# Pacific NorthWest LNG Project
# Marine Fish Survey Results: December 2014 to February 2016 Report

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# Acknowledgements

Stantec's team extends our appreciation for the input and participation of team members from Gitxaala Nation, Kitsumkalum First Nation, Kitselas First Nation and Metlakatla First Nation. Undertaking this Program would not have been possible without their input, assistance, and ongoing support.

We also extend our thanks to the captains and crews of the Metlakatla vessel MV *Ocean Star,* the MV *Active Pass*, and their support vessels. Their assistance has been invaluable throughout the Program.

## Table of Contents

**LIST OF TABLES**

## LIST OF FIGURES

## LIST OF APPENDICES

# Abbreviations

| | |
|---|---|
| # | Number |
| % | percent |
| °C | degrees celsius |
| µS/cm | microsiemens per centimetre |
| µg/L | micrograms per litre |
| ADCP | acoustic Doppler current profiler |
| ASL | ASL Environmental Sciences Inc. |
| CD | chart datum |
| CEA Agency | Canadian Environmental Assessment Agency |
| chl-*a* | chlorophyll *a* |
| CHS | Canadian Hydrographic Service |
| COSEWIC | Committee on the Status of Endangered Wildlife in Canada |
| CPUE | catch per unit effort |
| CRA | commercial, recreational and Aboriginal |
| CTD | conductivity-temperature-depth |
| dB | decibels |
| DFO | Fisheries and Oceans Canada |
| EIS | Environmental Impact Statement |
| g | grams |
| GPS | global positioning system |
| ha | hectare |
| LNG | liquefied natural gas |
| m | metre |
| mg/L | milligram per litre |
| mm | millimetres |

| | |
|---|---|
| MOF | materials offloading facility |
| ms | milliseconds |
| MVBS | mean volume backscattering strength |
| n | sample size |
| NTU | Nephelometric Turbidity Units |
| PNW LNG | Pacific NorthWest LNG Limited Partnership |
| PRPA | Prince Rupert Port Authority |
| PSU | practical salinity unit |
| RFBD | relative fish biomass density |
| ROV | remotely operated vehicle |
| SARA | *Species At Risk Act* |
| SCOR | Scientific Committee on Oceanic Research |
| sv | volume backscattering coefficient |
| Sv | logarithmic of sv |
| TS | target strength |
| UTM | Universal Transverse Mercator |

# 1.0 INTRODUCTION

## 1.1 PROGRAM SCOPE

Pacific NorthWest LNG Limited Partnership (PNW LNG) is proposing to construct and operate a liquefied natural gas (LNG) facility (the Project) on Lelu Island within the District of Port Edward, British Columbia and a marine terminal within Chatham Sound off Lelu Island. The Project would be located on federal lands and waters under the jurisdiction of the Prince Rupert Port Authority (PRPA) on the north coast of British Columbia.

Stantec Consulting Ltd. (Stantec) has designed and implemented a Marine Fish Program (the Program) on behalf of PNW LNG to support collection of information in the Project area about marine fish species abundance and distribution, including timing of fish key life stages. The objectives of the Program were to:

1. Describe the marine biophysical environment (i.e., water properties, zooplankton) in the vicinity of the Project's marine components and survey region (survey region and other key terms used in this report are defined in Table 1)
2. Identify fish and marine invertebrates present in the survey region
3. Identify spatial patterns of distribution, relative abundance, and biological characteristics for fish and marine invertebrates in the survey region
4. Identify temporal patterns of distribution, relative abundance and biological characteristics of fish and marine invertebrates in the survey region
5. Identify salmon smolt prey items through examination of stomach contents
6. Examine possible associations between water column properties and the presence of fish
7. Interpret the patterns of select fish species' habitat use in the survey region

This report expands on two interim data reports submitted to PNW LNG July 9 and November 3, 2015 and is a synthesis of data collected from December 2014 to the end of February 2016.

The material in this report is organized into the following six sections plus appendices, based on the program objectives presented above:

- Introduction with program scope, survey approach, and quality control / quality assurance (Section 1.0)
- Habitat in survey areas with methods, results, and summary (Section 2.0)
- Temporal and spatial distribution of fish and invertebrates caught with methods and results separated by general patterns of total fish abundance, relative abundance for subsets of key fish species, and demographics for these key fish species (Section 3.3)
- Associations between water properties and fish presence (Section 4.0)
- Patterns of fish habitat use in the survey region (Section 5.0)
- Review of the project objectives (Section 6.0)
- Survey schedule and effort (Appendix A)
- Data summaries (Appendix B)

- Hydroacoustic analysis segments (Appendix C)
- Marine fish survey incidental sightings (Appendix D)
- Exploratory sample methods and results (Appendix E)
- Hydroacoustic transect echograms (Appendix F)

Key terms used throughout the report are listed in Table 1.

## Table 1 Key Terms Used

| Key Term | Definition |
|---|---|
| Commercial, recreational, or Aboriginal (CRA) fishery species [a] | "Fish that are part of commercial, recreational or Aboriginal fisheries are interpreted to be those fish that fall within the scope of applicable federal or provincial fisheries regulations as well as those that can be fished by Aboriginal organizations or their members for food, social or ceremonial purposes or for purposes set out in a land claims agreement.<br>Fish that support these fisheries are those fish that contribute to the productivity of a fishery (often, but not exclusively, as prey species). The 'fish that support' may reside in water bodies that contain the commercial, recreational or Aboriginal fisheries or in water bodies that are connected by a watercourse to such water bodies." (*Fisheries Act*, Section 2(1)) |
| Exploratory sample methods | Refers to fishing techniques used in the marine fisheries program outside beach seine and trawls as presented in Appendix E. |
| Exploratory sample sites | Refers to each of the sample sites where data were collected using exploratory sample methods. |
| Fish [a] | "Parts of fish, shellfish, crustaceans, marine animals and any parts of shellfish, crustaceans or marine animals, and the eggs, sperm, spawn, larvae, spat and juvenile stages of fish, shellfish, crustaceans, and marine animals" (*Fisheries Act*, Section 2(1)) |
| Fish Habitat [a] | "Spawning grounds and any other areas, including nursery, rearing, food supply and migration areas, on which fish depend directly or indirectly in order to carry out their life processes." (*Fisheries Act*, Section 2(1)) |
| Focal species | Five anadromous salmon (pink, chum, sockeye, coho, and Chinook), three pelagic marine fish species (surf smelt, Pacific herring, and larval fish [a grouping that could possibly include larval eulachon]), and three benthic marine fish species (starry flounder, English sole, and Dungeness crab) were identified as focal species based on known key CRA fishery species and species of fisheries management concern using the criteria detailed in Table 2. |
| Habitat use | The direct or indirect use of a habitat by a fish species to carry out their life processes. In this report, the term 'habitat use' is used to describe the presence of fish species and life stage (based on size) in a habitat. |
| Incidental sightings | Observations of marine flora and fauna outside specific sample collections as defined in Section 2.2 and Section 3.2 methods. |
| Sample site | Refers to the specific physical location where data were collected using a certain type of gear (e.g., one beach seine, one CTD site). |
| Spatial distribution | Refers to patterns observed among survey areas (as shown on Figure 2). |
| Survey | Refers to one continuous field expedition aimed to complete a full round of sampling at all sample sites in all applicable survey areas. |

### Table 1 Key Terms Used

| Key Term | Definition |
|---|---|
| Survey area | Refers to each of the areas in Figure 2 labeled A through I. |
| Survey region | Refers to the greater regional context and includes the survey areas G, H, and I (which are outside of the vicinity of the marine Project components). |
| Temporal distribution | Refers to patterns observed across survey months. |

NOTE:
[a] Text in quotations are taken directly from the *Fisheries Act*, Section 2(1)

## 1.2 SURVEY APPROACH

The survey region included the waters of Porpoise and Lelu channels; Flora, Agnew, Horsey, and Robertson banks; and Inverness, Telegraph, and Marcus passages (Figure 1). The Program comprised multiple surveys to sample ocean water properties, zooplankton, crab, and fish species. It was initially designed as two surveys scheduled over two months (December 2014 and January 2015) with the understanding that lessons learned during these initial surveys would be used to refine and implement a longer term Program. The initial survey design and proposed methods were shared with the Canadian Environmental Assessment (CEA) Agency, Fisheries and Oceans Canada (DFO), the CEA Agency-PNW LNG Working Group, and the Tsimshian community in October of 2014. As a result of DFO and PNW LNG Working Group input and their feedback into the initial survey design, the surveys were extended to cover a period of 15 months, from December 2014 to February 2016.

The Program included daytime marine fish surveys, supplemented by nighttime surveys beginning in April 2015 to capture the April to July period of Skeena salmon smolt outmigration (Manzer 1956; Wood et al. 1998; Cox-Rogers and Spilsted 2012; Beacham et al. 2014).

***Daytime Marine Fish Surveys***—Daytime marine fish surveys were conducted once or twice per month (for four to eight days each survey) across the 15 months from December 2014 to February 2016 (see Appendix A for details) in the vicinity of the marine Project components (i.e., survey areas A through F, Figure 2). Starting in June 2015, daytime fish surveys were also conducted in three additional survey areas within Chatham Sound: Marcus Passage (survey area G); Inverness Passage (survey area H); and Telegraph Passage (survey area I) (Figure 2).

Initial surveys used a variety of fishing gear types (e.g., crab trap, trawl, beach seine, purse seine, fyke net) designed for different habitats and species to examine fish spatial distribution, species presence, abundance and biological characteristics (e.g., life cycle stages). A combined conductivity-temperature-depth (CTD), dissolved oxygen, turbidity and chl-*a* fluorometer sensor package was used to sample ocean water properties and a 0.5 m SCOR net was used to collect zooplankton. Methods and rationale of survey area selection are discussed in Section 2.2 and 2.3.


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| Legend | | |
|---|---|---|
| City or Town | Prince Rupert Port Authority Boundary | Bathymetry (m) |
| Project Component | Waterbody | 0 |
| Railway | Intertidal Bank | -300 |
| Highway | 0 - 5 m Shoal | |
| Secondary Road | 5 - 10 m Shoal | |
| Watercourse | | |

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**Marine Fish Survey Region**

MARINE FISH PROGRAM - FINAL REPORT

*Sources: Government of British Columbia; Prince Rupert Port Authority; Government of Canada, Natural Resources Canada, Centre for Topographic Information; Progress Energy Canada Ltd.*

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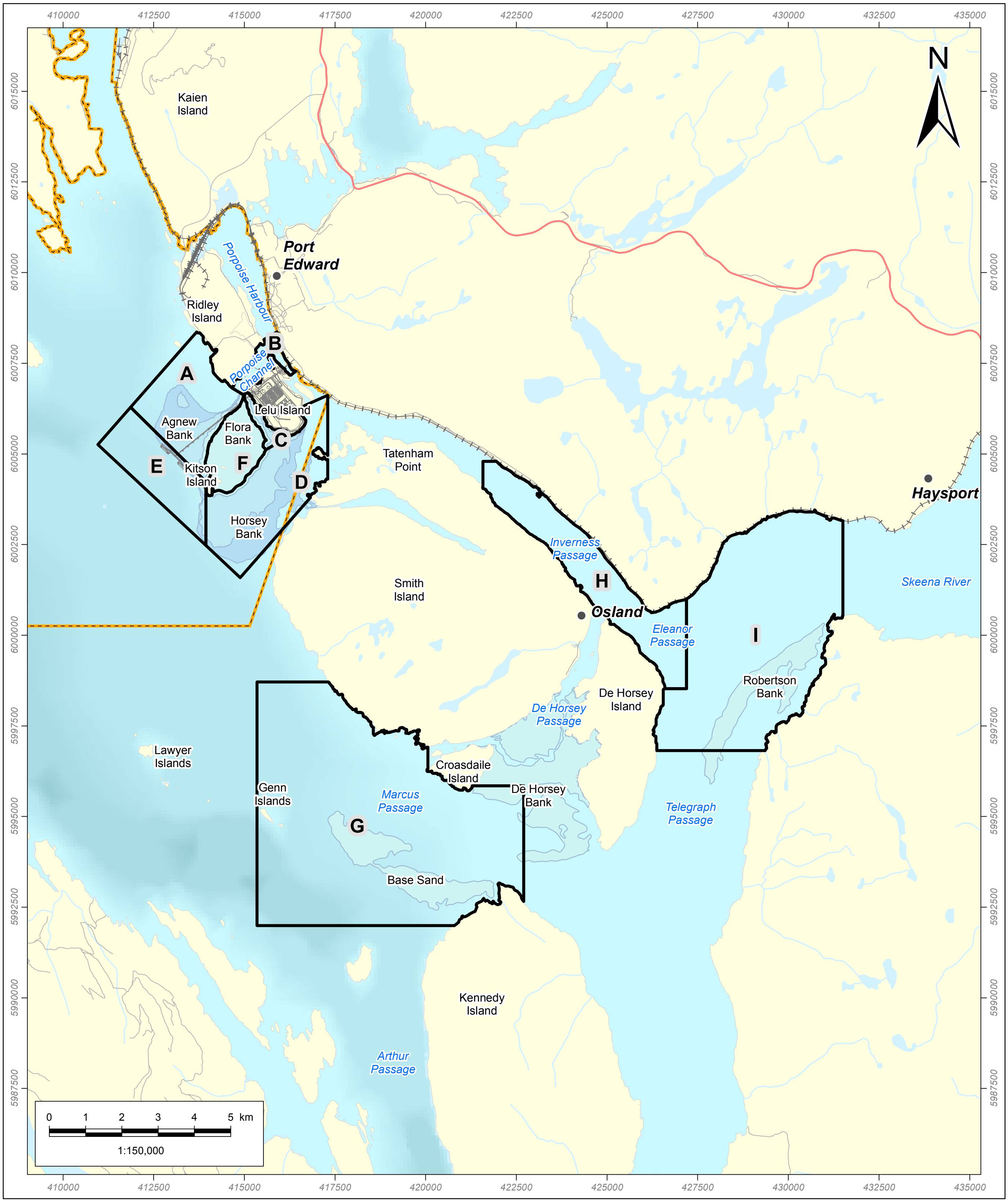


| | | |
|---|---|---|
| City or Town | Survey Area | Bathymetry (m) |
| Project Component | Prince Rupert Port Authority Boundary | 0 |
| Railway | Waterbody | -300 |
| Highway | Intertidal Bank | |
| Secondary Road | 0 - 5 m Shoal | |
| Watercourse | 5 - 10 m Shoal | |

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**Marine Fish**
**Survey Areas**

MARINE FISH PROGRAM - FINAL REPORT

*Sources: Government of British Columbia; Prince Rupert Port Authority; Government of Canada, Natural Resources Canada, Centre for Topographic Information; Progress Energy Canada Ltd.*

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FIGURE NO: **2**

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***Nighttime Marine Fish Surveys***—Dusk/night surveys were conducted once, twice, or four times a month (for four to nine days each survey) between April and July 2015 (see Appendix A for details). Trawl and hydroacoustic gear, along with zooplankton vertical hauls, were used to examine fish spatial distribution and plankton forage supply in survey areas A through G. Survey areas H and I were not sampled at night due to navigational safety considerations (e.g., many shallow areas and rocks to navigate). Field work was scheduled during known periods of spring-summer salmon smolt outmigration from freshwater to marine environments. The intent was to capture fish during periods of potentially lower spatial heterogeneity (reduced schooling behaviour), potentially enhanced vulnerability to active fishing gear types (Hahn et al. 2007), and greater activity (increased nocturnal foraging behavior and migration is documented for some juvenile salmon populations) (Whitney 1969; Godin 1980; Soeda, et al. 1987).

## 1.3 QUALITY CONTROL/QUALITY ASSURANCE

A series of protocols were implemented to promote high-quality data collection, analysis and interpretation during the Program.

### Routine Field Equipment Inspection and Calibration

- All fishing gear was inspected for tears and rips prior to field use. If wear or damage was identified, the net was mended by field crews (e.g., minor repairs such as small holes) and/or professionally repaired (large rips or tears requiring stitching) as required.
- Field calibration checks of hydroacoustic equipment were performed using a tungsten-carbide sphere to determine if calibration offsets were needed during data processing.
- CTD sensors used to sample marine water properties were rented from ASL Environmental Sciences. CTD equipment was maintained and calibrated by ASL prior each survey.
- All crab traps and lines were inspected and repaired prior to field use.

### Data Checks

- Quality control checks of raw data were scheduled and performed during the field program.
- Field data accuracy and completeness was reviewed and confirmed by a second biologist during the field surveys.
- Field data forms were photographed for inventory and storage in the advent of data loss.
- Photographs were downloaded from cameras, sorted, and labelled at the end of each day.
- Data files were uploaded to a secure Stantec server during each field survey as soon as possible.
- Data review, confirmation, and approval was scheduled and performed by a Registered Professional Biologist following field data entry, to limit possible errors (e.g., identify species size or count values with misplaced decimal points, identified as those that differ by orders of magnitude).

### Data Analysis

- All data analyses and report presentations were reviewed by Registered Professional Biologists, and reviewed through the Stantec Quality Management System (see below).

### Report Preparation and Review

- All Stantec reports are subject to a quality control process that includes review by a Quality (Technical) Reviewer and an Independent Review by qualified senior staff, in accordance with the project requirements of Stantec's ISO 9001 Quality Management System.

# 2.0 HABITAT IN SURVEY AREAS

## 2.1 INTRODUCTION

Nine survey areas were selected and delineated within the larger survey region (Figure 2, described in Section 2.3.1), including three survey areas (Inverness, Marcus, and Telegraph passages) outside of the vicinity of the marine Project components. The nine survey areas were representative of habitats that were common across the survey region (i.e., nearshore intertidal, nearshore subtidal, offshore pelagic). Survey area boundaries were chosen in consideration of logistical constraints related to site access and transit times (i.e., to allow for replicate sampling within each survey area during each survey).

## 2.2 METHODS

Qualitative and quantitative observations were used to describe the marine biophysical environment in the survey region. Literature and local qualitative visual observations were used to describe the general habitat setting (Section 2.2.1). Two sets of quantitative measures were used to describe marine water properties, including: 1) turbidity, dissolved oxygen, temperature, conductivity, and chlorophyll (chl-*a*) concentrations (phytoplankton abundance) (Section 2.2.2), and 2) zooplankton abundance (Section 2.2.3).

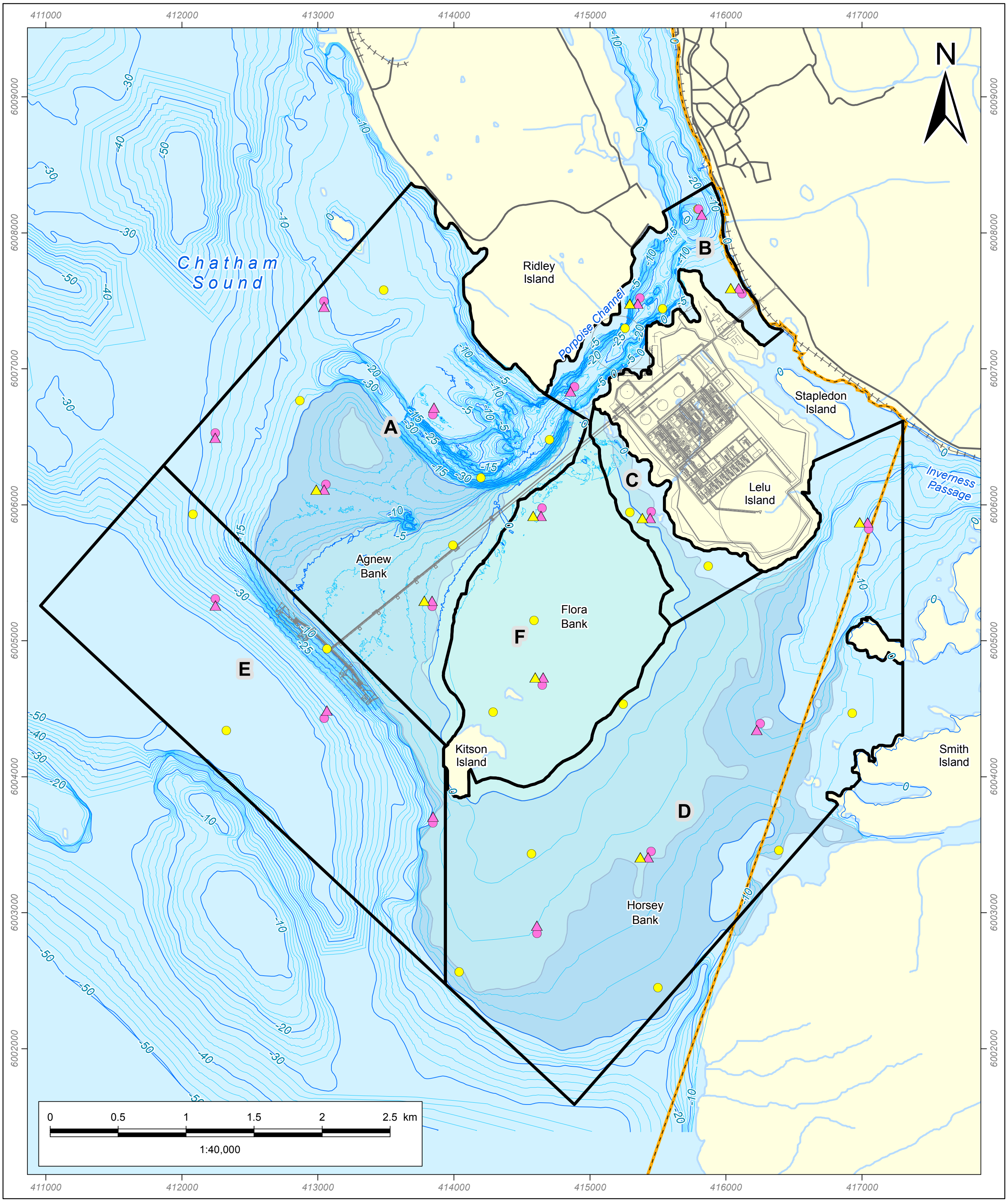
Daytime surveys used established sampling techniques to measure ocean water properties. Techniques were adjusted during the course of the Program based on site-specific field experience related to marine conditions, health and safety of field crew and gear, and effectiveness of the different survey methods and gear in catching targeted species.

The initial survey design, implemented in December 2014, included water column profiling with a CTD, coupled with additional sensors which, taken together, measured depth, conductivity, temperature, turbidity, dissolved oxygen, and chl-*a*. These measurements were used to characterize water properties within each survey area and over time. Temperature and salinity measurements were also used to calculate sound speed in the hydroacoustic data analysis (see Section 2.2.2).

Sample methods and sites (see Appendix A for a summary of methods by date) were refined to include:

- Expanded spatial and temporal coverage of oceanographic water property sites (starting June 2015)
- Nighttime CTD casts and zooplankton sampling (April to July 2015)
- Monthly daytime zooplankton sampling (August, September, and December 2015)

Sample sites for water properties within survey areas A through F are shown in Figure 3; survey area G is shown in Figure 4.




| | | | |
|---|---|---|---|
| Project Component | Survey Area | CTD (Daytime) (21) | |
| Railway | Prince Rupert Port Authority Boundary | CTD (Nighttime) (19) | |
| Road | Waterbody | Zooplankton (Daytime) (9) | |
| Secondary Road | Intertidal Bank | Zooplankton (Nighttime) (19) | |
| Watercourse | 0 - 5 m Shoal | | |
| **Bathymetry (m)** | 5 - 10 m Shoal | | |
| Major Contour | | | |
| Minor Contour | | | |

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**Water Properties Sample Sites: Survey Areas A, B, C, D, E, and F**

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*Sources: Government of British Columbia; Prince Rupert Port Authority; Government of Canada, Natural Resources Canada, Centre for Topographic Information; Progress Energy Canada Ltd.*

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FIGURE NO: 3

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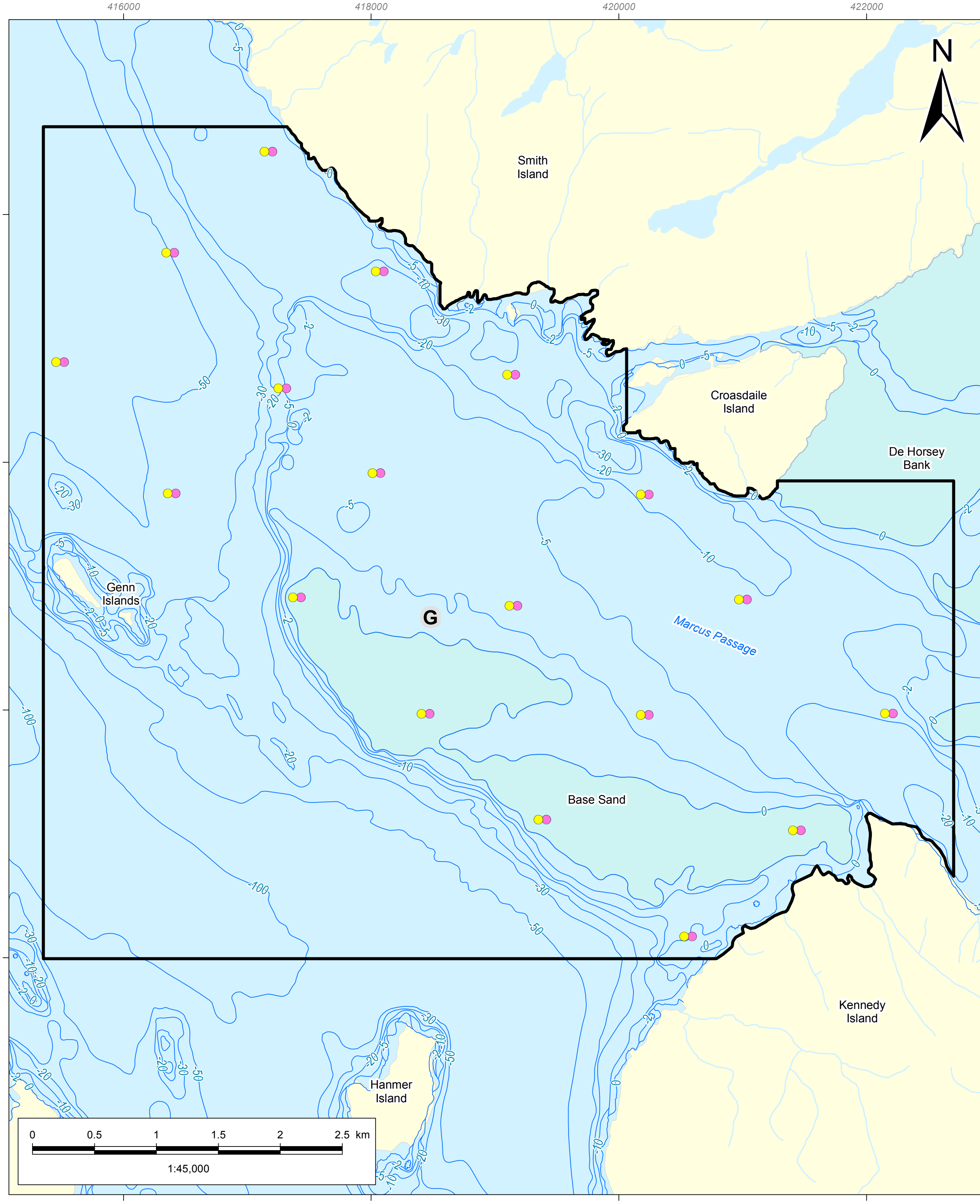


Watercourse
Bathymetric Contour
Survey Area
Waterbody
Intertidal Bank
CTD (Daytime) (18)
CTD (Nighttime) (18)

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**Water Properties Sample Sites: Survey Area G**

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*Sources: Government of British Columbia; Prince Rupert Port Authority; Government of Canada, Natural Resources Canada, Centre for Topographic Information; Progress Energy Canada Ltd.*

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FIGURE NO: **4**

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The following sections provide a discussion of the purpose, survey design and methods used to describe habitats based on qualitative descriptions of habitat features and empirical measurements of marine water properties and zooplankton.

### 2.2.1 General Habitat Description

Field crews made visual observations of general habitat attributes at each survey area, including prominent shoreline features, visible substrate types, shoreline exposure to waves, ocean currents, and dominant and interesting species. These observations were integrated with information from existing literature to form qualitative descriptions of the nine survey areas (see Section 2.3.1). Literature included peer-reviewed journal articles, project-specific reports (e.g., Environmental Impact Statement [EIS] and technical data reports), government technical reports and management plans, and oceanographic charts.

### 2.2.2 Water Properties: CTD, Turbidity, Dissolved Oxygen and Chlorophyll *a*

#### 2.2.2.1 Purpose

Water properties influence the production and distribution of biomass in aquatic (Falkowski et al. 1998) and marine ecosystems (Ware and Thompson 2005). For example, chl-*a* is a photosynthetic molecule produced by phytoplankton and acts as a surrogate for phytoplankton biomass in the water column. Higher chl-*a* concentrations during summer months are related to increased primary production driven by exposure to sunlight and reduced surface mixing (United States Global Change Research Program 2016). Concentrations are also influenced by other factors, including nutrient availability, freshwater inputs, grazing by zooplankton, advection, and export to the benthos. Sampling marine water properties concurrently with assessments of fish distribution and abundance can improve understanding of associations between habitat characteristics and marine fish in the survey region (discussed in Section 4.0).

#### 2.2.2.2 Sample Design

Water properties in the survey region were sampled using a CTD with additional sensors to measure dissolved oxygen, turbidity and chl-*a*. These measurements were taken during daytime surveys at five sample sites in survey area A, three in survey area B, two in survey area C, six in survey area D, three in survey area E, and two in survey area F (Figure 3). Area G was surveyed from August through to December 2015 at 18 sample sites during daytime surveys. The water property sample sites were located along the hydroacoustic and trawl transects, with the exception of one sample site in survey area B and one sample site in survey area F placed near Kitson Island (Figure 3). Exploratory CTD measurements were taken in areas H and I, with results presented in Appendix E, Section E.2.1.

CTD sample sites were located along trawl and hydroacoustic transects to explore potential associations between biophysical properties of water and fish distributions (Section 4.0). During daytime surveys in August, November, and December 2015, water property data were collected opportunistically and used to describe areas closer to the Skeena River and, therefore, more likely to be influenced by freshwater input (i.e., 14 sample sites in survey areas H and 17 in survey area I [Figure 5 and Figure 6, respectively; see Appendix E for results]).

Nighttime water property data were also collected in survey areas A through F (five sample sites in survey area A, four in survey area B, one in survey area C, four in survey area D, three in survey area E, and two in survey area F). Three nighttime sites were added within Porpoise Channel to examine water properties adjacent to the proposed MOF (materials offloading facility; Figure 3). During three nighttime surveys in June and July 2015, 18 sites were sampled in survey area G (Figure 4).

#### 2.2.2.3 Methods

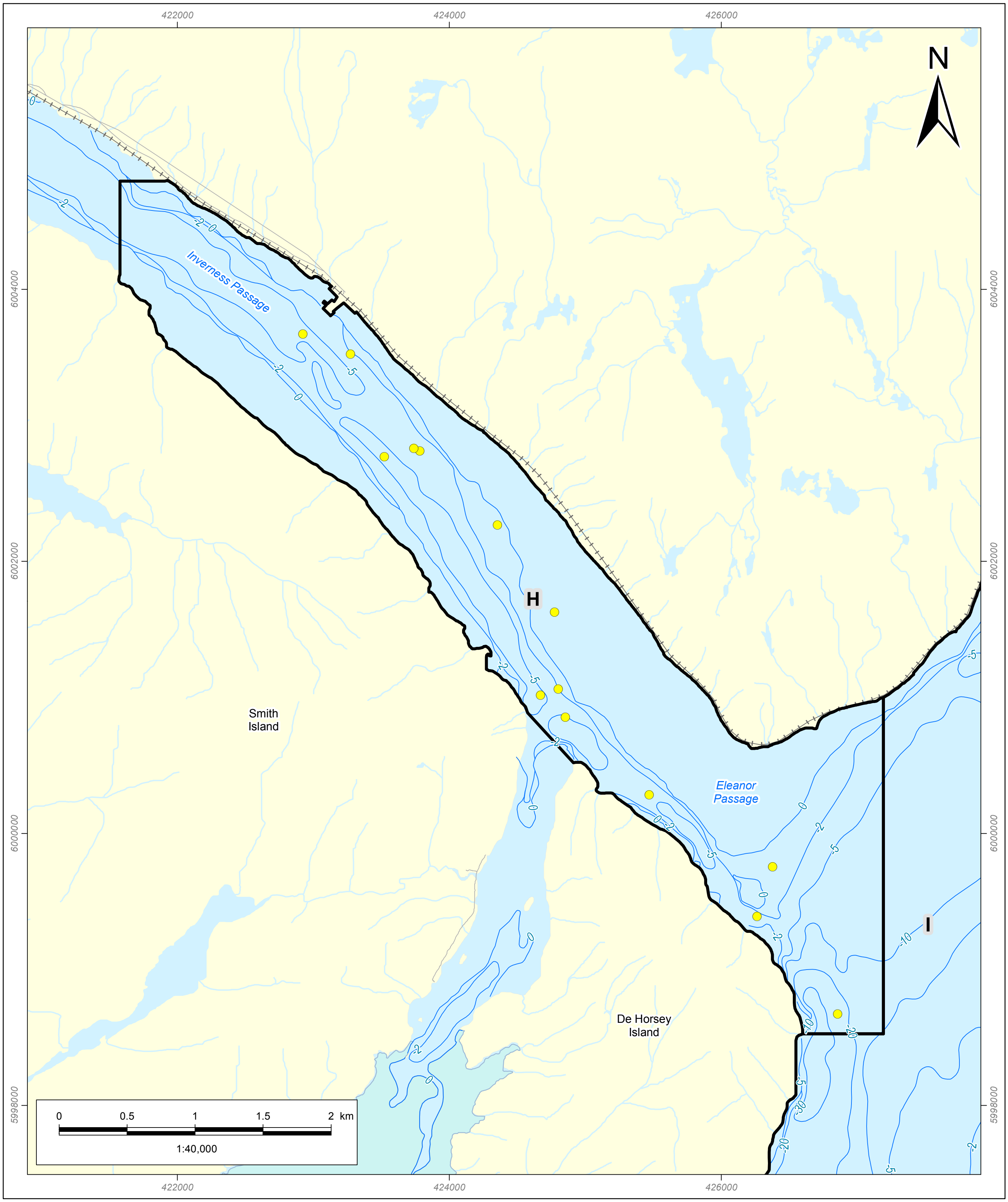
Water property data were collected by vertical water column profiling using a RBR XR 620 CTD (with dissolved oxygen, turbidity and chl-*a* sensors) or an ALEC CLW Infinity instrument (with chl-*a*, turbidity, and temperature sensors) combined with a RBR Concerto CTD (measuring depth, conductivity, temperature, and dissolved oxygen). Measurement units were recorded as follows:

- Turbidity (Nephelometric Turbidity Units [NTU])
- Temperature (degrees Celsius [°C])
- Conductivity (microsiemens per centimetre [μS/cm])
- Depth (m)
- Dissolved oxygen concentration (milligrams per litre [mg/L])
- Chl-*a* concentration (micrograms per litre [μg/L])

The CTD was lowered to the seabed at each sample site and retrieved vertically through the water column to the surface at a rate of approximately 1 m/s. The CTD recorded data six times every second (or approximately every 17 cm). Raw data were downloaded and analyzed using sensor-specific software and the OceanDataView program (Schlitzer 2002). Data analysis was completed by both Stantec and ASL staff.

Three seasonal sampling periods were used to summarize water property results across the survey period:

- Late Winter – early Spring: January, February, March and April
- Late Spring – Summer: May, June, July and August
- Fall – early Winter: September, October, November, and December.




| | | |
|---|---|---|
| Railway | Survey Area | CTD (Daytime) (14) |
| Watercourse | Waterbody | |
| Bathymetric Contour (m) | Intertidal Bank | |

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**Water Properties Exploratory Sample Sites: Survey Area H**

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*Sources: Government of British Columbia; Prince Rupert Port Authority; Government of Canada, Natural Resources Canada, Centre for Topographic Information; Progress Energy Canada Ltd.*

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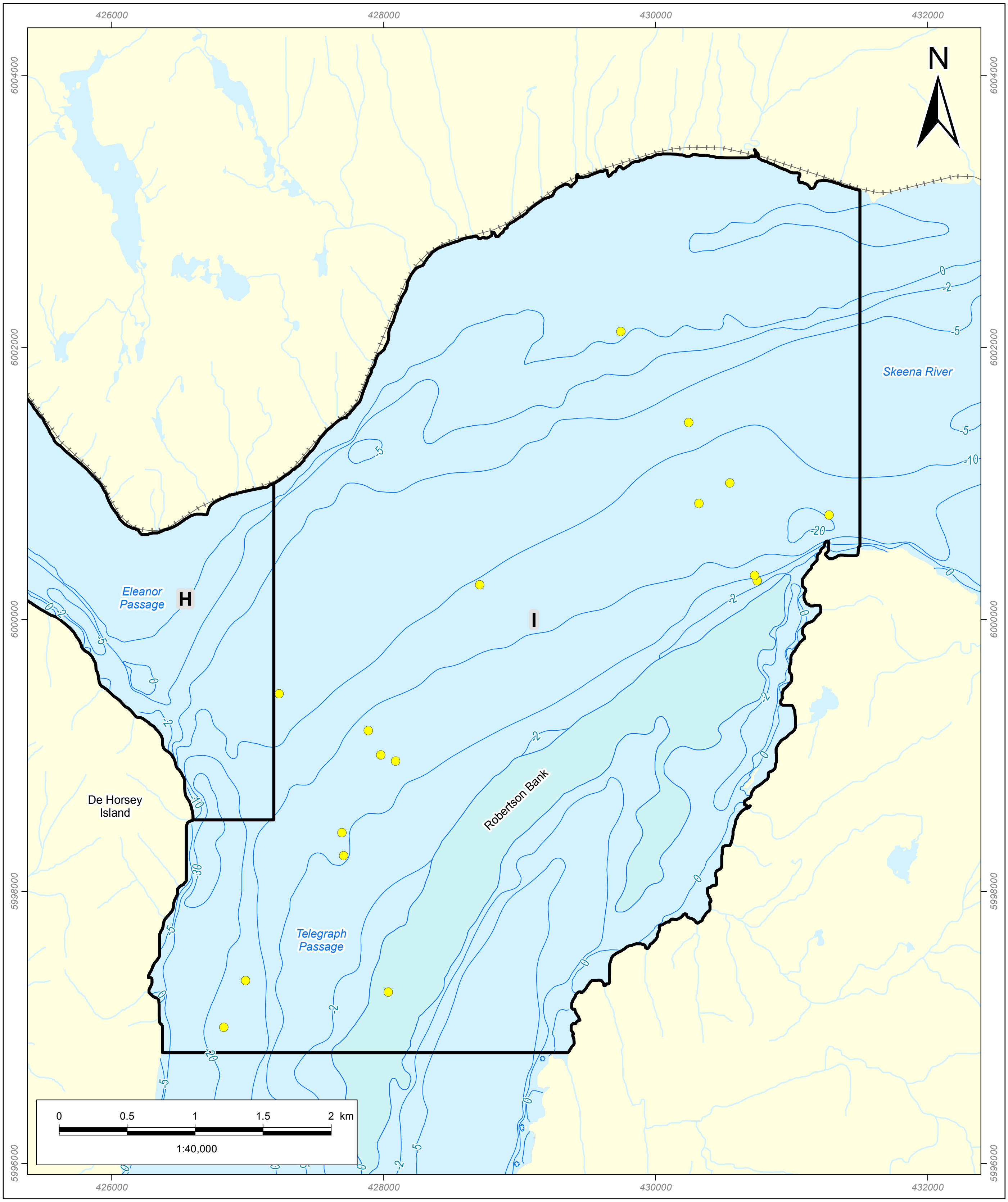


Railway
Watercourse
Bathymetric Contour (m)
Survey Area
Waterbody
Intertidal Bank
CTD (Daytime) (17)

**Pacific NorthWest LNG**

**Water Properties Exploratory Sample Sites: Survey Area I**

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*Sources: Government of British Columbia; Prince Rupert Port Authority; Government of Canada, Natural Resources Canada, Centre for Topographic Information; Progress Energy Canada Ltd.*

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FIGURE NO: 6

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### 2.2.3 Water Properties: Zooplankton

#### 2.2.3.1 Purpose

Zooplankton samples were used to describe fish habitats in terms of presence, abundance, and distribution of potential planktivorous prey for fish in survey areas A through F. Zooplankton are often herbivores and consume phytoplankton, but are in turn prey to larger species including planktivorous fish (Schweigert et al. 2007). As such, zooplankton provide an energetic link between primary producers and higher trophic level fish (Pomeroy 1974; Sheldon et al. 1977; Pauly and Christensen 1995, Schweigert et al. 2007).

#### 2.2.3.2 Sample Design

Zooplankton were collected during eight nighttime fish surveys from May to July 2015 and three daytime surveys in August, September, and December 2015. During the nighttime surveys, samples were collected concurrently with the CTD profiles from a total of 19 sample sites (five in survey area A, four in survey area B, one in survey area C, four in survey area D, three in survey area E, and two in survey area F; Figure 3). Daytime zooplankton samples were collected concurrently with the CTD profiles at nine sample sites (two in survey area A, two in survey area B [not sampled in December due to safety concerns and interactions in the field with non-project groups], one in survey area C, two in survey area D, and two in survey area F; Figure 3). A total of 176 zooplankton samples were processed and analyzed from 11 surveys.

## 2.3 SURVEY REGION HABITAT RESULTS AND DISCUSSION

### 2.3.1 Survey Region Literature Review Results

The survey region comprises the waters of Porpoise and Lelu channels; Flora, Agnew, Horsey, and Robertson banks; and, Inverness, Telegraph, and Marcus passages (Figure 1). Beaches of unconsolidated sands and gravels are limited along much of the mainland coast in the study region because of large areas of exposed bedrock, which have changed little since the retreat of glacial ice at the end of the Pleistocene (approximately 11,000 years ago) (Holland 1976). The geomorphology of the mainland coast and islands in the survey region is typical of the remnants of glacial scouring, which include troughs, banks, numerous rocky indented shorelines, inlets, passes, sounds, and narrows; as components of the larger Hecate Depression of the Coastal Trough physiographic region in British Columbia (Pickard and Giovando 1960; Holland 1976; Crawford et al. 2007).

The salinity, turbidity and non-tidal currents in the survey region are strongly influenced by freshwater input from the Skeena River (Holland 1976; Conway et al. 1996; Crawford et al. 2007). The Skeena River drains an area of approximately 52,000 $km^2$ and flows into Chatham Sound approximately 11 km southeast of Lelu Island. Discharge from the river primarily flows through three shallow passages. Approximately 25% of the discharge flows northwest through Inverness

Passage, to the east of Smith Island, towards Lelu Island; approximately 37.5% flows southward through Telegraph Passage, to the east of Kennedy Island; and approximately 37.5% flows northwest through Marcus Passage between Smith and Kennedy islands (Conway et al. 1996).

Large quantities of suspended sediment originate from the Skeena River during snowmelt-driven discharge in May and June (spring freshet) and, to a lesser extent, during higher fall rainfall from October to December (Birch et al. 1985; Stucchi and Orr 1993; Conway et al. 1996; DeGroot 2005; Stantec 2015). The transport of suspended sediment across the survey region follows the complex bathymetric contours extending from the Skeena River estuary (Conway et al. 1996).

The salinity profiles of many British Columbia inlets with large rivers commonly show a low salinity surface layer overlying higher salinity bottom waters (Pickard and Giovando 1960). The study region within the outer Skeena estuary experiences strong tidal mixing (Conway et al. 1996). As a result of local tide heights and tidal currents, and a limited salt water / freshwater interface (wedge), the Skeena River transports sediments to areas around Kennedy, Smith, and De Horsey islands, which help to maintain the Robertson and De Horsey banks and a sand bar in Marcus Passage known as Base Sand (Conway et al. 1996). Elsewhere in the survey region, soft-sediment deposits have formed pocket bays in sheltered sites with lower wind and wave exposure (e.g., around Lelu Island and neighbouring islands) and banks and shoals in shallower waters (Conway et al. 1996; McLaren 2016).

Currents along the north coast of British Columbia are comprised of both semi-diurnal tidal currents (two high and two low tides per day) and non-tidal currents (e.g., wind-driven and runoff/buoyancy driven currents) (Crawford et al. 2007). Coastal geomorphology and bathymetry strongly affect the movement of coastal currents throughout the survey region. Tidal currents in the survey region promote strong tidal mixing, but result in limited net movement due to ebb and flood tidal cycles within the region (Crawford et al. 2007). Tidal currents are stronger near the mouth of the Skeena River (up to 2 m/s [4 knots] in Telegraph and Marcus passages) than they are around Lelu Island due to weakening with increasing distance from the river mouth (Conway et al. 1996). Non-tidal currents flow northwest or south along central British Columbia's continental shelf associated with seasonal wind patterns and freshwater runoff. In the winter, currents extending from the Davidson Current flow northwest through Hecate Strait and the survey region. During the summer, the weakening of the Aleutian Low causes shelf currents to weaken and often reverse to a southerly flow (Crawford et al. 2007).

### 2.3.2 Survey Areas

Nine survey areas were used to characterize the habitats within the survey region. Seven biophysical attributes were observed across the survey region and used as a basis for qualitative descriptions of the nine survey areas (i.e., areas A to I), as follows:

- **Intertidal soft-sediment habitats with eelgrass:** Flora Bank (survey area F, Section 0 and survey area A, Section 2.3.2.1) and the channel between Lelu Island and Flora Bank (survey area C, Section 2.3.2.3)
- **Intertidal soft-sediment banks:** Flora Bank (survey area F, Section 2.3.2.6), De Horsey Bank and Base Sand (survey area G, Section 2.3.2.7)
- **Intertidal sand and gravel habitats:** Porpoise Channel (survey area B, Section 2.3.2.2) and Inverness and Eleanor passages (survey area H, Section 2.3.2.8)
- **Shallow subtidal soft-sediment banks**: Agnew Bank (survey area A, Section 2.3.2.1) and Horsey Bank (survey area D, Section 2.3.2.4)
- **Deeper subtidal soft-sediment habitats:** off of Agnew Bank (survey area A, Section 2.3.2.1 and survey area E, Section 0) and deeper waters of Marcus Passage (survey area G, Section 2.3.2.7)
- **Channels influenced by tidal currents and moderate freshwater outflow:** Porpoise Channel (survey area B, Section 2.3.2.2) and the channel between Lelu Island and Flora Bank (survey area C, Section 2.3.2.3)
- **Channels strongly influenced by freshwater outflow and tidal currents:** Inverness Passage (survey area H, Section 0) and Telegraph Passage (survey area I, Section 2.3.2.9)

#### 2.3.2.1 Survey Area A

Survey area A comprises Agnew Bank, including the areas of the bank that interface with the intertidal edges of Flora Bank, the outflow of Porpoise Channel that is southwest of Ridley and Lelu islands, and the intertidal and subtidal areas southwest of Ridley Island (Figure 2). Agnew Bank is a gently-sloping soft-sediment shoal that tapers into the shallow subtidal (to about -10 m chart datum [CD]), in a westerly direction, from the western edge of Flora Bank. The centre of the bank is located approximately 1.7 km northwest of Kitson Island. Agnew Bank is adjacent to deeper waters in the northeast connected to Porpoise Channel (to about -30 m CD) beyond Ridley and Lelu islands. Agnew Bank is connected to a steep slope leading to a deeper subtidal plain (at about -50 m CD) in the southwest (Canadian Hydrographic Service [CHS] 2009, Chart 3947). Acoustic Doppler current profiler (ADCP) measurements over the bank in February 2015 show tidal current velocities were low (< 0.5 m/s) but increased to just over 0.5 m/s in the surface and mid layers of Porpoise Channel during the ebbing tide (Stantec 2015). Surface currents greater than 0.5 m/s, were also recorded during flooding tides at the edge of the subtidal slope to the southwest of Agnew Bank (Hatch 2015, Stantec 2015).

Agnew Bank is predominantly composed of fine sand substrate, with increased proportions of coarse and medium silts with increasing depth (Stantec 2014a; McLaren 2016). Subtidal remotely operated vehicle (ROV) surveys in 2013 showed sparse patches of eelgrass that were limited to the intertidal interface of Flora Bank and Agnew Bank and did not extend onto Agnew Bank (Stantec 2014a). Patches of brown algae (*Laminaria* spp. and *Alaria* spp.) were observed adjacent to rock reefs northwest of Flora Bank. Habitats adjacent to Agnew Bank, near Porpoise Channel, with hard substrates (bedrock, boulder and cobble) were found to support a higher diversity and density of algae than soft substrate areas (Stantec 2014a).

Depth integrated median monthly values of ocean temperature in survey area A, which were recorded from December 2014 to February 2016 (excluding October), showed a seasonal increase from approximately 8°C in fall/winter to 11.5°C in late-summer and fall (Figure 7).

Chl-*a* concentrations mirrored the seasonal trend of temperature, rising from median monthly values of ≤ 1.5 µg/l in December 2014 to 3.5 µg/l in June (Figure 7). Chl-*a* concentrations were higher during the July nighttime survey than during the daytime survey.

Turbidity in survey area A was ≤ 2.5 NTU from December to April. Turbidity peaked in the May daytime survey (approximately 6.0 NTU), likely as a result of spring freshet of the Skeena River. However, the turbidity recorded during the nighttime survey during the same month was lower. Following the peak in May, turbidity levels gradually decreased (i.e., between approximately 4 and 2 NTU) from mid-June into September and November through February (Figure 7).

Median monthly values of salinity in survey area A ranged between 26 and 30 Practical Salinity Units (PSU) year-round. As is typical in other marine and outer estuarine environments, salinity levels in survey area A were lowest in the spring (particularly May) when snowmelt and rain increase freshwater flow from the Skeena River (Figure 7).

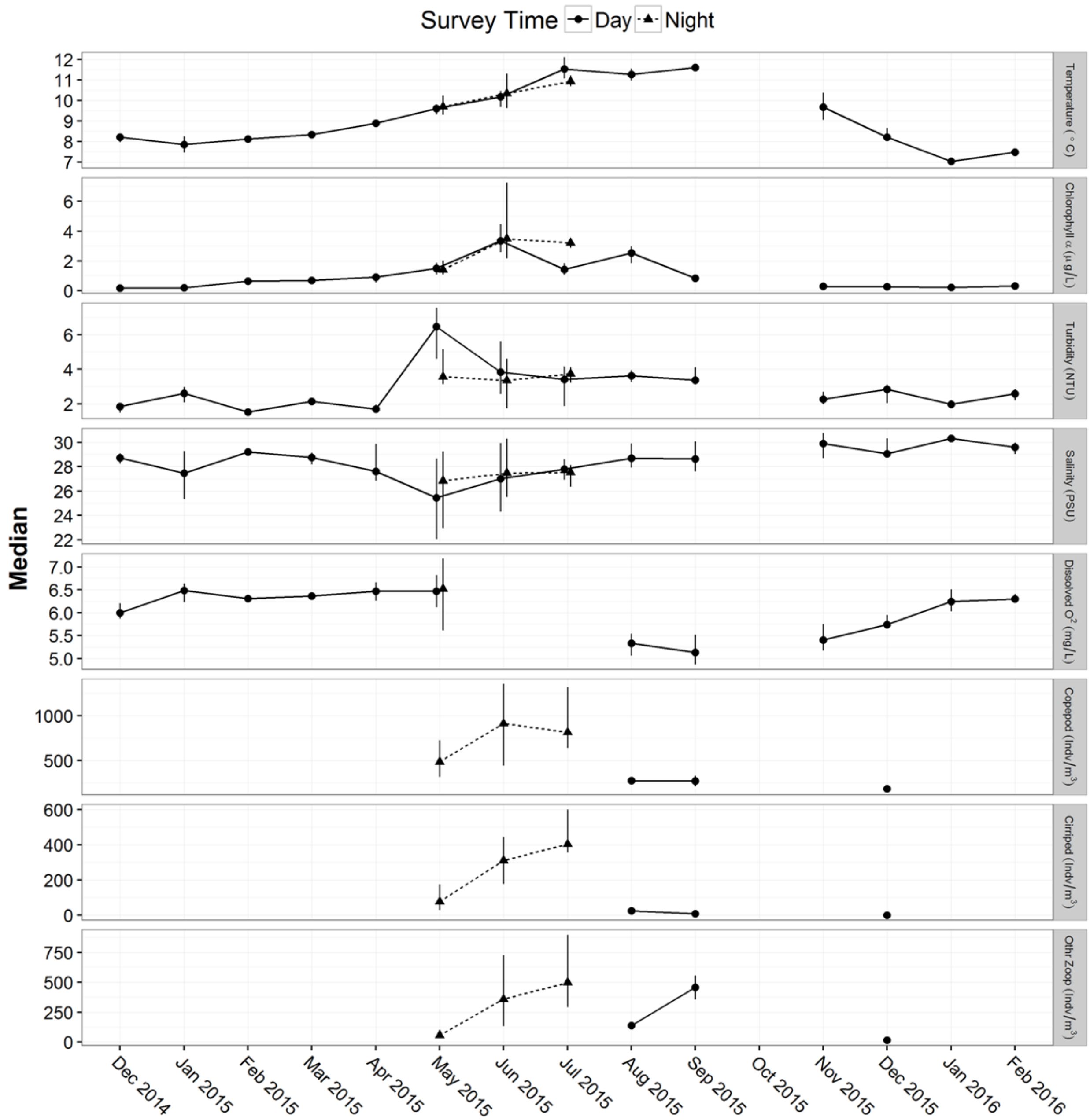
Dissolved oxygen concentrations in survey area A ranged from 6.0 to 6.5 mg/L during December 2014 to May 2015, were below 5.75 mg/L in August, September and November 2015, and then increased through to[1] February 2016, at which time levels were similar again to those in the same months in 2015.

Zooplankton samples combined across all areas were dominated by copepods and cirripeds. Overall, median copepod relative abundance was 56.2%, while median cirriped relative abundance was 15.9% (Appendix B, Table B.1). These two taxa were numerically dominant in each survey area, and as a result, we present more detailed information in all areas for these two taxa and show information of all other taxa combined (Table B.1).

In survey area A, copepod density ranged from 500 to 1,000 individuals/m$^3$ during nighttime surveys conducted May to July. Densities in August, September and December daytime surveys were notably lower that observed at night earlier in the summer (≤250 individuals/m$^3$). Cirriped abundance was lower than copepod abundance. Cirriped density was high in nighttime surveys during May, June, and July (approximately 100 to 400 individuals/m$^3$) relative to the densities found in daytime surveys in August, September and December (< 100 individuals/m$^3$). The

[1] The quality control analysis of the *in situ* field data for dissolved oxygen recorded in June and July suggests there was likely a calibration error. As such, the June and July dissolved oxygen measurements were omitted from the dataset.

density of all other zooplankton in survey area A (i.e., combined total minus copepods and cirripeds) appeared to increase from May to July during nighttime surveys; daytime surveys showed highest densities in September relative to lows in August and December (Figure 7).




NOTES: Dissolved oxygen sensor malfunctioned June and July 2015; values not displayed. Interquartile range shown as vertical bars.

**Figure 7 Survey Area A: Water Property Characteristics**

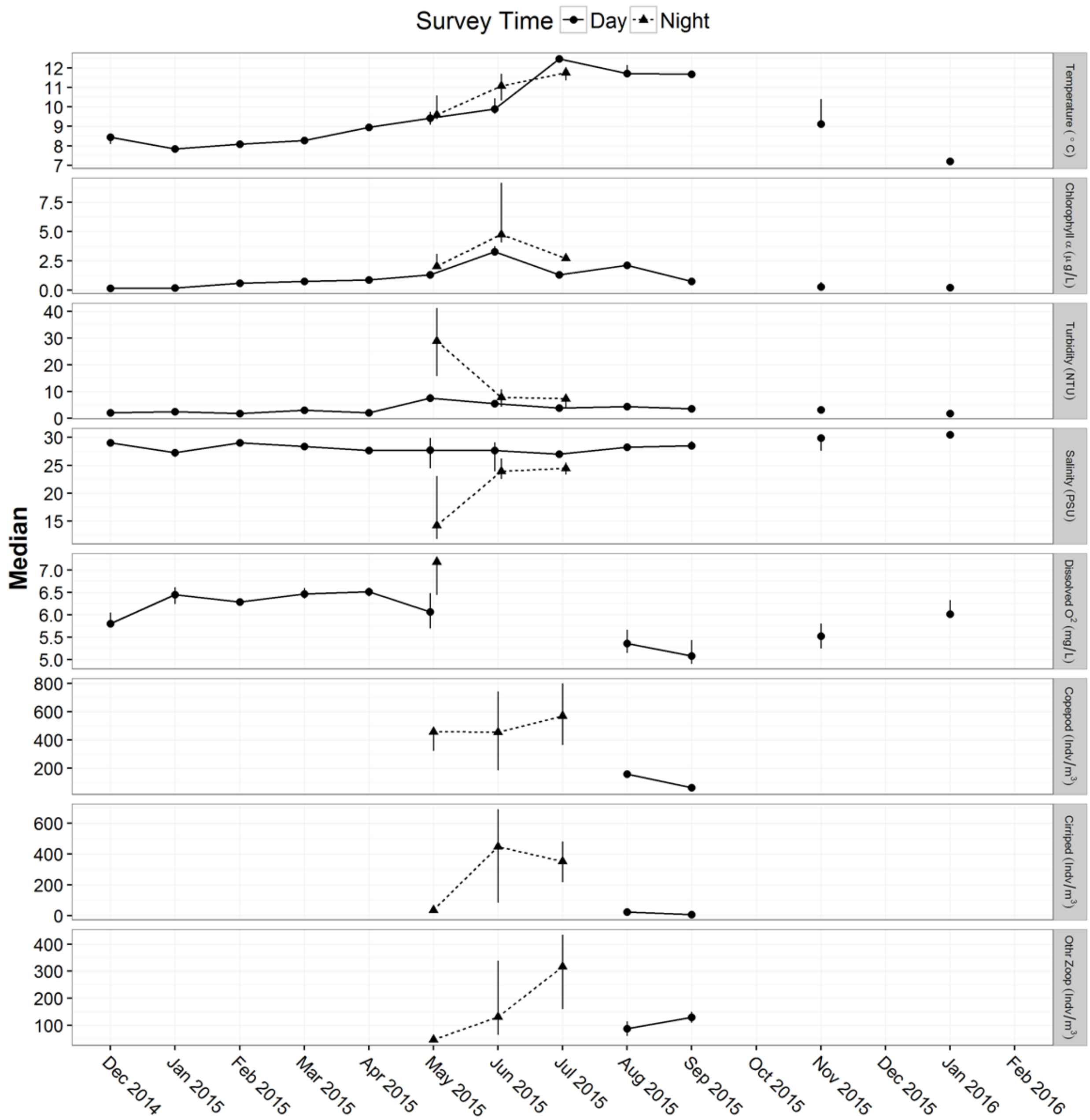
#### 2.3.2.2 Survey Area B

Survey area B comprises Porpoise Channel (between Ridley and Lelu islands) and the northwestern portion of the Lelu Slough (between Lelu Island and the mainland) (Figure 2). Porpoise Channel reaches depths of between -20 and -25 m CD across the channel, whereas the slough is shallow and intertidal (CHS 2009, Chart 3947). Hydrodynamic model predictions suggest flood currents can reach a maximum depth-averaged current velocity of 0.8 m/s in Porpoise Channel (Hatch 2015).

The substrate of Porpoise Channel comprises a mix of cobble and soft sediments in the center of the channel and bedrock, boulders, and cobble along the shallow subtidal and intertidal channel margins (Stantec 2014a). Subtidal and intertidal hard substrates in Porpoise Channel support a greater diversity and density of algae, compared with that recorded in local soft-sediment habitats (Stantec 2014a). Algae attached to hard substrate included kelp (predominantly *Laminaria spp.* and *Alaria* spp.), rockweed (*Fucus* spp.), green algae (*Ulva* spp.) and various species of red algae (predominantly *Mazzaella* and *Odenthalia* spp.) (Stantec 2016a). The intertidal substrate of Lelu Slough is predominately fine mud, with a sparse distribution of cobbles and gravel in the upper to mid intertidal. Field crews identified rockweed attached to cobbles in the upper intertidal and a band of *Ulva* spp. along the mid intertidal (Stantec 2014a, Stantec 2016a). Salt marsh species (predominantly sedge, i.e., *Carex* spp.) were found along the eastern intertidal areas). Subtidal and intertidal hard substrates in Porpoise Channel support a greater diversity and density of algae, compared with that recorded in local soft-sediment habitats (Stantec 2014a). Algae attached to hard substrate included kelp (predominantly *Laminaria spp.* and *Alaria* spp.), rockweed (*Fucus* spp.), green algae (*Ulva* spp.) and various species of red algae (predominantly *Mazzaella* and *Odenthalia* spp.) (Stantec 2016a). The intertidal substrate of Lelu Slough is predominately fine mud, with a sparse distribution of cobbles and gravel in the upper to mid intertidal. Field crews identified rockweed attached to cobbles in the upper intertidal and a band of *Ulva* spp. along the mid intertidal (Stantec 2014a, Stantec 2016a). Salt marsh species (predominantly sedge, i.e., *Carex* spp.) were found along the eastern shore of Lelu Island.

Ocean temperature in survey area B increased gradually from about 7.5°C to 10°C in winter to about 11.5°C and 12°C in late summer and fall (i.e., July, August and September). Temperature was lower in November and declined through January 2016 to about 7°C.

Concentrations of chl-*a* were ≤ 1.5 µg/l in winter and increased to 3.5 µg/L in June (Figure 8). After the peak in June, concentrations declined until September and remained low in November through January.




NOTES: Dissolved oxygen sensor malfunctioned June and July 2015; values not displayed. Interquartile range shown as vertical bars.

**Figure 8 Survey Area B: Water Property Characteristics**

Turbidity in survey area B was ≤ 3 NTU throughout the winter and early spring (from December to April). Peak observed turbidity measurements occurred during the nighttime survey in May (approximately 25 NTU), coinciding with the start of the Skeena River freshet; however, level during the daytime survey in May was lower (less than 10 NTU). Turbidity measured during daytime gradually decreased from mid-June into September and remained low from November through January (between 2 and 4 NTU; Figure 8).

Salinity in survey area B varied between 27 and 30 PSU, with the observed peak occurring in mid-November (about 30 PSU) during the daytime survey. The lowest salinity levels recorded were observed at night in May (about 27 PSU; Figure 8); however, levels measured during the day during the other months were consistent with the daytime trend (i.e., just below 30 PSU).

Dissolved oxygen concentrations in survey area B were between 5.75 and 6.5 mg/L from December to May 2015, and lower in August, September and December 2015 (≤ 5.5 mg/L) (Figure 8). DO recorded during the nighttime survey in May was higher than that recorded during the day (approximately 7 versus 6 mg/L).

Copepods densities were between 400 and 600 individuals/$m^3$ in May, June, and July nighttime surveys. Densities were lower (<200 individuals/$m^3$) for daytime surveys in August and September, which may have indicated a seasonal trend (high densities in early summer and lower densities in late summer), although any seasonal trends were confounded by timing of sampling and require further investigation. During nighttime surveys, cirriped density was higher in June and July (>400 individuals/$m^3$) than May (<50 individuals/$m^3$) and during daytime surveys in August and September numbers were low. Other zooplankton species appeared to increase in abundance from May to July during nighttime surveys, and to be lower during daytime surveys in August and September (Figure 8).

#### 2.3.2.3 Survey Area C

Survey area C encompasses the narrow north-south oriented subtidal channel and intertidal margins between Lelu Island and Flora Bank (CHS 2009, Chart 3947; Figure 2). When exposed, a small intertidal portion of Flora Bank periodically closes this channel at its westernmost edge, joining the bank with rocky outcrops off the westernmost tip of Lelu Island. Tidal currents in the channel are typically weak (<0.5 m/s); however, stronger tidal currents occur in Porpoise Channel to the northwest of the channel and out of Inverness Passage to the southeast (Hatch 2015; Stantec 2015).

Fine and medium sands support beds of eelgrass of varying density on both sides of the channel (McLaren 2016; Stantec 2014a, Stantec 2016a). Along the south and southwest shoreline of Lelu Island, intertidal and shallow subtidal rock reefs provide substrate for rockweed mats, red algae communities, and limited areas of kelp (*Laminaria* and *Alaria* spp.) at the northern end of the channel and its connection to Porpoise Channel (Stantec 2014a). Two pocket bays, along the southwest shoreline of Lelu Island, grade from cobbles and gravel inshore to silty sand in the lower intertidal. Sparsely distributed low density areas of salt marsh were recorded along the upper intertidal at several locations along the southwest shoreline of Lelu Island (Stantec 2014a).

Ocean temperature observed in survey area C rose steadily from about 7.1°C in winter to an observed peak of 12.2 °C in summer (July), then declined through January.

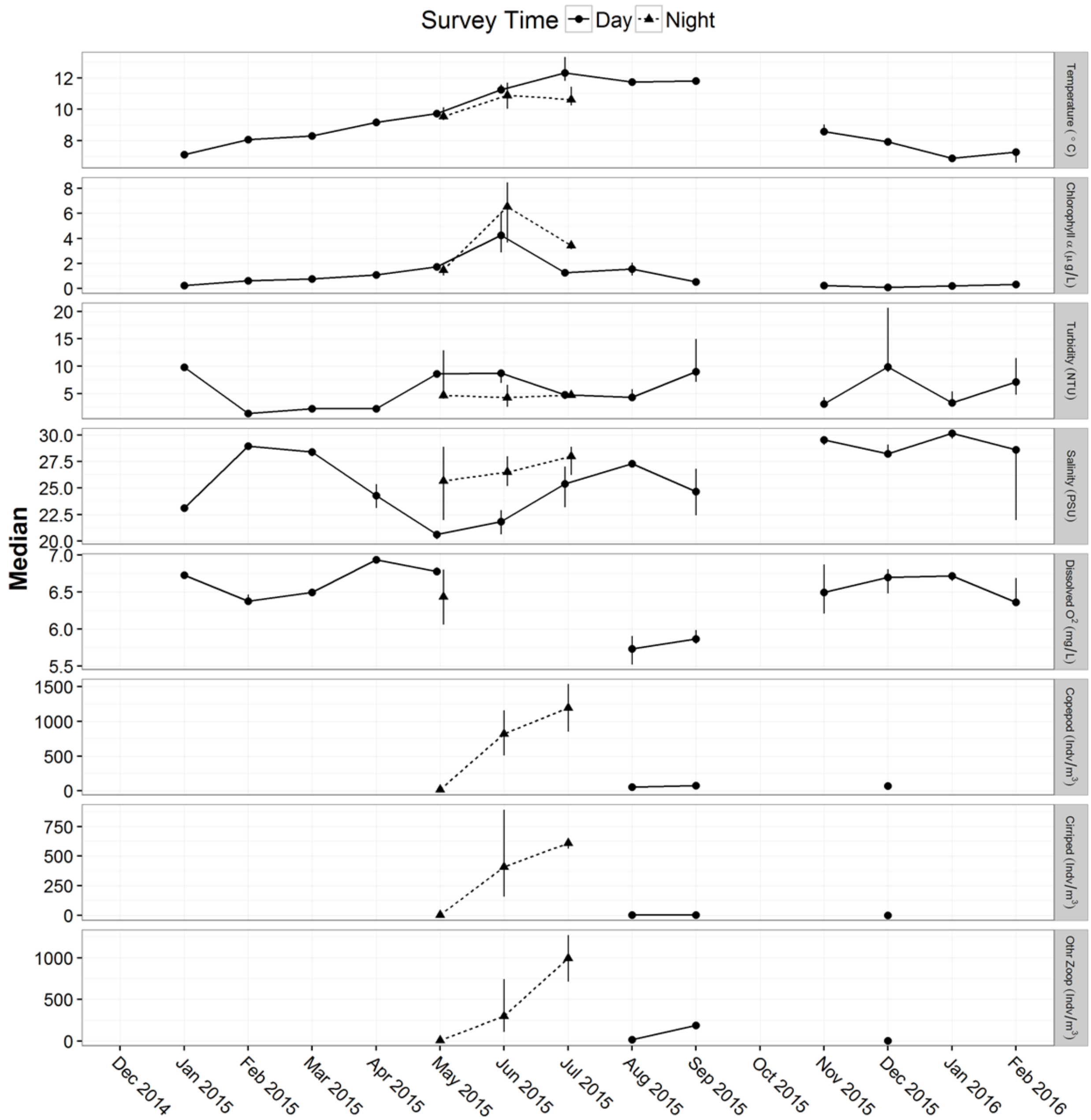
Chl-*a* concentrations were ≤ 1.0 µg/L in winter and increased gradually throughout the spring, peaking in mid-June (> 4.0 µg/L) during a nighttime survey (Figure 9). Data collected during daytime surveys also peaked in June, but at a lower median concentration. Chl-*a* concentrations were also higher from the nighttime sample than the daytime sample in July.

Turbidity in survey area C showed considerable month-to-month variation during the January 2014 to February 2016 surveys (approximate range of 1 to 10 NTU), with no clear seasonal pattern. The highest median turbidity value occurred in January and December 2015 (about 10.0 NTU) and the lowest median values were observed between February and April 2015 (Figure 9). Turbidity measured during the May and June nighttime surveys was slightly lower than that measured during the May and June daytime surveys but were similar in July.

Salinity observed in survey area C varied between about 20 and 30 PSU from December 2014 through February 2016. Median values were highest during most of the winter months (February and March 21015 and November 2015 to February 2016), but were relatively low in January 2015. Another seasonal high in median salinity appeared to occur in late summer. The lowest median values were observed in May (about 20 PSU) (Figure 9). The salinity data from nighttime surveys were consistently higher than during the daytime surveys during May, June, and July, but corroborated the pattern of relatively high salinity in late summer observed in the daytime data.

Dissolved oxygen concentrations in survey area C ranged between approximately 5.75 to 7.0 mg/L from January to May, with slightly lower values recorded in August and September (<6.0 mg/L) (Figure 9). Dissolved oxygen values reported from November through February were similar to the previous winter/early spring values (i.e., January through May 2015).

Copepod, cirriped, and other zooplankton densities showed similar abundance trends to other survey areas, with increasing numbers throughout the summer and a peak in July (up to approximately 1,500 individuals/$m^3$ for copepods; Figure 9). Zooplankton densities from daytime sampling in August, September, and December were relatively low in this survey area.




NOTES: Dissolved oxygen sensor malfunctioned June and July 2015; values not displayed. Interquartile range shown as vertical bars.

**Figure 9 Survey Area C: Water Property Characteristics**

#### 2.3.2.4 Survey Area D

Survey area D includes Horsey Bank, the entrance to Inverness Passage near Stapledon Island, and part of the intertidal soft-sediment bay on the northwestern end of Smith Island (Figure 2). Horsey Bank is a shallow subtidal bank that extends from the southern tip of Lelu Island and the eastern edge of Flora Bank to depths of between -11 m and -21.9 m CD west of Smith Island (CHS 2009, Chart 3947). A channel to the east of Horsey Bank carries the outflow from Inverness Passage and reaches a maximum depth of -26.5 m CD. Currents in survey area D are primarily tidal but are also influenced by discharge from the Skeena River. At the outflow of Inverness Passage, current speeds of 1.5 to 2 m/s (3 to 4 knots[2]) reach Horsey Bank (CHS 2009, Chart 3947; Hatch 2015).

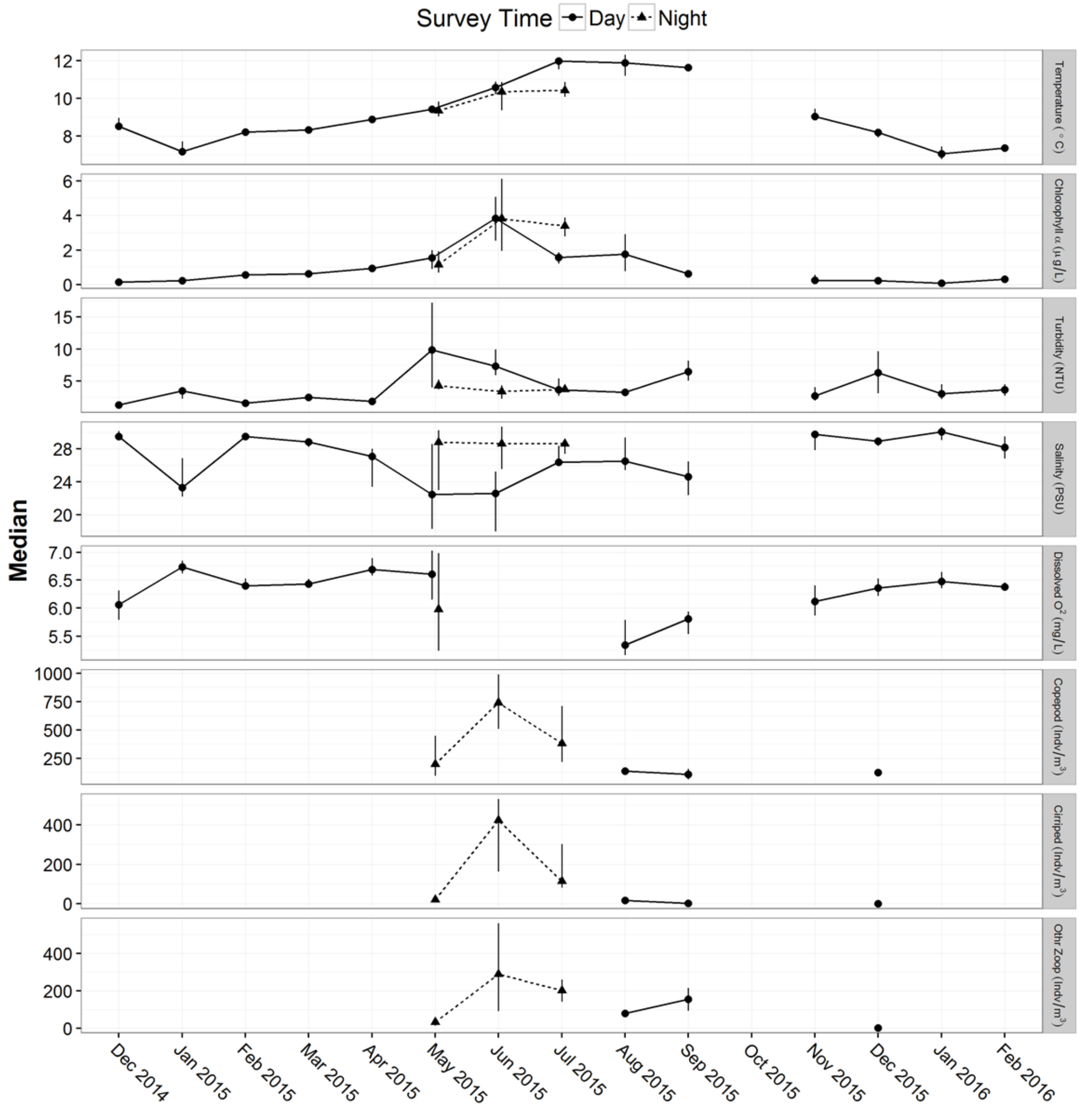
The predominant substrate of Horsey Bank and the area immediately southwest of the entrance to Inverness Passage is medium sand; however, patches of medium sand with shell and medium sand with boulders are also present (McLaren 2016; Stantec 2014b). In the channel between Horsey Bank and Smith Island, the substrate was found to grade from fine sand in the west to coarse silt in the intertidal at the northwest of Smith Island. Substrates near the outflow of Inverness Passage and intertidal areas around the southeast tip of Lelu Island were rocky with areas of medium sand, whereas fine sands and coarse silt were present around the southeast tip of Stapledon Island (McLaren 2016; Stantec 2014a, 2014b). Spaghetti kelp (*Chorda filum*) and unattached (drifting) green algae (*Ulva* spp.) were recorded in shallow subtidal areas of medium to fine sand and shell at Horsey Bank (Stantec 2014b).

Median ocean temperatures in survey area D increased steadily from January (about 7.2 °C) to mid-July (12 °C), then declined slightly until September and declined further from November through January.

Similarly, median concentrations of chl-*a* increased gradually from December to May, with the observed peak in mid-June (approximately 3.8 µg/L), followed by a decline in late summer and fall to a minimum level in winter (Figure 10).

Median turbidity in survey area D ranged from about 1 to 10 NTU from December 2014 through February 2016. Median levels were observed to peak in May during the daytime survey (about 10 NTU), with lesser peaks noted in September and December during the daytime surveys. Observed turbidity was lowest between December and April. Turbidity data from nighttime surveys was lower than from daytime surveys in May and June.

[2] Knot is a rate of speed equal to one nautical mile per hour and is equivalent to 1.852 km per hour.




NOTES: Dissolved oxygen sensor malfunctioned June and July 2015; values not displayed. Interquartile range shown as vertical bars.

**Figure 10 Survey Area D: Water Property Characteristics**

Median values of salinity in survey area D varied considerably from month to month, and was highest during the winter months (except January 2015, 23 PSU). Salinity recorded during the nighttime surveys in May, June, and July was relatively high compared with the data recorded during the daytime surveys. The lowest salinity levels were recorded during the daytime surveys in May and June (< 23 PSU) (Figure 10).

Dissolved oxygen concentrations in survey area D ranged from about 6.0 to 6.75 mg/L from December to May and November through February, with the lowest levels recorded in August and September (< 6.0 mg/L) (Figure 10).

Median densities of copepod, cirriped, and other zooplankton were highest during nighttime sampling in June (about 750, 400, and 300 individuals/$m^3$, respectively). Numbers were lower in August, September, and December during daytime sampling (Figure 10). Copepod density was higher than cirriped density (approximately 750 versus 400 individuals in June), but both followed a similar monthly trend.

### 2.3.2.5 Survey Area E

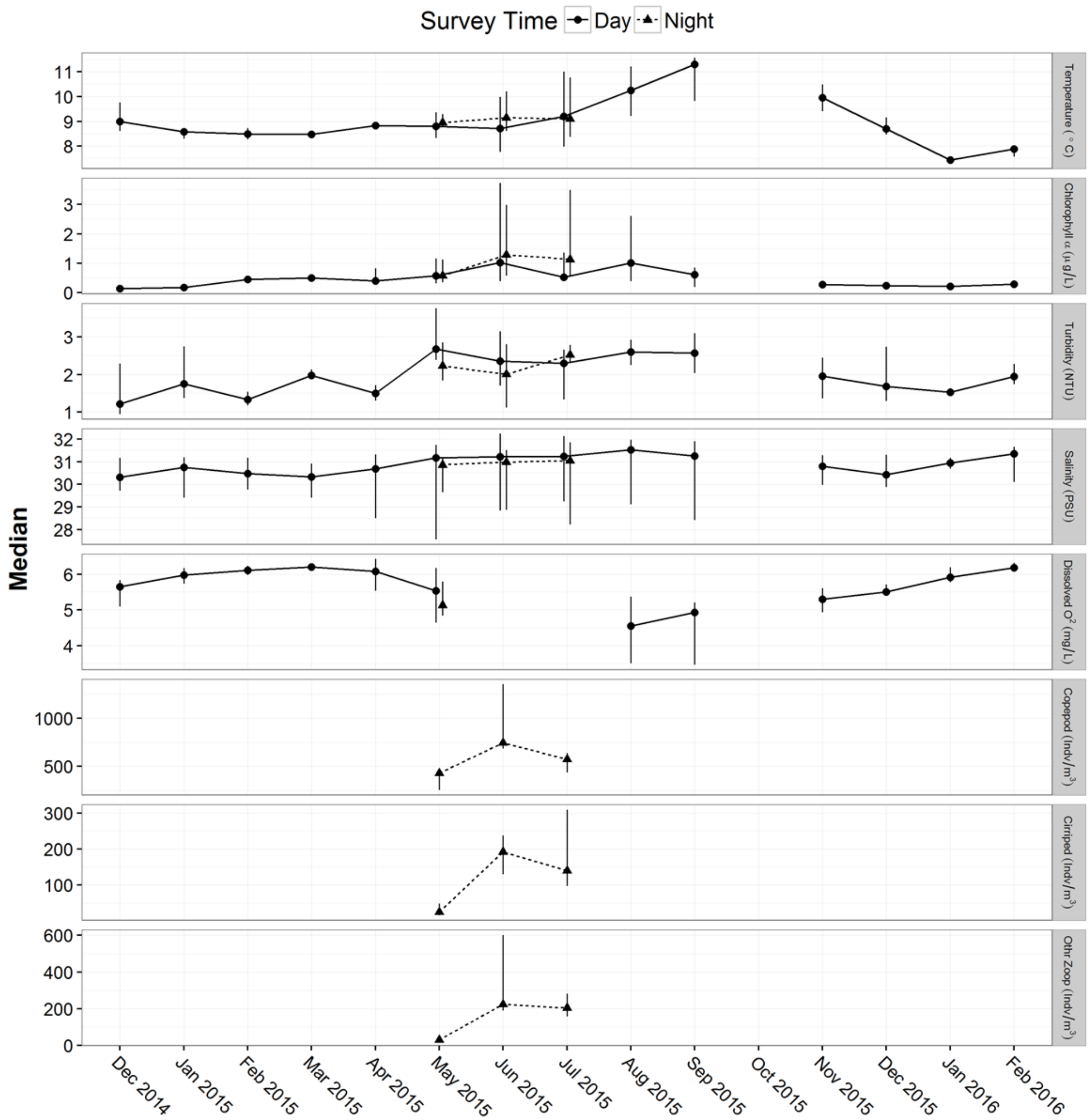
Survey area E includes the proposed deep berthing/terminal area southwest of Agnew Bank to the west of Kitson Island and Horsey Bank (Figure 2). Here, the sea bed features a steep slope, from the shallow subtidal edges of Agnew and Horsey banks (at about -5 m CD) to a deeper plain (at about -50 m CD) southwest and west of the banks (CHS 2009, Chart 3947). Currents in survey area E are influenced by tidal forcing out of Porpoise Channel (Hatch 2015). Surface currents at the site of the proposed terminal berth were approximately 0.5 m/s during flooding tide in February 2015, but decreased to approximately 0.25 m/s at 2 m below the water surface (Stantec 2015).

The predominant substrate along the slope and plain to the west of Agnew and Horsey banks is coarse to medium silt (Stantec 2014b; McLaren 2016). Sediments in this area became increasingly fine with depth beyond the edges of Agnew Bank to the east and Horsey Bank to the southeast (McLaren 2016). Most algae encountered during a shallow subtidal ROV survey conducted west of Agnew Bank, were drifting and not attached to substrate (Stantec 2014b).

Median temperatures showed typical seasonal variation, with lower temperatures during winter months and higher temperatures in the summer and fall. Median temperature was observed to peak in mid-September at about 11.0°C (Figure 11).

Median monthly values of chl-*a* remained at or below 1 μg/L from December 2014 through February 2016, with a modest increase in median concentrations in June and August (Figure 11).

Median turbidity appeared to be relatively low in winter (i.e., December to April and October to February), and higher in summer (i.e., May to September) (Figure 11). However, median turbidity showed relatively small changes from month-to month within both seasonal time periods.




NOTES: Dissolved oxygen sensor malfunctioned June and July 2015; values not displayed. Interquartile range shown as vertical bars.

**Figure 11 Survey Area E: Water Property Characteristics**

Median salinity in survey area E was relatively consistent and salty throughout the year in comparison to other survey areas that showed larger month-to-month changes; median values in survey area E ranged from about 30 to 31 PSU from December 2014 through February 2016.

Dissolved oxygen appeared to remain relatively high and steady from December to April (at about 6 mg/L) but declined to < 5.0 mg/L in August to September, before returning to an apparent high winter norm from November through February (Figure 11).

Median densities of copepod, cirriped, and other zooplankton were highest in the nighttime June survey, reaching about 750, 200, and 250 individuals/$m^3$, respectively (Figure 11). Copepod abundance was higher than cirriped abundance in survey area E across all three surveys completed, although both species followed the same overall month to month pattern. No daytime zooplankton sampling was conducted in survey area E.

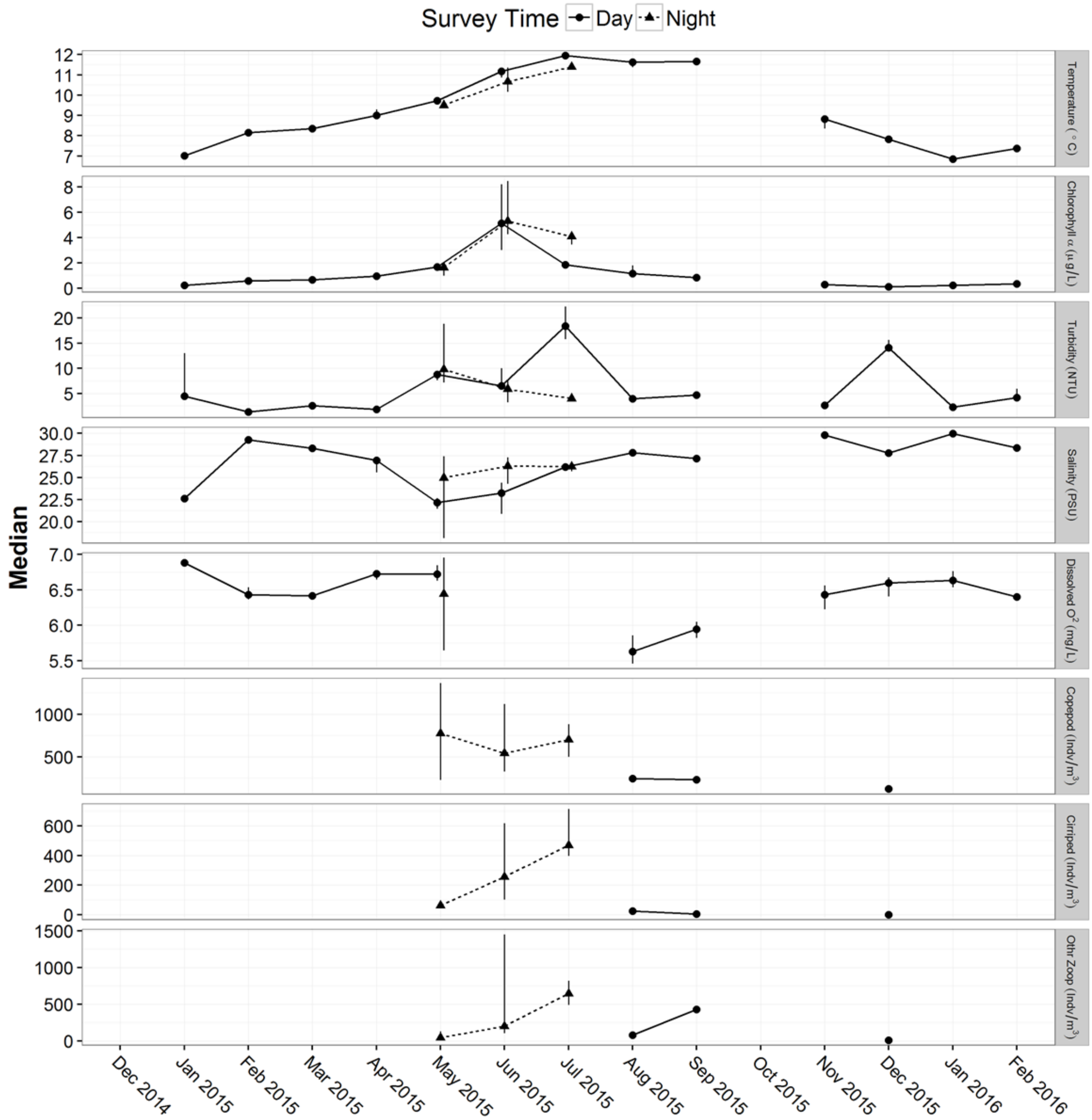
### 2.3.2.6 Survey Area F

Survey area F encompasses Flora Bank, which is an intertidal sand bar extending from the western tip of Lelu Island, approximately 2.75 km southwest, to Kitson Island (Figure 2). Water depths across the soft-sediment areas of the bank extend to approximately -3.8 m CD (CHS 2009, Chart 3947, Hatch 2015). Several rocky reefs are present north of Kitson Island and near Lelu Island, the largest being Kitson Islet. An ADCP survey in February 2015 recorded maximum current speeds over much of Flora Bank (0.25 to 0.5 m/s during a flooding tide) (Stantec 2015). Tidal currents were found to concentrate in dendritic channels that occur across the surface of Flora Bank (Stantec 2016b).

