	7	45
90	25-Sep-00	5	1	S	10	56	13	5	74	59	3	15	59	38	112
91	25-Sep-00	5	1	S	5	36	3	1	40	38	0	6	37	10	53

Table B-1. Con't.

SET#	TRAP HAUL DATE	TRIP NO.	LOCATION (1=Kin, 2=Rip, 3=Ice)	SET TYPE (S=stand., N=non-stand)	NO. OF TRAPS SAMPLED	Male_Legal_Catch	Male_Medium_Catch	Male_Small_Catch	Male_Total Catch	Male_Tagged	Male_Tag_Recaps	Female_Large_Catch	Female_Medium_Catch	Female_Small_Catch	Female_Total Catch
92	26-Sep-00	5	1	S	10	92	20	3	115	53	4	12	50	14	76
93	26-Sep-00	5	1	S	10	38	10	0	48	0	1	23	65	21	109
94	27-Oct-00	6	1	S	5	30	7	0	37	0	2	4	9	2	15
95	27-Oct-00	6	1	S	10	28	19	0	47	0	1	24	66	20	110
96	27-Oct-00	6	1	S	5	6	3	1	10	0	0	29	57	9	95
97	27-Oct-00	6	1	S	10	43	20	1	64	0	3	14	38	11	63
98	29-Oct-00	6	2	S	5	6	15	0	21	0	0	0	2	0	2
99	29-Oct-00	6	2	S	10	5	13	2	20	0	0	5	28	6	39
100	29-Oct-00	6	2	S	5	4	4	1	9	0	0	3	15	2	20
101	29-Oct-00	6	2	S	10	10	20	0	31	0	0	2	16	6	24
102	30-Oct-00	6	3	S	5	2	24	2	28	0	1	0	9	2	11
103	30-Oct-00	6	3	S	10	4	58	16	78	0	2	1	10	2	13
104	30-Oct-00	6	3	S	5	2	21	3	26	0	0	9	15	0	24
105	30-Oct-00	6	3	S	10	7	55	5	67	0	4	2	14	3	19
106	31-Oct-00	6	2	E	10	4	41	24	69	0	0	5	20	2	27
107	31-Oct-00	6	2	E	10	8	49	16	73	0	0	1	16	0	17
108	28-Nov-00	7	1	S	5	20	11	3	34	0	1	5	22	5	32
109	28-Nov-00	7	1	S	10	19	13	1	33	0	1	6	38	6	50
110	28-Nov-00	7	1	S	5	4	9	0	13	0	0	6	26	9	41
111	28-Nov-00	7	1	S	10	28	23	1	52	0	3	7	40	12	59
116	10-Apr-01	8	1	S	5	28	30	0	59	0	1	1	25	7	33
117	10-Apr-01	8	1	S	10	19	26	1	46	0	1	6	38	25	69
118	10-Apr-01	8	1	S	5	8	3	0	11	0	0	7	40	13	60
119	10-Apr-01	8	1	S	10	69	53	2	124	0	1	8	59	13	80
120	11-Apr-01	8	2	S	5	10	11	0	21	0	0	2	13	3	18
121	11-Apr-01	8	2	S	9	7	9	0	16	0	0	3	21	3	27
122	11-Apr-01	8	2	S	10	10	7	0	17	0	1	5	25	5	35
123	11-Apr-01	8	2	S	5	2	0	0	2	0	0	5	13	0	18
124	12-Apr-01	8	3	S	5	8	32	1	41	0	0	2	8	2	12
125	12-Apr-01	8	3	S	10	44	74	3	121	0	0	1	6	4	11
126	12-Apr-01	8	3	S	5	12	19	0	31	0	0	1	4	0	5
127	12-Apr-01	8	3	N	10	22	52	2	76	0	2	4	14	2	20
128	09-May-01	9	1	S	5	25	38	3	66	55	0	3	16	3	22
129	09-May-01	9	1	S	10	51	40	2	93	80	3	16	60	8	84
130	09-May-01	9	1	S	5	11	4	0	15	15	0	11	50	3	64
131	09-May-01	9	1	N	5	14	37	3	54	35	0	2	26	4	32
132	09-May-01	9	1	N	10	43	57	4	104	82	0	5	52	19	76
133	09-May-01	9	1	N	5	29	33	4	66	48	0	1	20	8	29
134	10-May-01	9	2	S	5	4	10	2	16	9	0	2	6	1	9
135	10-May-01	9	2	S	10	27	10	0	37	35	0	3	27	13	43
136	10-May-01	9	2	S	5	4	2	0	6	6	0	1	17	4	22
137	10-May-01	9	2	N	5	30	8	3	41	36	0	2	24	2	28
138	10-May-01	9	2	N	10	31	24	0	55	49	0	5	28	5	38
139	10-May-01	9	2	N	5	13	4	0	17	17	0	3	30	10	43
140	11-May-01	9	2	N	5	25	27	5	57	41	0	0	22	7	29
141	11-May-01	9	2	N	10	45	54	2	101	81	0	4	33	14	51
142	11-May-01	9	2	N	5	46	17	0	63	59	0	3	26	0	29

Table B-1. Con't.

SET#	TRAP HAUL DATE	TRIP NO.	LOCATION (1=Kin, 2=Rip, 3=Ice)	SET TYPE (S=stand., N=non-stand)	NO. OF TRAPS SAMPLED	Male_Legal_Catch	Male_Medium_Catch	Male_Small_Catch	Male_Total Catch	Male_Tagged	Male_Tag_Recaps	Female_Large_Catch	Female_Medium_Catch	Female_Small_Catch	Female_Total Catch
143	11-May-01	9	2	N	5	14	20	1	35	29	0	2	17	7	26
144	11-May-01	9	2	N	10	32	38	11	81	62	0	3	25	5	33
145	11-May-01	9	2	N	5	19	26	8	53	35	0	4	14	3	21
146	12-May-01	9	3	S	5	15	25	1	41	30	0	4	9	2	15
147	12-May-01	9	3	S	10	35	45	1	81	74	4	1	14	2	17
148	12-May-01	9	3	S	5	19	19	0	38	38	0	1	4	0	5
149	12-May-01	9	3	N	5	13	17	2	32	27	0	0	6	2	8
150	12-May-01	9	3	N	10	13	15	3	31	24	1	3	4	1	8
151	12-May-01	9	3	N	5	8	31	2	41	27	1	0	5	1	6
152	13-May-01	9	3	N	5	22	22	5	49	40	0	1	13	2	16
153	13-May-01	9	3	N	10	35	31	2	68	61	1	8	32	8	48
154	13-May-01	9	3	N	5	16	26	2	44	36	0	2	20	2	24
155	13-May-01	9	3	N	5	38	32	11	81	54	0	0	16	4	20
156	13-May-01	9	3	N	10	19	23	5	47	34	0	11	54	6	71
157	13-May-01	9	3	N	5	18	25	0	43	34	0	3	23	3	29
158	14-May-01	9	2	N	5	20	17	0	37	35	1	0	5	0	5
159	14-May-01	9	2	N	10	39	34	0	73	65	0	4	28	12	44
160	14-May-01	9	2	N	5	19	14	0	33	28	0	0	25	14	40
161	14-May-01	9	2	N	5	18	15	2	35	26	0	1	4	0	5
162	14-May-01	9	2	N	10	25	33	1	59	53	0	2	14	1	17
163	14-May-01	9	2	N	5	17	14	0	31	30	0	0	12	0	12
164	15-May-01	9	1	N	5	10	15	3	28	20	1	1	8	0	9
165	15-May-01	9	1	N	10	28	26	5	59	46	3	8	26	5	39
166	15-May-01	9	1	N	5	18	28	3	49	31	1	5	19	5	29
167	15-May-01	9	1	N	5	20	34	7	61	33	2	1	22	8	31
168	15-May-01	9	1	N	10	27	49	7	83	57	0	2	48	41	91
169	15-May-01	9	1	N	5	28	20	2	50	43	0	1	29	13	43
170	28-May-01	10	3	N	5	37	32	16	85	55	0	0	20	4	24
171	28-May-01	10	3	N	10	41	65	20	126	76	2	2	24	5	31
172	28-May-01	10	3	N	5	20	25	1	46	37	0	3	18	1	22
173	29-May-01	10	3	S	5	11	14	3	28	23	0	4	7	2	13
174	29-May-01	10	3	S	10	27	53	1	81	69	3	9	13	1	23
175	29-May-01	10	3	S	5	16	18	0	34	32	1	2	6	0	8
176	28-May-01	10	2	N	5	5	24	5	34	22	1	1	24	14	39
177	28-May-01	10	2	N	10	21	33	1	55	38	0	2	22	12	36
178	28-May-01	10	2	N	5	16	16	1	33	24	2	1	19	8	28
179	29-May-01	10	2	N	5	10	25	3	38	22	0	3	18	1	22
180	29-May-01	10	2	N	10	16	35	7	58	35	1	5	9	3	17
181	29-May-01	10	2	N	5	8	26	5	39	24	0	2	20	4	26
182	29-May-01	10	1	N	5	7	25	4	36	27	1	0	22	8	30
183	29-May-01	10	1	N	10	14	44	2	60	46	0	0	17	1	18
184	29-May-01	10	1	N	5	1	3	0	4	3	0	0	1	2	3
185	29-May-01	10	1	N	5	11	30	0	41	37	0	2	15	4	21
186	29-May-01	10	1	N	10	29	55	3	87	63	1	0	15	9	24
187	29-May-01	10	1	N	5	10	25	2	37	27	0	0	12	6	18
188	31-May-01	10	1	S	5	8	36	2	46	37	0	0	3	0	3
189	31-May-01	10	1	S	10	8	23	0	31	25	2	7	17	0	24

Table B-1. Con't.

SET#	TRAP HAUL DATE	TRIP NO.	LOCATION (1=Kin, 2=Rip, 3=Ice)	SET TYPE (S=stand., N=non-stand)	NO. OF TRAPS SAMPLED	Male_Legal_Catch	Male_Medium_Catch	Male_Small_Catch	Male_Total Catch	Male_Tagged	Male_Tag_Recaps	Female_Large_Catch	Female_Medium_Catch	Female_Small_Catch	Female_Total Catch
190	31-May-01	10	1	S	5	12	7	0	19	18	0	1	33	4	38
191	31-May-01	10	2	S	5	34	22	0	56	49	1	1	12	4	17
192	31-May-01	10	2	S	10	26	8	0	34	31	3	5	35	4	44
193	31-May-01	10	2	S	5	4	2	0	6	6	0	1	9	0	10
194	23-Jun-01	11	1	S	5	13	29	1	43	35	2	0	9	2	11
195	23-Jun-01	11	1	S	10	44	56	0	100	88	4	10	68	10	88
196	23-Jun-01	11	1	S	5	8	4	0	12	12	0	4	14	3	21
197	23-Jun-01	11	2	S	3	8	7	1	16	12	0	0	2	1	3
198	23-Jun-01	11	2	S	10	13	3	0	16	16	0	0	10	0	10
199	23-Jun-01	11	2	S	5	3	3	0	6	6	0	0	1	0	1
200	24-Jun-01	11	3	S	5	12	25	1	38	27	1	0	10	1	11
201	24-Jun-01	11	3	S	10	46	43	1	90	77	3	6	18	3	27
202	24-Jun-01	11	3	S	5	21	11	0	32	21	4	7	5	0	12
203	24-Jun-01	11	3	N	3	3	14	1	18	11	0	0	3	0	3
204	24-Jun-01	11	3	N	10	39	66	20	125	75	0	2	10	1	13
205	24-Jun-01	11	3	N	5	9	20	1	30	18	0	1	18	5	24
206	24-Jun-01	11	3	N	10	0	6	5	11	0	0	0	3	3	6
207	24-Jun-01	11	3	N	5	1	5	2	8	0	0	0	3	5	8
208	24-Jun-01	11	2	N	3	6	21	5	32	13	0	1	4	4	9
209	27-Aug-01	12	1	S	5	25	19	1	45	37	2	7	30	4	41
210	27-Aug-01	12	1	S	10	56	27	0	83	0	5	14	79	10	103
211	27-Aug-01	12	1	S	5	21	7	0	28	0	1	4	49	16	69
212	27-Aug-01	12	1	N	10	84	42	0	126	0	1	16	72	15	103
213	28-Aug-01	12	2	S	5	17	16	2	35	6	0	4	33	9	46
214	28-Aug-01	12	2	S	10	15	18	0	33	0	0	5	46	25	76
215	28-Aug-01	12	2	S	5	11	1	0	12	0	0	3	23	8	34
216	28-Aug-01	12	2	N	10	21	29	0	50	0	0	5	47	15	67
217	29-Aug-01	12	3	N	10	33	44	0	77	0	0	0	37	9	46
218	29-Aug-01	12	3	S	5	16	32	1	49	0	0	3	8	3	14
219	29-Aug-01	12	3	S	10	30	29	0	59	0	1	4	8	0	12
220	29-Aug-01	12	3	S	5	7	2	0	9	0	0	0	2	0	2
221	20-Sep-01	13	1	S	5	22	28	0	50	0	0	0	33	11	44
222	20-Sep-01	13	1	S	10	61	74	2	137	0	2	4	40	11	55
223	20-Sep-01	13	1	S	5	22	39	0	61	0	1	4	12	2	18
224	20-Sep-01	13	1	N	10	48	55	0	103	0	5	4	54	18	76
225	21-Sep-01	13	2	S	5	17	9	0	26	0	0	1	9	1	11
226	21-Sep-01	13	2	S	10	35	9	0	44	0	0	3	32	6	41
227	21-Sep-01	13	2	S	5	12	3	0	15	0	0	2	4	1	7
228	21-Sep-01	13	2	N	10	20	19	0	39	0	0	2	25	2	29
229	22-Sep-01	13	3	S	5	22	32	0	54	0	0	2	5	1	8
230	22-Sep-01	13	3	S	10	46	29	0	75	0	1	7	16	1	24
231	22-Sep-01	13	3	S	5	18	8	0	26	0	0	7	14	1	22
232	22-Sep-01	13	3	N	10	37	65	4	106	0	0	3	26	2	31
233	20-Oct-01	14	1	S	5	24	30	1	55	0	0	1	13	1	15
234	20-Oct-01	14	1	S	10	53	79	6	138	0	1	11	24	4	39
235	20-Oct-01	14	1	S	5	18	53	4	75	0	0	9	11	1	21
236	20-Oct-01	14	1	N	5	30	18	0	48	0	0	2	30	4	36

Table B-1. Con't.

SET#	TRAP HAUL DATE	TRIP NO.	LOCATION (1=Kin, 2=Rip, 3=Ice)	SET TYPE (S=stand., N=non-stand)	NO. OF TRAPS SAMPLED	Male_Legal_Catch	Male_Medium_Catch	Male_Small_Catch	Male_Total Catch	Male_Tagged	Male_Tag_Recaps	Female_Large_Catch	Female_Medium_Catch	Female_Small_Catch	Female_Total Catch
237	20-Oct-01	14	1	N	10	47	69	5	121	0	0	2	57	8	67
238	20-Oct-01	14	1	N	5	22	29	0	51	0	1	2	27	6	35
239	21-Oct-01	14	2	S	5	6	26	0	32	0	0	0	17	0	17
240	21-Oct-01	14	2	S	10	13	35	2	50	0	0	4	19	2	25
241	21-Oct-01	14	2	S	5	14	33	0	47	0	0	2	13	1	16
242	21-Oct-01	14	2	N	5	6	28	1	35	0	0	0	33	4	37
243	21-Oct-01	14	2	N	10	22	70	1	93	0	0	0	59	5	64
244	21-Oct-01	14	2	N	5	9	34	1	44	0	1	1	28	1	30
245	22-Oct-01	14	3	S	5	4	15	0	19	0	0	4	18	1	23
246	22-Oct-01	14	3	S	10	21	71	1	93	0	2	11	22	0	33
247	22-Oct-01	14	3	S	5	15	31	0	46	0	2	5	14	0	19
248	22-Oct-01	14	3	N	5	6	31	2	39	0	1	0	4	0	4
249	22-Oct-01	14	3	N	10	9	91	7	107	0	0	2	14	0	16
250	22-Oct-01	14	3	N	5	4	49	3	56	0	0	0	17	0	17
251	17-Apr-02	15	1	S	5	32	30	0	62	0	1	1	22	5	28
252	17-Apr-02	15	1	S	10	44	16	0	60	0	1	3	56	13	72
253	17-Apr-02	15	1	S	5	14	2	0	16	0	0	3	48	12	63
254	17-Apr-02	15	1	N	5	9	15	0	24	0	1	1	19	8	28
255	17-Apr-02	15	1	N	10	35	31	0	66	0	0	6	48	13	67
256	17-Apr-02	15	1	N	5	29	16	0	45	0	1	2	38	12	52
257	18-Apr-02	15	2	S	5	40	22	0	62	0	0	0	20	2	22
258	18-Apr-02	15	2	S	10	43	15	0	58	0	0	3	46	7	56
259	18-Apr-02	15	2	S	5	11	4	0	15	0	0	3	13	2	18
260	18-Apr-02	15	2	N	5	25	8	0	33	0	0	1	8	2	11
261	18-Apr-02	15	2	N	10	62	20	0	82	0	0	1	27	5	33
262	18-Apr-02	15	2	N	5	10	13	0	23	0	0	0	4	3	7
263	19-Apr-02	15	3	S	5	29	11	0	40	0	0	4	6	1	11
264	19-Apr-02	15	3	S	10	48	12	0	60	0	1	2	3	0	5
265	19-Apr-02	15	3	S	5	29	8	0	37	0	1	1	2	0	3
266	19-Apr-02	15	3	N	5	40	14	0	54	0	1	3	21	6	30
267	19-Apr-02	15	3	N	10	65	22	0	87	0	3	2	37	9	48
268	19-Apr-02	15	3	N	5	36	12	0	48	0	0	0	32	2	34

Note: No set data for sets 112-115.

APPENDIX C

Statistical data for the Nass Dungeness crab-sampling program, 2000-2002

Table C - 1. Results from a 1-factor ANOVA and Kruskal-Wallis statistical tests comparing the mean catch catch per trap of male Dungeness crabs caught in standard trap sets in the Nass Estuary, June 2000 to April 2002.

Legal-sized Males:

Sampling period	Mean Catch per Trap Kin. (K)	Rip (R)	Ice (I)	S.D. Kin.	Rip	Ice	n Kin.	Rip	Ice	ANOVA (1-Factor; P<0.05)) F	P	Results	Kruskal-Wallis NP-AOV F	P	Results
2000															
8-11 Jun	4.3	2.9	1.5	4.6	3.4	1.9	40	20	20	3.7	**0.029**	K or R > I	3.2	0.050	ns*
30 Jun - 2 Jul	2.2		2.5	2.3		2.3	40		35	0.5	0.465	ns	0.7	0.402	ns
23-25 Jul	5.0	2.6	1.5	3.7	2.6	2.0	20	40	20	8.3	**0.001**	K > R or I	7.9	**<0.001**	K > R or I
23-28 Aug	6.6	5.1	2.1	4.2	3.3	1.9	70	110	40	21.8	**<0.001**	K > R > I	24.4	**<0.001**	K or R > I
23-26 Sep	5.7	3.1	2.9	4.0	2.2	2.3	60	20	40	10.9	**<0.001**	K > R or I	8.0	**0.001**	K > R or I
27-31 Oct	3.6	0.8	0.5	3.4	1.0	0.6	30	30	30	19.5	**<0.001**	K > R or I	15.3	**<0.001**	K > R or I
28-29 Nov	2.4			1.9			30								
2001															
10-12 Apr	4.1	1.0	3.2	3.4	1.2	2.5	30	30	20	12.0	**<0.001**	K or I > R	13.7	**<0.001**	K or I > R
9-15 May	4.4	1.8	3.5	2.8	2.5	2.2	20	20	20	5.6	**0.006**	K or I > R	8.3	**0.001**	K or I > R
28-31 May	1.4	3.2	2.7	1.8	3.3	1.6	20	20	20	3.1	0.054	ns	3.6	0.050	ns
23-24 Jun	3.3	1.2	4.0	2.3	1.8	2.2	20	20	20	9.3	**<0.001**	K or I > R	10.7	**<0.001**	K or I > R
27-29 Aug	5.1	2.2	2.7	2.0	2.5	2.0	20	20	20	10.7	**<0.001**	K > R or I	15.0	**<0.001**	K > R or I
20-22 Sep	5.3	3.2	4.3	3.2	2.7	2.2	20	20	20	2.8	0.069	ns	2.6	0.082	ns
20-22 Oct	4.8	1.7	2.0	2.8	1.7	1.7	20	20	20	13.0	**<0.001**	K > R or I	12.0	**<0.001**	K > R or I
2002															
17-19 Apr	4.5	4.7	5.3	3.5	3.7	2.9	20	20	20	0.3	0.740	ns	0.5	0.590	ns
All	4.4	3.1	2.6	3.7	3.1	2.3	460	390	345	35.6	**<0.001**	K > R or I	27.8	**<0.001**	K > R or I

* Not Significant

Medium-sized Males

Sampling period	Mean Catch per Trap Kin. (K)	Rip (R)	Ice (I)	S.D. Kin.	Rip	Ice	n Kin.	Rip	Ice	ANOVA (1-Factor; P<0.05)) F	P	Results	Kruskal-Wallis NP-AOV F	P	Results
2000															
8-11 Jun	0.3	0.4	0.9	0.7	1.0	1.2	40	20	20	2.2	0.115	ns	2.0	0.139	ns
30 Jun - 2 Jul	0.4		1.2	0.7		1.2	40		35	11.8	**0.001**	I > K	10.3	**0.002**	I > K
23-25 Jul	0.4	0.3	1.0	0.9	0.5	1.2	20	40	20	3.9	**0.025**	I or K > R	2.2	0.129	ns
23-28 Aug	1.3	1.8	1.3	1.4	1.7	2.0	70	110	40	2.8	0.065	ns	4.5	**0.012**	K or R > I
23-26 Sep	1.2	0.8	4.3	1.4	1.3	3.3	60	20	40	29.3	**<0.001**	I > K or R	24.1	**<0.001**	I > K or R
27-31 Oct	1.6	1.7	5.3	1.5	1.6	2.9	30	30	30	28.3	**<0.001**	I > K or R	24.9	**<0.001**	I > K or R
28-29 Nov	1.9			1.3			30								
2001															
10-12 Apr	3.7	0.9	6.3	2.9	1.2	2.8	30	30	20	30.4	**<0.001**	I > K > R	32.9	**<0.001**	I > K > R
9-15 May	4.1	1.1	4.5	3.9	1.2	1.9	20	20	20	10.0	**<0.001**	I or K > R	16.4	**<0.001**	I or K > R
28-31 May	3.3	1.6	4.3	3.2	2.0	2.5	20	20	20	5.4	**0.007**	I or K > R	7.7	**0.001**	I or K > R
23-24 Jun	4.5	0.7	4.0	3.2	1.2	2.3	20	20	20	15.3	**<0.001**	I or K > R	19.4	**<0.001**	I or K > R
27-29 Aug	2.7	1.8	3.2	2.3	1.7	2.6	20	20	20	2.0	0.140	ns	1.8	0.180	ns
20-22 Sep	7.1	1.1	3.5	3.0	1.2	2.8	20	20	20	29.6	**<0.001**	K > I > R	32.3	**<0.001**	K > I > R
20-22 Oct	8.1	4.7	5.9	3.3	2.8	2.9	20	20	20	6.6	**0.003**	I or K > R	6.1	**0.004**	I or K > R
2002															
17-19 Apr	2.4	2.1	1.6	2.6	2.1	1.3	20	20	20	0.9	0.430	ns	0.1	0.870	ns
All	2.3	1.5	3.2	2.9	1.8	2.9	460	390	345	42.1	**<0.001**	I > K > R	38.9	**<0.001**	I > K > R

Table C - 2. Results from a 1-factor ANOVA and Kruskal-Wallis statistical tests comparing the mean catch per trap of female Dungeness crabs caught in standard trap sets in the Nass Estuary, June 2000 to April 2002.