The predominant substrate of Flora Bank is medium sand with smaller areas of fine sand (McLaren 2016; Stantec 2014a, Stantec 2016b). Extensive discontinuous patches of eelgrass (*Zostera marina*) cover the central area of Flora Bank, and there is evidence of inter-annual variability in eelgrass distribution and extent linked to sedimentary processes (Faggetter 2009; Higgins and Schouwenburg 1973; Stantec 2014a, Stantec 2016b). The extent of eelgrass on Flora Bank is limited to shallower intertidal depths that allow sufficient light penetration for growth; high turbidity experienced in the area is assumed to exacerbate this depth limitation (Faggetter 2009, Stantec 2014a, Stantec 2015, Stantec 2016b).

Median ocean temperatures observed in survey area F showed a steady increase from January to July, no apparent change from July to September (11.5°C), and a gradual return to the 7°C winter lower through to January 2016.

Median concentrations of chl-*a* varied little from January to May, although there appeared to be a marginal increase over that time. However, surveys conducted in both day and night showed an apparent spike in concentrations in June (about 5.1 µg/L), followed by a return to low concentrations by late-summer (<2 µg/L) and fall (about 0.1 µg/L; Figure 12), and remaining low in November through February. The nighttime ch-*a* data from July were higher than the daytime data from the same month, but showed agreement during the other surveys.




NOTES: Dissolved oxygen sensor malfunctioned June and July 2015; values not displayed. Interquartile range shown as vertical bars.

**Figure 12 Survey Area F: Water Property Characteristics**

Median turbidity values were highly variable from January 2014 through February 2016 (range of about 1 to 15 NTU), with the highest observed median values recorded in July during the daytime survey, and the lowest in February 2015 (Figure 12). The turbidity measured during the July daytime peak was higher than that measured during the nighttime survey, perhaps due to differences in tidal state, currents and influx of suspended sediments from the Skeena River.

Salinity values observed in survey area F were variable (approximate range = 22 – 30 PSU), with the lowest median concentrations recorded in January and May 2015 (approximately 22 PSU) and the highest in November (approximately 30 PSU; Figure 12). Salinity was higher in winter than summer months, although salinity values during June and July nighttime surveys were slightly higher than measured during the June and July daytime surveys.

Dissolved oxygen values observed in survey area F were steady from January to May (at about 6.5 mg/L) and lowest in August and September (<6.0 mg / L) (Figure 12). Median values were relatively high again the following winter, suggesting a possible seasonality where median concentrations dip in summer when water temperatures are highest.

Densities of copepod, cirriped, and other zooplankton were highly variable in samples collected in May, June and July (night surveys only), and median values were higher for these three groups in July relative to daytime observations in August, September and December (Figure 12).

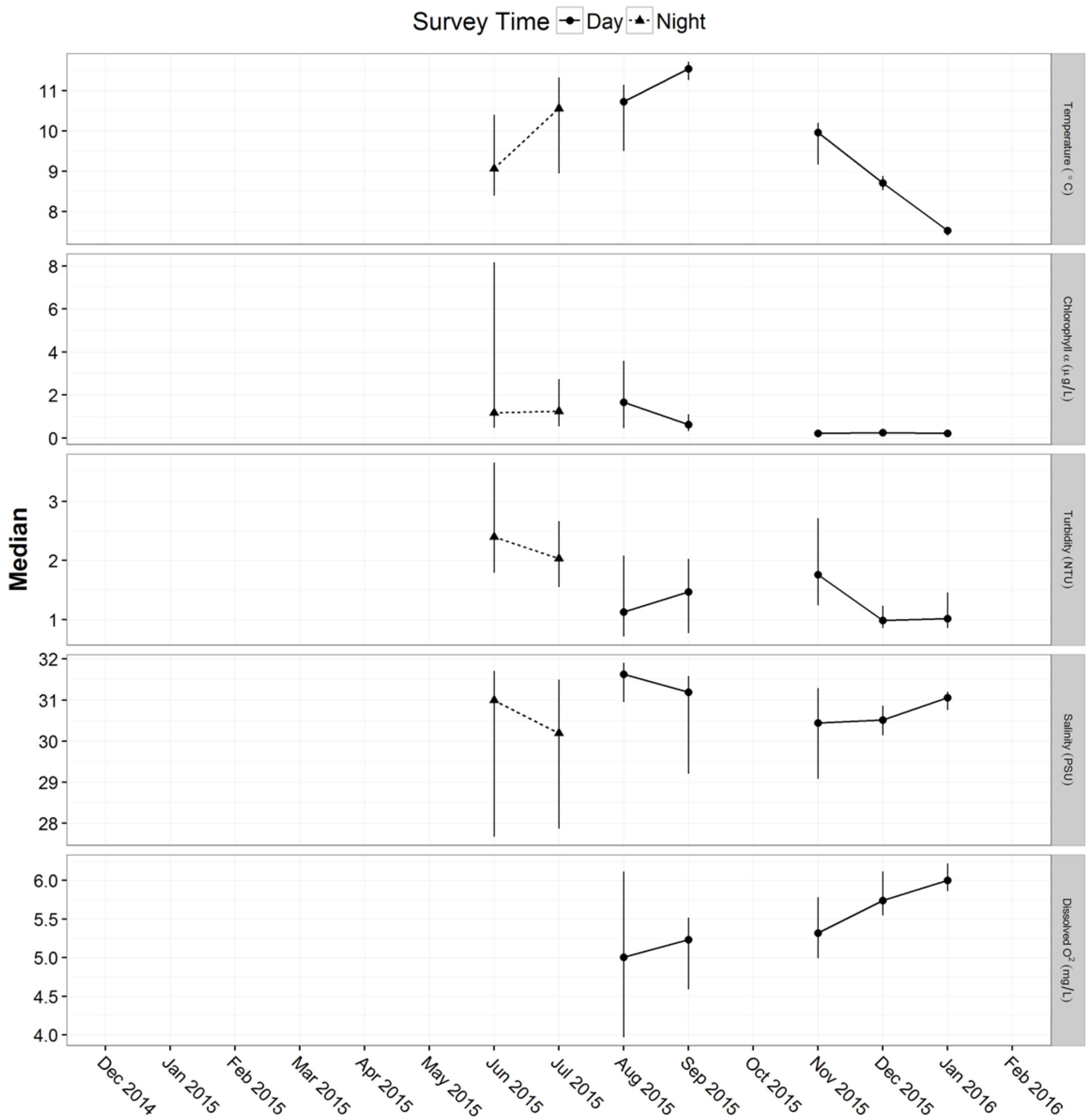
### 2.3.2.7 Survey Area G

Survey area G includes Marcus Passage, the southern shores of Smith and Croasdaile islands, northern shore of Kennedy Island, and intertidal shoals of southern De Horsey Bank and Base Sand (Figure 2). Marcus Passage is one of three main channels that extend from the mouth of the Skeena River. Water depths in Marcus Passage typically range between about 0 and -37 m CD, except up to -88 m CD in the southwest corner of survey area G, at the north end of Arthur Passage (CHS 2009, Chart 3947). Tidal current speeds through Marcus Passage can reach 2 m/s during the ebb, when the tide combines with outflow from the Skeena River (Conway et al. 1996). The predominant substrates in Marcus Passage are sand and mud (Conway et al. 1996). Sampling in survey area G began in June 2015 and continued until January 2016.

Median temperatures observed in survey area G showed typical seasonal variation with, low temperatures during winter months (January only) and higher temperatures in the summer and fall. Median temperature was observed to peak in mid-September at about 11.0°C (Figure 13).

Median monthly values of chl-*a* remained at or below 2 µg/L from June 2015 to February 2016, with a modest increase in median concentrations and variance in July and August (Figure 13).

Median turbidity was relatively low in winter (i.e., November to January), and higher in summer (i.e., June and July) (Figure 13). However, median turbidity values showed relatively small changes from month to month within both seasonal time periods. The range of turbidity observed was higher during June and July than the rest of the year.




NOTES: Dissolved oxygen sensor malfunctioned June and July 2015; values not displayed. Interquartile range shown as vertical bars.

**Figure 13 Survey Area G: Water Property Characteristics**

Median salinity in survey area G was relatively consistent and salty throughout the year in comparison to other survey areas that showed large month to month changes; median values ranged from about 30 to 31.5 PSU from June 2015 through January 2016.

Median dissolved oxygen increased from August and September (~5 mg/L) to January (~6 mg/L), perhaps related to lower water temperatures (Figure 13) and reduced seasonal discharge from the Skeena River.

Zooplankton were not collected in survey area G during the Program.

#### 2.3.2.8 Survey Area H

Survey area H encompasses Inverness Passage and Eleanor Passage, which channel outflow from the Skeena River between the mainland and the northeastern shores of De Horsey and Smith islands (Figure 2). Maximum water depth is about -8.5 m CD in Inverness Passage and -9.8 m in Eleanor Passage (CHS 2009, Chart 3947). The majority of Eleanor Passage is intertidal, except for a narrow shallow subtidal channel located close to the northeast coast of De Horsey Island. Inverness Passage is narrower and shallower than both Marcus and Telegraph passages and is reported to channel 25% of the discharge from the Skeena River (Conway et al. 1996). Tidal current speeds during the ebb are estimated at 1.5 m/s, when the outgoing tide combines with the river outflow (CHS 2009, Chart 3947).

The substrate in survey area H varies from hard ground with areas of medium to fine sand in Inverness Channel (McLaren 2016) to sand and gravel in Eleanor Passage (Conway et al. 1996).

No systematic water property collections were carried out in area H, but see Appendix E, Table E.2.1 for exploratory water property results.

#### 2.3.2.9 Survey Area I

Survey area I includes the mouth of the Skeena River, the northeast end of Telegraph Passage, and Robertson Bank (Figure 2). Within survey area I, Telegraph Passage descends to a maximum depth of about -23.6 m CD near the east coast of De Horsey Island (CHS 2009, Chart 3947). Similar to Marcus Passage, strong tidal currents flow through Telegraph Passage and current speeds may be up to 2 m/s on the ebb when the tide and river outflow combine (Conway et al 1996). Sand and gravel form the main substrates within survey area I (Conway et al. 1996).

No systematic water property collections were carried out in area I, but see Appendix E, Section E.2.1 for exploratory water property results.

## 2.4 SUMMARY

The habitat attributes of the nine survey areas were defined and described based on literature review and field observations. Common biophysical attributes across the survey region included: intertidal soft-sediment habitats with eelgrass; intertidal soft-sediment banks; intertidal sand and gravel habitats; shallow subtidal soft-sediment banks; deeper subtidal soft-sediment habitats; channels influenced by tidal currents and moderate freshwater outflow; and, channels strongly influenced by freshwater outflow and tidal currents.

Water properties within each of the nine survey areas was further characterized using field observations of water temperature, chl-*a*, turbidity, dissolved oxygen, and abundance of three groups of zooplankton taxa.

Water temperature data showed seasonality in all survey areas, with warmer temperatures in summer months and cooler temperatures in winter months. Chl-*a* followed a similar seasonal pattern, peaking in early summer, and lower concentrations the rest of the year.

Turbidity and salinity, both influenced by freshwater input from the Skeena River, showed seasonal turbidity peaks and decreased salinity in spring in survey areas A, B (nighttime data), C, and D (daytime data), associated with the spring freshet from the Skeena River. Trends were not apparent in other survey areas, and may be influenced by fluctuating tidal states at the time of sampling. Dissolved oxygen levels were lowest in August and September, but the lack of a complete data set (due to a meter malfunction) does not permit identification of trends.

Zooplankton was grouped by copepods, cirripeds, and other taxa combined. Data points were sparse (i.e., only three months sampled during daytime surveys and three during nighttime surveys), making identification of seasonal patterns difficult. However, across all survey areas, the highest median value were generally observed in June and July, and lowest median values were observed during the daytime surveys in August, September, and December.

Zooplankton was grouped by copepods, cirripeds, and other taxa combined. Data points were sparse (i.e., only three months sampled during daytime surveys and three during nighttime surveys), making identification of seasonal patterns difficult. However, across all survey areas, the highest median value were generally observed in June and July, and lowest median values were observed during the daytime surveys in August, September, and December 2015.

# 3.0 TEMPORAL AND SPATIAL DISTRIBUTION OF FISH AND INVERTEBRATES

## 3.1 INTRODUCTION

Marine habitats in the survey region and the larger northeast Pacific Ocean are considered diverse and productive (Clark and Jamieson 2006a, 2006b) and occupied by a variety of pelagic and benthic marine fish species (Hart 1988). The survey region provides rearing and migratory habitats for adult and juvenile Pacific salmon and eulachon (Manzer 1956; Higgins and Schouwenburg 1973; Department of the Environment 1973; DFO 1985; McCarter et al. 1986; Hyatt et al. 2007; Beacham et al. 2014). It supports locally important CRA marine fish species, including Pacific herring, surf smelt, larval fish (including eulachon), starry flounder, English sole, and Dungeness crab.

A variety of sampling techniques were used to identify and describe the fish and invertebrate species present in the survey region (Program objective 2), identify spatial and temporal patterns of distribution, abundance, and biological characteristics for fish and marine invertebrates in the survey region (Program objectives 3 and 4), and identify salmon smolt prey items through examination of stomach contents (Program objective 5).

## 3.2 METHODS

### 3.2.1 General Temporal Patterns in Distribution and Relative Abundance of Fish

#### 3.2.1.1 Purpose and Technical Background

General patterns in the spatial distribution and relative abundance of fish over time were examined using hydroacoustic survey results. Hydroacoustic surveys use high frequency sound pulses ("pings") sent through the water column by an acoustic transducer. The transducer then detects and characterizes the energy of echoes returning from objects in the water. Target strength (TS) is a measure of echo intensity. Fish that are larger and have a greater difference in density compared to the surrounding water have higher TS values than small fish or those without a swim bladder. For many species, TS is reasonably well known and hydroacoustic TS results can be used to obtain an understanding of fish size distribution contributing to the potential identification of species present in an area.

The ratio of the intensity of the energy returning through a volume of water to the intensity of the energy sent out is termed the 'volume backscattering coefficient' (sv) and is a metric used in hydroacoustics analysis as a basis to estimate fish abundance (Simmonds and McLennan 2003). When the logarithm of sv (Sv) is averaged over a range interval and unit distance, it is termed

'Mean Volume Backscattering Strength' (MVBS). When integrated over the entire water column, MVBS can be used as a standardized measure of relative fish biomass density (RFBD) [Food and Agriculture Organization of the United Nations (FAO) 1983; Simmonds and MacLennan 2003]. MVBS values are presented in decibels (dB) as negative values. Numbers further from zero (larger negative numbers) indicate less relative biomass and numbers closer to zero (smaller negative numbers) indicate higher RFBD.

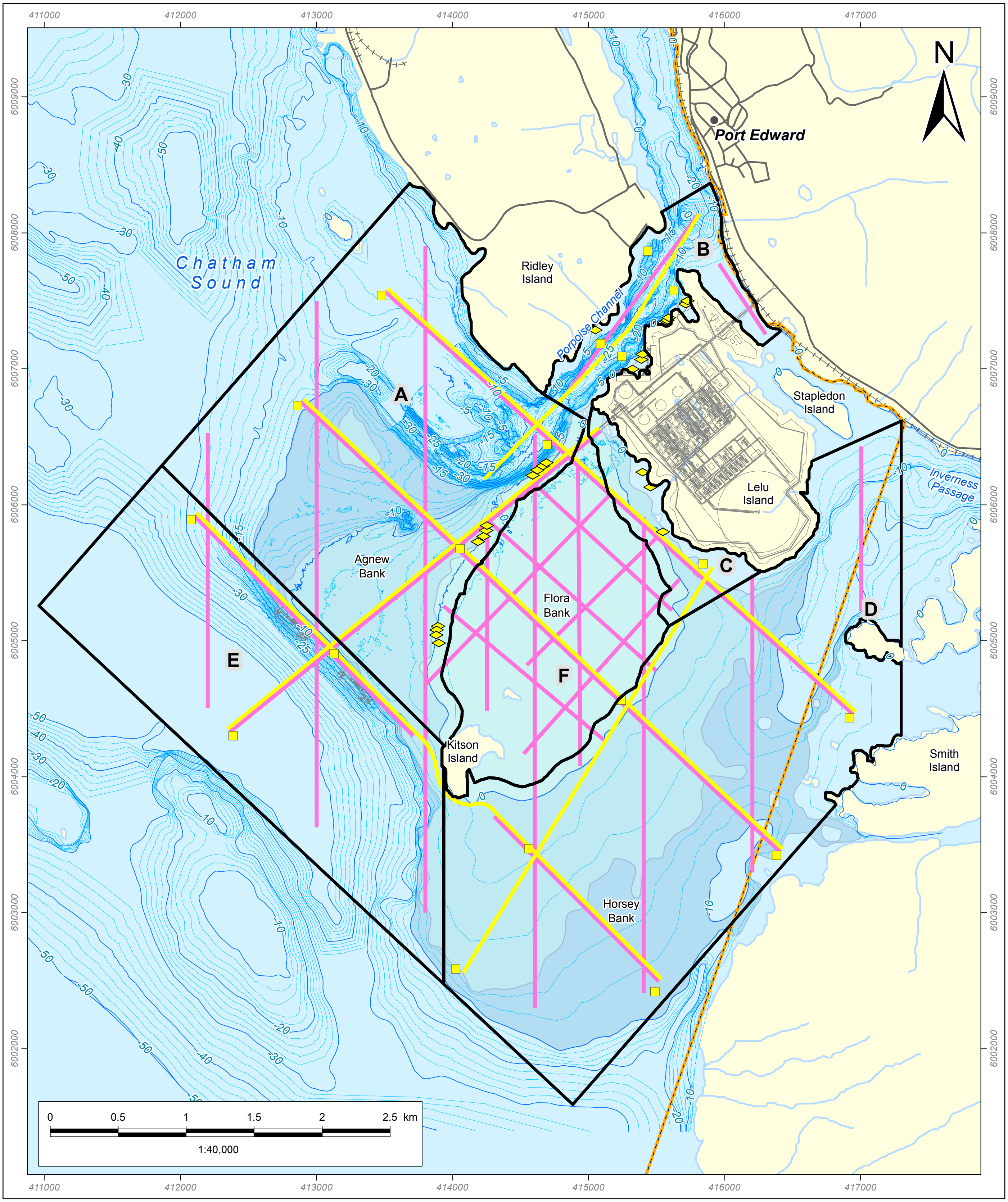
Returning acoustic energy can also be converted into fish density estimates (numbers of fish per area or volume). This is commonly done by a technique known as "echo integration". In echo integration, the total amount of acoustic energy reflected back from fish is scaled by the parameter $\sigma_{bs}$, which is equivalent to the amount of acoustic energy per fish (see Simmonds and McLennan 2003 for a description and review of this established approach to fishery hydroacoustics). The parameter $\sigma_{bs}$ for these data were estimated using the Visual Analyser software. Estimation of $\sigma_{bs}$ incorporates a TS threshold value, correlation factors, scaling factors, and sonar system parameters (Biosonics 2015). Specific analysis parameter settings for echo integration are further discussed in the hydroacoustic methods section below.

### 3.2.1.2 Sample Design

Hydroacoustics were initially used in daytime surveys in January 2015 by sampling four transects across survey areas A through F. A fifth transect was added within Porpoise Channel (survey area B) in February 2015 and a sixth transect was added to the east of Flora Bank (survey area D) in May 2015 (Figure 14). Transects were spaced across the study area and of sufficient total length to enable each transect to be segmented in smaller pieces of either 100 or 500 m to be able to display spatial heterogeneity and to bin them into the six study areas.

In July 2015, daytime hydroacoustic surveys were expanded to three additional survey areas (G, H, and I) south and outside of the immediate vicinity of Project's marine components. The expanded survey included six transects in survey area G (Marcus Passage; Figure 15), three transects in survey area H (Inverness Passage; Figure 16), and three transects in survey area I (Telegraph Passage; Figure 17). In addition, nighttime hydroacoustic sampling was conducted from May through July 2015 in survey areas A through F (Figure 14) and in June and July 2015 in survey area G (Figure 15).

Hydroacoustic data were collected using a 120 kHz DT-X digital echosounder (BioSonics Inc., Seattle, Washington) with an acoustic transducer mounted to an aluminum pole attached over the side of a 5.5 m aluminum skiff. The transducer was positioned looking downward while the skiff traveled at 3 to 4 knots. An onboard BioSonics deck unit processed hydroacoustic signals from the transducer, while a laptop was used to view echograms in real time (via BioSonics Visual Acquisition 6.0 software) and store electronic data files. The coordinates of each ping were determined by an onboard GPS (global positioning system) unit integrated into the deck unit.




- City or Town
- Project Component
- Railway
- Road
- Secondary Road
- Watercourse

**Bathymetry (m)**

- Major Contour
- Minor Contour
- Survey Area
- Prince Rupert Port Authority Boundary
- Waterbody
- Intertidal Bank
- 0 - 5 m Shoal
- 5 - 10 m Shoal
- Crab (Daytime) (18)
- Beach Seine (Daytime) (24)
- Hydroacoustic and Trawl Transect (Daytime) (6)
- Hydroacoustic and Trawl Transect (Nighttime) (25)

***Pacific NorthWest LNG***

**Marine Fish Program Sample Sites: Survey Areas A, B, C, D, E, and F**

MARINE FISH PROGRAM - FINAL REPORT

*Sources: Government of British Columbia; Prince Rupert Port Authority; Government of Canada, Natural Resources Canada, Centre for Topographic Information; Progress Energy Canada Ltd.*

*Although there is no reason to believe that there are any errors associated with the data used to generate this product or in the product itself, users of these data are advised that errors in the data may be present.*

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| DRAWN BY: R.COATTA | CHECKED BY: L.HOWELL |

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PREPARED FOR:

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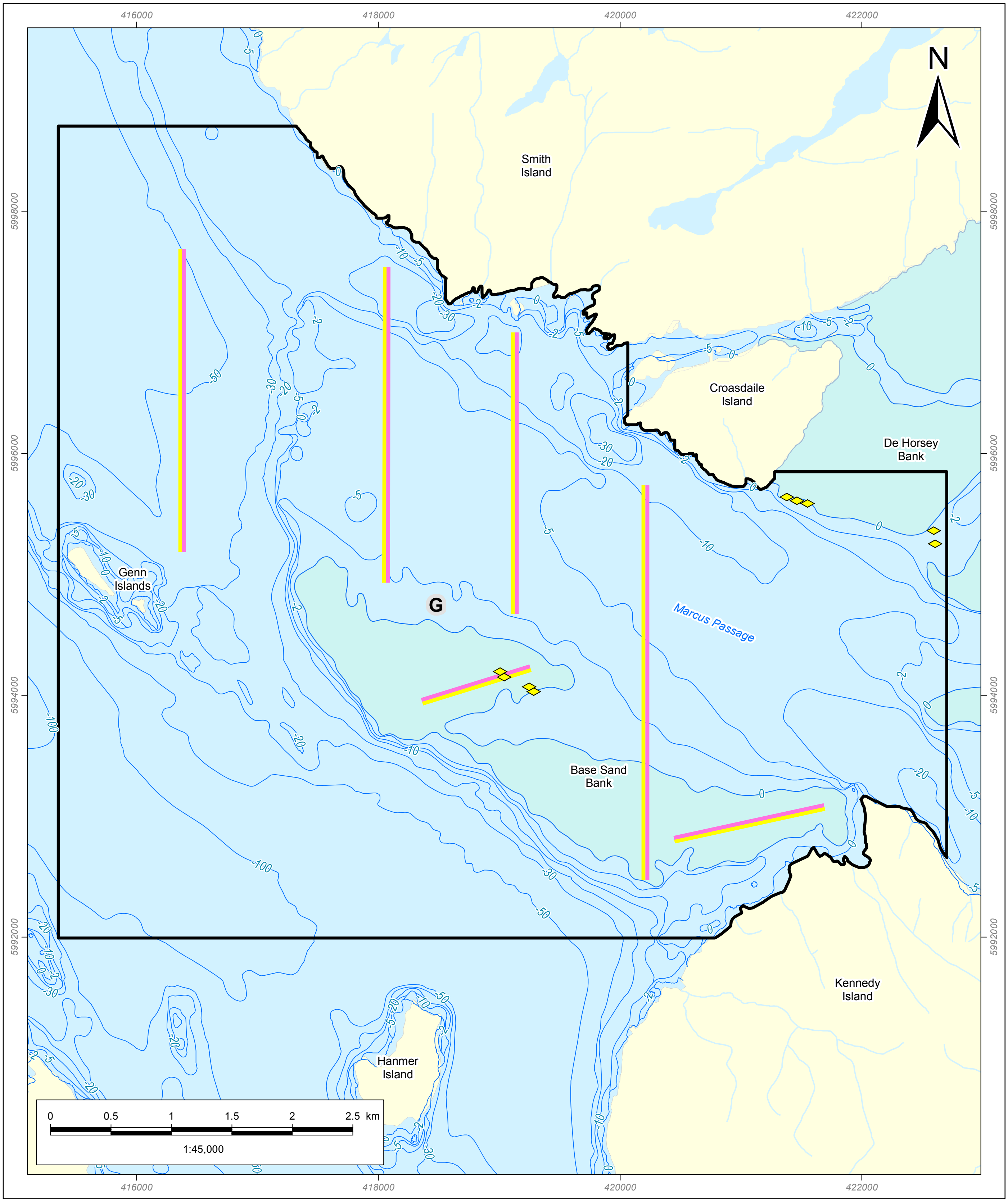


Watercourse
Bathymetric Contour
Survey Area
Waterbody
Intertidal Bank
Beach Seine (Daytime) (9)
Hydroacoustic and Trawl Transect (Daytime) (6)
Hydroacoustic and Trawl Transect (Nighttime) (6)

***Pacific NorthWest LNG***

**Marine Fish Program**
**Sample Sites: Survey Area G**

MARINE FISH PROGRAM - FINAL REPORT

*Sources: Government of British Columbia; Prince Rupert Port Authority; Government of Canada, Natural Resources Canada, Centre for Topographic Information; Progress Energy Canada Ltd.*

*Although there is no reason to believe that there are any errors associated with the data used to generate this product or in the product itself, users of these data are advised that errors in the data may be present.*

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PREPARED BY: Stantec

PREPARED FOR: Pacific NorthWest LNG

FIGURE NO: 15

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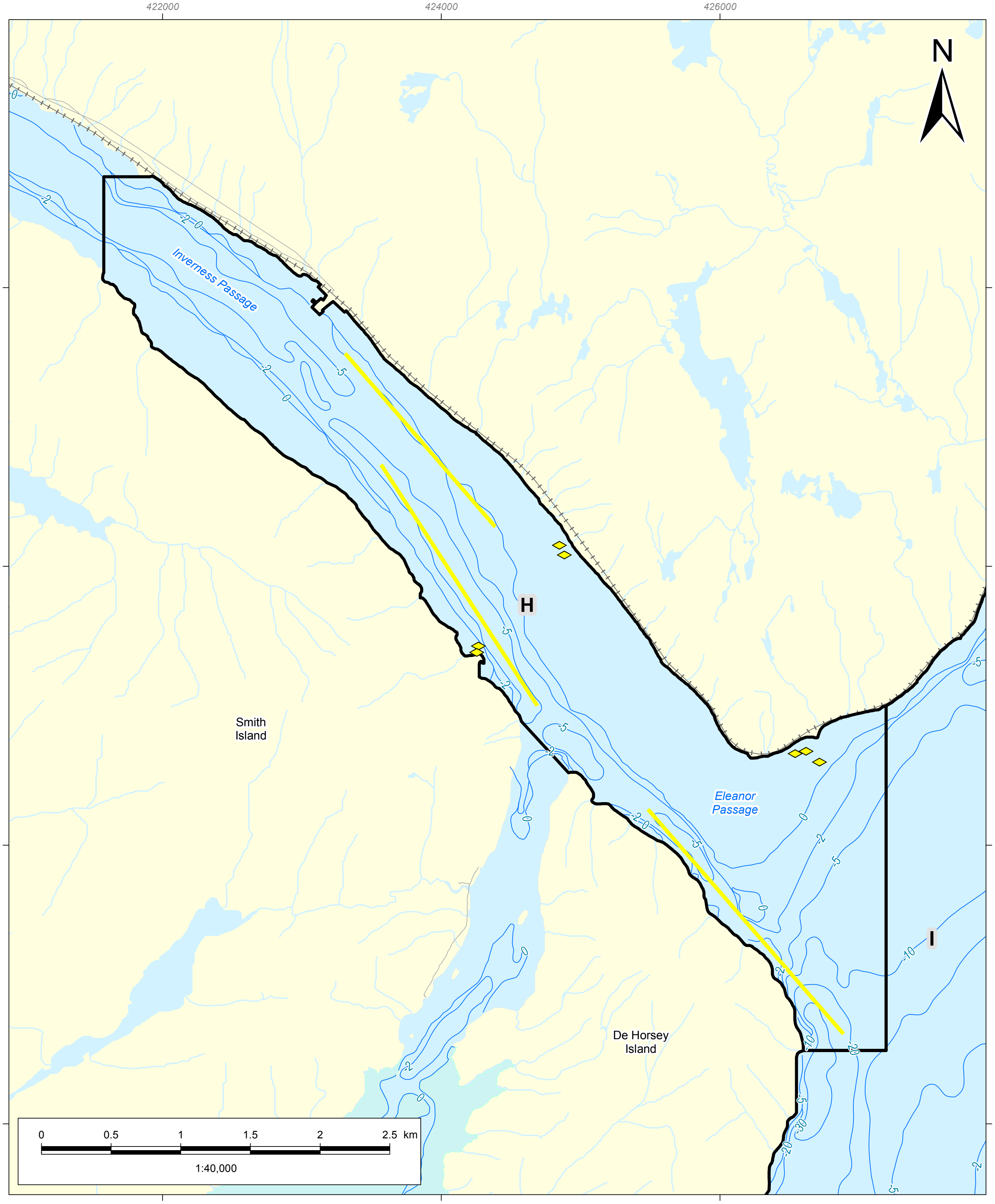


| | | |
|---|---|---|
| Railway | Survey Area | Beach Seine (Daytime) (7) |
| Watercourse | Waterbody | Hydroacoustic and Trawl Transect (Daytime) (3) |
| Bathymetric Contour (m) | Intertidal Bank | |

**Pacific NorthWest LNG**

**Marine Fish Program**
**Sample Sites: Survey Area H**

MARINE FISH PROGRAM - FINAL REPORT

*Sources: Government of British Columbia; Prince Rupert Port Authority; Government of Canada, Natural Resources Canada, Centre for Topographic Information; Progress Energy Canada Ltd.*

*Although there is no reason to believe that there are any errors associated with the data used to generate this product or in the product itself, users of these data are advised that errors in the data may be present.*

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PREPARED BY: Stantec

PREPARED FOR: Pacific NorthWest LNG

FIGURE NO: 16

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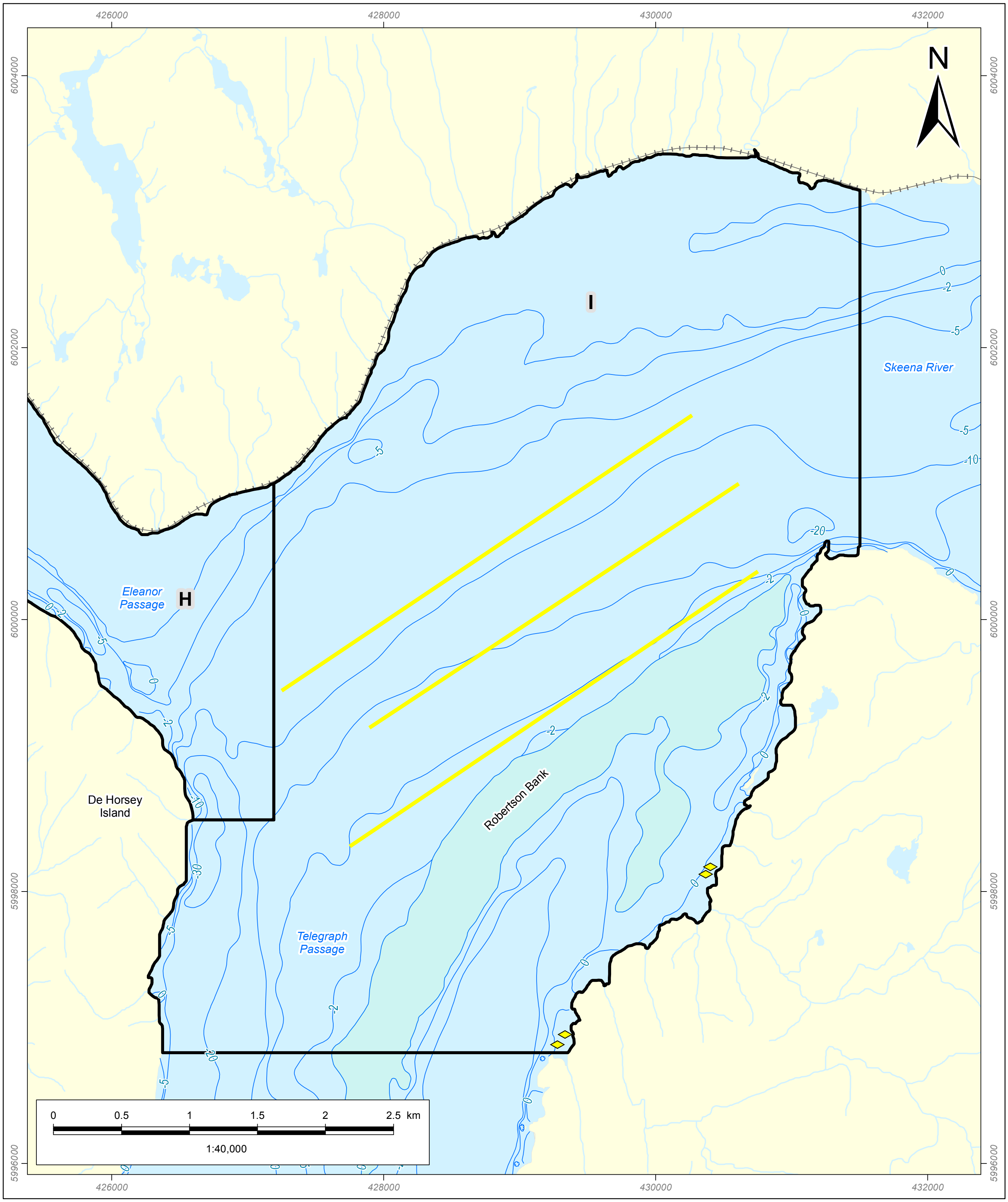


| Legend | | |
|---|---|---|
| Railway | Survey Area | Beach Seine (Daytime) (4) |
| Watercourse | Waterbody | Hydroacoustic and Trawl Transect (Daytime) (3) |
| Bathymetric Contour (m) | Intertidal Bank | |

***Pacific NorthWest LNG***

**Marine Fish Program**
**Sample Sites: Survey Area I**

MARINE FISH PROGRAM - FINAL REPORT

*Sources: Government of British Columbia; Prince Rupert Port Authority; Government of Canada, Natural Resources Canada, Centre for Topographic Information; Progress Energy Canada Ltd.*

*Although there is no reason to believe that there are any errors associated with the data used to generate this product or in the product itself, users of these data are advised that errors in the data may be present.*

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| DRAWN BY: R.COATTA | CHECKED BY: L.HOWELL |

PREPARED BY: Stantec

PREPARED FOR: Pacific NorthWest LNG

FIGURE NO: **17**

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### 3.2.1.3 Data Analysis

Raw hydroacoustic data files were processed and analyzed using Visual Analyser 4.2 software (BioSonics Inc.). Interpretation of the echograms was carried out in consultation with hydroacoustic specialists at BioSonics Inc. To facilitate visualization and interpretation of fish biomass and density results, each transect was divided into 100 m segments (for the daytime surveys) or 500 m segments (for the nighttime surveys). For each transect segment, an estimate of MVBS was calculated as the median monthly estimate of relative biomass and fish density for each survey area (using all the MVBS values derived from each transect segment for given survey area). Where possible, fish density (fish per hectare [ha]) was estimated.

#### 3.2.1.3.1 Field Methods

Field calibration checks of the hydroacoustic instrument were done by examining TS of a submerged standardized tungsten ball target. This calibration check technique is consistent with the protocol provided by the instrument manufacturer. Where calibration offsets for the instrument were calculated, they were less than 1 dB away from the theoretical value.

Prior to starting each transect, the depth range of data collection was set to the expected maximum water depth (based chart datum depth, plus a 5 to 10 m margin to reduce the likelihood of 'loosing' the bottom). The ping rate used was typically five pings/second unless a false bottom (a reflection of the bottom that appeared to be in the water column due the influence of surface reflectivity) was noted, in which case the ping rate was reduced to four pings/second. The pulse width was set at 0.4 milliseconds (ms), while the collection threshold was set at -130 dB to capture even acoustically faint targets for further analysis, if desired.

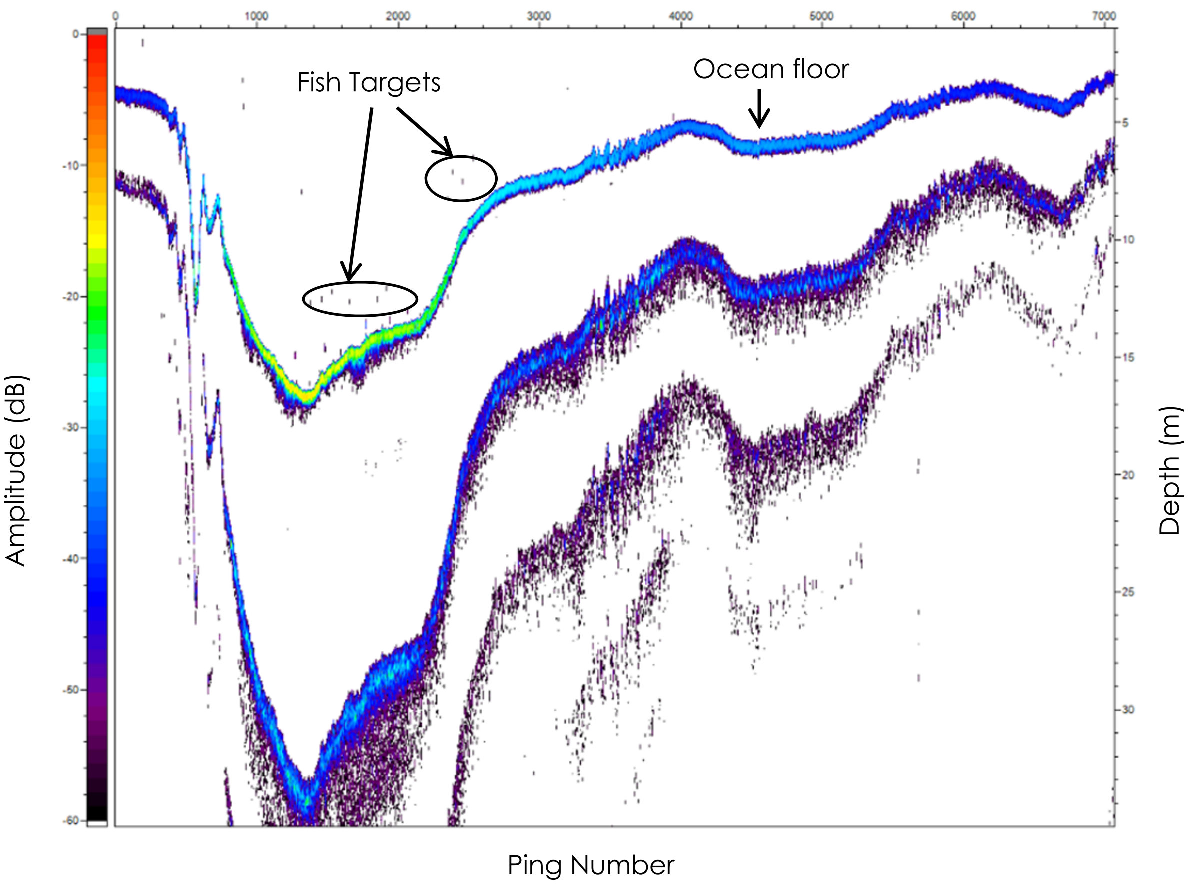
#### 3.2.1.3.2 Analysis Methods

Echograms were imported into Visual Analyser software with site- and survey- specific values for temperature and salinity to fine-tune the calculations of sound transmission speed and increase accuracy of results. Other parameters (correlation factor, minimum pulse width factor, and end point criteria) of echo recognition were left at the default value, except for the 'max pulse width factor', which was set at 1.5 to increase the stringency of the definition of fish echoes and reduce the likelihood of defining 'false targets'. Seafloor contours were manually defined by correcting the automated 'bottom line' to ensure it sufficiently excluded any echoes from the bottom substrate or seafloor vegetation. Surface disturbance was also removed from the analysis of the echogram.

Only acoustic returns with TS equal to or greater than -60 dB were imported into Visual Analyser software for analysis. According to Love's equation (Love 1970), a fish of about 30 mm length (e.g., size of a pink salmon fry) will have a TS of -55 dB. This -60 dB threshold allows for detection of small sized salmon smolts and adult eulachon, which have a low echo intensity (Gauthier and

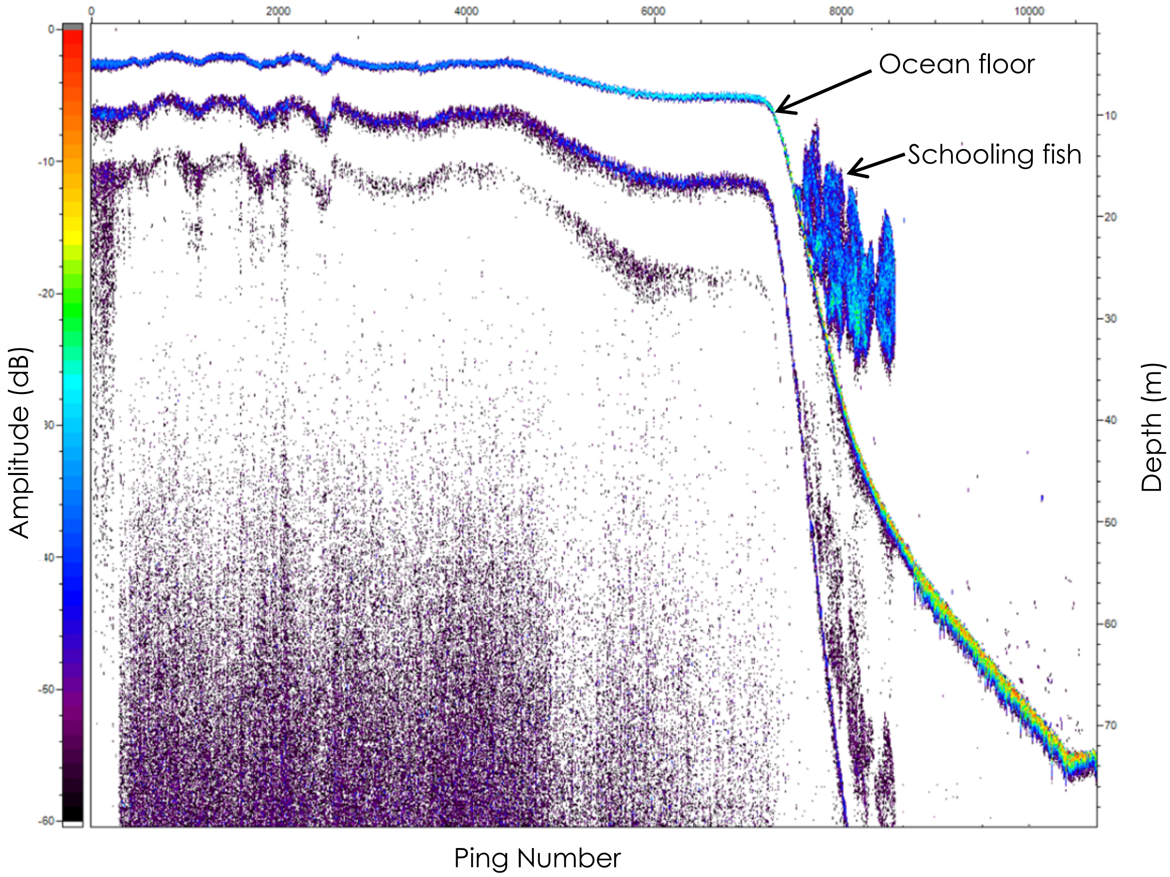
Horne 2004. The -60 dB threshold also limits the possible background sound energy that may be reflected from a high density plankton or detrital layer (Crawford et al. 1992).

Three general classes of acoustic signatures were identified: fish targets (scattered or schooling), surface noise, and plankton (examples are shown in Figure 18 to Figure 21). The characteristics of plankton layers (passive localization in the water column, accumulation in deep water) were confirmed through discussions with technical staff at Biosonics Inc. To accurately estimate fish biomass and density, acoustic energy returning from plankton layers and surface noise were filtered prior to analysis of the echograms for fish signatures. In some instances, a plankton layer (detritus, phytoplankton, and zooplankton) was distinct and created noise that had the potential to mask accurate estimation of fish acoustic energy. As a result, transect segments that contained pronounced plankton layers were excluded from density estimates (shown on the figures in Appendix F as a grey line).



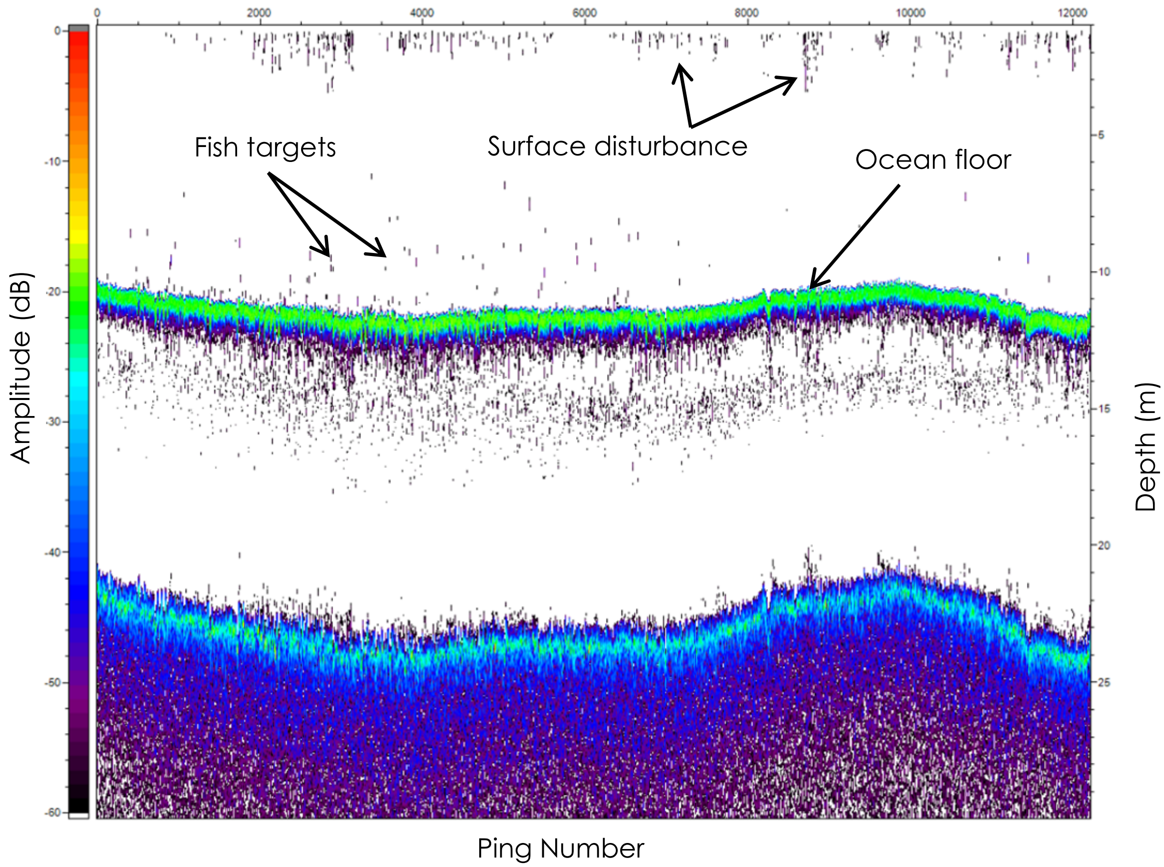

NOTES: Echogram source is Transect T4c Daytime May 21 – 23, 2015.

**Figure 18 Echogram Example Showing Scattered Fish along the Bottom Substrate and Mid-Water Column**



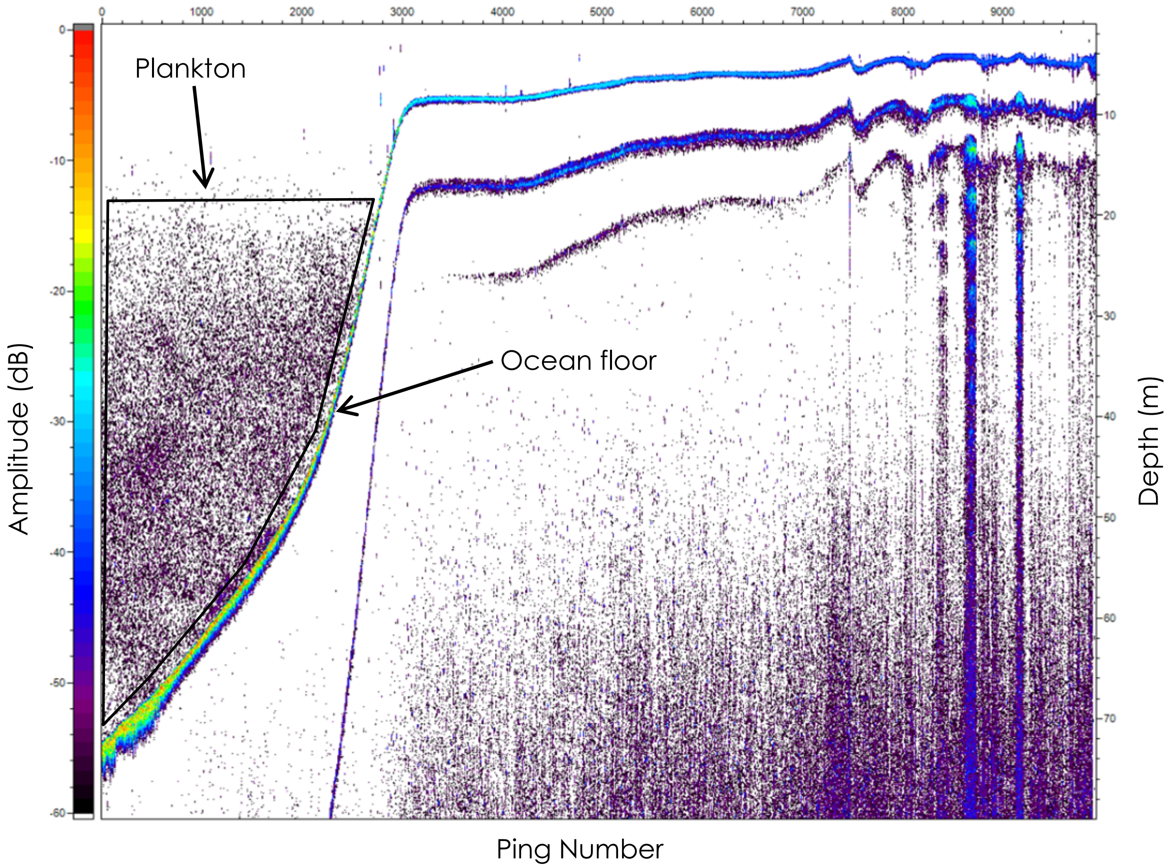

NOTES: Echogram source is Transect 1 (December 9 – 12, 2015 survey).

**Figure 19 Echogram Example Showing Schooling Fish (at 10 to 35 m) Along a Slope**




NOTES: Echogram source is Transect 1(November 26 – December 3, 2015 survey) survey area I. The echoes shown above in the surface to approximate 3 m range are examples of echoes that were scored as surface noise most likely due to suspended bubbles. Targets centered around 10 m are scattered fishes. Green band indicates ocean floor.

**Figure 20 Echogram Example Showing Surface Noise**




NOTES: Echogram source is Transect 1 (July 16 – 23, 2015 survey).

**Figure 21 Echogram Example Showing Plankton Accumulation (below 20 m)**

### 3.2.1.3.3 Limitations

The hydroacoustic survey used in this Program allowed for repeated sampling of a large area, yielding a high resolution view of temporal and spatial patterns in RFBD. The use of this survey approach allowed for estimation of RFBD and overall fish abundance, but not species-specific fish abundance estimates. This would require a dedicated ground-truthing program conducted using trawls or other fishing gear to fish the targets identified on the echograms. Net-based ground-truthing is subject to gear-bias and can be labour intensive, especially if sampling deeper waters. Targeted ground-truthing would be necessary to verify the species-specific distribution of fish and confirm the presence and characteristics (depth) of plankton layers. It is possible that small plankton-sized larval fish may make up some of these observed plankton layers in the echograms.

Interpreting patterns of fish detection over shallow waters (e.g., Flora Bank, Base Sand) has limitations needing consideration in sample design. First, the ability for downward-looking echo sounders to detect targets is proportional to water depth; in shallow water, the cone-shaped acoustic beam is relatively narrow and is therefore less likely to detect fish targets, than a wider beam in deeper water where the beam is wider.. Second, the use of mobile hydroacoustic surveys in shallow waters can result in fish avoiding the vessel. To address these issues, effort was made to survey the shallowest areas during the highest possible tide.

Fish abundance in this highly dynamic system shows high variability over short times scales (hours to days, particularly on intertidal Flora Bank) and estimates of fish biomass can be confounded when fishes are found in a tightly packed school. For example, Figure F-13 shows a portion of the same transect (T3a and T3b) that, due to logistical reasons in December 2015, were not wholly sampled at one time. The initial segment (T3a) was sampled at a high ebb tide, while the second (T3b) was sampled three days later at high slack. Where these transect segments overlap, the estimates of RFBD are not the same. This observation underscores the need to survey comparable transects over shallow water very close together in time. To appropriately interpolate between transects, the data must be coherent in time. Logistical circumstances (i.e., tides and concurrent survey demands) prevented a fully synoptic survey in a short enough time frame to ensure accurate interpolation.

## 3.2.2 Temporal Distribution and Relative Abundance of Focal Species

### 3.2.2.1 Selection of Focal Species

Five anadromous salmon species (pink, chum, sockeye, coho, and Chinook), three pelagic marine fish species (surf smelt, Pacific herring, and larval fish [a grouping that could possibly include larval eulachon]), and three benthic marine fish species (starry flounder, English sole, and Dungeness crab) were identified as focal species for more in-depth examination of temporal patterns in distribution, abundance, and biological characteristics. These focal species were selected based on known value to CRA fisheries and species of fisheries management concern using the following criteria (details in Table 2):

- Importance as a CRA fishery species or non-commercial supporting fish species as defined by DFO fishery management objectives and First Nation and local interests and concerns
- Committee on the Status of Endangered Wildlife in Canada (COSEWIC) and *Species at Risk Act* (SARA) status
- Catch within other regional fisheries studies
- Available catch and biological data from the 2014 – 2016 Marine Fish Program (reported here)

## Table 2 Selected Focal Marine Fish Species Selection and Criteria

| Abundant Marine Fish Species Observed in 2014 – 2016 Study | CRA Fishery Species | Non-Commercial, Fisheries Supporting Species | COSEWIC Status | SARA Status | Data Source: Reported Fish Species Capture | | | | | Selected Focal Fish Species |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Higgins and Schouwenburg 1973 | Anderson 1986 | Community Fisheries Development Center 2000-2001 | Gottesfeld et al. 2008; Carr-Harris et al. 2013, 2015 | Stantec 2014-2016 | |
| Pink Salmon (*Oncorhynchus gorbuscha*) | ✓ | X | - | - | ✓ | ✓ | ✓ | ✓ | ✓ | Yes |
| Chum Salmon (*Oncorhynchus keta*) | ✓ | X | - | - | ✓ | ✓ | ✓ | ✓ | ✓ | Yes |
| Sockeye Salmon (*Oncorhynchus nerka*) | ✓ | X | - | - | ✓ | ✓ | ✓ | ✓ | ✓ | Yes |
| Coho Salmon (*Oncorhynchus kisutch*) | ✓ | X | - | - | ✓ | ✓ | ✓ | ✓ | ✓ | Yes |
| Chinook Salmon (*Oncorhynchus tshawytscha*) | ✓ | X | - | - | ✓ | ✓ | ✓ | ✓ | ✓ | Yes |
| Steelhead (*Oncorhynchus mykiss*) | ✓ | X | - | - | NC | ✓ | - | ✓ | NC | No |
| Dolly Varden (*Salvelinus malma*) | ✓ | X | - | - | NC | ✓ | - | - | ✓ | No |
| Surf Smelt (*Hypomesus pretiosus*) | ✓ | ✓ | - | - | ✓ | ✓ | ✓ | ✓ | ✓ | Yes |
| Pacific Herring (*Clupea pallasi*) | ✓ | ✓ | - | - | ✓ | ✓ | ✓ | ✓ | ✓ | Yes |
| Shiner Perch (*Cymatogaster aggregate*) | X | X | - | - | NC | ✓ | - | - | ✓ | No |
| Larval fish (*Chordata* spp.) | NA | X | NA | NA | NC | - | - | - | ✓ | Yes |
| Eulachon (*Thaleichthys pacificus*) | ✓ | ✓ | SC | - | - | NC | - | - | ✓ | Integrated as Larval Fish |

Stantec

## Table 2 Selected Focal Marine Fish Species Selection and Criteria

| Abundant Marine Fish Species Observed in 2014 – 2016 Study | CRA Fishery Species | Non-Commercial, Fisheries Supporting Species | COSEWIC Status | SARA Status | Data Source: Reported Fish Species Capture | | | | | Selected Focal Fish Species |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Higgins and Schouwenburg 1973 | Anderson 1986 | Community Fisheries Development Center 2000-2001 | Gottesfeld et al. 2008; Carr-Harris et al. 2013, 2015 | Stantec 2014-2016 | |
| Starry Flounder (*Platichthys stellatus*) | ✓ | X | - | - | ✓ | ✓ | - | - | ✓ | Yes |
| English Sole (*Parophrys vetelus*) | ✓ | X | - | - | NC | ✓ | - | - | ✓ | Yes |
| Dungeness Crab (*Metacarcinus magister*) | ✓ | ✓ | - | - | NC | ✓ | - | - | ✓ | Yes |
| Sand Sole (*Psettichthys melanostictus*) | X | X | - | - | ✓ | ✓ | - | - | ✓ | No |
| Tubesnout (*Aulorhynchus flavidus*) | X | X | - | - | NC | NC | - | - | ✓ | No |
| Pacific Snake Prickleback (*Lumpenus sagitta*) | X | X | - | - | - | ✓ | - | - | ✓ | No |
| Crescent Gunnel (*Pholis laeta*) | X | X | - | - | NC | ✓ | - | - | ✓ | No |
| Pacific Staghorn Sculpin (*Leptocottus armatus*) | X | X | - | - | ✓ | ✓ | - | - | ✓ | No |

NOTES:
"✓" captured and accepted marine fish species
"X" not commercial, recreational and aboriginal fishery species and non-supporting fish species
"NC" not captured
"NA" not applicable
"SC" Special Concern
"-" not reported

### 3.2.2.2 Methods

Temporal patterns in distribution and relative abundance of focal species were examined using various gear types (beach seines, trawls, and crab traps), depending on species and habitat.

#### 3.2.2.2.1 Beach Seine

##### *3.2.2.2.1.1 Purpose and Sample Design*

Beach seining was included in the Program as a standard method, used to sample composition, abundance, and distribution of marine fish species in nearshore habitats (nearshore intertidal and shallow subtidal) (Conlin and Tutty 1979; Johnson et al. 2007).

Suitable beach seine sites within a given survey area were selected based on availability of beach where a net could be fished effectively. The initial survey design prioritized sampling effort in the vicinity of the Project's marine components (survey areas A and B). The western side of Flora Bank (survey area A; 12 sampling sites selected) and Porpoise Channel (survey area B; nine sampling sites selected) were identified as key area for nearshore fish sampling sites (Figure 14) based on the location of proposed Project infrastructure, substrate, hydrodynamic conditions (Hatch 2014, Stantec 2015), and fishing and shoreline knowledge and experience. Flora Bank (survey area F) was not directly sampled using beach seines because it was not considered safe or feasible, given rapid changes in tide heights across a shallow intertidal area. Fyke nets were used, but as they could not be employed reliably on Flora Bank at the same sample site each time (i.e., sample site was dependent on tides, access, safety), they are only reported as an exploratory sampling method (Section E.5).

Beach seining was expanded in May 2015 to include three additional sample sites in the channel between Lelu Island and Flora Bank (survey area C, Figure 14). Beach seine sites were also added in June 2015 in Marcus (survey area G; nine sampling sites on De Horsey Bank and Base Sand; Figure 15), Inverness (survey area H; seven sampling sites; Figure 16), and Telegraph (survey area I; four sampling sites; Figure 17) passages.

##### *3.2.2.2.1.2 Field and Analysis Methods*

Beach seine sets in survey areas A, B, G, H, and I were conducted with a 12 m long by 1.5 m deep net (6 mm mesh at tow ends and 4 mm mesh at the bunt). Each beach seine was set by two crew members. One would pull the net out perpendicular to shore into ~0.8 – 1.2 m water depth. Then both crew members would pull their net ends parallel to shore towing the net a given distance before circling the net and hauling into shore. A larger net (22 m long by 3 m deep, 13 mm mesh at the tow ends and 6 mm mesh at the bunt) was employed at the deeper sampling sites in survey area C, where wading was impractical. For these sets, the deep-water end of the net was pulled using a skiff.

All fish caught were identified to the lowest practicable taxonomic level (usually to species), a sub-set of fish was measured for length (size), and all were live-released. Set start and end coordinates were recorded and used to estimate a standard median set length for each sampling site. Seine net set width was estimated in the field or from photos and used, along with set length, to calculate total area sampled ($m^2$). Catch per unit effort (CPUE) was calculated as the number of individuals per 100 $m^2$ of seined area. To emphasize temporal trends within a given survey area, CPUE estimates for each set were log-transformed prior to visualization.

#### 3.2.2.2.2 Trawl

##### *3.2.2.2.2.1 Purpose and Sample Design*

A trawl net was towed along transects concurrently with hydroacoustics to estimate the relative abundance of nearshore surface fish (0.5 to 2.5 m depth range) across the survey areas and over time. The net was used from February 2015 onward and fished along transects across survey areas A through F (Figure 14). Trawling was also conducted at night from April to July across survey areas A through F and in June and July in survey area G (Figure 15). Daytime trawling was extended in June 2015 to survey areas G (Figure 15), H (Figure 16), and I (Figure 17).

##### *3.2.2.2.2.2 Field and Analysis Methods*

The 2 x 2 m Tucker trawl (50 mm to 6 mm graded mesh panels with a mesh tunnel in the last third of the net, 350 micrometre cod end) was deployed at the start of a transect, towed 100 m behind the vessel, and retrieved at the completion of the transect length. All fish and invertebrates captured were identified to the lowest practicable taxonomic level (usually to species), a sub-set was measured for length, and all were released (with the exception of salmon smolts). Catch was standardized to number of individuals per 15 minutes of trawling and, as with beach seine data, were log-transformed for presentation of results.

#### 3.2.2.2.3 Crab Trap

##### *3.2.2.2.3.1 Purpose and Sample Design*

Crab trapping was undertaken with the daytime fish surveys, to assess and characterize the distribution, relative abundance, sex ratio, and shell state (i.e., hardness category: soft or hard) of Dungeness crabs in the vicinity of the Project’s marine components. Traps were set at 24 sample sites during each daytime fish survey starting in December 2014 (eight sample sites in survey area A, four in survey area B, six in survey area D, and six in survey area E; Figure 14). Crab trapping effort was adjusted in June 2015 to balance effort and sampling schedules and was reduced to 18 sample sites set during daytime fish surveys (four in survey areas A and B, one in survey area C, five in survey area D, and three in survey area E; Figure 14). Crab traps were not set on Flora Bank (survey area F) given the tide heights and intertidal areas, and the potential for crab mortality as a result of prolonged exposure during dry low tide. DFO permits also do not allow trapping in intertidal areas.

##### *3.2.2.2.3.2 Field and Analysis Methods*

Commercial grade crab traps (0.91 m bottom ring, 0.86 m top ring, two 105 mm escape hatches, 25 mm weight bar, wrapped in standard mesh [0.05 m diamond weave]) were set using established crab sampling protocols (Dunham et al. 2011). Traps were baited with a single large herring (cut in half) and set to soak for 18 to 24 hours. All crabs were identified to species, sexed, measured for carapace width and shell state, and weighed (see Section 3.2.3). Monthly catch in a given survey area is reported as number per 24 hour soak period.

### 3.2.3 Demographics of Focal Species

All fish captured were identified to the lowest practicable taxonomic level (usually to species) and assessed visually for injuries and abnormalities. To examine life stages (using size [length] as a surrogate for 'stage'), a sub-set of ten individuals of each species at each sample site (e.g., seines, trawls) was measured for fork or total length (dependent on size and species). Dungeness crabs were also sexed, measured (carapace point width [mm]), weighed (grams [g]), and assessed visually for injuries and abnormalities (e.g., missing limbs or cracked shell). Crab shell hardness was assigned based on hard- or soft-shelled categories (DFO 2014). All fish and crabs were captured under DFO scientific collection permits[3] and live-released at (or nearby) the location of capture. Salmon smolts were also assessed the same way, but most salmon smolts were retained for stomach content analysis (Section 3.2.3.1).

Data from beach seines, trawls (2 x 2 m tucker trawl), and crab traps (for Dungeness crab only) were used to generate size (length) frequency distributions. Life stages were assessed by plotting the kernel density distribution using these size frequency data (i.e., the kernel density distributions are predicted, smoothed versions of the actual data—not all sizes of fish shown across the range were actually caught). Daytime and nighttime data are presented separately on each figure. Density distributions were plotted for each month and each survey area where sufficient data existed (in some months, too few individuals were caught and measured to allow a kernel density to be plotted) (Section 3.3.3).

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[3] Licence numbers include: XR 123 2015 (valid 01-Aug-2015 to 31-Dec-2015); XR 124 2015, Amendment 1 (valid 16-June-2015 to 31-Dec-2015; XR 125 2015, Amendment 1,2, 3 (Valid 24-April-2015 to 31-Dec-2015); XR 181 2015 (Valid 05-June-2015 to 31-Jan-2016); XR 205 2014, Amendment 1, 2 (Valid 15-June-2014 to 15-June-2015); XR 283 2014 (Valid 01-Aug-2014 to 01-Aug-2015); XR 284, Amendment 1 (Valid 01-Aug-2014 to 01-August-2015); XR 365, 2014-Amendment 1 (Valid 01-Oct-2014 to 01-Oct-2015)

#### 3.2.3.1 Salmon Smolt Stomach Sampling

##### 3.2.3.1.1 Purpose, Field and Analysis Methods

Salmon stomachs were examined to estimate prey items and presence. Salmon smolt stomach samples were retained from May 2015 to February 2016 under a DFO scientific sample collection permit (permit obtained May 2015). Salmon captured in early surveys prior to obtaining the permit were not retained for stomach content analysis. Salmon smolts captured were generally retained for stomach content analysis during nighttime surveys from May to July 2015 and during daytime surveys from July to December 2015. Salmon smolts were euthanized using clove oil and flash frozen on dry ice. Whole fish were sent to Biologica Environmental Services Ltd. to confirm species identification, measure biological characteristics, and analyze stomach contents.

Frozen stomachs were dissected from each fish and immediately measured for frozen and wet thawed weights. Stomach contents were assessed for content fullness, condition of digested prey, and count of prey taxa. Fullness was estimated based on a scale of 0 – 100%, with 0% being empty, 10% trace of prey, 50 – 75% full, and 100% distended. Digestive condition of individual prey items was assessed on a scale of 0 – 100%, with 0% being an intact full prey and 100% being a fully digested, often unrecognizable, prey item. Prey were identified to the lowest possible taxonomic level, enumerated, and weighed (wet thawed weight ±0.0001 g).

For each salmon species, prey taxa are expressed as the number of individuals of a given taxa as a percent of total individuals (%N) and the frequency of stomachs where that prey taxon was identified (%F) (Hyslop 1980).

### 3.2.4 Exploratory Sample Methods

A number of additional fish sampling methods were trialed during the Program. These methods did not become a stable component of the Program because of inconsistent sampling effort due to tides, depths, and currents, and high costs in time and effort for fishing each gear type within a given Program schedule. While these exploratory sampling methods were not used systematically, the data obtained provided insight to different sampling options for targeting marine fish species (or life stages). Exploratory sampling methods and data are described in Appendix E.

# 3.3 RESULTS AND DISCUSSION

## 3.3.1 General Temporal Patterns in Distribution and Relative Abundance of Fish

### 3.3.1.1 Fish Relative Biomass Density

Hydroacoustic data were used to estimate median depth-integrated "mean volume backscatter strength" (i.e., median MVBS values) and fish density (fish/ha), when possible. These data were used to examine the spatial and temporal patterns of total fish in the survey region.

#### 3.3.1.1.1 MVBS Interpretation

Median MVBS varied across the survey area throughout the duration of the Program, but provided insights into general patterns of fish distribution in the survey region. Three distinct time periods of fish density were identified: January to April 2015 (late winter to early spring); April to November 2015 (growing season, summer to early fall); November 2015 to February 2016 (fall – winter) (indicated by the dotted vertical lines on Figure 22). The general pattern of fish density across survey areas and time phases suggested that fish density was low during late winter and early spring, increased during the growing season, and declined, but showed a small increase and further decrease in fish density in January 2016—during the late fall and winter period (Figure 22).

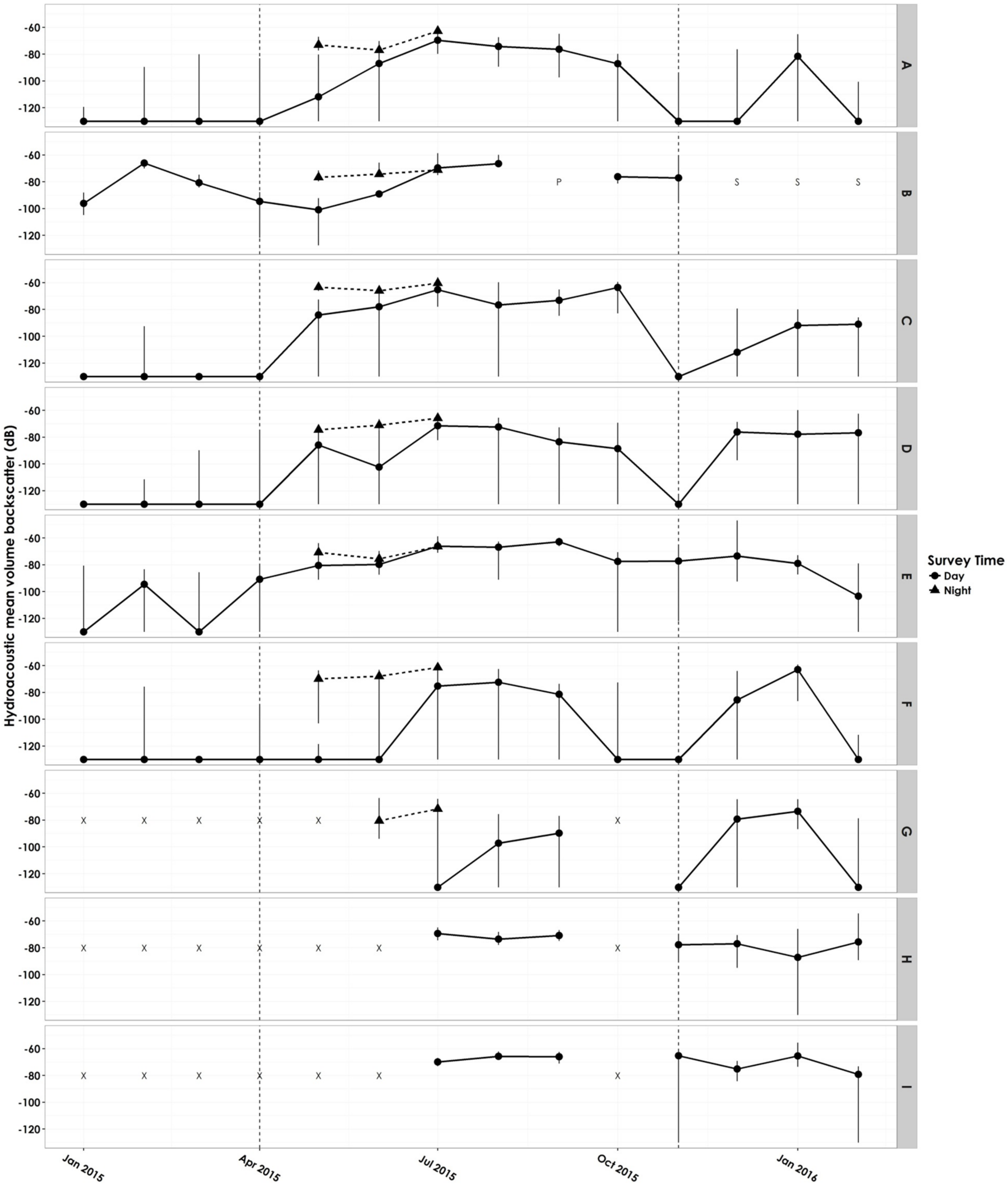
The results for each individual survey are presented as figures showing colour coded MVBS along each transect, for each survey to illustrate estimated RFBD (Appendix F). Figure F-1 through Figure F-39 show the daytime surveys colour coded in 100 m segments and Figure F-40 through Figure F-49 show the nighttime surveys colour coded in 500 m segments. For the daytime surveys carried out from February 11 – 17 (Figures F-15 and F-24), there was a failure in the continuous recording of GPS positions so the data were plotted along an idealized transect constructed from the recorded start and stop positions of the transect.

**Survey Area A**

During the daytime, survey area A contained low RFBD (median MVBS -130 dB) in January 2015 through April 2015, with only a few scattered 100 m segments near the opening of Porpoise Channel and along the northwest margin of Flora Bank with MVBS values of greater than -80 dB. After April, RFBD increased steadily to a peak in July (median MVBS -70 dB) (Figure F-1 to Figure F-4). The increases in RFBD were detected along all transects in this area, with increases particularly notable along the northern end of the trestle alignment (transect T1b) and at the northern ends of transects T3 and T4; however, the density of plankton at the southern end of Transect T5, at the entrance to Porpoise Channel, blocked estimation of fish biomass. RFBD remained relatively high from August through October, with a gradual decline from the July peak. RFBD was again most noticeable near the opening to Porpoise Channel and along the trestle alignment (Figure F-7 to Figure F-11). RFBD then decreased in November and early

December (median MVBS -130 dB), with only a few scattered 100 m segments showing a MVBS greater than -80 dB (Figure F-12 to Figure F-13). A slight increase in RFBD was observed during the mid-December survey along the northern end of transect T3b and near the intersection of Transect T3b and T1 near the trestle alignment. A spike in RFBD (median MVBS -82 dB) was observed during January 2016, with RFBD again higher than background near the intersection of transect T3b and T1 and along the southern end of the trestle alignment as well as along the middle and southern end of transect T6 (Figure F-14), before declining again to lower relative density (median MVBS -130 dB) in February, with only scattered 100 m segments higher than -80 dB seen along most transects, with a concentration of fish biomass at the southern ends of transects T6 and T2A (Figure F-15).

In the May through July 2015 nighttime surveys, survey area A showed consistently high RFBD (median MVBS -77dB to -63 dB, Figure 22). In May, RFBD was highest toward the southwest corner of the survey area adjacent to and on top of Agnew Bank (Figure F-40 to Figure F-42). RFBD densities diminished slightly during the June surveys (median MVBS -77 dB); however, scattered 500 m segments throughout the area remained at moderate to high levels (Figure F-43 to Figure F-44). The July surveys observed an increase in RFBD (median MVBS -63 dB) with moderate to high relative densities observed throughout the survey area (Figure F-46 and Figure F-48).




NOTES:

Dotted vertical lines indicate three distinct periods of fish density.

Error bars represent interquartile range.

X = did not fish.

S = Safety concerns; did not sample.

P = Plankton interfered with recording; data omitted.

**Figure 22 Median Depth Integrated Mean Volume Backscatter Strength (MVBS) per 100 m Segment (Day) and 500 m Segment (Night) by Survey Area**

**Survey Area B**

For the daytime, survey area B contained moderate RFBD within Porpoise Channel in January 2015 (median MVBS -96dB), which increased along the length of the channel. This increased to a high in February (median MVBS -66 dB) (Figure 22 and Figure F-1 to Figure F-2). From February onward, RFBD decreased steadily from March through May (median MVBS -81 dB to -101 dB), with only a few scattered 100 m segments showing MVBS values greater than -80dB (Figure F-3 to Figure F-5). RFBD again increased throughout Porpoise Channel in June through August (median MVBS -89 dB to -67 Db; Figure F-6 to Figure F-9) with a substantial plankton bloom interfering with fish biomass estimation during the mid-July survey (Figure F-8). October and November revealed scattered 100 m segments with moderate to high RFBD (median MVBS -77dB to -76 dB) within Porpoise Channel (Figure F-11 to Figure F-12). Another substantial plankton bloom interfered with fish biomass data collection during the September survey (Figure F-10). Hydroacoustic sampling could not be conducted during the December 2015-February 2016 surveys due to a safety concern in the area.

In the nighttime, survey area B showed moderate RFBD during the May survey (median MVBS -77 dB) (Figure F-40 to Figure F-42), which increased through June (MVBS -74 dB) (Figure F-43 to Figure F-44) and July (median MVBS -71 dB) (Figure F-46 and Figure F-48). RFBD varied within Porpoise Channel throughout the three months, although the northeast side of Lelu Island (towards Stapleton Island) consistently showed moderate to high RFBD (Figure F-40 to Figure F-44; Figure F-46 and Figure F-48).

**Survey Area C**

In the daytime, survey area C contained low RFBD (median MVBS -130 dB) from January through April 2015 across the majority of the southeastern portion of transect T4 and the northern portion of T6 and T10. Only a few scattered 100 m segments between the western edge of Lelu Island and the northeastern edge of Flora Bank showed MVBS values greater than -80 dB (Figure F-1 to Figure F-4). RFBD increased in May and June (median MVBS -84 dB to -78 dB). Scattered 100 m segments increased in MVBS between the western and southwestern edge of Lelu Island and the northeastern edge of Flora Bank (Figure F-5 to Figure F-6) (note that in the June survey the central part of Transect T4 was actually located in survey area F). Peak median RFBD for survey area C was observed in July (median MVBS -65 dB) with increases in RFBD observed throughout the southeastern portion of transect T4 and the northern portion of T6 (western and southwestern side of Lelu Island) (Figure F-7 to Figure F-8). RFBD remained relatively high from August through October (median MVBS -77 dB to -64dB) (Figure F-9 to Figure F-11) with the highest RFBD concentrated towards the southern side of survey area C in October (Figure F-11). In November there was a decrease across the southeastern portion of transect T4 and the northern portion of T6 (median MVBS -130 dB) (Figure F-12). RFBD increased steadily from low to moderate in December 2015 through February 2016 (median MVBS -114 dB to -91 dB) with highest RFBD observed toward the southwestern side (January)(Figure F-14) and western side (February) of Lelu Island (Figure F-15).

Surveys conducted at night in area C showed increasing RFBD throughout May (median MVBS – 63dB) (Figure F-40 to Figure F-42), a slight decline in June (median MVBS – 66dB) (Figure F-43 to Figure F-44), then an increase to peak in July (median MVBS – 60dB) (Figure F-46 and Figure F-48).

**Survey Area D**

During daylight hours, survey area D contained low RFBD (median MVBS -130 dB) in January through April 2015, with a few scattered 100 m segments showing a MVBS greater than -80 dB, with the highest RFBD during this time occurring off of the southern end of Kitson Island (Figure F-1 to Figure F-4). Median RFBD increased from low to moderate levels in May and June (median MVBS -102 dB to -86 dB). Moderate RFBD was observed within the mouth of Inverness Passage (May), sporadic 100 m segments along the eastern and southern sides of Flora and Horsey Bank, and segments of high relative density were concentrated off the southern side of Kitson Island (June) (Figure F-5 to Figure F-6). Median RFBD continued to increase and peaked in July and August (median MVBS -72 dB to -71 dB), with increases observed consistently throughout survey area D (Figure F-7 to Figure F-9). In September and October, the highest RFBD was observed towards the mouth of Inverness Passage and along the southern side of Lelu Island, and shifted to the southwest along the southern side of Flora Bank, off the southern side of Kitson Island, and out over Horsey Bank (Figure F-10 to Figure F-11). The one exception to this trend occurred during the November survey where low RFBD (MVBS -130 dB) was recorded throughout most of Area D, with a few 100 m segments in an area south of Flora Bank and Kitson Island showing moderate to high MVBS (Figure F-12).

In the nighttime surveys, area D showed an increasing trend in RFBD from May through July (median MVBS -75 dB to -66 dB), with variable fish densities observed across the southern edge of Flora Bank, Horsey Bank, and the mouth of Inverness Passage over the course of the nighttime surveys (Figure F-40 to Figure F-44; Figure F-46 and Figure F-48).

**Survey Area E**

During the daytime surveys, area E contained low RFBD (MVBS -130 dB) in January and March 2015 (Figure F-1 and Figure F-3), with a slight increase recorded in February (MVBS -95dB) along the southwestern side of Agnew Bank (Figure F-2). RFBD steadily increased at the steep drop-off along the southwestern edge of Agnew Bank and the southern side of Kitson Island (Figure F-4) starting in April (MVBS – 91 dB) and remained at moderate to high levels until January 2016 (MVBS -80dB to -66 dB) (Figure F-14) before decreasing in February (MVBS -103 dB) (Figure F-15). Peak RFBD was observed in July (MVBS – 66 dB) and September (MVBS – 63 dB) (Figure F-7 to Figure F-8 and Figure F-10).

For the nighttime surveys, area E showed moderate to high RFBD during the May surveys (median MVBS -71 dB), predominantly along the steep drop off on the eastern side of Agnew Bank (Figure F-40 to Figure F-42). RFBD in June diminished slightly (median MVBS -75 dB) (Figure F-43 to Figure F-44) before increasing to peak levels in July (median MVBS -66 dB) (Figure F-46 and Figure F-48).

**Survey Area F**

In the daytime, survey area F contained low RFBD in January through June 2015 (median MVBS -130 dB) (Figure F-1 to Figure F-6); however, scattered 100 m segments did show increasing MVBS across Flora Bank starting in May and June (Figure F-5 to Figure F-6). Relative biomass densities increased dramatically to high levels in July through September (median MVBS -72 dB to -81 dB) with increased fish biomass observed along the transects across Flora Bank (Figure F-7 to Figure F-10). RFBD returned to low levels in October and November (median MVBS -130 dB), with some scattered 100 m sections showing slightly higher MVBS levels along the southern side of Flora Bank (Figure F-11 to Figure F-12). RFBD then rapidly increased again in December 2015 (median MVBS -85 dB; Figure F-13) and peaked in January 2016 with the highest fish biomass densities observed across Flora Bank (median MVBS -63 dB) (Figure F-14). RFBD returned to low levels again in February 2016 (median MVBS -130 dB) (Figure F-15).

At night, survey area F showed moderate to high RFBD (median MVBS – 70 dB) across Flora Bank during the May surveys (Figure F-40 to Figure F-42). RFBD increased steadily through June (median MVBS -68 dB) (Figure F-43 to Figure F-44) and July (median MVBS -61 dB) (Figure F-46 and Figure F-48), with moderate to high relative densities observed across Flora Bank.

**Survey Area G**

In the daytime, survey area G showed steadily increasing RFBD from low to moderate (median MVBS -130 dB to -90 dB) across Marcus Passage transects in July through September 2015 (Figure F-16 and Figure F-18 to Figure F-19). RFBD returned to low in November (median MVBS -130 dB) throughout the area, with the exception of a couple of 100 m segments at the northern end of transects MP2 and MP3 (Figure F-20). A substantial plankton bloom, which interfered with fish data collection, was observed along transect MP1 during the November survey (Figure F-20). RFBD increased in December (median MVBS -79 dB), primarily along the southern portion of transect MP1 (Figure F-21 to Figure F-22) and reached a peak (median MVBS -73 dB) in January 2016, with moderate to high RFBD observed across five of six transects (Figure F-23). RFBD returned to low in February 2016 (median MVBS -130 dB) across all transects, with the exception of scattered 100 m segments that showed moderate to high RFBD (Figure F-24). Survey area G was not sampled in January through April, mid-July, and October 2015.

The nighttime surveys in area G showed relatively low RFBD in June (median MVBS -81 dB), with the exception of several 500 m segments over Base Sand (transect MP6), MP1, and the northern portion of transect MP2a (Figure F-45). RFBD increased in July (median MVBS -72 dB), with higher fish densities observed along transects located in slightly deeper water (Figure F-47 and Figure F-49). No nighttime surveys were conducted in May in survey area G.

### Survey Area H

In the daytime surveys, area H showed low to high RFBD in July through September 2015 (median MVBS -74 dB to -69 dB) across the 100 m segments throughout the survey area H (Figure F-16 to Figure F-19), with the highest RFBDs during this time observed on transects IVT1 and IVT3 during the mid-July survey (Figure F-17). A substantial plankton bloom, which interfered with fish data collection, was observed along transect IVT2 during the mid-July survey (Figure F-17). RFBD continued to vary throughout the survey area in November 2015 through February 2016, with the majority of transects showing low density with scattered 100 m segments of moderate to high relative density (median MVBS -86dB to -77 dB) (Figure F-20 to Figure F-24). Of note, the highest RFBD in January and February occurred along the southern end of transect IV1 towards the southern end of Inverness Passage (Figure F-23 to Figure F-24). Survey area H was not sampled in January through June, nor October 2015. No nighttime surveys were carried out in survey area H.