Large-sized Females:

Sampling period	Mean Catch per Trap Kin. (K)	Rip (R)	Ice (I)	S.D. Kin.	Rip	Ice	n Kin.	Rip	Ice	ANOVA (1-Factor; P<0.05)) F	P	Results	Kruskal-Wallis NP-AOV F	P	Results
2000															
8-11 Jun	1.7	1.1	0.9	1.6	1.4	1.0	40	20	20	2.6	0.079	ns	2.5	0.090	ns
30 Jun - 2 Jul	0.8		1.1	1.0		1.1	40		35	1.6	0.209	ns	1.9	0.170	ns
23-25 Jul	1.3	0.6	0.5	1.4	0.9	0.6	20	40	20	4.3	**0.017**	K > R or I	4.3	**0.017**	K > R or I
23-28 Aug	0.9	0.7	0.8	1.0	1.0	1.0	70	110	40	0.4	0.646	ns	0.5	0.612	ns
23-26 Sep	1.5	1.0	0.6	1.5	1.0	1.0	60	20	40	7.1	**0.001**	K or R > I	8.0	**0.005**	K or R > I
27-31 Oct	2.4	0.3	0.4	2.2	0.5	0.9	30	30	30	20.6	**<0.001**	K > R or I	22.6	**<0.001**	K > R or I
28-29 Nov	0.8			1.0			30								
2001															
10-12 Apr	0.7	0.5	0.2	1.3	0.8	0.4	30	30	20	1.8	0.178	ns	1.1	0.339	ns
9-15 May	1.5	0.3	0.3	1.4	0.5	0.7	20	20	20	10.7	**<0.001**	K > R or I	11.5	**<0.001**	K > R or I
28-31 May	0.4	0.4	0.8	0.8	0.5	0.9	20	20	20	1.7	0.185	ns	2.1	0.135	ns
23-24 Jun	0.7	0.0	0.7	0.7	0.0	1.0	20	20	20	6.1	**0.004**	K or I > R	10.8	**<0.001**	K or I > R
27-29 Aug	1.3	0.6	0.4	1.2	0.8	0.6	20	20	20	5.7	**0.006**	K or R > I	4.9	**0.011**	K or R > I
20-22 Sep	0.4	0.3	0.8	0.5	0.6	0.8	20	20	20	3.3	**0.044**	K or I > R	2.6	0.081	ns
20-22 Oct	1.1	0.3	1.0	0.9	0.8	0.7	20	20	20	5.1	**0.009**	K or I > R	8.1	**<0.001**	K or I > R
2002															
17-19 Apr	0.4	0.3	0.4	0.5	0.7	0.7	20	20	20	0.1	0.960	ns	0.4	0.710	ns
All	1.1	0.6	0.6	1.3	0.9	0.9	460	390	345	32.1	**<0.001**	K > R or I	27.8	**<0.001**	K > R or I

* Not Significant

Medium-sized Females:

Sampling period	Mean Catch per Trap Kin. (K)	Rip (R)	Ice (I)	S.D. Kin.	Rip	Ice	n Kin.	Rip	Ice	ANOVA (1-Factor; P<0.05)) F	P	Results	Kruskal-Wallis NP-AOV F	P	Results
2000															
8-11 Jun	6.6	4.9	1.4	4.4	4.8	1.6	40	20	20	11.5	**<0.001**	K or R > I	15.2	**<0.001**	K or R > I
30 Jun - 2 Jul	3.6		2.5	3.6		2.0	40		35	2.6	0.111	ns	0.7	0.406	ns
23-25 Jul	6.2	4.0	0.9	5.3	2.7	1.0	20	40	20	13.1	**<0.001**	K > R > I	18.2	**<0.001**	K or R > I
23-28 Aug	4.5	3.7	1.9	3.7	3.2	1.8	70	110	40	9.0	**<0.001**	K or R > I	9.1	**<0.001**	K or R > I
23-26 Sep	6.4	5.1	2.6	3.0	3.8	1.8	60	20	40	21.8	**<0.001**	K or R > I	28.6	**<0.001**	K or R > I
27-31 Oct	5.7	2.0	1.6	3.8	2.0	1.5	30	30	30	21.9	**<0.001**	K > R or I	18.0	**<0.001**	K > R or I
28-29 Nov	4.2			1.7			30								
2001															
10-12 Apr	5.4	2.4	0.9	3.0	1.5	0.8	30	30	20	31.1	**<0.001**	K > R > I	33.3	**<0.001**	K > R > I
9-15 May	6.3	2.5	1.4	5.1	2.5	1.2	20	20	20	12.0	**<0.001**	K > R or I	13.0	**<0.001**	K > R or I
28-31 May	2.7	2.8	1.3	2.7	1.9	1.2	20	20	20	3.3	**0.044**	K or R > I	3.5	**0.040**	K or R > I
23-24 Jun	4.6	0.7	1.7	4.0	1.0	1.6	20	20	20	12.4	**<0.001**	K > R or I	13.0	**<0.001**	K > R or I
27-29 Aug	7.9	5.1	0.9	3.3	3.0	1.3	20	20	20	34.7	**<0.001**	K > R > I	38.8	**<0.001**	K or R > I
20-22 Sep	4.3	2.3	1.8	3.2	2.2	1.3	20	20	20	6.3	**0.004**	K > R or I	4.8	**0.012**	K or R > I
20-22 Oct	2.4	2.5	2.7	1.8	1.7	1.6	20	20	20	0.2	0.830	ns	0.4	0.660	ns
2002															
17-19 Apr	6.3	4.0	0.6	3.5	3.1	0.8	20	20	20	22.3	**<0.001**	K > R > I	39.0	**<0.001**	K or R > I
All	5.2	3.3	1.7	3.8	3.0	1.6	460	390	345	132.9	**0.001**	K > R > I	142.3	**0.001**	K > R > I

Table C - 3. Results from a 1-factor ANOVA and Kruskal-Wallis statistical tests comparing the mean catch per trap of Dungeness crabs caught at different depth types during sampling periods in the Nass Estuary, June 2000 to April 2002.

Males:

Sampling period	Mean Catch per Trap: Deep (D)	Mod. (M)	Shallow (S)	S.D.: Deep	Mod.	Shallow	n: Deep	Mod	Shallow	ANOVA (1-Factor; P<0.05)): F	P	Results	Kruskal-Wallis NP-AOV: F	P	Results
2000															
8-11 Jun	1.1	4.0	5.8	1.7	5.0	3.0	21	40	19	7.7	**0.001**	S or M > D	12.8	**<0.001**	S > M > D
30 Jun - 2 Jul	2.9	5.0	5.0	4.4	3.4	2.8	25	65	30	3.5	**0.030**	S or M > D	6.6	**0.002**	S or M > D
23-25 Jul	1.8	3.9	6.5	2.3	3.2	4.2	25	65	29	14.2	**<0.001**	S > M > D	15.3	**<0.001**	S > M > D
23-28 Aug	2.4	5.9	8.3	2.4	4.1	4.6	25	65	130	22.8	**<0.001**	S > M > D	26.2	**<0.001**	S > M > D
23-26 Sep	2.0	7.0	8.0	1.7	4.0	4.2	15	45	60	14.0	**<0.001**	S or M > D	16.1	**<0.001**	S or M > D
27-31 Oct	3.0	5.5	5.7	2.1	4.7	3.3	15	39	56	3.2	**0.050**	S or M > D	4.0	**0.020**	S or M > D
28-29 Nov	2.6	3.3	5.7	1.8	2.2	2.3	5	10	15	5.7	**0.009**	S > M or D	5.3	0.050	ns*
2001															
10-12 Apr	2.9	6.1	7.5	3.4	5.7	5.0	15	30	45	4.6	**0.010**	S or M > D	6.0	**0.004**	S or M > D
9-15 May	5.0	6.5	8.3	4.0	5.1	4.4	20	55	205	7.3	**0.001**	S > M or D	10.0	**<0.001**	S > M or D
28-31 May	3.9	4.3	8.2	2.8	3.9	5.2	15	35	110	12.5	**<0.001**	S > M or D	14.2	**<0.001**	S > M or D
23-24 Jun	3.3	6.9	6.3	3.0	5.5	5.2	15	30	51	2.6	0.080	ns	2.4	0.090	ns
27-29 Aug	3.3	5.8	8.5	2.9	3.6	4.5	15	30	45	10.8	**<0.001**	S > M or D	11.4	**<0.001**	S > M or D
20-22 Sep	6.8	8.5	8.4	5.6	4.9	4.7	15	30	45	0.7	0.490	ns	0.9	0.410	ns
20-22 Oct	11.2	9.4	9.3	4.3	5.1	4.1	15	30	75	1.2	0.310	ns	1.0	0.360	ns
2002															
17-19 Apr	4.5	5.9	8.3	3.0	4.4	4.4	15	30	75	7.0	**0.001**	S > M or D	8.9	**<0.001**	S > M or D
All	3.6	5.8	7.8	3.9	4.6	4.5	256	599	990	104.4	**0.001**	S > M > D	129.3	**<0.001**	S > M > D

* Not significant.

Females:

Sampling period	Mean Catch per Trap: Deep (D)	Mod. (M)	Shallow (S)	S.D.: Deep	Mod	Shallow	n: Deep	Mod	Shallow	ANOVA (1-Factor; P<0.05)): F	P	Results	Kruskal-Wallis NP-AOV: F	P	Results
2000															
8-11 Jun	8.9	5.6	5.2	6.6	5.2	2.9	21	40	19	3.4	0.050	ns	1.8	0.170	ns
30 Jun - 2 Jul	5.7	4.4	3.0	3.4	3.3	2.2	25	65	30	5.3	**0.006**	D or M > S	5.9	**0.004**	D or M > S
23-25 Jul	6.6	4.6	4.0	5.7	3.9	2.7	25	65	29	3.0	0.060	ns	0.8	0.430	ns
23-28 Aug	8.8	5.3	4.1	5.0	4.5	3.0	25	65	130	17.3	**<0.001**	D > M or S	10.6	**0.001**	D > M or S
23-26 Sep	8.1	6.2	8.2	6.0	5.2	4.8	15	45	60	2.0	0.140	ns	3.0	0.050	ns
27-31 Oct	9.3	4.5	2.9	7.4	4.8	2.5	15	39	56	12.7	**<0.001**	D > M or S	6.3	**0.003**	D > M or S
28-29 Nov	8.2	5.0	6.1	3.6	2.8	1.8	5	10	15	2.7	0.090	ns	1.6	0.220	ns
2001															
10-12 Apr	5.5	3.8	4.2	5.1	4.2	3.2	15	30	45	1.0	0.390	ns	0.9	0.420	ns
9-15 May	4.9	4.8	4.6	6.1	4.4	3.5	20	55	205	0.1	0.940	ns	0.7	0.510	ns
28-31 May	3.7	2.7	3.5	3.4	2.1	2.8	15	35	110	1.4	0.240	ns	1.1	0.330	ns
23-24 Jun	2.3	4.2	1.7	2.1	4.4	2.4	15	30	51	5.8	**0.004**	D or M > S	4.1	**0.020**	D or M > S
27-29 Aug	7.0	6.4	7.0	6.4	5.9	4.4	15	30	45	0.2	0.850	ns	0.6	0.570	ns
20-22 Sep	3.1	4.0	4.4	1.9	3.3	4.0	15	30	45	0.8	0.460	ns	0.2	0.800	ns
20-22 Oct	3.7	3.2	4.8	1.5	2.2	3.6	15	30	75	3.0	0.050	ns	2.3	0.100	ns
2002															
17-19 Apr	5.6	4.4	4.9	6.2	4.3	3.5	15	30	75	0.4	0.660	ns	0.7	0.500	ns
All	6.2	4.7	4.5	5.4	4.3	3.6	256	599	990	17.2	**<0.001**	D > M or S	5.8	**0.003**	D > M or S

APPENDIX D

Shell hardness data for the Nass Dungeness crab-sampling program, 2000-2002

Table D - 1. Number and proportion of hard- and soft-shelled, legal- and medium-sized male Dungeness crab caught during sampling periods, 8 June to 29 November 2000.