### Survey Area I

Survey area I showed moderate to high RFBD along transects RBT1, RBT2b, and RBT3 during the July surveys (median MVBS -70 dB) (Figure F-16 to Figure F-17). RFBD continued to be moderate to high throughout much of the survey area in August (median MVBS -66 dB) (Figure F-18) and increased along the eastern portion of RBT1 in the shallower water adjacent to Robertson Bank during the September survey (median MVBS -66 dB) (Figure F-19). The November survey revealed low RFBD along the majority of transect RBT1 (adjacent to Robertson Bank), but consistently moderate to high RFBD in slightly deeper water along transects RBT2 and RBT3 (Figure F-20). RFBD increased along several 100 m segments during the December surveys (median MVBS -65) (Figure F-21 to Figure F-22) with the area adjacent to Robertson Bank (transect RB1) showing increased fish densities during the January 2016 survey (median MVBS -75 dB) (Figure F-23). Fish densities declined throughout the survey area during the February 2016 survey (median MVBS -79 dB) (Figure F-24). Survey area I was not sampled in January through June, nor October 2015. No nighttime surveys were carried out in survey area I.

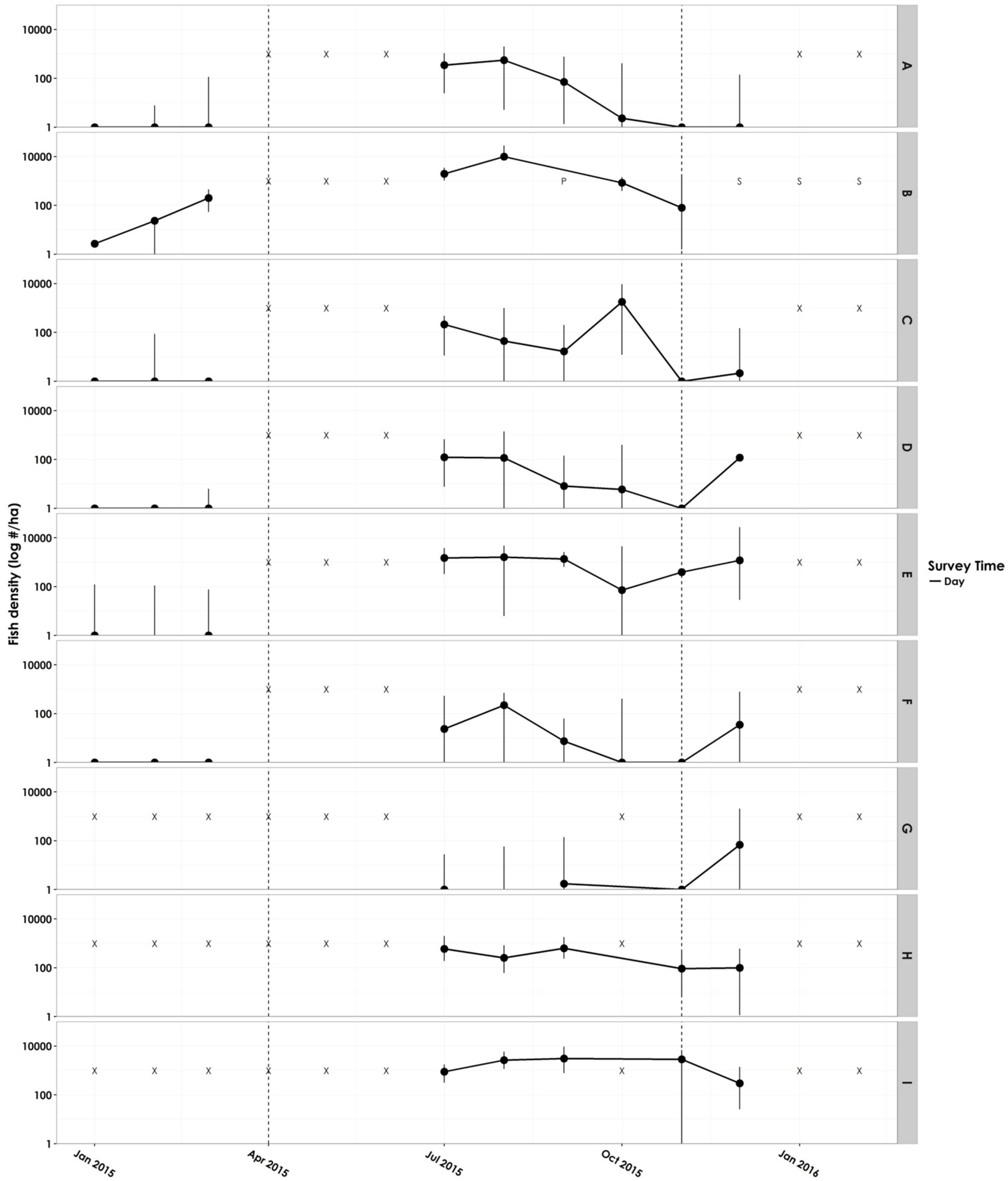
### Summary

Overall, RFBD was low in the winter (January and February 2015) and began increasing through to July 2015, with the most notable increase between February and April. After July, RFBD started to decline (Figure F-20), yet increased prevalence of schooling fishes was observed in the December 2015 survey around Lelu Island and Flora Bank and in Marcus Passage (Figure F-13 and Figure F-20).

Across the entire annual daytime survey series, consistently higher than background fish presence was noted south of the berthing area, in and just south of Porpoise Channel, southwest and southeast of Kitson island, and along the southeast margin of Flora Bank, southwest of Lelu Island and along the northern margin of Flora Bank and on central Flora Bank.

###### 3.3.1.1.2 Fish Density Per Hectare (ha)

As a result of a technical malfunction in the hydroacoustics unit, estimates of fish density (e.g., number of fish per hectare using echo integration) were only possible for select months. A defect in the echosounder was detected, which affected hydroacoustic surveys conducted in April, May, and June 2015 and January and February 2016. Although the defect did not affect quantification of MVBS, it reduced the accuracy of post data processing TS estimates (the split beam DT-X was effectively operating as a single beam instrument). Additionally, target density was often too low to allow for accurate statistical estimates of TS. Taken together, these issues limited the use of the echo integration to estimate fish numbers. This malfunction, which resulted in a loss of split beam capacity, also blocked accurate determination of the calibration offset. Despite the inability to produce a complete time series dataset using fish density estimates (as opposed to using fish biomass estimates available from MVBS values), the available fish density data are shown in Figure 23. While potential patterns are hard to clearly decipher, there are similarities in portions of these data with those described in Section 3.3.1.1.1 using MVBS values.




NOTES:
Dotted vertical lines indicate three distinct periods of fish density.
Error bars represent interquartile range.
X = did not fish.
S = Safety concerns; did not sample.
P = Plankton interfered with recording; data omitted.

**Figure 23 Log-Transformed Fish Density per Hectare (ha)**

## 3.3.2 Distribution and Relative Abundance of Focal Fish Species over Time

### 3.3.2.1 Fish and Invertebrate Species Observed

The Program used a variety of sampling techniques to identify and describe the fish and invertebrate species present in the survey region (Program objective 2). The full schedule of surveys by area is presented in Appendix A.

During the Program, 57 fish species and 8 invertebrate species were captured. Of these 65 species, 10 individual species, and a grouping of larval fish were focal species (as defined in Section 3.2.2.1 above, Table 3). Four groups of fish genera were identified in catches and included fish such as hybrid sole, sculpins, sanddab, and gadids (cod). Two fish groups were used to categorize an array of similar fish or life stages, including flatfish (flounder and sole) and fish larvae. There were 19 invertebrate groups identified to family, including taxa such as crab and invertebrate larvae, sea pen, sea stars, mysids, euphausiids, amphipods, isopods, and shrimp / prawn. The reported number of taxa caught should be considered a minimum, as despite the diversity of gear types used and habitats surveys, efforts were targeted towards focal species, and not designed as a comprehensive biodiversity survey.

The highest number of species and groupings was observed in catches during June and July 2015 (53 and 59 respectively; Table 3). The number of species and groupings were lower in May and August (42 and 40 respectively), and were approximately 40% less for all other months surveyed in the Program (< 26).

The 11 focal species were observed in May and June, when migratory salmon smolts were also present. Sockeye salmon were only observed in the survey region during May, June, and July. Dungeness crab, surf smelt, and starry flounder were observed in catches throughout the Program. Also, staghorn sculpin were observed in catches throughout the entire Program.

**Table 3 Summary of All Fish Species Caught by Month in Survey Region December 2014 through February 2016 Listed In Order Including: Focal Species, Other Fish and Invertebrate Species, and Incidental Invertebrate Species**

| Species | Latin Name | 14-Dec | 15-Jan | 15-Feb | 15-Mar | 15-Apr | 15-May | 15-Jun | 15-Jul | 15-Aug | 15-Sep | 15-Oct | 15-Nov | 15-Dec | 16-Jan | 16-Feb |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Focal Species Captured in Fishing Gear** | | | | | | | | | | | | | | | | |
| Chinook Salmon | *Oncorhynchus tshawytscha* | | | | | | ✓ | ✓ | ✓ | ✓ | ✓ | | ✓ | | | ✓ |
| Chum Salmon | *Oncorhynchus keta* | ✓ | | ✓ | ✓ | ✓ | ✓ | ✓ | | | | | | | ✓ | ✓ |
| Coho Salmon | *Oncorhynchus kisutch* | | | | | | ✓ | ✓ | ✓ | ✓ | ✓ | | | | | |
| Dungeness Crab | *Metacarcinus magister* | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| English Sole | *Parophrys vetelus* | | | | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | | | ✓ | ✓ | ✓ | ✓ |
| Fish Larvae | *Chordata* spp. | | ✓ | ✓ | | | ✓ | ✓ | ✓ | ✓ | | | | | | ✓ |
| Pacific Herring | *Clupea pallasi* | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | | ✓ | | ✓ | ✓ |
| Pink Salmon | *Oncorhynchus gorbuscha* | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | | | | | | | | ✓ |
| Sockeye Salmon | *Oncorhynchus nerka* | | | | | | ✓ | ✓ | ✓ | | | | | | | |
| Starry Flounder | *Platichthys stellatus* | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Surf Smelt | *Hypomesus pretiosus* | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| **Other Fish and Invertebrate Species Captured in Fishing Gear (Not a Species of Management Concern)** | | | | | | | | | | | | | | | | |
| Bay Pipefish | *Syngnathus leptorhyncus* | | ✓ | | ✓ | | ✓ | ✓ | ✓ | ✓ | ✓ | | | | | |
| Big Skate | *Raja binoculata* | | | | ✓ | | ✓ | ✓ | ✓ | ✓ | | | | | | |
| Buffalo Sculpin | *Enophrys bison* | | | | | | ✓ | ✓ | ✓ | ✓ | ✓ | | | | | ✓ |
| Cabezon | *Scorpaenicthys marmoratus* | ✓ | | ✓ | | | | | | | | | | | | |

**Table 3 Summary of All Fish Species Caught by Month in Survey Region December 2014 through February 2016 Listed In Order Including: Focal Species, Other Fish and Invertebrate Species, and Incidental Invertebrate Species**

| Species | Latin Name | 14-Dec | 15-Jan | 15-Feb | 15-Mar | 15-Apr | 15-May | 15-Jun | 15-Jul | 15-Aug | 15-Sep | 15-Oct | 15-Nov | 15-Dec | 16-Jan | 16-Feb |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Cockscomb Prickleback | *Anoplarchus purpurescens* | | | | | | | | | | ✓ | | | | | |
| Coonstripe Shrimp | *Pandalus danae* | | | ✓ | ✓ | ✓ | ✓ | | ✓ | | | | | | | |
| Crab Larvae | *Malacostraca* spp. | | | | | | ✓ | ✓ | ✓ | | | | | | | |
| Crescent Gunnel | *Pholis laeta* | | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | | | | | |
| Dolly Varden | *Salvelinus malma* | | | | | | ✓ | ✓ | ✓ | ✓ | | | | ✓ | | ✓ |
| Eulachon (larvae and juveniles) | *Thaleichthys pacificus* | | | | | | | ✓ | ✓ | | | | | | | |
| Flatfish spp. | *Pleuronectiformes* spp. | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | | | | | ✓ |
| Gadid spp. | *Gadid* spp . | | | | | | | ✓ | ✓ | | | | | | | |
| Giant Wrymouth | *Delolepis gigantea* | | | | | ✓ | | | | | | | | | | |
| Graceful Crab | *Metacarcinus gracilis* | | | | | | | | | ✓ | | | | | | |
| Great Sculpin | *Myoxocephalus polyacanthocephalus* | | | | | | | | ✓ | ✓ | ✓ | | | | | ✓ |
| Gunnel spp. | *Pholidae* spp. | | | | | | | ✓ | | | | | | | | |
| Humpback Shrimp | *Pandalus hypsinotus* | | | ✓ | ✓ | | | | | | | | | | | |
| Hybrid Sole | *Soleidae* spp. | | | | | | | ✓ | | | | | | | | |
| Invertebrate Larvae | *Decapoda* spp. | | | | | | | ✓ | ✓ | | | | | | | |
| Kelp Clingfish | *Rimicola muscarum* | | | | | | | | | | ✓ | | | | | |

**Table 3 Summary of All Fish Species Caught by Month in Survey Region December 2014 through February 2016 Listed In Order Including: Focal Species, Other Fish and Invertebrate Species, and Incidental Invertebrate Species**

| Species | Latin Name | 14-Dec | 15-Jan | 15-Feb | 15-Mar | 15-Apr | 15-May | 15-Jun | 15-Jul | 15-Aug | 15-Sep | 15-Oct | 15-Nov | 15-Dec | 16-Jan | 16-Feb |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Kelp Greenling | *Hexagrammos decagrammus* | | | | | | | ✓ | | | | | | | | |
| Lingcod | *Ophiodon elongatus* | | | | | | | | ✓ | | | | | | | |
| Longfin Smelt | *Spirinchus thaleichthys* | | | | | | | ✓ | | ✓ | | | ✓ | | | ✓ |
| Lump Sucker | *Cyclopteridae* spp. | | | | | | ✓ | | | | | | | | | |
| Northern Spearnose Poacher | *Agonopsis vulsa* | | | | | | | | ✓ | | | | | | ✓ | |
| Pacific Cod | *Gadus macrocephalus* | | | | | | ✓ | ✓ | ✓ | | | | | | | |
| Pacific Lamprey | *Lampetra tridentatus* | | | | | | ✓ | ✓ | ✓ | ✓ | | | | | | |
| Pacific Sanddab | *Citharichthys sordidus* | | | | | | | | ✓ | ✓ | | | | | | |
| Pacific Sandfish | *Trichodon trichodon* | | | ✓ | ✓ | | ✓ | ✓ | ✓ | ✓ | ✓ | | | | | |
| Pacific Sandlance | *Ammodytes hexapterus* | | | | | | ✓ | ✓ | ✓ | ✓ | ✓ | | | | | |
| Pacific Snake Prickleback | *Lumpenus sagitta* | ✓ | ✓ | | | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | | ✓ | | | |
| Pacific Staghorn Sculpin | *Leptocottus armatus* | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Pacific Tomcod | *Microgadus proximus* | | | ✓ | | | ✓ | ✓ | ✓ | ✓ | ✓ | | ✓ | | | |
| Penpoint Gunnel | *Apodichthys flavidus* | | | | | | | | | ✓ | ✓ | | | | | |
| Poacher spp. | *Agonidae* spp. | | | | | | ✓ | | | | | | | | | |
| Prawn/Shrimp spp. | *Decapoda* spp. | | | | | | | ✓ | ✓ | | ✓ | | | | | |

**Table 3 Summary of All Fish Species Caught by Month in Survey Region December 2014 through February 2016 Listed In Order Including: Focal Species, Other Fish and Invertebrate Species, and Incidental Invertebrate Species**

| Species | Latin Name | 14-Dec | 15-Jan | 15-Feb | 15-Mar | 15-Apr | 15-May | 15-Jun | 15-Jul | 15-Aug | 15-Sep | 15-Oct | 15-Nov | 15-Dec | 16-Jan | 16-Feb |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Prowfish | *Zaprora silenus* | | | | | | | | ✓ | | | | | | | |
| Quillfish | *Ptilichthys goodei* | | | | | | | | ✓ | | | | | | | |
| Red Irish Lord | *Hemilepidotus hemilepidoyus* | ✓ | | | | | | | | ✓ | | | | | | |
| Rock Greenling | *Hexagrommos lagocephalus* | | | | | ✓ | ✓ | | | | | | | | | |
| Rock Sole | *Lepidopsetta bilineata* | | | | | | | ✓ | ✓ | ✓ | ✓ | | ✓ | | | ✓ |
| Sand Sole | *Psettichthys melanostictus* | | | | | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Sanddab spp. | *Citharichthys* spp. | | | | | | | | ✓ | | | | | | | |
| Sculpin spp. | *Cottoidea* spp. | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | | | | | | ✓ |
| Shiner Perch | *Cymatogaster aggregata* | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | | ✓ | ✓ | ✓ | | |
| Shrimp (Crangon spp.) | *Crangon* spp. | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | | | ✓ | ✓ | | ✓ |
| Sidestripe Shrimp | *Pandalopsis dispar* | | | | | ✓ | | | ✓ | | | | | | | |
| Slender Sole | *Lyopsetta exilis* | | | | | | | | ✓ | | | | | | | |
| Slimy Sculpin | *Cottus cognatus* | | | | | | ✓ | | | | | | | | | |
| Soft Sculpin | *Psychrolutes sigalutes* | | | | | | ✓ | ✓ | | | | | | | | |
| Speckled Sanddab | *Citharichthys stigmaeus* | | | | | | | | | ✓ | | | | | | |
| Spotted Snailfish | *Liparis callyodon* | | | | ✓ | | | | | ✓ | | | | | | |

**Table 3 Summary of All Fish Species Caught by Month in Survey Region December 2014 through February 2016 Listed In Order Including: Focal Species, Other Fish and Invertebrate Species, and Incidental Invertebrate Species**

| Species | Latin Name | 14-Dec | 15-Jan | 15-Feb | 15-Mar | 15-Apr | 15-May | 15-Jun | 15-Jul | 15-Aug | 15-Sep | 15-Oct | 15-Nov | 15-Dec | 16-Jan | 16-Feb |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Steelhead | *Oncorhynchus mykiss* | | | | | | | ✓ | | | | | | | | |
| Striped Surf Perch | *Embiotoca lateralis* | | | | | | | ✓ | ✓ | | | | | | | |
| Sturgeon Poacher | *Podothecus accipenserinus* | | | | | | | ✓ | | | | | | | | |
| Threespine Stickleback | *Gasterosteus aculeatus* | | | | | ✓ | | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | | ✓ | ✓ |
| Tidepool Sculpin | *Oligocottus maculatus* | | | | | | | | ✓ | ✓ | ✓ | | | | | ✓ |
| Tubesnout | *Aulorhynchus flavidus* | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | | ✓ | ✓ | | | | | | ✓ |
| Walleye Pollock | *Gadus chalcogrammus* | | | | | | ✓ | ✓ | ✓ | | | | | | | |
| Whitespotted Greenling | *Hexagrammos stelleri* | | | | | | ✓ | | ✓ | ✓ | | | | | | |
| Yellowfin Flounder | *Pleuronectes ferruginea* | ✓ | ✓ | | | | ✓ | | | | | | | | | |
| **Less Mobile Invertebrate Species Incidentally Captured in Fishing Gear** | | | | | | | | | | | | | | | | |
| Amphipod spp. | *Amphipoda* spp. | | | | | | | | ✓ | | | | | ✓ | | |
| Brittle Star | *Ophiuroidea* spp. | | | | | | | | ✓ | | | | | | | |
| Decorator Crab | *Majidae* spp. | ✓ | | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | | | | | | | |
| Hermit Crab spp. | *Pagurus* spp. | | | ✓ | | | | ✓ | ✓ | | | | | | | |
| Isopod spp. | *Idotea* spp. | | | | | | ✓ | ✓ | ✓ | | | | | | | |
| Jelly spp. (Translucent) | *Medusozoa* spp. | | | | | ✓ | ✓ | ✓ | | ✓ | | | ✓ | | | ✓ |
| Krill spp. | *Euphausiacea* spp. | | | | | | | | | | | | | ✓ | ✓ | ✓ |

**Table 3 Summary of All Fish Species Caught by Month in Survey Region December 2014 through February 2016 Listed In Order Including: Focal Species, Other Fish and Invertebrate Species, and Incidental Invertebrate Species**

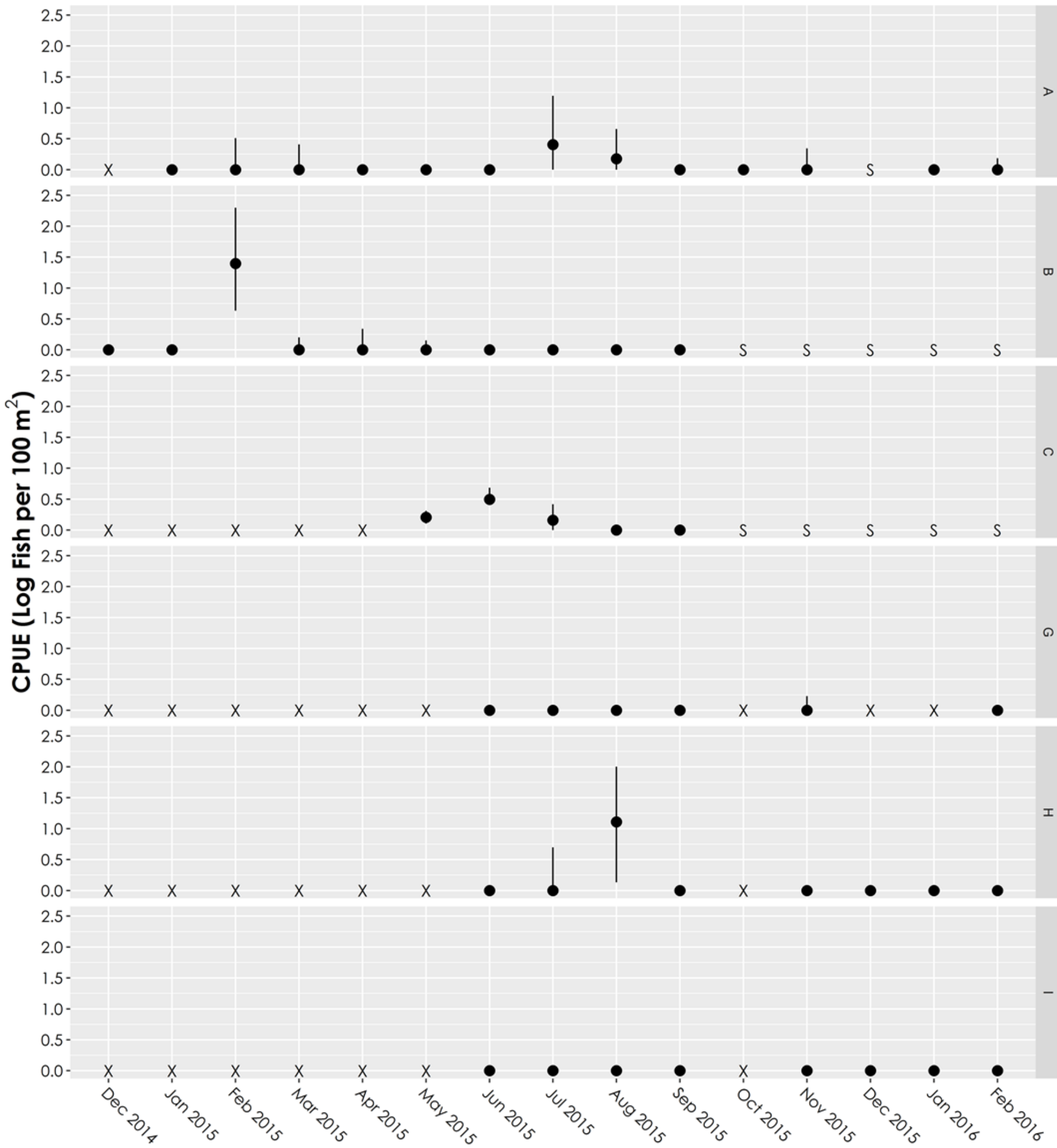
| Species | Latin Name | 14-Dec | 15-Jan | 15-Feb | 15-Mar | 15-Apr | 15-May | 15-Jun | 15-Jul | 15-Aug | 15-Sep | 15-Oct | 15-Nov | 15-Dec | 16-Jan | 16-Feb |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lion's Mane Jelly | *Cyanea capillata* | | | | | | | | ✓ | | | | | | | |
| Mysida spp. | *Mysida* spp. | | | | | | | ✓ | | | | | | ✓ | | |
| Nereid Worm spp. | *Nereidae* spp. | | | | | | | ✓ | ✓ | | | | | | | |
| Nudibranch spp. | *Nudibranchia* spp. | | | | | | | | ✓ | | | | | | | |
| Polychaete Worm spp. | *Polychaeta* spp. | | | | | | | ✓ | | | | | | | | |
| Prawn/Shrimp spp. | *Decapoda* spp. | | | | | | | ✓ | ✓ | | ✓ | | | | | |
| Sea Louse | *Caligidae* spp. | | | | | | | | | ✓ | | | | | | ✓ |
| Sea Pen | *Pennatulacea* spp. | | | | | | | | ✓ | | | | | | | |
| Sea Star spp. | *Asteroidea* spp. | | | ✓ | | | | | | | | | | | | |
| Stubby Squid | *Rossia pacifica* | | | | | | | ✓ | ✓ | ✓ | ✓ | | | | | |
| Tanner Crab | *Chionoecetes bairdi* | | ✓ | | | | | | | | | | | | | |
| Unidentified Parasite | *n/a* | | | | | | | | | | | | | | | ✓ |

### 3.3.2.2 Focal Species Distribution and Relative Abundance

Data used to estimate CPUE for focal fish species were derived from beach seine and trawl (2 x 2 m tucker trawl) catches and for Dungeness crab from trap catches. Daytime and nighttime survey data are presented separately on each figure (where applicable).

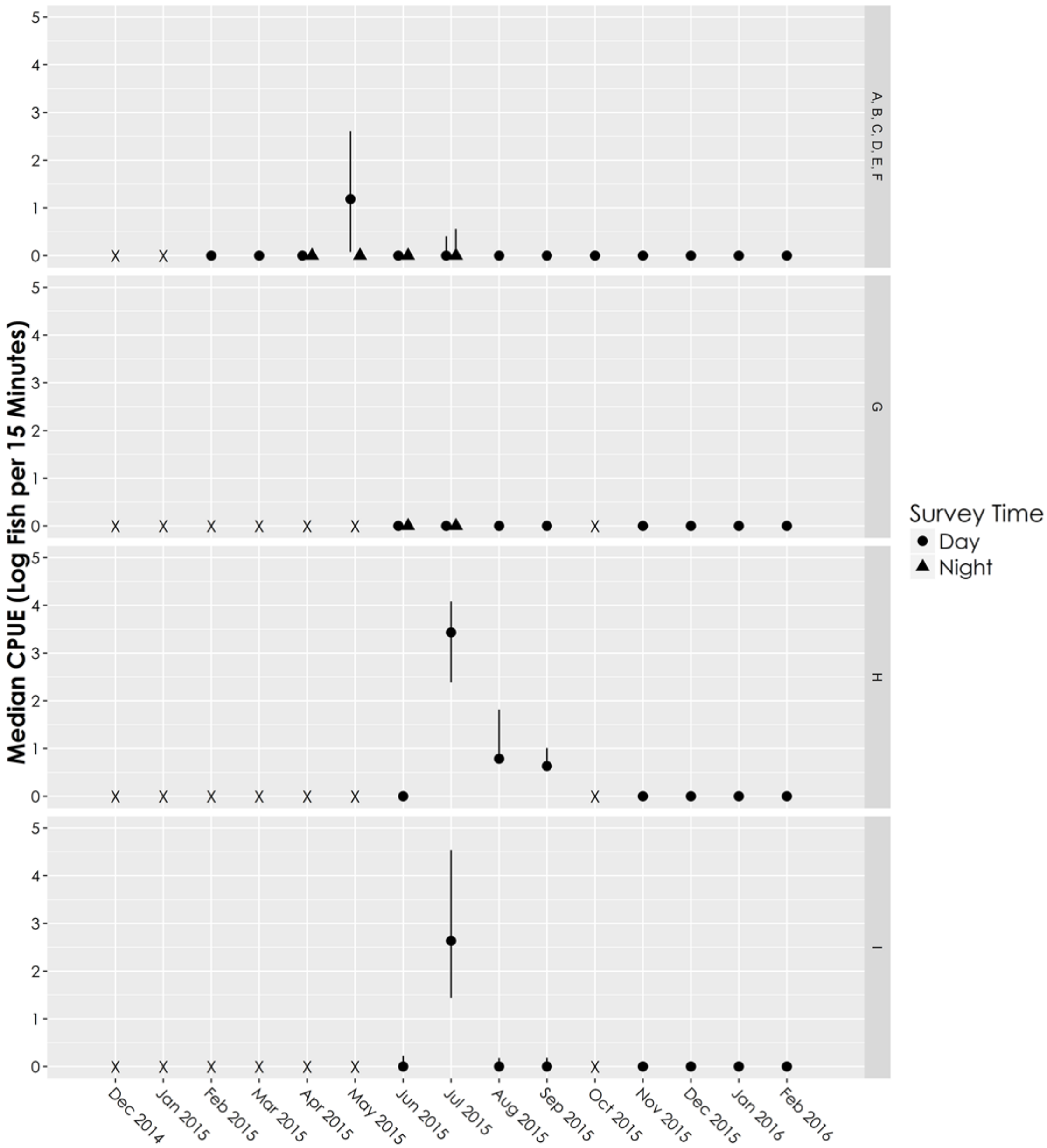
#### 3.3.2.2.1 Pacific Herring

Beach seine data for Pacific herring showed generally low CPUE (median catch was typically fewer than three fish per 100 $m^2$, Appendix B, Section B.2), with greater numbers of fish captured during summer in survey areas A, C, and H. Survey area B showed higher CPUE (about three fish per 100 $m^2$, Appendix B, Section B.2) in February (Figure 24). Trawl catch data for Pacific herring varied, with the highest CPUE recorded in May (median catch  of 3.4 fish per 15 minutes of trawl, Appendix B, Section B.2) for the general survey areas (inclusive; see Figure 25 panel "A, B, C, D, E, F,"), and in July for survey areas H and I (up to 30 fish per 15 minutes of trawl, Appendix B, Section B.2). No discernible differences in herring catch data were observed between night and daytime trawl surveys.




NOTES:
X = did not fish
S = Safety concerns; did not fish

**Figure 24 Median Catch Per Unit Area and Interquartile Range of Pacific Herring in Beach Seine Catches**

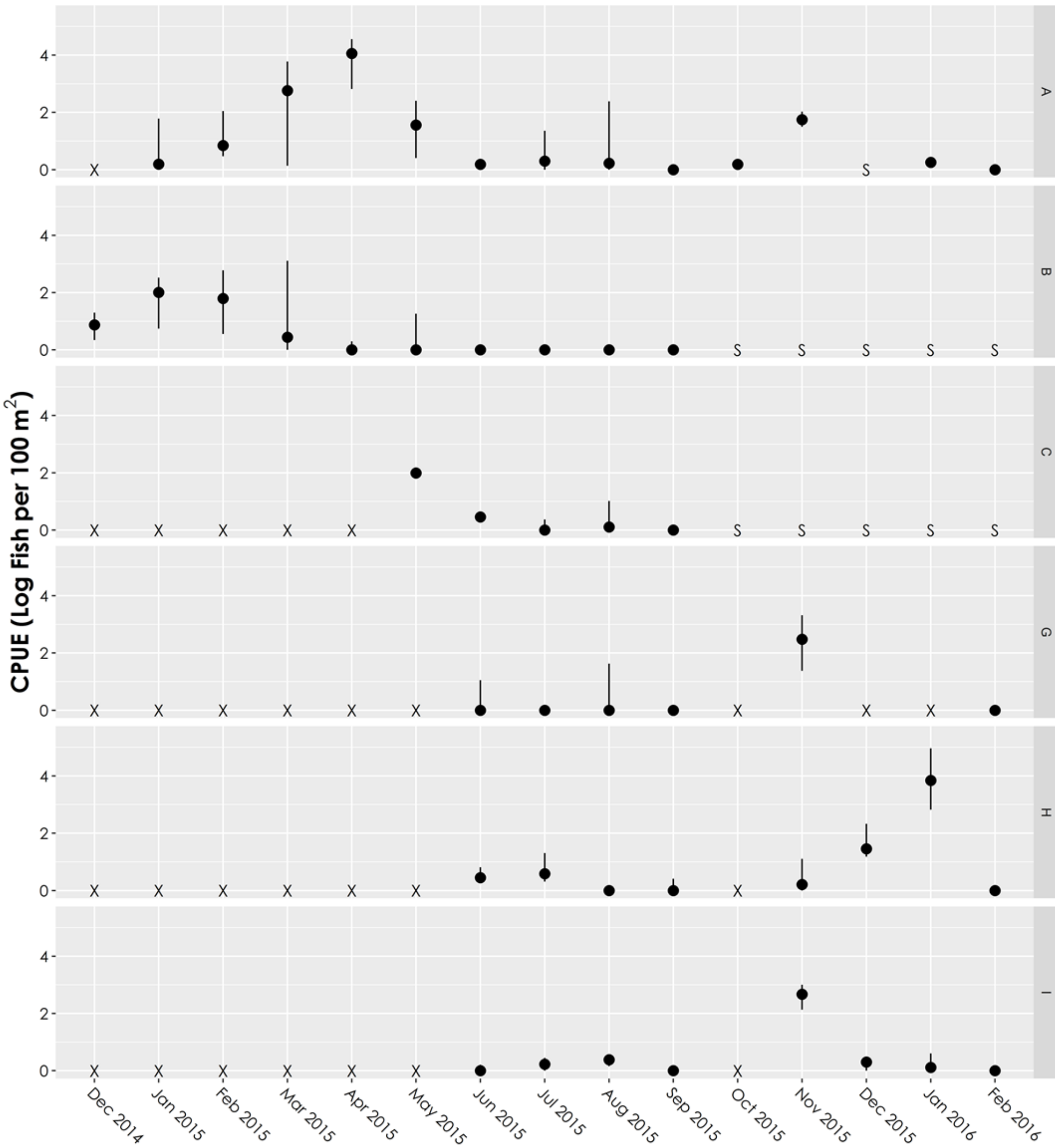



NOTE:
X = did not fish

**Figure 25 Median Catch Per Unit Effort and Interquartile Range of Pacific Herring in Trawl Catches**

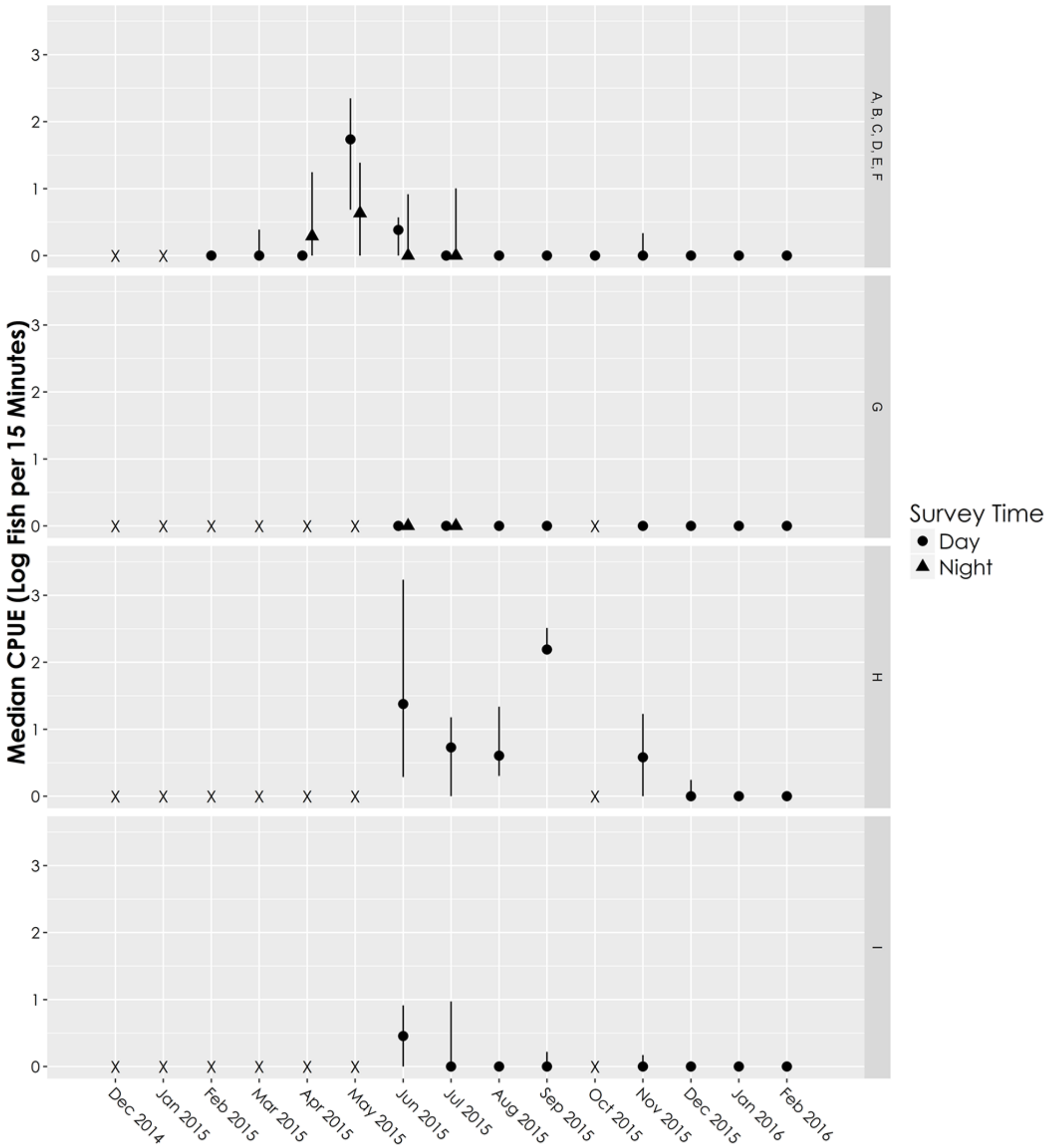
###### 3.3.2.2.2 Surf Smelt

Median CPUE of surf smelt in beach seines were generally highest in winter months (November to April, when measured, i.e., survey areas A, B, G, H, and I, Figure 26). Surf smelt were rarely caught in beach seines during the summer (Appendix B, Section B.2). Trawl CPUE for surf smelt increased during spring and summer months (e.g., Figure 27 panel “A, B, C, D, E, F” and survey area H), with a maximum median catch of 4.7 fish per 15 minutes of trawl (Appendix B, Section B.2). No surf smelt were caught in survey area G and they were only recorded in survey area I in June (those areas were not surveyed from December 2014 through May 2015). No marked differences in surf smelt catch were observed between night and daytime trawl surveys (Figure 27).




NOTE:
X = did not fish
S = Safety concerns; did not fish

**Figure 26 Median Catch Per Unit Effort and Interquartile Range of Surf Smelt in Beach Seine Catches**

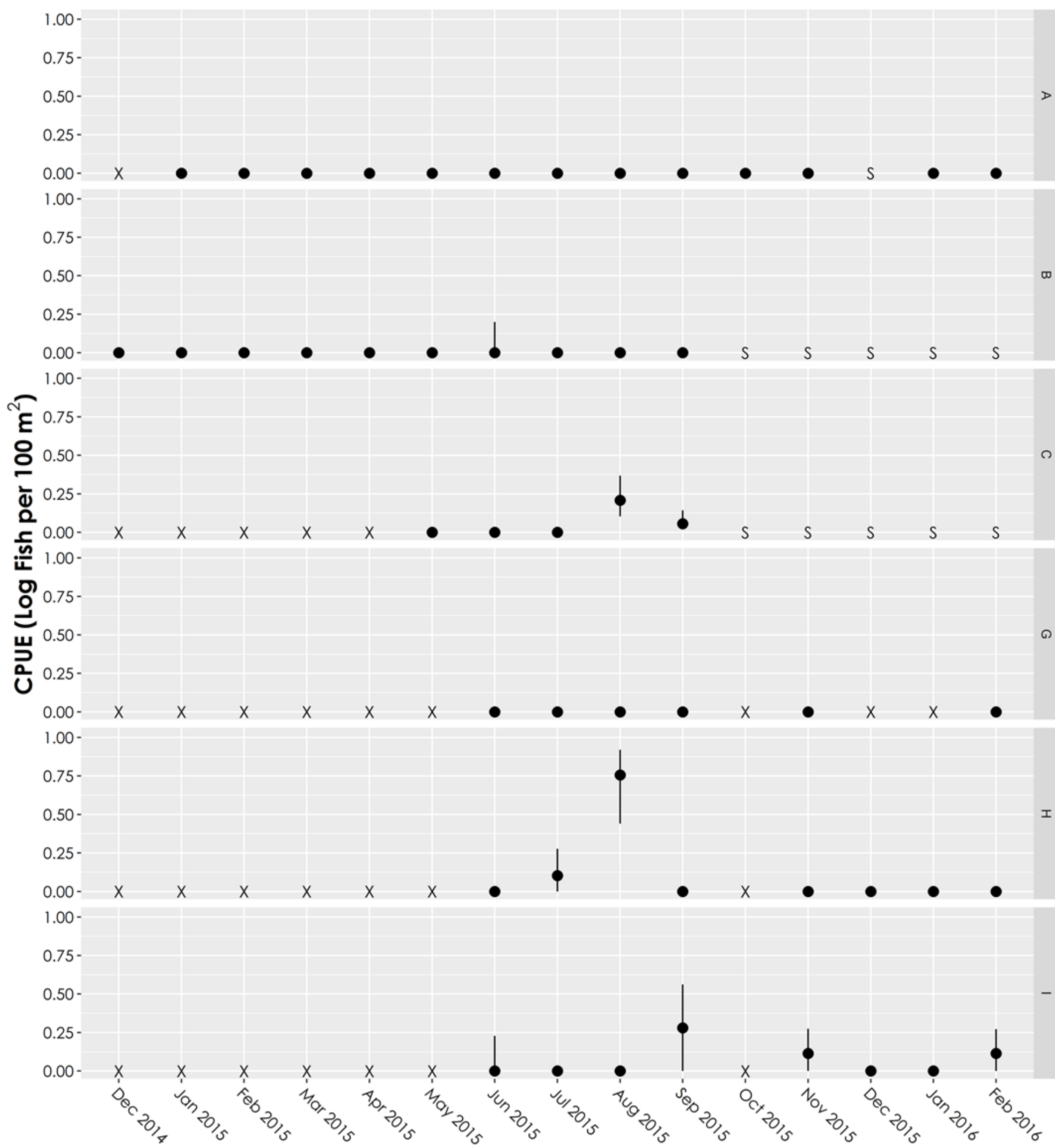



NOTE:
X = did not fish

**Figure 27 Median Catch Per Unit Effort and Interquartile Range of Surf Smelt in Trawl Catches**

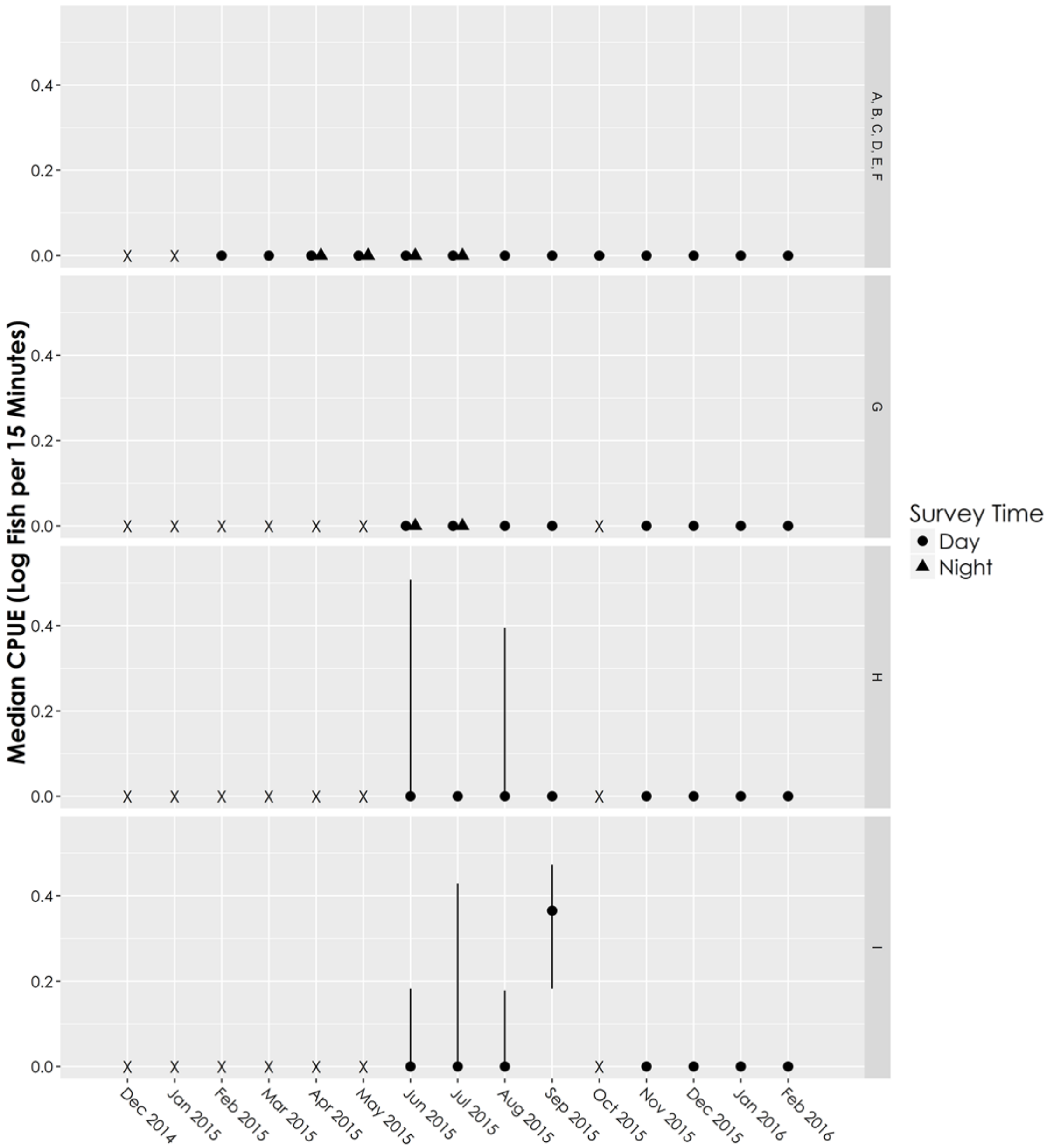
#### 3.3.2.2.3 Chinook Salmon

Chinook salmon beach seine catch data showed low CPUE throughout all survey areas (zero median catch in most months), with a maximum median catch in survey area H in August (1.1 fish per 100 $m^2$, Appendix B, Section B.2). Chinook were recorded in beach seine catches in June through September, and again in November 2015 and February 2016 (Figure 28). Chinook trawl catch increased in September in survey area I (Figure 29), however median catch was fewer than one fish per 15 minutes of trawl (Appendix B, Section B.2). No other patterns were observed within the trawl catch data for Chinook salmon (Figure 29).




NOTE:
X = did not fish
S = Safety concerns; did not fish

**Figure 28 Median Catch Per Unit Effort and Interquartile Range of Chinook Salmon in Beach Seine Catches**

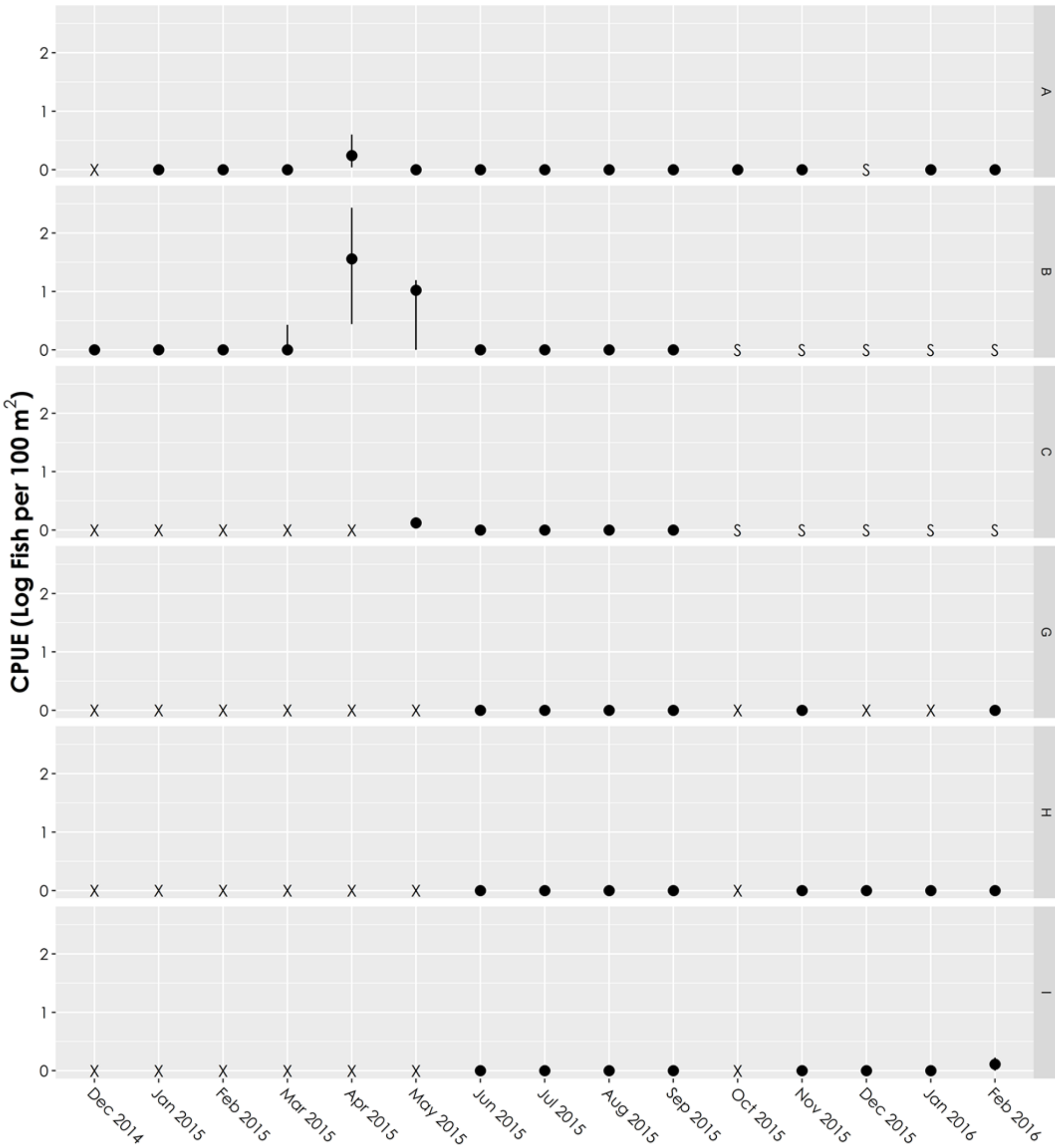



NOTE:
X = did not fish

**Figure 29 Median Catch Per Unit Effort and Interquartile Range of Chinook Salmon in Trawl Catches**

#### 3.3.2.2.4 Chum Salmon

CPUE of chum salmon was low (maximum median catch was fewer than four fish per 100 $m^2$, Appendix B, Section B.2) in beach seines across survey areas A through I. Survey area B had increased CPUE in April and May (Figure 30). Chum salmon were captured in night trawls in May and June (in area "A, B, C, D, E, F") but median and interquartile range were zero for both months, making graphical presentation unnecessary (Appendix B, Section B.2).

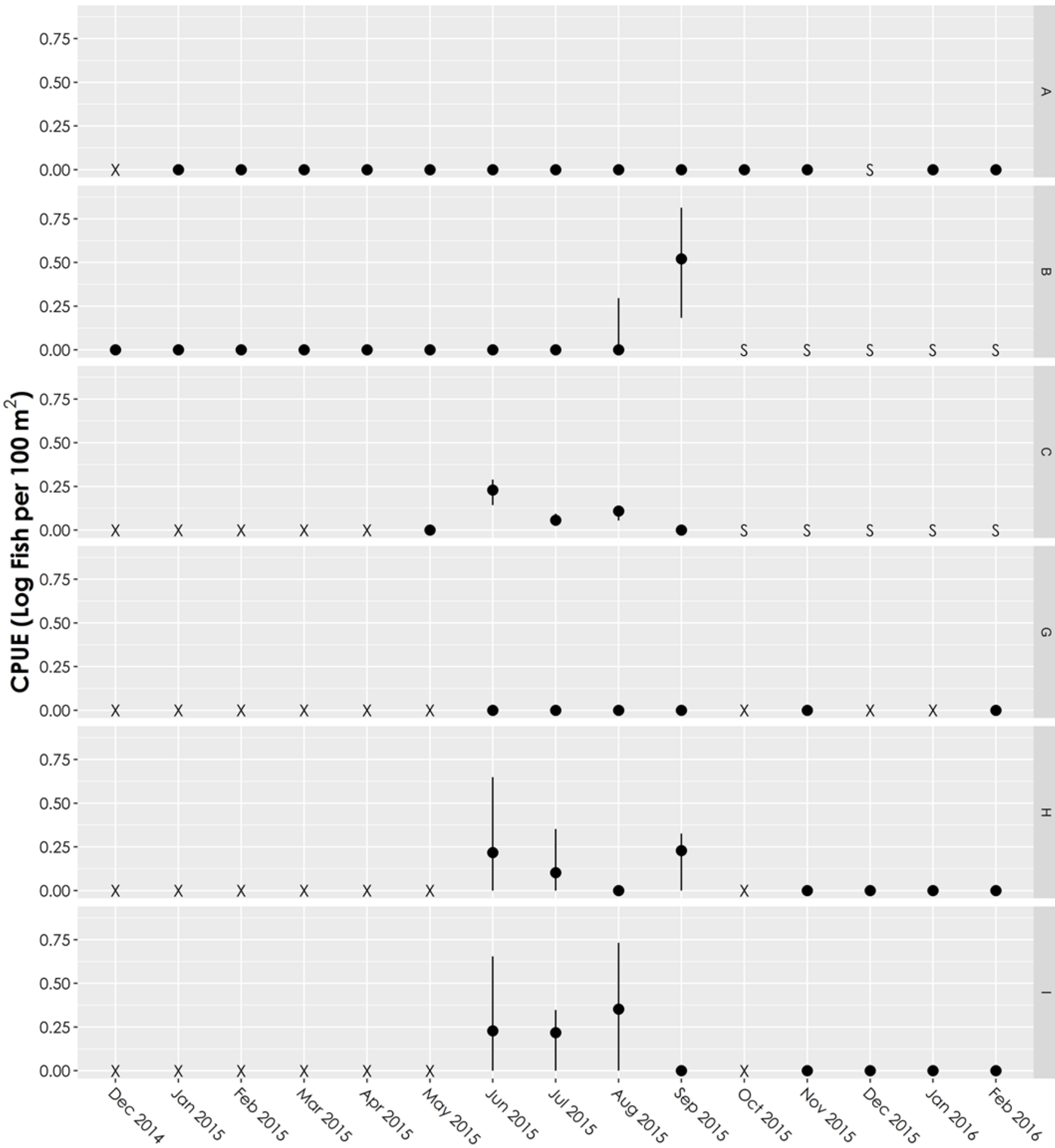



NOTE:
X = did not fish
S = Safety concerns; did not fish

**Figure 30 Median Catch Per Unit Effort and Interquartile Range of Chum Salmon in Beach Seine Catches**

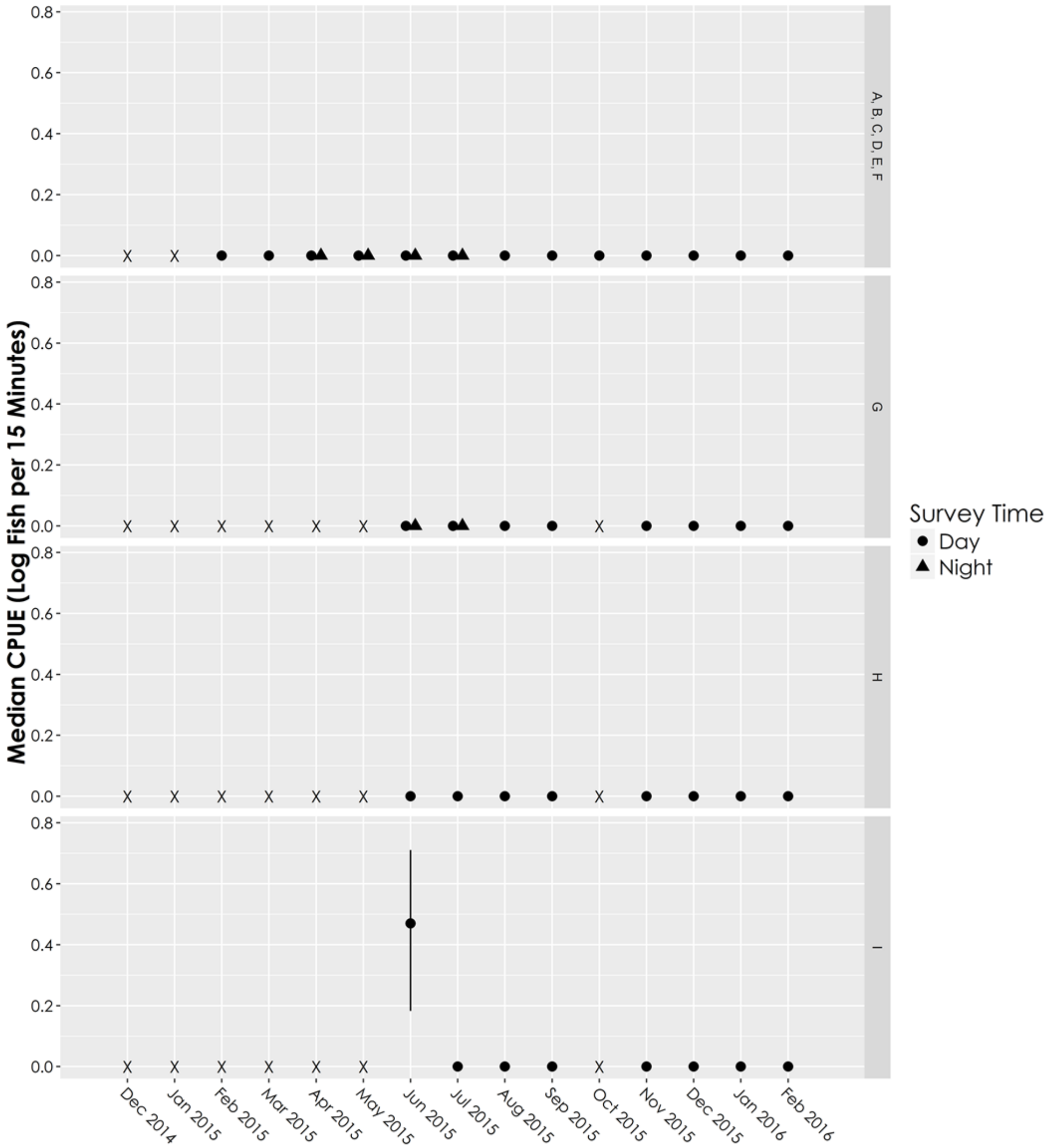
### 3.3.2.2.5 Coho Salmon

Beach seine catches of coho salmon increased in September in survey area B (median catch of 0.8 fish per 100 $m^2$, Appendix B, Section B.2), while survey areas C, H and I showed higher catches between June and September (Figure 31), relative to the other areas and times sampled. Median trawl catch of coho salmon low, except for in survey area I in June (Figure 32, Appendix B, Section B.2).




NOTE:
X = did not fish
S = safety concerns; did not fish

**Figure 31 Median Catch Per Unit Effort and Interquartile Range of Coho Salmon in Beach Seine Catches**

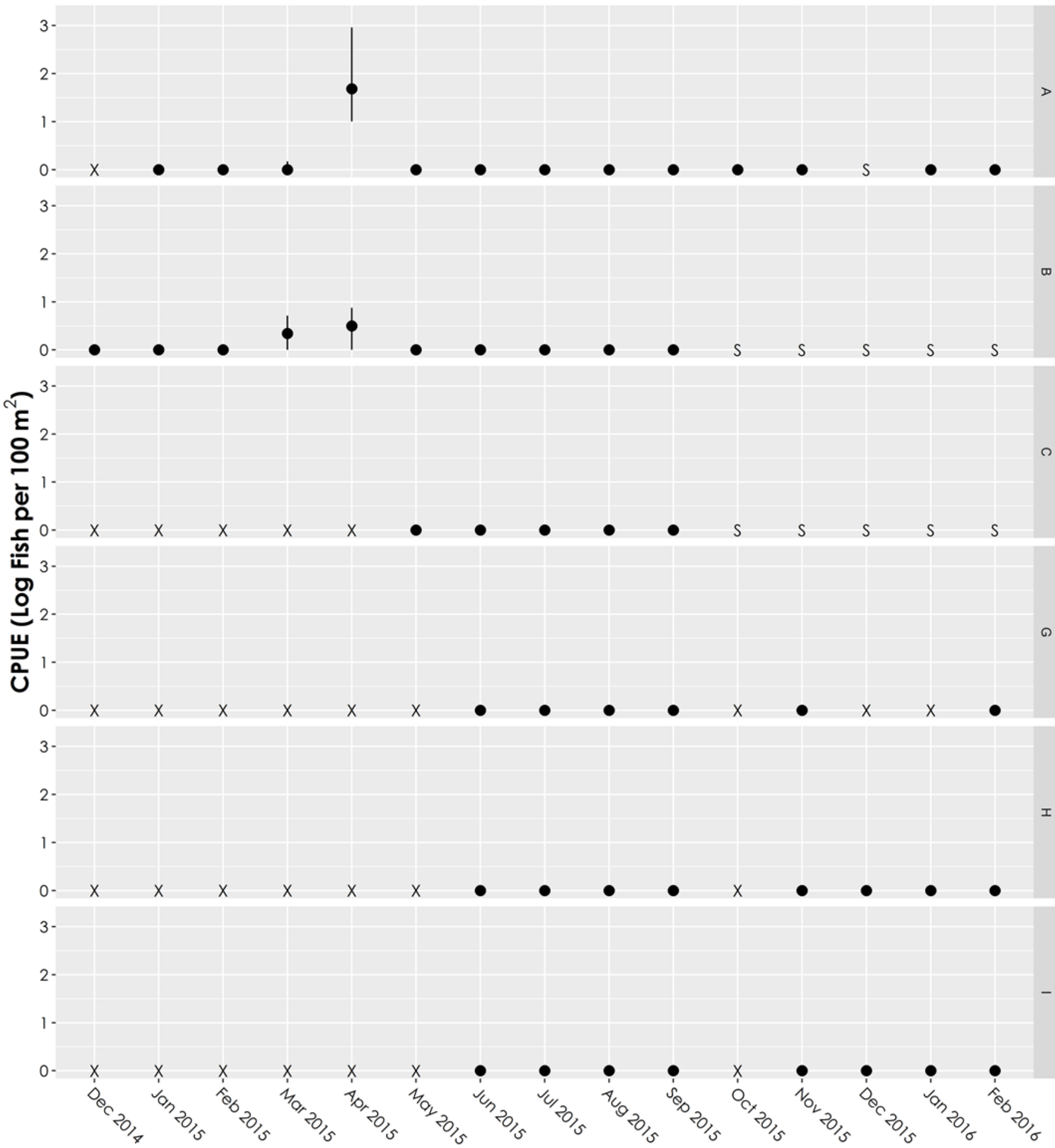



NOTE:
X = did not fish

**Figure 32 Median Catch Per Unit Effort and Interquartile Range of Coho Salmon in Trawl Catches**

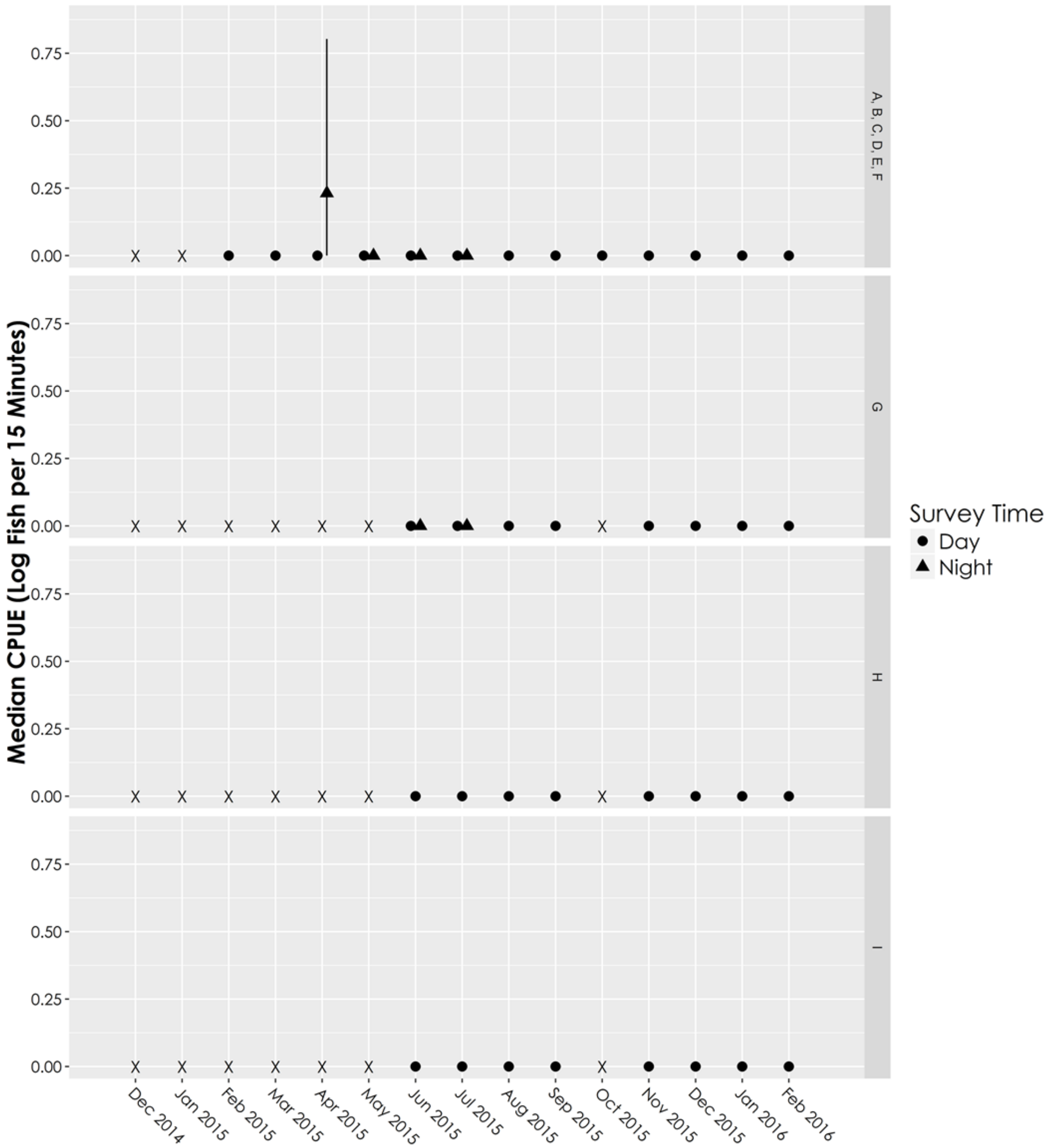
#### 3.3.2.2.6 Pink Salmon

CPUE of pink salmon in beach seine catches was generally low but higher catches were recorded in survey area A in April 2015 (Figure 33, median CPUE 4.9 fish per 100 $m^2$, Appendix B, Section B.2). CPUE of pink salmon in trawl catches was also relatively low, with the exception of some night time catches in April (in survey area "A, B, C, D, E, F", Figure 34, Appendix B, Section B.2).




NOTE:
X = did not fish
S = Safety concerns; did not fish

**Figure 33 Median Catch Per Unit Effort and Interquartile Range of Pink Salmon in Beach Seine Catches**

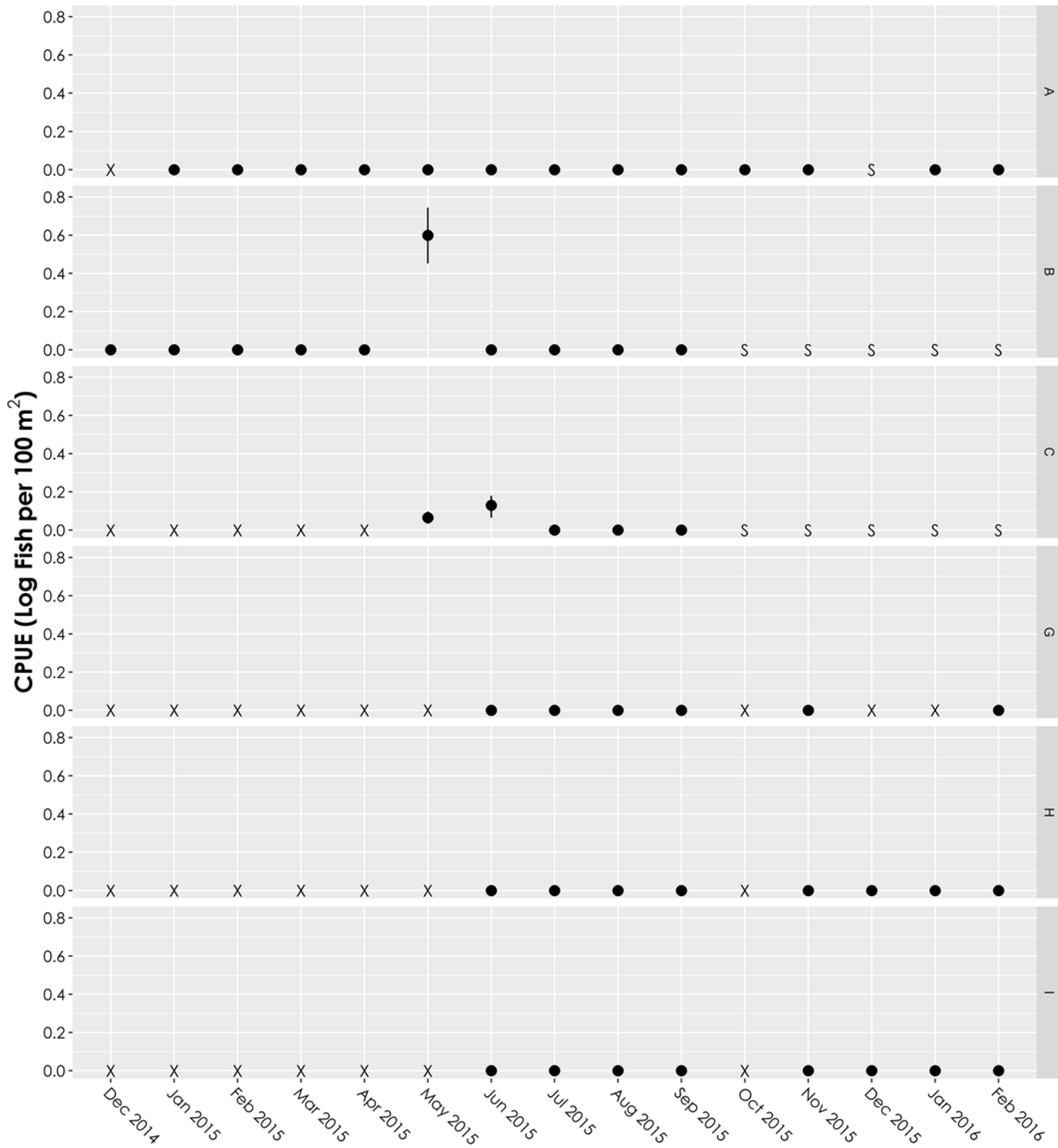



NOTE:
X = did not fish

**Figure 34 Median Catch Per Unit Effort and Interquartile Range of Pink Salmon in Trawl Catches**

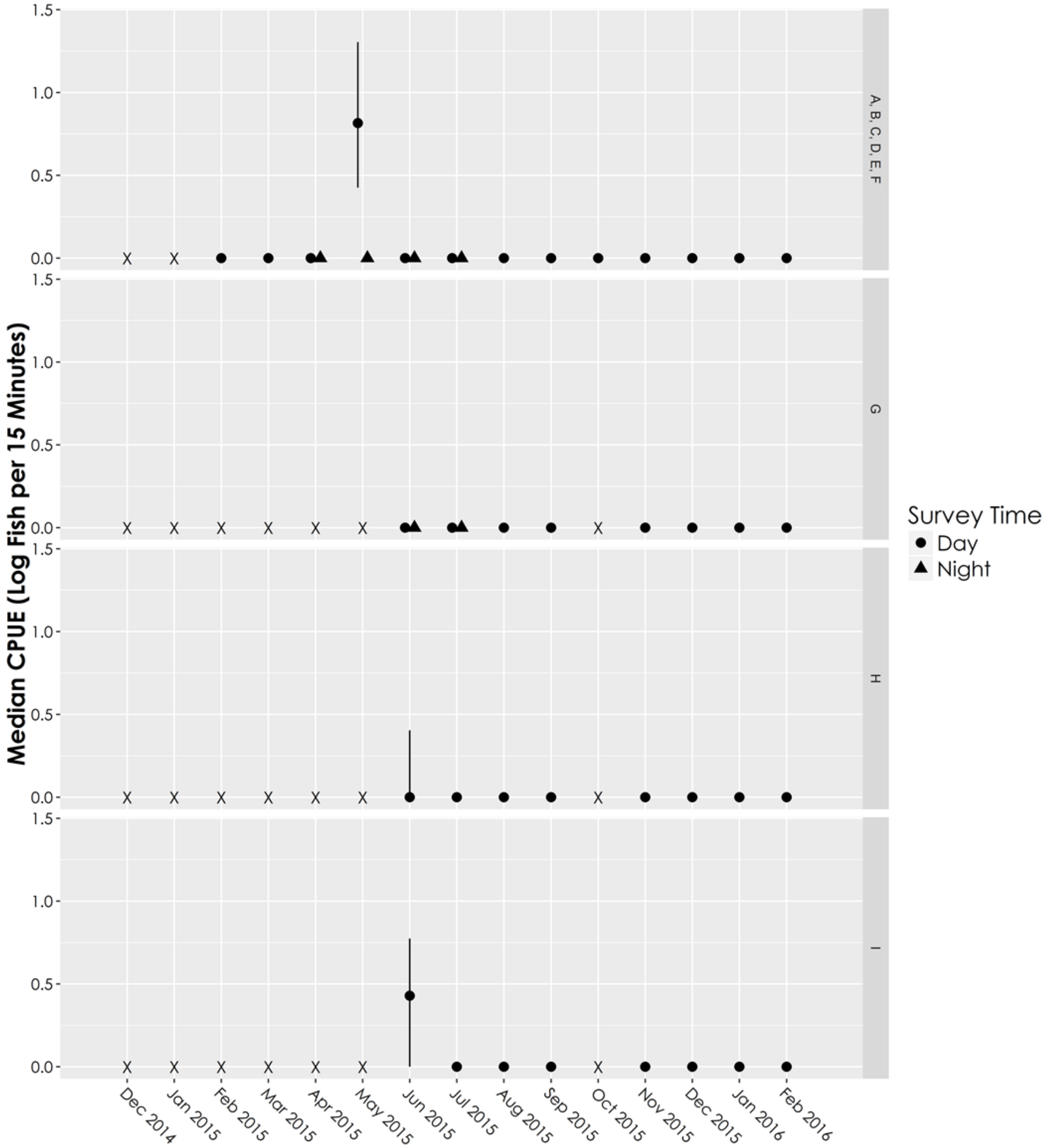
#### 3.3.2.2.7 Sockeye Salmon

Sockeye salmon were predominantly caught in beach seines in May (survey area B) and June (survey area C) (Figure 35). Similarly, sockeye salmon were most abundant in trawl catches in May and June within survey areas A through F and in June within survey area I, although monthly median catches were typically less than two fish per 15 minutes of trawl, Appendix B, Section B.2, Figure 36).




NOTE:
X = did not fish
S = safety concerns; did not fish

**Figure 35 Median Catch Per Unit Effort and Interquartile Range of Sockeye Salmon in Beach Seine Catches**

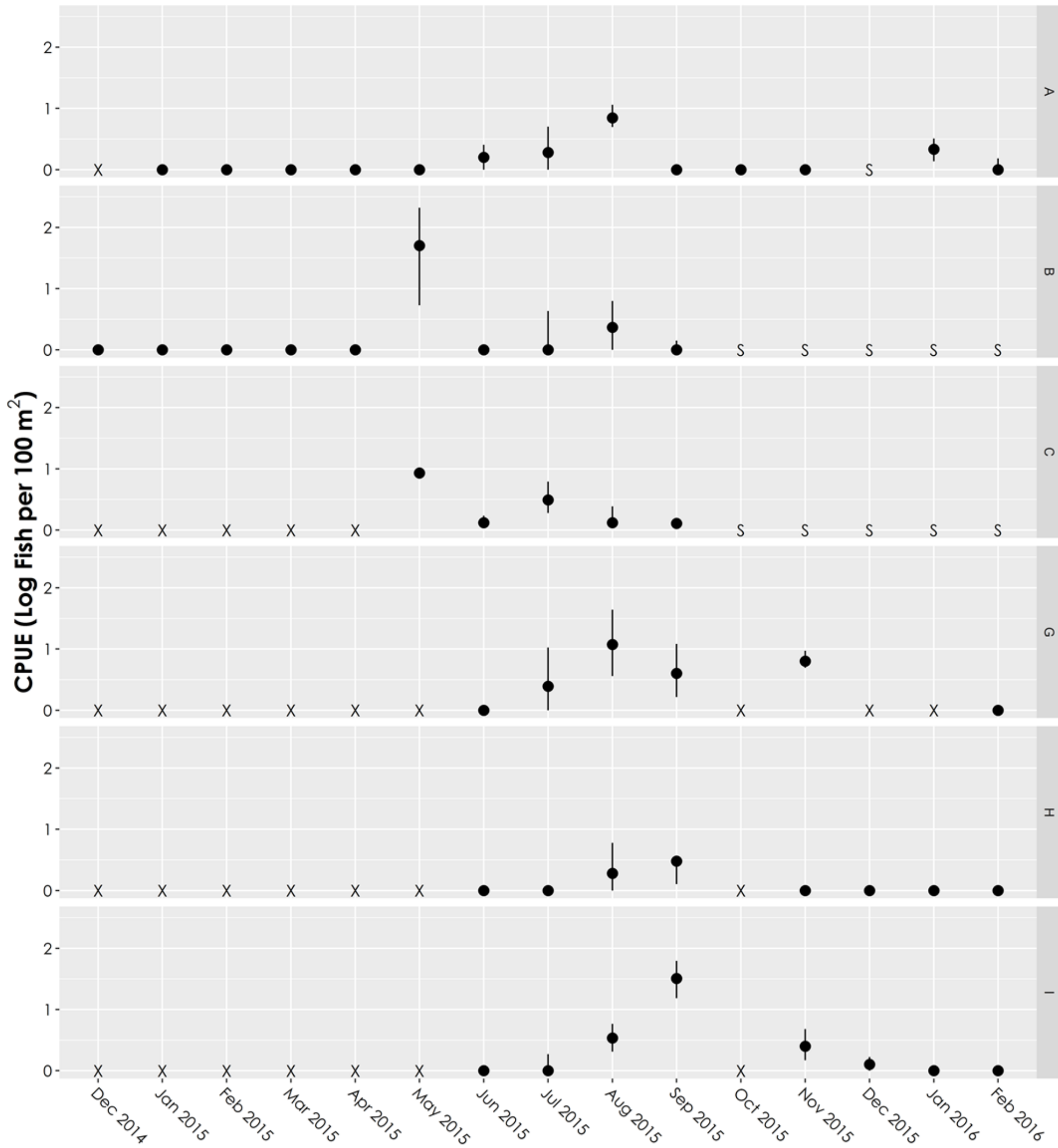



NOTE:
X = did not fish

**Figure 36 Median Catch Per Unit Effort and Interquartile Range of Sockeye Salmon in Trawl Catches**

#### 3.3.2.2.8 English Sole

Median English sole beach seine catches generally increased July through September, with high numbers also observed in survey area B in May and survey areas G and I in November (Figure 37, Appendix B, Section B.2).English sole were only incidentally captured during trawls. Median and interquartile range of trawl CPUE in all months, across all areas, was zero (Appendix B, Section B.2).

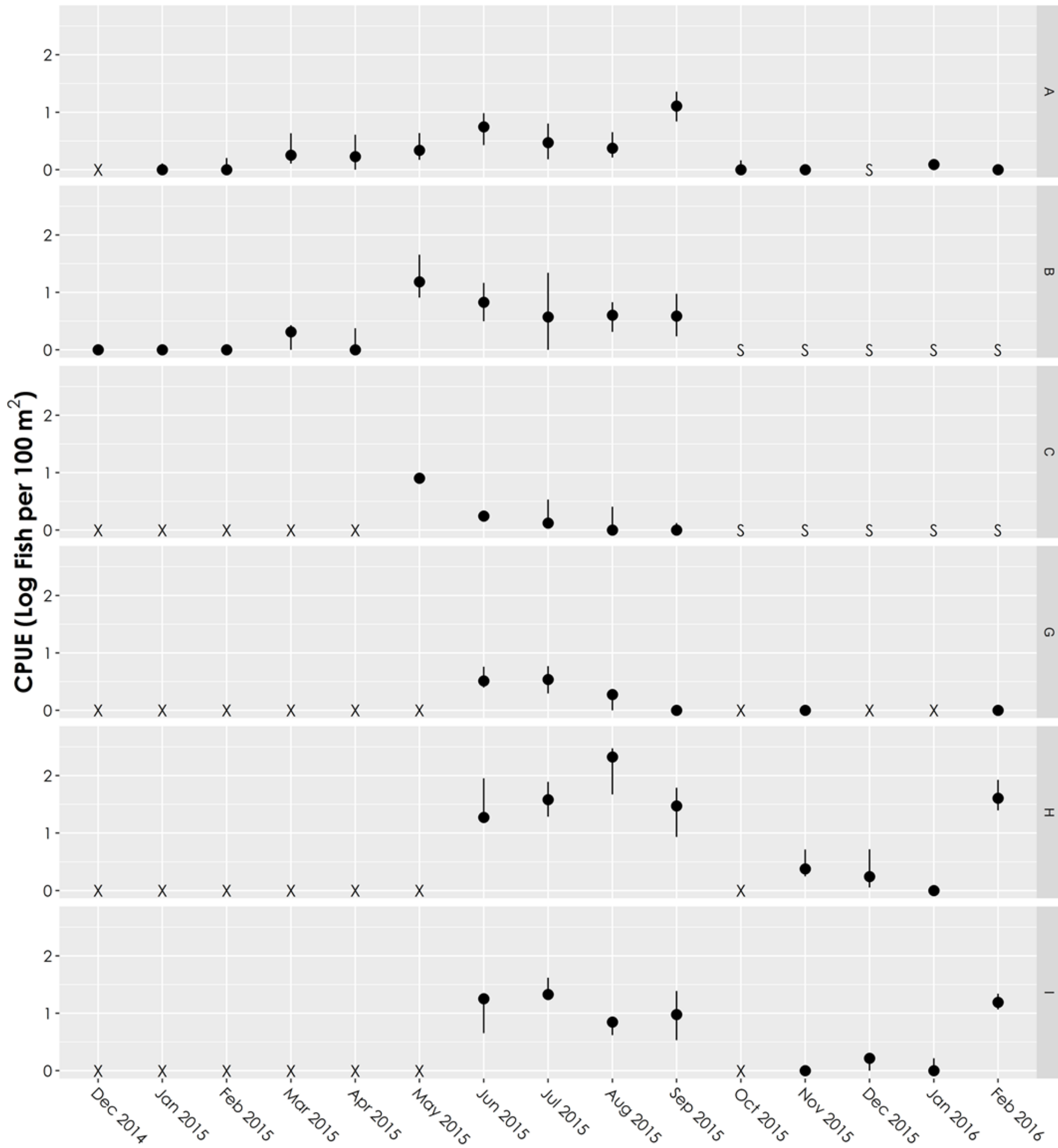



NOTE:
X = did not fish
S = Safety concerns; did not fish

**Figure 37 Median Catch Per Unit Effort and Interquartile Range of English Sole in Beach Seine Catches**

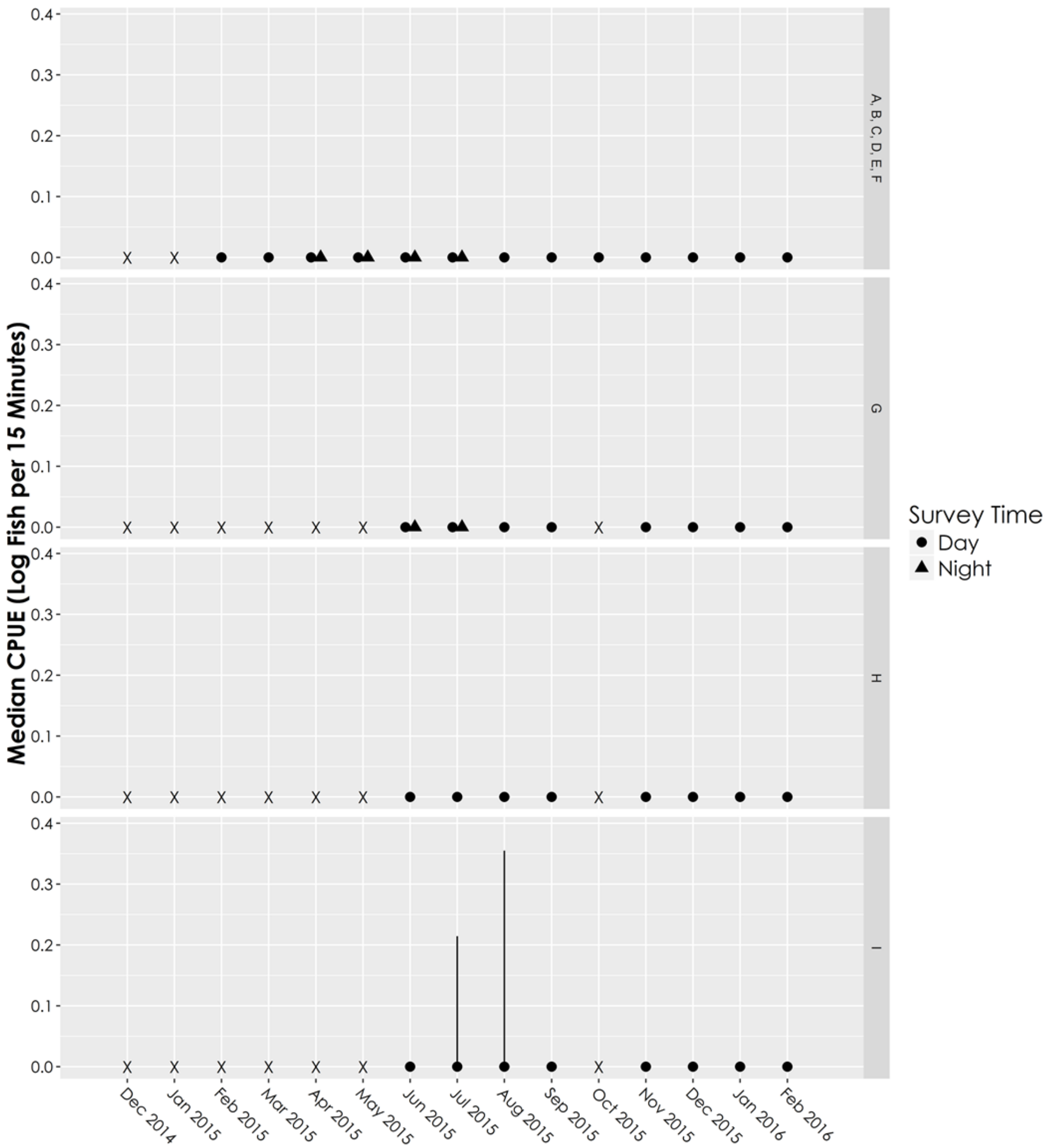
#### 3.3.2.2.9 Starry Flounder

Starry flounder were consistently caught throughout the survey period and in most survey areas (median catch up to 9.2 fish per 100 $m^2$, Appendix B, Section B.2) (Figure 38). The highest relative starry flounder CPUE was observed in survey area H in the summer months, with another peak in February. Catch also increased during summer and fall months for most survey areas. Starry flounder were incidentally caught in trawl catches from May through August (Figure 39, Appendix B, Section B.2).