		Number								%							
		Sampling Period								Sampling Period							
Size/Area	Shell hardness category [a]	8-11 Jun	30 Jun - 2 Jul	23-25 Jul	23-28 Aug	23-26 Sep	27-31 Oct	28-29 Nov	Total	8-11 Jun	30 Jun - 2 Jul	23-25 Jul	23-28 Aug	23-26 Sep	27-31 Oct	28-29 Nov	Total
Legal-sized (>153 mm NW)																	
Kincolith	1	68	43	74	342	191	37	4	759	40	50	63	74	56	35	6	56
	2	44	24	16	56	41	9	2	192	26	28	14	12	12	8	3	14
	3	18	0	1	4	21	1	1	46	11	0	1	1	6	1	1	3
	4/5	0	0	1	3	5	0	0	9	0	0	1	1	1	0	0	1
	6/7	39	19	25	56	86	60	64	349	23	22	21	12	25	56	90	26
	Total	169	86	117	461	344	107	71	1355	100	100	100	100	100	100	100	100
Ripple	1	29	133	152	398	43	5		760	50	59	72	70	70	14		66
	2	17	64	39	58	9	2		189	29	29	19	10	15	5		16
	3	3	3	4	31	6	2		49	5	1	2	5	10	5		4
	4/5	0	1	0	20	0	1		22	0	0	0	4	0	3		2
	6/7	9	23	15	58	3	27		135	16	10	7	10	5	73		12
	Total	58	224	210	565	61	37		1155	100	100	100	100	100	100		100
Iceberg	1	13	55	22	56	45	1		192	45	56	76	67	39	7		52
	2	7	24	1	5	5	2		44	24	24	3	6	4	13		12
	3	0	2	0	2	9	3		16	0	2	0	2	8	20		4
	4/5	0	0	0	0	7	1		8	0	0	0	0	6	7		2
	6/7	9	17	6	21	50	8		111	31	17	21	25	43	53		30
	Total	29	98	29	84	116	15		371	100	100	100	100	100	100		100
Medium-sized (127-153 mm NW)																	
Kincolith	1	4	5	8	46	16	9	13	101	31	31	33	51	23	18	23	32
	2	3	8	3	19	21	13	19	86	23	50	13	21	30	27	34	27
	3	4	0	7	14	24	19	12	80	31	0	29	15	34	39	21	25
	4/5	0	0	4	3	5	3	2	17	0	0	17	3	7	6	4	5
	6/7	2	3	2	9	5	5	10	36	15	19	8	10	7	10	18	11
	Total	13	16	24	91	71	49	56	320	100	100	100	100	100	100	100	100
Ripple	1	2	35	23	71	2	19		152	25	52	45	35	13	13		31
	2	2	25	22	63	4	39		155	25	37	43	31	27	27		32
	3	4	2	2	42	8	25		83	50	3	4	21	53	18		17
	4/5	0	0	1	12	0	4		17	0	0	2	6	0	3		4
	6/7	0	5	3	13	1	55		77	0	7	6	6	7	39		16
	Total	8	67	51	201	15	142		484	100	100	100	100	100	100		100
Iceberg	1	8	18	11	20	24	42		123	47	44	58	38	14	27		27
	2	6	12	6	13	25	37		99	35	29	32	25	14	23		22
	3	1	6	1	12	48	32		100	6	15	5	23	28	20		22
	4/5	0	0	1	1	51	3		56	0	0	5	2	29	2		12
	6/7	2	5	0	6	25	44		82	12	12	0	12	14	28		18
	Total	17	41	19	52	173	158		460	100	100	100	100	100	100		100

[a] Shell Hardness Category: 1= New Hard; 2= Spring New; 3= Crackly New; 4=Plastic Soft; 5=Moulting; 6=Old Shell; 7=Very Old Shell.

Table D - 2. Number and proportion of hard- and soft-shelled, legal- and medium-sized male Dungeness crab caught during sampling periods, 10 April 2001 to 19 April 2002.

		Number									%								
		Sampling Period									Sampling Period								
Size/Area	Shell hardness category [a]	10-12 Apr	9-15 May	28-31 May	23-24 Jun	27-29 Aug	20-22 Sep	20-22 Oct	17-19 Apr	Total	10-12 Apr	9-15 May	28-31 May	23-24 Jun	27-29 Aug	20-22 Sep	20-22 Oct	17-19 Apr	Total
Legal-sized (>153 mm NW)																			
Kincolith	1	9	35	83	83	35	99	44	111	499	7	21	43	54	54	53	44	37	39
	2	19	40	42	18	3	8	11	36	177	15	25	22	12	5	4	11	12	14
	3	29	32	25	17	5	4	11	76	199	23	20	13	11	8	2	11	25	15
	4/5	27	33	6	4	0	4	7	29	110	22	20	3	3	0	2	7	10	9
	6/7	40	23	38	31	22	71	27	52	304	32	14	20	20	34	38	27	17	24
	Total	124	163	194	153	65	186	100	304	1289	100	100	100	100	100	100	100	100	100
Ripple	1	4	61	25	48	24	42	79	155	438	14	32	36	57	80	66	56	36	42
	2	5	36	14	2	2	0	18	96	173	17	19	20	2	7	0	13	22	17
	3	7	46	13	5	2	1	14	71	159	24	24	19	6	7	2	10	17	15
	4/5	4	37	10	2	0	2	8	24	87	14	19	14	2	0	3	6	6	8
	6/7	9	11	8	27	2	19	21	82	179	31	6	11	32	7	30	15	19	17
	Total	29	191	70	84	30	64	140	428	1036	100	100	100	100	100	100	100	100	100
Iceberg	1	11	48	22	59	87	28	74	77	406	13	19	37	48	66	33	49	31	36
	2	14	77	18	16	20	15	31	52	243	16	31	31	13	15	17	20	21	21
	3	34	69	8	14	5	9	13	59	211	40	28	14	11	4	10	9	24	19
	4/5	7	43	5	10	7	17	22	44	155	8	17	8	8	5	20	14	18	14
	6/7	20	10	6	24	12	17	12	19	120	23	4	10	20	9	20	8	8	11
	Total	86	247	59	123	131	86	152	251	1135	100	100	100	100	100	100	100	100	100
Medium-sized (127-153 mm NW)																			
Kincolith	1	30	42	84	54	41	40	111	149	551	27	38	30	28	46	42	45	39	37
	2	26	7	106	53	19	13	25	44	293	23	6	38	27	21	14	10	12	19
	3	29	12	55	49	13	1	48	128	335	26	11	20	25	15	1	19	34	22
	4/5	7	4	0	2	0	1	8	22	44	6	4	0	1	0	1	3	6	3
	6/7	20	45	33	38	16	40	56	38	286	18	41	12	19	18	42	23	10	19
	Total	112	110	278	196	89	95	248	381	1509	100	100	100	100	100	100	100	100	100
Ripple	1	8	39	73	6	17	27	92	130	392	30	48	32	15	50	42	48	35	38
	2	7	11	75	11	6	19	40	67	236	26	13	33	28	18	30	21	18	23
	3	5	16	42	15	3	9	33	115	238	19	20	19	38	9	14	17	31	23
	4/5	2	3	3	1	1	2	7	28	47	7	4	1	3	3	3	4	8	5
	6/7	5	13	32	7	7	7	19	27	117	19	16	14	18	21	11	10	7	11
	Total	27	82	225	40	34	64	191	367	1030	100	100	100	100	100	100	100	100	100
Iceberg	1	51	25	103	42	81	30	72	84	488	29	32	36	31	43	28	35	27	33
	2	33	16	88	46	47	14	41	59	344	19	20	31	34	25	13	20	19	23
	3	41	8	55	25	28	34	41	96	328	23	10	19	19	15	32	20	31	22
	4/5	10	6	2	7	12	12	31	25	105	6	8	1	5	6	11	15	8	7
	6/7	42	24	40	14	22	17	22	47	228	24	30	14	10	12	16	11	15	15
	Total	177	79	288	134	190	107	207	311	1493	100	100	100	100	100	100	100	100	100

[a] Shell Hardness Category: 1= New Hard; 2= Spring New; 3= Crackly New; 4=Plastic Soft; 5=Moulting; 6=Old Shell; 7=Very Old Shell.

Table D - 3. Number and proportion of hard- and soft-shelled, large- and medium-sized female Dungeness crab caught during sampling periods, 8 June to 29 November 2000.

		Number								%							
		Sampling Period								Sampling Period							
Size/Area	Shell hardness category [a]	8-11 Jun	30 Jun - 2 Jul	23-25 Jul	23-28 Aug	23-26 Sep	27-31 Oct	28-29 Nov	Total	8-11 Jun	30 Jun - 2 Jul	23-25 Jul	23-28 Aug	23-26 Sep	27-31 Oct	28-29 Nov	Total
Large-sized (>153 mm NW)																	
Kincolith	1	1	6	5	10	0	3	1	26	1	19	10	16	0	4	4	7
	2	0	2	1	0	2	3	4	12	0	6	2	0	2	4	17	3
	3	0	0	0	0	2	4	1	7	0	0	0	0	2	6	4	2
	4/5	0	0	0	1	15	2	0	18	0	0	0	2	16	3	0	5
	6/7	67	23	42	51	72	59	18	332	99	74	88	82	79	83	75	84
	Total	68	31	48	62	91	71	24	395	100	100	100	100	100	100	100	100
Ripple	1	0	7	2	10	0	0		19	0	29	4	12	0	0		9
	2	0	0	0	0	0	5		5	0	0	0	0	0	31		2
	3	0	0	0	1	1	3		5	0	0	0	1	5	19		2
	4/5	0	0	0	5	0	3		8	0	0	0	6	0	19		4
	6/7	22	17	43	66	18	5		171	100	71	96	80	95	31		82
	Total	22	24	45	82	19	16		208	100	100	100	100	100	100		100
Iceberg	1	1	7	0	0	0	2		10	6	15	0	0	0	17		7
	2	0	2	0	0	0	0		2	0	4	0	0	0	0		1
	3	0	0	0	0	1	0		1	0	0	0	0	5	0		1
	4/5	0	0	0	0	4	0		4	0	0	0	0	18	0		3
	6/7	17	37	9	33	17	10		123	94	80	100	100	77	83		88
	Total	18	46	9	33	22	12		140	100	100	100	100	100	100		100
Medium-sized (127-153 mm NW)																	
Kincolith	1	0	37	39	69	29	13	23	210	0	26	19	22	8	8	18	13
	2	1	8	8	5	41	29	32	124	0	6	4	2	11	17	25	8
	3	1	1	1	2	29	26	12	72	0	1	0	1	8	15	10	4
	4/5	0	0	0	1	34	4	5	44	0	0	0	0	9	2	4	3
	6/7	263	96	154	239	252	98	54	1156	99	68	76	76	65	58	43	72
	Total	265	142	202	316	385	170	126	1606	100	100	100	100	100	100	100	100
Ripple	1	0	20	27	97	15	25		184	0	13	12	24	15	26		17
	2	0	2	5	21	3	26		57	0	1	2	5	3	27		5
	3	0	0	3	19	11	11		44	0	0	1	5	11	11		4
	4/5	0	0	1	8	2	4		15	0	0	0	2	2	4		1
	6/7	98	137	187	266	70	31		789	100	86	84	65	69	32		72
	Total	98	159	223	411	101	97		1089	100	100	100	100	100	100		100
Iceberg	1	0	19	2	4	0	12		37	0	20	11	5	0	25		10
	2	0	6	0	7	10	8		31	0	6	0	9	10	17		8
	3	0	1	1	6	11	4		23	0	1	6	8	11	8		6
	4/5	0	1	1	5	27	1		35	0	1	6	7	26	2		9
	6/7	27	70	14	54	55	23		243	100	72	78	71	53	48		66
	Total	27	97	18	76	103	48		369	100	100	100	100	100	100		100

[a] Shell Hardness Category: 1= New Hard; 2= Spring New; 3= Crackly New; 4=Plastic Soft; 5=Moulting; 6=Old Shell; 7=Very Old Shell.

Table D - 4. Number and proportion of hard- and soft-shelled, large- and medium-sized female Dungeness crab caught during sampling periods, 10 April 2001 to 19 April 2002.