NOTE:
X = did not fish
S = Safety concerns; did not fish

**Figure 38 Median Catch Per Unit Effort and Interquartile Range of Starry Flounder in Beach Seine Catches**

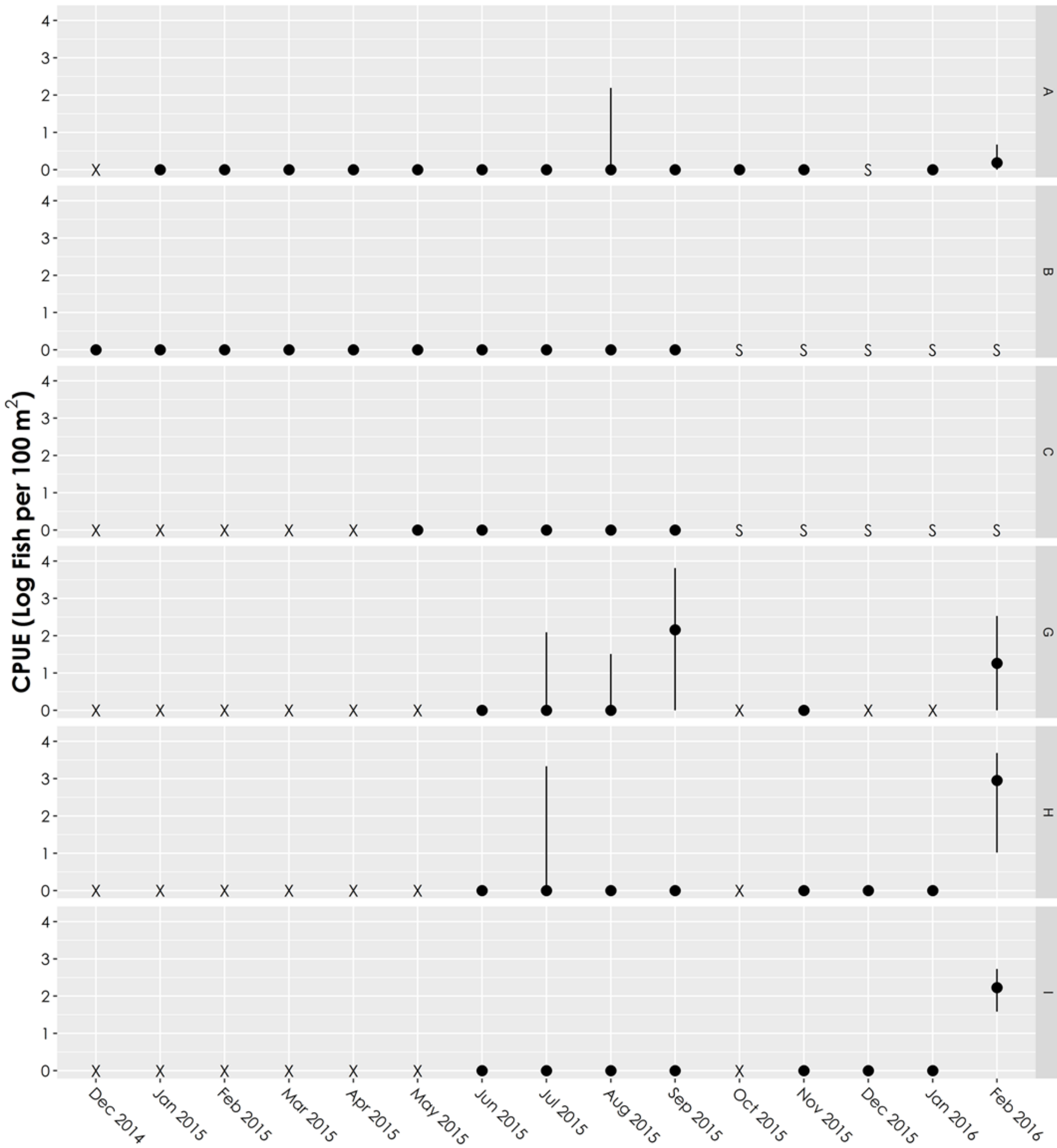



NOTE:
X = did not fish

**Figure 39 Median Catch Per Unit Effort and Interquartile Range of Starry Flounder in Trawl Catches**

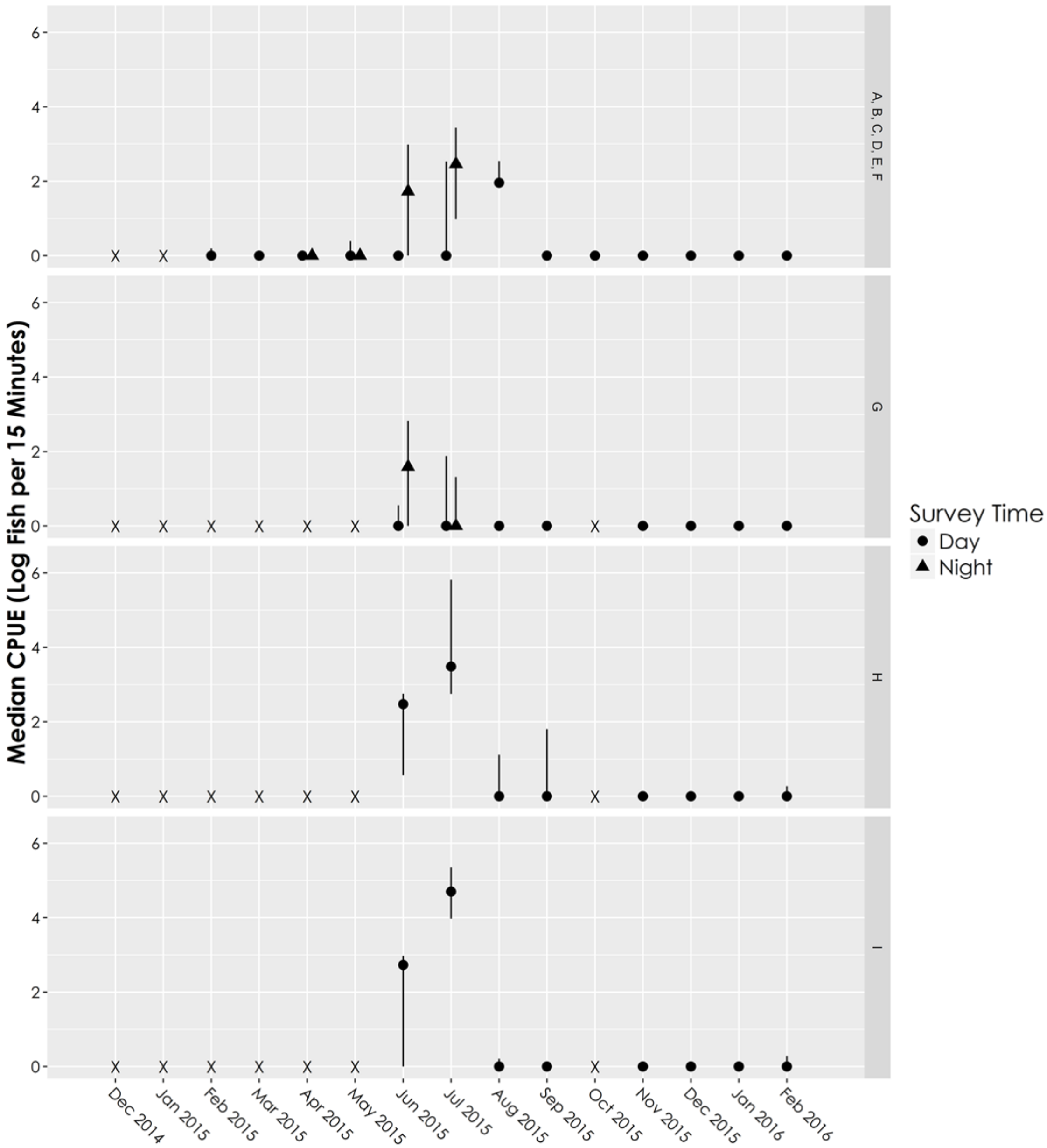
#### 3.3.2.2.10 Fish Larvae

Although median CPUE of fish larvae in beach seines was typically low, large catches were occasionally encountered in areas A, G, and H in the summer months (Appendix B, Section B.2). Relatively large larval fish CPUE was also noted in survey areas G, H, and I in February (Figure 40). Fish larvae were caught in trawls between June and September in all survey areas (Figure 41, Appendix B, Section B.2).




NOTE:
X = did not fish
S = Safety concerns; did not fish

**Figure 40 Median Catch Per Unit Effort and Interquartile Range of Fish Larvae in Beach Seine Catches**

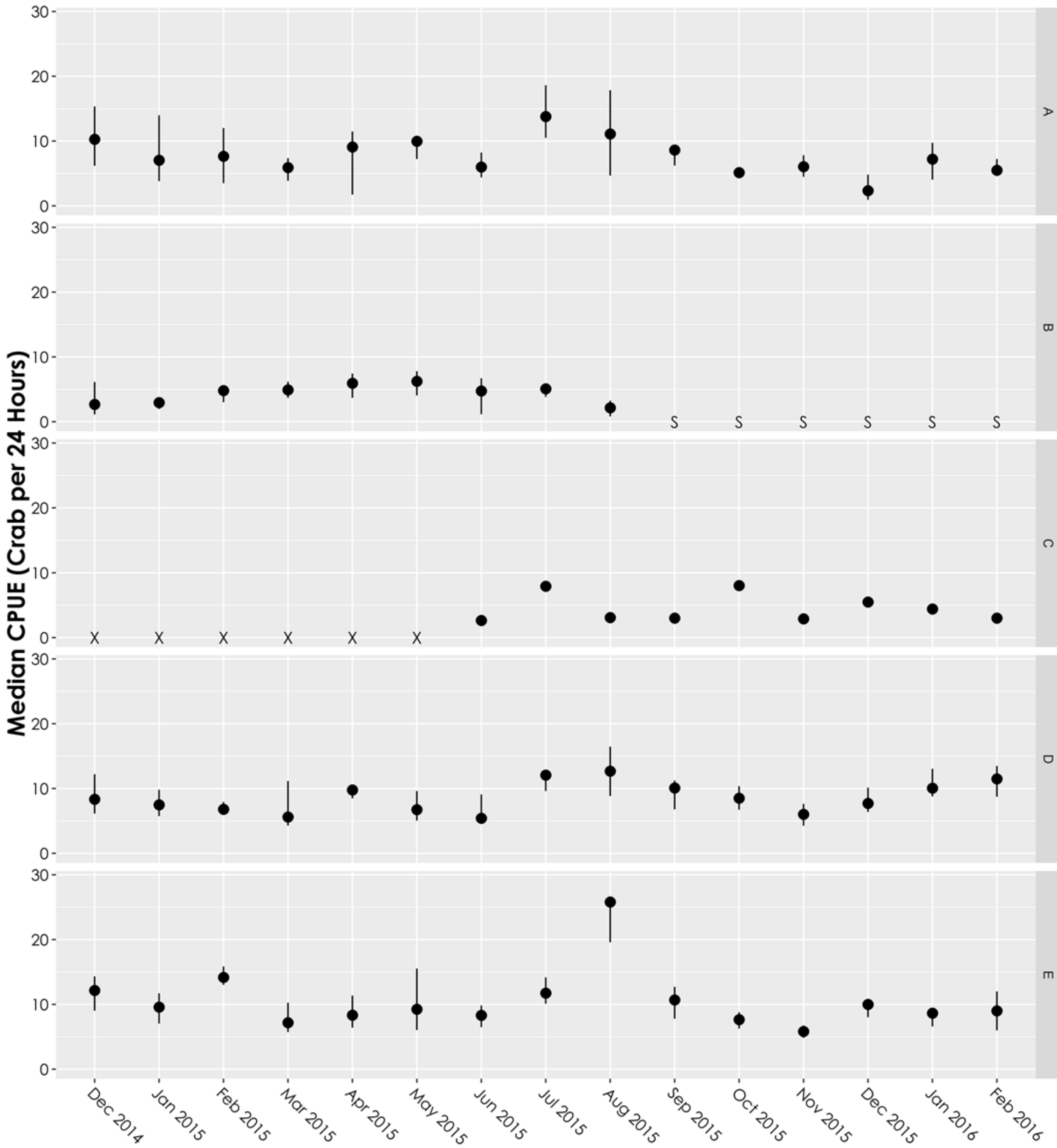



NOTE:
X = did not fish

**Figure 41 Median Catch Per Unit Effort and Interquartile Range of Fish Larvae in Trawl Catches**

### 3.3.2.2.11 Dungeness Crab

Dungeness crab catch varied across all survey areas, from 2 to 26 crabs per 24 hours of soak time, with no clearly discernable seasonality (Figure 42). Survey areas A and D showed relative consistent catches between 5 and 10 crabs per 24 hours of soak time throughout the year, whereas survey area E fluctuated around 10 but with a distinct high observed in August of over 25 crabs per 24 hours of soak time. Catches in survey areas B and C were consistently below 10.




NOTE:
X = did not fish
S = safety concerns; did not fish

**Figure 42 Median Catch Per Unit Effort and Interquartile Range of Dungeness Crab in Trap Gear**

## 3.3.3 Demographics

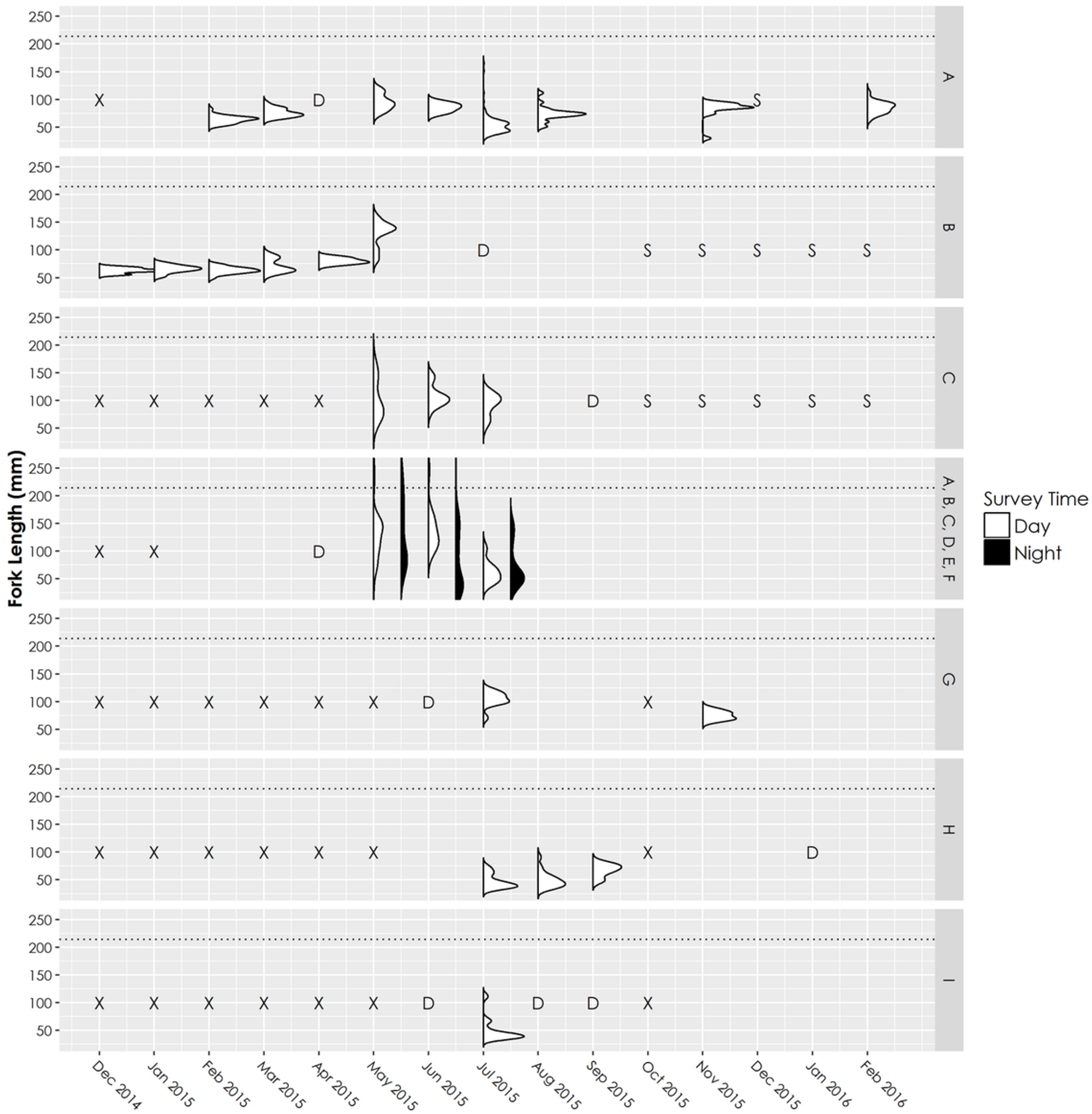
The fishing techniques used in the Program were not selected to equally target all fish and invertebrate species' life stages given the changes in species growth and habitat selection over time. For example, it is not surprising that adult Pacific salmon were not caught, given that commercial salmon fishery-sized gear or type (large purse seines, gillnets, trolling) were not used. Similarly, commercial crab traps are not designed (even with modifications to the escape hatches) to catch small sized crab. Given the types of fishing gear used and the different times sampled in different survey areas, the demographic size frequency data may not be comprehensive for some species with large size range. In contrast, the gear types used are expected to have effectively sampled the full range of sizes for life stages of Pacific herring, surf smelt, salmon smolts, and other smaller size life stages and species.

### 3.3.3.1 Fork length

#### 3.3.3.1.1 Pacific Herring

Pacific herring ranged from 30 to 257 mm (fork length). The majority of herring were immature juveniles between 49 and 93 mm, as demonstrated by the frequency distribution, interquartile range, and length at which 50% of the population are mature (i.e., 214 mm), shown as the dotted line in Figure 43 (Lassuy and Moran 1989; FishBase 2016). A small proportion of mature adults was caught in May and June 2015 (inclusive; see panel "A, B, C, D, E, F,").

The size frequency data indicated that survey areas were often occupied by larval or juvenile herring throughout much of the year. Low numbers of adult herring were observed in the survey region during the summer growing season. These observations coincided with a small herring spawn on marine vegetation patches in survey area F in late May (see Appendix D – Incidental Sightings for further discussion).



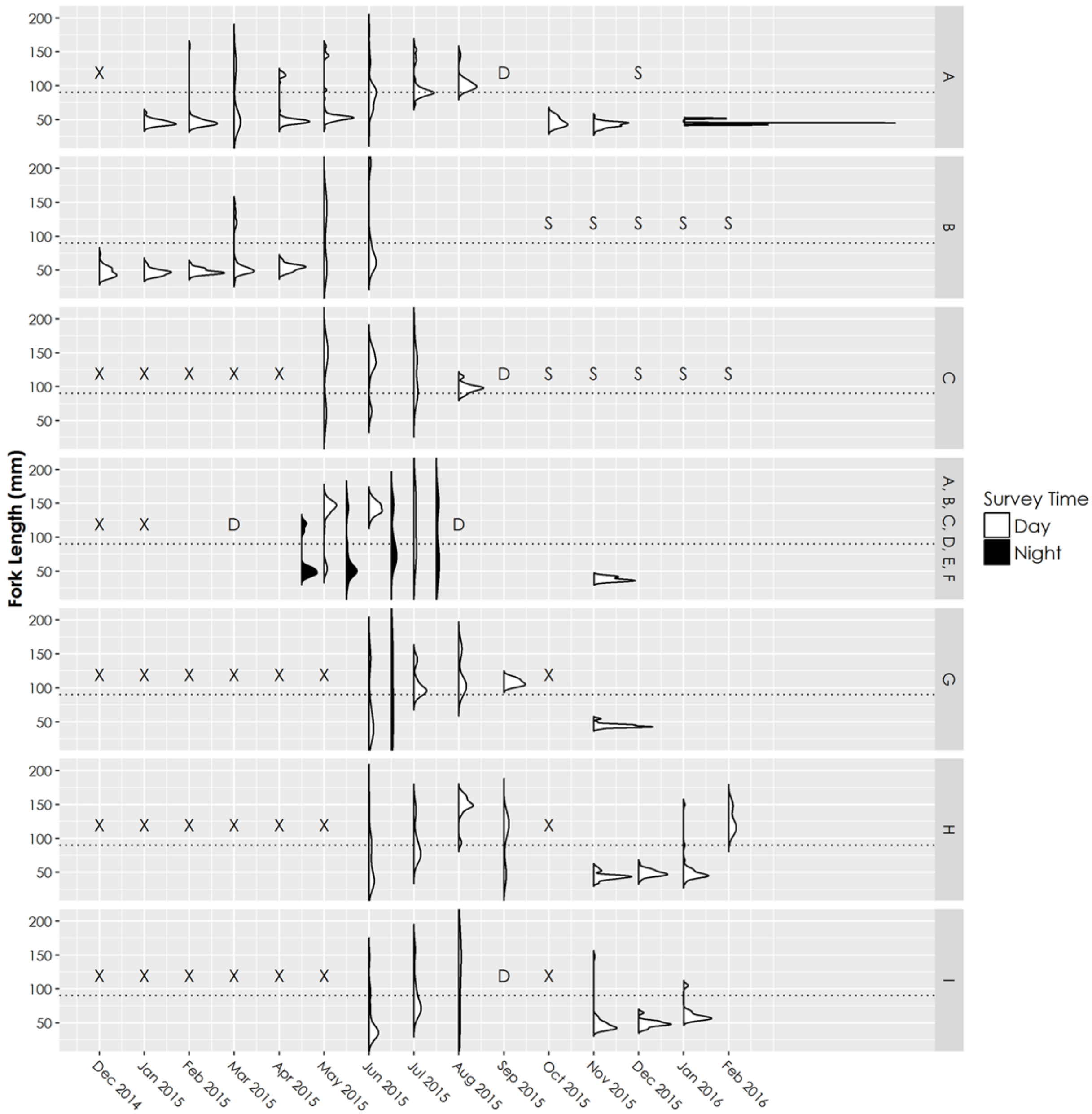

NOTE:

Blank entries = area fished but zero fish caught.
X = did not fish.
D = data deficient; cannot calculate kernel density (i.e., fewer than 3 data points).
S = safety concerns; did not fish.
Dotted line = length at which 50% of the population is mature (214 mm).

## Figure 43 Size Frequency Distribution for Pacific Herring

### 3.3.3.1.2 Surf Smelt

Surf smelt ranged from 40 to 208 mm (fork length) (Figure 44). Fish under 40 mm were hard to identify in the field and were conservatively classified as "fish larvae". The majority of surf smelt were between 41 and 105 mm, and were immature fish (length at which 50% of population are mature = 90 mm; shown as a dotted line on Figure 44) (FishBase 2016). Mature surf smelt were caught in low numbers in most months and more frequently between May and August. In British Columbia, size at maturity for surf smelt is poorly defined, but individuals greater than 140 mm in length are generally thought to be mature (Therriault et al. 2002).

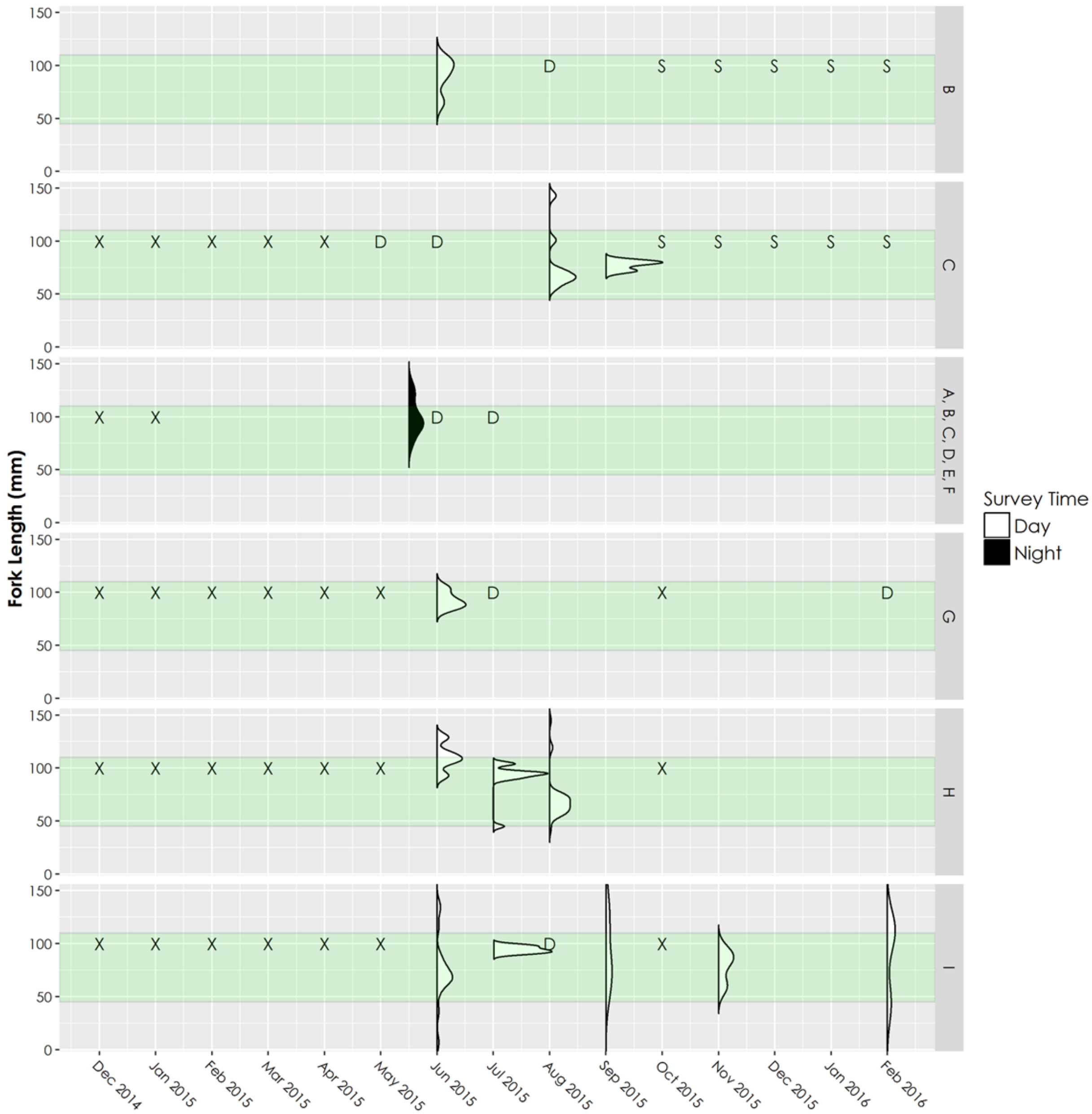



NOTE: Blank entries = area fished but zero fish caught.
X = did not fish.
D = data deficient; cannot calculate kernel density (i.e., fewer than 3 data points).
S = safety concerns; did not fish.
Dotted line = length at which 50% of the population is mature (90 mm).
Panel A – Jan 2016 = x-axis extended to accommodate extremely peaked kernel density.

**Figure 44 Size Frequency Distribution for Surf Smelt**

#### 3.3.3.1.3 Chinook Salmon

Chinook salmon caught ranged from 36 to 149 mm (fork length), with a higher proportion between 66 and 101 mm (Figure 45). In some instances in both survey area and month, multiple peaks were observed with limited size ranges for Chinook smolts. For example, survey area I in June 2015 had a small peak above 100 mm and a larger peak at 70 to 80 mm. The size range of Chinook observed indicates the potential presence of two age classes (one and two year old smolts) in the survey region (McPhail 2007; Quinn 2005). Smaller one year old Chinook smolts often range from 45 to 110 mm, while two year old smolts are often larger than 110 mm. The presence, although in low numbers, of juvenile Chinook in survey area I in September and February also suggests that some Chinook may use the outer Skeena estuary for rearing (Ocean Ecology 2014).



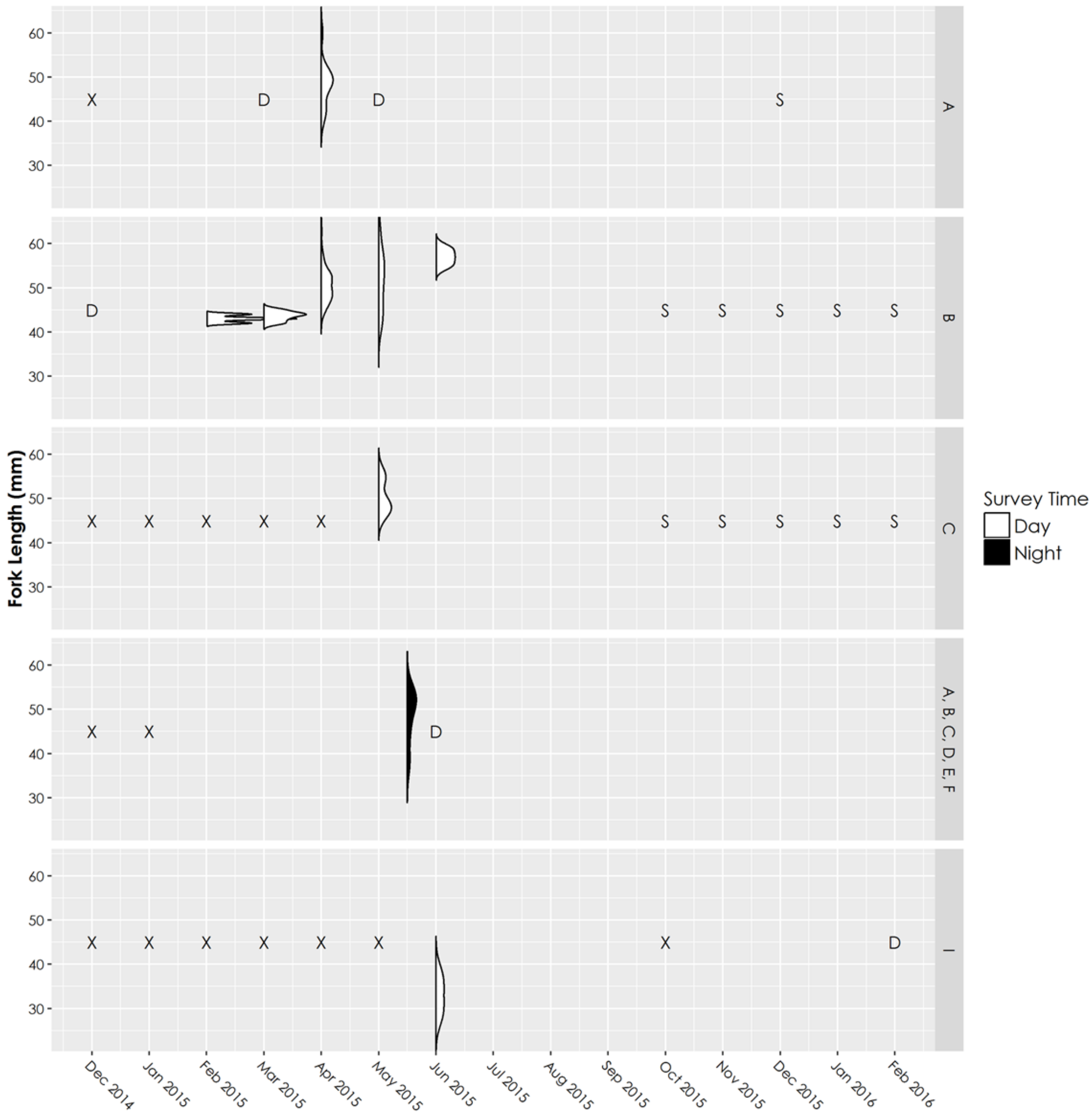

NOTE:

Blank entries = area fished but zero fish caught.
X = did not fish.
D = data deficient; cannot calculate kernel density (i.e., fewer than 3 data points).
S = safety concerns; did not fish.
Green rectangle = size range at which Chinook smolts transition to yearling smolts (45 – 110 mm).

**Figure 45 Size Frequency Distribution for Chinook Salmon**

#### 3.3.3.1.4 Chum Salmon

Chum salmon ranged from 28 to 87 mm (fork length), with the majority of fish between 45 and 53 mm (Figure 46). The chum salmon were identified as smolts during seaward migrations from freshwater (FishBase 2016; Lamb and Edgell 2010; McPhail 2007; Quinn 2005). Chum salmon smolts were caught from February to June 2016 in survey areas A, B, C, D, I, and trawls across survey areas A, B, C, D, E, F. No legal-sized chum salmon (greater than 30 cm) were caught during the surveys.




NOTE:

Blank entries = area fished but zero fish caught.
X = did not fish.
D = data deficient; cannot calculate kernel density (i.e., fewer than 3 data points).
S = safety concerns; did not fish.

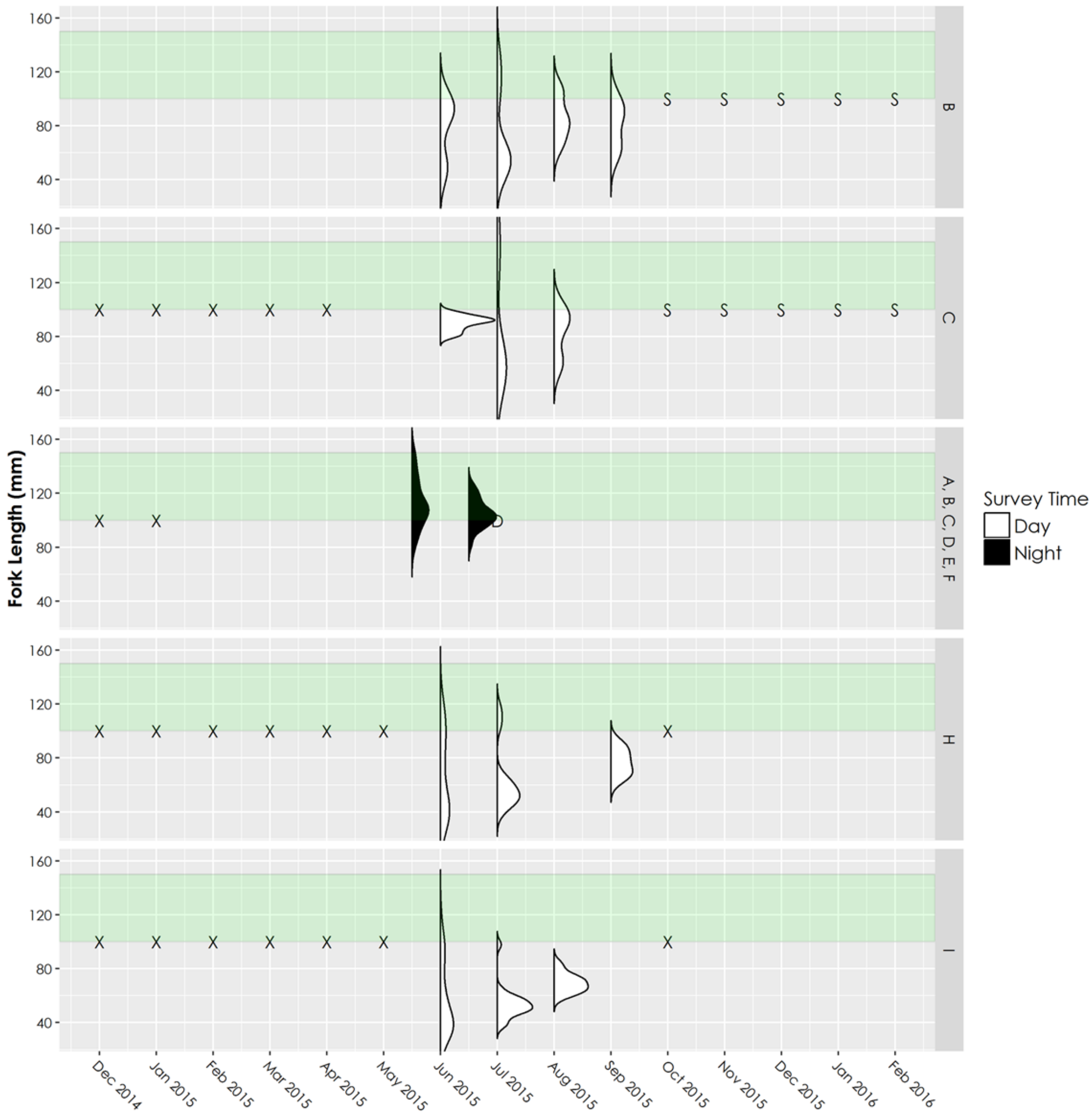
**Figure 46 Size Frequency Distribution for Chum Salmon**

### 3.3.3.1.5 Coho Salmon

Coho salmon ranged from 32 to 162 mm (fork length), with the majority of fish between 52 and 100 mm (Figure 47). The coho salmon were identified as smolts during seaward migrations from freshwater (McPhail 2007; Quinn 2005).

However, a second life stage (yearling smolts, ranging from 100 to 150 mm), may also have been caught (see the green rectangle on

Figure 47 which indicates the size at which coho transition to yearling smolts; McPhail 2007; Quinn 2005). Larger coho smolts (e.g., greater than 125 mm) were observed in areas B and C in August and September, but not in survey areas H and I. Coho were caught from May to September 2015 in survey areas B, C, H, I, and in June and July in trawls across survey areas A, B, C, D, E, F.

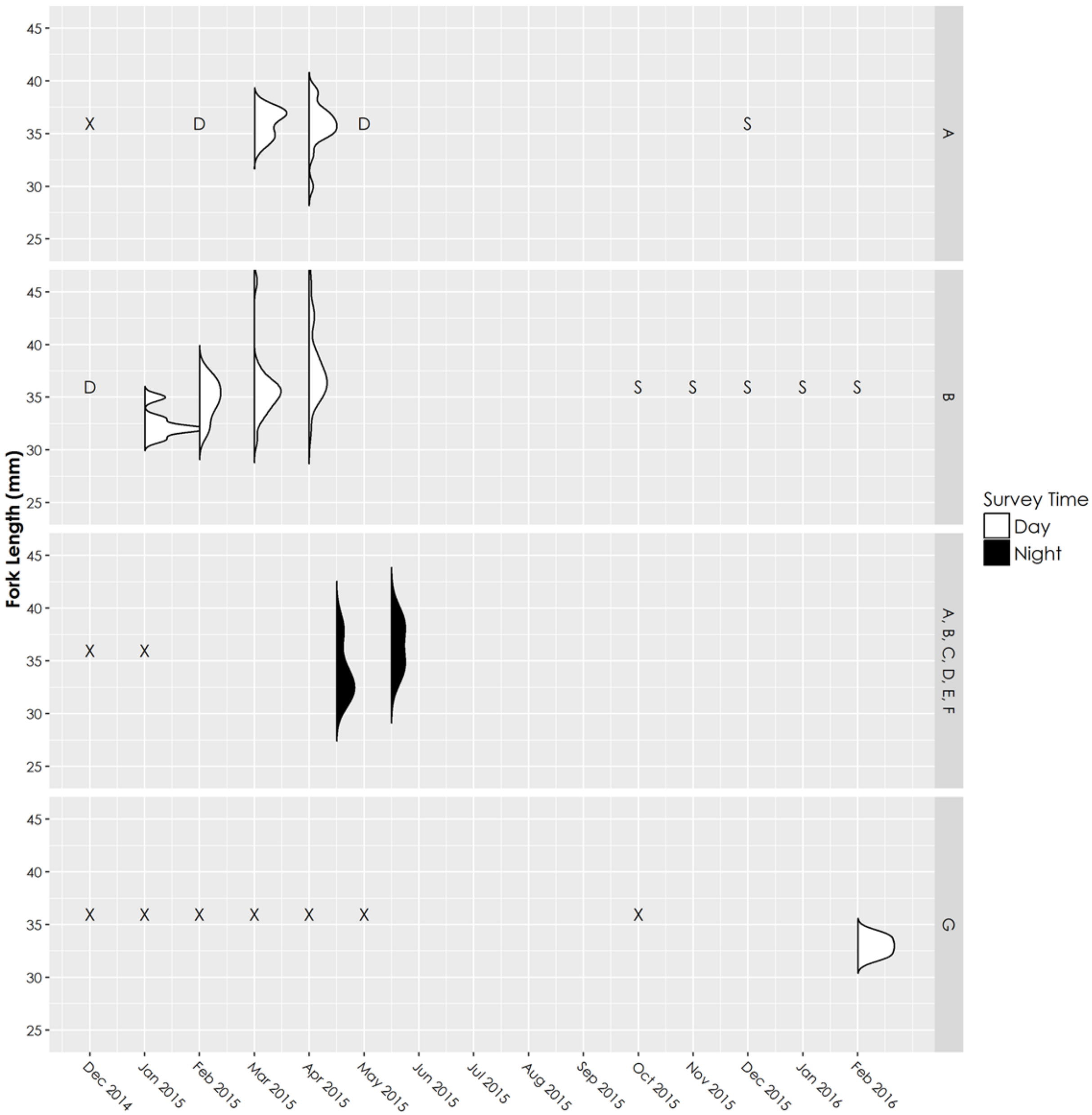



NOTE:
Blank entries = area fished but zero fish caught.
X = did not fish.
D = data deficient; cannot calculate kernel density (i.e., fewer than 3 data points).
S = safety concerns; did not fish.
Green rectangle = size range at which coho transition to yearling smolts (100 – 150 mm).

**Figure 47 Size Frequency Distribution for Coho Salmon**

#### 3.3.3.1.6 Pink Salmon

Pink salmon had a small size range, with fork length ranging from 30 to 46 mm, with the majority of fish from 34 to 37 mm (Figure 48). All pink salmon captured were identified as smolts during seaward migrations from freshwater (McPhail 2007; Quinn 2005). Smolt migrations in the survey areas were observed from January to June.



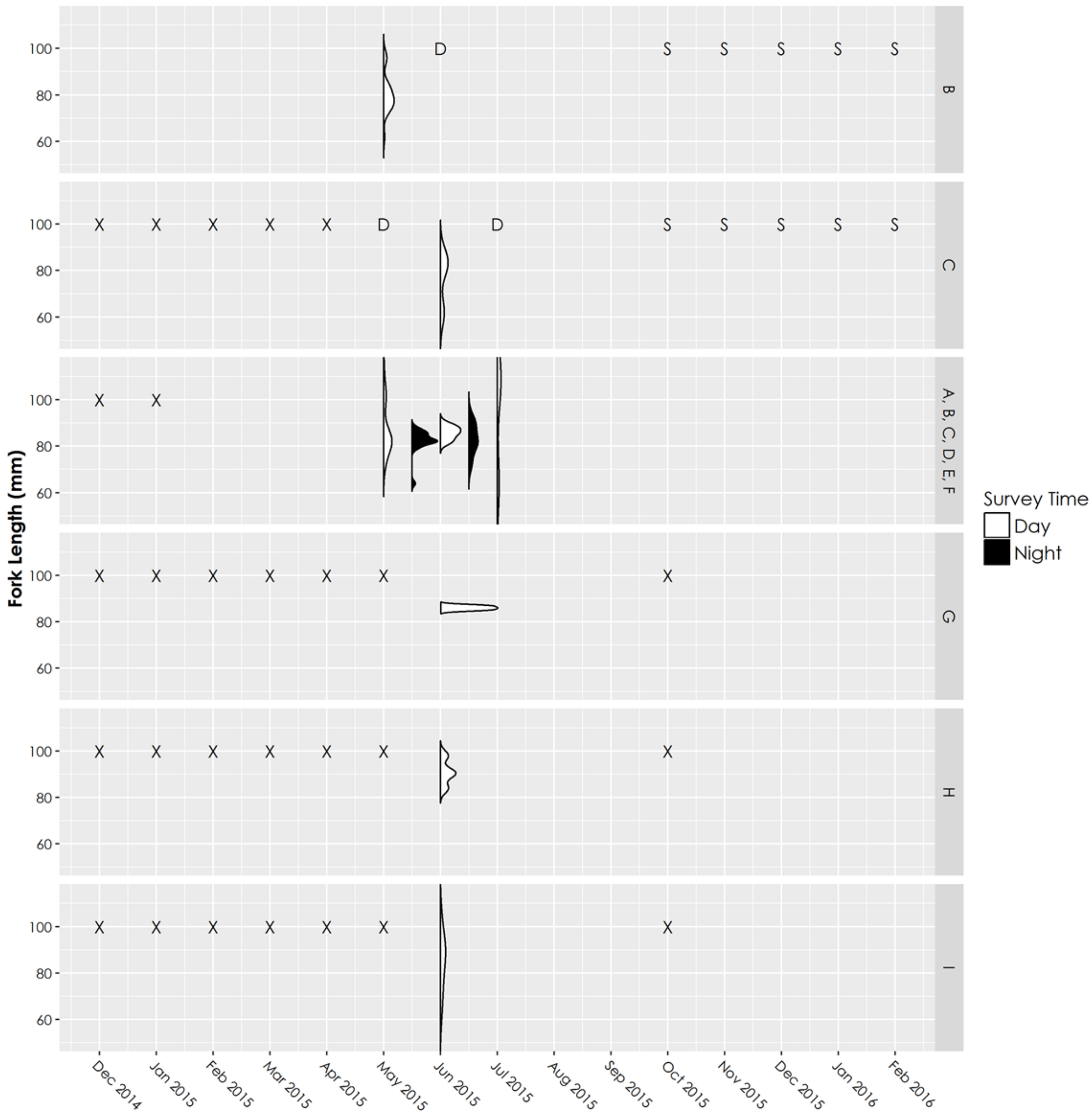

NOTE:

Blank entries = area fished but zero fish caught.
X = did not fish.
D = data deficient; cannot calculate kernel density (i.e., fewer than 3 data points).
S = safety concerns; did not fish.

## Figure 48 Size Frequency Distribution for Pink Salmon

### 3.3.3.1.7 Sockeye Salmon

Sockeye salmon ranged from 49 to 138 mm (fork length), with the majority of fish ranging from 80 to 88 mm (Figure 49). The sockeye salmon were identified as primarily year one smolts during seaward migrations from freshwater (McPhail 2007; Quinn 2005). Sockeye year one smolts were observed in three months (May through July) in survey areas B, C, F, H, I, and in trawls across survey areas A, B, C, D, E, F. However, it is possible that year two smolts (generally > 100 mm; Groot and Margolis 2003) were also detected during the same time period.



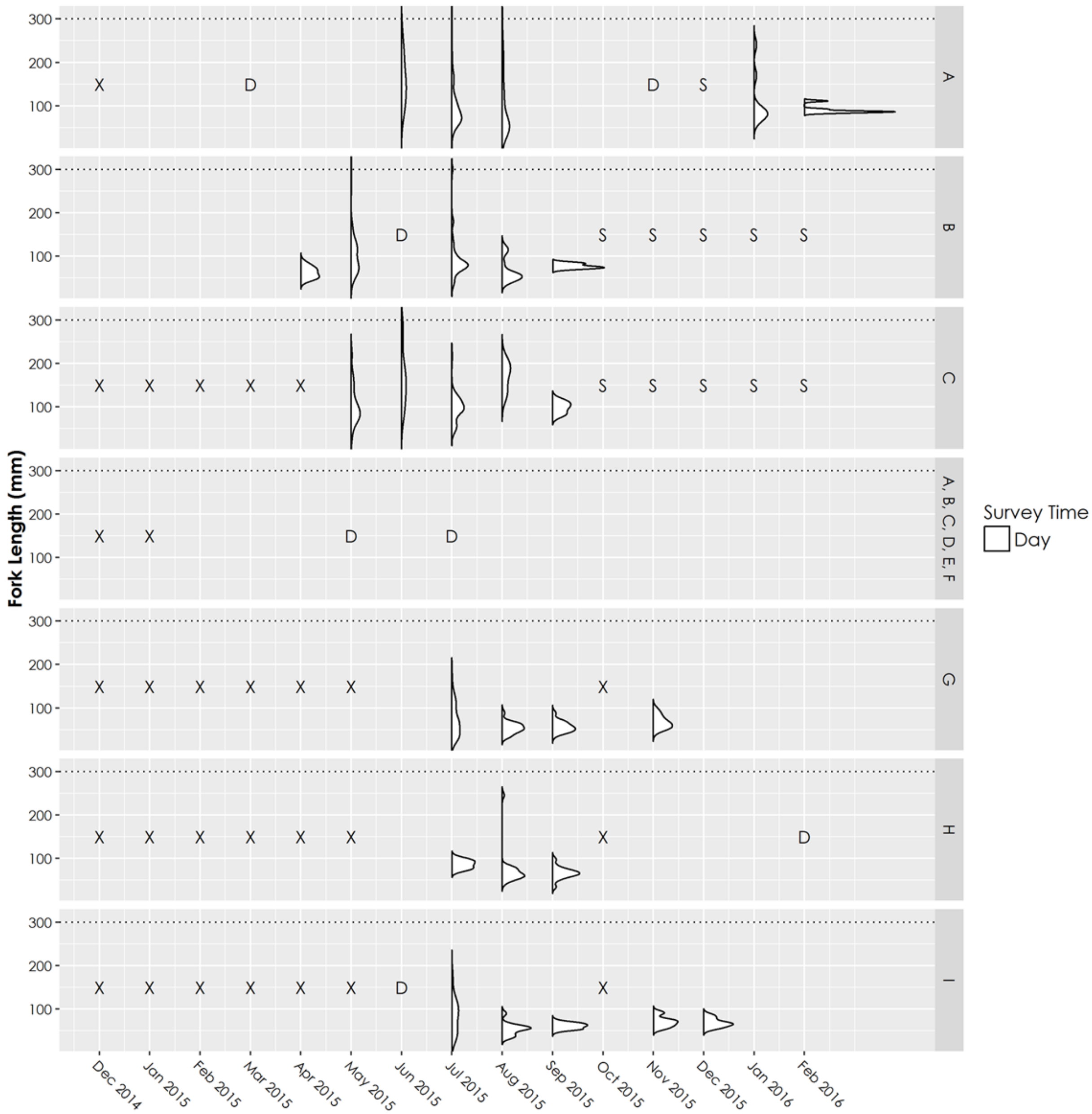

NOTE:

Blank entries = area fished but zero fish caught.
X = did not fish.
D = data deficient; cannot calculate kernel density (i.e., fewer than 3 data points).
S = safety concerns; did not fish.

## Figure 49 Size Frequency Distribution for Sockeye Salmon

#### 3.3.3.1.8 English Sole

English sole ranged from 30 to 315 mm (fork length), with the majority of fish ranging from 51 to 102 mm. Fish in this size range are considered immature juveniles, with the length at which 50% of the population is mature be equal to 300 mm (FishBase 2016; Figure 50). Small flatfish (less than 30 mm) were difficult to identify in the field and were classed as "unidentified flatfish". Low numbers of larger adult sole (greater than 300 mm) were caught in May through August 2015 in survey areas A, B, C.

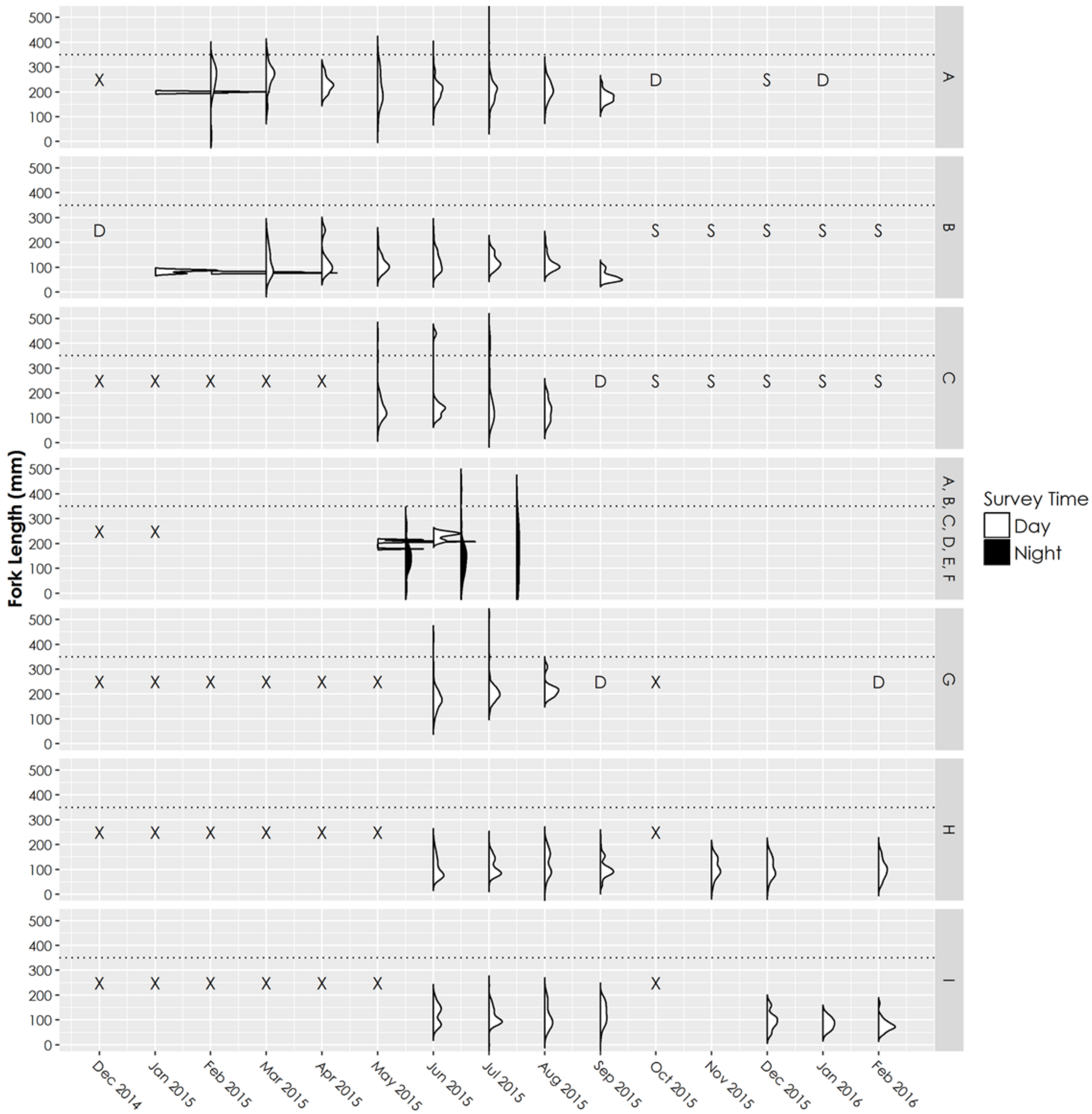



NOTE:
Blank entries = area fished but zero fish caught.
X = did not fish.
D = data deficient; cannot calculate kernel density (i.e., fewer than 3 data points).
S = safety concerns; did not fish.
Dotted line = length at which 50% of the population is mature (300 mm).

**Figure 50 Size Frequency Distribution for English Sole**

### 3.3.3.1.9 Starry Flounder

Starry flounder ranged from approximately 50 to 520 mm (fork length) (Figure 51). Most individuals caught were immature fish ranging from 94 to190 mm, with the length at which 50% of the population is mature = 350 mm (FishBase 2016). Low numbers of adult flounder were observed in survey areas A, C, and G between February and July and also caught in trawls in June and July. Juvenile starry flounder were caught in most beach seine sets throughout the survey period, in most areas.




NOTE:

Blank entries = area fished but zero fish caught.
X = did not fish.
D = data deficient; cannot calculate kernel density (i.e., fewer than 3 data points).
S = safety concerns; did not fish.
Dotted line = length at which 50% of the population is mature (350 mm).

**Figure 51 Size Frequency Distribution for Starry Flounder**

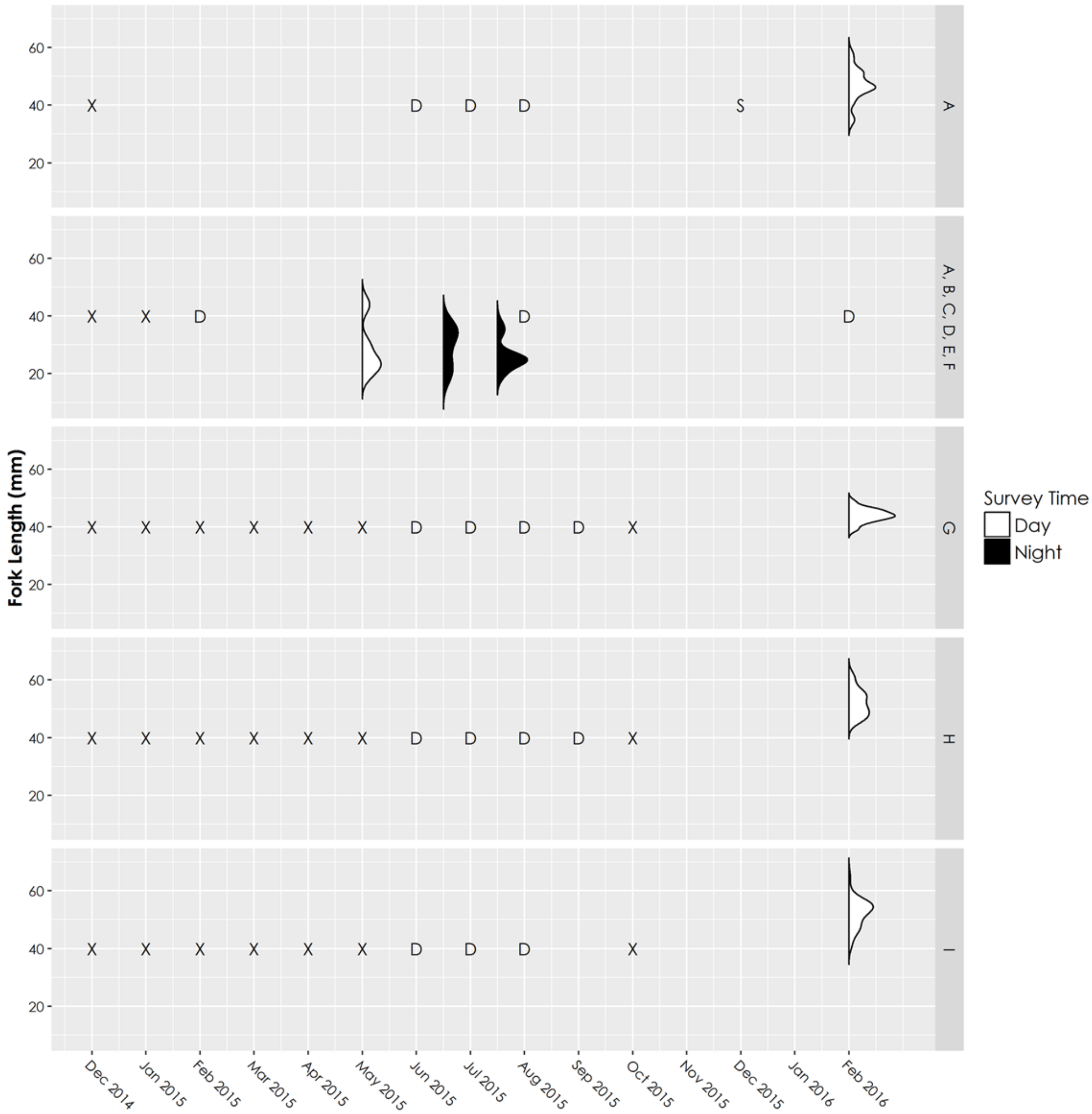
#### 3.3.3.1.10 Fish Larvae

Larval fish ranged from 20 to 75 mm (total length), with the majority of fish ranging from 35 to 46 mm (Figure 52).

Larval fish were too small to identify to genus and species in the field. Larval fish samples were retained from survey areas A, B, and F from June 2015 trawl catches and sent for genetic analysis to the Canadian Centre for DNA Barcoding, University of Guelph, Ontario.

Of the 159 larval fish sent for DNA barcoding, species identification was confirmed in 148 through genetic analyses. Of these, 49 (33%) were confirmed as eulachon, originating from survey area A and F trawls. The 18 larvae collected from survey area F were identified to species: 17 (94%) were eulachon and one was a surf smelt. Of the 72 individuals collected from survey area B, 69 could be identified, and all of them were Pacific herring. Survey area A larval fish were the most diverse: of the 61 individuals able to be identified to species, 32 (52%) were eulachon, 18 (30%) were Pacific herring, 5 (8%) were surf smelt, 6 (10%) were sculpins (*Cottoidea spp.*) and 1 (2%) was a spotted snailfish.

Fish larvae were captured in both winter and summer months, with slightly larger larvae (greater than 40 mm) observed more often during winter (i.e., in February).




NOTE:

Blank entries = area fished but zero fish caught.
X = did not fish.
D = data deficient; cannot calculate kernel density (i.e., fewer than 3 data points).
S = safety concerns; did not fish.

## Figure 52 Size Frequency Distribution for Larval Fish

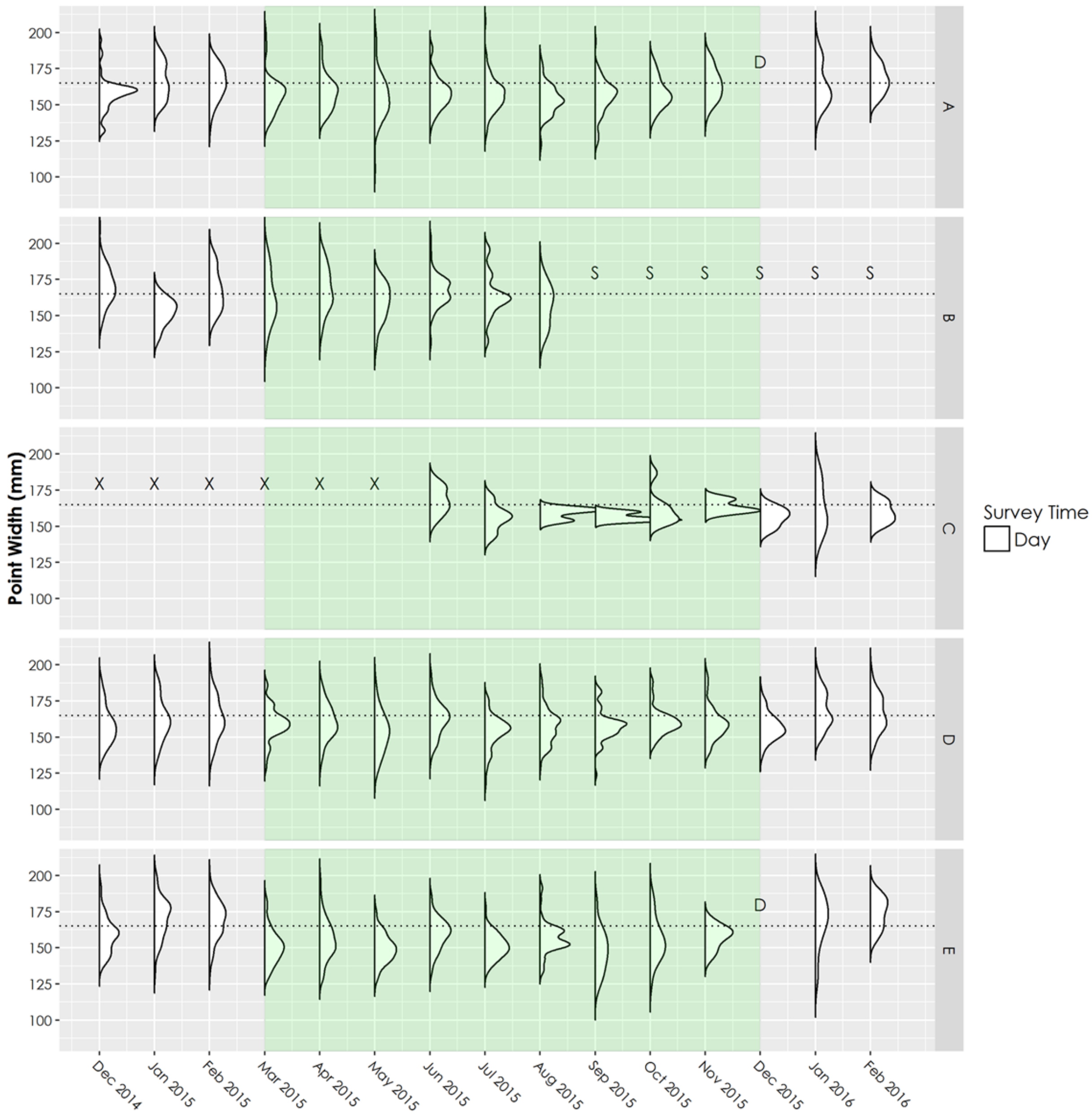
#### 3.3.3.1.11 Dungeness Crab

Dungeness crab caught by trap ranged from 106 to 212 mm (point width), with the majority of crab ranging from 151 to 167 mm (Figure 53). Life stages observed in the survey region, based on size, included sub-adults (greater than 70 but less than 100 or 120 mm, for females and males, respectively), and mature individuals (greater 100 or 120 mm, for females and males, respectively (Dunham, et al. 2011). A horizontal dotted line at 165 mm shows the legal size limit for male Dungeness crabs on each panel in Figure 53. Most crabs caught were mature individuals. Dungeness crab weights were also plotted but are presented in Appendix B.

A high proportion of crab caught were males (median monthly proportion for males = 0.90, range of 0.51 to 1.00; Figure 54). The observed proportion of male crab was higher in the winter than in summer. The observed decline in male crab size seemed to coincide with the opening of the commercial crab fishery in area B, which is targeted on male crabs only. The commercial crab trap fishery has previously been documented to cause higher mortality to legal sized male crabs (Smith and Jamieson 1989). However, a competing and not necessarily mutually exclusive explanation for the increase in proportion of male crabs caught in the winter is that male and female crab have different catchabilities in baited crab traps, especially during winter months when females are less active (Dunham et al. 2011).

The monthly proportion of Dungeness crabs observed with some sign of injury was approximately 0.31 (31%), and ranged from 0.17 to 0.48 (17 – 48%, Figure 55). The largest proportion of injured crabs was observed in April 2015, with nearly half of all individuals showing some sign of injury (e.g., missing limb, damaged carapace, or having a regenerating limb). In contrast, the proportion of injured crabs was lowest in May 2015 (0.17 or 17%). With the exception of April and May, the proportion of injured crabs remained relatively constant around 0.31 (31%).

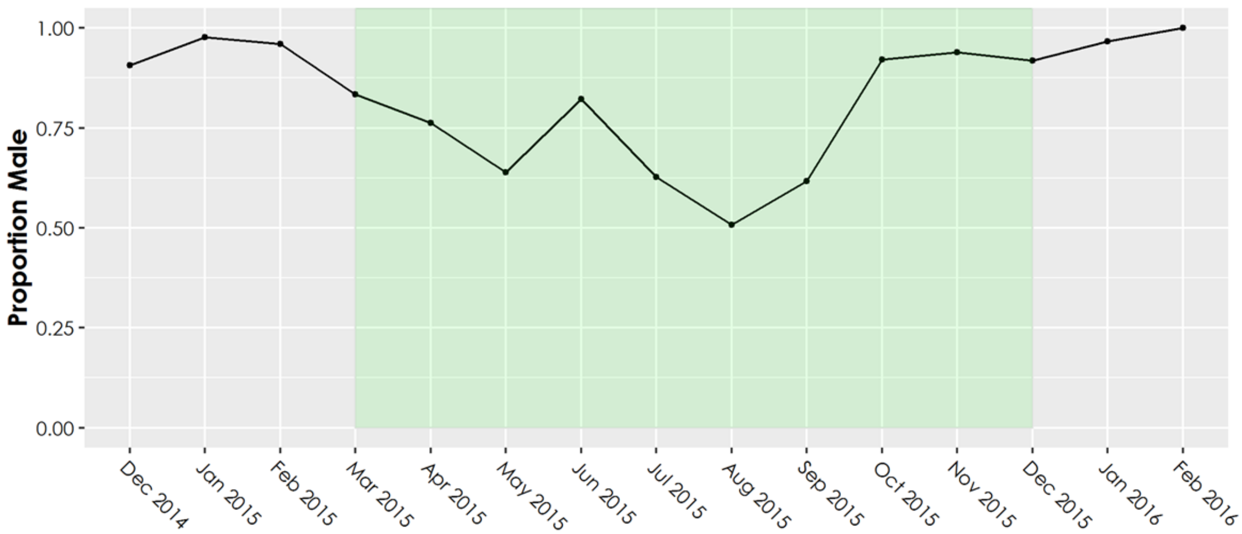
While it may be possible that the opening of the commercial crab fishery (in March) contributed to the incidence of injuries detected (e.g., handling injuries), another possible (and *not* mutually exclusive) explanation is the timing of mating. Male and female crabs generally mate in April or May; the potential for injuries inflicted by competing male interactions may have led to higher proportions of male injury at that time.




NOTE:

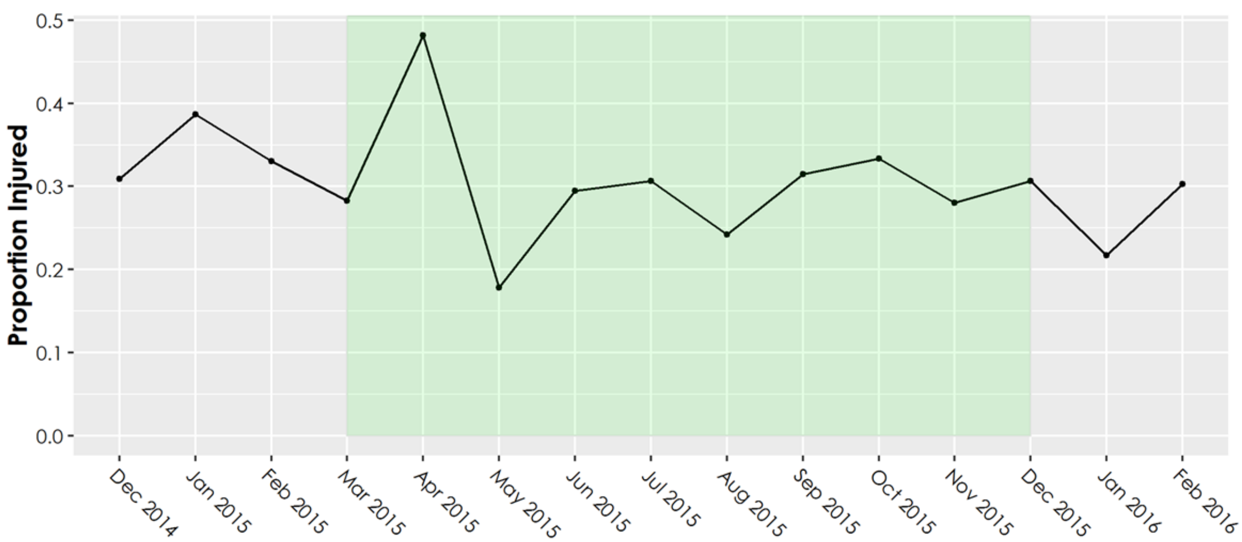
X = did not fish.
D = data deficient; cannot calculate kernel density (i.e., fewer than 3 data points).
S = safety concerns; did not fish.
Dotted line = legal size limit (165 mm)
Green rectangle = commercial crab fishery opening in Area B.

## Figure 53 Size Frequency Distribution for Dungeness Crab




NOTES: Green rectangle = commercial crab fishery opening in Area B.

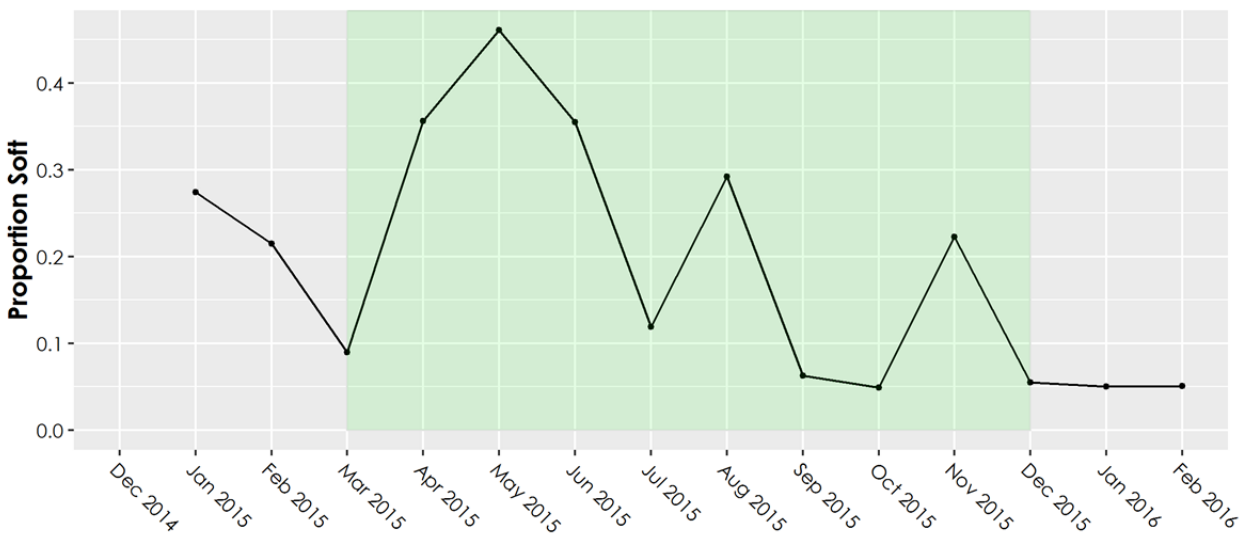
**Figure 54 Proportion Male Dungeness Crab**




NOTES: Green rectangle = commercial crab fishery opening in Area B.

**Figure 55 Proportion Injured Dungeness Crab**

The median monthly proportion of soft-shelled crab caught by trap was 0.17 (17%), and ranged from 0.05 to 0.46 (5 to 46%). The proportion of soft-shelled crabs was highest in May and it declined through the summer to fall (Figure 56). Female crabs molt (April through August) prior to mating in the spring and summer, and this may partially explain the increases in the proportion of soft-shelled crabs detected in May and August. However, the timing of molting varies for juvenile and adults crabs, and between male and female crabs (Dunham et al. 2011) such that no clear association with known life history characteristics and these data is evident.




NOTES: Green rectangle = commercial crab fishery opening in survey area B.

**Figure 56 Proportion of Soft Shelled Dungeness Crab**

### 3.3.3.2 Salmon Smolt Stomach Contents

Stomach content analysis was done on 246 salmon smolts (152 coho, 51 sockeye, 36 Chinook 7 chum and 0 pink) collected during daytime and nighttime surveys across all survey areas. Fish were captured in beach seines, purse seines, and trawls. Targets of 100 stomach samples per salmon species could not be met because of low numbers of juvenile salmon captured. To compare stomach contents of salmon smolts, results were grouped by survey area to represent the natural variability of fish, fish habitats, and fish prey across the survey region. The results of trawl-captured salmon from survey areas A through F (Table 4) are summarized together because the location of the salmon captured along transects could not be assigned to a single survey area. Due to low survey area specific sample sizes of salmon smolts from seines, results are not necessarily an accurate reflection of salmon smolt diets; these results are presented in Appendix B.4.

## Table 4 Percent by Number (% N) of Prey Organisms and Percent Frequency of Occurrence (% F) in Salmon Smolt Stomach Contents caught by trawl in Survey Areas A through F

| Stomach Content Prey Taxa | Salmon Smolts | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Pink (n = 0) | | Chinook (n = 9) | | Chum (n = 7) | | Coho (n = 43) | | Sockeye (n = 34) | |
| | % N | % F | % N | % F | % N | % F | % N | % F | % N | % F |
| **Crustacea (Planktonic)** | | | | | | | | | | |
| Euphausiacea (krill) | - | - | 0.0 | 0.0 | 0.0 | 0.0 | 1.2 | 4.7 | 0.1 | 2.9 |
| Copepoda | - | - | 1.2 | 11.1 | 0.4 | 42.9 | 1.3 | 11.6 | 1.4 | 26.5 |
| Cladocera | - | - | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 2.5 | 5.9 |
| Decapoda | - | - | 72.0 | 11.1 | 0.0 | 0.0 | 4.4 | 18.6 | 0.4 | 8.8 |
| **Crustacea (Benthic/Planktonic)** | | | | | | | | | | |
| Cumacea | - | - | 0.0 | 0.0 | 6.0 | 28.6 | 52.8 | 14.0 | 18.0 | 20.6 |
| Cirripedia | - | - | 1.2 | 11.1 | 0.0 | 0.0 | 0.2 | 2.3 | 23.5 | 35.3 |
| Amphipoda/Isopoda | - | - | 1.2 | 11.1 | 1.4 | 57.1 | 3.0 | 23.3 | 0.3 | 14.7 |
| Ostracoda | - | - | 0.0 | 0.0 | 0.0 | 0.0 | 1.0 | 7.0 | 0.0 | 0.0 |
| Unknown Crustacea | - | - | 0.0 | 0.0 | 3.3 | 28.6 | 0.5 | 7.0 | 1.2 | 8.8 |
| **Insects/Arachnids** | - | - | 20.7 | 55.6 | 88.3 | 85.7 | 15.0 | 51.2 | 49.4 | 55.9 |
| **Pisces (fish)** | - | - | 0.0 | 0.0 | 0.0 | 0.0 | 2.1 | 9.3 | 0.1 | 2.9 |
| **Mollusca/Gastropoda** | - | - | 0.0 | 0.0 | 0.0 | 0.0 | 16.9 | 4.7 | 0.0 | 0.0 |
| **Nematoda** | - | - | 0.0 | 0.0 | 0.0 | 0.0 | 0.2 | 2.3 | 0.0 | 0.0 |
| **Nemertea** | - | - | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| **Polychaeta** | - | - | 0.0 | 0.0 | 0.0 | 0.0 | 0.2 | 2.3 | 0.0 | 0.0 |
| **Unknown Arthropod** | - | - | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| **Non-food items** | - | - | 0.0 | 0.0 | 0.4 | 14.3 | 1.3 | 11.6 | 2.4 | 23.5 |
| **Undetermined materials** | - | - | 2.4 | 22.2 | 0.0 | 0.0 | 0.0 | 0.0 | 0.7 | 32.4 |
| **% Fullness (Median)** | - | | 10 | | 55 | | 20 | | 50 | |
| **% Digested (Median)** | - | | 90 | | 80 | | 70 | | 90 | |
| **Total prey items counted** | - | | 82 | | 927 | | 608 | | 1783 | |
| **Prey items per fish** | - | | 9.1 | | 132.4 | | 14.1 | | 52.4 | |
| **Empty stomachs (%)** | - | | 11.1 | | 0 | | 28 | | 11.8 | |

NOTE:

%N Percent by number of prey relative to prey counted

%F Percent occurrence observed in stomach samples

#### 3.3.3.2.1 Survey Areas A, B, C, D, E, and F

Across survey areas A, B, C, D, E, and F, 93 salmon smolts (9 Chinook, 7 chum, 43 coho and 34 sockeye) were captured in trawls. All salmon captured had a relatively low proportion of stomach fullness (10 – 55 %) and a high proportion of digested prey and materials (70 – 90%).

Stomach contents of the salmon smolts captured by trawl across survey areas A through F were dominated (in number and frequency) by crustacean planktonic prey, crustacean benthic prey, and terrestrial insects (Table 4).

Terrestrial insects and arachnids comprised a high proportion of contents in stomachs of chum (88.3%) and sockeye (49.4%) salmon, with lower proportions in Chinook (20.7%) and coho (15%) salmon. Insects included terrestrial species like common flies, mosquitos, beetles, bees, and wasps, which often float and are discharged from river surface waters. Small fish prey was found in 9.3% (4 of 43) of coho salmon stomachs and 2.9% (1 of 34) of sockeye salmon stomachs, with none present in chum or Chinook salmon stomachs. Coho salmon stomachs showed the greatest diversity in prey types across benthic and planktonic crustaceans, nearshore benthic crustaceans, terrestrial insects, and small fish. Sockeye salmon stomachs contained primarily insects, arachnids, and benthic/planktonic crustacea (cumaceans, cirripedes, amphipods, and isopods) and less frequently planktonic crustacea (euphausiids, copepods, cladocerans, and decapods). Chinook salmon stomachs contained more decapods than the other species of salmon. Chum salmon had the largest number of prey per fish. Empty stomachs were observed in coho, Chinook, and sockeye salmon.

## 3.4 SUMMARY

Four specific survey techniques, three exploratory techniques, and stomach content analyses were used to identify and describe the fish and invertebrate species present in the survey region and describe salmon smolt prey:

- Hydroacoustic transects that provided estimates of general patterns in distribution and relative abundance over time, without the ability to examine species-specific patterns
- Beach seines that provided estimates of nearshore area patterns in species-specific distribution and relative abundance over time
- Trawls that provided estimates of pelagic area patterns in species-specific distribution and relative abundance over time
- Crab traps that provided estimates of deep water benthic area patterns in crab-specific distribution and relative abundance over time
- Exploratory use of fyke nets, purse seines, and prawn/shrimp traps that provided some indications of species-specific fish distribution and relative abundance over time on intertidal Flora Bank, deeper water pelagic areas, and deep water benthic areas
- Stomach content analyses, used to examine salmon-specific prey items and presence.

Hydroacoustic fish surveys indicated that relative total fish abundance and distribution generally increased during the summer period and varied among survey areas. Total fish abundance was low during the fall, winter, and early spring in the survey region.

There were 57 fish species and 8 invertebrate species (in 90 taxonomic groupings) captured across all gear used in the surveys. The highest numbers of species and groupings were observed in catches during May through August.

Nine fish species (including five anadromous salmon), Dungeness crab, and larval fish were classified as focal species and used to examine species-specific patterns of distribution and relative abundance. The highest number of focal species was observed in May and June, associated with the presence of migratory salmon smolts. Dungeness crab, surf smelt, starry flounder, and English sole were observed in catches throughout all the months of the Program.

Salmon smolt seaward migration was observed in the beach seine and trawl catch data from the Program. Pink and chum salmon smolts were observed early in the spring (e.g., April and May) and Chinook, sockeye, and coho salmon smolts were observed later in May and in June, although it should be noted that not all areas were sampled during all times and peak migration periods may have been missed. The patterns of abundance for other species (e.g., English sole and Dungeness crab) peaked during the summer in a pattern consistent with observations from hydroacoustic survey results.

Species-specific timing and distribution in the survey region was observed in the demographics results. Juvenile Pacific herring and surf smelt were abundant in nearshore areas for much of the summer season. Mature Pacific herring were observed only in late May, corresponding to observations of small local spawning events (Appendix D). Larval fish were observed in May and June, consistent with known patterns of March spawning for both Pacific herring and anadromous eulachon.

Salmon caught in the survey region generally had low stomach fullness and higher proportions of digested prey and materials. Prey presence varied between survey areas and salmon species, but were generally dominated by copepods, decapods, cumaceans, cirripeds, terrestrial insects and amphipods.

# 4.0 ASSOCIATIONS BETWEEN WATER COLUMN PROPERTIES AND FISH PRESENCE

## 4.1 INTRODUCTION

Physical oceanographic conditions interact with biological resources (i.e., resources required by marine organisms to support their life processes) to influence species use and trophic level productivity in British Columbia coastal waters (Ware and Thomson 2005). The survey region examined during the Program experiences changing oceanographic conditions associated with seasons, tidal cycles, seasonal Skeena River discharge and, on a broader scale, coastal upwelling and downwelling, among other factors. These oceanographic conditions influence the local productivity and habitat conditions available for the marine fish community over scales of space and time (Cury et al. 2003, Shin et al. 2010).

Temperature, turbidity, dissolved oxygen, and salinity are measurable water properties that vary over time and space, and condition the seasonal physical marine environment. These water properties have the potential to influence primary productivity, as measured by chl-*a*, which in turn supports secondary producers, as measured by zooplankton species and abundance, and higher trophic level consumers, as measured by larval fish and marine fish relative abundance and distribution over time (Cury et al. 2005, Lucas et al. 2007, Perry 2014, Chandler et al. 2015). Productive local waters and habitats support food prey for marine fish species within physical habitats and can influence timing of life processes and abundance. For example, the outmigration of juvenile salmon typically coincides with times of peak seasonal zooplankton production (Peterman et al. 1994, Mueter et al. 2002, Pyper et al. 2005, Preikshot et al. 2010).

This section examines potential associations between water column properties and the presence of fish (Program objective 6).

## 4.2 METHODS

The potential associations between water column properties and the presence of fish were examined by categorizing water property and fish abundance values into different bins based on observed distribution of data, and then conducting a qualitative review to identify potential parallel patterns of change over the sampling period (see Section 2.3.2) within the survey region.

Water column properties used for this analysis included median ocean temperature (Tmp), turbidity (Turb), chl-*a* and total zooplankton (Zp). Salinity, conductivity and dissolved oxygen were not explicitly included because their general seasonal trends were considered to be consistent and/or related to those reflected in either turbidity or median ocean temperature (see Section 2.3.2., Figure 7, Figure 8, Figure 9, Figure 10, Figure 11, Figure 12, Figure 13).

Categorization of fish presence and water properties was carried out as follows:

1. Focal fish species (with life stages, where appropriate) were listed based on results presented in Section 3.3.2. Appendix B.3 and Appendix D.

2. Categories of relative fish abundance were defined based on:

3. Range of observed CPUE across all areas and sample periods from the most abundant focal fish species in beach seines and trawls (surf smelt; Section 3.3, and Appendix B.2) – applied to all focal species except crab

4. Range of observed CPUE (fish/ha) from hydroacoustic surveys across all areas and sample periods – applied to total fish abundance (Section 3.3.1, Appendix Appendix C)

5. Range of observed crab trap CPUE across all areas and sample periods (Section 3.3, and Appendix B.2)

6. Based on these ranges, categories were subsequently described as:
   - Abundant (**A**) – relative species / total fish abundance equal to or greater than the 75th percentile of the observed CPUE range ( i.e., a CPUE of ≥ 255 for focal species, a hydroacoustic total fish abundance ≥ 7,363 fish/ha, and crab CPUE > 16.1)
   - Common (**C**) – relative species abundance between the 25th and 75th percentile of the observed CPUE range (i.e., a CPUE of 86 to 254 for focal species, a hydroacoustic total fish abundance 2,488 to 7,362 fish/ha, and crab CPUE 7.9 to 16.0)
   - Medium (**M**) – relative species abundance between the 10th to < 25th percentile of observed CPUE range (i.e., a CPUE 35 to 85 for focal species, a hydroacoustic total fish abundance 995 to 2,487 fish/ha, and crab CPUE 2.7 to 7.8)
   - Low (**L**) – relative species abundance between the 1st to < 10th percentiles of the observed CPUE range (i.e., A CPUE 4 to 34 CPUE for focal species, a hydroacoustic total fish abundance 100 to 994 fish/ha, and crab CPUE 0.3 to 2.6)
   - Infrequent or rare (**IN**) – relative species abundance < 1st percentile of the observed CPUE range (i.e., A CPUE >0 to < 4 for focal species, a hydroacoustic total fish abundance of < 100 fish/ha, and crab CPUE > 0 to < 0.3 )
   - Absent (**AT**) – 0 fish or crab caught/detected
   - No observations (**-**) – no fish or crab samples were collected or surveys carried out

7. Water properties were categorized based on abundance or concentration from the range of observed values for each property (ocean temperature, turbidity, chl-*a*, zooplankton) as across the entire survey period and all survey areas:
   - High (**h**) – upper (Q3) quartile (> 75th percentile) in the range of observed water property values (Tmp ≥ 12.5°C; Turb ≥ 30.5 NTU; Chl-*a* ≥ 5.3 mg/L; Zp ≥ 1851/m$^3$)
   - Medium (**m**) – lower (Q1) to upper (Q3) quartile (between the 26th and 74th percentile) in the range of observed water property values (Tmp = 8.4 to 12.4°C; Turb = 5.9 to 30.4 NTU; Chl-*a* = 0.43 to 5.2 mg/L; Zp = 481 to 1850/m$^3$)
   - Low (**l**) – lower (Q1) quartile (>25th percentile) in the range of observed water property values(Tmp ≤ 8.4°C; Turb ≤ 5.9 NTU; Chl-*a* ≤ 0.43 mg/L; Zp ≤ 481/m$^3$)
   - No observations (**-**) - no measurement collected within the survey region

8. Pairs of categories (Fish-Water property) were assigned for each fish category and seasonal time period

9. Associations were highlighted in Table 5 if there was a possible association observed between changes in water properties and congruent changes in relative fish abundance parameters (i.e., there was an apparent parallel pattern of change across all sampling periods).

It should be noted that these categorical associations are not intended to be evidence of a causal link between the environment and fish abundance and fish distribution. Nevertheless, these results can be used to direct future surveys to monitor specific locations and timing of biophysical drivers of fish distribution, sampling intensity at those sites and at different times of year and, ultimately, for the assessment of potential project-specific effects, should the Project be built. Conversely, these results also help identify specific parameters that have potentially limited power to explain and understand spatial and temporal fish distribution, sites, or times of year, which may not be useful to monitor for the assessment of potential project-specific effects to fish distribution and could, therefore, be omitted from future sampling efforts.

## 4.3 RESULTS AND DISCUSSION

Observations of categorical pairs and potential association between focal fish species and, where possible, for life stages of a focal species, and water properties are presented in Table 5. Where applicable, associations were identified when category pairs seemed to change in apparent parallel patterns across all three sampling periods (with the exception of zooplankton where data were only available for two periods).

The main association revealed through this analysis, despite the use of broad categories and a coarse temporal scale, is one between total fish abundance and water temperature, chl-*a*, and zooplankton. Total fish abundance appears to be positively associated with higher values in temperature, chl-*a*, and zooplankton, with concurrent lower values in the later winter – spring, higher values in late spring – summer, and lower values again in the fall – early winter. This overall fish abundance association pattern is reflected and observed in several other groups, including juvenile Pacific herring, juvenile and adult surf smelt, larval fish, and juvenile and adult crab. Chum, coho, and sockeye smolt relative abundance appears to be positively associated with zooplankton abundance, although this has likely to do with the timing of salmon out-migration than with the abundance of zooplankton. Turbidity and corresponding seasonal patterns of salinity (Section 2.3.2), did not appear to have any associations with relative fish abundance values for the focal fish species.

**Table 5 Review of Focal Fish Species Presence and Association With Seasonal Water Properties Across Seasonal Sampling Periods**

| Observed Focal Fish Species Presence | Seasonal Water Properties | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Late Winter – Early Spring (Jan, Feb, Mar, Apr) | | | | Late Spring - Summer (May, Jun, Jul, Aug) | | | | Fall – Early Winter (Sep, Oct, Nov, Dec) | | | |
| | Tmp | Turb | Chl-*a* | Zp | Tmp | Turb | Chl-*a* | Zp | Tmp | Turb | Chl-*a* | Zp |
| **Total Fish Abundance** | L-m | L-m | L-m | - | A-h | A-h | A-h | A-h | C-m | C-h | C-m | C-m |
| **Chinook Smolt** | IN-m | IN-m | IN-m | - | IN-h | IN-h | IN-h | IN-h | IN-m | IN-h | IN-m | IN-m |
| **Chum Smolt** | L-m | L-m | L-m | - | L-h | L-h | L-h | L-h | IN-m | IN-h | IN-m | IN-m |
| **Coho Smolt** | AT-m | AT-m | AT-m | - | L-h | L-h | L-h | L-h | IN-m | IN-h | IN-m | IN-m |
| **Pink Smolt** | M-m | M-m | M-m | - | IN-h | IN-h | IN-h | IN-h | IN-m | IN-h | IN-m | IN-m |
| **Sockeye Smolt** | IN-m | IN-m | IN-m | - | L-h | L-h | L-h | L-h | AT-m | AT-h | AT-m | AT-m |
| **Pacific Herring** | | | | | | | | | | | | |
| **Eggs / Larvae** | AT-m | AT-m | AT-m | - | IN-h | IN-h | IN-h | IN-h | AT-m | AT-h | AT-m | AT-m |
| **Juvenile** | L-m | L-m | L-m | - | A-h | A-h | A-h | A-h | L-m | L-h | L-m | L-m |
| **Adult** | AT-m | AT-m | AT-m | - | IN-h | IN-h | IN-h | IN-h | AT-m | AT-h | AT-m | AT-m |
| **Surf Smelt** | | | | | | | | | | | | |
| **Larvae** | AT-m | AT-m | AT-m | - | IN-h | IN-h | IN-h | IN-h | AT-m | AT-h | AT-m | AT-m |
| **Juvenile** | C-m | C-m | C-m | - | A-h | A-h | A-h | A-h | L-m | L-h | L-m | L-m |
| **Adult** | IN-m | IN-m | IN-m | - | C-h | C-h | C-h | C-h | IN-m | IN-h | IN-m | IN-m |
| **Larval Fish** | IN-m | IN-m | IN-m | - | A-H | A-h | A-h | A-h | IN-m | IN-h | IN-m | IN-m |
| **Starry Flounder** | IN-m | IN-m | IN-m | - | IN-h | IN-h | IN-h | IN-h | IN-m | IN-h | IN-m | IN-m |
| **English Sole** | IN-m | IN-m | IN-m | - | IN-h | IN-h | IN-h | IN-h | IN-m | IN-h | IN-m | IN-m |
| **Dungeness Crab** | | | | | | | | | | | | |
| **Juvenile/Adult** | C-m | C-m | C-m | - | A-h | A-h | A-h | A-h | M-m | M-h | M-m | M-m |
| **Crab Moult** | AT-m | AT-m | AT-m | - | L-h | L-h | L-h | L-h | AT-m | AT-h | AT-m | AT-m |

**Relative Fish Abundance (See Section 4.2 for category values):**
**A** – Abundant
**C –** Common
**M** – Medium
**L** – Low
**IN** – Infrequent or rare
**AT** – Absent
**-** no observations

**Water Property Concentration or Abundance**
**h** - High, **m** – Medium, **l** – Low, **-** no observation
(blue) an observed association where water temperature and relative fish abundance changed in parallel patterns
(green) an observed association where chl-*a* and relative fish abundance changed in parallel patterns
(orange) an observed association where zooplankton and relative fish abundance changed in parallel pattern

Although this analysis is not intended to evaluate causal links or strength of potential associations, the parallel patterns of change identified as associations support the general observation that fish populations, and potentially species relative abundance, co-vary with regional warming and enhanced primary and secondary production (phytoplankton and zooplankton abundance, respectively) during late spring and summer periods. Our findings are consistent with those of Ware and Thomson (2005,) who suggested that British Columbia coastal marine fish abundance is often controlled by bottom-up trophic interactions driven by locally enhanced warming, nutrients, and phytoplankton and zooplankton abundance. Ware and Thomson (2005) suggest that fish biomass and primary productivity in Chatham Sound and Hecate Strait marine ecosystems are positively related to bottom-up driven nutrients potentially channeled through both pelagic and benthic trophic levels. The late spring and summer pattern of enhanced local chl-*a* observed in the survey region is consistent with the timing of enhanced Skeena River discharge (freshet), particularly in May through October, which has a strong influence on local water properties (temperature, oxygen, salinity, transparency, nutrients) in southern and central Chatham Sound (Trites 1956; Birch et al. 1985). The observations of locally enhanced chl-*a* concentrations in the survey region from spring to summer are also supported by results from a remote sensing analyses of monthly sea surface data between 2004 and 2014, which demonstrate a positive relationship between Skeena River discharge, sea surface temperature, water clarity and turbidity, and primary production (Stantec 2015).

Overall, this analysis suggests that temperature, primary production (chl-*a*), and zooplankton may be potential drivers of fish distribution and presence in this study area and that they may warrant additional analysis using site specific marine fish program results. Results also suggest that these environmental factors should be carefully considered when designing and interpreting any potential monitoring in the future.

# 5.0 PATTERNS OF FISH HABITAT USE IN THE SURVEY REGION

## 5.1 INTRODUCTION

The following methods and results use the Program's habitat-related presence and relative fish abundance data to interpret patterns of focal fish species habitat presence over the sampling period within each survey area. For the purpose of this report, habitat use is defined as fish presence in any given area over time, with no inference on any potentially associated fish behaviour (selection/preference) and habitat availability (quality).

Observations of presence or absence of a fish species in a specific habitat or survey area are not intended to examine or indicate the ability of a focal species or entire fish population to support and sustain itself within a habitat (Schultz and Ludwig 2005). Additional, more detailed spatial and temporal sampling, fish species age class, stomach content, behaviour, sex ratio, and sexual maturity data would be needed to more fully examine patterns of fish habitat use, including habitat selection, preference and availability.

This section examines potential patterns of habitat use by total fish and focal species in the survey region (Program objective 7).

## 5.2 METHODS

Following the approach detailed in Section 5, we examined the data for associations between categories of fish presence (Absent, Infrequent, Low, Medium, Common, Abundant) in each survey area across seasonal time periods. As noted in Section 4, categorical fish habitat presence is not intended to be evidence of a causal link between habitats or the biophysical attributes that comprise habitat conditions, and fish abundance and distribution. These results can, however, be used to identify and monitor specific locations, habitats, and timing of fish distribution, sampling intensity at habitats and at different times of year.

## 5.3 RESULTS AND DISCUSSION

Observations of categorical fish presence derived for total fish abundance and for focal species, across survey areas and seasonal time periods, are presented in Table 6.

**Table 6 Review of Focal Fish Species Presence Across Survey Area and Seasonal Time Periods**

| Fish Presence | Survey Areas / Seasonal Time Period (Hydroacoustic Density) | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | A | | | B | | | C | | | D | | | E | | | F | | | G | | | H-I | | |
| | W | S | F | W | S | F | W | S | F | W | S | F | W | S | F | W | S | F | W | S | F | W | S | F |
| **Total Fish Abundance** | \ | L | IN | IN | A | L | \ | M | M | \ | L | IN | \ | M | M | \ | L | IN | \ | IN | IN | \ | C | C |
| | Survey Areas / Seasonal Time Period (Beach Seine and Trawl CPUE) | | | | | | | | | | | | | | | | | | | | | | | |
| **Observed Focal Fish Species Presence** | A (Beach Seine) | | | B (Beach Seine) | | | C (Beach Seine) | | | A,B,C,D,E,F (A-F) (Trawl) | | | G (Beach Seine) | | | G (Trawl) | | | H-I (Beach Seine) | | | H-I (Trawl) | | |
| | W | S | F | W | S | F | W | S | F | W | S | F | W | S | F | W | S | F | W | S | F | W | S | F |
| **Chinook Smolt** | AT | IN | AT | AT | IN | AT | \ | IN | IN | AT | IN | AT | IN | IN | AT | IN | IN | AT | IN | IN | IN | AT | IN | IN |
| **Chum Smolt** | IN | IN | AT | IN | L | IN | \ | IN | AT | AT | IN | AT | AT | AT | AT | AT | AT | AT | IN | IN | AT | AT | AT | AT |
| **Coho Smolt** | AT | IN | AT | AT | IN | IN | \ | IN | AT | AT | IN | AT | AT | IN | AT | AT | AT | AT | AT | IN | AT | AT | IN | AT |
| **Pink Smolt** | M | IN | AT | AT | IN | AT | \ | IN | IN | IN | IN | AT | IN | IN | AT | AT | AT | AT | IN | IN | IN | AT | AT | AT |
| **Sockeye Smolt** | AT | IN | AT | AT | IN | AT | \ | IN | IN | AT | L | AT | IN | IN | AT | AT | IN | AT | AT | IN | IN | AT | IN | AT |
| **Pacific Herring** | | | | | | | | | | | | | | | | | | | | | | | | |
| **Eggs / Larvae** | AT | IN | AT | AT | IN | AT | \ | IN | AT | IN | L | AT | \ | \ | AT | AT | \ | AT | \ | \ | \ | \ | \ | \ |
| **Juvenile** | L | L | L | IN | IN | AT | \ | IN | IN | IN | A | AT | AT | IN | IN | AT | AT | AT | IN | L | AT | AT | A | IN |
| **Adult** | AT | AT | AT | AT | AT | AT | \ | IN | AT | AT | L | AT | AT | AT | AT | AT | AT | AT | AT | AT | AT | AT | AT | AT |
| **Surf Smelt** | | | | | | | | | | | | | | | | | | | | | | | | |
| **Larvae** | AT | IN | AT | AT | IN | AT | \ | IN | AT | IN | L | AT | \ | \ | AT | AT | \ | AT | \ | \ | \ | \ | \ | \ |
| **Juvenile** | C | C | L | C | A | IN | \ | L | IN | L | C | IN | AT | L | L | AT | IN | AT | A | IN | C | AT | M | L |
| **Adult** | IN | L | AT | IN | IN | AT | \ | C | AT | AT | L | AT | AT | L | AT | AT | IN | AT | AT | L | IN | AT | IN | AT |
| **Larval Fish** | AT | IN | AT | IN | IN | AT | \ | IN | IN | IN | A | AT | IN | IN | AT | AT | L | AT | IN | IN | IN | IN | A | L |
| **Starry Flounder** | AT | IN | AT | AT | IN | AT | \ | IN | IN | AT | IN | AT | IN | IN | AT | AT | IN | AT | IN | IN | IN | AT | IN | AT |
| **English Sole** | AT | IN | AT | AT | IN | AT | \ | IN | IN | AT | IN | AT | IN | IN | AT | AT | AT | AT | IN | IN | IN | AT | IN | AT |
| **Dungeness Crab** | | | | | | | | | | | | | | | | | | | | | | | | |
| **Juvenile/Adult** | \ | \ | \ | \ | \ | \ | \ | \ | \ | C | A | M | \ | \ | \ | \ | \ | \ | \ | \ | \ | \ | \ | \ |
| **Moult** | AT | L | AT | AT | AT | AT | \ | AT | AT | AT | L | AT | AT | AT | AT | \ | \ | \ | AT | AT | AT | \ | \ | \ |

**Relative Fish Abundance (See Section 4.2 for category values and Appendix B for data)**

| | |
|---|---|
| **A** | Abundant - relative species total fish abundance ≥ than the 75th percentile of the observed CPUE range |
| **C** | Common - relative species abundance between the 25th and 75th percentile of the observed CPUE range |
| **M** | Medium - relative species abundance between the 10th to < 25th percentile of observed CPUE range8 |
| **L** | Low - relative species abundance between the 1st to < 10th percentiles of the observed CPUE range6 |
| **IN** | Infrequent or rare - relative species abundance < 1st percentile of the observed CPUE range |
| **AT** | Absent - 0 fish or crab caught/detected |
| **** | no observations - no fish or crab samples were collected or surveys carried out |

**Seasonal Time Period**

**W** late winter - early spring (Jan, Feb, Mar, Apr)

**S** late spring – summer (May, Jun, Jul, Aug)

**F** fall –early winter (Sep, Oct, Nov, Dec)

Total observed fish abundance was highest in late spring - summer in survey area B, but overall, numbers appeared to be higher in southern survey areas (H and I) and in survey areas C and E, compared to other survey areas during all periods sampled. Observed total fish presence was highest in late spring - summer throughout the study area, with a decrease into fall - early winter in survey areas A, B, D, and F, but remaining at similar levels in areas C, E, G, and H-I. This overall total fish abundance pattern is reflected and observed in several abundant and common focal species in survey areas A, B, C, A-F, G and H-I, where comparison can be made, and included Abundant and Common relative abundance for juvenile and adult surf smelt, juvenile Pacific herring, larval fish, and juvenile and adult crab. Compared to surf smelt, focal fish species abundance was Low in most areas and time periods.

Surf smelt were observed with the highest relative abundance among focal fish species in beach seine and trawl catches in all survey areas during the late winter - early spring and late spring - summer, with the exception of low abundance observed in survey area G. Pacific herring and larval fish were observed with the highest relative abundance in trawl catches during the late spring - summer in survey areas A-F and H-I. This larval fish occurrence is consistent with patterns of spring and summer herring, eulachon, and smelt spawning events and observations of larval fish distribution in offshore pelagic areas for Pacific herring (Haegele et al. 1979, DFO 1999, DFO 2015, Appendix D, Section 3.3.2.2.1), anadromous eulachon (Hay and McCarter 2000, Section 3.3.2.2.10), and surf smelt (Therriault et al. 2002, Section 3.3.2.2.2).

Juvenile and adult Dungeness crab were only sampled using crab traps in offshore survey areas A through F. Incidental sightings of moulted crab shells and soft-shelled crab moults were made opportunistically throughout the survey region. Crabs had a high level of relative abundance during late winter - early spring and late spring - summer sampling periods. Crabs had a lower habitat presence in fall - early winter. Soft-shelled crab moults and shells were observed in both offshore survey areas A-F and in nearshore survey area A during the late spring - summer sampling period (Section 3.3.3.1.11, Appendix B.3)

Survey areas with higher total fish abundance in both late spring - summer and fall - early winter sampling periods were characterized by more channels and slopes with a stronger influence of tidal mixing and moderate to strong freshwater outflow. Smaller forage fish species, including juvenile surf smelt and Pacific herring focal species and early migrating pink and chum salmon, were observed in survey areas A, B, H-I and combined survey area A-F respectively, characterized as both shallow and deeper soft-sediment habitats.

As discussed in Section 5.3, total fish and potentially species relative abundance appeared to be associated with regional warming and enhanced primary and secondary production (phytoplankton and zooplankton abundance respectively) during late spring - summer. The observations of patterns and associations with seasonal relative fish abundance in the survey areas, is consistent with the suggested patterns of seasonal nutrient-driven enhanced production (Perry et al. 1983, Ware and Thomson 2005).

# 6.0 REVIEW OF PROJECT OBJECTIVES

This report is organized around seven specific objectives to review and present December 2014 to February 2016 data collected for the Marine Fish Program. The seven objectives have been addressed in the following manner:

1. Describe the marine biophysical environment (i.e., water properties, zooplankton) in the vicinity of the Project's marine components and survey region.

   The methods, results and discussion for marine biophysical environment were presented for the survey region and in the nine survey areas in Sections 2.3.1 (Survey Region) and Section 2.3.2 (Survey Areas) respectively. The biophysical attributes were presented for each of the survey areas sampled across monthly sample periods.

2. Identify fish and marine invertebrates present in the survey region.

   The methods, results, and discussion for observed fish and marine invertebrates were presented for the survey region and the nine survey areas in Section 3.3.2.1 (Fish and Invertebrate Species Observed).

3. Identify spatial patterns of distribution, relative abundance, and biological characteristics for fish and marine invertebrates in the survey region

   The methods, results, and discussion were presented in Section 3.3.1 (General Temporal Patterns in Distribution and Relative Abundance of Fish), Section 3.3.2 (Distribution and Relative Abundance of Focal Fish Species Over Time), and Section 3.3.3 (Demographics), including Appendix B.2(Focal Species Catch Per Unit Effort), Appendix B.3 (Focal Species Demographics), Appendix C (Hydroacoustic Analysis Segments), Appendix D (Marine Fish Survey Incidental Sightings), and Appendix E (Exploratory Sample Methods and Results).

4. Identify temporal patterns of distribution, relative abundance and biological characteristics of fish and marine invertebrates in the survey region

   The methods, results, and discussion were presented in Section 3.3.1 (General Temporal Patterns in Distribution and Relative Abundance of Fish), Section 3.3.2 (Distribution and Relative Abundance of Focal Fish Species Over Time), Section 3.2.3 (Demographics) and Appendix B.

5. Identify salmonid prey items through examination of stomach contents

   The methods, results, and discussion were presented in Section 3.3.3.2 (Salmon Smolt Stomach Contents).

6. Examine any associations between water column properties and the presence of fish

   The methods, results, and discussion were presented in Section 4.0 (Associations between Water Column Properties and Fish Presence).

7. Interpret the patterns of select fish species' habitat use in the survey region

   The methods, results, and discussion were presented in Section 5.0 (Patterns of Fish Habitat Use in the Survey region).

# 7.0 CLOSURE

We trust that the above information meets with PNW LNG requirements. Should you have any further questions or require further information, please contact Mark Johannes at (604) 412-3098.

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# APPENDIX A
# SURVEY SCHEDULE AND EFFORT

# Appendix A SURVEY SCHEDULE AND EFFORT

## Table A-1 Marine Fish and Fish Habitat Survey Effort Summary

| Survey Type | Survey Number | Date | Effort (Days) | Area Surveyed |
|---|---|---|---|---|
| **Daytime** Marine Fish and Fish Habitat Survey | Daytime-01 | December 16–20, 2014 | 5 | A to F |
| | Daytime-02 | January 27–31, 2015 | 5 | A to F |
| | Daytime-03 | February 17–22, 2015 | 6 | A to F |
| | Daytime-04 | March 20–24, 2015 | 5 | A to F |
| | Daytime-05 | April 23–29, 2015 | 7 | A to F |
| | Daytime-06 | May 18–23, 2015 | 6 | A to F |
| | Daytime-07 | June 7–14, 2015 | 8 | A to I |
| | Daytime-08 | June 16–22, 2015 | 7 | A to I |
| | Daytime-09 | July 2–8, 2015 | 7 | A to I |
| | Daytime-10 | July 16–23, 2015 | 8 | A to I |
| | Daytime-11 | August 12–19, 2015 | 8 | A to I |
| | Daytime-12 | September 14–20, 2015 | 7 | A to I |
| | Daytime-13 | October 29–November 4, 2015 | 7 | A to I |
| | Daytime-14 | November 26–December 3, 2015 | 8 | A to I |
| | Daytime-15 | December 9–12, 2015 | 4 | A to I |
| | Daytime-16 | January 17–24, 2016 | 8 | A to I |
| | Daytime-17 | February 11–17 , 2016 | 7 | A to I |
| **Nighttime** Marine Fish and Fish Habitat Survey | Nighttime-01 | April 30–May 4, 2015 | 5 | A to F |
| | Nighttime-02 | May 12–15, 2015 | 4 | A to F |
| | Nighttime-03 | May 25–30, 2015 | 6 | A to F |
| | Nighttime-04 | June 3–8, 2015 | 6 | A to F |
| | Nighttime-05 | June 9–16, 2015 | 8 | A to G |
| | Nighttime-06 | June 16–23, 2015 | 8 | A to G |
| | Nighttime-07 | June 24–July 1, 2015 | 8 | A to G |
| | Nighttime-08 | July 1–9, 2015 | 9 | A to G |
| | Nighttime-09 | July 10–15, 2015 | 6 | A to G |
| **Total** | | | **173** | |

NOTE:
Effort (days) does not include weather days

## Table A-2 Fish and Fish Habitat Total Sample Effort (December 2014 – January 2016)

| Survey Number | Effort (Days) | Tucker Trawl 1 x 1 m | Tucker Trawl 2 x 2 m | Otter Trawl 5 x 5 m | Hydroacoustic Passes | Beach Seine 12 x 1.5 m | Beach Seine 22 x 3 m | Purse Seine 50 x 6 m | Fyke Net 15 x 1 m | Crab Traps | Zooplankton |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Daytime-01 | 5 | 0 | 0 | 0 | 0 | 5 | 4 | 0 | 0 | 25 | 0 |
| Daytime-02 | 5 | 5 | 0 | 0 | 5 | 14 | 4 | 0 | 0 | 24 | 0 |
| Daytime-03 | 6 | 0 | 6 | 0 | 6 | 22 | 0 | 0 | 0 | 22 | 0 |
| Daytime-04 | 5 | 0 | 5 | 0 | 5 | 22 | 0 | 0 | 4 | 21 | 0 |
| Daytime-05 | 7 | 0 | 1 | 4 | 1 | 15 | 0 | 0 | 2 | 22 | 0 |
| Daytime-06 | 6 | 0 | 10 | 0 | 10 | 16 | 6 | 0 | 3 | 23 | 0 |
| Daytime-07 | 8 | 0 | 15 | 0 | 0* | 39 | 0 | 0 | 0 | 18 | 0 |
| Daytime-08 | 7 | 0 | 18 | 3 | 0* | 41 | 3 | 0 | 1 | 17 | 0 |
| Daytime-09 | 7 | 0 | 20 | 0 | 20 | 42 | 3 | 0 | 0 | 18 | 0 |
| Daytime-10 | 8 | 0 | 15 | 0 | 15 | 43 | 3 | 0 | 0 | 18 | 0 |
| Daytime-11 | 8 | 0 | 15 | 0 | 15 | 41 | 3 | 0 | 0 | 18 | 0 |
| Daytime-12 | 7 | 0 | 18 | 0 | 18 | 28 | 3 | 0 | 0 | 14 | 0 |
| Daytime-13 | 7 | 0 | 18 | 0 | 18 | 14 | 0 | 0 | 0 | 13 | 0 |
| Daytime-14 | 8 | 0 | 16 | 0 | 16 | 20 | 0 | 0 | 0 | 14 | 0 |
| Daytime-15 | 4 | 0 | 17 | 0 | 17 | 10 | 0 | 0 | 0 | 14 | 0 |
| Daytime-16 | 8 | 0 | 17 | 0 | 17 | 12 | 0 | 0 | 0 | 14 | 0 |
| Daytime-17 | 7 | 0 | 17 | 0 | 17 | 29 | 0 | 0 | 0 | 14 | 0 |
| Nighttime-01 | 5 | 0 | 14 | 0 | 14 | 0 | 0 | 0 | 1 | 0 | 0 |
| Nighttime-02 | 4 | 0 | 19 | 0 | 19 | 0 | 0 | 0 | 3 | 0 | 19 |
| Nighttime-03 | 6 | 0 | 34 | 0 | 34 | 0 | 0 | 0 | 3 | 0 | 18 |
| Nighttime-04 | 6 | 0 | 33 | 0 | 33 | 0 | 0 | 0 | 0 | 0 | 37 |

## Table A-2 Fish and Fish Habitat Total Sample Effort (December 2014 – January 2016)

| Survey Number | Effort (Days) | Tucker Trawl 1 x 1 m | Tucker Trawl 2 x 2 m | Otter Trawl 5 x 5 m | Hydroacoustic Passes | Beach Seine 12 x 1.5 m | Beach Seine 22 x 3 m | Purse Seine 50 x 6 m | Fyke Net 15 x 1 m | Crab Traps | Zooplankton |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Nighttime-05 | 8 | 0 | 37 | 0 | 0* | 0 | 0 | 0 | 2 | 0 | 37 |
| Nighttime-06 | 8 | 0 | 55 | 0 | 0* | 0 | 0 | 7 | 3 | 0 | 37 |
| Nighttime-07 | 8 | 0 | 48 | 0 | 48 | 0 | 0 | 15 | 4 | 0 | 37 |
| Nighttime-08 | 9 | 0 | 41 | 0 | 41 | 0 | 0 | 24 | 0 | 0 | 37 |
| Nighttime-09 | 6 | 0 | 47 | 0 | 47 | 0 | 0 | 10 | 0 | 0 | 37 |
| **Total** | **173** | **5** | **536** | **7** | **416** | **413** | **29** | **56** | **26** | **309** | **259** |

NOTES:

* Indicates a period during which the hydroacoustics device was being repaired and no acoustic surveys were completed. Trawl and hydroacoustic surveys were otherwise paired; hydroacoustic passes were inferred from trawl data.

# APPENDIX B
# DATA SUMMARIES

# Appendix B DATA SUMMARIES

## B.1 ZOOPLANKTON RELATIVE ABUNDANCE

**Table B-1 Median Relative Abundance (%) of Organisms for All Zooplankton Hauls Combined (May to December 2015; n = 176)**

| Taxonomic Group | Uncorrected[a] Median % Relative Abundance (Inter-Quartile Range) | | | | | | |
|---|---|---|---|---|---|---|---|
| | All Areas Combined | A | B | C | D | E | F |
| Crustacea–Copepoda | 56.2 (43.3–72.8) | 53.3 (43.7-69.7) | 50.5 (37.6-65.7) | 53.3 (40.2-73.3) | 60.3 (45.8-72.8) | 66.7 (53.1-79.4) | 56.9 (36.6-77) |
| Crustacea–Cirripedia | 15.9 (8.5-26.8) | 17.1 (9.5-26.7) | 27.5 (11.2-36.5) | 16.9 (5.5-24.3) | 14.8 (8.8-23.1) | 12.5 (8.4-15.1) | 15.8 (4.8-20.7) |
| Crustacea–Cladocera | 3.0 (0–8.2) | 3.3 (0.6-7.8) | 3.7 (0-9.9) | 5 (0-7.4) | 2.5 (0-8.2) | 1.7 (0.4-3.7) | 4.2 (0.1-10.6) |
| Appendicularia | 1.6 (0.6–5.5) | 1.7 (0.8-6.6) | 1.7 (0.8-4.1) | 2.1 (0.6-2.8) | 1.4 (0.4-5.4) | 2 (0.6-8) | 2.1 (0.6-6.1) |
| Crustacea–Eumalacostraca | 1.4 (0.4-3.2) | 1.5 (0.4-3.1) | 1 (0.5-2) | 1.3 (0.2-2.6) | 1.3 (0.4-4.7) | 1.8 (0.5-3.5) | 0.8 (0.5-3.2) |
| Crustacea–Decapoda | 0.9 (0.4–2.1) | 0.8 (0.4-2.1) | 1.8 (0.4-4) | 0.5 (0-1.9) | 0.8 (0.4-1.5) | 0.9 (0.5-1.7) | 0.5 (0.4-1.5) |
| Mollusca–Gastropoda | 0.8 (0.3–1.7) | 1.7 (0.6-3) | 0.7 (0.4-1.3) | 0.4 (0-0.5) | 0.6 (0-1.5) | 1 (0.4-1.6) | 0.4 (0-1) |
| Crustacea | 0.5 (0–1.4) | 0.6 (0-1.4) | 0.5 (0-1.4) | 0.8 (0-1.9) | 0.5 (0-1.2) | 0.5 (0-1.3) | 0 (0-0.6) |
| Cnidaria | 0.5 (0–1.2) | 0.5 (0-1.1) | 0.9 (0-2.3) | 0.5 (0.2-1.9) | 0 (0-0.8) | 0.4 (0-0.9) | 0.5 (0.1-1) |
| Chaetognatha | 0 (0–0.5) | 0.2 (0-0.5) | 0 (0-0.3) | 0 (0-0.7) | 0 (0-0.5) | 0.3 (0-0.5) | 0 (0-0.4) |
| Polychaeta | 0 (0–0.5) | 0 (0-0.5) | 0.4 (0-0.8) | 0 (0-0.4) | 0 (0-0.4) | 0.2 (0-0.4) | 0 (0-0.4) |
| Cnidaria–Hydrozoa | 0 (0–0.4) | 0 (0-0.5) | 0 (0-0) | 0 (0-3.8) | 0 (0-0.4) | 0 (0-0.4) | 0 (0-0.5) |
| Unknown | 0 (0–0.4) | 0 (0-0.6) | 0 (0–0) | 0 (0–0) | 0 (0–0) | 0.1 (0-1.9) | 0 (0-0.4) |
| Unidentified benthic organism | 0 (0–0.3) | 0 (0-0.1) | 0 (0-0.6) | 0 (0–0) | 0 (0-0.4) | 0 (0-0.3) | 0 (0-0.2) |
| Pisces | 0 (0–0.1) | 0 (0-0.1) | 0 (0-0.1) | 0 (0–0) | 0 (0–0.2) | 0 (0-0.1) | 0 (0-0.1) |

**Table B-1 Median Relative Abundance (%) of Organisms for All Zooplankton Hauls Combined (May to December 2015; n = 176)**

| Taxonomic Group | Uncorrected[a] Median % Relative Abundance (Inter-Quartile Range) | | | | | | |
|---|---|---|---|---|---|---|---|
| | All Areas Combined | A | B | C | D | E | F |
| Bryozoa | 0 (0–0) | 0 (0–0) | 0 (0–0) | 0 (0–0) | 0 (0–0) | 0 (0–0) | 0 (0–0) |
| Cnidaria–Scyphozoa | 0 (0–0) | 0 (0-0.5) | 0 (0-0) | 0 (0-3.8) | 0 (0-0.4) | 0 (0-0.4) | 0 (0-0.5) |
| Crustacea–Amphipoda | 0 (0–0) | 0 (0–0) | 0 (0–0) | 0 (0–0) | 0 (0–0) | 0 (0–0) | 0 (0–0) |
| Crustacea–Isopoda | 0 (0–0) | 0 (0–0) | 0 (0–0) | 0 (0–0) | 0 (0–0) | 0 (0-0.3) | 0 (0–0) |
| Crustacea–Mysidacea | 0 (0–0) | 0 (0–0) | 0 (0–0) | 0 (0–0) | 0 (0–0) | 0 (0–0) | 0 (0–0) |
| Crustacea–Ostracoda | 0 (0–0) | 0 (0–0) | 0 (0–0) | 0 (0–0) | 0 (0–0) | 0 (0-0.3) | 0 (0–0) |
| Ctenophore | 0 (0–0) | 0 (0–0) | 0 (0–0) | 0 (0–0) | 0 (0–0) | 0 (0–0) | 0 (0–0) |
| Echinodermata–Asteroidea | 0 (0–0) | 0 (0–0) | 0 (0–0) | 0 (0–0) | 0 (0–0) | 0 (0–0) | 0 (0–0) |
| Echinodermata–Echinoidea | 0 (0–0) | 0 (0–0) | 0 (0–0) | 0 (0–0) | 0 (0–0) | 0 (0–0) | 0 (0–0) |
| Echinodermata–Holothuroidea | 0 (0–0) | 0 (0–0) | 0 (0–0) | 0 (0–0) | 0 (0–0) | 0 (0–0) | 0 (0–0) |
| Echinodermata–Ophiuroidea | 0 (0–0) | 0 (0–0) | 0 (0–0) | 0 (0–0) | 0 (0–0) | 0 (0–0) | 0 (0-0.2) |
| Echiura | 0 (0–0) | 0 (0–0) | 0 (0–0) | 0 (0–0) | 0 (0–0) | 0 (0–0) | 0 (0–0) |
| Unidentified terrestrial organism | 0 (0–0) | 0 (0–0) | 0 (0–0) | 0 (0–0) | 0 (0–0) | 0 (0–0) | 0 (0–0) |
| Mollusca–Bivalvia | 0 (0–0) | 0 (0-0.3) | 0 (0–0) | 0 (0–0) | 0 (0–0) | 0 (0–0) | 0 (0–0) |
| Nemertea | 0 (0–0) | 0 (0–0) | 0 (0–0) | 0 (0–0) | 0 (0–0) | 0 (0–0) | 0 (0–0) |
| Phoronida | 0 (0–0) | 0 (0–0) | 0 (0–0) | 0 (0–0) | 0 (0–0) | 0 (0–0) | 0 (0–0) |

**Table B-1 Median Relative Abundance (%) of Organisms for All Zooplankton Hauls Combined (May to December 2015; n = 176)**

| Taxonomic Group | Uncorrected[a] Median % Relative Abundance (Inter-Quartile Range) | | | | | | |
|---|---|---|---|---|---|---|---|
| | All Areas Combined | A | B | C | D | E | F |
| Polychaeta–Errantia | 0 (0–0) | 0 (0–0) | 0 (0–0) | 0 (0–0) | 0 (0–0) | 0 (0–0) | 0 (0–0) |
| Polychaeta–Sedentaria | 0 (0–0) | 0 (0–0) | 0 (0–0) | 0 (0–0) | 0 (0–0) | 0 (0–0) | 0 (0–0) |
| Sipuncula | 0 (0–0) | 0 (0–0) | 0 (0–0) | 0 (0–0) | 0 (0–0) | 0 (0–0) | 0 (0–0) |
| Ascidiacea | 0 (0–0) | 0 (0–0) | 0 (0–0) | 0 (0–0) | 0 (0–0) | 0 (0–0) | 0 (0–0) |

NOTE:

[a] Values labelled as uncorrected because they were calculated by treating all sample sites as independent samples rather than first weighting values by sampling areas.

## B.2 FOCAL SPECIES CATCH PER UNIT EFFORT

### Table B-2 CPUE (Fish per 100 m$^2$) Summary Statistics for Pacific Herring in Beach Seine Catches

| Area | Month | Min | Q1 | Median | Q3 | Max | Mean | SD | Individuals Caught | Area Seined |
|---|---|---|---|---|---|---|---|---|---|---|
| A | Jan-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2,969 |
| A | Feb-15 | 0 | 0 | 0 | 0.66 | 7.72 | 0.97 | 2.17 | 62 | 7,914 |
| A | Mar-15 | 0 | 0 | 0 | 0.51 | 1.34 | 0.31 | 0.45 | 19 | 7,914 |
| A | Apr-15 | 0 | 0 | 0 | 0 | 0.19 | 0.03 | 0.08 | 1 | 3,037 |
| A | May-15 | 0 | 0 | 0 | 0 | 0.22 | 0.04 | 0.08 | 4 | 4,860 |
| A | Jun-15 | 0 | 0 | 0 | 0 | 0.22 | 0.04 | 0.09 | 4 | 7,104 |
| A | Jul-15 | 0 | 0 | 0.5 | 2.3 | 27.53 | 3.86 | 7.88 | 454 | 5,780 |
| A | Aug-15 | 0 | 0 | 0.19 | 0.96 | 11.44 | 1.52 | 3.32 | 88 | 5,780 |
| A | Sep-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2,018 |
| A | Oct-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1,505 |
| A | Nov-15 | 0 | 0 | 0 | 0.41 | 6.09 | 0.87 | 2.12 | 34 | 3,998 |
| A | Jan-16 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2,018 |
| A | Feb-16 | 0 | 0 | 0 | 0.2 | 3.47 | 0.58 | 1.2 | 23 | 4,401 |
| B | Dec-14 | 0 | 0 | 0 | 0 | 3.79 | 0.42 | 1.26 | 11 | 2,397 |
| B | Jan-15 | 0 | 0 | 0 | 0 | 7.1 | 0.84 | 2.35 | 12 | 2,397 |
| B | Feb-15 | 0.47 | 0.89 | 3.03 | 8.97 | 44.39 | 10.83 | 16.33 | 213 | 2,397 |
| B | Mar-15 | 0 | 0 | 0 | 0.22 | 0.53 | 0.13 | 0.2 | 3 | 2,397 |
| B | Apr-15 | 0 | 0 | 0 | 0.41 | 1.48 | 0.26 | 0.49 | 6 | 2,397 |
| B | May-15 | 0 | 0 | 0 | 0.21 | 1.84 | 0.33 | 0.68 | 8 | 2,210 |
| B | Jun-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2,397 |
| B | Jul-15 | 0 | 0 | 0 | 0 | 0.22 | 0.01 | 0.05 | 1 | 2,397 |
| B | Aug-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2,397 |
| B | Sep-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1,099 |
| C | May-15 | 0 | 0.13 | 0.26 | 0.39 | 0.51 | 0.26 | 0.36 | 9 | 1,498 |
| C | Jun-15 | 0.58 | 0.61 | 0.64 | 1.02 | 1.39 | 0.87 | 0.45 | 25 | 3,228 |
| C | Jul-15 | 0 | 0 | 0.17 | 0.55 | 0.9 | 0.31 | 0.39 | 18 | 3,228 |
| C | Aug-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3,228 |
| C | Sep-15 | 0 | 0 | 0 | 0.03 | 0.06 | 0.02 | 0.03 | 1 | 3,228 |
| G | Jun-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3,209 |
| G | Jul-15 | 0 | 0 | 0 | 0 | 3.47 | 0.2 | 0.79 | 12 | 3,299 |

### Table B-2 CPUE (Fish per 100 m²) Summary Statistics for Pacific Herring in Beach Seine Catches

| Area | Month | Min | Q1 | Median | Q3 | Max | Mean | SD | Individuals Caught | Area Seined |
|---|---|---|---|---|---|---|---|---|---|---|
| G | Aug-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3,209 |
| G | Sep-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3,209 |
| G | Nov-15 | 0 | 0 | 0 | 0.38 | 1.5 | 0.38 | 0.75 | 6 | 1,633 |
| G | Feb-16 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3,209 |
| H | Jun-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2,644 |
| H | Jul-15 | 0 | 0 | 0 | 1.01 | 4.33 | 0.75 | 1.27 | 41 | 2,644 |
| H | Aug-15 | 0 | 0.15 | 2.03 | 6.55 | 11.39 | 3.83 | 4.49 | 114 | 2,644 |
| H | Sep-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2,644 |
| H | Nov-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2,644 |
| H | Dec-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2,254 |
| H | Jan-16 | 0 | 0 | 0 | 0.06 | 0.23 | 0.06 | 0.12 | 1 | 1,485 |
| H | Feb-16 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2,644 |
| I | Jun-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1,614 |
| I | Jul-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 8 | 1,614 |
| I | Aug-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1,614 |
| I | Sep-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1,614 |
| I | Nov-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1,614 |
| I | Dec-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1,614 |
| I | Jan-16 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1,614 |
| I | Feb-16 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1,614 |

NOTE:

Minimum, Q1, median, Q3, maximum, mean, and standard deviation are calculated for 100 m² area fished. Individuals caught and area seined is the monthly totals.

## Table B-3 CPUE (Fish per 15 minutes) Summary Statistics for Pacific Herring in Trawl Catches

| Survey Time | Area | Month | Min | Q1 | Median | Q3 | Max | Mean | SD | Individuals Caught | Minutes Trawled |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Day | A, B, C, D, E, F | Feb-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 189 |
| Day | A, B, C, D, E, F | Mar-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 198 |
| Day | A, B, C, D, E, F | Apr-15 | 0 | 0 | 0 | 0 | 0 | 0 | NA | 0 | 63 |
| Day | A, B, C, D, E, F | May-15 | 0 | 0.1 | 3.35 | 12.65 | 15.75 | 6.24 | 6.94 | 86 | 247 |
| Day | A, B, C, D, E, F | Jun-15 | 0 | 0 | 0 | 0 | 854.38 | 65.72 | 236.96 | 1,367 | 425 |
| Day | A, B, C, D, E, F | Jul-15 | 0 | 0 | 0 | 0.5 | 23.57 | 2.02 | 6.49 | 85 | 448 |
| Day | A, B, C, D, E, F | Aug-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 175 |
| Day | A, B, C, D, E, F | Sep-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 173 |
| Day | A, B, C, D, E, F | Oct-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 174 |
| Day | A, B, C, D, E, F | Nov-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 243 |
| Day | A, B, C, D, E, F | Dec-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 158 |
| Day | A, B, C, D, E, F | Jan-16 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 191 |
| Day | A, B, C, D, E, F | Feb-16 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 160 |
| Day | G | Jun-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 131 |
| Day | G | Jul-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 210 |
| Day | G | Aug-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 76 |
| Day | G | Sep-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 125 |
| Day | G | Nov-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 127 |
| Day | G | Dec-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 202 |
| Day | G | Jan-16 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 108 |

## Table B-3 CPUE (Fish per 15 minutes) Summary Statistics for Pacific Herring in Trawl Catches

| Survey Time | Area | Month | Min | Q1 | Median | Q3 | Max | Mean | SD | Individuals Caught | Minutes Trawled |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Day | G | Feb-16 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 150 |
| Day | H | Jun-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 107 |
| Day | H | Jul-15 | 0 | 11.97 | 30 | 65.82 | 121.76 | 43.91 | 46.82 | 343 | 125 |
| Day | H | Aug-15 | 0.83 | 1.02 | 1.2 | 8.68 | 16.15 | 6.06 | 8.74 | 17 | 56 |
| Day | H | Sep-15 | 0.71 | 0.8 | 0.88 | 1.94 | 3 | 1.53 | 1.27 | 5 | 53 |
| Day | H | Nov-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 103 |
| Day | H | Dec-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 76 |
| Day | H | Jan-16 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 54 |
| Day | H | Feb-16 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 55 |
| Day | I | Jun-15 | 0 | 0 | 0 | 0.29 | 0.6 | 0.17 | 0.29 | 2 | 175 |
| Day | I | Jul-15 | 0 | 3.23 | 12.95 | 96.48 | 810 | 146.05 | 296.37 | 624 | 131 |
| Day | I | Aug-15 | 0 | 0 | 0 | 0.21 | 0.43 | 0.14 | 0.25 | 1 | 94 |
| Day | I | Sep-15 | 0 | 0 | 0 | 0.22 | 0.44 | 0.15 | 0.25 | 1 | 118 |
| Day | I | Nov-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 62 |
| Day | I | Dec-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 156 |
| Day | I | Jan-16 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 100 |
| Day | I | Feb-16 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 49 |
| Night | A, B, C, D, E, F | Apr-15 | 0 | 0 | 0 | 0 | 0.29 | 0.05 | 0.12 | 1 | 124 |
| Night | A, B, C, D, E, F | May-15 | 0 | 0 | 0 | 0 | 9.38 | 0.58 | 1.57 | 39 | 551 |

## Table B-3 CPUE (Fish per 15 minutes) Summary Statistics for Pacific Herring in Trawl Catches

| Survey Time | Area | Month | Min | Q1 | Median | Q3 | Max | Mean | SD | Individuals Caught | Minutes Trawled |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Night | A, B, C, D, E, F | Jun-15 | 0 | 0 | 0 | 0 | 20 | 0.48 | 1.89 | 58 | 493 |
| Night | A, B, C, D, E, F | Jul-15 | 0 | 0 | 0 | 0.75 | 286.88 | 4.57 | 34.5 | 179 | 229 |
| Night | G | Jun-15 | 0 | 0 | 0 | 0 | 0.68 | 0.02 | 0.12 | 1 | 281 |
| Night | G | Jul-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 173 |

NOTE:

Minimum, Q1, median, Q3, maximum, mean, and standard deviation are calculated for 15 minute tows. Individuals caught and minutes trawled are the monthly totals.

## Table B-4 CPUE (Fish per 100 m²) Summary Statistics for Surf Smelt in Beach Seine Catches

| Area | Month | Min | Q1 | Median | Q3 | Max | Mean | SD | Individuals Caught | Area Seined |
|---|---|---|---|---|---|---|---|---|---|---|
| A | Jan-15 | 0 | 0 | 0.21 | 7.62 | 18.69 | 4.88 | 7.93 | 180 | 2,969 |
| A | Feb-15 | 0 | 0.6 | 1.32 | 6.74 | 59.79 | 10.61 | 18.72 | 591 | 7,914 |
| A | Mar-15 | 0 | 0.15 | 14.83 | 42.58 | 83.6 | 24.94 | 27.5 | 1,458 | 7,914 |
| A | Apr-15 | 0 | 18.06 | 61.62 | 94.38 | 169.65 | 66.95 | 63.63 | 1,731 | 3,037 |
| A | May-15 | 0.17 | 0.5 | 3.76 | 10.04 | 112.29 | 25.79 | 44.13 | 1,120 | 4,860 |
| A | Jun-15 | 0 | 0 | 0.2 | 0.35 | 2.23 | 0.52 | 0.78 | 42 | 7,104 |
| A | Jul-15 | 0 | 0 | 0.36 | 2.9 | 27.04 | 4.13 | 7.88 | 438 | 5,780 |
| A | Aug-15 | 0 | 0 | 0.28 | 10.11 | 22.74 | 5.4 | 7.9 | 294 | 5,780 |
| A | Sep-15 | 0 | 0 | 0 | 0.1 | 0.4 | 0.1 | 0.2 | 2 | 2,018 |
| A | Oct-15 | 0 | 0.1 | 0.2 | 0.41 | 0.62 | 0.27 | 0.32 | 4 | 1,505 |
| A | Nov-15 | 1.91 | 3.57 | 4.75 | 6.62 | 7.28 | 4.81 | 2.13 | 192 | 3,998 |
| A | Jan-16 | 0.19 | 0.2 | 0.29 | 0.6 | 1.25 | 0.51 | 0.5 | 10 | 2,018 |
| A | Feb-16 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 4,401 |
| B | Dec-14 | 0 | 0.41 | 1.4 | 2.67 | 4.06 | 1.6 | 1.58 | 39 | 2,397 |
| B | Jan-15 | 0 | 1.1 | 6.42 | 11.44 | 163.8 | 28.1 | 54 | 806 | 2,397 |
| B | Feb-15 | 0 | 0.74 | 5.01 | 15.06 | 135.86 | 26.24 | 46.04 | 453 | 2,397 |
| B | Mar-15 | 0 | 0 | 0.55 | 21.4 | 26.74 | 9.81 | 11.74 | 253 | 2,397 |
| B | Apr-15 | 0 | 0 | 0 | 0.34 | 45.2 | 5.24 | 14.99 | 74 | 2,397 |
| B | May-15 | 0 | 0 | 0 | 3.82 | 13.65 | 3.29 | 5.73 | 84 | 2,210 |
| B | Jun-15 | 0 | 0 | 0 | 0 | 345.2 | 20.43 | 83.69 | 1,006 | 2,397 |
| B | Jul-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2,397 |
| B | Aug-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2,397 |
| B | Sep-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1,099 |
| C | May-15 | 4.72 | 5.63 | 6.54 | 7.45 | 8.36 | 6.54 | 2.58 | 109 | 1,498 |
| C | Jun-15 | 0.26 | 0.42 | 0.58 | 0.84 | 1.11 | 0.65 | 0.43 | 20 | 3,228 |
| C | Jul-15 | 0 | 0 | 0 | 0.49 | 1.03 | 0.29 | 0.45 | 15 | 3,228 |
| C | Aug-15 | 0 | 0.06 | 0.12 | 2.95 | 5.79 | 1.97 | 3.31 | 47 | 3,228 |
| C | Sep-15 | 0 | 0 | 0 | 0.07 | 0.14 | 0.05 | 0.08 | 1 | 3,228 |
| G | Jun-15 | 0 | 0 | 0 | 1.9 | 14.99 | 2.82 | 5.1 | 155 | 3,209 |
| G | Jul-15 | 0 | 0 | 0 | 0 | 2.64 | 0.21 | 0.63 | 15 | 3,299 |
| G | Aug-15 | 0 | 0 | 0 | 4.1 | 6.01 | 1.84 | 2.49 | 56 | 3,209 |
| G | Sep-15 | 0 | 0 | 0 | 0 | 1.26 | 0.16 | 0.45 | 4 | 3,209 |

## Table B-4 CPUE (Fish per 100 m²) Summary Statistics for Surf Smelt in Beach Seine Catches

| Area | Month | Min | Q1 | Median | Q3 | Max | Mean | SD | Individuals Caught | Area Seined |
|---|---|---|---|---|---|---|---|---|---|---|
| G | Nov-15 | 0.75 | 3.33 | 15.3 | 26.56 | 27.05 | 14.6 | 14.07 | 225 | 1,633 |
| G | Feb-16 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3,209 |
| H | Jun-15 | 0 | 0.29 | 0.57 | 1.26 | 18.46 | 2.52 | 5.29 | 121 | 2,644 |
| H | Jul-15 | 0 | 0.37 | 0.8 | 2.78 | 6.12 | 1.71 | 2.02 | 87 | 2,644 |
| H | Aug-15 | 0 | 0 | 0 | 0.23 | 0.51 | 0.14 | 0.24 | 4 | 2,644 |
| H | Sep-15 | 0 | 0 | 0 | 0.64 | 1.84 | 0.45 | 0.78 | 11 | 2,644 |
| H | Nov-15 | 0 | 0 | 0.23 | 2.03 | 6.61 | 1.44 | 2.16 | 65 | 2,644 |
| H | Dec-15 | 1.13 | 2.25 | 3.34 | 9.98 | 93.96 | 19.31 | 36.78 | 476 | 2,254 |
| H | Jan-16 | 13.25 | 15.9 | 68.73 | 148.39 | 231.54 | 95.56 | 103.44 | 1,624 | 1,485 |
| H | Feb-16 | 0 | 0 | 0 | 0.16 | 0.65 | 0.14 | 0.25 | 3 | 2,644 |
| I | Jun-15 | 0 | 0 | 0 | 0.23 | 0.26 | 0.08 | 0.12 | 3 | 1,614 |
| I | Jul-15 | 0 | 0 | 0.25 | 0.57 | 3.07 | 0.61 | 1.03 | 19 | 1,614 |
| I | Aug-15 | 0 | 0.17 | 0.49 | 0.75 | 0.77 | 0.44 | 0.38 | 7 | 1,614 |
| I | Sep-15 | 0 | 0 | 0 | 0.06 | 0.25 | 0.06 | 0.13 | 1 | 1,614 |
| I | Nov-15 | 2.82 | 8.21 | 14.01 | 19.2 | 22.78 | 13.4 | 8.81 | 218 | 1,614 |
| I | Dec-15 | 0 | 0 | 0.36 | 0.57 | 1.5 | 0.44 | 0.51 | 14 | 1,614 |
| I | Jan-16 | 0 | 0 | 0.13 | 1.35 | 4.61 | 1.22 | 2.27 | 19 | 1,614 |
| I | Feb-16 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1,614 |

NOTE:

Minimum, Q1, median, Q3, maximum, mean, and standard deviation are calculated for 100 m² area fished. Individuals caught and area seined are the monthly totals.

## Table B-5 CPUE (Fish per 15 minutes) Summary Statistics for Surf Smelt in Trawl Catches

| Survey Time | Area | Month | Min | Q1 | Median | Q3 | Max | Mean | SD | Individuals Caught | Minutes Trawled |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Day | A, B, C, D, E, F | Feb-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 189 |
| Day | A, B, C, D, E, F | Mar-15 | 0 | 0 | 0 | 0.48 | 0.48 | 0.19 | 0.26 | 4 | 198 |
| Day | A, B, C, D, E, F | Apr-15 | 0 | 0 | 0 | 0 | 0 | 0 | NA | 0 | 63 |
| Day | A, B, C, D, E, F | May-15 | 0 | 1.3 | 4.69 | 9.5 | 20.29 | 6.72 | 6.73 | 84 | 247 |
| Day | A, B, C, D, E, F | Jun-15 | 0 | 0 | 0.47 | 0.77 | 8.75 | 1.06 | 2.35 | 26 | 425 |
| Day | A, B, C, D, E, F | Jul-15 | 0 | 0 | 0 | 0 | 1.53 | 0.14 | 0.42 | 6 | 448 |
| Day | A, B, C, D, E, F | Aug-15 | 0 | 0 | 0 | 0 | 0.71 | 0.14 | 0.32 | 1 | 175 |
| Day | A, B, C, D, E, F | Sep-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 173 |
| Day | A, B, C, D, E, F | Oct-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 174 |
| Day | A, B, C, D, E, F | Nov-15 | 0 | 0 | 0 | 0.4 | 0.48 | 0.18 | 0.23 | 3 | 243 |
| Day | A, B, C, D, E, F | Dec-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 158 |
| Day | A, B, C, D, E, F | Jan-16 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 191 |
| Day | A, B, C, D, E, F | Feb-16 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 160 |
| Day | G | Jun-15 | 0 | 0 | 0 | 0 | 2 | 0.29 | 0.76 | 4 | 131 |
| Day | G | Jul-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 210 |
| Day | G | Aug-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 76 |
| Day | G | Sep-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 125 |
| Day | G | Nov-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 127 |
| Day | G | Dec-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 202 |
| Day | G | Jan-16 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 108 |

## Table B-5 CPUE (Fish per 15 minutes) Summary Statistics for Surf Smelt in Trawl Catches

| Survey Time | Area | Month | Min | Q1 | Median | Q3 | Max | Mean | SD | Individuals Caught | Minutes Trawled |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Day | G | Feb-16 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 150 |
| Day | H | Jun-15 | 0 | 0.54 | 3.07 | 32.94 | 71.43 | 20.03 | 30.1 | 195 | 107 |
| Day | H | Jul-15 | 0 | 0 | 1.07 | 2.29 | 7.17 | 1.83 | 2.59 | 17 | 125 |
| Day | H | Aug-15 | 0 | 0.42 | 0.83 | 3.88 | 6.92 | 2.59 | 3.78 | 7 | 56 |
| Day | H | Sep-15 | 7.14 | 7.54 | 7.94 | 11.97 | 16 | 10.36 | 4.9 | 35 | 53 |
| Day | H | Nov-15 | 0 | 0 | 0.79 | 2.42 | 13.85 | 3.41 | 5.92 | 18 | 103 |
| Day | H | Dec-15 | 0 | 0 | 0 | 0.42 | 1.67 | 0.42 | 0.83 | 2 | 76 |
| Day | H | Jan-16 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 54 |
| Day | H | Feb-16 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 55 |
| Day | I | Jun-15 | 0 | 0 | 0.58 | 1.54 | 7.14 | 1.54 | 2.58 | 17 | 175 |
| Day | I | Jul-15 | 0 | 0 | 0 | 3 | 9.81 | 2.26 | 4.01 | 19 | 131 |
| Day | I | Aug-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 94 |
| Day | I | Sep-15 | 0 | 0 | 0 | 0.28 | 0.56 | 0.19 | 0.32 | 1 | 118 |
| Day | I | Nov-15 | 0 | 0 | 0 | 0.25 | 1 | 0.25 | 0.5 | 2 | 62 |
| Day | I | Dec-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 156 |
| Day | I | Jan-16 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 100 |
| Day | I | Feb-16 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 49 |
| Night | A, B, C, D, E, F | Apr-15 | 0 | 0 | 0.39 | 2.7 | 4.12 | 1.37 | 1.86 | 17 | 124 |
| Night | A, B, C, D, E, F | May-15 | 0 | 0 | 0.88 | 3 | 18.75 | 2.38 | 3.89 | 161 | 551 |
| Night | A, B, C, D, E, F | Jun-15 | 0 | 0 | 0 | 1.5 | 138.33 | 3.37 | 12.88 | 518 | 493 |

### Table B-5 CPUE (Fish per 15 minutes) Summary Statistics for Surf Smelt in Trawl Catches

| Survey Time | Area | Month | Min | Q1 | Median | Q3 | Max | Mean | SD | Individuals Caught | Minutes Trawled |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Night | A, B, C, D, E, F | Jul-15 | 0 | 0 | 0 | 1.73 | 27.5 | 2.1 | 4.76 | 130 | 229 |
| Night | G | Jun-15 | 0 | 0 | 0 | 0 | 4.29 | 0.2 | 0.8 | 6 | 281 |
| Night | G | Jul-15 | 0 | 0 | 0 | 0 | 0.62 | 0.03 | 0.14 | 1 | 173 |

NOTE:

Minimum, Q1, median, Q3, maximum, mean, and standard deviation are calculated for 15 minute tows. Individuals caught and minutes trawled are the monthly totals.

## Table B-6 CPUE (Fish per 100 m²) Summary Statistics Chinook Salmon in Beach Seine Catches

| Area | Month | Min | Q1 | Median | Q3 | Max | Mean | SD | Individuals Caught | Area Seined |
|---|---|---|---|---|---|---|---|---|---|---|
| A | Jan-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2,969 |
| A | Feb-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 7,914 |
| A | Mar-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 7,914 |
| A | Apr-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3,037 |
| A | May-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 4,860 |
| A | Jun-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 7,104 |
| A | Jul-15 | 0 | 0 | 0 | 0 | 0.25 | 0.01 | 0.05 | 1 | 5,780 |
| A | Aug-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 5,780 |
| A | Sep-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2,018 |
| A | Oct-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1,505 |
| A | Nov-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3,998 |
| A | Jan-16 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2,018 |
| A | Feb-16 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 4,401 |
| B | Dec-14 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2,397 |
| B | Jan-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2,397 |
| B | Feb-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2,397 |
| B | Mar-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2,397 |
| B | Apr-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2,397 |
| B | May-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2,210 |
| B | Jun-15 | 0 | 0 | 0 | 0.22 | 1.72 | 0.2 | 0.44 | 9 | 2,397 |
| B | Jul-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2,397 |
| B | Aug-15 | 0 | 0 | 0 | 0 | 0.41 | 0.05 | 0.14 | 1 | 2,397 |
| B | Sep-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1,099 |
| C | May-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1,498 |
| C | Jun-15 | 0 | 0 | 0 | 0.03 | 0.06 | 0.02 | 0.03 | 1 | 3,228 |
| C | Jul-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3,228 |
| C | Aug-15 | 0 | 0.12 | 0.23 | 0.46 | 0.69 | 0.31 | 0.35 | 9 | 3,228 |
| C | Sep-15 | 0 | 0.03 | 0.06 | 0.16 | 0.26 | 0.11 | 0.14 | 3 | 3,228 |
| G | Jun-15 | 0 | 0 | 0 | 0 | 1.18 | 0.08 | 0.31 | 4 | 3,209 |
| G | Jul-15 | 0 | 0 | 0 | 0 | 0.25 | 0.01 | 0.06 | 1 | 3,299 |
| G | Aug-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3,209 |
| G | Sep-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3,209 |

## Table B-6 CPUE (Fish per 100 m²) Summary Statistics Chinook Salmon in Beach Seine Catches

| Area | Month | Min | Q1 | Median | Q3 | Max | Mean | SD | Individuals Caught | Area Seined |
|---|---|---|---|---|---|---|---|---|---|---|
| G | Nov-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1,633 |
| G | Feb-16 | 0 | 0 | 0 | 0 | 0.23 | 0.03 | 0.08 | 1 | 3,209 |
| H | Jun-15 | 0 | 0 | 0 | 0 | 0.31 | 0.03 | 0.09 | 1 | 2,644 |
| H | Jul-15 | 0 | 0 | 0.11 | 0.32 | 0.65 | 0.21 | 0.25 | 10 | 2,644 |
| H | Aug-15 | 0.23 | 0.59 | 1.13 | 1.51 | 3.55 | 1.3 | 1.12 | 32 | 2,644 |
| H | Sep-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2,644 |
| H | Nov-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2,644 |
| H | Dec-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2,254 |
| H | Jan-16 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1,485 |
| H | Feb-16 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2,644 |
| I | Jun-15 | 0 | 0 | 0 | 0.26 | 2.08 | 0.43 | 0.74 | 16 | 1,614 |
| I | Jul-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1,614 |
| I | Aug-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1,614 |
| I | Sep-15 | 0 | 0 | 0.38 | 0.75 | 0.77 | 0.38 | 0.44 | 6 | 1,614 |
| I | Nov-15 | 0 | 0 | 0.13 | 0.32 | 0.51 | 0.19 | 0.25 | 3 | 1,614 |
| I | Dec-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1,614 |
| I | Jan-16 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1,614 |
| I | Feb-16 | 0 | 0 | 0.13 | 0.32 | 0.5 | 0.19 | 0.24 | 3 | 1,614 |

NOTE:

Minimum, Q1, median, Q3, maximum, mean, and standard deviation are calculated for 100 m² area fished. Individuals caught and area seined are the monthly totals.

## Table B-7 CPUE (Fish per 15 minutes) Summary Statistics for Chinook Salmon in Trawl Catches

| Survey Time | Area | Month | Min | Q1 | Median | Q3 | Max | Mean | SD | Individuals Caught | Minutes Trawled |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Day | A, B, C, D, E, F | Feb-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 189 |
| Day | A, B, C, D, E, F | Mar-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 198 |
| Day | A, B, C, D, E, F | Apr-15 | 0 | 0 | 0 | 0 | 0 | 0 | NA | 0 | 63 |
| Day | A, B, C, D, E, F | May-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 247 |
| Day | A, B, C, D, E, F | Jun-15 | 0 | 0 | 0 | 0 | 0.48 | 0.07 | 0.16 | 2 | 425 |
| Day | A, B, C, D, E, F | Jul-15 | 0 | 0 | 0 | 0 | 0.31 | 0.02 | 0.08 | 1 | 448 |
| Day | A, B, C, D, E, F | Aug-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 175 |
| Day | A, B, C, D, E, F | Sep-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 173 |
| Day | A, B, C, D, E, F | Oct-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 174 |
| Day | A, B, C, D, E, F | Nov-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 243 |
| Day | A, B, C, D, E, F | Dec-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 158 |
| Day | A, B, C, D, E, F | Jan-16 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 191 |
| Day | A, B, C, D, E, F | Feb-16 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 160 |
| Day | G | Jun-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 131 |
| Day | G | Jul-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 210 |
| Day | G | Aug-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 76 |
| Day | G | Sep-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 125 |
| Day | G | Nov-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 127 |
| Day | G | Dec-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 202 |
| Day | G | Jan-16 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 108 |

## Table B-7 CPUE (Fish per 15 minutes) Summary Statistics for Chinook Salmon in Trawl Catches

| Survey Time | Area | Month | Min | Q1 | Median | Q3 | Max | Mean | SD | Individuals Caught | Minutes Trawled |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Day | G | Feb-16 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 150 |
| Day | H | Jun-15 | 0 | 0 | 0 | 0.73 | 1.36 | 0.39 | 0.61 | 4 | 107 |
| Day | H | Jul-15 | 0 | 0 | 0 | 0 | 1 | 0.14 | 0.38 | 1 | 125 |
| Day | H | Aug-15 | 0 | 0 | 0 | 0.6 | 1.2 | 0.4 | 0.69 | 2 | 56 |
| Day | H | Sep-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 53 |
| Day | H | Nov-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 103 |
| Day | H | Dec-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 76 |
| Day | H | Jan-16 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 54 |
| Day | H | Feb-16 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 55 |
| Day | I | Jun-15 | 0 | 0 | 0 | 0.22 | 1.73 | 0.31 | 0.65 | 4 | 175 |
| Day | I | Jul-15 | 0 | 0 | 0 | 0.54 | 0.58 | 0.24 | 0.29 | 3 | 131 |
| Day | I | Aug-15 | 0 | 0 | 0 | 0.21 | 0.43 | 0.14 | 0.25 | 1 | 94 |
| Day | I | Sep-15 | 0 | 0.22 | 0.44 | 0.62 | 0.79 | 0.41 | 0.4 | 4 | 118 |
| Day | I | Nov-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 62 |
| Day | I | Dec-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 156 |
| Day | I | Jan-16 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 100 |
| Day | I | Feb-16 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 49 |
| Night | A, B, C, D, E, F | Apr-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 124 |
| Night | A, B, C, D, E, F | May-15 | 0 | 0 | 0 | 0 | 2.81 | 0.12 | 0.45 | 8 | 551 |
| Night | A, B, C, D, E, F | Jun-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 493 |

## Table B-7 CPUE (Fish per 15 minutes) Summary Statistics for Chinook Salmon in Trawl Catches

| Survey Time | Area | Month | Min | Q1 | Median | Q3 | Max | Mean | SD | Individuals Caught | Minutes Trawled |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Night | A, B, C, D, E, F | Jul-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 229 |
| Night | G | Jun-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 281 |
| Night | G | Jul-15 | 0 | 0 | 0 | 0 | 1.07 | 0.06 | 0.25 | 1 | 173 |

NOTE:

Minimum, Q1, median, Q3, maximum, mean, and standard deviation are calculated for 15 minute tows. Individuals caught and minutes trawled are the monthly totals.

### Table B-8 CPUE (Fish per 100 m²) Summary Statistics Chum Salmon in Beach Seine Catches

| Area | Month | Min | Q1 | Median | Q3 | Max | Mean | SD | Individuals Caught | Area Seined |
|---|---|---|---|---|---|---|---|---|---|---|
| A | Jan-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2,969 |
| A | Feb-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 7,914 |
| A | Mar-15 | 0 | 0 | 0 | 0 | 0.22 | 0.02 | 0.06 | 1 | 7,914 |
| A | Apr-15 | 0 | 0.04 | 0.28 | 0.85 | 1.24 | 0.47 | 0.53 | 15 | 3,037 |
| A | May-15 | 0 | 0 | 0 | 0 | 0.2 | 0.04 | 0.09 | 2 | 4,860 |
| A | Jun-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 7,104 |
| A | Jul-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 5,780 |
| A | Aug-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 5,780 |
| A | Sep-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2,018 |
| A | Oct-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1,505 |
| A | Nov-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3,998 |
| A | Jan-16 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2,018 |
| A | Feb-16 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 4,401 |
| B | Dec-14 | 0 | 0 | 0 | 0 | 0.37 | 0.04 | 0.12 | 1 | 2,397 |
| B | Jan-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2,397 |
| B | Feb-15 | 0 | 0 | 0 | 0 | 1.11 | 0.17 | 0.38 | 4 | 2,397 |
| B | Mar-15 | 0 | 0 | 0 | 0.53 | 1.22 | 0.28 | 0.45 | 6 | 2,397 |
| B | Apr-15 | 0 | 0.55 | 3.74 | 10.4 | 12.76 | 5.74 | 5.29 | 144 | 2,397 |
| B | May-15 | 0 | 0 | 1.78 | 2.33 | 6.38 | 1.89 | 2.15 | 41 | 2,210 |
| B | Jun-15 | 0 | 0 | 0 | 0 | 0.69 | 0.06 | 0.19 | 3 | 2,397 |
| B | Jul-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2,397 |
| B | Aug-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2,397 |
| B | Sep-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1,099 |
| C | May-15 | 0 | 0.07 | 0.14 | 0.21 | 0.28 | 0.14 | 0.2 | 3 | 1,498 |
| C | Jun-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3,228 |
| C | Jul-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3,228 |
| C | Aug-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3,228 |
| C | Sep-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3,228 |
| G | Jun-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3,209 |
| G | Jul-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3,299 |
| G | Aug-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3,209 |
| G | Sep-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3,209 |

### Table B-8 CPUE (Fish per 100 m²) Summary Statistics Chum Salmon in Beach Seine Catches

| Area | Month | Min | Q1 | Median | Q3 | Max | Mean | SD | Individuals Caught | Area Seined |
|---|---|---|---|---|---|---|---|---|---|---|
| G | Nov-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1,633 |
| G | Feb-16 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3,209 |
| H | Jun-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2,644 |
| H | Jul-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2,644 |
| H | Aug-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2,644 |
| H | Sep-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2,644 |
| H | Nov-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2,644 |
| H | Dec-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2,254 |
| H | Jan-16 | 0 | 0 | 0 | 0.08 | 0.32 | 0.08 | 0.16 | 1 | 1,485 |
| H | Feb-16 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2,644 |
| I | Jun-15 | 0 | 0 | 0 | 0 | 1.03 | 0.11 | 0.34 | 4 | 1,614 |
| I | Jul-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1,614 |
| I | Aug-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1,614 |
| I | Sep-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1,614 |
| I | Nov-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1,614 |
| I | Dec-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1,614 |
| I | Jan-16 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1,614 |
| I | Feb-16 | 0 | 0 | 0.13 | 0.25 | 0.26 | 0.13 | 0.15 | 2 | 1,614 |

NOTE:

Minimum, Q1, median, Q3, maximum, mean, and standard deviation are calculated for 100 m² area fished. Individuals caught and area seined are the monthly totals.

**Table B-9 CPUE (Fish per 15 minutes) Summary Statistics for Chum Salmon in Trawl Catches**

| Survey Time | Area | Month | Min | Q1 | Median | Q3 | Max | Mean | SD | Individuals Caught | Minutes Trawled |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Day | A, B, C, D, E, F | Feb-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 189 |
| Day | A, B, C, D, E, F | Mar-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 198 |
| Day | A, B, C, D, E, F | Apr-15 | 0 | 0 | 0 | 0 | 0 | 0 | NA | 0 | 63 |
| Day | A, B, C, D, E, F | May-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 247 |
| Day | A, B, C, D, E, F | Jun-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 425 |
| Day | A, B, C, D, E, F | Jul-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 448 |
| Day | A, B, C, D, E, F | Aug-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 175 |
| Day | A, B, C, D, E, F | Sep-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 173 |
| Day | A, B, C, D, E, F | Oct-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 174 |
| Day | A, B, C, D, E, F | Nov-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 243 |
| Day | A, B, C, D, E, F | Dec-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 158 |
| Day | A, B, C, D, E, F | Jan-16 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 191 |
| Day | A, B, C, D, E, F | Feb-16 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 160 |
| Day | G | Jun-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 131 |
| Day | G | Jul-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 210 |
| Day | G | Aug-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 76 |
| Day | G | Sep-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 125 |
| Day | G | Nov-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 127 |
| Day | G | Dec-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 202 |
| Day | G | Jan-16 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 108 |

**Table B-9 CPUE (Fish per 15 minutes) Summary Statistics for Chum Salmon in Trawl Catches**

| Survey Time | Area | Month | Min | Q1 | Median | Q3 | Max | Mean | SD | Individuals Caught | Minutes Trawled |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Day | G | Feb-16 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 150 |
| Day | H | Jun-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 107 |
| Day | H | Jul-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 125 |
| Day | H | Aug-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 56 |
| Day | H | Sep-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 53 |
| Day | H | Nov-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 103 |
| Day | H | Dec-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 76 |
| Day | H | Jan-16 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 54 |
| Day | H | Feb-16 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 55 |
| Day | I | Jun-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 175 |
| Day | I | Jul-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 131 |
| Day | I | Aug-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 94 |
| Day | I | Sep-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 118 |
| Day | I | Nov-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 62 |
| Day | I | Dec-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 156 |
| Day | I | Jan-16 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 100 |
| Day | I | Feb-16 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 49 |
| Night | A, B, C, D, E, F | Apr-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 124 |
| Night | A, B, C, D, E, F | May-15 | 0 | 0 | 0 | 0 | 1.88 | 0.09 | 0.32 | 6 | 551 |
| Night | A, B, C, D, E, F | Jun-15 | 0 | 0 | 0 | 0 | 1.25 | 0.01 | 0.12 | 2 | 493 |

## Table B-9 CPUE (Fish per 15 minutes) Summary Statistics for Chum Salmon in Trawl Catches

| Survey Time | Area | Month | Min | Q1 | Median | Q3 | Max | Mean | SD | Individuals Caught | Minutes Trawled |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Night | A, B, C, D, E, F | Jul-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 229 |
| Night | G | Jun-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 281 |
| Night | G | Jul-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 173 |

NOTE:

Minimum, Q1, median, Q3, maximum, mean, and standard deviation are calculated for 15 minute tows. Individuals caught and minutes trawled are the monthly totals.

### Table B-10 CPUE (Fish per 100 m$^2$) Summary Statistics Coho Salmon in Beach Seine Catches

| Area | Month | Min | Q1 | Median | Q3 | Max | Mean | SD | Individuals Caught | Area Seined |
|---|---|---|---|---|---|---|---|---|---|---|
| A | Jan-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2,969 |
| A | Feb-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 7,914 |
| A | Mar-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 7,914 |
| A | Apr-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3,037 |
| A | May-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 4,860 |
| A | Jun-15 | 0 | 0 | 0 | 0 | 0.19 | 0.01 | 0.05 | 1 | 7,104 |
| A | Jul-15 | 0 | 0 | 0 | 0 | 0.25 | 0.02 | 0.06 | 2 | 5,780 |
| A | Aug-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 5,780 |
| A | Sep-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2,018 |
| A | Oct-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1,505 |
| A | Nov-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3,998 |
| A | Jan-16 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2,018 |
| A | Feb-16 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 4,401 |
| B | Dec-14 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2,397 |
| B | Jan-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2,397 |
| B | Feb-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2,397 |
| B | Mar-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2,397 |
| B | Apr-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2,397 |
| B | May-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2,210 |
| B | Jun-15 | 0 | 0 | 0 | 0 | 0.46 | 0.07 | 0.16 | 3 | 2,397 |
| B | Jul-15 | 0 | 0 | 0 | 0 | 1.6 | 0.18 | 0.47 | 7 | 2,397 |
| B | Aug-15 | 0 | 0 | 0 | 0.34 | 0.93 | 0.24 | 0.4 | 7 | 2,397 |
| B | Sep-15 | 0 | 0.21 | 0.75 | 1.26 | 1.37 | 0.72 | 0.68 | 7 | 1,099 |
| C | May-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1,498 |
| C | Jun-15 | 0.06 | 0.16 | 0.26 | 0.34 | 0.42 | 0.24 | 0.18 | 6 | 3,228 |
| C | Jul-15 | 0 | 0.03 | 0.06 | 0.1 | 0.39 | 0.1 | 0.13 | 7 | 3,228 |
| C | Aug-15 | 0 | 0.06 | 0.12 | 0.12 | 0.13 | 0.08 | 0.07 | 3 | 3,228 |
| C | Sep-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3,228 |
| G | Jun-15 | 0 | 0 | 0 | 0 | 0.21 | 0.01 | 0.06 | 1 | 3,209 |
| G | Jul-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3,299 |
| G | Aug-15 | 0 | 0 | 0 | 0 | 0.29 | 0.03 | 0.1 | 1 | 3,209 |
| G | Sep-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3,209 |

## Table B-10 CPUE (Fish per 100 m$^2$) Summary Statistics Coho Salmon in Beach Seine Catches

| Area | Month | Min | Q1 | Median | Q3 | Max | Mean | SD | Individuals Caught | Area Seined |
|---|---|---|---|---|---|---|---|---|---|---|
| G | Nov-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1,633 |
| G | Feb-16 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3,209 |
| H | Jun-15 | 0 | 0 | 0.24 | 0.91 | 1.22 | 0.42 | 0.45 | 19 | 2,644 |
| H | Jul-15 | 0 | 0 | 0.11 | 0.42 | 0.7 | 0.22 | 0.26 | 12 | 2,644 |
| H | Aug-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2,644 |
| H | Sep-15 | 0 | 0 | 0.26 | 0.39 | 0.97 | 0.29 | 0.35 | 7 | 2,644 |
| H | Nov-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2,644 |
| H | Dec-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2,254 |
| H | Jan-16 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1,485 |
| H | Feb-16 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2,644 |
| I | Jun-15 | 0 | 0 | 0.26 | 0.92 | 7.69 | 1.12 | 2.49 | 40 | 1,614 |
| I | Jul-15 | 0 | 0 | 0.24 | 0.45 | 2 | 0.47 | 0.7 | 21 | 1,614 |
| I | Aug-15 | 0 | 0 | 0.51 | 1.08 | 1.25 | 0.57 | 0.66 | 9 | 1,614 |
| I | Sep-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1,614 |
| I | Nov-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1,614 |
| I | Dec-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1,614 |
| I | Jan-16 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1,614 |
| I | Feb-16 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1,614 |

NOTE:

Minimum, Q1, median, Q3, maximum, mean, and standard deviation are calculated for 100 m2 area fished. Individuals caught and area seined are the monthly totals.

### Table B-11 CPUE (Fish per 15 minutes) Summary Statistics for Coho Salmon in Trawl Catches

| Survey Time | Area | Month | Min | Q1 | Median | Q3 | Max | Mean | SD | Individuals Caught | Minutes Trawled |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Day | A, B, C, D, E, F | Feb-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 189 |
| Day | A, B, C, D, E, F | Mar-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 198 |
| Day | A, B, C, D, E, F | Apr-15 | 0 | 0 | 0 | 0 | 0 | 0 | NA | 0 | 63 |
| Day | A, B, C, D, E, F | May-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 247 |
| Day | A, B, C, D, E, F | Jun-15 | 0 | 0 | 0 | 0 | 0.68 | 0.05 | 0.19 | 1 | 425 |
| Day | A, B, C, D, E, F | Jul-15 | 0 | 0 | 0 | 0 | 0.31 | 0.04 | 0.11 | 2 | 448 |
| Day | A, B, C, D, E, F | Aug-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 175 |
| Day | A, B, C, D, E, F | Sep-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 173 |
| Day | A, B, C, D, E, F | Oct-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 174 |
| Day | A, B, C, D, E, F | Nov-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 243 |
| Day | A, B, C, D, E, F | Dec-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 158 |
| Day | A, B, C, D, E, F | Jan-16 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 191 |
| Day | A, B, C, D, E, F | Feb-16 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 160 |
| Day | G | Jun-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 131 |
| Day | G | Jul-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 210 |
| Day | G | Aug-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 76 |
| Day | G | Sep-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 125 |
| Day | G | Nov-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 127 |
| Day | G | Dec-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 202 |
| Day | G | Jan-16 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 108 |

## Table B-11 CPUE (Fish per 15 minutes) Summary Statistics for Coho Salmon in Trawl Catches

| Survey Time | Area | Month | Min | Q1 | Median | Q3 | Max | Mean | SD | Individuals Caught | Minutes Trawled |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Day | G | Feb-16 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 150 |
| Day | H | Jun-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 107 |
| Day | H | Jul-15 | 0 | 0 | 0 | 0 | 1.07 | 0.15 | 0.4 | 1 | 125 |
| Day | H | Aug-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 56 |
| Day | H | Sep-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 53 |
| Day | H | Nov-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 103 |
| Day | H | Dec-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 76 |
| Day | H | Jan-16 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 54 |
| Day | H | Feb-16 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 55 |
| Day | I | Jun-15 | 0 | 0.22 | 0.6 | 1.04 | 2.31 | 0.77 | 0.8 | 10 | 175 |
| Day | I | Jul-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 131 |
| Day | I | Aug-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 94 |
| Day | I | Sep-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 118 |
| Day | I | Nov-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 62 |
| Day | I | Dec-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 156 |
| Day | I | Jan-16 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 100 |
| Day | I | Feb-16 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 49 |
| Night | A, B, C, D, E, F | Apr-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 124 |
| Night | A, B, C, D, E, F | May-15 | 0 | 0 | 0 | 0 | 2.81 | 0.28 | 0.65 | 18 | 551 |
| Night | A, B, C, D, E, F | Jun-15 | 0 | 0 | 0 | 0 | 1.5 | 0.12 | 0.34 | 21 | 493 |

## Table B-11 CPUE (Fish per 15 minutes) Summary Statistics for Coho Salmon in Trawl Catches

| Survey Time | Area | Month | Min | Q1 | Median | Q3 | Max | Mean | SD | Individuals Caught | Minutes Trawled |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Night | A, B, C, D, E, F | Jul-15 | 0 | 0 | 0 | 0 | 1.07 | 0.03 | 0.18 | 2 | 229 |
| Night | G | Jun-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 281 |
| Night | G | Jul-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 173 |

NOTE:

Minimum, Q1, median, Q3, maximum, mean, and standard deviation are calculated for 15 minute tows. Individuals caught and minutes trawled are the monthly totals.

## Table B-12 CPUE (Fish per 100 m²) Summary Statistics Pink Salmon in Beach Seine Catches

| Area | Month | Min | Q1 | Median | Q3 | Max | Mean | SD | Individuals Caught | Area Seined |
|---|---|---|---|---|---|---|---|---|---|---|
| A | Jan-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2,969 |
| A | Feb-15 | 0 | 0 | 0 | 0 | 0.25 | 0.02 | 0.07 | 1 | 7,914 |
| A | Mar-15 | 0 | 0 | 0 | 0.19 | 0.4 | 0.09 | 0.13 | 7 | 7,914 |
| A | Apr-15 | 1.18 | 1.76 | 4.91 | 20.25 | 50.53 | 14.6 | 19.7 | 549 | 3,037 |
| A | May-15 | 0 | 0 | 0 | 0 | 0.17 | 0.03 | 0.07 | 2 | 4,860 |
| A | Jun-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 7,104 |
| A | Jul-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 5,780 |
| A | Aug-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 5,780 |
| A | Sep-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2,018 |
| A | Oct-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1,505 |
| A | Nov-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3,998 |
| A | Jan-16 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2,018 |
| A | Feb-16 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 4,401 |
| B | Dec-14 | 0 | 0 | 0 | 0 | 0.74 | 0.08 | 0.25 | 2 | 2,397 |
| B | Jan-15 | 0 | 0 | 0 | 0 | 2.21 | 0.28 | 0.73 | 7 | 2,397 |
| B | Feb-15 | 0 | 0 | 0 | 0 | 1.6 | 0.32 | 0.64 | 5 | 2,397 |
| B | Mar-15 | 0 | 0 | 0.41 | 1.03 | 4.8 | 0.9 | 1.54 | 24 | 2,397 |
| B | Apr-15 | 0 | 0 | 0.65 | 1.4 | 4.1 | 1.03 | 1.31 | 21 | 2,397 |
| B | May-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2,210 |
| B | Jun-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2,397 |
| B | Jul-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2,397 |
| B | Aug-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2,397 |
| B | Sep-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1,099 |
| C | May-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1,498 |
| C | Jun-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3,228 |
| C | Jul-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3,228 |
| C | Aug-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3,228 |
| C | Sep-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3,228 |
| G | Jun-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3,209 |
| G | Jul-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3,299 |
| G | Aug-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3,209 |
| G | Sep-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3,209 |

### Table B-12 CPUE (Fish per 100 m²) Summary Statistics Pink Salmon in Beach Seine Catches

| Area | Month | Min | Q1 | Median | Q3 | Max | Mean | SD | Individuals Caught | Area Seined |
|---|---|---|---|---|---|---|---|---|---|---|
| G | Nov-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1,633 |
| G | Feb-16 | 0 | 0 | 0 | 0 | 0.46 | 0.09 | 0.18 | 3 | 3,209 |
| H | Jun-15 | 0 | 0 | 0 | 0 | 0.32 | 0.03 | 0.09 | 1 | 2,644 |
| H | Jul-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2,644 |
| H | Aug-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2,644 |
| H | Sep-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2,644 |
| H | Nov-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2,644 |
| H | Dec-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2,254 |
| H | Jan-16 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1,485 |
| H | Feb-16 | 0 | 0 | 0 | 0 | 0.32 | 0.05 | 0.12 | 1 | 2,644 |
| I | Jun-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1,614 |
| I | Jul-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1,614 |
| I | Aug-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1,614 |
| I | Sep-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1,614 |
| I | Nov-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1,614 |
| I | Dec-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1,614 |
| I | Jan-16 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1,614 |
| I | Feb-16 | 0 | 0 | 0 | 0.06 | 0.25 | 0.06 | 0.13 | 1 | 1,614 |

NOTE:
Minimum, Q1, median, Q3, maximum, mean, and standard deviation are calculated for 100 m² area fished. Individuals caught and area seined are the monthly totals.