		Number									%								
		Sampling Period									Sampling Period								
Size/Area	Shell hardness category [a]	10-12 Apr	9-15 May	28-31 May	23-24 Jun	27-29 Aug	20-22 Sep	20-22 Oct	17-19 Apr	Total	10-12 Apr	9-15 May	28-31 May	23-24 Jun	27-29 Aug	20-22 Sep	20-22 Oct	17-19 Apr	Total
Large-sized (>153 mm NW)																			
Kincolith	1	0	0	5	1	0	4	0	1	11	0	0	19	8	0	10	0	2	6
	2	0	1	4	0	0	0	0	1	6	0	6	15	0	0	0	0	2	3
	3	0	0	0	1	1	0	1	0	3	0	0	0	8	7	0	10	0	2
	4/5	0	1	0	0	0	0	0	0	1	0	6	0	0	0	0	0	0	1
	6/7	22	14	18	10	13	37	9	54	177	100	88	67	83	93	90	90	96	89
	Total	22	16	27	12	14	41	10	56	198	100	100	100	100	100	100	100	100	100
Ripple	1	1	2	0	2	1	2	1	7	16	7	25	0	25	100	12	5	18	14
	2	0	0	1	0	0	0	1	0	2	0	0	14	0	0	0	5	0	2
	3	1	0	0	0	0	0	0	4	5	7	0	0	0	0	0	0	10	4
	4/5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	6/7	13	6	6	6	0	15	19	28	93	87	75	86	75	0	88	90	72	80
	Total	15	8	7	8	1	17	21	39	116	100	100	100	100	100	100	100	100	100
Iceberg	1	0	3	0	0	2	1	0	3	9	0	25	0	0	13	14	0	9	7
	2	0	2	3	0	0	0	0	1	6	0	17	14	0	0	0	0	3	4
	3	0	1	0	1	0	0	0	0	2	0	8	0	5	0	0	0	0	1
	4/5	0	0	1	0	0	0	0	0	1	0	0	5	0	0	0	0	0	1
	6/7	8	6	18	18	14	6	20	30	120	100	50	82	95	88	86	100	88	87
	Total	8	12	22	19	16	7	20	34	138	100	100	100	100	100	100	100	100	100
Medium-sized (127-153 mm NW)																			
Kincolith	1	17	75	87	64	17	95	35	106	496	10	32	54	46	19	41	26	28	33
	2	13	5	24	17	4	7	8	8	86	8	2	15	12	4	3	6	2	6
	3	6	0	12	6	4	0	1	9	38	4	0	7	4	4	0	1	2	2
	4/5	2	0	4	1	2	0	6	2	17	1	0	2	1	2	0	4	1	1
	6/7	124	151	35	51	64	128	85	251	889	77	65	22	37	70	56	63	67	58
	Total	162	231	162	139	91	230	135	376	1526	100	100	100	100	100	100	100	100	100
Ripple	1	15	64	71	37	5	76	65	159	492	21	54	42	53	29	51	39	45	44
	2	13	2	58	4	1	13	13	31	135	18	2	34	6	6	9	8	9	12
	3	0	5	7	4	3	1	3	30	53	0	4	4	6	18	1	2	8	5
	4/5	0	0	10	0	1	2	4	2	19	0	0	6	0	6	1	2	1	2
	6/7	44	47	23	25	7	57	83	135	421	61	40	14	36	41	38	49	38	38
	Total	72	118	169	70	17	149	168	357	1120	100	100	100	100	100	100	100	100	100
Iceberg	1	2	37	37	17	36	16	21	55	221	6	37	42	28	51	29	24	28	32
	2	6	4	10	3	5	2	7	13	50	19	4	11	5	7	4	8	7	7
	3	0	2	2	1	1	4	1	6	17	0	2	2	2	1	7	1	3	2
	4/5	1	0	0	3	3	4	0	2	13	3	0	0	5	4	7	0	1	2
	6/7	23	58	40	37	25	29	59	124	395	72	57	45	61	36	53	67	62	57
	Total	32	101	89	61	70	55	88	200	696	100	100	100	100	100	100	100	100	100

[a] Shell Hardness Category: 1= New Hard; 2= Spring New; 3= Crackly New; 4=Plastic Soft; 5=Moulting; 6=Old Shell; 7=Very Old Shell.

APPENDIX E

Ultrasonic tag and tracking data from the Nass Dungeness crab sampling program, 2000.

Table E - 1. Information regarding male Dungeness crabs that were ultrasonic-tagged in the Nass Estuary, 2000.

Anchor tag no.	Ultrasonic code [a]	Tagging Date	Set no.	Location	Holding time				Shell NW Width (mm)	Shell hardness [b]	Injury code [c]	Release Position
					Hauled	Tag	Rel.	Total				
1516	2	24-Aug	55	Kincolith	9:55	10:45	14:40	4:45	166	1		54 59.49N 129 58.56W
1505	6	24-Aug	55	Kincolith	9:55	10:47	14:40	4:45	165	1	5	54 59.49N 129 58.56W
1517	8	24-Aug	55	Kincolith	9:55	10:45	14:40	4:45	166	1		54 59.49N 129 58.56W
1501	10	24-Aug	55	Kincolith	9:55	10:51	14:40	4:45	163	1		54 59.49N 129 58.56W
1496	14	24-Aug	55	Kincolith	9:55	10:53	14:40	4:45	160	1		54 59.49N 129 58.56W
1565	17	24-Aug	56	Kincolith	14:10	14:58	20:10	6:00	161	1		54 59.71N 129 58.74W
1566	18	24-Aug	56	Kincolith	14:10	14:53	20:10	6:00	172	1	11	54 59.71N 129 58.74W
1569	22	24-Aug	56	Kincolith	14:10	14:55	20:10	6:00	190	1		54 59.73N 129 58.76W
1570	24	24-Aug	56	Kincolith	14:10	14:57	20:10	6:00	157	2		54 59.73N 129 58.76W
2320	25	28-Aug	76	Kincolith	9:30	9:50	13:30	4:00	151	3		54 59.67N 129 58.61W
1695	26	25-Aug	61	Ripple	11:30	12:15	20:00	8:30	162	1		54 57.56N 129 55.89W
1552	28	24-Aug	54	Ripple	11:56	12:40	17:35	5:39	183	1		54 58.36N 129 56.64W
1529	30	24-Aug	54	Ripple	11:56	12:44	17:35	5:39	171	1		54 58.36N 129 56.63W
1652	43	25-Aug	60	Ripple	10:12	10:59	15:23	5:11	187	1		54 57.91N 129 56.62W
1536	44	24-Aug	54	Ripple	11:56	12:50	17:35	5:39	153	2		54 58.36N 129 56.62W
1667	46	25-Aug	60	Ripple	10:12	11:01	15:23	5:11	168	2		54 57.91N 129 56.62W
1541	50	24-Aug	54	Ripple	11:56	12:53	17:35	5:39	176	1		54 58.36N 129 56.61W
1690	56	25-Aug	61	Ripple	11:30	12:18	20:00	8:30	157	1		54 57.56N 129 55.89W
1550	62	24-Aug	54	Ripple	11:56	12:47	17:35	5:39	149	1		54 58.36N 129 56.61W
1687	69	25-Aug	61	Ripple	11:30	12:20	20:00	8:30	147	2		54 57.56N 129 55.89W
1950	74	26-Aug	64	Nass Hr.	14:45	15:46	20:30	5:45	156	1		54 56.20N 129 55.98W
1944	86	26-Aug	64	Nass Hr.	14:45	15:49	20:30	5:45	164	3	4	54 56.20N 129 55.98W
1947	98	26-Aug	64	Nass Hr.	14:45	15:53	20:30	5:45	160	1		54 56.20N 129 55.98W
1800	70	25-Aug	58	Iceberg	17:10	18:11	20:05	2:55	157	1		54 55.03N 129 59.12W
1809	73	25-Aug	58	Iceberg	17:10	17:55	20:05	2:55	179	1		54 55.03N 129 59.12W
1769	82	25-Aug	57	Iceberg	15:50	18:07	20:07	4:17	174	1		54 54.96N 129 59.06W
1802	93	25-Aug	58	Iceberg	17:10	18:04	20:05	2:55	167	1		54 55.03N 129 59.12W
1761	94	25-Aug	57	Iceberg	15:50	18:18	20:07	4:17	147	2		54 54.96N 129 59.06W
1759	96	25-Aug	57	Iceberg	15:50	18:23	20:07	4:17	142	3		54 54.96N 129 59.06W
1765	106	25-Aug	57	Iceberg	15:50	18:15	20:07	4:17	157	3		54 54.96N 129 59.06W

[a] Ultrasonic transmitter was 11 mm x 40 mm in size had 106 d operational life and was programmed at 77 KHz frequency with individual codes.

[b] Shell Hardness Category: 1= New Hard; 2= Spring New; 3= Crackly New; 4=Plastic Soft; 5=Moulting; 6=Old Shell; 7=Very Old Shell.

[c] Injury Code: 1=deformed shell, 2=hole in shell, 3=torn abdomen, 4=regen claw, 5=regen leg, 6=regen both, 7=multiple inj., 8=shell disease, 9=dead, 10=missing claw, 11=missing leg

Table E - 2. Opportunistic ultrasonic-tracking surveys conducted in the Nass Estuary during sampling periods, September to November 2000.

Location	Area Desc.	Date	Start time	End time	Total Time (h:m)	Comments
Kincolith		24-Sep	11:35	13:40	2:05	
Kincolith		24-Sep	17:45	20:00	2:15	
Kincolith		25-Sep	8:45	9:30	0:45	
Kincolith		25-Sep	14:00	14:30	0:30	
Kincolith	S of Kin	24-Oct	17:50	18:45	0:55	Way points 1-4
Kincolith	S of Kin. R.	28-Oct	14:15	15:30	1:15	Way point 1-3
Kincolith	S of Mill Bay & Fort Pt	28-Oct	16:15	17:30	1:15	Way point 42-57
Kincolith	W of Kin.	27-Nov	14:45	15:05	0:20	Way points 1-2
Kincolith	SW of Gov. Bar	27-Nov	15:45	17:00	1:15	Way points 2-5
Kincolith	S of Gov. Bar	28-Nov	14:45	15:50	1:05	Way points 5-6; very rough & windy
Kincolith/Obs	NW of Kin	25-Oct	9:30	10:35	1:05	Way points 120-126
Observatory	Pub. dock to N. of Nass Pt.	27-Nov	11:30	12:30	1:00	Way points 120-130
Ripple		23-Sep	16:50	17:25	0:35	
Ripple		25-Sep	9:30	10:00	0:30	
Ripple	S of Gov. Bar	25-Oct	10:50	11:40	0:50	Way points 5 and 34; windy & rough
Ripple	N of Dble Islet	26-Oct	8:30	9:35	1:05	Way points 5-9
Ripple	E of Dble Islet	26-Oct	13:00	13:20	0:20	Way points 10-11
Ripple	W of Dble Islet	26-Oct	15:40	15:50	0:10	Way point 12
Ripple	W of Dble Islet	26-Oct	18:05	18:40	0:35	Way point 12
Ripple	E of Stevens Pt	27-Oct	9:00	9:20	0:20	Way point 100-102; windy & rough
Ripple	E of Dble Islet	28-Oct	10:40	11:55	1:15	Way point 73-75
Ripple	W of Stevens Pt	28-Oct	17:40	18:40	1:00	Way point 100-105
Ripple	N of Dble Islet	27-Nov	12:30	13:00	0:30	
Ripple	N of Dble Islet	28-Nov	15:50	16:50	1:00	
Nass Hr.	Mud Island	29-Oct	12:30	14:30	2:00	Way points 13-26
Nass Hr.	N of Nass Hr	30-Oct	8:10	8:45	0:35	Way point 75-77
Nass Hr.	Mud Island	30-Oct	16:05	16:55	0:50	Way point 27-33: heavy rain
Nass Hr.	Mud Island	23-Sep	16:00	16:50	0:50	
Iceberg Bay		23-Sep	8:50	11:00	2:10	
Iceberg Bay		23-Sep	15:10	16:00	0:50	
Iceberg Bay		25-Sep	14:31	17:00	2:29	
Iceberg Bay	N shore of Ice	26-Oct	13:40	15:40	2:00	Way points 60-74
Iceberg Bay	SE of Iceberg Bay	29-Oct	14:30	16:30	2:00	Way points 78-90
Iceberg Bay	N of Chambers Cr.	30-Oct	7:15	7:40	0:25	Way point 91-93

Table E - 3. Information regarding ultrasonic-tagged male Dungeness crabs that were tracked in the Nass Estuary, August to November 2000.