## Table B-13 CPUE (Fish per 15 minutes) Summary Statistics for Pink Salmon in Trawl Catches

| Survey Time | Area | Month | Min | Q1 | Median | Q3 | Max | Mean | SD | Individuals Caught | Minutes Trawled |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Day | A, B, C, D, E, F | Feb-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 189 |
| Day | A, B, C, D, E, F | Mar-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 198 |
| Day | A, B, C, D, E, F | Apr-15 | 0 | 0 | 0 | 0 | 0 | 0 | NA | 0 | 63 |
| Day | A, B, C, D, E, F | May-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 247 |
| Day | A, B, C, D, E, F | Jun-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 425 |
| Day | A, B, C, D, E, F | Jul-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 448 |
| Day | A, B, C, D, E, F | Aug-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 175 |
| Day | A, B, C, D, E, F | Sep-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 173 |
| Day | A, B, C, D, E, F | Oct-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 174 |
| Day | A, B, C, D, E, F | Nov-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 243 |
| Day | A, B, C, D, E, F | Dec-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 158 |
| Day | A, B, C, D, E, F | Jan-16 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 191 |
| Day | A, B, C, D, E, F | Feb-16 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 160 |
| Day | G | Jun-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 131 |
| Day | G | Jul-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 210 |
| Day | G | Aug-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 76 |
| Day | G | Sep-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 125 |
| Day | G | Nov-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 127 |
| Day | G | Dec-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 202 |
| Day | G | Jan-16 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 108 |

## Table B-13 CPUE (Fish per 15 minutes) Summary Statistics for Pink Salmon in Trawl Catches

| Survey Time | Area | Month | Min | Q1 | Median | Q3 | Max | Mean | SD | Individuals Caught | Minutes Trawled |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Day | G | Feb-16 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 150 |
| Day | H | Jun-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 107 |
| Day | H | Jul-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 125 |
| Day | H | Aug-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 56 |
| Day | H | Sep-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 53 |
| Day | H | Nov-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 103 |
| Day | H | Dec-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 76 |
| Day | H | Jan-16 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 54 |
| Day | H | Feb-16 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 55 |
| Day | I | Jun-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 175 |
| Day | I | Jul-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 131 |
| Day | I | Aug-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 94 |
| Day | I | Sep-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 118 |
| Day | I | Nov-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 62 |
| Day | I | Dec-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 156 |
| Day | I | Jan-16 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 100 |
| Day | I | Feb-16 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 49 |
| Night | A, B, C, D, E, F | Apr-15 | 0 | 0 | 0.29 | 1.27 | 1.67 | 0.63 | 0.78 | 4 | 124 |
| Night | A, B, C, D, E, F | May-15 | 0 | 0 | 0 | 0 | 0.71 | 0.03 | 0.12 | 4 | 551 |
| Night | A, B, C, D, E, F | Jun-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 493 |

### Table B-13 CPUE (Fish per 15 minutes) Summary Statistics for Pink Salmon in Trawl Catches

| Survey Time | Area | Month | Min | Q1 | Median | Q3 | Max | Mean | SD | Individuals Caught | Minutes Trawled |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Night | A, B, C, D, E, F | Jul-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 229 |
| Night | G | Jun-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 281 |
| Night | G | Jul-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 173 |

NOTE:

Minimum, Q1, median, Q3, maximum, mean, and standard deviation are calculated for 15 minute tows. Individuals caught and minutes trawled are the monthly totals.

**Table B-14 CPUE (Fish per 100 m²) Summary Statistics Sockeye Salmon in Beach Seine Catches**

| Area | Month | Min | Q1 | Median | Q3 | Max | Mean | SD | Individuals Caught | Area Seined |
|---|---|---|---|---|---|---|---|---|---|---|
| A | Jan-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2,969 |
| A | Feb-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 7,914 |
| A | Mar-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 7,914 |
| A | Apr-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3,037 |
| A | May-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 4,860 |
| A | Jun-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 7,104 |
| A | Jul-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 5,780 |
| A | Aug-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 5,780 |
| A | Sep-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2,018 |
| A | Oct-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1,505 |
| A | Nov-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3,998 |
| A | Jan-16 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2,018 |
| A | Feb-16 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 4,401 |
| B | Dec-14 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2,397 |
| B | Jan-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2,397 |
| B | Feb-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2,397 |
| B | Mar-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2,397 |
| B | Apr-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2,397 |
| B | May-15 | 0 | 0.58 | 0.82 | 1.11 | 1.82 | 0.86 | 0.56 | 20 | 2,210 |
| B | Jun-15 | 0 | 0 | 0 | 0 | 0.65 | 0.04 | 0.16 | 1 | 2,397 |
| B | Jul-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2,397 |
| B | Aug-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2,397 |
| B | Sep-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1,099 |
| C | May-15 | 0 | 0.03 | 0.07 | 0.1 | 0.14 | 0.07 | 0.1 | 1 | 1,498 |
| C | Jun-15 | 0 | 0.07 | 0.14 | 0.2 | 0.26 | 0.13 | 0.13 | 3 | 3,228 |
| C | Jul-15 | 0 | 0 | 0 | 0 | 0.06 | 0.01 | 0.02 | 1 | 3,228 |
| C | Aug-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3,228 |
| C | Sep-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3,228 |
| G | Jun-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3,209 |
| G | Jul-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3,299 |
| G | Aug-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3,209 |
| G | Sep-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3,209 |

### Table B-14 CPUE (Fish per 100 m²) Summary Statistics Sockeye Salmon in Beach Seine Catches

| Area | Month | Min | Q1 | Median | Q3 | Max | Mean | SD | Individuals Caught | Area Seined |
|---|---|---|---|---|---|---|---|---|---|---|
| G | Nov-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1,633 |
| G | Feb-16 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3,209 |
| H | Jun-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2,644 |
| H | Jul-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2,644 |
| H | Aug-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2,644 |
| H | Sep-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2,644 |
| H | Nov-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2,644 |
| H | Dec-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2,254 |
| H | Jan-16 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1,485 |
| H | Feb-16 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2,644 |
| I | Jun-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1,614 |
| I | Jul-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1,614 |
| I | Aug-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1,614 |
| I | Sep-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1,614 |
| I | Nov-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1,614 |
| I | Dec-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1,614 |
| I | Jan-16 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1,614 |
| I | Feb-16 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1,614 |

NOTE:

Minimum, Q1, median, Q3, maximum, mean, and standard deviation are calculated for 100 m² area fished. Individuals caught and area seined are the monthly totals.

## Table B-15 CPUE (Fish per 15 minutes) Summary Statistics for Sockeye Salmon in Trawl Catches

| Survey Time | Area | Month | Min | Q1 | Median | Q3 | Max | Mean | SD | Individuals Caught | Minutes Trawled |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Day | A, B, C, D, E, F | Feb-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 189 |
| Day | A, B, C, D, E, F | Mar-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 198 |
| Day | A, B, C, D, E, F | Apr-15 | 0 | 0 | 0 | 0 | 0 | 0 | NA | 0 | 63 |
| Day | A, B, C, D, E, F | May-15 | 0 | 0.53 | 1.28 | 2.72 | 11.47 | 2.34 | 3.41 | 28 | 247 |
| Day | A, B, C, D, E, F | Jun-15 | 0 | 0 | 0 | 0 | 1.12 | 0.13 | 0.34 | 4 | 425 |
| Day | A, B, C, D, E, F | Jul-15 | 0 | 0 | 0 | 0 | 0.92 | 0.07 | 0.25 | 3 | 448 |
| Day | A, B, C, D, E, F | Aug-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 175 |
| Day | A, B, C, D, E, F | Sep-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 173 |
| Day | A, B, C, D, E, F | Oct-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 174 |
| Day | A, B, C, D, E, F | Nov-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 243 |
| Day | A, B, C, D, E, F | Dec-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 158 |
| Day | A, B, C, D, E, F | Jan-16 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 191 |
| Day | A, B, C, D, E, F | Feb-16 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 160 |
| Day | G | Jun-15 | 0 | 0 | 0 | 0 | 2.14 | 0.31 | 0.81 | 3 | 131 |
| Day | G | Jul-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 210 |
| Day | G | Aug-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 76 |
| Day | G | Sep-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 125 |
| Day | G | Nov-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 127 |
| Day | G | Dec-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 202 |
| Day | G | Jan-16 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 108 |

## Table B-15 CPUE (Fish per 15 minutes) Summary Statistics for Sockeye Salmon in Trawl Catches

| Survey Time | Area | Month | Min | Q1 | Median | Q3 | Max | Mean | SD | Individuals Caught | Minutes Trawled |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Day | G | Feb-16 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 150 |
| Day | H | Jun-15 | 0 | 0 | 0 | 0.54 | 1.45 | 0.36 | 0.61 | 4 | 107 |
| Day | H | Jul-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 125 |
| Day | H | Aug-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 56 |
| Day | H | Sep-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 53 |
| Day | H | Nov-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 103 |
| Day | H | Dec-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 76 |
| Day | H | Jan-16 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 54 |
| Day | H | Feb-16 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 55 |
| Day | I | Jun-15 | 0 | 0 | 0.54 | 1.19 | 1.73 | 0.66 | 0.73 | 9 | 175 |
| Day | I | Jul-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 131 |
| Day | I | Aug-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 94 |
| Day | I | Sep-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 118 |
| Day | I | Nov-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 62 |
| Day | I | Dec-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 156 |
| Day | I | Jan-16 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 100 |
| Day | I | Feb-16 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 49 |
| Night | A, B, C, D, E, F | Apr-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 124 |
| Night | A, B, C, D, E, F | May-15 | 0 | 0 | 0 | 0 | 2.81 | 0.29 | 0.68 | 19 | 551 |
| Night | A, B, C, D, E, F | Jun-15 | 0 | 0 | 0 | 0 | 1.88 | 0.08 | 0.31 | 13 | 493 |

## Table B-15 CPUE (Fish per 15 minutes) Summary Statistics for Sockeye Salmon in Trawl Catches

| Survey Time | Area | Month | Min | Q1 | Median | Q3 | Max | Mean | SD | Individuals Caught | Minutes Trawled |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Night | A, B, C, D, E, F | Jul-15 | 0 | 0 | 0 | 0 | 0.75 | 0.01 | 0.09 | 1 | 229 |
| Night | G | Jun-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 281 |
| Night | G | Jul-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 173 |

NOTE:

Minimum, Q1, median, Q3, maximum, mean, and standard deviation are calculated for 15 minute tows. Individuals caught and minutes trawled are the monthly totals.

**Table B-16 CPUE (Fish per 100 m²) Summary Statistics for English Sole in Beach Seine Catches**

| Area | Month | Min | Q1 | Median | Q3 | Max | Mean | SD | Individuals Caught | Area Seined |
|---|---|---|---|---|---|---|---|---|---|---|
| A | Jan-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2,969 |
| A | Feb-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 7,914 |
| A | Mar-15 | 0 | 0 | 0 | 0 | 0.15 | 0.01 | 0.04 | 1 | 7,914 |
| A | Apr-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3,037 |
| A | May-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 4,860 |
| A | Jun-15 | 0 | 0 | 0.22 | 0.5 | 0.8 | 0.32 | 0.3 | 23 | 7,104 |
| A | Jul-15 | 0 | 0 | 0.32 | 1.02 | 2.14 | 0.61 | 0.65 | 70 | 5,780 |
| A | Aug-15 | 0.2 | 1.01 | 1.33 | 1.97 | 5.82 | 1.91 | 1.67 | 112 | 5,780 |
| A | Sep-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2,018 |
| A | Oct-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1,505 |
| A | Nov-15 | 0 | 0 | 0 | 0 | 0.19 | 0.02 | 0.07 | 1 | 3,998 |
| A | Jan-16 | 0 | 0.15 | 0.41 | 0.66 | 0.78 | 0.4 | 0.36 | 8 | 2,018 |
| A | Feb-16 | 0 | 0 | 0 | 0.2 | 0.62 | 0.16 | 0.27 | 7 | 4,401 |
| B | Dec-14 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2,397 |
| B | Jan-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2,397 |
| B | Feb-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2,397 |
| B | Mar-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2,397 |
| B | Apr-15 | 0 | 0 | 0 | 0 | 2.76 | 0.38 | 0.92 | 9 | 2,397 |
| B | May-15 | 0 | 1.13 | 4.88 | 9.37 | 13.67 | 5.78 | 5.5 | 117 | 2,210 |
| B | Jun-15 | 0 | 0 | 0 | 0 | 0.34 | 0.04 | 0.1 | 2 | 2,397 |
| B | Jul-15 | 0 | 0 | 0 | 0.89 | 5.24 | 0.87 | 1.54 | 46 | 2,397 |
| B | Aug-15 | 0 | 0 | 0.44 | 1.22 | 2.58 | 0.71 | 0.87 | 15 | 2,397 |
| B | Sep-15 | 0 | 0 | 0 | 0.21 | 0.83 | 0.21 | 0.41 | 3 | 1,099 |
| C | May-15 | 1.53 | 1.53 | 1.54 | 1.54 | 1.54 | 1.54 | 0.01 | 23 | 1,498 |
| C | Jun-15 | 0.12 | 0.12 | 0.13 | 0.27 | 0.42 | 0.22 | 0.17 | 6 | 3,228 |
| C | Jul-15 | 0 | 0.32 | 0.64 | 1.21 | 1.8 | 0.79 | 0.65 | 57 | 3,228 |
| C | Aug-15 | 0 | 0.06 | 0.13 | 0.53 | 0.92 | 0.35 | 0.5 | 17 | 3,228 |
| C | Sep-15 | 0 | 0.06 | 0.12 | 0.13 | 0.14 | 0.08 | 0.07 | 3 | 3,228 |
| G | Jun-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3,209 |
| G | Jul-15 | 0 | 0 | 0.48 | 1.79 | 10.58 | 1.53 | 2.53 | 99 | 3,299 |
| G | Aug-15 | 0 | 0.75 | 1.93 | 4.16 | 5.59 | 2.53 | 1.96 | 79 | 3,209 |
| G | Sep-15 | 0 | 0.24 | 0.9 | 1.96 | 5.59 | 1.49 | 1.85 | 41 | 3,209 |

### Table B-16 CPUE (Fish per 100 m²) Summary Statistics for English Sole in Beach Seine Catches

| Area | Month | Min | Q1 | Median | Q3 | Max | Mean | SD | Individuals Caught | Area Seined |
|---|---|---|---|---|---|---|---|---|---|---|
| G | Nov-15 | 0.5 | 1.02 | 1.23 | 1.75 | 3.23 | 1.55 | 1.18 | 24 | 1,633 |
| G | Feb-16 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3,209 |
| H | Jun-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2,644 |
| H | Jul-15 | 0 | 0 | 0 | 0 | 1.62 | 0.14 | 0.43 | 6 | 2,644 |
| H | Aug-15 | 0 | 0 | 0.32 | 1.45 | 2.96 | 0.88 | 1.3 | 26 | 2,644 |
| H | Sep-15 | 0 | 0.12 | 0.61 | 0.65 | 2.31 | 0.64 | 0.79 | 16 | 2,644 |
| H | Nov-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2,644 |
| H | Dec-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2,254 |
| H | Jan-16 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1,485 |
| H | Feb-16 | 0 | 0 | 0 | 0 | 0.32 | 0.05 | 0.12 | 1 | 2,644 |
| I | Jun-15 | 0 | 0 | 0 | 0 | 0.51 | 0.06 | 0.17 | 2 | 1,614 |
| I | Jul-15 | 0 | 0 | 0 | 0.32 | 0.75 | 0.19 | 0.29 | 13 | 1,614 |
| I | Aug-15 | 0 | 0.38 | 0.72 | 1.19 | 2 | 0.86 | 0.85 | 14 | 1,614 |
| I | Sep-15 | 0.69 | 2.48 | 3.54 | 5.37 | 9.48 | 4.31 | 3.72 | 68 | 1,614 |
| I | Nov-15 | 0 | 0.19 | 0.51 | 1.01 | 1.75 | 0.69 | 0.77 | 11 | 1,614 |
| I | Dec-15 | 0 | 0 | 0.12 | 0.25 | 1 | 0.22 | 0.34 | 7 | 1,614 |
| I | Jan-16 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1,614 |
| I | Feb-16 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1,614 |

NOTE:

Minimum, Q1, median, Q3, maximum, mean, and standard deviation are calculated for 100 m² area fished. Individuals caught and area seined are the monthly totals.

## Table B-17 CPUE (Fish per 15 minutes) Summary Statistics for English Sole in Trawl Catches

| Survey Time | Area | Month | Min | Q1 | Median | Q3 | Max | Mean | SD | Individuals Caught | Minutes Trawled |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Day | A, B, C, D, E, F | Feb-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 189 |
| Day | A, B, C, D, E, F | Mar-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 198 |
| Day | A, B, C, D, E, F | Apr-15 | 0 | 0 | 0 | 0 | 0 | 0 | NA | 0 | 63 |
| Day | A, B, C, D, E, F | May-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 247 |
| Day | A, B, C, D, E, F | Jun-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 425 |
| Day | A, B, C, D, E, F | Jul-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 448 |
| Day | A, B, C, D, E, F | Aug-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 175 |
| Day | A, B, C, D, E, F | Sep-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 173 |
| Day | A, B, C, D, E, F | Oct-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 174 |
| Day | A, B, C, D, E, F | Nov-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 243 |
| Day | A, B, C, D, E, F | Dec-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 158 |
| Day | A, B, C, D, E, F | Jan-16 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 191 |
| Day | A, B, C, D, E, F | Feb-16 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 160 |
| Day | G | Jun-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 131 |
| Day | G | Jul-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 210 |
| Day | G | Aug-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 76 |
| Day | G | Sep-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 125 |
| Day | G | Nov-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 127 |
| Day | G | Dec-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 202 |
| Day | G | Jan-16 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 108 |
| Day | G | Feb-16 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 150 |

### Table B-17 CPUE (Fish per 15 minutes) Summary Statistics for English Sole in Trawl Catches

| Survey Time | Area | Month | Min | Q1 | Median | Q3 | Max | Mean | SD | Individuals Caught | Minutes Trawled |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Day | H | Jun-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 107 |
| Day | H | Jul-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 125 |
| Day | H | Aug-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 56 |
| Day | H | Sep-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 53 |
| Day | H | Nov-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 103 |
| Day | H | Dec-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 76 |
| Day | H | Jan-16 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 54 |
| Day | H | Feb-16 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 55 |
| Day | I | Jun-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 175 |
| Day | I | Jul-15 | 0 | 0 | 0 | 0 | 0.68 | 0.1 | 0.26 | 1 | 131 |
| Day | I | Aug-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 94 |
| Day | I | Sep-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 118 |
| Day | I | Nov-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 62 |
| Day | I | Dec-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 156 |
| Day | I | Jan-16 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 100 |
| Day | I | Feb-16 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 49 |
| Night | A, B, C, D, E, F | Apr-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 124 |
| Night | A, B, C, D, E, F | May-15 | 0 | 0 | 0 | 0 | 0.44 | 0.01 | 0.06 | 1 | 551 |
| Night | A, B, C, D, E, F | Jun-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 493 |
| Night | A, B, C, D, E, F | Jul-15 | 0 | 0 | 0 | 0 | 0.88 | 0.01 | 0.11 | 1 | 229 |

### Table B-17 CPUE (Fish per 15 minutes) Summary Statistics for English Sole in Trawl Catches

| Survey Time | Area | Month | Min | Q1 | Median | Q3 | Max | Mean | SD | Individuals Caught | Minutes Trawled |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Night | G | Jun-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 281 |
| Night | G | Jul-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 173 |

NOTE:

Minimum, Q1, median, Q3, maximum, mean, and standard deviation are calculated for 15 minute tows. Individuals caught and minutes trawled are the monthly totals.

### Table B-18 CPUE (Fish per 100 m²) Summary Statistics for Starry Flounder in Beach Seine Catches

| Survey Area | Month | Min | Q1 | Median | Q3 | Max | Mean | SD | Individuals Caught | Area Seined |
|---|---|---|---|---|---|---|---|---|---|---|
| A | Jan-15 | 0 | 0 | 0 | 0.12 | 0.38 | 0.09 | 0.16 | 3 | 2,969 |
| A | Feb-15 | 0 | 0 | 0 | 0.22 | 0.76 | 0.18 | 0.26 | 11 | 7,914 |
| A | Mar-15 | 0 | 0.11 | 0.29 | 0.88 | 1.41 | 0.47 | 0.47 | 34 | 7,914 |
| A | Apr-15 | 0 | 0 | 0.29 | 0.84 | 1.26 | 0.46 | 0.55 | 11 | 3,037 |
| A | May-15 | 0 | 0.19 | 0.4 | 0.89 | 3.35 | 0.95 | 1.18 | 56 | 4,860 |
| A | Jun-15 | 0 | 0.53 | 1.11 | 1.68 | 2.14 | 1.05 | 0.74 | 183 | 7,104 |
| A | Jul-15 | 0 | 0.2 | 0.6 | 1.23 | 3.43 | 0.88 | 1.03 | 108 | 5,780 |
| A | Aug-15 | 0 | 0.24 | 0.45 | 0.92 | 1.87 | 0.62 | 0.55 | 36 | 5,780 |
| A | Sep-15 | 0.62 | 1.36 | 2.07 | 2.95 | 4.2 | 2.24 | 1.52 | 46 | 2,018 |
| A | Oct-15 | 0 | 0 | 0 | 0.19 | 0.38 | 0.13 | 0.22 | 2 | 1,505 |
| A | Nov-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3,998 |
| A | Jan-16 | 0 | 0 | 0.1 | 0.2 | 0.21 | 0.1 | 0.12 | 2 | 2,018 |
| A | Feb-16 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 4,401 |
| B | Dec-14 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2,397 |
| B | Jan-15 | 0 | 0 | 0 | 0 | 0.55 | 0.09 | 0.19 | 3 | 2,397 |
| B | Feb-15 | 0 | 0 | 0 | 0 | 0.83 | 0.09 | 0.28 | 3 | 2,397 |
| B | Mar-15 | 0 | 0 | 0.37 | 0.53 | 2.44 | 0.51 | 0.76 | 12 | 2,397 |
| B | Apr-15 | 0 | 0 | 0 | 0.46 | 1.29 | 0.32 | 0.45 | 6 | 2,397 |
| B | May-15 | 0.37 | 1.5 | 2.31 | 4.28 | 7.3 | 3.05 | 2.37 | 74 | 2,210 |
| B | Jun-15 | 0 | 0.65 | 1.29 | 2.21 | 4.14 | 1.47 | 1.1 | 76 | 2,397 |
| B | Jul-15 | 0 | 0 | 0.78 | 2.83 | 12.76 | 2.31 | 3.84 | 144 | 2,397 |
| B | Aug-15 | 0 | 0.37 | 0.83 | 1.29 | 7.53 | 1.69 | 2.42 | 54 | 2,397 |
| B | Sep-15 | 0 | 0.28 | 0.87 | 1.71 | 2.76 | 1.12 | 1.23 | 14 | 1,099 |
| C | May-15 | 1.42 | 1.44 | 1.47 | 1.5 | 1.53 | 1.47 | 0.08 | 45 | 1,498 |
| C | Jun-15 | 0.23 | 0.25 | 0.28 | 0.33 | 0.39 | 0.3 | 0.08 | 9 | 3,228 |
| C | Jul-15 | 0 | 0.06 | 0.13 | 0.77 | 1.25 | 0.43 | 0.57 | 26 | 3,228 |
| C | Aug-15 | 0 | 0 | 0 | 0.62 | 1.25 | 0.42 | 0.72 | 9 | 3,228 |
| C | Sep-15 | 0 | 0 | 0 | 0.14 | 0.28 | 0.09 | 0.16 | 2 | 3,228 |
| G | Jun-15 | 0 | 0.49 | 0.67 | 1.14 | 1.85 | 0.8 | 0.62 | 42 | 3,209 |
| G | Jul-15 | 0 | 0.34 | 0.71 | 1.16 | 7.45 | 1.25 | 1.72 | 77 | 3,299 |
| G | Aug-15 | 0 | 0 | 0.32 | 0.39 | 1.18 | 0.33 | 0.4 | 9 | 3,209 |
| G | Sep-15 | 0 | 0 | 0 | 0.08 | 0.39 | 0.09 | 0.16 | 2 | 3,209 |

**Table B-18 CPUE (Fish per 100 m²) Summary Statistics for Starry Flounder in Beach Seine Catches**

| Survey Area | Month | Min | Q1 | Median | Q3 | Max | Mean | SD | Individuals Caught | Area Seined |
|---|---|---|---|---|---|---|---|---|---|---|
| G | Nov-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1,633 |
| G | Feb-16 | 0 | 0 | 0 | 0 | 0.23 | 0.03 | 0.08 | 1 | 3,209 |
| H | Jun-15 | 0 | 2.27 | 2.57 | 6.05 | 10.17 | 4.01 | 3.14 | 193 | 2,644 |
| H | Jul-15 | 2.11 | 2.61 | 3.87 | 5.68 | 9.14 | 4.38 | 2.31 | 235 | 2,644 |
| H | Aug-15 | 0 | 5 | 9.23 | 10.9 | 12.88 | 7.7 | 4.81 | 217 | 2,644 |
| H | Sep-15 | 0 | 1.62 | 3.37 | 5.05 | 6.15 | 3.27 | 2.34 | 92 | 2,644 |
| H | Nov-15 | 0 | 0.28 | 0.46 | 1.09 | 3.67 | 1.02 | 1.31 | 43 | 2,644 |
| H | Dec-15 | 0 | 0.06 | 0.27 | 1.11 | 1.64 | 0.59 | 0.72 | 15 | 2,254 |
| H | Jan-16 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1,485 |
| H | Feb-16 | 2.26 | 3.07 | 3.98 | 6.01 | 7.98 | 4.63 | 2.25 | 125 | 2,644 |
| I | Jun-15 | 0 | 0.92 | 2.5 | 2.75 | 3.33 | 1.81 | 1.23 | 65 | 1,614 |
| I | Jul-15 | 1.03 | 2.5 | 2.78 | 4.08 | 14.59 | 4.37 | 4.3 | 169 | 1,614 |
| I | Aug-15 | 0 | 0.96 | 1.33 | 1.55 | 2.05 | 1.18 | 0.86 | 19 | 1,614 |
| I | Sep-15 | 0.51 | 0.7 | 1.88 | 3 | 3 | 1.82 | 1.37 | 30 | 1,614 |
| I | Nov-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1,614 |
| I | Dec-15 | 0 | 0 | 0.24 | 0.26 | 0.51 | 0.19 | 0.18 | 6 | 1,614 |
| I | Jan-16 | 0 | 0 | 0 | 0.35 | 1.39 | 0.35 | 0.69 | 6 | 1,614 |
| I | Feb-16 | 1.5 | 1.91 | 2.3 | 2.86 | 3.84 | 2.48 | 1 | 40 | 1,614 |

NOTE:
Minimum, Q1, median, Q3, maximum, mean, and standard deviation are calculated for 100 m² area fished. Individuals caught and area seined are the monthly totals.

**Table B-19 CPUE (Fish per 15 minutes) Summary Statistics for Starry Flounder in Trawl Catches**

| Survey Time | Area | Month | Min | Q1 | Median | Q3 | Max | Mean | SD | Individuals Caught | Minutes Trawled |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Day | A, B, C, D, E, F | Feb-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 189 |
| Day | A, B, C, D, E, F | Mar-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 198 |
| Day | A, B, C, D, E, F | Apr-15 | 0 | 0 | 0 | 0 | 0 | 0 | NA | 0 | 63 |
| Day | A, B, C, D, E, F | May-15 | 0 | 0 | 0 | 0 | 2.25 | 0.36 | 0.79 | 5 | 247 |
| Day | A, B, C, D, E, F | Jun-15 | 0 | 0 | 0 | 0 | 1.88 | 0.14 | 0.52 | 3 | 425 |
| Day | A, B, C, D, E, F | Jul-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 448 |
| Day | A, B, C, D, E, F | Aug-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 175 |
| Day | A, B, C, D, E, F | Sep-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 173 |
| Day | A, B, C, D, E, F | Oct-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 174 |
| Day | A, B, C, D, E, F | Nov-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 243 |
| Day | A, B, C, D, E, F | Dec-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 158 |
| Day | A, B, C, D, E, F | Jan-16 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 191 |
| Day | A, B, C, D, E, F | Feb-16 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 160 |
| Day | G | Jun-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 131 |
| Day | G | Jul-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 210 |
| Day | G | Aug-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 76 |
| Day | G | Sep-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 125 |
| Day | G | Nov-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 127 |
| Day | G | Dec-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 202 |
| Day | G | Jan-16 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 108 |

## Table B-19 CPUE (Fish per 15 minutes) Summary Statistics for Starry Flounder in Trawl Catches

| Survey Time | Area | Month | Min | Q1 | Median | Q3 | Max | Mean | SD | Individuals Caught | Minutes Trawled |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Day | G | Feb-16 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 150 |
| Day | H | Jun-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 107 |
| Day | H | Jul-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 125 |
| Day | H | Aug-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 56 |
| Day | H | Sep-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 53 |
| Day | H | Nov-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 103 |
| Day | H | Dec-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 76 |
| Day | H | Jan-16 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 54 |
| Day | H | Feb-16 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 55 |
| Day | I | Jun-15 | 0 | 0 | 0 | 0 | 0.5 | 0.07 | 0.19 | 1 | 175 |
| Day | I | Jul-15 | 0 | 0 | 0 | 0.27 | 0.68 | 0.17 | 0.3 | 2 | 131 |
| Day | I | Aug-15 | 0 | 0 | 0 | 0.52 | 1.03 | 0.34 | 0.6 | 2 | 94 |
| Day | I | Sep-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 118 |
| Day | I | Nov-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 62 |
| Day | I | Dec-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 156 |
| Day | I | Jan-16 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 100 |
| Day | I | Feb-16 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 49 |
| Night | A, B, C, D, E, F | Apr-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 124 |
| Night | A, B, C, D, E, F | May-15 | 0 | 0 | 0 | 0 | 3.21 | 0.18 | 0.59 | 10 | 551 |

**Table B-19 CPUE (Fish per 15 minutes) Summary Statistics for Starry Flounder in Trawl Catches**

| Survey Time | Area | Month | Min | Q1 | Median | Q3 | Max | Mean | SD | Individuals Caught | Minutes Trawled |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Night | A, B, C, D, E, F | Jun-15 | 0 | 0 | 0 | 0 | 9 | 0.26 | 1.05 | 29 | 493 |
| Night | A, B, C, D, E, F | Jul-15 | 0 | 0 | 0 | 0 | 5 | 0.12 | 0.64 | 4 | 229 |
| Night | G | Jun-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 281 |
| Night | G | Jul-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 173 |

NOTE:
Minimum, Q1, median, Q3, maximum, mean, and standard deviation are calculated for 15 minute tows. Individuals caught and minutes trawled are the monthly totals.

### Table B-20 CPUE (Fish per 100 m²) Summary Statistics for Fish Larvae in Beach Seine Catches

| Area | Month | Min | Q1 | Median | Q3 | Max | Mean | SD | Individuals Caught | Area Seined |
|---|---|---|---|---|---|---|---|---|---|---|
| A | Jan-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2,969 |
| A | Feb-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 7,914 |
| A | Mar-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 7,914 |
| A | Apr-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3,037 |
| A | May-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 4,860 |
| A | Jun-15 | 0 | 0 | 0 | 0 | 0.41 | 0.03 | 0.1 | 2 | 7,104 |
| A | Jul-15 | 0 | 0 | 0 | 0 | 12.25 | 0.88 | 2.79 | 103 | 5,780 |
| A | Aug-15 | 0 | 0 | 0 | 7.97 | 10.15 | 3.61 | 4.53 | 205 | 5,780 |
| A | Sep-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2,018 |
| A | Oct-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1,505 |
| A | Nov-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3,998 |
| A | Jan-16 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2,018 |
| A | Feb-16 | 0 | 0 | 0.2 | 0.95 | 1.4 | 0.48 | 0.58 | 21 | 4,401 |
| B | Dec-14 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2,397 |
| B | Jan-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2,397 |
| B | Feb-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2,397 |
| B | Mar-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2,397 |
| B | Apr-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2,397 |
| B | May-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2,210 |
| B | Jun-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2,397 |
| B | Jul-15 | 0 | 0 | 0 | 0 | 6.1 | 0.35 | 1.44 | 16 | 2,397 |
| B | Aug-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2,397 |
| B | Sep-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1,099 |
| C | May-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1,498 |
| C | Jun-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3,228 |
| C | Jul-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3,228 |
| C | Aug-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3,228 |
| C | Sep-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3,228 |
| G | Jun-15 | 0 | 0 | 0 | 0 | 0.21 | 0.01 | 0.06 | 1 | 3,209 |
| G | Jul-15 | 0 | 0 | 0 | 7.2 | 29.4 | 4.89 | 8.6 | 335 | 3,299 |
| G | Aug-15 | 0 | 0 | 0 | 3.52 | 117.6 | 14.47 | 38.8 | 439 | 3,209 |
| G | Sep-15 | 0 | 0 | 9.6 | 44.29 | 76.87 | 23.35 | 29.11 | 671 | 3,209 |

## Table B-20 CPUE (Fish per 100 m²) Summary Statistics for Fish Larvae in Beach Seine Catches

| Area | Month | Min | Q1 | Median | Q3 | Max | Mean | SD | Individuals Caught | Area Seined |
|---|---|---|---|---|---|---|---|---|---|---|
| G | Nov-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1,633 |
| G | Feb-16 | 0 | 0 | 2.52 | 11.52 | 31.82 | 8.38 | 11.54 | 275 | 3,209 |
| H | Jun-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2,644 |
| H | Jul-15 | 0 | 0 | 0 | 27.58 | 205.14 | 24.32 | 54.25 | 1263 | 2,644 |
| H | Aug-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2,644 |
| H | Sep-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2,644 |
| H | Nov-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2,644 |
| H | Dec-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2,254 |
| H | Jan-16 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1,485 |
| H | Feb-16 | 0 | 2.37 | 18.1 | 39.47 | 85.92 | 26.81 | 31.33 | 747 | 2,644 |
| I | Jun-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1,614 |
| I | Jul-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1,614 |
| I | Aug-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1,614 |
| I | Sep-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1,614 |
| I | Nov-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1,614 |
| I | Dec-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1,614 |
| I | Jan-16 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1,614 |
| I | Feb-16 | 1.79 | 4.08 | 9.3 | 14.35 | 16.12 | 9.13 | 6.89 | 146 | 1,614 |

NOTE:

Minimum, Q1, median, Q3, maximum, mean, and standard deviation are calculated for 100 m² area fished. Individuals caught and area seined are the monthly totals.

## Table B-21 CPUE (Fish per 15 minutes) Summary Statistics for Fish Larvae in Trawl Catches

| Survey Time | Area | Month | Min | Q1 | Median | Q3 | Max | Mean | SD | Individuals Caught | Minutes Trawled |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Day | A, B, C, D, E, F | Feb-15 | 0 | 0 | 0 | 0.22 | 0.36 | 0.11 | 0.17 | 2 | 189 |
| Day | A, B, C, D, E, F | Mar-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 198 |
| Day | A, B, C, D, E, F | Apr-15 | 0 | 0 | 0 | 0 | 0 | 0 | NA | 0 | 63 |
| Day | A, B, C, D, E, F | May-15 | 0 | 0 | 0 | 0.51 | 1.03 | 0.25 | 0.41 | 5 | 247 |
| Day | A, B, C, D, E, F | Jun-15 | 0 | 0 | 0 | 0 | 11.54 | 0.92 | 3.19 | 31 | 425 |
| Day | A, B, C, D, E, F | Jul-15 | 0 | 0 | 0 | 11.54 | 15.31 | 4.62 | 6.21 | 191 | 448 |
| Day | A, B, C, D, E, F | Aug-15 | 3.57 | 5.23 | 6.08 | 11.67 | 18.1 | 8.93 | 5.96 | 105 | 175 |
| Day | A, B, C, D, E, F | Sep-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 173 |
| Day | A, B, C, D, E, F | Oct-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 174 |
| Day | A, B, C, D, E, F | Nov-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 243 |
| Day | A, B, C, D, E, F | Dec-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 158 |
| Day | A, B, C, D, E, F | Jan-16 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 191 |
| Day | A, B, C, D, E, F | Feb-16 | 0 | 0 | 0 | 0 | 1.07 | 0.18 | 0.44 | 2 | 160 |
| Day | G | Jun-15 | 0 | 0 | 0 | 1.02 | 23.57 | 3.66 | 8.81 | 36 | 131 |
| Day | G | Jul-15 | 0 | 0 | 0 | 5.58 | 6.82 | 2.3 | 3.2 | 40 | 210 |
| Day | G | Aug-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 76 |
| Day | G | Sep-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 125 |
| Day | G | Nov-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 127 |
| Day | G | Dec-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 202 |
| Day | G | Jan-16 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 108 |

## Table B-21 CPUE (Fish per 15 minutes) Summary Statistics for Fish Larvae in Trawl Catches

| Survey Time | Area | Month | Min | Q1 | Median | Q3 | Max | Mean | SD | Individuals Caught | Minutes Trawled |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Day | G | Feb-16 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 150 |
| Day | H | Jun-15 | 0 | 2.14 | 11.1 | 14.66 | 16.67 | 8.98 | 7.46 | 67 | 107 |
| Day | H | Jul-15 | 9.38 | 14.64 | 31.58 | 439.44 | 750.65 | 242.83 | 341.53 | 2,201 | 125 |
| Day | H | Aug-15 | 0 | 0 | 0 | 4.17 | 8.33 | 2.78 | 4.81 | 10 | 56 |
| Day | H | Sep-15 | 0 | 0 | 0 | 17.86 | 35.71 | 11.9 | 20.62 | 50 | 53 |
| Day | H | Nov-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 103 |
| Day | H | Dec-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 76 |
| Day | H | Jan-16 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 54 |
| Day | H | Feb-16 | 0 | 0 | 0 | 0.36 | 0.71 | 0.24 | 0.41 | 1 | 55 |
| Day | I | Jun-15 | 0 | 0 | 14.29 | 19.04 | 24 | 10.91 | 10.84 | 130 | 175 |
| Day | I | Jul-15 | 13.39 | 56.55 | 108.75 | 214.45 | 900 | 223.45 | 309.83 | 1,444 | 131 |
| Day | I | Aug-15 | 0 | 0 | 0 | 0.26 | 0.52 | 0.17 | 0.3 | 1 | 94 |
| Day | I | Sep-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 118 |
| Day | I | Nov-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 62 |
| Day | I | Dec-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 156 |
| Day | I | Jan-16 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 100 |
| Day | I | Feb-16 | 0 | 0 | 0 | 0.38 | 0.75 | 0.25 | 0.43 | 1 | 49 |
| Night | A, B, C, D, E, F | Apr-15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 124 |
| Night | A, B, C, D, E, F | May-15 | 0 | 0 | 0 | 0 | 9.55 | 0.59 | 1.84 | 30 | 551 |
| Night | A, B, C, D, E, F | Jun-15 | 0 | 0 | 4.62 | 18.75 | 937.5 | 19.36 | 79.45 | 2,647 | 493 |

### Table B-21 CPUE (Fish per 15 minutes) Summary Statistics for Fish Larvae in Trawl Catches

| Survey Time | Area | Month | Min | Q1 | Median | Q3 | Max | Mean | SD | Individuals Caught | Minutes Trawled |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Night | A, B, C, D, E, F | Jul-15 | 0 | 1.67 | 10.71 | 30 | 475 | 28.88 | 63.2 | 1,290 | 229 |
| Night | G | Jun-15 | 0 | 0 | 3.93 | 15.88 | 28.85 | 8.25 | 9.97 | 226 | 281 |
| Night | G | Jul-15 | 0 | 0 | 0 | 3.39 | 25 | 4.34 | 8.36 | 37 | 173 |

NOTE:
Minimum, Q1, median, Q3, maximum, mean, and standard deviation are calculated for 15 minute tows. Individuals caught and minutes trawled are the monthly totals.

### Table B-22 CPUE (Crab per 24 hours) Summary Statistics for Dungeness Crab in Trap Catches

| Area | Month | Min | Q1 | Median | Q3 | Max | Mean | SD | Individuals Caught | Trap Hours |
|---|---|---|---|---|---|---|---|---|---|---|
| A | Dec-14 | 5.13 | 6.21 | 10.29 | 15.35 | 15.41 | 10.48 | 4.87 | 47 | 107 |
| A | Jan-15 | 2.06 | 3.81 | 7.04 | 13.98 | 21.98 | 9.1 | 7.07 | 68 | 180 |
| A | Feb-15 | 3.24 | 3.53 | 7.65 | 12.01 | 13.73 | 7.98 | 5.01 | 51 | 149 |
| A | Mar-15 | 1.88 | 3.87 | 5.92 | 7.35 | 10.64 | 5.84 | 2.98 | 40 | 168 |
| A | Apr-15 | 1.02 | 1.75 | 9.11 | 11.47 | 13.02 | 7.3 | 5.2 | 54 | 182 |
| A | May-15 | 1.19 | 7.25 | 9.98 | 10.31 | 23.46 | 9.81 | 6.43 | 75 | 185 |
| A | Jun-15 | 2.01 | 4.39 | 6 | 8.23 | 16.18 | 7.32 | 5.11 | 58 | 190 |
| A | Jul-15 | 2.96 | 10.5 | 13.8 | 18.62 | 23.63 | 14.02 | 6.93 | 77 | 115 |
| A | Aug-15 | 2.22 | 4.68 | 11.11 | 17.84 | 21.22 | 11.41 | 9.01 | 43 | 89 |
| A | Sep-15 | 3.81 | 6.22 | 8.62 | 9.08 | 9.54 | 7.33 | 3.08 | 23 | 75 |
| A | Oct-15 | 4.71 | 4.93 | 5.14 | 5.36 | 5.57 | 5.14 | 0.61 | 11 | 51 |
| A | Nov-15 | 3.83 | 4.48 | 6.07 | 7.82 | 8.93 | 6.23 | 2.37 | 27 | 103 |
| A | Dec-15 | 0.94 | 0.95 | 2.37 | 4.81 | 7.92 | 3.4 | 3.3 | 14 | 100 |
| A | Jan-16 | 1.01 | 4.08 | 7.22 | 9.74 | 10.92 | 6.59 | 4.46 | 28 | 100 |
| A | Feb-16 | 4 | 4.75 | 5.5 | 7.25 | 11 | 6.5 | 3.11 | 26 | 24 |
| B | Dec-14 | 0 | 1.14 | 2.67 | 6.13 | 12.74 | 4.28 | 4.23 | 46 | 265 |
| B | Jan-15 | 1 | 1.97 | 2.95 | 3.42 | 3.89 | 2.61 | 1.48 | 8 | 73 |
| B | Feb-15 | 1.2 | 3 | 4.8 | 4.8 | 4.8 | 3.6 | 2.08 | 9 | 40 |
| B | Mar-15 | 2.49 | 3.7 | 4.91 | 6.17 | 7.44 | 4.95 | 2.48 | 12 | 58 |
| B | Apr-15 | 1.48 | 3.71 | 5.94 | 7.43 | 8.91 | 5.45 | 3.74 | 11 | 32 |
| B | May-15 | 1.25 | 4.07 | 6.23 | 7.79 | 8.8 | 5.63 | 3.31 | 18 | 77 |
| B | Jun-15 | 0.96 | 1.15 | 4.74 | 6.71 | 9.68 | 4.66 | 3.21 | 40 | 182 |
| B | Jul-15 | 2.04 | 3.84 | 5.09 | 5.35 | 6.09 | 4.58 | 1.43 | 36 | 189 |
| B | Aug-15 | 0 | 0.82 | 2.16 | 3.23 | 3.24 | 1.89 | 1.61 | 7 | 89 |
| C | Jun-15 | 1.99 | 2.32 | 2.65 | 2.98 | 3.31 | 2.65 | 0.93 | 8 | 68 |
| C | Jul-15 | 7.32 | 7.62 | 7.92 | 8.22 | 8.51 | 7.92 | 0.85 | 13 | 39 |
| C | Aug-15 | 3.09 | 3.09 | 3.09 | 3.09 | 3.09 | 3.09 | NA | 3 | 23 |
| C | Sep-15 | 3.01 | 3.01 | 3.01 | 3.01 | 3.01 | 3.01 | NA | 3 | 24 |
| C | Oct-15 | 8.02 | 8.02 | 8.02 | 8.02 | 8.02 | 8.02 | NA | 8 | 24 |
| C | Nov-15 | 2.9 | 2.9 | 2.9 | 2.9 | 2.9 | 2.9 | NA | 3 | 25 |

### Table B-22 CPUE (Crab per 24 hours) Summary Statistics for Dungeness Crab in Trap Catches

| Area | Month | Min | Q1 | Median | Q3 | Max | Mean | SD | Individuals Caught | Trap Hours |
|---|---|---|---|---|---|---|---|---|---|---|
| C | Dec-15 | 5.49 | 5.49 | 5.49 | 5.49 | 5.49 | 5.49 | NA | 7 | 31 |
| C | Jan-16 | 4.41 | 4.41 | 4.41 | 4.41 | 4.41 | 4.41 | NA | 5 | 27 |
| C | Feb-16 | 3 | 3 | 3 | 3 | 3 | 3 | NA | 3 | 24 |
| D | Dec-14 | 1.12 | 6.13 | 8.34 | 12.21 | 14.4 | 8.52 | 4.93 | 46 | 86 |
| D | Jan-15 | 1 | 5.77 | 7.49 | 9.82 | 16.16 | 7.98 | 4.84 | 52 | 159 |
| D | Feb-15 | 2.36 | 5.93 | 6.81 | 7.95 | 10.37 | 6.76 | 2.52 | 47 | 165 |
| D | Mar-15 | 3.12 | 4.28 | 5.61 | 11.17 | 16.12 | 7.88 | 5.28 | 43 | 132 |
| D | Apr-15 | 7.62 | 8.48 | 9.78 | 10.47 | 12.87 | 9.8 | 1.89 | 51 | 126 |
| D | May-15 | 1.31 | 5.08 | 6.76 | 9.63 | 10.62 | 6.76 | 3.53 | 37 | 130 |
| D | Jun-15 | 3.32 | 4.9 | 5.43 | 9.09 | 13.93 | 6.83 | 3.33 | 105 | 419 |
| D | Jul-15 | 6.44 | 9.61 | 12.09 | 12.87 | 25.91 | 12.28 | 4.94 | 135 | 265 |
| D | Aug-15 | 8.43 | 8.84 | 12.68 | 16.47 | 18.17 | 12.87 | 4.46 | 72 | 135 |
| D | Sep-15 | 6.03 | 6.8 | 10.08 | 11.22 | 14.06 | 9.59 | 3.18 | 57 | 119 |
| D | Oct-15 | 5.93 | 6.74 | 8.52 | 10.38 | 18.77 | 9.81 | 4.77 | 60 | 123 |
| D | Nov-15 | 1.97 | 4.26 | 6.02 | 7.63 | 7.94 | 5.63 | 2.4 | 34 | 145 |
| D | Dec-15 | 3.2 | 6.39 | 7.71 | 10.15 | 15.79 | 8.55 | 4.34 | 64 | 179 |
| D | Jan-16 | 3.61 | 8.78 | 10.07 | 13.05 | 13.88 | 10 | 3.83 | 61 | 149 |
| D | Feb-16 | 4 | 8.75 | 11.5 | 13.5 | 14 | 10.5 | 3.89 | 63 | 24 |
| E | Dec-14 | 2.41 | 9.02 | 12.14 | 14.3 | 17.01 | 11.12 | 5.2 | 55 | 119 |
| E | Jan-15 | 1.09 | 7.05 | 9.59 | 11.7 | 12.49 | 8.56 | 4.28 | 48 | 134 |
| E | Feb-15 | 12.62 | 13.01 | 14.17 | 15.85 | 17.92 | 14.65 | 2.12 | 93 | 176 |
| E | Mar-15 | 4.93 | 5.74 | 7.19 | 10.26 | 16.12 | 8.66 | 4.26 | 50 | 159 |
| E | Apr-15 | 5.24 | 6.41 | 8.34 | 11.34 | 12.45 | 8.75 | 3.04 | 48 | 133 |
| E | May-15 | 5.03 | 6.06 | 9.26 | 15.53 | 18.34 | 10.75 | 5.78 | 61 | 159 |
| E | Jun-15 | 5.39 | 6.5 | 8.32 | 9.83 | 18.46 | 9.45 | 4.75 | 54 | 136 |
| E | Jul-15 | 8.26 | 10.12 | 11.75 | 14.17 | 21.71 | 13 | 4.83 | 59 | 96 |
| E | Aug-15 | 13.36 | 19.58 | 25.79 | 26.47 | 27.15 | 22.1 | 7.6 | 61 | 66 |
| E | Sep-15 | 4.86 | 7.78 | 10.7 | 12.71 | 14.71 | 10.09 | 4.95 | 31 | 49 |
| E | Oct-15 | 4.88 | 6.27 | 7.66 | 8.79 | 9.92 | 7.48 | 2.52 | 23 | 74 |
| E | Nov-15 | 3.88 | 4.85 | 5.82 | 6.75 | 7.69 | 5.8 | 1.9 | 18 | 50 |

**Table B-22 CPUE (Crab per 24 hours) Summary Statistics for Dungeness Crab in Trap Catches**

| Area | Month | Min | Q1 | Median | Q3 | Max | Mean | SD | Individuals Caught | Trap Hours |
|---|---|---|---|---|---|---|---|---|---|---|
| E | Dec-15 | 6.03 | 8.01 | 10 | 10.06 | 10.12 | 8.72 | 2.33 | 26 | 72 |
| E | Jan-16 | 4.55 | 6.61 | 8.66 | 9.07 | 9.48 | 7.56 | 2.64 | 26 | 82 |
| E | Feb-16 | 3 | 6 | 9 | 12 | 15 | 9 | 6 | 27 | 24 |

NOTE:
Minimum, Q1, median, Q3, maximum, mean, and standard deviation are calculated for 24 hours soak periods. Individuals caught and trap hours are the monthly totals.

# B.3 FOCAL SPECIES DEMOGRAPHICS

## Table B-23 Demographic Summary Statistics for Pacific Herring Fork Length (mm)

| Survey Area | Month | Min | Q1 | Median | Q3 | Max | Mean | SD | Individuals Caught | Individuals Measured |
|---|---|---|---|---|---|---|---|---|---|---|
| A | Feb-15 | 52 | 59 | 65 | 68 | 83 | 63.69 | 6.92 | 62 | 31 |
| A | Mar-15 | 66 | 70 | 74 | 84 | 94 | 76 | 8.01 | 19 | 19 |
| A | Apr-15 | 79 | 79 | 79 | 79 | 79 | 79 | NA | 1 | 1 |
| A | May-15 | 78 | 87 | 93.5 | 101.75 | 116 | 95.25 | 15.9 | 4 | 4 |
| A | Jun-15 | 75 | 81 | 86 | 90.5 | 95 | 85.5 | 8.54 | 4 | 4 |
| A | Jul-15 | 32 | 43 | 53 | 59 | 166 | 55.11 | 19.58 | 454 | 110 |
| A | Aug-15 | 50 | 69.5 | 74 | 77 | 112 | 73.87 | 12.89 | 88 | 32 |
| A | Nov-15 | 30 | 84.25 | 85.5 | 91.5 | 96 | 82.5 | 16.34 | 34 | 15 |
| A | Feb-16 | 64 | 77 | 87 | 93 | 112 | 85.58 | 11 | 23 | 20 |
| B | Dec-14 | 55 | 61.25 | 63 | 66 | 70 | 62.8 | 4.8 | 11 | 11 |
| B | Jan-15 | 52 | 62.5 | 67 | 69.5 | 77 | 65.73 | 7.02 | 12 | 12 |
| B | Feb-15 | 49 | 59 | 63 | 67.5 | 76 | 63.33 | 6.15 | 213 | 55 |
| B | Mar-15 | 62 | 63.5 | 65 | 76 | 87 | 71.33 | 13.65 | 3 | 3 |
| B | Apr-15 | 73 | 76.75 | 79.5 | 83.75 | 88 | 80.17 | 5.56 | 6 | 6 |
| B | May-15 | 84 | 123 | 139 | 141.5 | 158 | 129.5 | 24.31 | 8 | 8 |
| B | Jul-15 | 36 | 36 | 36 | 36 | 36 | 36 | NA | 1 | 1 |
| C | May-15 | 70 | 81 | 85 | 134 | 160 | 102.22 | 35.01 | 9 | 9 |
| C | Jun-15 | 75 | 94 | 106 | 116 | 147 | 108.4 | 19.21 | 25 | 25 |
| C | Jul-15 | 51 | 80.25 | 100 | 105.25 | 119 | 92.78 | 20.05 | 18 | 18 |

**Table B-23 Demographic Summary Statistics for Pacific Herring Fork Length (mm)**

| Survey Area | Month | Min | Q1 | Median | Q3 | Max | Mean | SD | Individuals Caught | Individuals Measured |
|---|---|---|---|---|---|---|---|---|---|---|
| C | Sep-15 | 30 | 30 | 30 | 30 | 30 | 30 | NA | 1 | 1 |
| A, B, C, D, E, F | Apr-15 | 83 | 83 | 83 | 83 | 83 | 83 | NA | 1 | 1 |
| A, B, C, D, E, F | May-15 | 36 | 87 | 125.5 | 154.5 | 257 | 130.64 | 50.2 | 125 | 94 |
| A, B, C, D, E, F | Jun-15 | 30 | 38.25 | 106 | 145 | 247 | 97.17 | 55.7 | 1425 | 72 |
| A, B, C, D, E, F | Jul-15 | 30 | 46 | 57.5 | 74.75 | 153 | 70.22 | 34.46 | 265 | 49 |
| G | Jun-15 | 117 | 117 | 117 | 117 | 117 | 117 | NA | 1 | 1 |
| G | Jul-15 | 71 | 98.75 | 105 | 112.75 | 122 | 104.5 | 13.64 | 12 | 12 |
| G | Nov-15 | 65 | 70 | 74.5 | 79.75 | 87 | 75.17 | 8.18 | 6 | 6 |
| H | Jul-15 | 34 | 37 | 43 | 57 | 75 | 47.31 | 12.57 | 384 | 65 |
| H | Aug-15 | 31 | 40 | 46 | 56 | 93 | 49.72 | 14.3 | 131 | 131 |
| H | Sep-15 | 49 | 63 | 70 | 75 | 80 | 67.4 | 12.05 | 5 | 5 |
| H | Jan-16 | 65 | 65 | 65 | 65 | 65 | 65 | NA | 1 | 1 |
| I | Jun-15 | 83 | 85.75 | 88.5 | 91.25 | 94 | 88.5 | 7.78 | 2 | 2 |
| I | Jul-15 | 32 | 37 | 42 | 50 | 115 | 49.29 | 20.5 | 632 | 45 |
| I | Aug-15 | 34 | 34 | 34 | 34 | 34 | 34 | NA | 1 | 1 |
| I | Sep-15 | 45 | 45 | 45 | 45 | 45 | 45 | NA | 1 | 1 |

## Table B-24 Demographic Summary Statistics for Surf Smelt Fork Length (mm)

| Survey Area | Month | Min | Q1 | Median | Q3 | Max | Mean | SD | Individuals Caught | Individuals Measured |
|---|---|---|---|---|---|---|---|---|---|---|
| A | Jan-15 | 41 | 43 | 45 | 48 | 60 | 46.14 | 4.3 | 178 | 29 |
| A | Feb-15 | 41 | 43 | 46 | 49 | 161 | 49.13 | 17.76 | 581 | 83 |
| A | Mar-15 | 41 | 45 | 50 | 119.75 | 150 | 74 | 39.07 | 1,455 | 106 |
| A | Apr-15 | 42 | 46 | 48 | 52.25 | 120 | 60.18 | 26.62 | 1,729 | 60 |
| A | May-15 | 44 | 51 | 54 | 58 | 161 | 69.88 | 35.97 | 1,119 | 81 |
| A | Jun-15 | 59 | 73 | 89 | 97 | 182 | 91.76 | 26.89 | 41 | 41 |
| A | Jul-15 | 72 | 88 | 91 | 98.25 | 162 | 99.94 | 21.97 | 438 | 104 |
| A | Aug-15 | 89 | 95.5 | 100 | 106 | 149 | 103.51 | 12.86 | 294 | 43 |
| A | Sep-15 | 44 | 44 | 44 | 44 | 44 | 44 | NA | 1 | 1 |
| A | Oct-15 | 41 | 41.75 | 45 | 50 | 56 | 46.75 | 6.9 | 4 | 4 |
| A | Nov-15 | 41 | 43 | 45 | 46 | 55 | 44.75 | 2.68 | 168 | 55 |
| A | Jan-16 | 42 | 44.25 | 45 | 45 | 52 | 45.6 | 3.34 | 10 | 10 |
| B | Dec-14 | 41 | 44 | 50 | 53.5 | 74 | 49.61 | 7.32 | 32 | 31 |
| B | Jan-15 | 41 | 44 | 47 | 49.25 | 62 | 47.5 | 4.76 | 800 | 52 |
| B | Feb-15 | 42 | 45 | 47 | 51 | 60 | 47.98 | 4.08 | 452 | 63 |
| B | Mar-15 | 44 | 48 | 51 | 58.5 | 149 | 65.96 | 31.69 | 252 | 51 |
| B | Apr-15 | 45 | 49 | 55 | 56 | 65 | 53.69 | 5.27 | 74 | 13 |
| B | May-15 | 49 | 53 | 114 | 146 | 180 | 102.05 | 45.71 | 84 | 37 |
| B | Jun-15 | 56 | 59.25 | 65.5 | 83.75 | 208 | 90.33 | 58.85 | 1,006 | 6 |
| C | May-15 | 52 | 66 | 145 | 152.25 | 160 | 117.97 | 44.49 | 109 | 30 |
| C | Jun-15 | 59 | 124.25 | 134 | 148.25 | 165 | 125.15 | 33.46 | 20 | 20 |

## Table B-24 Demographic Summary Statistics for Surf Smelt Fork Length (mm)

| Survey Area | Month | Min | Q1 | Median | Q3 | Max | Mean | SD | Individuals Caught | Individuals Measured |
|---|---|---|---|---|---|---|---|---|---|---|
| C | Jul-15 | 75 | 92.5 | 105 | 141 | 182 | 117.6 | 31.18 | 15 | 15 |
| C | Aug-15 | 87 | 94.5 | 98 | 100.5 | 115 | 98.36 | 7.38 | 47 | 11 |
| C | Sep-15 | 105 | 105 | 105 | 105 | 105 | 105 | NA | 1 | 1 |
| A, B, C, D, E, F | Mar-15 | NA | NA | NA | NA | NA | NA | NA | 4 | 0 |
| A, B, C, D, E, F | Apr-15 | 42 | 46 | 52 | 56 | 122 | 64.85 | 29.96 | 17 | 13 |
| A, B, C, D, E, F | May-15 | 45 | 51.75 | 68.5 | 144.25 | 165 | 93.43 | 45.19 | 221 | 148 |
| A, B, C, D, E, F | Jun-15 | 52 | 71 | 87 | 139 | 165 | 100.06 | 35.55 | 542 | 236 |
| A, B, C, D, E, F | Jul-15 | 41 | 70.25 | 92.5 | 150.5 | 184 | 106.03 | 42.86 | 122 | 98 |
| A, B, C, D, E, F | Aug-15 | 145 | 145 | 145 | 145 | 145 | 145 | NA | 1 | 1 |
| A, B, C, D, E, F | Nov-15 | 42 | 42 | 42 | 42 | 42 | 42 | NA | 1 | 1 |
| G | Jun-15 | 43 | 63.5 | 86 | 138 | 158 | 100.87 | 41.72 | 143 | 23 |
| G | Jul-15 | 86 | 95 | 99 | 117.75 | 145 | 108.62 | 20.64 | 16 | 16 |
| G | Aug-15 | 93 | 101 | 106 | 147.75 | 163 | 118.59 | 25.81 | 56 | 34 |
| G | Sep-15 | 103 | 104.5 | 107.5 | 111.25 | 115 | 108.25 | 5.38 | 4 | 4 |
| G | Nov-15 | 42 | 42.5 | 43 | 45.5 | 55 | 44.71 | 3.26 | 223 | 31 |
| H | Jun-15 | 42 | 63.75 | 87 | 98.75 | 172 | 87.27 | 28.5 | 281 | 44 |
| H | Jul-15 | 62 | 73 | 85 | 106 | 152 | 94.55 | 27.36 | 104 | 73 |
| H | Aug-15 | 94 | 147 | 149 | 158 | 167 | 146.91 | 19.44 | 11 | 11 |
| H | Sep-15 | 49 | 99.25 | 118.5 | 125.25 | 143 | 105.92 | 29.86 | 41 | 36 |
| H | Nov-15 | 41 | 43 | 44 | 46 | 59 | 45.98 | 4.78 | 71 | 41 |
| H | Dec-15 | 43 | 46 | 48 | 52.75 | 63 | 49.26 | 4.43 | 476 | 50 |

## Table B-24 Demographic Summary Statistics for Surf Smelt Fork Length (mm)

| Survey Area | Month | Min | Q1 | Median | Q3 | Max | Mean | SD | Individuals Caught | Individuals Measured |
|---|---|---|---|---|---|---|---|---|---|---|
| H | Jan-16 | 41 | 45 | 47 | 53 | 150 | 52.3 | 18.73 | 1,621 | 37 |
| H | Feb-16 | 111 | 116 | 121 | 135 | 149 | 127 | 19.7 | 3 | 3 |
| I | Jun-15 | 44 | 63 | 80 | 98.5 | 147 | 84.86 | 34.02 | 7 | 7 |
| I | Jul-15 | 61 | 70 | 75 | 102.25 | 164 | 89.28 | 30.31 | 38 | 36 |
| I | Aug-15 | 50 | 110.5 | 144.5 | 153 | 173 | 127.83 | 44.99 | 6 | 6 |
| I | Sep-15 | 60 | 60 | 60 | 60 | 60 | 60 | NA | 1 | 1 |
| I | Nov-15 | 41 | 42 | 45 | 51 | 148 | 49.85 | 18.54 | 218 | 33 |
| I | Dec-15 | 42 | 47 | 48 | 52 | 65 | 49.85 | 5.54 | 13 | 13 |
| I | Jan-16 | 54 | 56 | 57 | 62.5 | 105 | 63 | 14.59 | 19 | 11 |

NOTE:
"NA" across a row indicates individuals were caught, but not measured.

## Table B-25 Demographic Summary Statistics for Chinook Salmon Fork Length (mm)

| Survey Area | Month | Min | Q1 | Median | Q3 | Max | Mean | SD | Individuals Caught | Individuals Measured |
|---|---|---|---|---|---|---|---|---|---|---|
| A | Jun-15 | 105 | 106.25 | 107.5 | 108.75 | 110 | 107.5 | 3.54 | 2 | 2 |
| A | Jul-15 | 83 | 83 | 83 | 83 | 83 | 83 | NA | 1 | 1 |
| B | Jun-15 | 65 | 87 | 95 | 103 | 106 | 91.11 | 15.92 | 9 | 9 |
| B | Aug-15 | 77 | 77 | 77 | 77 | 77 | 77 | NA | 1 | 1 |
| C | May-15 | 88 | 88 | 88 | 88 | 88 | 88 | NA | 1 | 1 |
| C | Jun-15 | 86 | 86 | 86 | 86 | 86 | 86 | NA | 1 | 1 |
| C | Aug-15 | 56 | 64 | 67 | 73 | 143 | 78.11 | 27.45 | 9 | 9 |
| C | Sep-15 | 72 | 75.5 | 79 | 80 | 81 | 77.33 | 4.73 | 3 | 3 |
| A, B, C, D, E, F | May-15 | 76 | 90.5 | 96 | 108.5 | 128 | 100 | 16.83 | 8 | 8 |
| A, B, C, D, E, F | Jun-15 | 97 | 100 | 103 | 106 | 109 | 103 | 8.49 | 2 | 2 |
| A, B, C, D, E, F | Jul-15 | 124 | 124 | 124 | 124 | 124 | 124 | NA | 1 | 1 |
| G | Jun-15 | 86 | 87.5 | 91 | 96.5 | 104 | 93 | 8.08 | 4 | 4 |
| G | Jul-15 | 117 | 123.25 | 129.5 | 135.75 | 142 | 129.5 | 17.68 | 2 | 2 |
| G | Feb-16 | 43 | 43 | 43 | 43 | 43 | 43 | NA | 1 | 1 |
| H | Jun-15 | 93 | 106 | 109 | 114 | 129 | 110.2 | 13.07 | 5 | 5 |
| H | Jul-15 | 45 | 91.5 | 95 | 96 | 104 | 91 | 15.97 | 11 | 11 |
| H | Aug-15 | 43 | 60 | 66 | 73 | 145 | 70.53 | 19.96 | 34 | 34 |
| I | Jun-15 | 36 | 66.5 | 70 | 82.5 | 137 | 78.37 | 25.25 | 20 | 19 |
| I | Jul-15 | 91 | 92.5 | 94 | 96 | 98 | 94.33 | 3.51 | 3 | 3 |
| I | Aug-15 | 104 | 104 | 104 | 104 | 104 | 104 | NA | 1 | 1 |
| I | Sep-15 | 52 | 74.25 | 80 | 120 | 149 | 92.8 | 32.93 | 10 | 10 |

### Table B-25 Demographic Summary Statistics for Chinook Salmon Fork Length (mm)

| Survey Area | Month | Min | Q1 | Median | Q3 | Max | Mean | SD | Individuals Caught | Individuals Measured |
|---|---|---|---|---|---|---|---|---|---|---|
| I | Nov-15 | 60 | 71.5 | 83 | 87.5 | 92 | 78.33 | 16.5 | 3 | 3 |
| I | Feb-16 | 44 | 77.5 | 111 | 112.5 | 114 | 89.67 | 39.58 | 3 | 3 |

## Table B-26 Demographic Summary Statistics for Chum Salmon Fork Length (mm)

| Survey Area | Month | Min | Q1 | Median | Q3 | Max | Mean | SD | Individuals Caught | Individuals Measured |
|---|---|---|---|---|---|---|---|---|---|---|
| A | Mar-15 | 44 | 44 | 44 | 44 | 44 | 44 | NA | 1 | 1 |
| A | Apr-15 | 40 | 45.5 | 49 | 50.5 | 60 | 48.33 | 4.91 | 15 | 15 |
| A | May-15 | 43 | 47.75 | 52.5 | 57.25 | 62 | 52.5 | 13.44 | 2 | 2 |
| B | Dec-14 | 41 | 41 | 41 | 41 | 41 | 41 | NA | 1 | 1 |
| B | Feb-15 | 42 | 42.75 | 43 | 43.25 | 44 | 43 | 0.82 | 4 | 4 |
| B | Mar-15 | 42 | 43 | 44 | 44 | 45 | 43.6 | 1.14 | 6 | 5 |
| B | Apr-15 | 44 | 48 | 50 | 53 | 63 | 50.59 | 3.71 | 144 | 61 |
| B | May-15 | 41 | 47 | 53 | 56 | 64 | 51.58 | 6.68 | 41 | 33 |
| B | Jun-15 | 55 | 56 | 57 | 58 | 59 | 57 | 2 | 3 | 3 |
| C | May-15 | 47 | 48 | 49 | 52 | 55 | 50.33 | 4.16 | 3 | 3 |
| A, B, C, D, E, F | May-15 | 38 | 46.25 | 51 | 52.75 | 54 | 48.67 | 6.12 | 6 | 6 |
| A, B, C, D, E, F | Jun-15 | 40 | 51.75 | 63.5 | 75.25 | 87 | 63.5 | 33.23 | 2 | 2 |
| H | Jan-16 | 43 | 43 | 43 | 43 | 43 | 43 | NA | 1 | 1 |
| I | Jun-15 | 28 | 30.25 | 33 | 35.75 | 38 | 33 | 4.4 | 4 | 4 |
| I | Feb-16 | 39 | 40.25 | 41.5 | 42.75 | 44 | 41.5 | 3.54 | 2 | 2 |

## Table B-27 Demographic Summary Statistics for Coho Salmon Fork Length (mm)

| Survey Area | Month | Min | Q1 | Median | Q3 | Max | Mean | SD | Individuals Caught | Individuals Measured |
|---|---|---|---|---|---|---|---|---|---|---|
| A | Jun-15 | 51 | 51 | 51 | 51 | 51 | 51 | NA | 1 | 1 |
| A | Jul-15 | 90 | 92 | 94 | 96 | 98 | 94 | 5.66 | 2 | 2 |
| B | Jun-15 | 49 | 69.5 | 90 | 93 | 96 | 78.33 | 25.58 | 3 | 3 |
| B | Jul-15 | 47 | 53 | 59 | 82.5 | 128 | 72.14 | 31.58 | 7 | 7 |
| B | Aug-15 | 65 | 76 | 85 | 95 | 106 | 85.43 | 15.67 | 7 | 7 |
| B | Sep-15 | 58 | 66.5 | 88 | 91 | 103 | 80.57 | 16.81 | 7 | 7 |
| C | Jun-15 | 81 | 87.25 | 91.5 | 92.75 | 97 | 90 | 5.66 | 6 | 6 |
| C | Jul-15 | 50 | 54 | 63 | 98.5 | 162 | 82.86 | 45.01 | 7 | 7 |
| C | Aug-15 | 61 | 75 | 89 | 94 | 99 | 83 | 19.7 | 3 | 3 |
| A, B, C, D, E, F | May-15 | 82 | 104 | 109 | 125 | 149 | 112.18 | 17.93 | 18 | 17 |
| A, B, C, D, E, F | Jun-15 | 83 | 99.25 | 104.5 | 111.75 | 126 | 105.27 | 10.33 | 22 | 22 |
| A, B, C, D, E, F | Jul-15 | 113 | 114.5 | 119 | 126.5 | 137 | 122 | 10.89 | 4 | 4 |
| G | Jun-15 | 76 | 76 | 76 | 76 | 76 | 76 | NA | 1 | 1 |
| G | Aug-15 | 65 | 65 | 65 | 65 | 65 | 65 | NA | 1 | 1 |
| H | Jun-15 | 36 | 38.5 | 52 | 96.5 | 117 | 66.89 | 30.59 | 19 | 19 |
| H | Jul-15 | 41 | 48.75 | 55 | 64.25 | 116 | 63 | 23.37 | 13 | 12 |
| H | Sep-15 | 65 | 69 | 78 | 84 | 90 | 77 | 9.78 | 7 | 7 |
| I | Jun-15 | 32 | 36 | 43 | 73 | 118 | 56.9 | 25.86 | 50 | 29 |
| I | Jul-15 | 38 | 49 | 53 | 58 | 98 | 53.9 | 12.17 | 21 | 21 |
| I | Aug-15 | 60 | 64 | 68 | 73 | 83 | 69.44 | 7.09 | 9 | 9 |

## Table B-28 Demographic Summary Statistics for Pink Salmon Fork Length (mm)

| Survey Area | Month | Min | Q1 | Median | Q3 | Max | Mean | SD | Individuals Caught | Individuals Measured |
|---|---|---|---|---|---|---|---|---|---|---|
| A | Feb-15 | 35 | 35 | 35 | 35 | 35 | 35 | NA | 1 | 1 |
| A | Mar-15 | 34 | 35 | 37 | 37 | 37 | 36 | 1.29 | 7 | 7 |
| A | Apr-15 | 30 | 35 | 36 | 37 | 39 | 35.81 | 2.06 | 549 | 54 |
| A | May-15 | 34 | 34 | 34 | 34 | 34 | 34 | 0 | 2 | 2 |
| B | Dec-14 | 31 | 31 | 31 | 31 | 31 | 31 | 0 | 2 | 2 |
| B | Jan-15 | 31 | 32 | 32 | 32.75 | 35 | 32.5 | 1.38 | 7 | 6 |
| B | Feb-15 | 32 | 34 | 35 | 36 | 37 | 34.8 | 1.92 | 5 | 5 |
| B | Mar-15 | 31 | 34 | 35 | 36 | 46 | 35.62 | 2.85 | 24 | 21 |
| B | Apr-15 | 32 | 36 | 37 | 39 | 46 | 37.81 | 3.33 | 21 | 21 |
| A, B, C, D, E, F | Apr-15 | 32 | 32 | 33 | 35 | 38 | 34 | 2.83 | 4 | 4 |
| A, B, C, D, E, F | May-15 | 34 | 34.75 | 36.5 | 38.25 | 39 | 36.5 | 2.38 | 4 | 4 |
| G | Feb-16 | 32 | 32.5 | 33 | 33.5 | 34 | 33 | 1 | 3 | 3 |
| H | Jun-15 | 34 | 34 | 34 | 34 | 34 | 34 | NA | 1 | 1 |
| H | Feb-16 | 33 | 33 | 33 | 33 | 33 | 33 | NA | 1 | 1 |
| I | Feb-16 | 33 | 33 | 33 | 33 | 33 | 33 | NA | 1 | 1 |

## Table B-29 Demographic Summary Statistics for Sockeye Salmon Fork Length (mm)

| Survey Area | Month | Min | Q1 | Median | Q3 | Max | Mean | SD | Individuals Caught | Individuals Measured |
|---|---|---|---|---|---|---|---|---|---|---|
| B | May-15 | 62 | 75.75 | 78 | 84 | 97 | 80.3 | 8.43 | 20 | 20 |
| B | Jun-15 | 91 | 91 | 91 | 91 | 91 | 91 | NA | 1 | 1 |
| C | May-15 | 81 | 81 | 81 | 81 | 81 | 81 | NA | 1 | 1 |
| C | Jun-15 | 62 | 72.5 | 83 | 83.5 | 84 | 76.33 | 12.42 | 3 | 3 |
| C | Jul-15 | 49 | 49 | 49 | 49 | 49 | 49 | NA | 1 | 1 |
| A, B, C, D, E, F | May-15 | 64 | 81 | 83 | 86 | 115 | 85.07 | 9.4 | 47 | 43 |
| A, B, C, D, E, F | Jun-15 | 72 | 81 | 83 | 89 | 93 | 83.82 | 5.84 | 17 | 17 |
| A, B, C, D, E, F | Jul-15 | 64 | 97.75 | 109 | 116.25 | 138 | 105 | 30.56 | 4 | 4 |
| G | Jun-15 | 85 | 85.5 | 86 | 86.5 | 87 | 86 | 1 | 3 | 3 |
| H | Jun-15 | 84 | 88.5 | 90.5 | 92.75 | 98 | 90.75 | 5.74 | 4 | 4 |
| I | Jun-15 | 63 | 77 | 88 | 93 | 104 | 84.89 | 12.49 | 9 | 9 |

## Table B-30 Demographic Summary Statistics for English Sole Fork Length (mm)

| Survey Area | Month | Min | Q1 | Median | Q3 | Max | Mean | SD | Individuals Caught | Individuals Measured |
|---|---|---|---|---|---|---|---|---|---|---|
| A | Mar-15 | 178 | 178 | 178 | 178 | 178 | 178 | NA | 1 | 1 |
| A | Jun-15 | 70 | 115 | 151 | 208 | 275 | 159.1 | 56.31 | 23 | 21 |
| A | Jul-15 | 40 | 66.5 | 86 | 114.75 | 296 | 100.29 | 48.71 | 70 | 70 |
| A | Aug-15 | 35 | 51 | 62 | 133.5 | 310 | 100.12 | 68.77 | 112 | 84 |
| A | Nov-15 | 78 | 78 | 78 | 78 | 78 | 78 | NA | 1 | 1 |
| A | Jan-16 | 68 | 79.25 | 85 | 112.25 | 241 | 112.38 | 60.95 | 8 | 8 |
| A | Feb-16 | 83 | 85.5 | 87 | 89.5 | 111 | 90.14 | 9.6 | 7 | 7 |
| B | Apr-15 | 47 | 52 | 64 | 72 | 85 | 63.11 | 13.04 | 9 | 9 |
| B | May-15 | 36 | 71.25 | 93 | 122 | 315 | 105.44 | 49.26 | 117 | 54 |
| B | Jun-15 | 72 | 76.25 | 80.5 | 84.75 | 89 | 80.5 | 12.02 | 2 | 2 |
| B | Jul-15 | 32 | 72.5 | 82.5 | 97.5 | 301 | 93.32 | 46.63 | 47 | 38 |
| B | Aug-15 | 42 | 49 | 58 | 71.5 | 121 | 67.27 | 26.79 | 15 | 15 |
| B | Sep-15 | 72 | 74 | 76 | 80 | 84 | 77.33 | 6.11 | 3 | 3 |
| C | May-15 | 33 | 79 | 95 | 122 | 221 | 105.57 | 44.71 | 23 | 21 |
| C | Jun-15 | 85 | 124 | 156 | 188 | 278 | 164.5 | 67.86 | 6 | 6 |
| C | Jul-15 | 41 | 82 | 97 | 115 | 217 | 96.16 | 30.33 | 57 | 49 |
| C | Aug-15 | 119 | 142 | 177 | 194.25 | 215 | 170.25 | 31.94 | 17 | 12 |
| C | Sep-15 | 83 | 91.5 | 100 | 106.5 | 113 | 98.67 | 15.04 | 3 | 3 |
| A, B, C, D, E, F | May-15 | 202 | 202 | 202 | 202 | 202 | 202 | NA | 1 | 1 |
| A, B, C, D, E, F | Jul-15 | 98 | 98 | 98 | 98 | 98 | 98 | NA | 1 | 1 |

## Table B-30 Demographic Summary Statistics for English Sole Fork Length (mm)

| Survey Area | Month | Min | Q1 | Median | Q3 | Max | Mean | SD | Individuals Caught | Individuals Measured |
|---|---|---|---|---|---|---|---|---|---|---|
| G | Jul-15 | 30 | 46.25 | 69 | 99.75 | 174 | 75.65 | 35.2 | 88 | 66 |
| G | Aug-15 | 31 | 45 | 54 | 62.5 | 92 | 54.46 | 13.21 | 79 | 59 |
| G | Sep-15 | 36 | 47 | 55 | 65 | 89 | 57.16 | 12.73 | 41 | 31 |
| G | Nov-15 | 45 | 56 | 65 | 77 | 99 | 67.65 | 15.07 | 24 | 23 |
| H | Jul-15 | 75 | 78 | 87 | 93.75 | 99 | 86.5 | 9.89 | 6 | 6 |
| H | Aug-15 | 44 | 57.5 | 64 | 75.5 | 246 | 72.68 | 40.11 | 26 | 22 |
| H | Sep-15 | 35 | 59.75 | 66 | 73.5 | 98 | 66.38 | 14.1 | 16 | 16 |
| H | Feb-16 | 87 | 87 | 87 | 87 | 87 | 87 | NA | 1 | 1 |
| I | Jun-15 | 91 | 93.25 | 95.5 | 97.75 | 100 | 95.5 | 6.36 | 2 | 2 |
| I | Jul-15 | 40 | 45.25 | 88 | 110 | 173 | 85.21 | 39.36 | 14 | 14 |
| I | Aug-15 | 34 | 44.5 | 55.5 | 57.75 | 90 | 54 | 14.26 | 14 | 14 |
| I | Sep-15 | 47 | 54 | 61 | 65 | 76 | 60.76 | 7.02 | 68 | 33 |
| I | Nov-15 | 55 | 63 | 72 | 75 | 92 | 70.73 | 12.47 | 11 | 11 |
| I | Dec-15 | 55 | 62 | 67 | 73 | 86 | 68.29 | 10.67 | 7 | 7 |

**Table B-31 Demographic Summary Statistics for Starry Flounder Fork Length (mm)**

| Survey Area | Month | Min | Q1 | Median | Q3 | Max | Mean | SD | Individuals Caught | Individuals Measured |
|---|---|---|---|---|---|---|---|---|---|---|
| A | Jan-15 | 195 | 197 | 199 | 200 | 201 | 198.33 | 3.06 | 3 | 3 |
| A | Feb-15 | 186 | 230 | 261 | 296 | 310 | 260 | 41.26 | 10 | 10 |
| A | Mar-15 | 127 | 233.25 | 270 | 288.75 | 360 | 260.06 | 52.63 | 34 | 34 |
| A | Apr-15 | 184 | 211.5 | 225 | 243.5 | 290 | 229.64 | 31.21 | 11 | 11 |
| A | May-15 | 76 | 173.25 | 198.5 | 259.75 | 345 | 213.98 | 63.1 | 56 | 44 |
| A | Jun-15 | 100 | 180 | 210 | 227 | 372 | 208.51 | 41.68 | 183 | 177 |
| A | Jul-15 | 72 | 171 | 202 | 223 | 511 | 204.97 | 60.15 | 108 | 97 |
| A | Aug-15 | 118 | 188.5 | 208.5 | 235 | 296 | 209.81 | 37.96 | 36 | 36 |
| A | Sep-15 | 129 | 163 | 178 | 190 | 239 | 179.03 | 23.75 | 46 | 31 |
| A | Oct-15 | 222 | 250.25 | 278.5 | 306.75 | 335 | 278.5 | 79.9 | 2 | 2 |
| A | Jan-16 | 195 | 200 | 205 | 210 | 215 | 205 | 14.14 | 2 | 2 |
| B | Dec-14 | 265 | 265 | 265 | 265 | 265 | 265 | NA | 1 | 1 |
| B | Jan-15 | 75 | 81 | 87 | 87.5 | 88 | 83.33 | 7.23 | 3 | 3 |
| B | Feb-15 | 76 | 77 | 78 | 79.5 | 81 | 78.33 | 2.52 | 3 | 3 |
| B | Mar-15 | 58 | 84 | 92.5 | 147.75 | 218 | 118.25 | 50.07 | 12 | 12 |
| B | Apr-15 | 82 | 91 | 107.5 | 128.5 | 250 | 128 | 62.7 | 6 | 6 |
| B | May-15 | 63 | 91 | 107 | 132.75 | 221 | 114.05 | 33.34 | 74 | 44 |
| B | Jun-15 | 65 | 90.25 | 115 | 150.5 | 251 | 123.34 | 39.56 | 76 | 74 |
| B | Jul-15 | 76 | 104.5 | 118.5 | 145 | 196 | 125.11 | 28.92 | 144 | 72 |
| B | Aug-15 | 75 | 95 | 105 | 126.5 | 215 | 115.77 | 32.23 | 54 | 35 |
| B | Sep-15 | 44 | 46 | 56.5 | 65.25 | 106 | 62.07 | 19.99 | 14 | 14 |

## Table B-31 Demographic Summary Statistics for Starry Flounder Fork Length (mm)

| Survey Area | Month | Min | Q1 | Median | Q3 | Max | Mean | SD | Individuals Caught | Individuals Measured |
|---|---|---|---|---|---|---|---|---|---|---|
| C | May-15 | 57 | 111 | 128 | 165 | 435 | 145 | 67.15 | 45 | 41 |
| C | Jun-15 | 100 | 116 | 138 | 146 | 440 | 165.11 | 105.35 | 9 | 9 |
| C | Jul-15 | 71 | 103.75 | 136.5 | 188.5 | 431 | 178.27 | 109.48 | 26 | 26 |
| C | Aug-15 | 80 | 99 | 139 | 143 | 195 | 131.2 | 44.52 | 9 | 5 |
| C | Sep-15 | 128 | 168.5 | 209 | 249.5 | 290 | 209 | 114.55 | 2 | 2 |
| A, B, C, D, E, F | May-15 | 103 | 150 | 178 | 208 | 270 | 175.54 | 47.8 | 14 | 13 |
| A, B, C, D, E, F | Jun-15 | 30 | 100 | 150 | 181.5 | 420 | 152.32 | 77.12 | 32 | 31 |
| A, B, C, D, E, F | Jul-15 | 30 | 90 | 160 | 225 | 270 | 155 | 106.3 | 4 | 4 |
| G | Jun-15 | 84 | 157.75 | 181.5 | 206.5 | 430 | 183.64 | 57.08 | 42 | 42 |
| G | Jul-15 | 129 | 186 | 202 | 222.5 | 520 | 208.14 | 51.94 | 77 | 66 |
| G | Aug-15 | 187 | 195 | 215 | 225 | 310 | 220.11 | 36.7 | 9 | 9 |
| G | Sep-15 | 201 | 213.75 | 226.5 | 239.25 | 252 | 226.5 | 36.06 | 2 | 2 |
| G | Feb-16 | 286 | 286 | 286 | 286 | 286 | 286 | NA | 1 | 1 |
| H | Jun-15 | 59 | 75 | 93 | 136 | 221 | 107.99 | 41.62 | 193 | 103 |
| H | Jul-15 | 45 | 83 | 98 | 143 | 220 | 112.05 | 35.03 | 235 | 148 |
| H | Aug-15 | 40 | 87.75 | 120.5 | 164.25 | 214 | 128.34 | 46.79 | 216 | 56 |
| H | Sep-15 | 32 | 85 | 97 | 119 | 230 | 106.11 | 39.76 | 92 | 53 |
| H | Nov-15 | 38 | 87.5 | 105 | 140.5 | 170 | 108.86 | 34.03 | 42 | 35 |
| H | Dec-15 | 38 | 81 | 89 | 136.5 | 168 | 106.87 | 37.72 | 15 | 15 |
| H | Feb-16 | 34 | 76 | 102.5 | 122 | 189 | 102.28 | 37.68 | 125 | 68 |
| I | Jun-15 | 63 | 85.25 | 132 | 154 | 198 | 122.82 | 38.75 | 66 | 62 |

## Table B-31 Demographic Summary Statistics for Starry Flounder Fork Length (mm)

| Survey Area | Month | Min | Q1 | Median | Q3 | Max | Mean | SD | Individuals Caught | Individuals Measured |
|---|---|---|---|---|---|---|---|---|---|---|
| I | Jul-15 | 72 | 91 | 102 | 140 | 240 | 116.21 | 33.25 | 170 | 97 |
| I | Aug-15 | 55 | 88 | 95 | 154 | 203 | 114.95 | 45.98 | 21 | 21 |
| I | Sep-15 | 36 | 96 | 130 | 163 | 191 | 126.64 | 41.09 | 30 | 25 |
| I | Dec-15 | 47 | 80.5 | 98 | 110.25 | 160 | 98.67 | 37.98 | 6 | 6 |
| I | Jan-16 | 57 | 69.75 | 87 | 99.75 | 119 | 86.33 | 23.15 | 6 | 6 |
| I | Feb-16 | 38 | 64.25 | 74.5 | 88.75 | 167 | 78.29 | 25.01 | 40 | 34 |

## Table B-32 Demographic Summary Statistics for Fish Larvae Fork Length (mm)

| Survey Area | Month | Min | Q1 | Median | Q3 | Max | Mean | SD | Individuals Caught | Individuals Measured |
|---|---|---|---|---|---|---|---|---|---|---|
| A | Jan-15 | 38 | 38.5 | 39 | 39.5 | 40 | 39 | 1.41 | 2 | 2 |
| A | Feb-15 | 37 | 38 | 38.5 | 40 | 40 | 38.7 | 1.25 | 10 | 10 |
| A | Mar-15 | 38 | 39 | 40 | 40 | 40 | 39.33 | 1.15 | 3 | 3 |
| A | Apr-15 | 38 | 38.5 | 39 | 39.5 | 40 | 39 | 1.41 | 2 | 2 |
| A | May-15 | 38 | 38 | 38 | 38 | 38 | 38 | NA | 1 | 1 |
| A | Jun-15 | 25 | 25 | 25 | 29.5 | 34 | 28 | 5.2 | 3 | 3 |
| A | Jul-15 | 20 | 23.75 | 27.5 | 31.25 | 35 | 27.5 | 10.61 | 103 | 2 |
| A | Aug-15 | NA | NA | NA | NA | NA | NA | NA | 205 | 0 |
| A | Sep-15 | 37 | 37 | 37 | 37 | 37 | 37 | NA | 1 | 1 |
| A | Nov-15 | 31 | 36 | 39 | 40 | 40 | 37.92 | 2.43 | 24 | 24 |
| A | Feb-16 | 35 | 46 | 46 | 51 | 58 | 47 | 5.74 | 21 | 21 |
| B | Dec-14 | 38 | 38 | 38 | 38.5 | 40 | 38.43 | 0.79 | 7 | 7 |
| B | Jan-15 | 39 | 39 | 39 | 39.75 | 40 | 39.33 | 0.52 | 6 | 6 |
| B | Feb-15 | 40 | 40 | 40 | 40 | 40 | 40 | NA | 1 | 1 |
| B | Mar-15 | 35 | 35 | 35 | 35 | 35 | 35 | NA | 1 | 1 |
| B | Jul-15 | 20 | 20 | 20 | 20 | 20 | 20 | NA | 16 | 1 |
| A, B, C, D, E, F | Feb-15 | NA | NA | NA | NA | NA | NA | NA | 2 | 0 |
| A, B, C, D, E, F | May-15 | 20 | 20 | 20 | 30 | 44 | 25.73 | 7.74 | 59 | 30 |
| A, B, C, D, E, F | Jun-15 | 20 | 26.5 | 33 | 35 | 36 | 30.27 | 6.18 | 2,680 | 11 |
| A, B, C, D, E, F | Jul-15 | 20 | 25 | 29 | 38 | 75 | 31.61 | 9.95 | 1,595 | 36 |
| A, B, C, D, E, F | Aug-15 | NA | NA | NA | NA | NA | NA | NA | 105 | 0 |
| A, B, C, D, E, F | Nov-15 | 35 | 35.5 | 36 | 36.5 | 37 | 36 | 1.41 | 2 | 2 |
| A, B, C, D, E, F | Feb-16 | 20 | 26 | 32 | 38 | 44 | 32 | 16.97 | 2 | 2 |
| G | Jun-15 | 26 | 32 | 35 | 37 | 44 | 34.62 | 4.3 | 285 | 21 |

## Table B-32 Demographic Summary Statistics for Fish Larvae Fork Length (mm)

| Survey Area | Month | Min | Q1 | Median | Q3 | Max | Mean | SD | Individuals Caught | Individuals Measured |
|---|---|---|---|---|---|---|---|---|---|---|
| G | Jul-15 | 25 | 25 | 25 | 28.75 | 40 | 28.75 | 7.5 | 412 | 4 |
| G | Aug-15 | NA | NA | NA | NA | NA | NA | NA | 439 | 0 |
| G | Sep-15 | NA | NA | NA | NA | NA | NA | NA | 671 | 0 |
| G | Nov-15 | 39 | 39.25 | 39.5 | 39.75 | 40 | 39.5 | 0.71 | 2 | 2 |
| G | Feb-16 | 39 | 43 | 44 | 46 | 49 | 43.98 | 2.35 | 275 | 51 |
| H | Jun-15 | 32 | 33 | 35 | 37 | 40 | 35.51 | 2.39 | 102 | 35 |
| H | Jul-15 | NA | NA | NA | NA | NA | NA | NA | 3,464 | 0 |
| H | Aug-15 | NA | NA | NA | NA | NA | NA | NA | 10 | 0 |
| H | Sep-15 | 40 | 40 | 40 | 40 | 40 | 40 | 0 | 55 | 5 |
| H | Nov-15 | 34 | 36.5 | 39 | 40 | 40 | 38.08 | 2.43 | 12 | 12 |
| H | Dec-15 | 38 | 38.5 | 39 | 39.5 | 40 | 39 | 1.41 | 2 | 2 |
| H | Jan-16 | 35 | 37 | 39 | 39.5 | 40 | 38 | 2.65 | 3 | 3 |
| H | Feb-16 | 45 | 49 | 51 | 55 | 62 | 52.09 | 4.64 | 748 | 53 |
| I | Jun-15 | 30 | 34 | 36 | 36 | 39 | 34.92 | 2.72 | 143 | 13 |
| I | Jul-15 | NA | NA | NA | NA | NA | NA | NA | 1,444 | 0 |
| I | Aug-15 | 35 | 35 | 35 | 35 | 35 | 35 | NA | 2 | 1 |
| I | Sep-15 | 40 | 40 | 40 | 40 | 40 | 40 | NA | 1 | 1 |
| I | Nov-15 | 39 | 39.25 | 39.5 | 39.75 | 40 | 39.5 | 0.71 | 2 | 2 |
| I | Dec-15 | 40 | 40 | 40 | 40 | 40 | 40 | NA | 1 | 1 |
| I | Feb-16 | 41 | 48 | 53 | 56 | 65 | 52.27 | 4.95 | 147 | 37 |

NOTE:
"NA" across a row indicates individuals were caught, but not measured.