Tagging location	Ultrasonic code	Date	Recap or Tag			Distance from tagging site (m) [a]
			Location	Lat.	Long.	
Kincolith	2	24-Aug	Kincolith	54 59.49	129 58.56	0
Kincolith	2	24-Sep	Kincolith	54 59.27	129 58.35	470
Kincolith	6	24-Aug	Kincolith	54 59.49	129 58.56	0
Kincolith	6	25-Sep	Ripple	54 58.86	129 58.39	1190
Kincolith	6	01-Oct	Ripple	**Commercial Removal**		NA
Kincolith	8	24-Aug	Kincolith	54 59.49	129 58.56	0
Kincolith	8	28-Nov	Ripple	54 58.50	129 58.31	1849
Kincolith	10	24-Aug	Kincolith	54 59.49	129 58.56	0
Kincolith	10	24-Sep	Kincolith	54 59.46	129 58.49	90
Kincolith	10	03-Nov	Kincolith	**Nisga'a Removal**		NA
Kincolith	14	24-Aug	Kincolith	54 59.49	129 58.56	0
Kincolith	14	24-Sep	Kincolith	54 59.80	129 58.65	580
Kincolith	14	31-Oct	Kincolith	54 59.31	129 58.15	551
Kincolith	14	27-Nov	Kincolith	54 59.58	129 58.62	173
Kincolith	17	24-Aug	Kincolith	54 59.71	129 58.74	0
Kincolith	17	24-Sep	Kincolith	54 59.64	129 58.48	300
Kincolith	17	25-Oct	Ripple	54 59.08	129 58.37	1237
Kincolith	17	27-Nov	Ripple	54 58.77	129 58.01	1916
Kincolith	18	24-Aug	Kincolith	54 59.71	129 58.74	0
Kincolith	18	25-Sep	Ripple	54 58.91	129 58.21	1590
Kincolith	18	27-Nov	Ripple	54 58.92	129 58.24	1571
Kincolith	22	24-Aug	Kincolith	54 59.73	129 58.76	0
Kincolith	24	24-Aug	Kincolith	54 59.73	129 58.76	0
Kincolith	24	24-Sep	Kincolith	54 59.67	129 58.60	200
Kincolith	24	27-Oct	Kincolith	54 59.61	129 58.67	241
Kincolith	25	28-Aug	Kincolith	54 59.67	129 58.61	0
Kincolith	25	24-Sep	Kincolith	54 59.91	129 59.01	700
Kincolith	25	31-Oct	Kincolith	54 59.03	129 57.47	1706
Ripple	26	25-Aug	Ripple	54 57.56	129 55.89	0
Ripple	26	27-Oct	Ripple	54 57.48	129 56.45	618
Ripple	28	24-Aug	Ripple	54 58.36	129 56.64	0
Ripple	30	24-Aug	Ripple	54 58.36	129 56.63	0
Ripple	30	24-Sep	Ripple	54 58.26	129 57.68	1130
Ripple	30	15-Oct	Ripple	**Commercial Release**		NA
Ripple	30	27-Oct	Ripple	54 58.24	129 58.61	2136
Ripple	43	25-Aug	Ripple	54 57.91	129 56.62	0
Ripple	43	26-Oct	Ripple	54 57.91	129 57.35	781
Ripple	44	24-Aug	Ripple	54 58.36	129 56.62	0
Ripple	44	27-Oct	Ripple	54 57.62	129 56.59	1373
Ripple	46	25-Aug	Ripple	54 57.91	129 56.62	0
Ripple	46	25-Sep	Ripple	54 57.57	129 56.79	660
Ripple	46	29-Oct	Mud Island	54 56.86	129 55.52	2286
Ripple	50	24-Aug	Ripple	54 58.36	129 56.61	0
Ripple	50	23-Sep	Nass Hr	54 56.37	129 55.90	3770
Ripple	50	01-Oct	Ripple	**Commercial Removal**		NA

Table E-3. Con't.

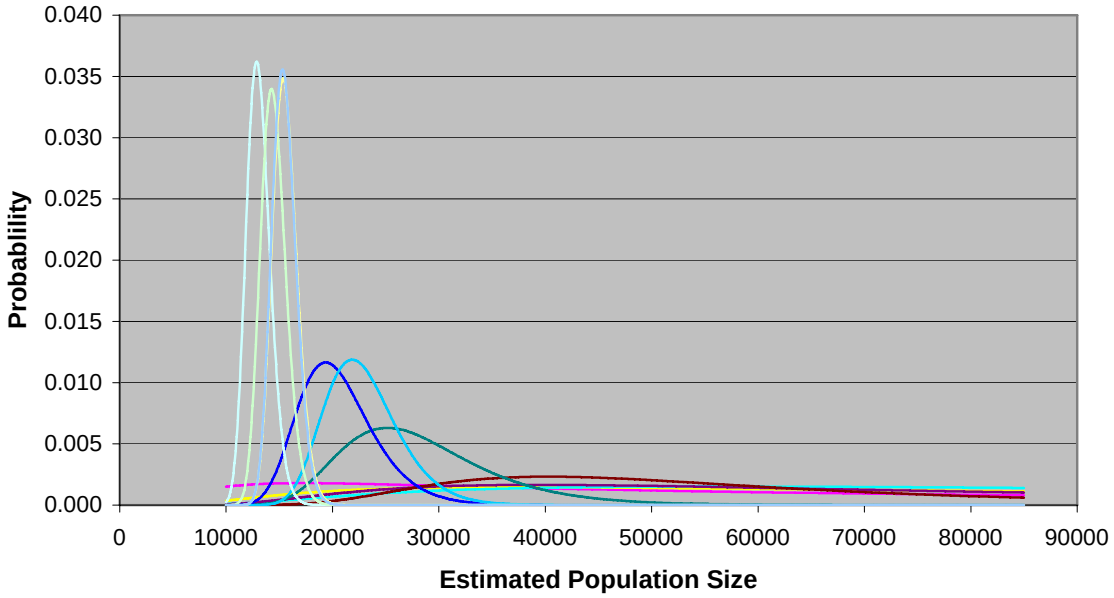
Tagging location	Ultrasonic code	Date	Recap or Tag Location	Lat.	Long.	Distance from tagging site (m) [a]
Ripple	56	25-Aug	Ripple	54 57.56	129 55.89	0
Ripple	56	24-Sep	Ripple	54 58.26	129 57.68	2310
Ripple	56	29-Oct	Mud Island	54 56.94	129 55.44	1257
Ripple	62	24-Aug	Ripple	54 58.36	129 56.61	0
Ripple	62	29-Oct	Mud Island	54 56.83	129 55.24	3192
Ripple	69	25-Aug	Ripple	54 57.56	129 55.89	0
Ripple	69	29-Oct	Mud Island	54 56.83	129 55.59	1407
Iceberg	70	25-Aug	Iceberg Bay	54 55.03	129 59.12	0
Iceberg	70	23-Sep	Iceberg Bay	54 55.03	129 59.02	110
Iceberg	70	02-Oct	Iceberg Bay	**Commercial Removal**		NA
Iceberg	73	25-Aug	Iceberg Bay	54 55.03	129 59.12	0
Nass Hr	74	26-Aug	Nass Hr	54 56.20	129 55.98	0
Nass Hr	74	25-Sep	Nass Hr	54 56.37	129 56.68	810
Nass Hr	74	30-Oct	Ripple	54 56.81	129 56.79	1423
Iceberg	82	25-Aug	Iceberg Bay	54 54.96	129 59.06	0
Iceberg	82	23-Sep	Iceberg Bay	54 54.91	129 58.76	330
Iceberg	82	03-Oct	Ripple	**Commercial Removal**		NA
Nass Hr	86	26-Aug	Nass Hr	54 56.20	129 55.98	0
Nass Hr	86	23-Sep	Mud Island	54 57.34	129 55.31	2240
Nass Hr	86	25-Oct	Obs. Inlet	55 00.95	130 00.38	9992
Nass Hr	86	27-Nov	Obs. Inlet	55 01.64	130 00.29	11112
Iceberg	93	25-Aug	Iceberg Bay	54 55.03	129 59.12	0
Iceberg	93	23-Sep	Iceberg Bay	54 55.59	129 59.53	1130
Iceberg	93	26-Oct	Iceberg Bay	54 55.47	129 59.27	832
Iceberg	94	25-Aug	Iceberg Bay	54 54.96	129 59.06	0
Iceberg	94	23-Sep	Iceberg Bay	54 55.84	129 59.44	1680
Iceberg	94	29-Oct	Ripple	54 56.64	129 54.73	5591
Iceberg	96	25-Aug	Iceberg Bay	54 54.96	129 59.06	0
Iceberg	96	23-Sep	Iceberg Bay	54 55.63	129 59.51	1330
Nass Hr	98	26-Aug	Nass Hr	54 56.20	129 55.98	0
Nass Hr	98	23-Sep	Nass Hr	54 56.28	129 56.21	290
Iceberg	106	25-Aug	Iceberg Bay	54 54.96	129 59.06	0

[a] Distance moved was calculated as a straight line from tagging to relocation.

APPENDIX F

Sequential posterior distributions for legal-sized male Dungeness crabs in the commercially-closed and open areas of the Nass Estuary in 2000 and 2001

(A) Closed Commercial Area (Kincolith)



(B) Open Commercial Area (Ripple & Iceberg)

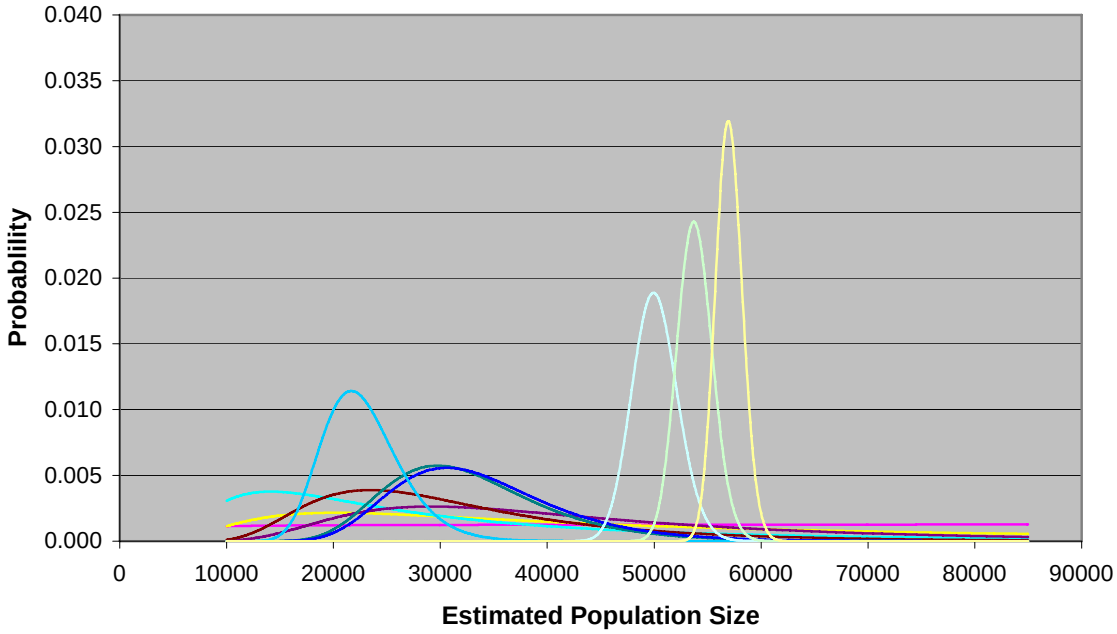
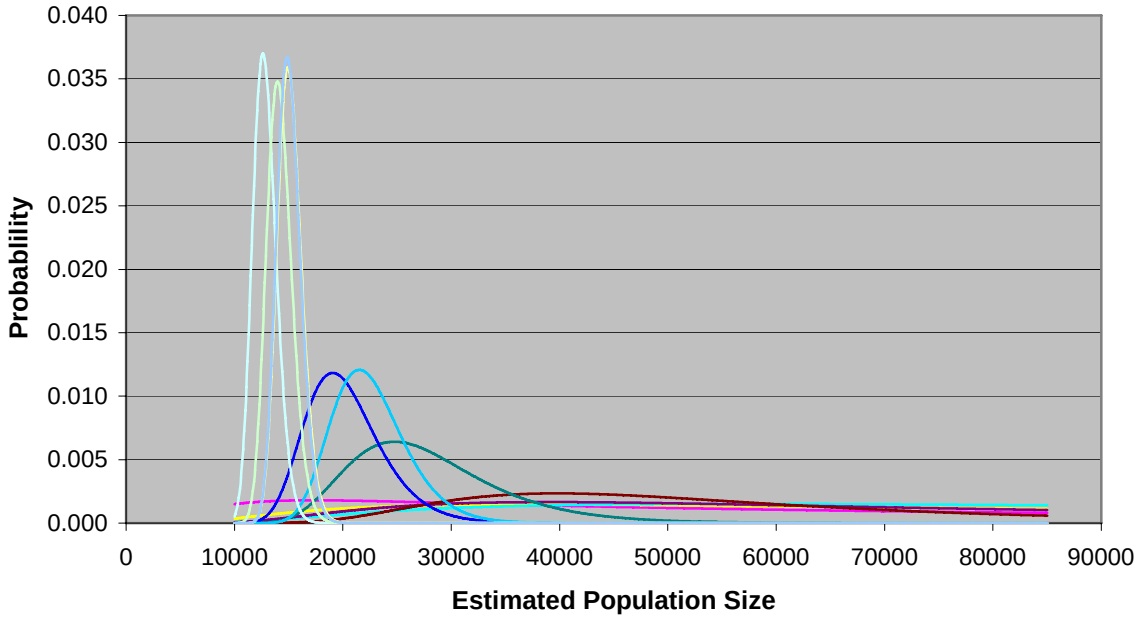


Figure F - 1. Sequential posterior distributions for legal-sized male Dungeness crabs in the commercially-closed (A) and open (B) areas of the Nass Estuary in 2000 using a NMR factor equal to 1.0.