**Table B-33 Demographic Summary Statistics for Dungeness Crab Carapace Width (mm)**

| Area | Month | Min | Q1 | Median | Q3 | Max | Mean | SD | Individuals Caught | Individuals Measured |
|---|---|---|---|---|---|---|---|---|---|---|
| A | Dec-14 | 132 | 153.5 | 159 | 161.5 | 195 | 157.74 | 12.04 | 47 | 47 |
| A | Jan-15 | 146 | 156 | 165 | 178 | 190 | 166.74 | 12.41 | 68 | 68 |
| A | Feb-15 | 135 | 157 | 165 | 173.5 | 185 | 165.02 | 11.44 | 51 | 51 |
| A | Mar-15 | 135 | 148.75 | 157 | 163 | 201 | 157.4 | 13.4 | 40 | 40 |
| A | Apr-15 | 140 | 149.25 | 158.5 | 164 | 193 | 159 | 12.48 | 54 | 54 |
| A | May-15 | 106 | 146 | 155 | 165 | 200 | 156.13 | 15.75 | 75 | 75 |
| A | Jun-15 | 134 | 151.25 | 157.5 | 163 | 191 | 158.17 | 11.36 | 58 | 58 |
| A | Jul-15 | 129 | 150 | 157 | 163 | 208 | 157.36 | 12.41 | 77 | 77 |
| A | Aug-15 | 123 | 149 | 153 | 161 | 180 | 153.86 | 10.5 | 43 | 43 |
| A | Sep-15 | 123 | 150 | 157 | 162 | 194 | 155.47 | 12.95 | 68 | 68 |
| A | Oct-15 | 142 | 152 | 158 | 164 | 179 | 158.64 | 10.61 | 11 | 11 |
| A | Nov-15 | 143 | 156 | 164 | 170 | 185 | 164.26 | 11.01 | 27 | 27 |
| A | Dec-15 | NA | NA | NA | NA | NA | NA | NA | 14 | 0 |
| A | Jan-16 | 139 | 152.75 | 160 | 176.25 | 195 | 163.96 | 14.35 | 28 | 28 |
| A | Feb-16 | 152 | 160.5 | 166 | 174.75 | 190 | 167.85 | 10.11 | 26 | 26 |
| B | Dec-14 | 144 | 163 | 171 | 180.75 | 212 | 170.76 | 13.42 | 46 | 46 |
| B | Jan-15 | 136 | 147 | 154.5 | 158.25 | 165 | 152.62 | 9.12 | 8 | 8 |
| B | Feb-15 | 150 | 159 | 168 | 175 | 189 | 167.78 | 13.99 | 9 | 9 |
| B | Mar-15 | 133 | 152.25 | 159 | 176 | 192 | 162.67 | 17.39 | 12 | 12 |

## Table B-33 Demographic Summary Statistics for Dungeness Crab Carapace Width (mm)

| Area | Month | Min | Q1 | Median | Q3 | Max | Mean | SD | Individuals Caught | Individuals Measured |
|---|---|---|---|---|---|---|---|---|---|---|
| B | Apr-15 | 142 | 159.5 | 164 | 177.5 | 192 | 168.64 | 14.94 | 11 | 11 |
| B | May-15 | 131 | 149.75 | 161 | 169.75 | 177 | 159.39 | 12.31 | 18 | 18 |
| B | Jun-15 | 132 | 161 | 165.5 | 174 | 203 | 167.5 | 11.93 | 40 | 40 |
| B | Jul-15 | 132 | 157.75 | 162 | 168.5 | 197 | 163.83 | 14.99 | 36 | 36 |
| B | Aug-15 | 139 | 146 | 162 | 165 | 176 | 157 | 13.74 | 7 | 7 |
| C | Jun-15 | 155 | 163.5 | 166 | 177.25 | 178 | 168 | 8.85 | 8 | 8 |
| C | Jul-15 | 141 | 152 | 157 | 161 | 171 | 156.08 | 8.81 | 13 | 13 |
| C | Aug-15 | 154 | 157.5 | 161 | 161.5 | 162 | 159 | 4.36 | 3 | 3 |
| C | Sep-15 | 154 | 154.5 | 155 | 157.5 | 160 | 156.33 | 3.21 | 3 | 3 |
| C | Oct-15 | 152 | 154.75 | 158 | 163.75 | 187 | 161.62 | 11.36 | 8 | 8 |
| C | Nov-15 | 160 | 161 | 162 | 165.5 | 169 | 163.67 | 4.73 | 3 | 3 |
| C | Dec-15 | 147 | 153 | 156 | 161 | 165 | 156.57 | 6.43 | 7 | 7 |
| C | Jan-16 | 143 | 154 | 157 | 173 | 187 | 162.8 | 17.27 | 5 | 5 |
| C | Feb-16 | 152 | 155.5 | 159 | 163.5 | 168 | 159.67 | 8.02 | 3 | 3 |
| D | Dec-14 | 136 | 149 | 157.5 | 165 | 190 | 158.67 | 13.1 | 46 | 46 |
| D | Jan-15 | 133 | 152.75 | 161.5 | 170.25 | 191 | 162.23 | 14.27 | 52 | 52 |
| D | Feb-15 | 134 | 154 | 161 | 173 | 198 | 162.98 | 14.18 | 47 | 47 |
| D | Mar-15 | 129 | 155 | 160 | 165 | 187 | 159.3 | 11.75 | 43 | 43 |
| D | Apr-15 | 131 | 153 | 160 | 169 | 188 | 160.55 | 12.15 | 51 | 51 |
| D | May-15 | 126 | 142 | 154 | 162 | 187 | 153.24 | 13.98 | 37 | 37 |

## Table B-33 Demographic Summary Statistics for Dungeness Crab Carapace Width (mm)

| Area | Month | Min | Q1 | Median | Q3 | Max | Mean | SD | Individuals Caught | Individuals Measured |
|---|---|---|---|---|---|---|---|---|---|---|
| D | Jun-15 | 134 | 154 | 163 | 170 | 195 | 162.59 | 12.13 | 105 | 105 |
| D | Jul-15 | 116 | 148 | 155 | 161 | 178 | 153.71 | 11.77 | 135 | 135 |
| D | Aug-15 | 131 | 150.75 | 160 | 163.25 | 190 | 157.93 | 12.24 | 72 | 72 |
| D | Sep-15 | 124 | 153 | 158 | 161 | 185 | 158.32 | 11.1 | 57 | 57 |
| D | Oct-15 | 143 | 155 | 159 | 164 | 190 | 160.57 | 9.48 | 60 | 60 |
| D | Nov-15 | 140 | 152.25 | 159.5 | 163.75 | 193 | 159.76 | 11.91 | 34 | 34 |
| D | Dec-15 | 136 | 151.75 | 156.5 | 163 | 182 | 157.22 | 9.33 | 64 | 64 |
| D | Jan-16 | 149 | 161 | 165 | 180 | 197 | 168.92 | 12.5 | 61 | 61 |
| D | Feb-16 | 142 | 157 | 165 | 176 | 197 | 166.33 | 12.53 | 63 | 63 |
| E | Dec-14 | 137 | 149 | 160 | 164 | 194 | 159.31 | 12.59 | 55 | 55 |
| E | Jan-15 | 134 | 162.75 | 173 | 179.25 | 199 | 170.52 | 14.03 | 48 | 48 |
| E | Feb-15 | 134 | 161 | 170 | 177 | 198 | 169.02 | 12.85 | 93 | 93 |
| E | Mar-15 | 130 | 143.25 | 150 | 157 | 184 | 151.34 | 12.25 | 50 | 50 |
| E | Apr-15 | 129 | 148.5 | 155 | 164.25 | 197 | 155.79 | 14.28 | 48 | 48 |
| E | May-15 | 128 | 142 | 150 | 155 | 175 | 149.67 | 9.88 | 61 | 61 |
| E | Jun-15 | 133 | 152.25 | 160.5 | 166.75 | 185 | 159.61 | 11.01 | 54 | 54 |
| E | Jul-15 | 133 | 145 | 151 | 156.5 | 178 | 151.36 | 8.62 | 59 | 59 |
| E | Aug-15 | 134 | 152 | 154 | 162 | 192 | 156.8 | 10.92 | 61 | 60 |
| E | Sep-15 | 120 | 138 | 149 | 157.5 | 183 | 148.16 | 15.33 | 31 | 31 |
| E | Oct-15 | 126 | 145.5 | 155 | 164.5 | 188 | 155.83 | 14.96 | 23 | 23 |

**Table B-33 Demographic Summary Statistics for Dungeness Crab Carapace Width (mm)**

| Area | Month | Min | Q1 | Median | Q3 | Max | Mean | SD | Individuals Caught | Individuals Measured |
|---|---|---|---|---|---|---|---|---|---|---|
| E | Nov-15 | 142 | 152.75 | 159.5 | 163.5 | 170 | 157.67 | 7.83 | 18 | 18 |
| E | Dec-15 | NA | NA | NA | NA | NA | NA | NA | 26 | 0 |
| E | Jan-16 | 125 | 161.25 | 172.5 | 183.25 | 192 | 168.31 | 17.76 | 26 | 26 |
| E | Feb-16 | 155 | 165.5 | 175 | 182.5 | 192 | 174.22 | 10.69 | 27 | 27 |

NOTE:
"NA" across a row indicates individuals were caught, but not measured.

**Table B-34 Demographic Summary Statistics for Dungeness Crab Weight (g)**

| Area | Month | Min | Q1 | Median | Q3 | Max | Mean | SD | Number Caught | Number Measured |
|---|---|---|---|---|---|---|---|---|---|---|
| A | Dec-14 | 280 | 415.5 | 525 | 567 | 887 | 516.79 | 129.59 | 47 | 47 |
| A | Jan-15 | 389 | 508 | 578 | 733 | 850 | 611.94 | 132.92 | 68 | 68 |
| A | Feb-15 | 346 | 529 | 595 | 683 | 859 | 602.98 | 119.44 | 51 | 51 |
| A | Mar-15 | 333 | 424 | 507.5 | 566.5 | 1,066 | 522.38 | 144.69 | 40 | 40 |
| A | Apr-15 | 349 | 438.5 | 506.5 | 573 | 970 | 526.31 | 135.41 | 54 | 54 |
| A | May-15 | 155 | 409 | 469 | 578.5 | 1006 | 502.61 | 162.49 | 75 | 75 |
| A | Jun-15 | 268 | 422 | 487.5 | 540.75 | 763 | 486.28 | 103.33 | 58 | 58 |
| A | Jul-15 | 308 | 441 | 494 | 574 | 1,136 | 523.55 | 143.45 | 77 | 77 |
| A | Aug-15 | 244 | 403 | 470 | 512.5 | 671 | 466.95 | 93.47 | 43 | 43 |
| A | Sep-15 | 308 | 445 | 512 | 561 | 792 | 504.93 | 93.58 | 68 | 68 |
| A | Oct-15 | 420 | 491 | 517 | 559.5 | 753 | 531.82 | 89.46 | 11 | 11 |
| A | Nov-15 | 348 | 492 | 575 | 601 | 785 | 567.48 | 109.52 | 27 | 27 |
| A | Dec-15 | NA | NA | NA | NA | NA | NA | NA | 14 | 0 |
| A | Jan-16 | 312 | 475 | 591.5 | 693.5 | 930 | 596.07 | 149.27 | 28 | 28 |
| A | Feb-16 | 443 | 515.5 | 601.5 | 683.75 | 898 | 614 | 120.89 | 26 | 26 |
| B | Dec-14 | 345 | 559.75 | 628 | 706 | 1271 | 642.26 | 154.48 | 46 | 46 |
| B | Jan-15 | 279 | 437.5 | 480.5 | 536.25 | 615 | 475.5 | 103.02 | 8 | 8 |
| B | Feb-15 | 455 | 554 | 571 | 645 | 922 | 634.44 | 167.27 | 9 | 9 |
| B | Mar-15 | 321 | 472.5 | 541.5 | 695.25 | 971 | 589 | 190.54 | 12 | 12 |
| B | Apr-15 | 288 | 451 | 547 | 641 | 839 | 556.73 | 160.76 | 11 | 11 |
| B | May-15 | 297 | 442.25 | 553 | 580 | 737 | 528.22 | 116.12 | 18 | 18 |

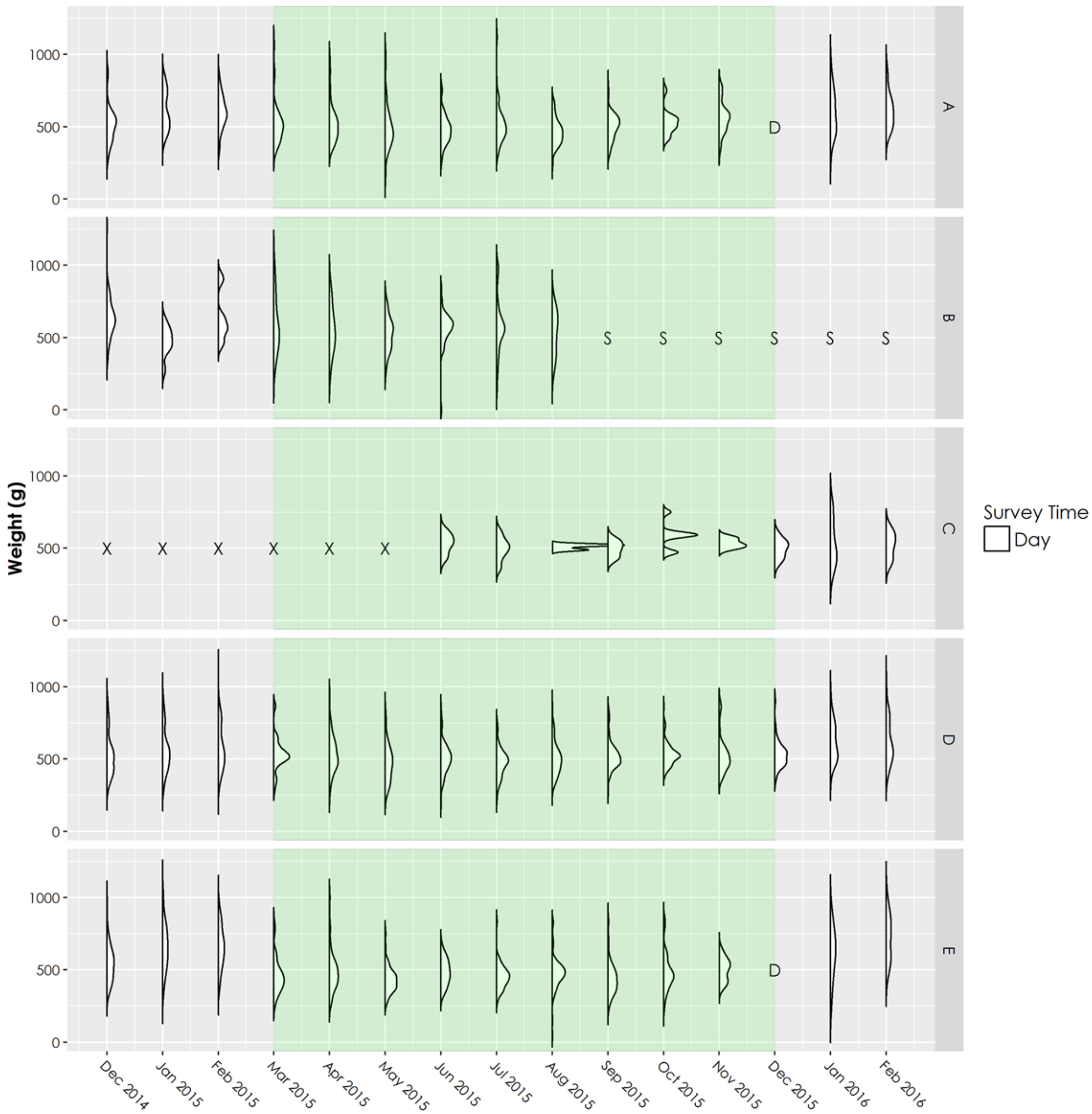
## Table B-34 Demographic Summary Statistics for Dungeness Crab Weight (g)

| Area | Month | Min | Q1 | Median | Q3 | Max | Mean | SD | Number Caught | Number Measured |
|---|---|---|---|---|---|---|---|---|---|---|
| B | Jun-15 | 409 | 539 | 588 | 624 | 1,017 | 591.7 | 113.58 | 40 | 40 |
| B | Jul-15 | 155 | 490.75 | 564 | 639.75 | 989 | 577.37 | 198.46 | 36 | 30 |
| B | Aug-15 | 313 | 420.5 | 591 | 640.5 | 698 | 532 | 148.63 | 7 | 7 |
| C | Jun-15 | 439 | 499 | 536 | 585 | 622 | 533.88 | 67.3 | 8 | 8 |
| C | Jul-15 | 368 | 449 | 504 | 534 | 621 | 499.23 | 77.72 | 13 | 13 |
| C | Aug-15 | 489 | 505 | 521 | 522 | 523 | 511 | 19.08 | 3 | 3 |
| C | Sep-15 | 435 | 468 | 501 | 527.5 | 554 | 496.67 | 59.62 | 3 | 3 |
| C | Oct-15 | 471 | 557.25 | 592 | 596.5 | 751 | 582.88 | 87.32 | 8 | 8 |
| C | Nov-15 | 503 | 517 | 531 | 552 | 573 | 535.67 | 35.23 | 3 | 3 |
| C | Dec-15 | 402 | 454 | 524 | 532.5 | 594 | 499 | 65.39 | 7 | 7 |
| C | Jan-16 | 355 | 461 | 465 | 625 | 781 | 537.4 | 166.86 | 5 | 5 |
| C | Feb-16 | 418 | 475.5 | 533 | 574 | 615 | 522 | 98.96 | 3 | 3 |
| D | Dec-14 | 301 | 416.25 | 519.5 | 579.5 | 905 | 533.2 | 149.31 | 46 | 46 |
| D | Jan-15 | 302 | 450.25 | 541.5 | 625.75 | 937 | 562.9 | 152 | 52 | 52 |
| D | Feb-15 | 320 | 469 | 545 | 733 | 1,055 | 588.06 | 161.96 | 47 | 47 |
| D | Mar-15 | 288 | 490 | 524 | 568.5 | 874 | 533.42 | 112.98 | 43 | 43 |
| D | Apr-15 | 271 | 460.5 | 517 | 611.5 | 915 | 537.04 | 122.36 | 51 | 51 |
| D | May-15 | 279 | 368 | 488 | 541 | 799 | 475.59 | 125.06 | 37 | 37 |
| D | Jun-15 | 189 | 448 | 511 | 564 | 856 | 510.13 | 112.37 | 105 | 105 |
| D | Jul-15 | 218 | 419 | 484 | 533.5 | 759 | 480.04 | 103.11 | 135 | 135 |
| D | Aug-15 | 295 | 423.75 | 494.5 | 558.5 | 863 | 503.89 | 113.63 | 72 | 72 |
| D | Sep-15 | 278 | 470 | 517 | 563 | 849 | 529.4 | 105.98 | 57 | 57 |

## Table B-34 Demographic Summary Statistics for Dungeness Crab Weight (g)

| Area | Month | Min | Q1 | Median | Q3 | Max | Mean | SD | Number Caught | Number Measured |
|---|---|---|---|---|---|---|---|---|---|---|
| D | Oct-15 | 386 | 490.25 | 523.5 | 568.5 | 864 | 538.52 | 88.98 | 60 | 60 |
| D | Nov-15 | 372 | 458.5 | 512.5 | 570.75 | 879 | 530.91 | 126.88 | 34 | 34 |
| D | Dec-15 | 361 | 471.75 | 523 | 566.75 | 904 | 530 | 88.46 | 64 | 64 |
| D | Jan-16 | 369 | 514 | 606 | 711 | 958 | 617.21 | 130.63 | 61 | 61 |
| D | Feb-16 | 390 | 519.5 | 581 | 752 | 1,039 | 623.6 | 150.46 | 63 | 63 |
| E | Dec-14 | 323 | 453.5 | 545 | 612.5 | 971 | 547.84 | 133.66 | 55 | 55 |
| E | Jan-15 | 335 | 549.25 | 652 | 771.75 | 1051 | 658.2 | 163.9 | 48 | 44 |
| E | Feb-15 | 350 | 547 | 656 | 762 | 992 | 659.72 | 149.44 | 93 | 93 |
| E | Mar-15 | 262 | 385 | 441.5 | 506.25 | 820 | 459.96 | 120.55 | 50 | 50 |
| E | Apr-15 | 267 | 406.5 | 474 | 543.75 | 1000 | 487.38 | 137.88 | 48 | 48 |
| E | May-15 | 277 | 370.75 | 424 | 471 | 751 | 433.1 | 87.8 | 61 | 60 |
| E | Jun-15 | 324 | 422.75 | 487.5 | 554.5 | 671 | 486.04 | 88.78 | 54 | 54 |
| E | Jul-15 | 283 | 406.5 | 459 | 497 | 835 | 453.08 | 86.56 | 59 | 59 |
| E | Aug-15 | 150 | 437 | 481 | 525 | 833 | 483.02 | 110.73 | 61 | 61 |
| E | Sep-15 | 247 | 366 | 427 | 491 | 835 | 445.81 | 119.95 | 31 | 31 |
| E | Oct-15 | 252 | 423.5 | 470 | 554.5 | 826 | 492.78 | 137.56 | 23 | 23 |
| E | Nov-15 | 387 | 427.5 | 515.5 | 555 | 640 | 502.5 | 77.95 | 18 | 18 |
| E | Dec-15 | NA | NA | NA | NA | NA | NA | NA | 26 | 0 |
| E | Jan-16 | 243 | 506 | 634.5 | 749 | 913 | 615.5 | 175.48 | 26 | 26 |
| E | Feb-16 | 466 | 583 | 750 | 869.5 | 1030 | 720.59 | 156.9 | 27 | 27 |

NOTE:
"NA" across a row indicates individuals were caught, but not measured.




NOTES:

X = did not fish.
D = data deficient; cannot calculate kernel density (i.e., fewer than 3 data points).
S = Safety concerns; did not fish.
Green rectangle = open time of the commercial crab fishery in Area B.

## Figure B-1 Weight Frequency Distribution for Dungeness Crab

# B.4 SALMON SMOLT STOMACH CONTENTS FROM SEINES IN EACH SURVEY AREA

## B.4.1 Survey Area A

A total of four salmon smolts (one Chinook and three coho) were captured in survey area A using beach and purse seines. Coho and Chinook salmon captured in survey area A had a relatively high proportion of stomach fullness (90 – 100%) and a high (80%) and low (25%) proportion of digested prey and materials in Chinook and coho salmon respectively.

Stomach contents of all salmon smolt species were dominated (in number and frequency) by crustacean planktonic prey, crustacean benthic prey, terrestrial insects, and small fish prey (Table B-35). Terrestrial insects and arachnids comprised a high numerical proportion of contents in stomachs of coho (64.7%) with none present in the Chinook salmon. Small fish prey were found in the one Chinook salmon stomach and 2 of the 3 coho salmon stomachs. Coho salmon fed primarily on insects and smaller numbers of decapods, and less frequently on amphipods, isopods, and small fish. Coho salmon had the largest number of prey per fish. None of the three salmon collected from survey area A had empty stomachs.

## Table B-35 Percent by Number (% N) of Prey Organisms and Percent Frequency of Occurrence (% F) in Salmon Smolt Stomach Contents caught by Seine in Survey Area A

| Stomach Content Prey Taxa | Salmon Smolts | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Pink (n = 0) | | Chinook (n = 1) | | Chum (n = 0) | | Coho (n = 3) | | Sockeye (n = 0) | |
| | % N | % F | % N | % F | % N | % F | % N | % F | % N | % F |
| **Crustacea (Planktonic)** | | | | | | | | | | |
| Euphausiacea (krill) | - | - | 0.0 | 0.0 | - | - | 0.0 | 0.0 | - | - |
| Copepoda | - | - | 0.0 | 0.0 | - | - | 2.9 | 33.3 | - | - |
| Cladocera | - | - | 0.0 | 0.0 | - | - | 0.0 | 0.0 | - | - |
| Decapoda | - | - | 0.0 | 0.0 | - | - | 17.6 | 100.0 | - | - |
| **Crustacea (Benthic/Planktonic)** | | | | | | | | | | |
| Cumacea | - | - | 0.0 | 0.0 | - | - | 0.0 | 0.0 | - | - |
| Cirripedia | - | - | 0.0 | 0.0 | - | - | 0.0 | 0.0 | - | - |
| Amphipoda/Isopoda | - | - | 0.0 | 0.0 | - | - | 5.9 | 66.7 | - | - |
| Ostracoda | - | - | 0.0 | 0.0 | - | - | 0.0 | 0.0 | - | - |
| Unknown Crustacea | - | - | 0.0 | 0.0 | - | - | 0.0 | 0.0 | - | - |
| **Insects/Arachnids** | - | - | 0.0 | 0.0 | - | - | 64.7 | 100.0 | - | - |
| **Pisces (fish)** | - | - | 100.0 | 100.0 | - | - | 5.9 | 66.7 | - | - |
| **Mollusca/Gastropoda** | - | - | 0.0 | 0.0 | - | - | 0.0 | 0.0 | - | - |
| **Nematoda** | - | - | 0.0 | 0.0 | - | - | 0.0 | 0.0 | - | - |
| **Nemertea** | - | - | 0.0 | 0.0 | - | - | 0.0 | 0.0 | - | - |
| **Polychaeta** | - | - | 0.0 | 0.0 | - | - | 0.0 | 0.0 | - | - |
| **Unknown Arthropod** | | | 0.0 | 0.0 | | | 0.0 | 0.0 | | |
| **Non-food items** | - | - | 0.0 | 0.0 | - | - | 2.9 | 33.3 | - | - |
| **Undetermined materials** | - | - | 0.0 | 0.0 | - | - | 0.0 | 0.0 | - | - |
| **% Fullness (Median)** | - | | 90 | | - | | 100 | | - | |
| **% Digested (Median)** | - | | 80 | | - | | 25 | | - | |
| **Total prey items counted** | - | | 6 | | - | | 34 | | - | |
| **Prey items per fish** | - | | 6 | | - | | 11.3 | | - | |
| **Empty stomachs (%)** | - | | 0 | | - | | 0 | | - | |

NOTES:

%N Percent by number of prey relative to prey counted

%F Percent occurrence observed in stomach samples

### B.4.2 Survey Area B

A total of 38 salmon smolts (one Chinook, two sockeye, and 35 coho) were captured in survey area B using beach and purse seines. Salmon captured in survey area B had a relatively high proportion of stomach fullness (60 – 95%) and digested prey and materials (70 – 90%).

Stomach contents of all salmon smolt species were dominated (in number and frequency) by crustacean planktonic prey, crustacean benthic prey, terrestrial insects, and small fish prey (Table B-36). Terrestrial insects and arachnids comprised a high numerical proportion of contents in stomachs of coho (53.1%) with lower in the one Chinook salmon (2.5%). Small fish prey were found in 1 of the 2 sockeye salmon stomachs and 20% (7 of 35) of coho salmon stomachs. Insects, arachnids, and small fish prey were not present in the Chinook salmon stomach. The Chinook salmon stomach contained mostly euphausiid prey (57.9%), whereas coho stomachs contained mostly insects and arachnids (53.1%) and sockeye stomachs contained mostly copepod (38.9%) and cladoceran (34.9%) zooplankton. The one Chinook salmon stomach contained euphausiids and smaller numbers of copepods, and fewer cirripedes, decopods, cumaceans, and insects. Coho stomachs contained more insects and arachnids, a smaller number of decapods, amphipods, isopods, and cumaceans, and less copepods, cirripedes and caldocerans. Sockeye stomachs contained primarily on copepods and cladocerans, and fewer decopods, euphausiids, cirripedes, amphipods, and isopods. Sockeye salmon stomachs contained the largest number of prey per fish. Empty stomachs were observed in coho salmon.

## Table B-36 Percent by Number (% N) of Prey Organisms and Percent Frequency of Occurrence (% F) in Salmon Smolt Stomach Contents caught by Seine in Survey Area B

| Stomach Content Prey Taxa | Salmon Smolts | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Pink (n = 0) | | Chinook (n = 1) | | Chum (n = 0) | | Coho (n = 35) | | Sockeye (n = 2) | |
| | % N | % F | % N | % F | % N | % F | % N | % F | % N | % F |
| **Crustacea (Planktonic)** | | | | | | | | | | |
| Euphausiacea (krill) | - | - | 57.9 | 100.0 | - | - | 0.0 | 0.0 | 6.6 | 50.0 |
| Copepoda | - | - | 19.0 | 100.0 | - | - | 2.9 | 5.7 | 38.9 | 100.0 |
| Cladocera | - | - | 0.0 | 0.0 | - | - | 0.1 | 2.9 | 34.9 | 50.0 |
| Decapoda | - | - | 8.3 | 100.0 | - | - | 12.1 | 37.1 | 7.1 | 100.0 |
| **Crustacea (Benthic/Planktonic)** | | | | | | | | | | |
| Cumacea | - | - | 2.5 | 100.0 | - | - | 10.2 | 25.7 | 0.0 | 0.0 |
| Cirripedia | - | - | 9.1 | 100.0 | - | - | 1.9 | 11.4 | 5.8 | 100.0 |
| Amphipoda/Isopoda | - | - | 0.0 | 0.0 | - | - | 10.7 | 45.7 | 0.3 | 50.0 |
| Ostracoda | - | - | 0.0 | 0.0 | - | - | 0.0 | 0.0 | 0.0 | 0.0 |
| Unknown Crustacea | - | - | 0.0 | 0.0 | - | - | 1.6 | 11.4 | 0.0 | 0.0 |
| **Insects/Arachnids** | - | - | 2.5 | 100.0 | - | - | 53.1 | 65.7 | 0.0 | 0.0 |
| **Pisces (fish)** | - | - | 0.0 | 0.0 | - | - | 6.1 | 20.0 | 6.1 | 50.0 |
| **Mollusca/Gastropoda** | - | - | 0.0 | 0.0 | - | - | 0.0 | 0.0 | 0.0 | 0.0 |
| **Nematoda** | - | - | 0.0 | 0.0 | - | - | 0.0 | 0.0 | 0.0 | 0.0 |
| **Nemertea** | - | - | 0.0 | 0.0 | - | - | 0.1 | 2.9 | 0.0 | 0.0 |
| **Polychaeta** | - | - | 0.0 | 0.0 | - | - | 0.0 | 0.0 | 0.0 | 0.0 |
| **Unknown Arthropod** | | | 0.0 | 0.0 | | | 0.1 | 2.9 | 0.0 | 0.0 |
| **Non-food items** | - | - | 0.8 | 100.0 | - | - | 0.3 | 8.6 | 0.0 | 0.0 |
| **Undetermined materials** | - | - | 0.0 | 0.0 | - | - | 0.8 | 22.9 | 0.3 | 50.0 |
| **% Fullness (Median)** | - | | 80 | | - | | 60 | | 95 | |
| **% Digested (Median)** | - | | 90 | | - | | 70 | | 90 | |
| **Total prey items counted** | - | | 121 | | - | | 1042 | | 378 | |
| **Prey items per fish** | - | | 121 | | - | | 29.8 | | 189 | |
| **Empty stomachs (%)** | - | | 0 | | - | | 5.7 | | 0 | |

NOTES:

%N Percent by number of prey relative to prey counted

%F Percent occurrence observed in stomach samples

### B.4.3 Survey Area C

A total of 17 salmon smolts (one sockeye and 16 coho) were captured in survey area C using beach seines. Salmon captured in survey area C had a relatively moderate to high proportion of stomach fullness (50 – 70%) and a low proportion of digested prey and materials (25 – 50%).

Stomach contents of all salmon smolt species were dominated (in number and frequency) by crustacean benthic/planktonic prey and insects and arachnids (Table B-37). Terrestrial insects and arachnids comprised a high numerical proportion of contents in stomachs of coho (78.5%) with lower in the one sockeye salmon smolt (16.3%). Small fish prey were found in 12.5% (2 of 16) of coho salmon stomachs with none present in the one sockeye salmon stomach. Coho salmon stomach contents contained more insects and smaller numbers of cumaceans, and fewer decapods, copepods, amphipods, isopods, cirripedes, and euphausiids. The sockeye salmon stomach contained cumaceans and fewer insects and arachnids, cirripedes, and copepods. The sockeye salmon had the largest number of prey per fish. Empty stomachs were observed in coho salmon.

### Table B-37 Percent by Number (% N) of Prey Organisms and Percent Frequency of Occurrence (% F) in Salmon Smolt Stomach Contents caught by Seine in Survey Area C

| Stomach Content Prey Taxa | Salmon Smolts | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Pink (n = 0) | | Chinook (n = 0) | | Chum (n = 0) | | Coho (n = 16) | | Sockeye (n = 1) | |
| | % N | % F | % N | % F | % N | % F | % N | % F | % N | % F |
| **Crustacea (Planktonic)** | | | | | | | | | | |
| Euphausiacea (krill) | - | - | - | - | - | - | 0.2 | 6.3 | 0.0 | 0.0 |
| Copepoda | - | - | - | - | - | - | 1.2 | 18.8 | 2.0 | 100.0 |
| Cladocera | - | - | - | - | - | - | 0.0 | 0.0 | 0.0 | 0.0 |
| Decapoda | - | - | - | - | - | - | 3.6 | 18.8 | 0.0 | 0.0 |
| **Crustacea (Benthic/Planktonic)** | | | | | | | | | | |
| Cumacea | - | - | - | - | - | - | 12.1 | 12.5 | 77.6 | 100.0 |
| Cirripedia | - | - | - | - | - | - | 0.2 | 6.3 | 4.1 | 100.0 |
| Amphipoda/Isopoda | - | - | - | - | - | - | 0.6 | 18.8 | 0.0 | 0.0 |
| Ostracoda | - | - | - | - | - | - | 0.0 | 0.0 | 0.0 | 0.0 |
| Unknown Crustacea | - | - | - | - | - | - | 0.2 | 6.3 | 0.0 | 0.0 |
| **Insects/Arachnids** | - | - | - | - | - | - | 78.5 | 81.3 | 16.3 | 100.0 |
| **Pisces (fish)** | - | - | - | - | - | - | 2.8 | 12.5 | 0.0 | 0.0 |
| **Mollusca/Gastropoda** | - | - | - | - | - | - | 0.0 | 0.0 | 0.0 | 0.0 |
| **Nematoda** | - | - | - | - | - | - | 0.0 | 0.0 | 0.0 | 0.0 |
| **Nemertea** | - | - | - | - | - | - | 0.0 | 0.0 | 0.0 | 0.0 |
| **Polychaeta** | - | - | - | - | - | - | 0.0 | 0.0 | 0.0 | 0.0 |
| **Unknown Arthropod** | | | | | | | 0.0 | 0.0 | 0.0 | 0.0 |
| **Non-food items** | - | - | - | - | - | - | 0.0 | 0.0 | 0.0 | 0.0 |
| **Undetermined materials** | - | - | - | - | - | - | 0.6 | 18.8 | 0.0 | 0.0 |
| **% Fullness (Median)** | - | | - | | - | | 70 | | 50 | |
| **% Digested (Median)** | - | | - | | - | | 50 | | 25 | |
| **Total prey items counted** | - | | - | | - | | 497 | | 49 | |
| **Prey items per fish** | - | | - | | - | | 31.1 | | 49 | |
| **Empty stomachs (%)** | - | | - | | - | | 6.3 | | 0 | |

NOTES:

%N Percent by number of prey relative to prey counted

%F Percent occurrence observed in stomach samples

### B.4.4 Survey Area F

A total of seven salmon smolts (one coho and six sockeye) were captured in survey area F in a single purse seine. Sockeye salmon captured in survey area F had a relatively moderate proportion of stomach fullness (50 – 70%) and a moderate to high proportion of digested prey and materials (55 – 80%).

Stomach contents of all salmon smolt species were dominated (in number and frequency) by crustacean planktonic prey and crustacean benthic prey (Table B-38). Terrestrial insects and arachnids comprised a high numerical proportion of contents in stomach of the one coho salmon (70%) with lower in the six sockeye salmon stomachs (0.04%). Small fish prey were not observed in either species of salmon. Sockeye salmon stomachs contained primarily cladocerans, and less frequently cirripedes and copepods. The coho salmon stomach contents contained more insects and smaller numbers of benthic/ planktonic crustacea (cumaceans and cirripedes). Sockeye salmon stomachs had the largest number of prey per fish. Salmon collected from survey area F were not observed to have any empty stomachs.

### Table B-38 Percent by Number (% N) of Prey Organisms and Percent Frequency of Occurrence (% F) Salmon Smolt Stomach Contents caught by Seine in Survey Area F

| Stomach Content Prey Taxa | Salmon Smolts | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Pink (n = 0) | | Chinook (n = 0) | | Chum (n = 0) | | Coho (n = 1) | | Sockeye (n = 6) | |
| | % N | % F | % N | % F | % N | % F | % N | % F | % N | % F |
| **Crustacea (Planktonic)** | | | | | | | | | | |
| Euphausiacea (krill) | - | - | - | - | - | - | 0.0 | 0.0 | 0.0 | 0.0 |
| Copepoda | - | - | - | - | - | - | 0.0 | 0.0 | 0.3 | 66.7 |
| Cladocera | - | - | - | - | - | - | 0.0 | 0.0 | 85.1 | 100.0 |
| Decapoda | - | - | - | - | - | - | 0.0 | 0.0 | 0.0 | 16.7 |
| **Crustacea (Benthic/Planktonic)** | | | | | | | | | | |
| Cumacea | - | - | - | - | - | - | 3.3 | 100.0 | 0.0 | 16.7 |
| Cirripedia | - | - | - | - | - | - | 6.7 | 100.0 | 14.5 | 100.0 |
| Amphipoda/Isopoda | - | - | - | - | - | - | 0.0 | 0.0 | 0.0 | 0.0 |
| Ostracoda | - | - | - | - | - | - | 0.0 | 0.0 | 0.0 | 0.0 |
| Unknown Crustacea | - | - | - | - | - | - | 0.0 | 0.0 | 0.0 | 16.7 |
| **Insects/Arachnids** | - | - | - | - | - | - | 70.0 | 100.0 | 0.04 | 33.3 |
| **Pisces (fish)** | - | - | - | - | - | - | 0.0 | 0.0 | 0.0 | 0.0 |
| **Mollusca/Gastropoda** | - | - | - | - | - | - | 0.0 | 0.0 | 0.0 | 0.0 |
| **Nematoda** | - | - | - | - | - | - | 0.0 | 0.0 | 0.0 | 0.0 |
| **Nemertea** | - | - | - | - | - | - | 0.0 | 0.0 | 0.0 | 0.0 |
| **Polychaeta** | - | - | - | - | - | - | 0.0 | 0.0 | 0.0 | 0.0 |
| **Unknown Arthropod** | | | | | | | 0.0 | 0.0 | 0.0 | 0.0 |
| **Non-food items** | - | - | - | - | - | - | 16.7 | 100.0 | 0.0 | 16.7 |
| **Undetermined materials** | - | - | - | - | - | - | 3.3 | 100.0 | 0.1 | 83.3 |
| **% Fullness (Median)** | - | | - | | - | | 70 | | 50 | |
| **% Digested (Median)** | - | | - | | - | | 80 | | 55 | |
| **Total prey items counted** | - | | - | | - | | 30 | | 11654 | |
| **Prey items per fish** | - | | - | | - | | 30 | | 1942.3 | |
| **Empty stomachs (%)** | - | | - | | - | | 0 | | 0 | |

NOTES:

%N Percent by number of prey relative to prey counted

%F Percent occurrence observed in stomach samples

### B.4.5 Survey Area G

A total of 16 salmon smolts (one coho, seven Chinook, and eight sockeye) were captured in survey area G using trawl, beach and purse seines. Chinook and sockeye stomach captured in survey area G had a relatively high proportion of stomach fullness (95 – 100%) and a moderate proportion of digested prey and materials (50 – 60%).

Stomach contents of all salmon smolt species were dominated (in number and frequency) by crustacean planktonic prey and terrestrial insects (Table B-39). Terrestrial insects and arachnids comprised a high numerical proportion of contents in the coho salmon stomach (80%) with none present in Chinook or sockeye salmon. Small fish prey were found in 87.5% (7 of 8) of sockeye salmon stomachs and 71.4% (5 of 7) of Chinook salmon stomachs with none present in the coho salmon stomach. Chinook and sockeye salmon stomachs contained primarily crustacean planktonic prey (euphausiids, copepods, and decopods) and fewer crustacea benthic/planktonic (cumaceans, cirripedes, amphipods, and isopods). The single coho salmon stomach contained insects, arachnids, and euphausiid prey. Chinook salmon had the largest number of prey per fish. Salmon collected from survey area G were not observed to have any empty stomachs.

### Table B-39 Percent by Number (% N) of Prey Organisms and Percent Frequency of Occurrence (% F) Salmon Smolt Stomach Contents caught by Seine in Survey Area G

| Stomach Content Prey Taxa | Salmon Smolts | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Pink (n = 0) | | Chinook (n = 7) | | Chum (n = 0) | | Coho (n = 1) | | Sockeye (n = 8) | |
| | % N | % F | % N | % F | % N | % F | % N | % F | % N | % F |
| **Crustacea (Planktonic)** | | | | | | | | | | |
| Euphausiacea (krill) | - | - | 71.7 | 71.4 | - | - | 20.0 | 100.0 | 79.9 | 87.5 |
| Copepoda | - | - | 19.9 | 71.4 | - | - | 0.0 | 0.0 | 12.9 | 100.0 |
| Cladocera | - | - | 0.0 | 0.0 | - | - | 0.0 | 0.0 | 0.0 | 0.0 |
| Decapoda | - | - | 0.9 | 57.1 | - | - | 0.0 | 0.0 | 0.2 | 50.0 |
| **Crustacea (Benthic/Planktonic)** | | | | | | | | | | |
| Cumacea | - | - | 0.05 | 14.3 | - | - | 0.0 | 0.0 | 0.0 | 0.0 |
| Cirripedia | - | - | 6.1 | 42.9 | - | - | 0.0 | 0.0 | 1.7 | 62.5 |
| Amphipoda/Isopoda | - | - | 0.1 | 28.6 | - | - | 0.0 | 0.0 | 0.2 | 37.5 |
| Ostracoda | - | - | 0.0 | 0.0 | - | - | 0.0 | 0.0 | 0.0 | 0.0 |
| Unknown Crustacea | - | - | 0.0 | 0.0 | - | - | 0.0 | 0.0 | 0.0 | 0.0 |
| **Insects/Arachnids** | - | - | 0.0 | 14.3 | - | - | 80.0 | 100.0 | 0.0 | 0.0 |
| **Pisces (fish)** | - | - | 1.3 | 71.4 | - | - | 0.0 | 0.0 | 4.6 | 87.5 |
| **Mollusca/Gastropoda** | - | - | 0.0 | 0.0 | - | - | 0.0 | 0.0 | 0.4 | 37.5 |
| **Nematoda** | - | - | 0.0 | 0.0 | - | - | 0.0 | 0.0 | 0.0 | 0.0 |
| **Nemertea** | - | - | 0.0 | 0.0 | - | - | 0.0 | 0.0 | 0.0 | 0.0 |
| **Polychaeta** | - | - | 0.0 | 0.0 | - | - | 0.0 | 0.0 | 0.0 | 0.0 |
| **Unknown Arthropod** | | | 0.0 | 0.0 | | | 0.0 | 0.0 | 0.0 | 0.0 |
| **Non-food items** | - | - | 0.0 | 0.0 | - | - | 0.0 | 0.0 | 0.0 | 0.0 |
| **Undetermined materials** | - | - | 0.0 | 0.0 | - | - | 0.0 | 0.0 | 0.1 | 25.0 |
| **% Fullness (Median)** | - | | 95 | | - | | 5 | | 100 | |
| **% Digested (Median)** | - | | 60 | | - | | 0 | | 50 | |
| **Total prey items counted** | - | | 2096 | | - | | 5 | | 2200 | |
| **Prey items per fish** | - | | 299.4 | | - | | 5 | | 275 | |
| **Empty stomachs (%)** | - | | 0 | | - | | 0 | | 0 | |

NOTES:
%N Percent by number of prey relative to prey counted
%F Percent occurrence observed in stomach samples

### B.4.6 Survey Area H

A total of 31 salmon smolts (11 Chinook and 20 coho) were captured in survey area H using trawl and beach seines. Chinook salmon captured in survey area H had a relatively high proportion of stomach fullness (90%) and a high proportion of digested prey and materials (80%). Coho salmon captured in survey area H had a relatively moderate proportion of stomach fullness (50%) and of digested prey and materials (67.5%).

Stomach contents of all salmon smolt species were dominated (in number and frequency) by crustacean planktonic prey, crustacean benthic prey, and terrestrial insects (Table B-40). Terrestrial insects and arachnids comprised a high numerical proportion of stomach contents in Chinook (80.4%) and coho (70.9%) salmon. Small fish prey were found in 54.5% (6 of 11) of Chinook salmon stomachs and 20% (4 of 20) of coho salmon stomachs. Chinook salmon stomach contained primarily insect, arachnid, and smaller numbers of copepods, and less frequently decapods, amphipods and isopods. Coho salmon stomachs contained primarily insect and arachnid, and smaller numbers of cumaceans, and less frequently on amphipods, isopods, decapods and cirripedes. Chinook salmon had the largest number of prey per fish. Salmon collected from survey area H were not observed to have any empty stomachs.

## Table B-40 Percent by Number (% N) of Prey Organisms and Percent Frequency of Occurrence (% F) Salmon Smolt Stomach Contents caught by Seine in Survey Area H

| Stomach Content Prey Taxa | Salmon Smolts | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Pink (n = 0) | | Chinook (n = 11) | | Chum (n = 0) | | Coho (n = 20) | | Sockeye (n = 0) | |
| | % N | % F | % N | % F | % N | % F | % N | % F | % N | % F |
| **Crustacea (Planktonic)** | | | | | | | | | | |
| Euphausiacea (krill) | - | - | 0.0 | 0.0 | - | - | 0.0 | 0.0 | - | - |
| Copepoda | - | - | 14.0 | 9.1 | - | - | 0.0 | 0.0 | - | - |
| Cladocera | - | - | 0.0 | 0.0 | - | - | 0.0 | 0.0 | - | - |
| Decapoda | - | - | 0.2 | 9.1 | - | - | 0.8 | 10.0 | - | - |
| **Crustacea (Benthic/Planktonic)** | | | | | | | | | | |
| Cumacea | - | - | 0.0 | 0.0 | - | - | 14.0 | 30.0 | - | - |
| Cirripedia | - | - | 0.0 | 0.0 | - | - | 0.3 | 5.0 | - | - |
| Amphipoda/Isopoda | - | - | 2.2 | 36.4 | - | - | 6.3 | 45.0 | - | - |
| Ostracoda | - | - | 0.0 | 0.0 | - | - | 0.0 | 0.0 | - | - |
| Unknown Crustacea | - | - | 0.0 | 0.0 | - | - | 1.6 | 5.0 | - | - |
| **Insects/Arachnids** | - | - | 80.4 | 90.9 | - | - | 70.9 | 80.0 | - | - |
| **Pisces (fish)** | - | - | 2.5 | 54.5 | - | - | 3.4 | 20.0 | - | - |
| **Mollusca/Gastropoda** | - | - | 0.0 | 0.0 | - | - | 0.0 | 0.0 | - | - |
| **Nematoda** | - | - | 0.0 | 0.0 | - | - | 0.0 | 0.0 | - | - |
| **Nemertea** | - | - | 0.0 | 0.0 | - | - | 0.0 | 0.0 | - | - |
| **Polychaeta** | - | - | 0.0 | 0.0 | - | - | 0.0 | 0.0 | - | - |
| **Unknown Arthropod** | | | 0.0 | 0.0 | | | 0.0 | 0.0 | | |
| **Non-food items** | - | - | 0.3 | 18.2 | - | - | 0.3 | 5.0 | - | - |
| **Undetermined materials** | - | - | 0.5 | 27.3 | - | - | 2.4 | 35.0 | - | - |
| **% Fullness (Median)** | - | | 90 | | - | | 50 | | - | |
| **% Digested (Median)** | - | | 80 | | - | | 67.5 | | - | |
| **Total prey items counted** | - | | 641 | | - | | 378 | | - | |
| **Prey items per fish** | - | | 58.3 | | - | | 18.9 | | - | |
| **Empty stomachs (%)** | - | | 0 | | - | | 0 | | - | |

NOTES:

%N Percent by number of prey relative to prey counted

%F Percent occurrence observed in stomach samples

### B.4.7 Survey Area I

A total of 40 salmon smolts (seven Chinook and 33 coho) were captured from survey area I using trawl and beach seines. Coho and Chinook salmon captured in survey area I had a relatively high proportion of stomach fullness (70 – 80%) and a moderate (50%) and high (75%) proportion of digested prey and materials in Chinook and coho salmon respectively.

Stomach contents of all salmon smolt species were dominated (in number and frequency) by crustacean planktonic prey, crustacean benthic prey, and terrestrial insects (Table B-41). Terrestrial insects and arachnids comprised a high numerical proportion of stomach contents of Chinook (82.4%) with lower in coho (24.1%) salmon. Small fish prey were found in 57.1% (4 of 7) of Chinook salmon stomachs and 6.1% (2 of 33) of coho salmon stomachs. Chinook salmon stomachs contained primarily insects and arachnids and less frequently small fish and crustacea benthic/planktonic (cumaceans, amphipods, and isopods). Coho salmon showed the greatest diversity in prey types across benthic and planktonic crustaceans, nearshore benthic crustaceans, terrestrial insects, and small fish. Chinook salmon had the largest number of prey per fish. Salmon collected from survey area I were not observed to have any empty stomachs.

## Table B-41 Percent by Number (% N) of Prey Organisms and Percent Frequency of Occurrence (% F) Salmon Smolt Stomach Contents caught by Seine in Survey Area I

| Stomach Content Prey Taxa | Salmon Smolts | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Pink (n = 0) | | Chinook (n = 7) | | Chum (n = 0) | | Coho (n = 33) | | Sockeye (n = 0) | |
| | % N | % F | % N | % F | % N | % F | % N | % F | % N | % F |
| **Crustacea (Planktonic)** | | | | | | | | | | |
| Euphausiacea (krill) | - | - | 0.0 | 0.0 | - | - | 27.8 | 15.2 | - | - |
| Copepoda | - | - | 0.0 | 0.0 | - | - | 0.9 | 9.1 | - | - |
| Cladocera | - | - | 0.0 | 0.0 | - | - | 0.0 | 0.0 | - | - |
| Decapoda | - | - | 0.0 | 0.0 | - | - | 0.0 | 0.0 | - | - |
| **Crustacea (Benthic/Planktonic)** | | | | | | | | | | |
| Cumacea | - | - | 1.0 | 14.3 | - | - | 7.0 | 30.3 | - | - |
| Cirripedia | - | - | 0.0 | 0.0 | - | - | 12.3 | 3.0 | - | - |
| Amphipoda/Isopoda | - | - | 3.4 | 28.6 | - | - | 23.7 | 63.6 | - | - |
| Ostracoda | - | - | 0.0 | 0.0 | - | - | 0.0 | 0.0 | - | - |
| Unknown Crustacea | - | - | 0.0 | 0.0 | - | - | 0.0 | 0.0 | - | - |
| **Insects/Arachnids** | - | - | 82.4 | 42.9 | - | - | 24.1 | 69.7 | - | - |
| **Pisces (fish)** | - | - | 10.3 | 57.1 | - | - | 0.5 | 6.1 | - | - |
| **Mollusca/Gastropoda** | - | - | 0.0 | 0.0 | - | - | 0.0 | 0.0 | - | - |
| **Nematoda** | - | - | 0.0 | 0.0 | - | - | 0.0 | 0.0 | - | - |
| **Nemertea** | - | - | 0.0 | 0.0 | - | - | 0.0 | 0.0 | - | - |
| **Polychaeta** | - | - | 0.0 | 0.0 | - | - | 0.0 | 0.0 | - | - |
| **Unknown Arthropod** | | | 0.0 | 0.0 | | | 0.0 | 0.0 | | |
| **Non-food items** | - | - | 1.5 | 14.3 | - | - | 0.7 | 3.0 | - | - |
| **Undetermined materials** | - | - | 1.5 | 42.9 | - | - | 3.1 | 21.2 | - | - |
| **% Fullness (Median)** | - | | 80 | | - | | 70 | | - | |
| **% Digested (Median)** | - | | 50 | | - | | 75 | | - | |
| **Total prey items counted** | - | | 204 | | - | | 586 | | - | |
| **Prey items per fish** | - | | 29.1 | | - | | 17.8 | | - | |
| **Empty stomachs (%)** | - | | 0 | | - | | 0 | | - | |

NOTES:

%N Percent by number of prey relative to prey counted

%F Percent occurrence observed in stomach samples

# APPENDIX C
# HYDROACOUSTIC ANALYSIS SEGMENTS

# Appendix C HYDROACOUSTIC ANALYSIS SEGMENTS

**Table C-1 Number of Hydroacoustic Analysis Segments**

| Survey Area | Jan 2015 | Feb 2015 | Mar 2015 | Apr 2015 | May 2015 | Jun 2015 | Jul 2015 | Aug 2015 | Sep 2015 | Oct 2015 | Nov 2015 | Dec 2015 | Jan 2016 | Feb 2016 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Number of 100 m Daytime Hydroacoustic Segments** | | | | | | | | | | | | | | |
| A | 90 | 70 | 71 | 85 | 99 | 87 | 138 | 64 | 65 | 47 | 82 | 60 | 60 | 59 |
| B | 17 | 17 | 19 | 36 | 18 | 17 | 34 | 17 | NA | 18 | 17 | NA | NA | NA |
| C | 13 | 16 | 12 | 12 | 18 | 12 | 35 | 16 | 17 | 15 | 13 | 14 | 16 | 15 |
| D | 68 | 82 | 53 | 52 | 85 | 73 | 158 | 89 | 78 | 58 | 102 | 61 | 74 | 72 |
| E | 46 | 42 | 45 | 40 | 41 | 22 | 88 | 22 | 27 | 29 | 40 | 12 | 43 | 35 |
| F | 18 | 33 | 17 | 18 | 32 | 32 | 46 | 26 | 23 | 14 | 39 | 32 | 22 | 23 |
| G | NA | NA | NA | NA | NA | NA | 120 | 67 | 100 | NA | 93 | 235 | 136 | 130 |
| H | NA | NA | NA | NA | NA | NA | 107 | 59 | 59 | NA | 100 | 75 | 61 | 58 |
| I | NA | NA | NA | NA | NA | NA | 127 | 84 | 113 | NA | 105 | 170 | 107 | 103 |
| **Number of 500 m Nighttime Hydroacoustic Segments** | | | | | | | | | | | | | | |
| A | NA | NA | NA | NA | 88 | 78 | 55 | NA | NA | NA | NA | NA | NA | NA |
| B | NA | NA | NA | NA | 18 | 13 | 9 | NA | NA | NA | NA | NA | NA | NA |
| C | NA | NA | NA | NA | 3 | 11 | 6 | NA | NA | NA | NA | NA | NA | NA |
| D | NA | NA | NA | NA | 98 | 68 | 47 | NA | NA | NA | NA | NA | NA | NA |
| E | NA | NA | NA | NA | 56 | 39 | 27 | NA | NA | NA | NA | NA | NA | NA |
| F | NA | NA | NA | NA | 68 | 87 | 67 | NA | NA | NA | NA | NA | NA | NA |
| G | NA | NA | NA | NA | NA | 15 | 54 | NA | NA | NA | NA | NA | NA | NA |

# APPENDIX D
# MARINE FISH SURVEY INCIDENTAL SIGHTINGS

# Appendix D MARINE FISH SURVEY INCIDENTAL SIGHTINGS

Incidental sightings of marine flora and fauna and species-related events, like observations of fish or invertebrate eggs, larvae and other life stages, spawning or crab moulting events, were recorded in field notes during marine fish and fish habitat surveys. Table D-1 presents a summary of incidental sightings by survey date.

**Table D-3 Marine Fish and Fish Habitat Survey Incidental Sighting Summary**

| Survey Type | Survey Number | Date | Incidental Sightings |
|---|---|---|---|
| Daytime | Daytime-01 | December 16–20, 2014 | Humpback whales sighted offshore survey area E<br>Harbour porpoise sighted offshore survey area A<br>Herring school sighted offshore area A |
| | Daytime-02 | January 27–31, 2015 | Humpback whales sighted offshore survey area E<br>Harbour porpoise sighted offshore survey area A<br>Harbour porpoise sighted in survey area A and B |
| | Daytime-03 | February 17–22, 2015 | Harbour porpoise sighted offshore survey area A<br>Stellar sea lion sighted in survey area F and offshore survey area A |
| | Daytime-04 | March 20–24, 2015 | Big skate captured in survey area A in beach seine<br>Pink and chum salmon first captured in survey area A in beach seines<br>Harbour porpoise sighted in survey area A |
| | Daytime-05 | April 23–29, 2015 | No sightings |
| | Daytime-06 | May 18–23, 2015 | Gravid adult herring observed in survey area A<br>Juvenile crab captured in beach seines<br>Giant wrymouth captured in beach seine<br>Crab larvae captured in offshore trawls<br>Gravid Pacific staghorn sculpin captured in beach seine in survey area B |
| | Daytime-07 | June 7–14, 2015 | Herring eggs observed on eastern patches of eelgrass in survey area F<br>Herring eggs captured in trawl net in survey area A<br>Dungeness crab shells observed in survey area A<br>Bald eagles observed during low tide in survey area F<br>High number of fish species observed in net catches in all survey areas<br>Two Harbour seal pups observed washed up onto intertidal area in survey area A and F<br>Many Harbour seals observed in survey area A and B<br>Commercial salmon gillnetters observed (June 12, 2015) in survey area D, G and H<br>Juvenile crab captured in nets in survey area H<br>Over 3,000 sandlance captured in a trawl net in survey area G |

## Table D-3 Marine Fish and Fish Habitat Survey Incidental Sighting Summary

| Survey Type | Survey Number | Date | Incidental Sightings |
|---|---|---|---|
| **Daytime (cont'd)** | Daytime-08 | June 16–22, 2015 | Gravid surf smelt captured in trawl in survey area A<br>Larval and juvenile herring captured in trawls offshore survey area B, A and E<br>Gravid starry flounder and Pacific staghorn sculpin captured in beach seines in survey area A<br>Jellyfish captured in trawls in survey area H |
| | Daytime-09 | July 2–8, 2015 | Larval and juvenile herring sighted and captured in survey area B in trawls and beach seines<br>Bald eagles observed feeding on Big skate carcass in survey area F and in trees on Kitson Island in survey area E<br>Commercial gillnetters fishing in survey area D<br>Shore birds observed in intertidal areas in survey area F |
| | Daytime-10 | July 16–23, 2015 | Juvenile herring captured in beach seines in survey area B<br>Stubby squid observed in trawl catch in survey area H |
| | Daytime-11 | August 12–19, 2015 | Seabirds (western grebes) observed in offshore survey area E and D<br>Adult sockeye salmon observed jumping out of the water in survey area H and G<br>Stubby squid observed in trawl catch in survey area H |
| | Daytime-12 | September 14–20, 2015 | Dall's porpoise sighted in survey area G<br>Harbour porpoise sighted in survey area B |
| | Daytime-13 | October 29–November 4, 2015 | Western grebe sighted in survey area E<br>Surf scoters, bald eagles sighted in survey area B<br>Harbour porpoise sighted in survey area B<br>Four killer whales observed off Port Edward in Porpoise Harbour |
| | Daytime-14 | November 26–December 3, 2015 | Humpback whales sighted offshore from survey area E |
| | Daytime-15 | December 9–12, 2015 | Euphausiids captured in trawls |
| | Daytime-16 | January 17–24, 2016 | Juvenile shrimp captured in trawls in survey area A and B<br>Euphausiids captured in trawls |
| | Daytime-17 | February 11–17 , 2016 | Euphausiids captured in trawls |

## Table D-3 Marine Fish and Fish Habitat Survey Incidental Sighting Summary

| Survey Type | Survey Number | Date | Incidental Sightings |
|---|---|---|---|
| Nighttime | Nighttime-01 | April 30–May 4, 2015 | No sightings |
| | Nighttime-02 | May 12–15, 2015 | No sightings |
| | Nighttime-03 | May 25–30, 2015 | Harbour seals sighted off survey area A<br>Gravid adult herring observed in survey area A<br>Full bellied staghorn sculpins captured in survey area B<br>Initial capture of larval fish in surface trawls |
| | Nighttime-04 | June 3–8, 2015 | Herring eggs observed on eelgrass in survey area F |
| | Nighttime-05 | June 9–16, 2015 | Concentrations of phytoplankton diatoms sighted offshore in survey area E |
| | Nighttime-06 | June 16–23, 2015 | Stubby squid observed in trawl catch in survey area E |
| | Nighttime-07 | June 24–July 1, 2015 | Larval and juvenile herring captured in seine net in survey area B<br>Four fishing vessels grounded in survey area C<br>Big skate and tomcod captured in fyke net in survey area F<br>Derelict crab traps washed up into survey area F<br>Gravid starry flounder captured in trawl in survey area A |
| | Nighttime-08 | July 1–9, 2015 | Commercial gillnetters fishing in survey area D<br>Larval and juvenile herring captured in seine net in survey area B<br>Stubby squid observed in trawl catch in survey area H |
| | Nighttime-09 | July 10–15, 2015 | Quillfish captured in trawl in survey area E<br>Juvenile octopus captured in trawl in survey area B<br>Juvenile herring captured in trawl in survey area B<br>Crab larvae captured in trawl in survey area H |

# APPENDIX E
# EXPLORATORY SAMPLE METHODS AND RESULTS

# Appendix E EXPLORATORY SAMPLE METHODS AND RESULTS

## E.1 METHODS

### E.1.1 Prawn Trapping

Prawn trapping was trialed in February 2015 to evaluate the feasibility and value of adding systematic prawn sampling to the overall Program. Prawn traps were deployed at selected crab sample sites and stratified by depth within the vicinity of the Project's marine components (i.e., survey areas A through F; Figure E-1). In May 2015, prawn trapping was removed from the Program due to difficult sampling conditions (traps being lost), and low prawn catches from shallow nearshore sites (limited deep water sites within the survey area which are typically used by prawns).

Commercial grade prawn traps (71 cm diameter, 7.6 cm stainless steel ring opening, web of 38 mm mesh) were deployed at each prawn sample site. Traps were baited with commercial dried pellets and soaked for 18 to 24 hours before being retrieved. All prawns captured were identified to the lowest taxonomic level possible (ideally to species), and live released. Results of the exploratory prawn sampling are summarized in Table E-1.

**Table E-1 Exploratory Sample Methods Effort (December 2014 – February 2016)**

| Survey Number | Tucker Trawl 1 x 1 m | Otter Trawl 5 x 5 m | Purse Seine 50 x 6 m | Fyke Net 15 x 1 m | Prawn Trapping | CTD |
|---|---|---|---|---|---|---|
| Daytime-01 | 0 | 0 | 0 | 0 | 0 | **11** |
| Daytime-02 | **5** | 0 | 0 | 0 | 0 | **17** |
| Daytime-03 | 0 | 0 | 0 | 0 | **10** | **17** |
| Daytime-04 | 0 | 0 | 0 | **4** | **8** | **17** |
| Daytime-05 | 0 | **4** | 0 | **2** | **4** | **17** |
| Daytime-06 | 0 | 0 | 0 | **3** | 0 | **17** |
| Daytime-07 | 0 | 0 | 0 | 0 | 0 | **21** |
| Daytime-08 | 0 | **3** | 0 | **1** | 0 | **14** |
| Daytime-09 | 0 | 0 | 0 | 0 | 0 | **21** |
| Daytime-10 | 0 | 0 | 0 | 0 | 0 | **13** |
| Daytime-11 | 0 | 0 | 0 | 0 | 0 | **32** |
| Daytime-12 | 0 | 0 | 0 | 0 | 0 | **39** |
| Daytime-13 | 0 | 0 | 0 | 0 | 0 | **38** |
| Daytime-14 | 0 | 0 | 0 | 0 | 0 | **39** |
| Daytime-15 | 0 | 0 | 0 | 0 | 0 | **47** |
| Daytime-16 | 0 | 0 | 0 | 0 | 0 | **48** |

## Table E-1 Exploratory Sample Methods Effort (December 2014 – February 2016)

| Survey Number | Tucker Trawl 1 x 1 m | Otter Trawl 5 x 5 m | Purse Seine 50 x 6 m | Fyke Net 15 x 1 m | Prawn Trapping | CTD |
|---|---|---|---|---|---|---|
| Daytime-17 | 0 | 0 | 0 | 0 | 0 | **18** |
| Nighttime-01 | 0 | 0 | 0 | **1** | 0 | 0 |
| Nighttime-02 | 0 | 0 | 0 | **3** | 0 | **19** |
| Nighttime-03 | 0 | 0 | 0 | **3** | 0 | **18** |
| Nighttime-04 | 0 | 0 | 0 | 0 | 0 | **14** |
| Nighttime-05 | 0 | 0 | 0 | **2** | 0 | **18** |
| Nighttime-06 | 0 | 0 | **7** | **3** | 0 | **37** |
| Nighttime-07 | 0 | 0 | **15** | **4** | 0 | **37** |
| Nighttime-08 | 0 | 0 | **21** | 0 | 0 | **18** |
| Nighttime-09 | 0 | 0 | **10** | 0 | 0 | **38** |
| **Total** | **5** | **7** | **53** | **26** | **22** | **625** |

### Alternate Trawl Nets

Three other trawl net types were trialed to collect pelagic fish along pre-defined transects in the survey areas. Different trawl types were used to explore best match between existing marine tidal currents and conditions and vessels and targeted marine fish species or life stages. The three trawl nets included: (a) modified Otter trawl net (18 m long with an opening 5 m wide and 4.6 m deep), (b) 2 m x 2 m Tucker trawl, and (c) 1 m x 1 m Tucker trawl.

The 1 m x 1 m Tucker trawl net was used initially during daytime fish surveys until replaced with a Program specific custom made 2 m x 2 m Tucker trawl (Section 3.2.2.2.2). After evaluation of catch by species, the 1 m x 1 m Tucker trawl was deemed inefficient for fish sampling within the survey areas due to small mesh size and low relative capture efficiency. It was removed from surveys in February 2015, and replaced by a more effective 2 m x 2 m Tucker trawl.

The Otter trawl net fished waters from 0 m to 5 m in depth, the 2 m x 2 m Tucker trawl net fished waters from 0.5 m to 3 m, and the 1 m x 1 m Tucker trawl fished obliquely though the water column from 5 m to 20 m. The modified Otter trawl was constructed with a baffled holding box specifically designed for live capture of fish (i.e., non-lethal sampling), and was used on transects in water deeper than 1 m (due to draft requirements of the fishing vessel). All species live-captured were released, with the exception of salmon species, which were retained for stomach content analysis (Section 3.2.3.1) under DFO scientific collection permits.

### Fyke Net

Fyke nets were used to sample the shallow intertidal areas on Flora Bank (survey area F) where other methods were constrained because of rapid changes in tides and current speeds reaching 0.5 m/second during ebb and flood tides (Hatch 2015). As discussed in Section 3.2.1.1, beach seines could not be safely or effectively used on most (90%) of the surface of Flora Bank (i.e., only the edges of the bank could be fished using beach seine techniques). No fyke nets were deployed successfully in Marcus Passage on Base Sand (survey area G) due to the loose substrate which compromised the fyke net set and net openings' ability to effectively fish as a passive fishing gear (trap net).

Fyke nets were set during daytime fish surveys in March 2015 to provide additional information on fish species presence, movement, and distribution across the shallow areas on Flora Bank. Fyke nets are an effective passive fishing method for sampling migratory fish species in habitats with moving water (tides, currents). This form of passive live-fish sampling and capture is effective over long duration sets and tidal cycles (six to 10 hour sets) and across shallow and intertidal habitats such as Flora Bank (Conlin and Tutty 1979; Shreffler et al. 1990; Portt et al. 2006; Johnson et al. 2007).

Fyke nets are constructed with a cone-shaped net bag mounted on a series of hoop rings (0.6 m diameter by 3.8 m long) with mesh wings to direct fish into the net. At the front, the outside lead (7.3 m long wing) guides the fish towards the square opening of the net bag (0.76 m high by 0.86 m wide). A third central lead (14.6 m) also directs fish into the net (Photograph E-1).

**Photograph E-1 Fyke Net Set on Flora Bank**

Varying tidal heights between surveys exposed different areas of Flora Bank such that exact sample sites had to be determined at each low tide based on:

- Local site conditions
- Safe sample site access
- Transport of the gear to the site
- Positioning and orientation of the fyke net opening at each site to ebb or flood tidal currents during the next tidal cycle
- Local habitat complexity (e.g., eelgrass presence, shallow dendritic channels; Figure E-2)

In general, sample site access and conditions were ideal along the northwest corner of Flora Bank, although sample sites were also successfully completed on the northeast corner of Flora Bank. The frequency of successful sampling ranged from zero to four net sets per survey (see Table E-4 for a summary of results). Nets were initially set at both high and low tides. However, setting nets at low tide became the method of choice due to the added effort required to ensure proper setup from a vessel during high water.

Samples of captured fish were processed for biological characteristics as described in Section 3.2.3.

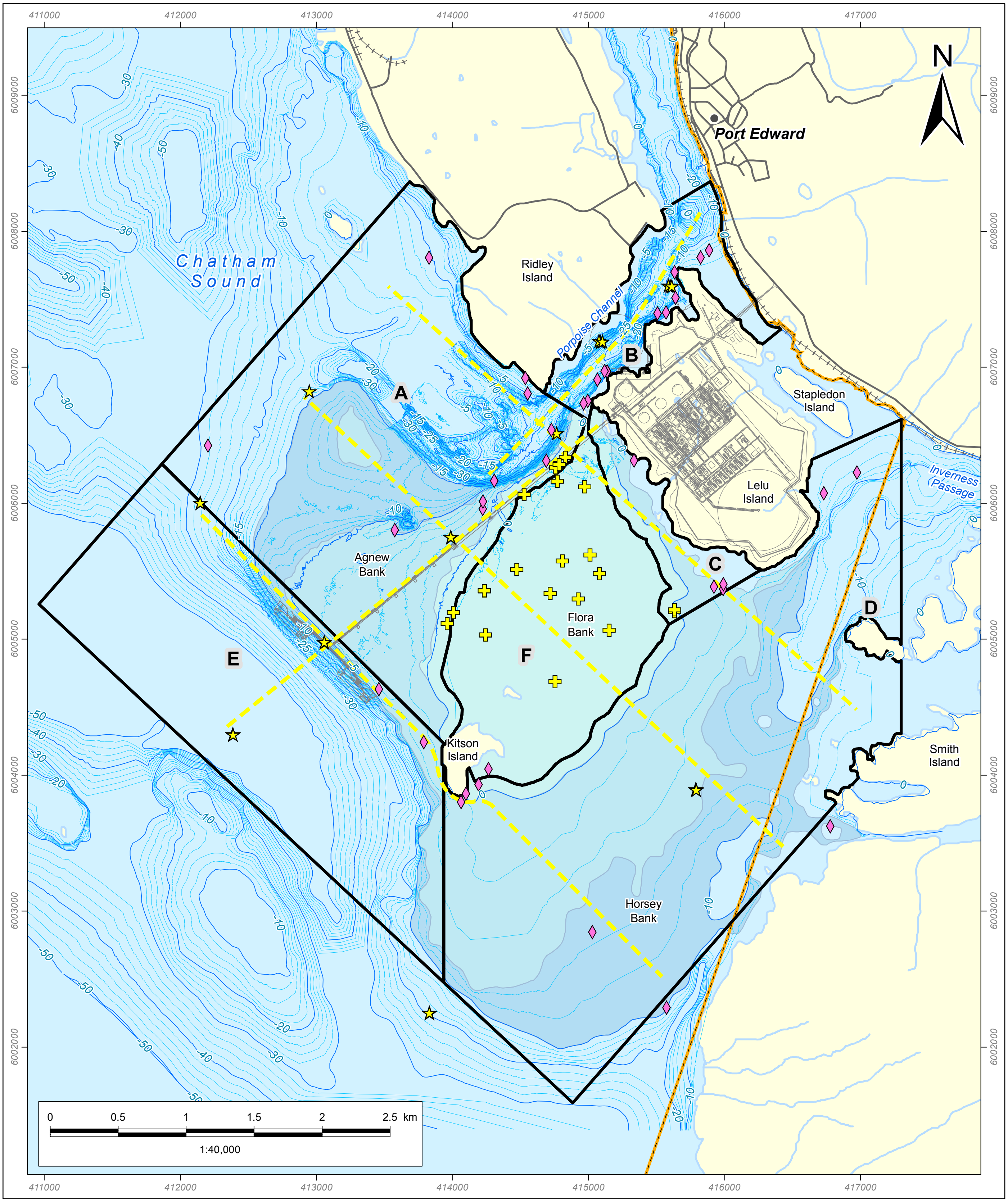
**Purse Seine**

Purse seines were used to sample offshore pelagic nearshore habitats fish (e.g., Beamish et al. 2003) during nighttime fish surveys. Purse seining was added as a component to the nighttime fish surveys at the end of June 2015 to diversify the gear and gear sampling size (area) in the Program consistent with other past sampling programs (for example Higgins and Schoewenburg 1973). Sample sites fished within the vicinity of the Project's marine components included survey area B (Porpoise Channel) and survey area D (near Horsey Bank)(Figure E-1). Within survey area G (Marcus Passage), sample sites included areas along the southwestern edge of Smith Island and the northern edge of Kennedy Island (Figure E-2).

Purse seine sample sites were chosen based on field conditions associated with tide height for site water depths, tidal currents and weather (i.e., they were not fixed) and occurred in survey areas B and D; Figure E-1) and within survey area G (Figure E-2).

The purse seine was 50 m in length and 6 m deep with a mesh size of 11 mm. The net was pursed using a perimeter line drawn through a set of rings along the entire vertical and bottom horizontal panels of the net. The purse seine was set from a boat and hauled straight for approximately 10 m to confirm no twists or tangles were present in the set (specifically that lead lines did not cross the float line). Once the net was set in the water, the boat circled back to the opposite end of the purse seine to retrieve the net lead to complete full circle of net in the water. The lead and purse line of the seine net was pulled in to close the net bottom to prevent fish from escaping. Once pursed, the net was hauled up and into the boat. Fish were left in the water before being collected for processing. UTM coordinates were recorded for seine set start points, and water depths were recorded at the deepest point of the set.