(A) Closed Commercial Area (Kincolith)



(B) Open Commercial Area (Ripple & Iceberg)

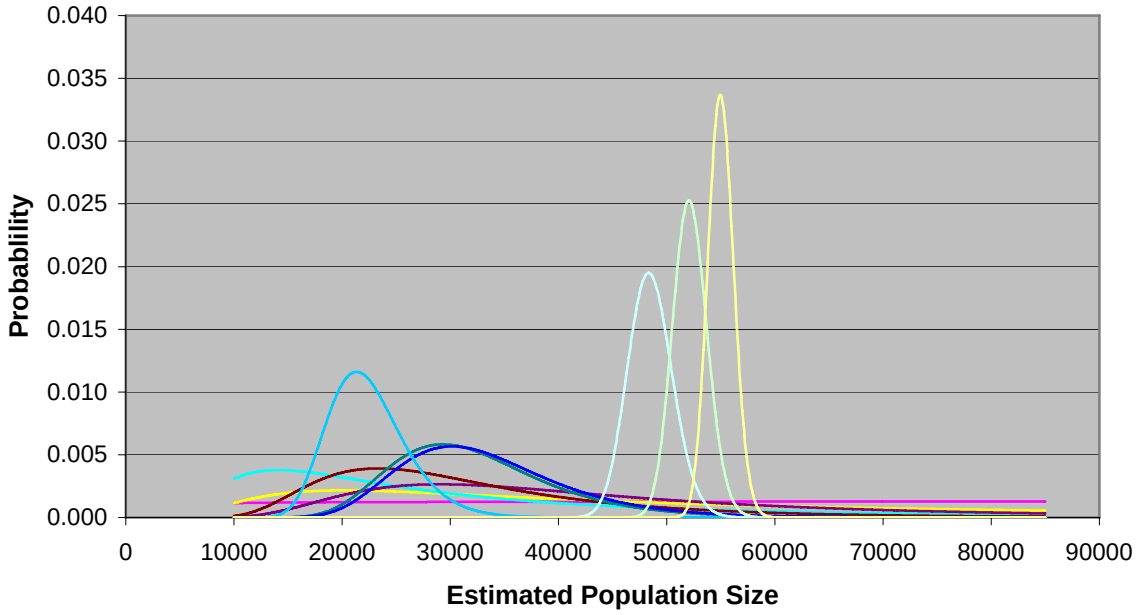
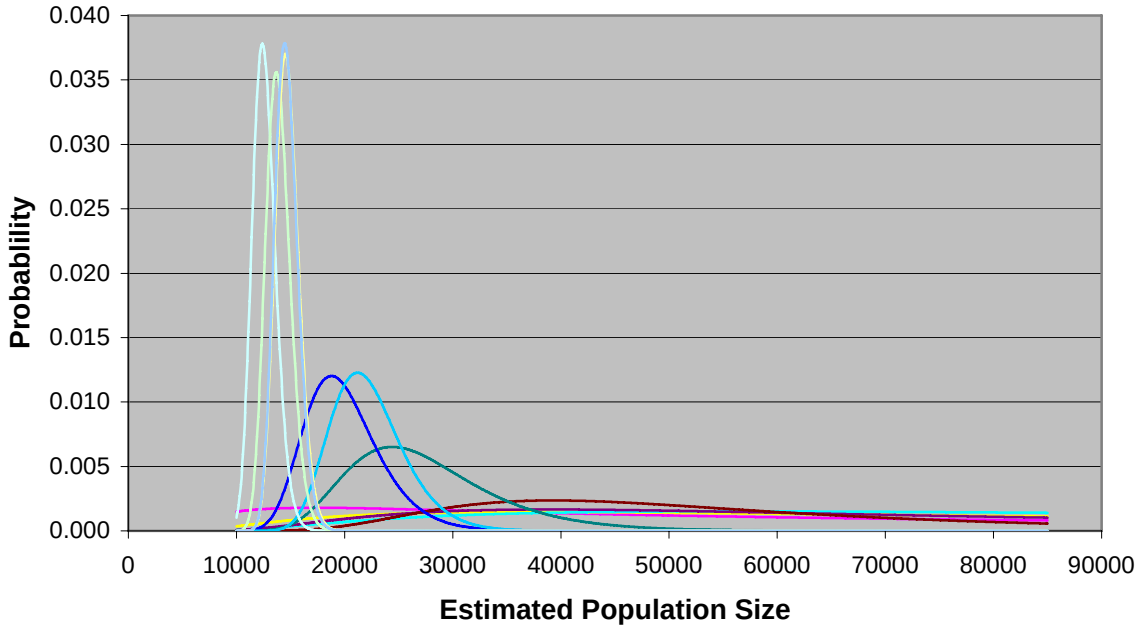


Figure F - 2. Sequential posterior distributions for legal-sized male Dungeness crabs in the commercially-closed (A) and open (B) areas of the Nass Estuary in 2000 using a NMR factor equal to 1.5.

(A) Closed Commercial Area (Kincolith)



(B) Open Commercial Area (Ripple & Iceberg)

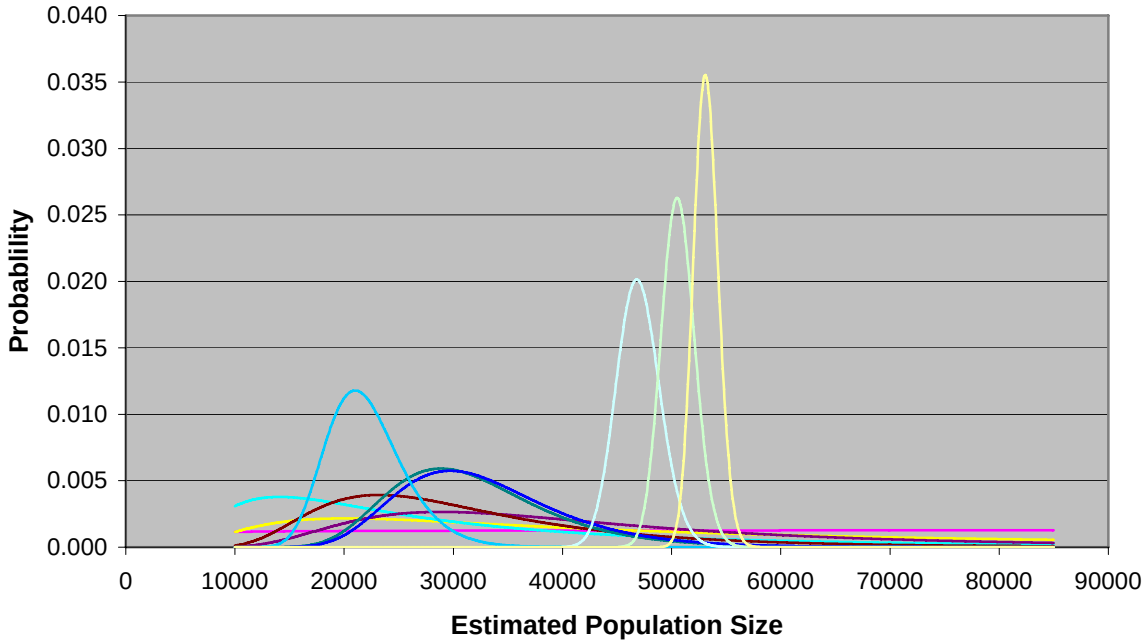
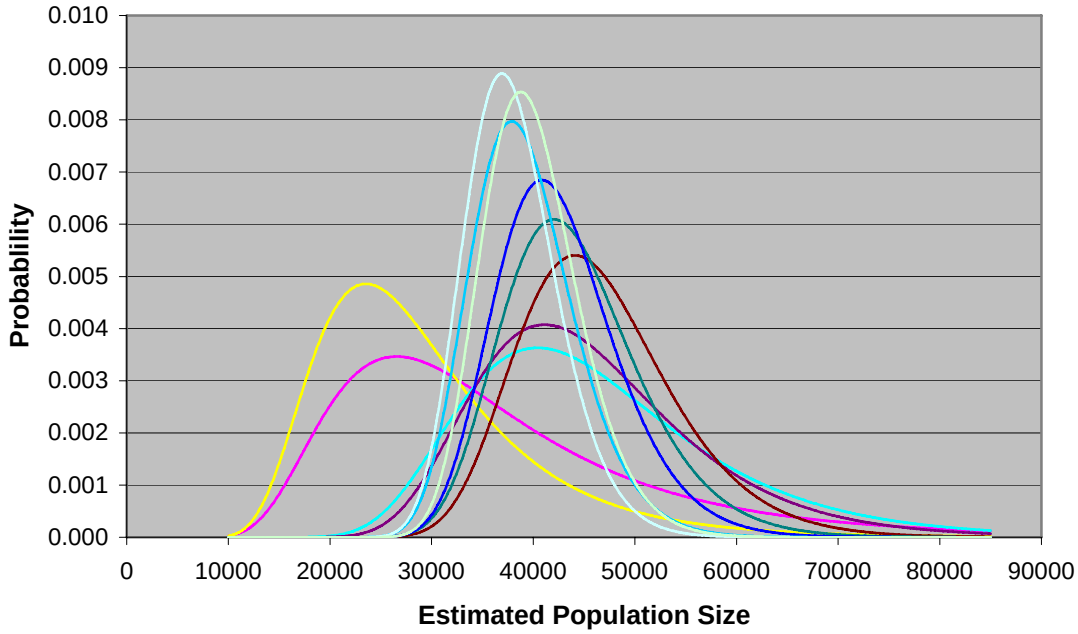


Figure F - 3. Sequential posterior distributions for legal-sized male Dungeness crabs in the commercially-closed (A) and open (B) areas of the Nass Estuary in 2000 using a NMR factor equal to 2.0.

(A) Closed Commercial Area (Kincolith)



(B) Open Commercial Area (Ripple & Iceberg)

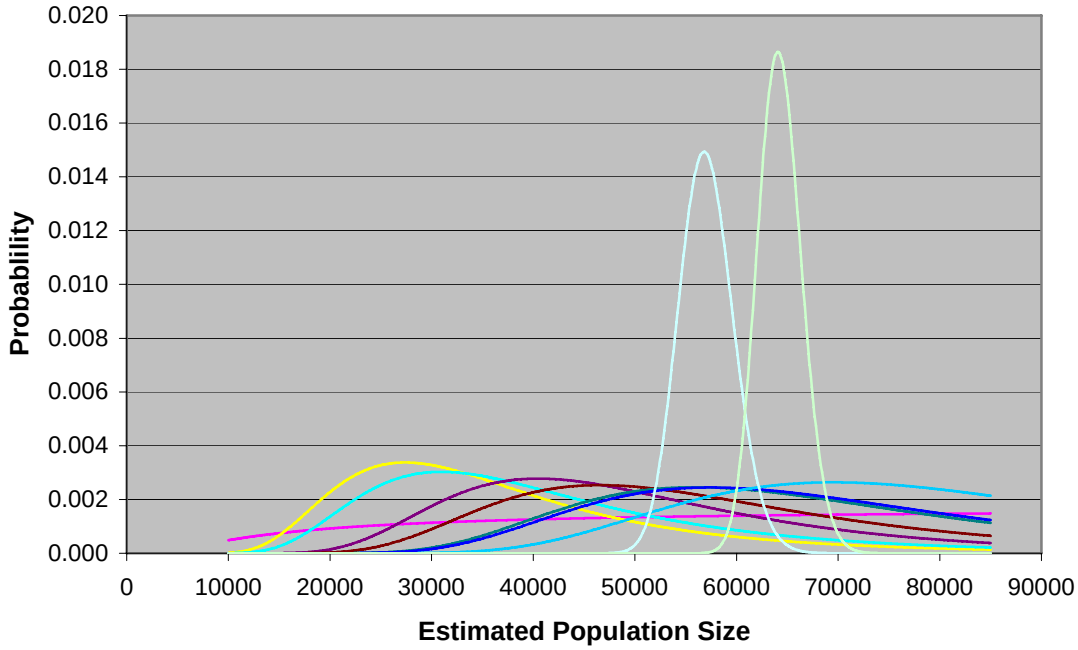
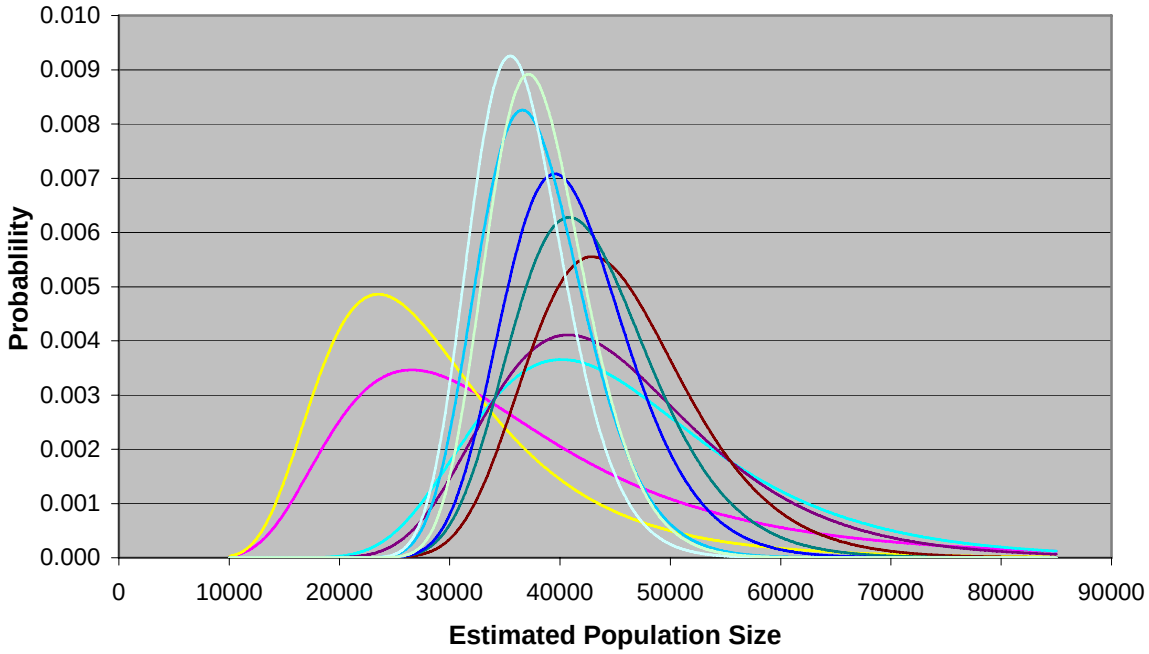


Figure F - 4. Sequential posterior distributions for legal-sized male Dungeness crabs in the commercially-closed (A) and open (B) areas of the Nass Estuary in 2001 using a NMR factor equal to 1.0.

(A) Closed Commercial Area (Kincolith)



(B) Open Commercial Area (Ripple & Iceberg)

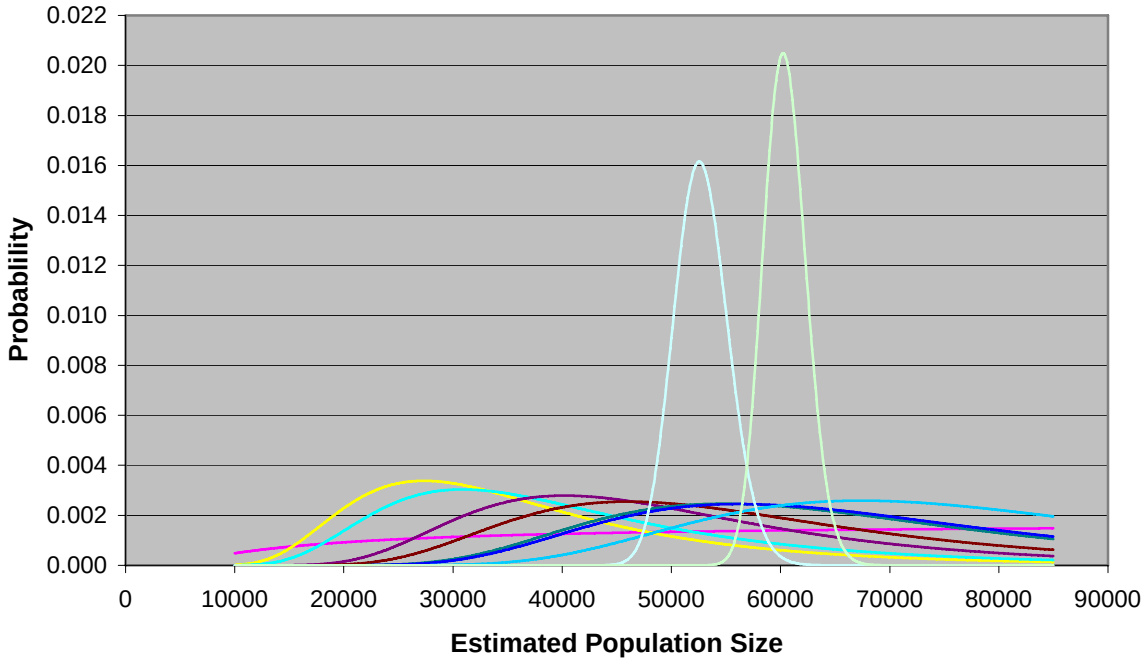
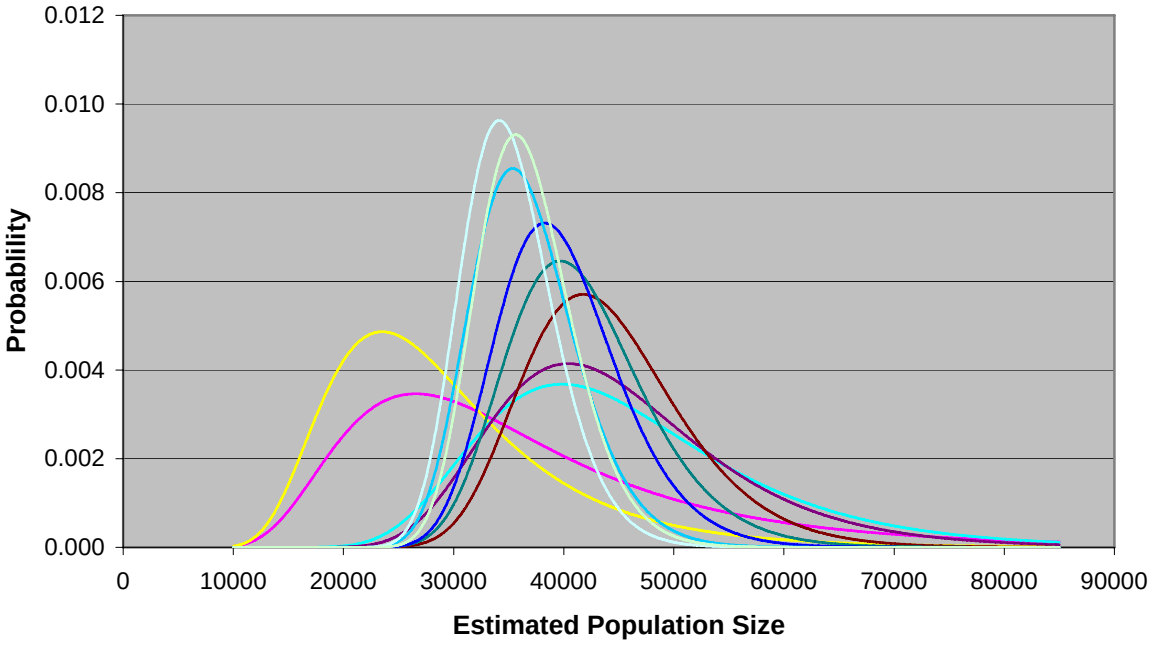


Figure F - 5. Sequential posterior distributions for legal-sized male Dungeness crabs in the commercially-closed (A) and open (B) areas of the Nass Estuary in 2001 using a NMR factor equal to 1.5.

(A) Closed Commercial Area (Kincolith)



(B) Open Commercial Area (Ripple & Iceberg)

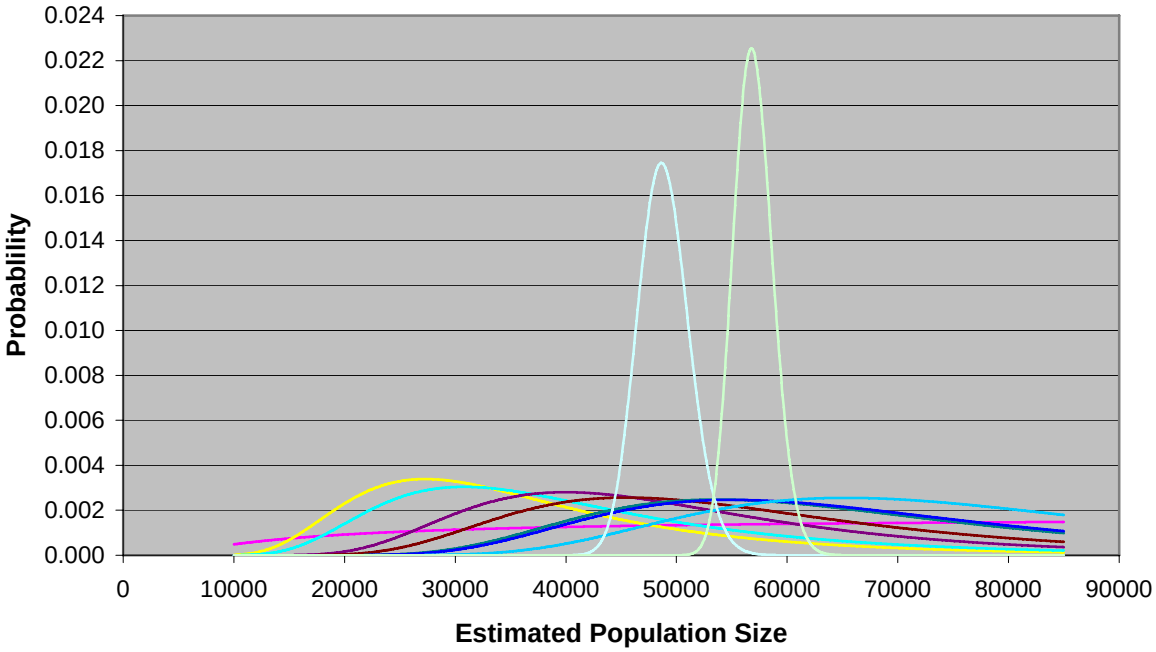


Figure F - 6. Sequential posterior distributions for legal-sized male Dungeness crabs in the commercially-closed (A) and open (B) areas of the Nass Estuary in 2001 using a NMR factor equal to 2.0.