Samples of captured fish were processed for biological characteristics as described in 3.2.3.




| | | |
|---|---|---|
| City or Town | Survey Area | Fyke Net (Daytime) (24)* |
| Project Component | Prince Rupert Port Authority Boundary | Prawn Trap (Daytime) (22)* |
| Railway | Waterbody | Purse Seine (Nighttime) (36)* |
| Road | Intertidal Bank | Hydroacoustic and Trawl Transect (Daytime, 1x1/5x5 m) (5) |
| Secondary Road | 0 - 5 m Shoal | |
| Watercourse | 5 - 10 m Shoal | |
| **Bathymetry (m)** | | |
| Major Contour | | |
| Minor Contour | | |

*Due to sampling effort, some data points may be overlapping

***Pacific NorthWest LNG***

**Exploratory Survey Methods Sample Sites: Survey Areas A, B, C, D, E, and F**

MARINE FISH PROGRAM - FINAL REPORT

*Sources: Government of British Columbia; Prince Rupert Port Authority; Government of Canada, Natural Resources Canada, Centre for Topographic Information; Progress Energy Canada Ltd.*

*Although there is no reason to believe that there are any errors associated with the data used to generate this product or in the product itself, users of these data are advised that errors in the data may be present.*

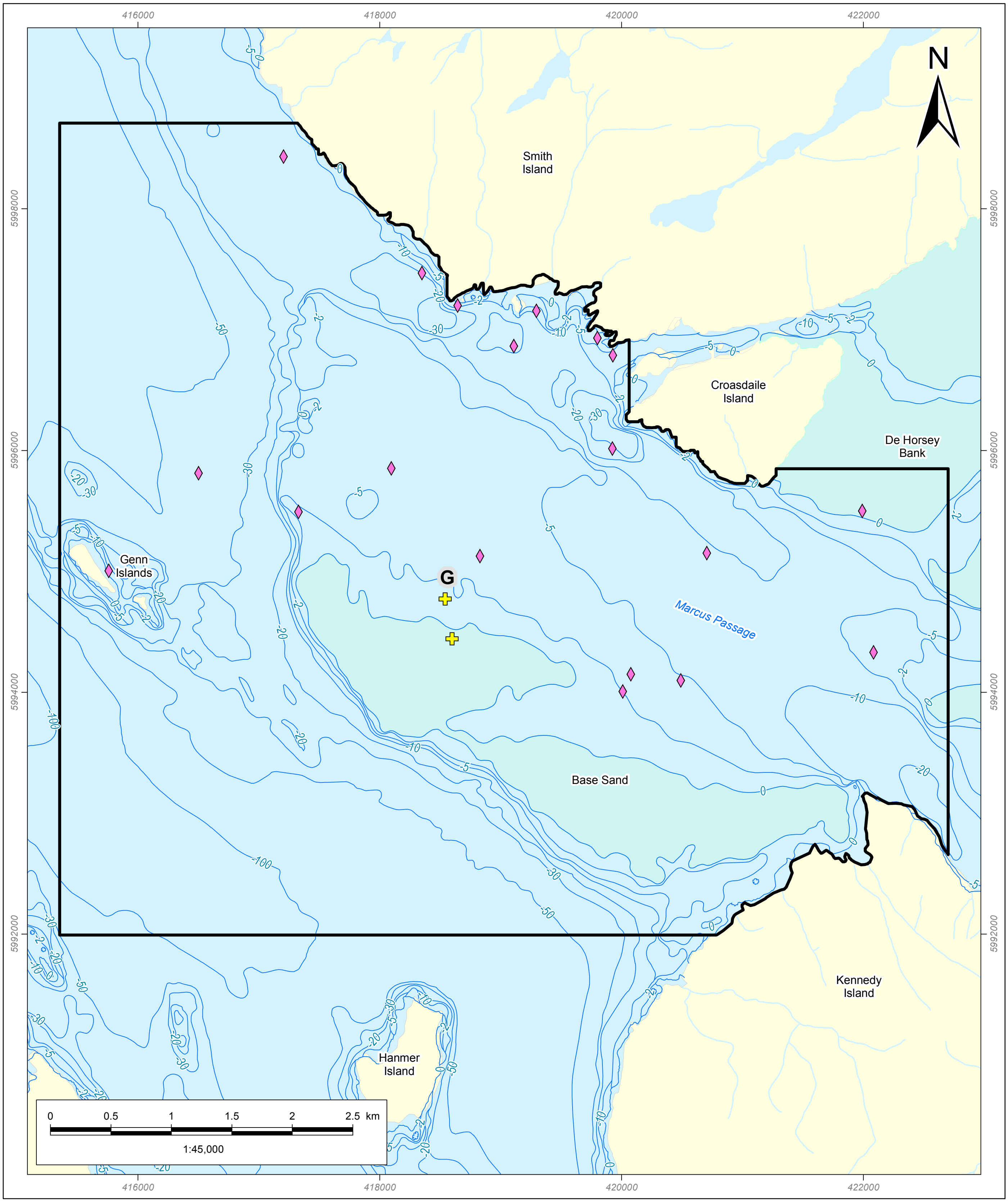
DATE: 02-MAY-16
FIGURE ID: 123110537
DRAWN BY: R.COATTA

PROJECTION: UTM - ZONE 9
DATUM: NAD 83
CHECKED BY: L.HOWELL

PREPARED BY: Stantec

PREPARED FOR: Pacific NorthWest LNG

FIGURE NO: **E-1**




Watercourse
Bathymetric Contour
Survey Area
Waterbody
Intertidal Bank
Fyke Net (Daytime) (2)*
Purse Seine (Nighttime) (20)*

*Due to sampling effort, some data points may be overlapping

***Pacific NorthWest LNG***

**Exploratory Survey Methods**
**Sample Sites: Survey Area G**

MARINE FISH PROGRAM - FINAL REPORT

*Sources: Government of British Columbia; Prince Rupert Port Authority; Government of Canada, Natural Resources Canada, Centre for Topographic Information; Progress Energy Canada Ltd.*

*Although there is no reason to believe that there are any errors associated with the data used to generate this product or in the product itself, users of these data are advised that errors in the data may be present.*

| | |
|---|---|
| DATE: 02-MAY-16 | PROJECTION: UTM - ZONE 9 |
| FIGURE ID: 123110537 | DATUM: NAD 83 |
| DRAWN BY: R.COATTA | CHECKED BY: L.HOWELL |

PREPARED BY:

Stantec

PREPARED FOR:

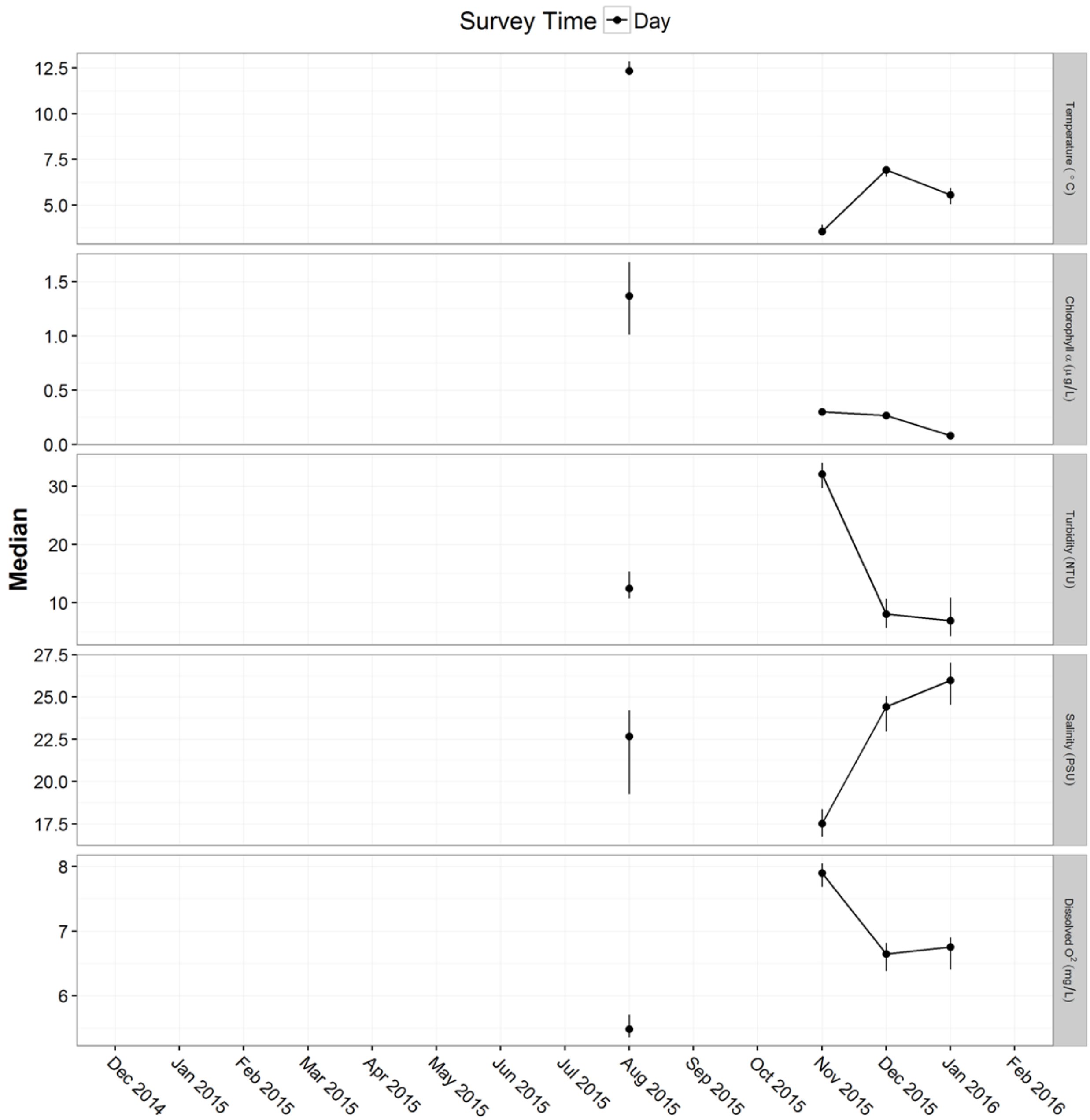
Pacific NorthWest LNG

FIGURE NO:

**E-2**

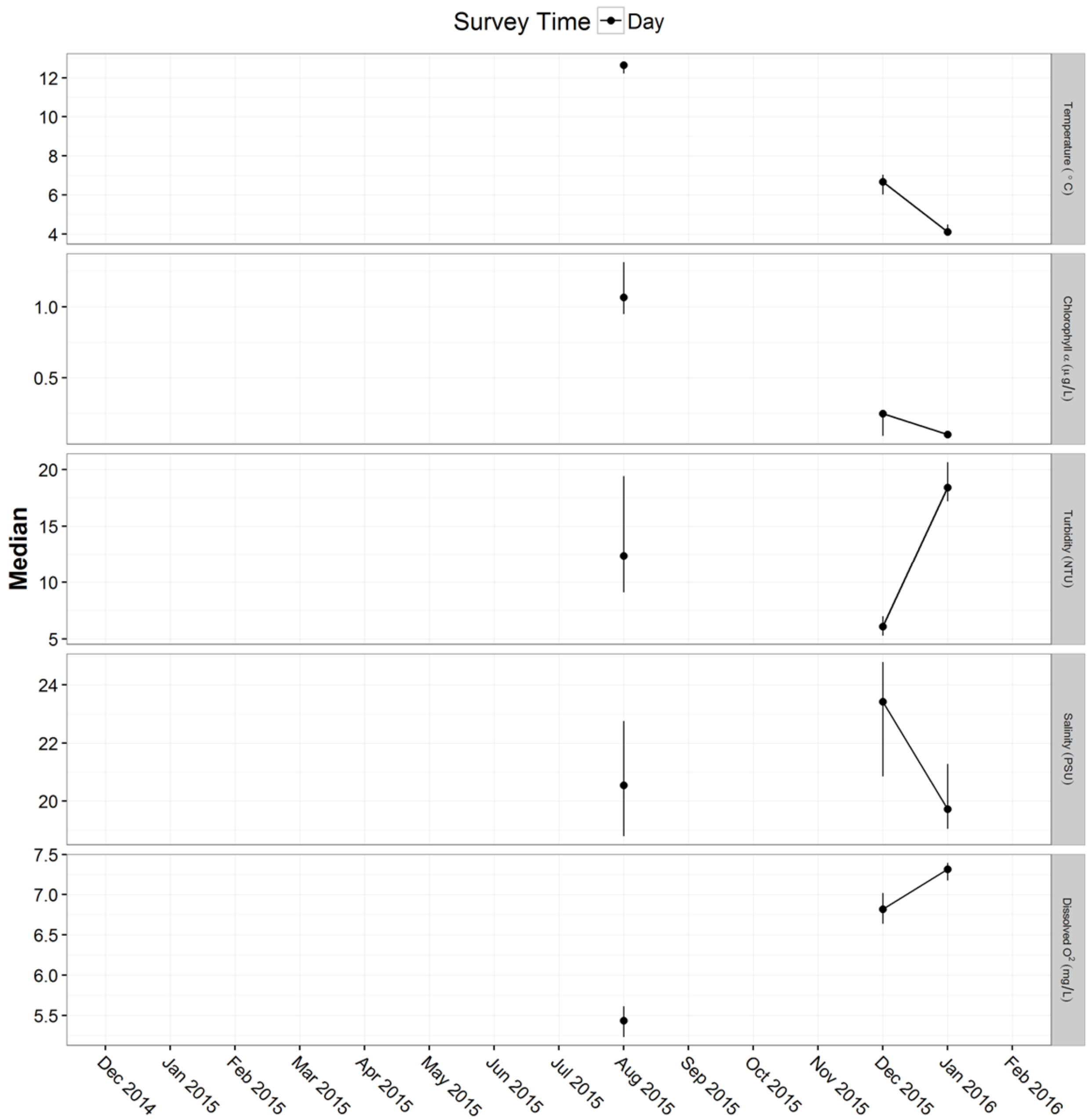
# E.2 RESULTS

## E.2.1 Water Properties Exploratory Sample Sites




NOTE: Error bars represent the interquartile range

**Figure E-3 Survey Area H: Water Property Characteristics**




NOTE: Error bars represent the interquartile range

**Figure E-4 Survey Area I: Water Property Characteristics**

# E.3 PRAWN TRAPPING

Prawn traps were set on February 21 (11 sample sites), March 21 – 22 (9 sample sites), and April 24 – 25 (5 sample sites). Total effort was 25 traps set (Table E-2), totaling 466.7 trap hours (247, 158.8, and 60.9 hours respectively). Depths sampled ranged from 6.0 to 72.3 m.

This sampling resulted in 13 individuals in four different prawn species: humpback shrimp (*Pandalus hysinotus*), sidestripe shrimp (*Pandalopsis dispar*), coonstripe shrimp (*Pandalus hysinotus*), and Pacific spot prawn (*Pandalus platyceros*) (Table E-2).

**Table E-2 Prawns Caught Per Trap and Depth**

| Month (Sets) | Depth (m) | Species | Number Caught |
|---|---|---|---|
| February (11) | 0 – 10 | Humpback Shrimp | 0 |
| | 11 – 30 | | 2 |
| | > 31 | | 4 |
| **February Total** | | **Humpback Shrimp** | **6** |
| March (9) | 0 – 10 | Humpback Shrimp | 0 |
| | 11 – 30 | | 0 |
| | > 31 | | 3 |
| **March Total** | | **Humpback Shrimp** | **3** |
| April (5[a]) | 0 – 10 | Sidestripe Shrimp | 0 |
| | | Pacific Spot Prawn | 0 |
| | | Coonstripe Shrimp | 0 |
| | 11 – 30 | Sidestripe Shrimp | 0 |
| | | Pacific Spot Prawn | 0 |
| | | Coonstripe Shrimp | 1 |
| | > 31 | Sidestripe Shrimp | 2 |
| | | Pacific Spot Prawn | 1 |
| | | Coonstripe Shrimp | 0 |
| **April Total** | | **All Species** | **4** |

NOTE:

[a] One trap was not recovered; data summarized from four sets

# E.4 OTHER SIZE TRAWL NETS

The 1 x 1 m Tucker trawl net was used during the January 2015 daytime survey (Table E-1). Five trawls were completed and only caught fish larvae.

The 5 x 5 m Otter trawl net was used during two surveys (April and June 2015 daytime) (Table E-1). Seven trawls were completed and caught *Medusozoa spp*. (70 individuals) and six fish species (2,266 individuals). Fish species caught included: surf smelt (56), Pacific herring (2,205), starry flounder (3), Pacific sandfish (1), sockeye salmon (1), and Pacific lamprey (1).

# E.5 FYKE NETS

Fyke nets were used during four daytime surveys (March, April, May, and July 2015) and during six nighttime surveys (early May through the end of June 2015), with a total of 26 sets completed (Table E-1). Twenty-four fish species (430 individuals) were caught in the fyke nets (Table E-3).

**Table E-3 Marine Species and Number of Individuals Captured in Fyke Nets (December 2014 – February 2016)**

| Fish Common Name | Scientific Name | Number Individuals |
|---|---|---|
| Surf Smelt | *Hypomesus pretiosus* | 2 |
| Pacific Herring | *Clupea pallasi* | 4 |
| Shiner Perch | *Cymatogaster aggregata* | 166 |
| Pacific Staghorn Sculpin | *Leptocottus armatus* | 72 |
| Starry Flounder | *Platichthys stellatus* | 5 |
| Pacific Snake Prickleback | *Lumpenus sagitta* | 3 |
| Sand Sole | *Psettichthys melanostictus* | 5 |
| Flatfish spp. | *Pleuronectiformes spp.* | 11 |
| Crescent Gunnel | *Pholis laeta* | 7 |
| Sculpin spp. | *Cottoidea spp.* | 3 |
| English Sole | *Parophrys vetelus* | 7 |
| Tubesnout | *Aulorhynchus flavidus* | 25 |
| Rock Sole | *Lepidopsetta bilineata* | 39 |
| Buffalo Sculpin | *Enophrys bison* | 1 |
| Pacific Sandfish | *Trichodon trichodon* | 2 |
| Big Skate | *Raja binoculata* | 1 |
| Rock Greenling | *Hexagrommos lagocephalus* | 2 |
| Pacific Cod | *Gadus macrocephalus* | 2 |
| Striped Surf Perch | *Embiotoca lateralis* | 1 |
| Whitespotted Greenling | *Hexagrammos stelleri* | 1 |

**Table E-3 Marine Species and Number of Individuals Captured in Fyke Nets (December 2014 – February 2016)**

| Fish Common Name | Scientific Name | Number Individuals |
|---|---|---|
| Spotted Snailfish | *Liparis callyodon* | 1 |
| Dungeness Crab | *Metacarcinus magister* | 67 |
| Shrimp (Crangon spp.) | *Crangon spp.* | 2 |
| Decorator Crab | *Majidae spp.* | 1 |
| **Total** | | **430** |

## E.6 PURSE SEINES

Purse seines were used during four nighttime surveys (mid-June to mid-July 2015), with a total of 56 sets completed (Table E-1). Fifteen fish species (3,666 individuals) and four invertebrate species (52 individuals) were caught in the purse seines (Table E-4). Four species (653 individuals) were captured in survey area G (Marcus Passage) (Table E-4).

**Table E-4 Marine Species and Number of Individuals Captured in Purse Seines (June – July 2015)**

| Fish Common Name | Scientific Name | Number Individuals |
|---|---|---|
| **Survey Areas A,B,C,D,E, and F: Fish** | | |
| Surf Smelt | *Hypomesus pretiosus* | 578 |
| Pacific Herring | *Clupea pallasi* | 2,645 |
| Shiner Perch | *Cymatogaster aggregata* | 217 |
| Fish Larvae | *Chordata spp.* | 130 |
| Starry Flounder | *Platichthys stellatus* | 2 |
| Pacific Snake Prickleback | *Lumpenus sagitta* | 1 |
| Sand Sole | *Psettichthys melanostictus* | 3 |
| Crescent Gunnel | *Pholis laeta* | 1 |
| Buffalo Sculpin | *Enophrys bison* | 3 |
| Pacific Sandfish | *Trichodon trichodon* | 62 |
| Sockeye Salmon | *Oncorhynchus nerka* | 8 |
| Coho Salmon | *Oncorhynchus kisutch* | 13 |
| Chinook Salmon | *Oncorhynchus tshawytscha* | 1 |
| Pacific Cod | *Gadus macrocephalus* | 1 |
| Walleye Pollock | *Gadus chalcogrammus* | 1 |

## Table E-4 Marine Species and Number of Individuals Captured in Purse Seines (June – July 2015)

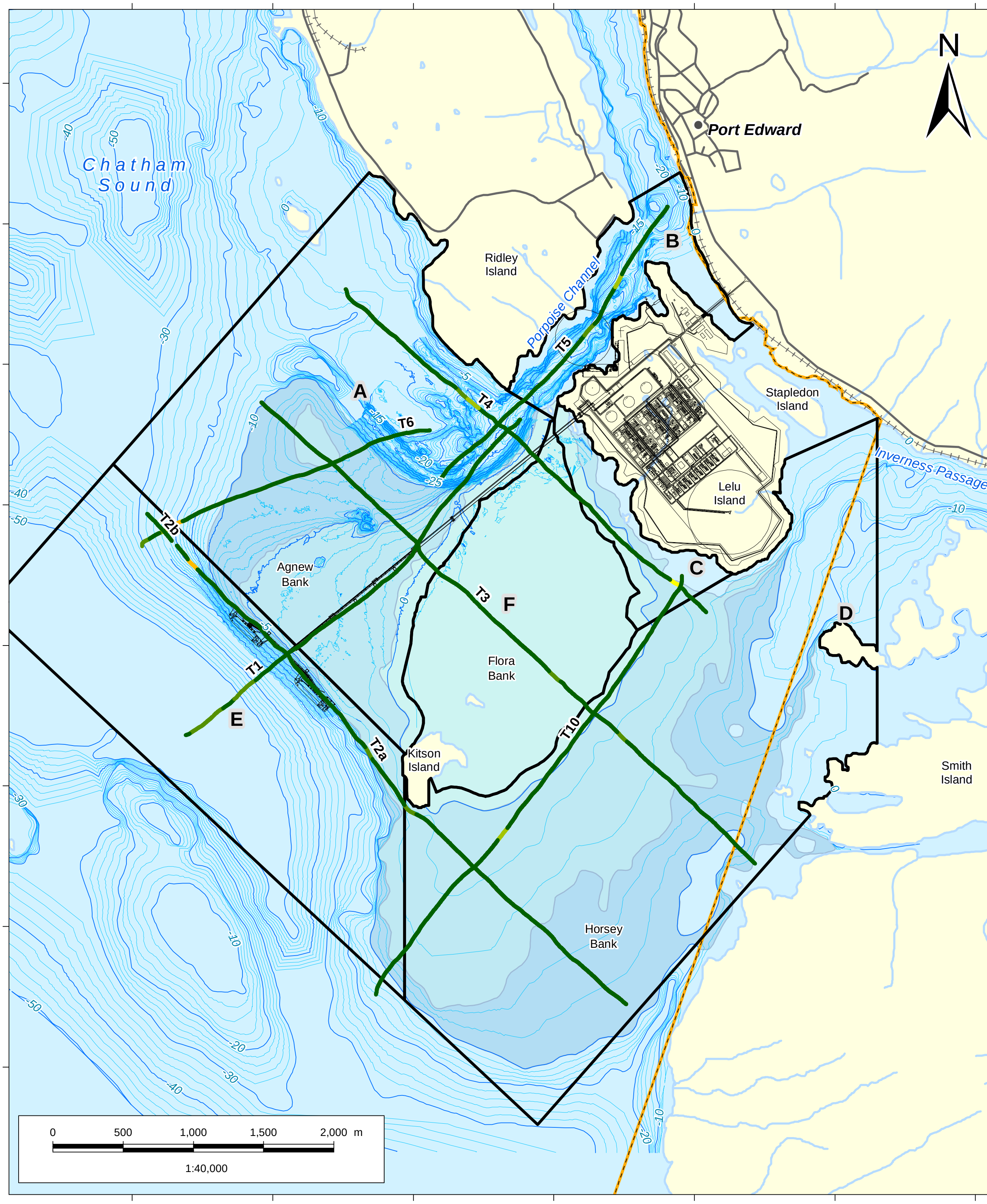
| Fish Common Name | Scientific Name | Number Individuals |
|---|---|---|
| **Survey Areas A,B,C,D,E, and F Invertebrate Species** | | |
| Crab Larvae | *Malacostraca spp.* | 5 |
| Dungeness Crab | *Metacarcinus magister* | 3 |
| Prawn/Shrimp spp. | *Decapoda spp.* | 43 |
| Coonstripe Shrimp | *Pandalus danae* | 1 |
| **Survey Area G Fish** | | |
| Surf Smelt | *Hypomesus pretiosus* | 297 |
| Pacific Herring | *Clupea pallasi* | 343 |
| Sockeye Salmon | *Oncorhynchus nerka* | 9 |
| Chinook Salmon | *Oncorhynchus tshawytscha* | 4 |

# APPENDIX F
# HYDROACOUSTIC TRANSECTS

# Appendix F HYDROACOUSTIC TRANSECTS

**Figure F-48 Nighttime Fish Hydroacoustic Survey 9 (July 10 – 14, 2015): MVBS 500 m Segments**

**Figure F-49 Survey Areas G, H, and I: Nighttime Fish Hydroacoustic Survey 9 (July 15 – 16, 2015): MVBS 500 m Segment**




**Mean Volume Backscatter (MVBS) (dB)**

- -80 and less
- -75 to -80
- -70 to -75
- -65 to -70
- -60 to -65
- -55 to -60
- -55 and greater
- Substantial Plankton

Project Component

**Bathymetry (m)**

- Major Contour
- Minor Contour
- Railway
- Secondary Road
- Watercourse

- Prince Rupert Port Authority Boundary
- Survey Area
- Waterbody
- Intertidal Bank
- 0 - 5 m Shoal
- 5 - 10 m Shoal

## *Pacific NorthWest LNG*
## Daytime Fish Hydroacoustic Survey 2 (January 29 - 31, 2015): MVBS 100 m Segments

*MARINE FISH PROGRAM - FINAL REPORT*

*Sources: Government of British Columbia; Prince Rupert Port Authority; Government of Canada, Natural Resources Canada, Centre for Topographic Information; Progress Energy Canada Ltd.*

*Although there is no reason to believe that there are any errors associated with the data used to generate this product or in the product itself, users of these data are advised that errors in the data may be present.*

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| FIGURE ID: 123110537 | DATUM: NAD 83 |
| DRAWN BY: S. PARKER | CHECKED BY: R. CAMPBELL |

PREPARED BY: Stantec

PREPARED FOR: Pacific NorthWest LNG

FIGURE NO: **F-1**

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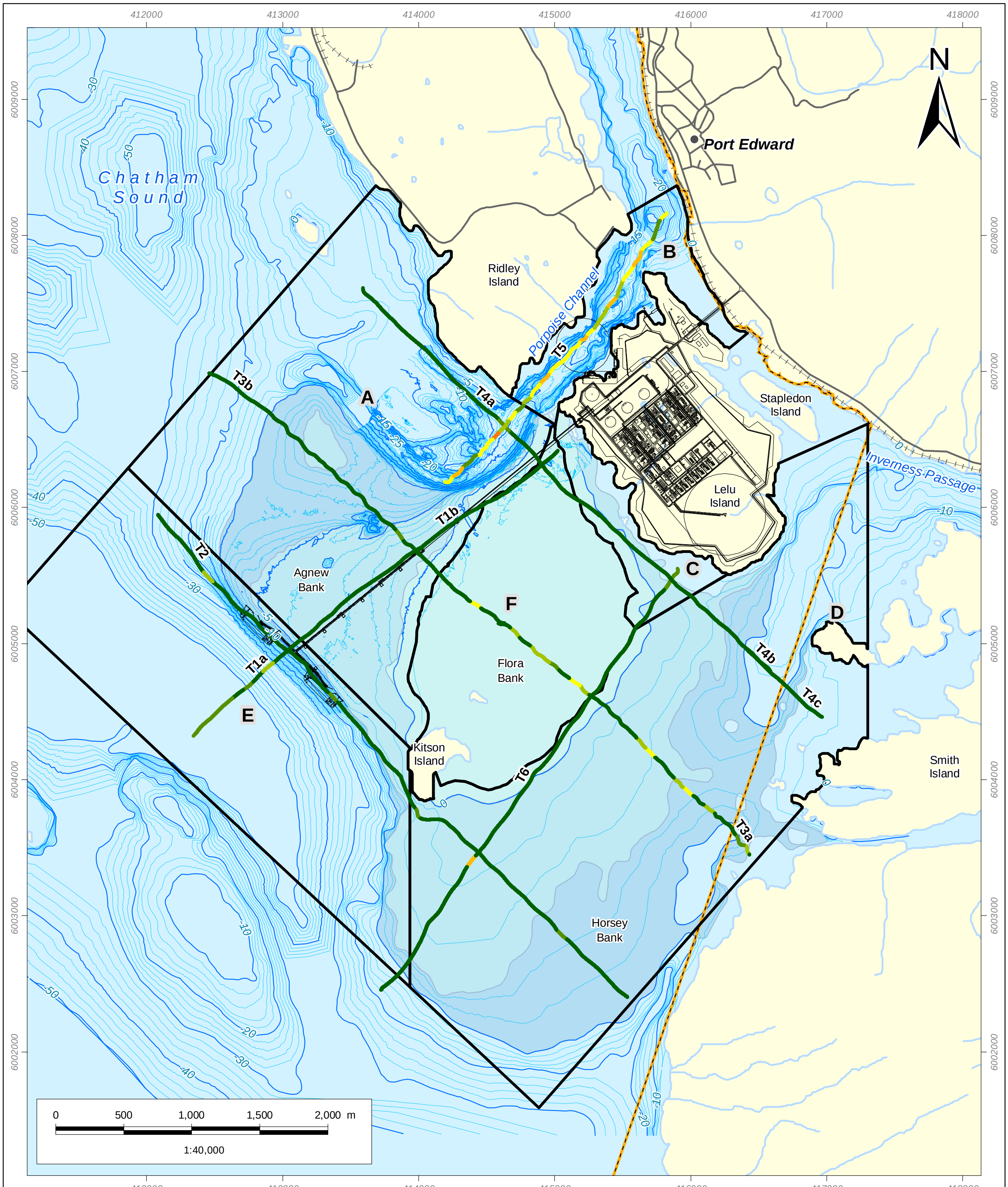


**Mean Volume Backscatter (MVBS) (dB)**

- -80 and less
- -75 to -80
- -70 to -75
- -65 to -70
- -60 to -65
- -55 to -60
- -55 and greater
- Substantial Plankton

Project Component

**Bathymetry (m)**

- Major Contour
- Minor Contour

Railway

Secondary Road

Watercourse

Prince Rupert Port Authority Boundary

Survey Area

Waterbody

Intertidal Bank

0 - 5 m Shoal

5 - 10 m Shoal

***Pacific NorthWest LNG***

**Daytime Fish Hydroacoustic Survey 3 (February 18 - 21, 2015): MVBS 100 m Segments**

*MARINE FISH PROGRAM - FINAL REPORT*

*Sources: Government of British Columbia; Prince Rupert Port Authority; Government of Canada, Natural Resources Canada, Centre for Topographic Information; Progress Energy Canada Ltd.*

*Although there is no reason to believe that there are any errors associated with the data used to generate this product or in the product itself, users of these data are advised that errors in the data may be present.*

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|---|---|
| DATE: 20-APR-16 | PROJECTION: UTM - ZONE 9 |
| FIGURE ID: 123110537 | DATUM: NAD 83 |
| DRAWN BY: K. JAMES | CHECKED BY: R. CAMPBELL |

PREPARED BY: Stantec

PREPARED FOR: Pacific NorthWest LNG

FIGURE NO: **F-2**

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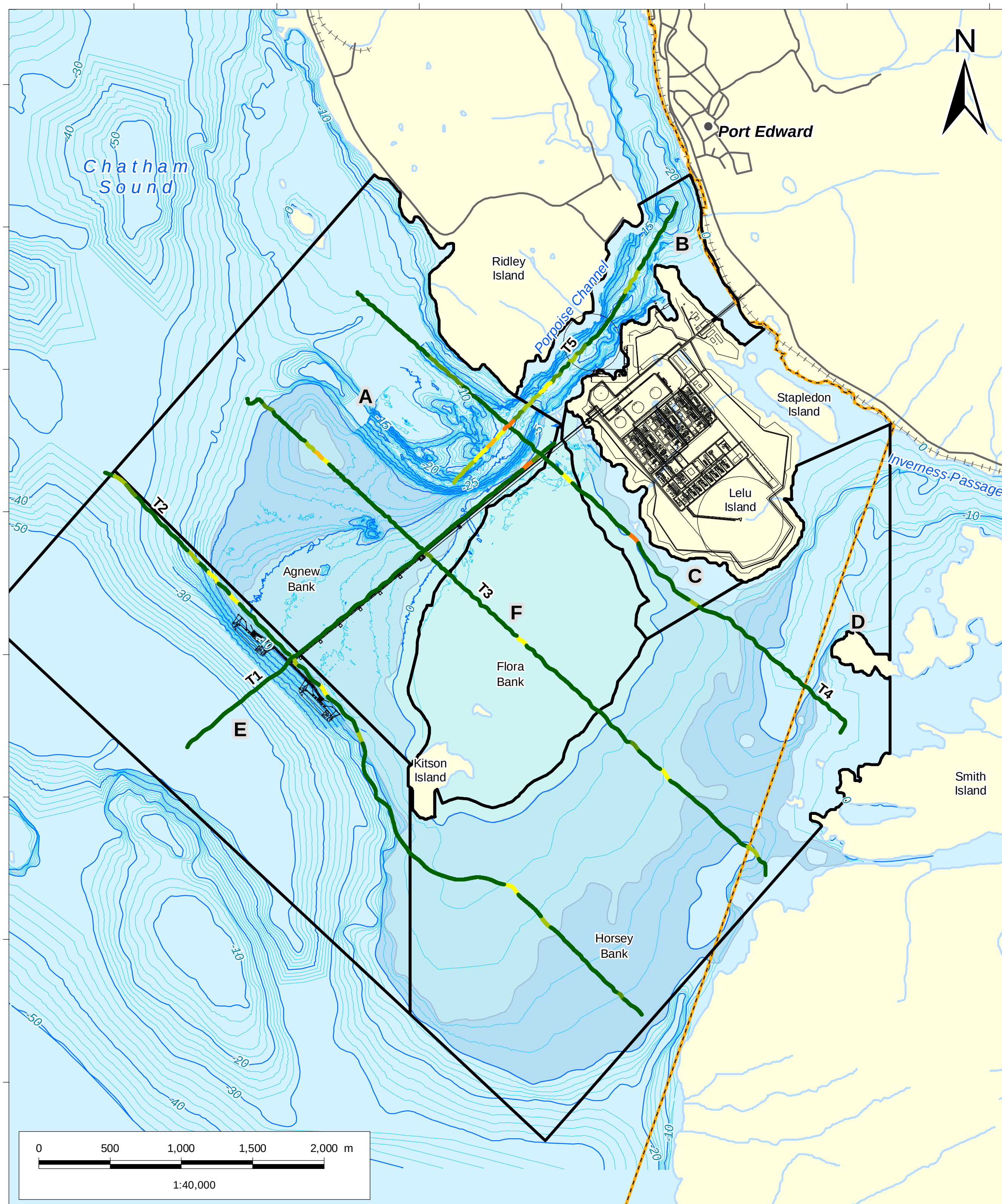


**Mean Volume Backscatter (MVBS) (dB)**

- -80 and less
- -75 to -80
- -70 to -75
- -65 to -70
- -60 to -65
- -55 to -60
- -55 and greater
- Substantial Plankton

Project Component

**Bathymetry (m)**

- Major Contour
- Minor Contour
- Railway
- Secondary Road
- Watercourse

- Prince Rupert Port Authority Boundary
- Survey Area
- Waterbody
- Intertidal Bank
- 0 - 5 m Shoal
- 5 - 10 m Shoal

## *Pacific NorthWest LNG*
## Daytime Fish Hydroacoustic Survey 4 (March 23 - 24, 2015): MVBS 100 m Segments

*MARINE FISH PROGRAM - FINAL REPORT*

*Sources: Government of British Columbia; Prince Rupert Port Authority; Government of Canada, Natural Resources Canada, Centre for Topographic Information; Progress Energy Canada Ltd.*

*Although there is no reason to believe that there are any errors associated with the data used to generate this product or in the product itself, users of these data are advised that errors in the data may be present.*

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FIGURE ID: 123110537
DRAWN BY: S. PARKER

PROJECTION: UTM - ZONE 9
DATUM: NAD 83
CHECKED BY: R. CAMPBELL

PREPARED BY: Stantec

PREPARED FOR: Pacific NorthWest LNG

FIGURE NO: **F-3**

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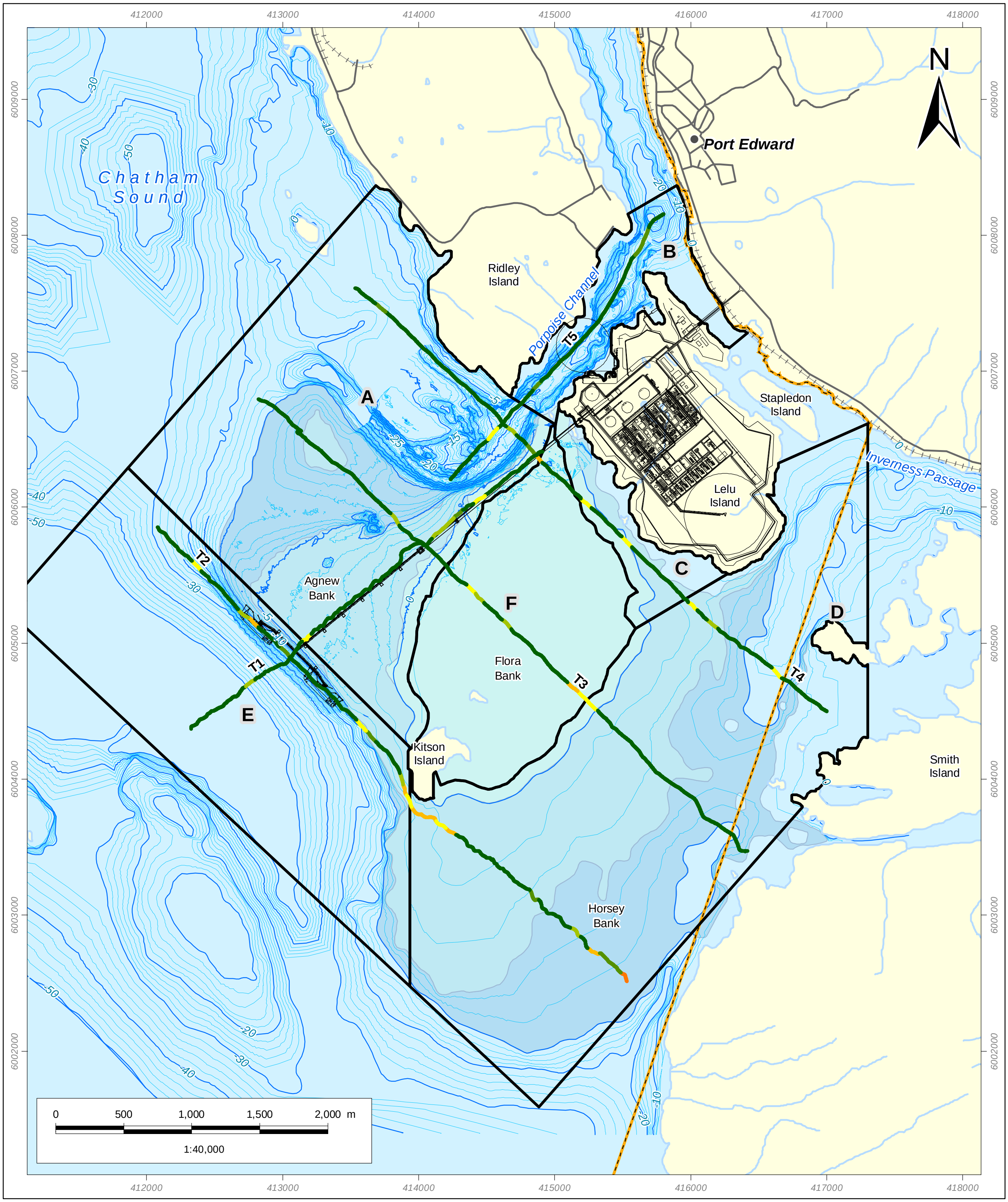


**Mean Volume Backscatter (MVBS) (dB)**
- -80 and less
- -75 to -80
- -70 to -75
- -65 to -70
- -60 to -65
- -55 to -60
- -55 and greater
- Substantial Plankton

Project Component

**Bathymetry (m)**
- Major Contour
- Minor Contour
- Railway
- Secondary Road
- Watercourse

Prince Rupert Port Authority Boundary
Survey Area
Waterbody
Intertidal Bank
0 - 5 m Shoal
5 - 10 m Shoal

## *Pacific NorthWest LNG*
## Daytime Fish Hydroacoustic Survey 5 (April 26 - 27, 2015): MVBS 100 m Segments

*MARINE FISH PROGRAM - FINAL REPORT*

*Sources: Government of British Columbia; Prince Rupert Port Authority; Government of Canada, Natural Resources Canada, Centre for Topographic Information; Progress Energy Canada Ltd.*

*Although there is no reason to believe that there are any errors associated with the data used to generate this product or in the product itself, users of these data are advised that errors in the data may be present.*

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|---|---|
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| FIGURE ID: 123110537 | DATUM: NAD 83 |
| DRAWN BY: L. HOPPER | CHECKED BY: R. CAMPBELL |

PREPARED BY: Stantec

PREPARED FOR: Pacific NorthWest LNG

FIGURE NO: **F-4**

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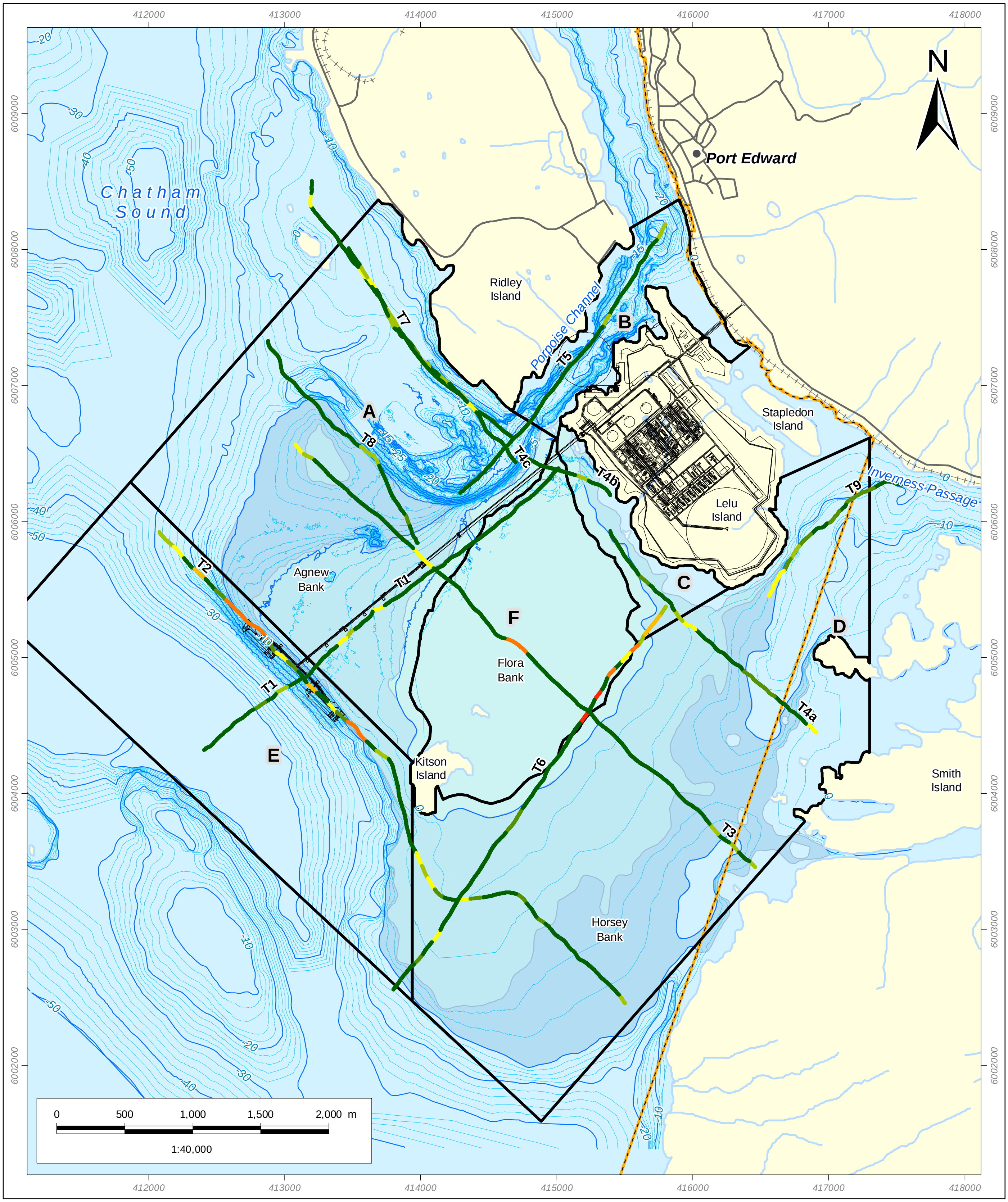


**Mean Volume Backscatter (MVBS) (dB)**

- -80 and less
- -75 to -80
- -70 to -75
- -65 to -70
- -60 to -65
- -55 to -60
- -55 and greater
- Substantial Plankton

- Project Component

**Bathymetry (m)**

- Major Contour
- Minor Contour
- Railway
- Secondary Road
- Watercourse

- Prince Rupert Port Authority Boundary
- Survey Area
- Waterbody
- Intertidal Bank
- 0 - 5 m Shoal
- 5 - 10 m Shoal

***Pacific NorthWest LNG***

**Daytime Fish Hydroacoustic Survey 6 (May 21 - 23, 2015): MVBS 100 m Segments**

*MARINE FISH PROGRAM - FINAL REPORT*

*Sources: Government of British Columbia; Prince Rupert Port Authority; Government of Canada, Natural Resources Canada, Centre for Topographic Information; Progress Energy Canada Ltd.*

*Although there is no reason to believe that there are any errors associated with the data used to generate this product or in the product itself, users of these data are advised that errors in the data may be present.*

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| FIGURE ID: 123110537 | DATUM: NAD 83 |
| DRAWN BY: R. CAMPBELL | CHECKED BY: S. O'REGAN |

PREPARED BY: Stantec

PREPARED FOR: Pacific NorthWest LNG

FIGURE NO: **F-5**

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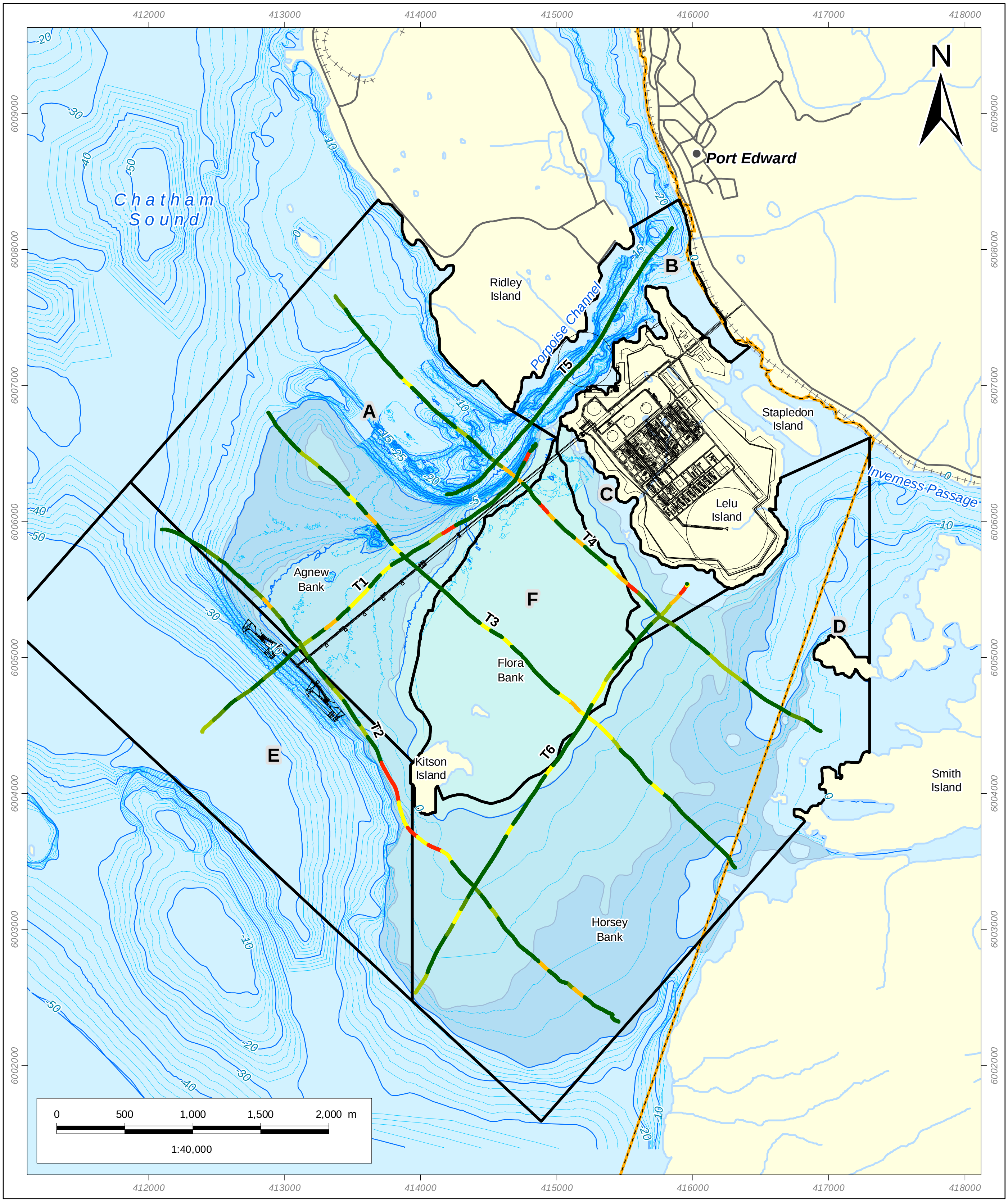


**Mean Volume Backscatter (MVBS) (dB)**

- -80 and less
- -75 to -80
- -70 to -75
- -65 to -70
- -60 to -65
- -55 to -60
- -55 and greater
- Substantial Plankton

Project Component

**Bathymetry (m)**

- Major Contour
- Minor Contour

Railway

Secondary Road

Watercourse

Prince Rupert Port Authority Boundary

Survey Area

Waterbody

Intertidal Bank

0 - 5 m Shoal

5 - 10 m Shoal

***Pacific NorthWest LNG***

**Daytime Fish Hydroacoustic Survey 7 (June 9 - 10, 2015): MVBS 100 m Segments**

*MARINE FISH PROGRAM - FINAL REPORT*

*Sources: Government of British Columbia; Prince Rupert Port Authority; Government of Canada, Natural Resources Canada, Centre for Topographic Information; Progress Energy Canada Ltd.*

*Although there is no reason to believe that there are any errors associated with the data used to generate this product or in the product itself, users of these data are advised that errors in the data may be present.*

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| FIGURE ID: 123110537 | DATUM: NAD 83 |
| DRAWN BY: R. CAMPBELL | CHECKED BY: S. O'REGAN |

PREPARED BY: Stantec

PREPARED FOR: Pacific NorthWest LNG

FIGURE NO: **F-6**

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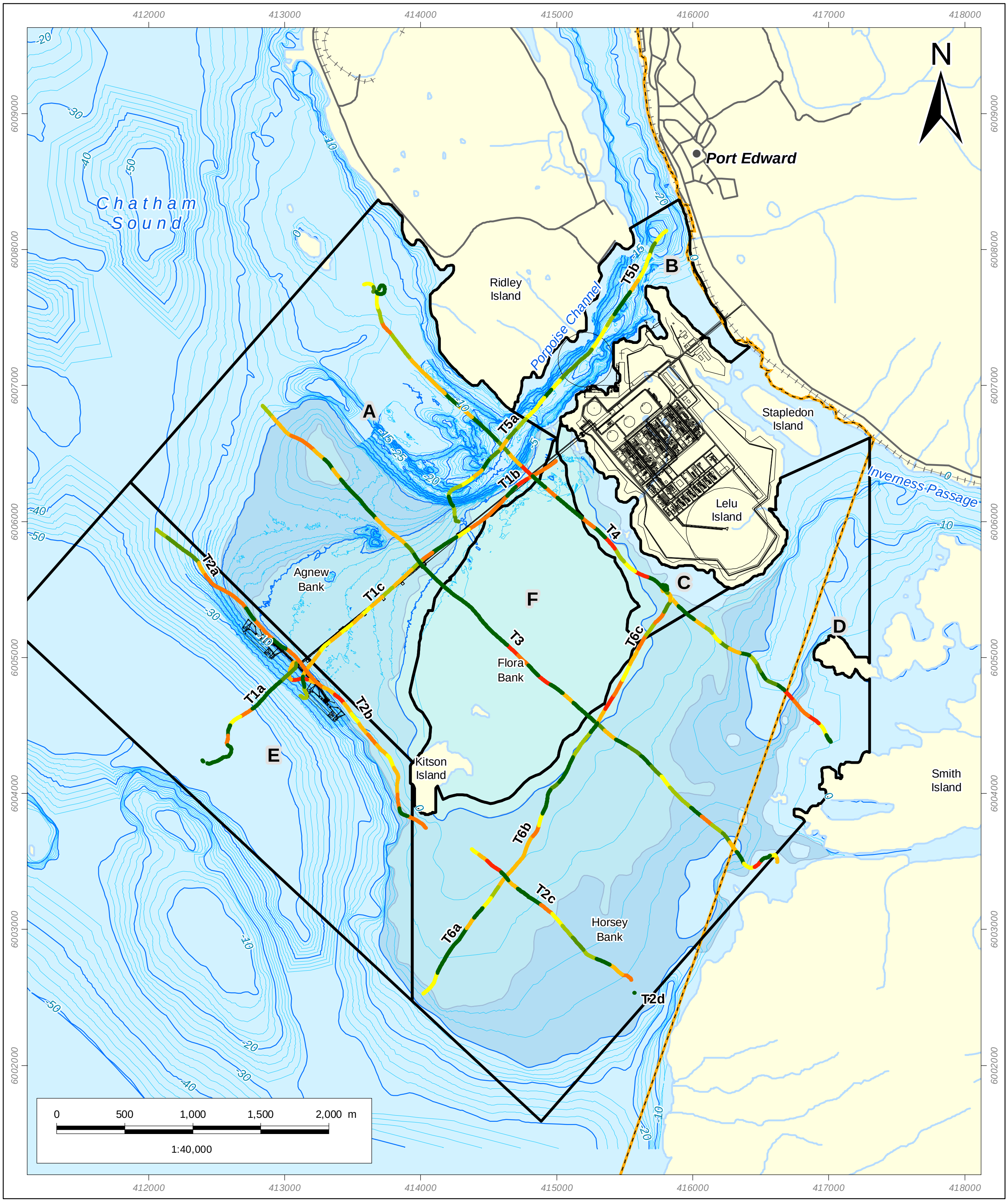


**Mean Volume Backscatter (MVBS) (dB)**

- -80 and less
- -75 to -80
- -70 to -75
- -65 to -70
- -60 to -65
- -55 to -60
- -55 and greater
- Substantial Plankton

- Project Component

**Bathymetry (m)**

- Major Contour
- Minor Contour
- Railway
- Secondary Road
- Watercourse

- Prince Rupert Port Authority Boundary
- Survey Area
- Waterbody
- Intertidal Bank
- 0 - 5 m Shoal
- 5 - 10 m Shoal

***Pacific NorthWest LNG***

**Daytime Fish Hydroacoustic Survey 9 (July 2 - 8, 2015): MVBS 100 m Segments**

*MARINE FISH PROGRAM - FINAL REPORT*

*Sources: Government of British Columbia; Prince Rupert Port Authority; Government of Canada, Natural Resources Canada, Centre for Topographic Information; Progress Energy Canada Ltd.*

*Although there is no reason to believe that there are any errors associated with the data used to generate this product or in the product itself, users of these data are advised that errors in the data may be present.*

DATE: 20-APR-16
FIGURE ID: 123110537
DRAWN BY: R. CAMPBELL

PROJECTION: UTM - ZONE 9
DATUM: NAD 83
CHECKED BY: S. O'REGAN

PREPARED BY: Stantec

PREPARED FOR: Pacific NorthWest LNG

FIGURE NO: **F-7**

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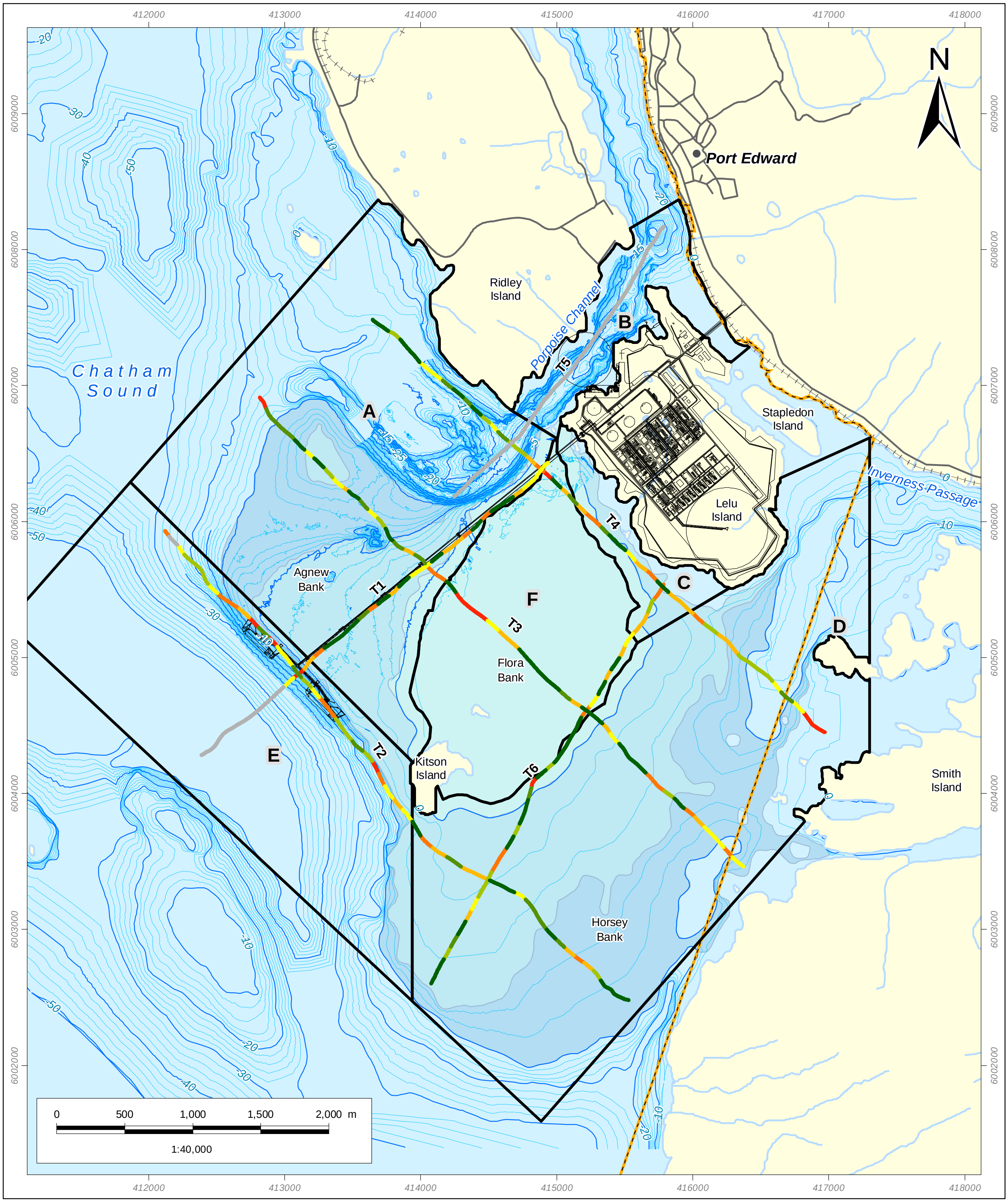


**Mean Volume Backscatter (MVBS) (dB)**
- -80 and less
- -75 to -80
- -70 to -75
- -65 to -70
- -60 to -65
- -55 to -60
- -55 and greater
- Substantial Plankton

Project Component

**Bathymetry (m)**
- Major Contour
- Minor Contour
- Railway
- Secondary Road
- Watercourse

- Prince Rupert Port Authority Boundary
- Survey Area
- Waterbody
- Intertidal Bank
- 0 - 5 m Shoal
- 5 - 10 m Shoal

***Pacific NorthWest LNG***
**Daytime Fish Hydroacoustic Survey 10 (July 16 - 23, 2015): MVBS 100 m Segments**

*MARINE FISH PROGRAM - FINAL REPORT*

*Sources: Government of British Columbia; Prince Rupert Port Authority; Government of Canada, Natural Resources Canada, Centre for Topographic Information; Progress Energy Canada Ltd.*

*Although there is no reason to believe that there are any errors associated with the data used to generate this product or in the product itself, users of these data are advised that errors in the data may be present.*

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| DATE: 20-APR-16 | PROJECTION: UTM - ZONE 9 |
| FIGURE ID: 123110537 | DATUM: NAD 83 |
| DRAWN BY: R. CAMPBELL | CHECKED BY: S. O'REGAN |

PREPARED BY: Stantec

PREPARED FOR: Pacific NorthWest LNG

FIGURE NO: **F-8**

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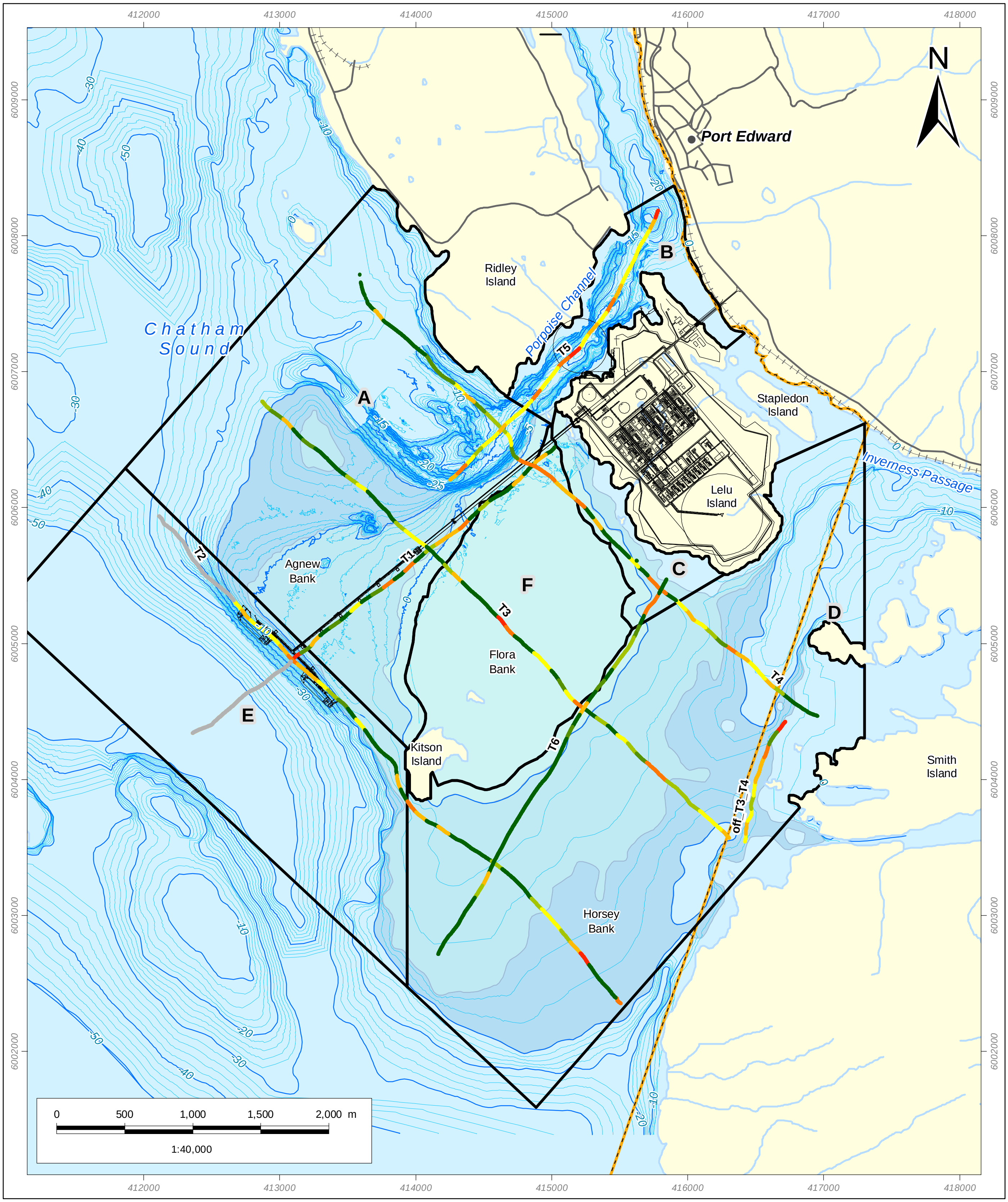


**Mean Volume Backscatter (MVBS) (dB)**

- -80 and less
- -75 to -80
- -70 to -75
- -65 to -70
- -60 to -65
- -55 to -60
- -55 and greater
- Substantial Plankton

Project Component

**Bathymetry (m)**

- Major Contour
- Minor Contour

Railway

Secondary Road

Watercourse

Prince Rupert Port Authority Boundary

Survey Area

Waterbody

Intertidal Bank

0 - 5 m Shoal

5 - 10 m Shoal

***Pacific NorthWest LNG***

**Daytime Fish Hydroacoustic Survey 11 (August 12 - 19, 2015): MVBS 100 m Segments**

*MARINE FISH PROGRAM - FINAL REPORT*

*Sources: Government of British Columbia; Prince Rupert Port Authority; Government of Canada, Natural Resources Canada, Centre for Topographic Information; Progress Energy Canada Ltd.*

*Although there is no reason to believe that there are any errors associated with the data used to generate this product or in the product itself, users of these data are advised that errors in the data may be present.*

| | |
|---|---|
| DATE: 20-APR-16 | PROJECTION: UTM - ZONE 9 |
| FIGURE ID: 123110537 | DATUM: NAD 83 |
| DRAWN BY: R. CAMPBELL | CHECKED BY: P. REECE |

PREPARED BY: Stantec

PREPARED FOR: Pacific NorthWest LNG

FIGURE NO: **F-9**

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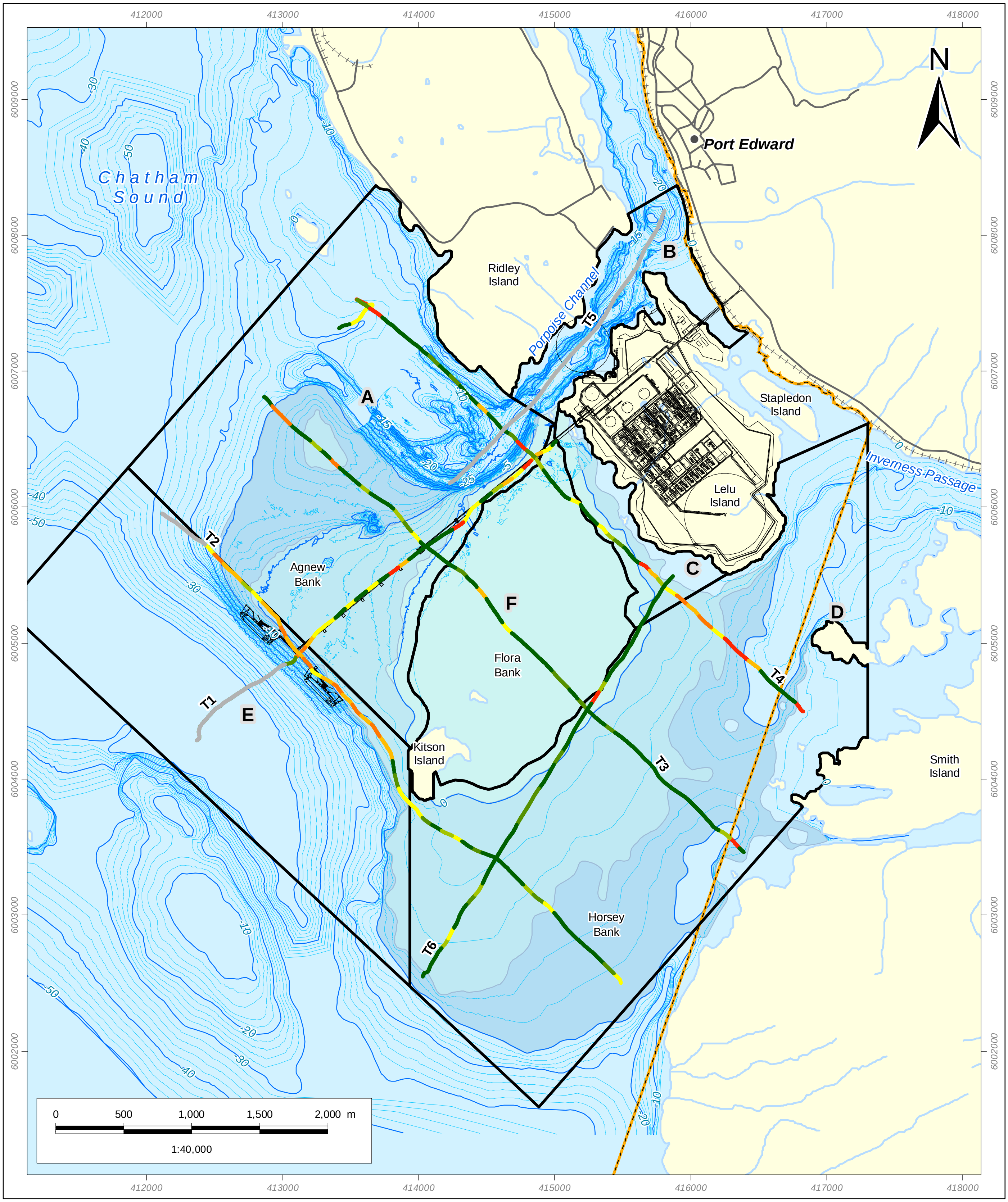


**Mean Volume Backscatter (MVBS) (dB)**

- -80 and less
- -75 to 80
- -70 to -75
- -65 to -70
- -60 to -65
- -55 to -60
- -55 and greater
- Substantial Plankton

Project Component

**Bathymetry (m)**

- Major Contour
- Minor Contour

Railway

Secondary Road

Watercourse

Prince Rupert Port Authority Boundary

Survey Area

Waterbody

Intertidal Bank

0 - 5 m Shoal

5 - 10 m Shoal

***Pacific NorthWest LNG***

## Daytime Fish Hydroacoustic Survey 12 (September 14 - 19, 2015): MVBS 100 m Segments

*MARINE FISH PROGRAM - FINAL REPORT*

*Sources: Government of British Columbia; Prince Rupert Port Authority; Government of Canada, Natural Resources Canada, Centre for Topographic Information; Progress Energy Canada Ltd.*

*Although there is no reason to believe that there are any errors associated with the data used to generate this product or in the product itself, users of these data are advised that errors in the data may be present.*

| | |
|---|---|
| DATE: 20-APR-16 | PROJECTION: UTM - ZONE 9 |
| FIGURE ID: 123110537 | DATUM: NAD 83 |
| DRAWN BY: K. JAMES | CHECKED BY: R. CAMPBELL |

PREPARED BY: Stantec

PREPARED FOR: Pacific NorthWest LNG

FIGURE NO: **F-10**

\\cd1186-f04\workgroup\active\123110537\gis\figures\Marine_Fish_All_Surveys\Hydroacoustic_Surveys\Marfish_100m_intervals\fig_123110537_e-10_marine_Hydroacoustic_Survey_marfish_12_100m_Biomass.mxd

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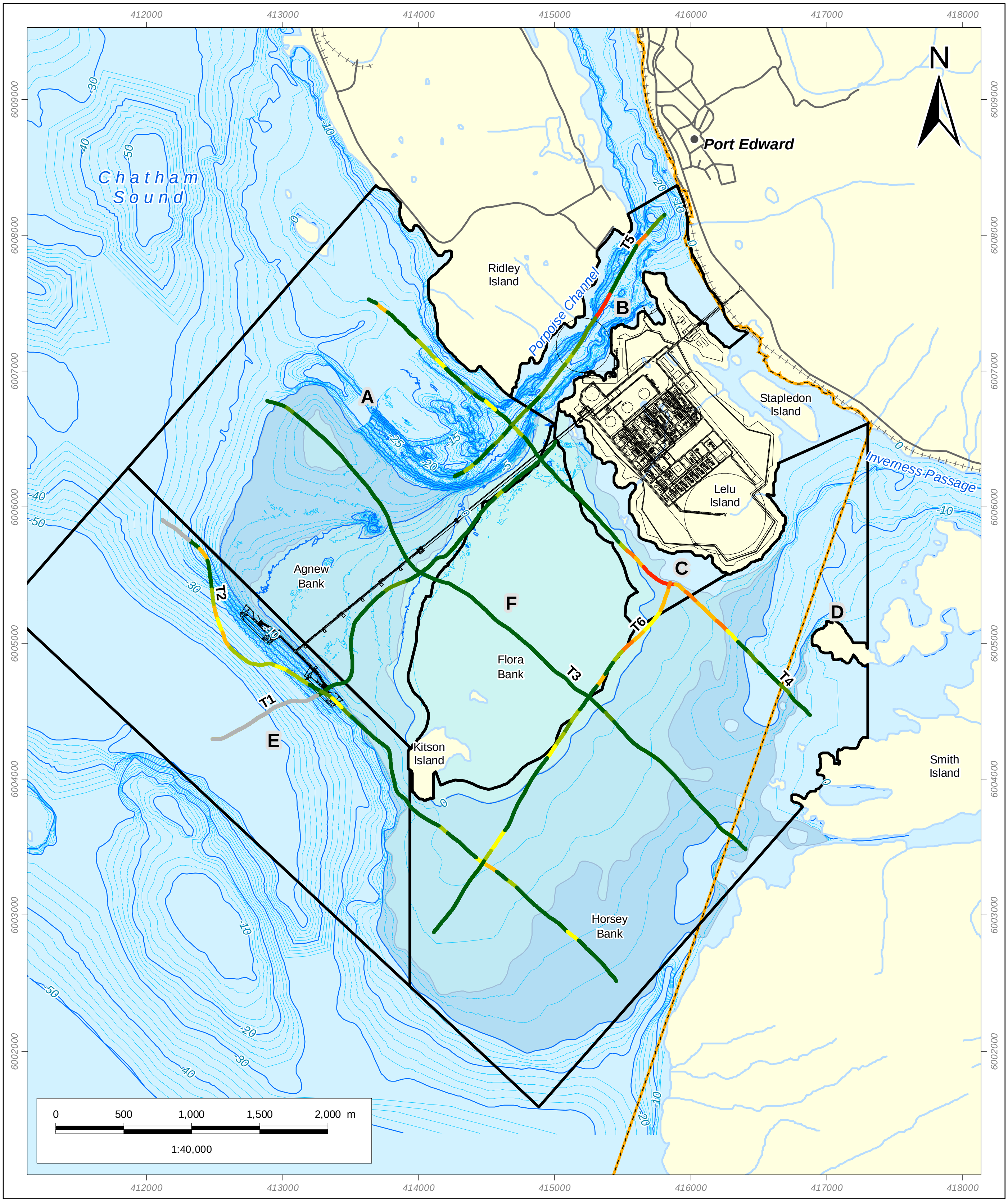


**Mean Volume Backscatter (MVBS) (dB)**
- -80 and less
- -75 to -80
- -70 to -75
- -65 to -70
- -60 to -65
- -55 to -60
- -55 and greater
- Substantial Plankton

- Project Component

**Bathymetry (m)**
- Major Contour
- Minor Contour
- Railway
- Secondary Road
- Watercourse

- Prince Rupert Port Authority Boundary
- Survey Area
- Waterbody
- Intertidal Bank
- 0 - 5 m Shoal
- 5 - 10 m Shoal

***Pacific NorthWest LNG***
**Daytime Fish Hydroacoustic Survey 13 (October 30 - November 4, 2015): MVBS 100 m Segments**

*MARINE FISH PROGRAM - FINAL REPORT*

*Sources: Government of British Columbia; Prince Rupert Port Authority; Government of Canada, Natural Resources Canada, Centre for Topographic Information; Progress Energy Canada Ltd.*

*Although there is no reason to believe that there are any errors associated with the data used to generate this product or in the product itself, users of these data are advised that errors in the data may be present.*

| | |
|---|---|
| DATE: 20-APR-16 | PROJECTION: UTM - ZONE 9 |
| FIGURE ID: 123110537 | DATUM: NAD 83 |
| DRAWN BY: K. JAMES | CHECKED BY: R. CAMPBELL |

PREPARED BY: Stantec

PREPARED FOR: Pacific NorthWest LNG

FIGURE NO: **F-11**

\\cd1186-f04\workgroup\active\123110537\gis\figures\Marine_Fish_All_Surveys\Hydroacoustic_Surveys\Marfish_100m_intervals\fig_123110537_e-11_marine_Hydroacoustic_Survey_marfish_13_100m_Biomass.mxd

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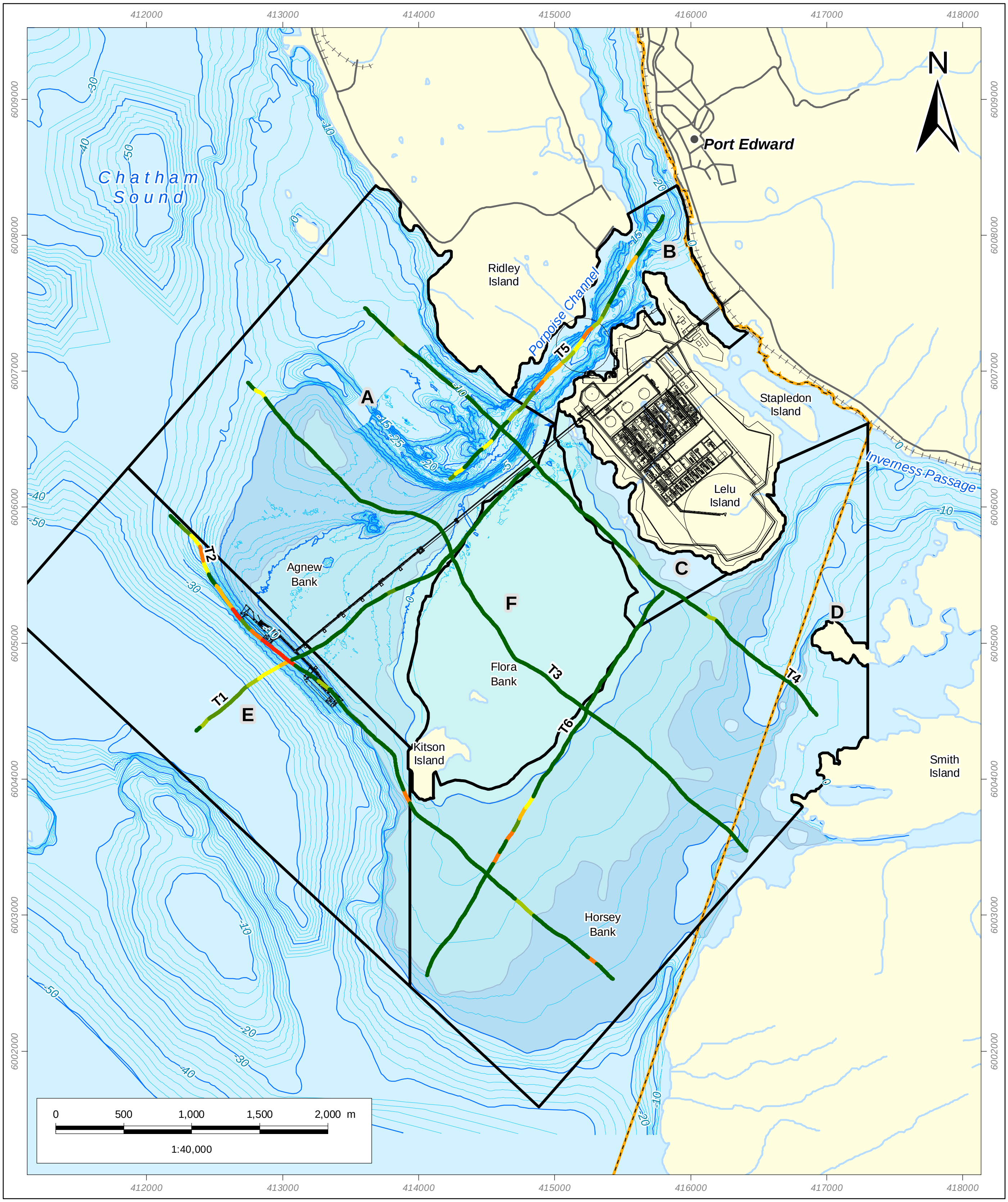


**Mean Volume Backscatter (MVBS) (dB)**

- -80 and less
- -75 to 80
- -70 to -75
- -65 to -70
- -60 to -65
- -55 to -60
- -55 and greater
- Substantial Plankton

Project Component

**Bathymetry (m)**

- Major Contour
- Minor Contour

Railway

Secondary Road

Watercourse

Prince Rupert Port Authority Boundary

Survey Area

Waterbody

Intertidal Bank

0 - 5 m Shoal

5 - 10 m Shoal

***Pacific NorthWest LNG***

**Daytime Fish Hydroacoustic Survey 14 (November 26 - December 3, 2015): MVBS 100 m Segments**

*MARINE FISH PROGRAM - FINAL REPORT*

*Sources: Government of British Columbia; Prince Rupert Port Authority; Government of Canada, Natural Resources Canada, Centre for Topographic Information; Progress Energy Canada Ltd.*

*Although there is no reason to believe that there are any errors associated with the data used to generate this product or in the product itself, users of these data are advised that errors in the data may be present.*

DATE: 20-APR-16
FIGURE ID: 123110537
DRAWN BY: K. JAMES

PROJECTION: UTM - ZONE 9
DATUM: NAD 83
CHECKED BY: R. CAMPBELL

PREPARED BY: Stantec

PREPARED FOR: Pacific NorthWest LNG

FIGURE NO:

**F-12**

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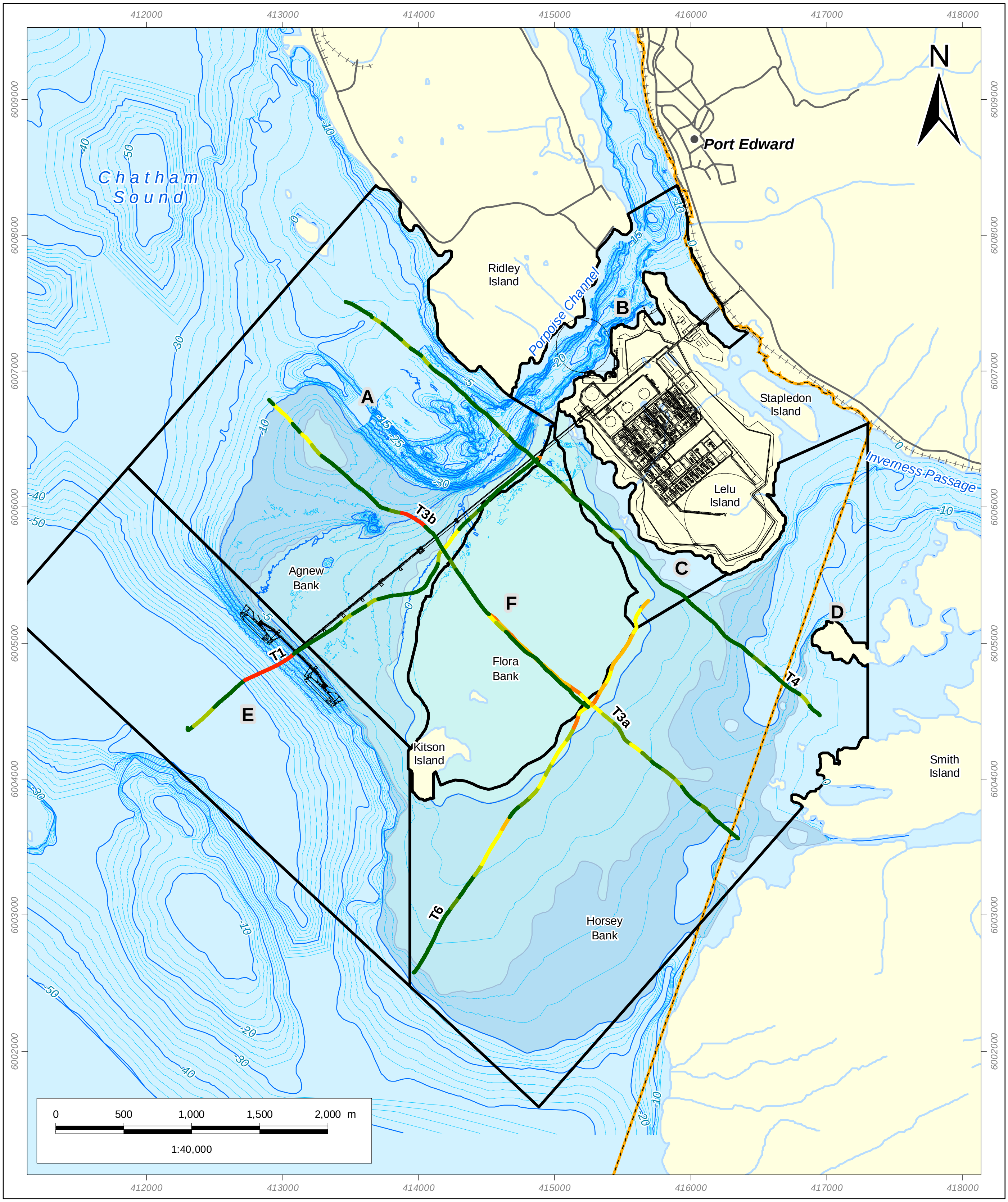


**Mean Volume Backscatter (MVBS) (dB)**
- -80 and less
- -75 to 80
- -70 to -75
- -65 to -70
- -60 to -65
- -55 to -60
- -55 and greater
- Substantial Plankton

Project Component

**Bathymetry (m)**
- Major Contour
- Minor Contour

Railway

Secondary Road

Watercourse

Prince Rupert Port Authority Boundary

Survey Area

Waterbody

Intertidal Bank

0 - 5 m Shoal

5 - 10 m Shoal

## *Pacific NorthWest LNG*
## Daytime Fish Hydroacoustic Survey 15 (December 10-13, 2015): MVBS 100 m Segments

MARINE FISH PROGRAM - FINAL REPORT

*Sources: Government of British Columbia; Prince Rupert Port Authority; Government of Canada, Natural Resources Canada, Centre for Topographic Information; Progress Energy Canada Ltd.*

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| | |
|---|---|
| DATE: 20-APR-16 | PROJECTION: UTM - ZONE 9 |
| FIGURE ID: 123110537 | DATUM: NAD 83 |
| DRAWN BY: K. JAMES | CHECKED BY: R. CAMPBELL |

PREPARED BY: Stantec

PREPARED FOR: Pacific NorthWest LNG

FIGURE NO:

**F-13**

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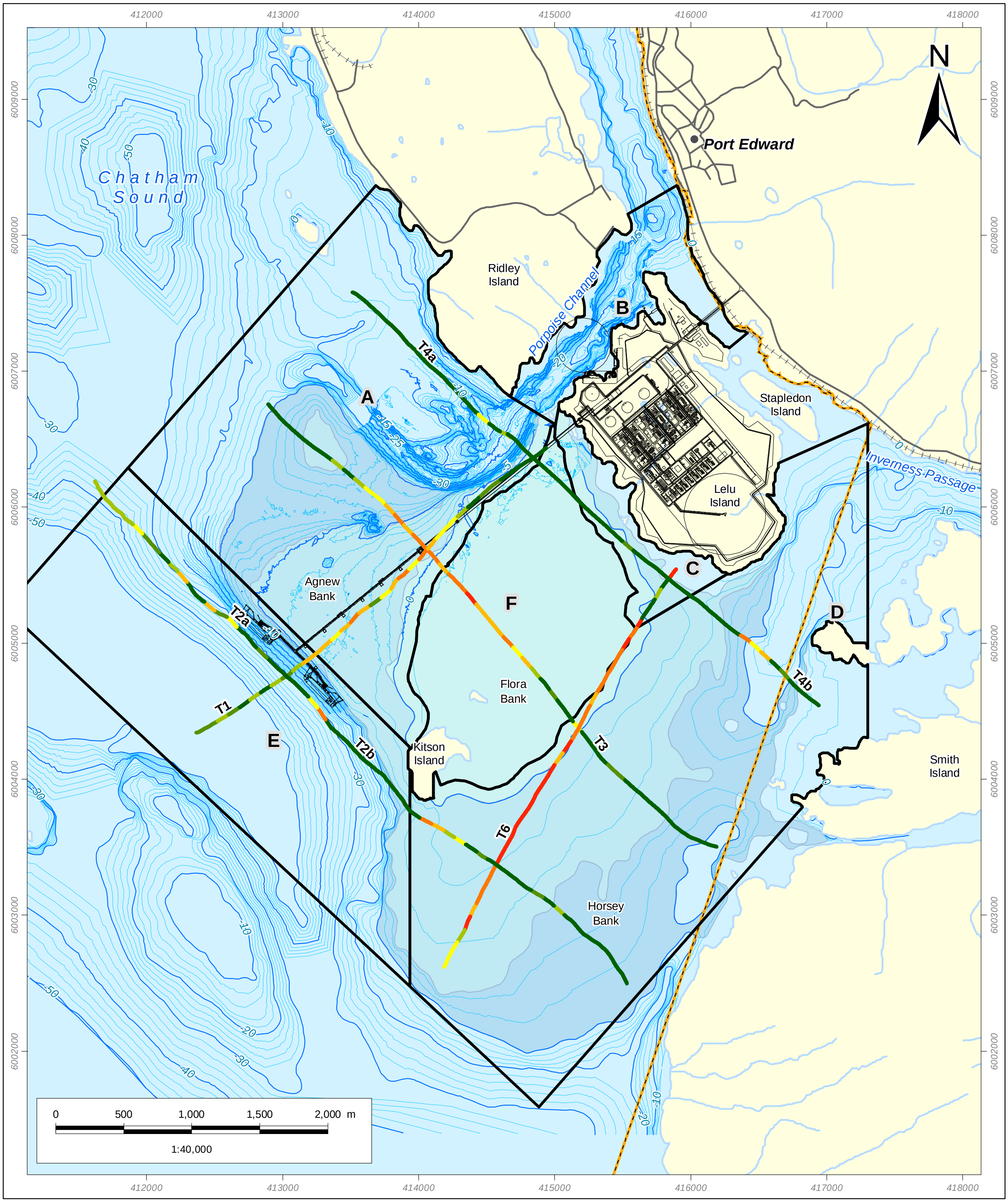


**Mean Volume Backscatter (MVBS) (dB)**
- -80 and less
- -75 to 80
- -70 to -75
- -65 to -70
- -60 to -65
- -55 to -60
- -55 and greater

Project Component

**Bathymetry (m)**
- Major Contour
- Minor Contour
- Railway
- Secondary Road
- Watercourse

Prince Rupert Port Authority Boundary
Survey Area
Waterbody
Intertidal Bank
0 - 5 m Shoal
5 - 10 m Shoal

***Pacific NorthWest LNG***
**Daytime Fish Hydroacoustic Survey 16 (January 17-24, 2016): MVBS 100 m Segments**

*MARINE FISH PROGRAM - FINAL REPORT*

*Sources: Government of British Columbia; Prince Rupert Port Authority; Government of Canada, Natural Resources Canada, Centre for Topographic Information; Progress Energy Canada Ltd.*

*Although there is no reason to believe that there are any errors associated with the data used to generate this product or in the product itself, users of these data are advised that errors in the data may be present.*

DATE: 20-APR-16
FIGURE ID: 123110537
DRAWN BY: R. CAMPBELL
PROJECTION: UTM - ZONE 9
DATUM: NAD 83
CHECKED BY: J. NELSON

PREPARED BY: Stantec

PREPARED FOR: Pacific NorthWest LNG

FIGURE NO: **F-14**

\\cd1186-f04\workgroup\active\123110537\gis\figures\Marine_Fish_All_Surveys\Hydroacoustic_Surveys\Marfish_100m_intervals\fig_123110537_e-14_marine_Hydroacoustic_Survey_marfish_16_100m_Biomass.mxd
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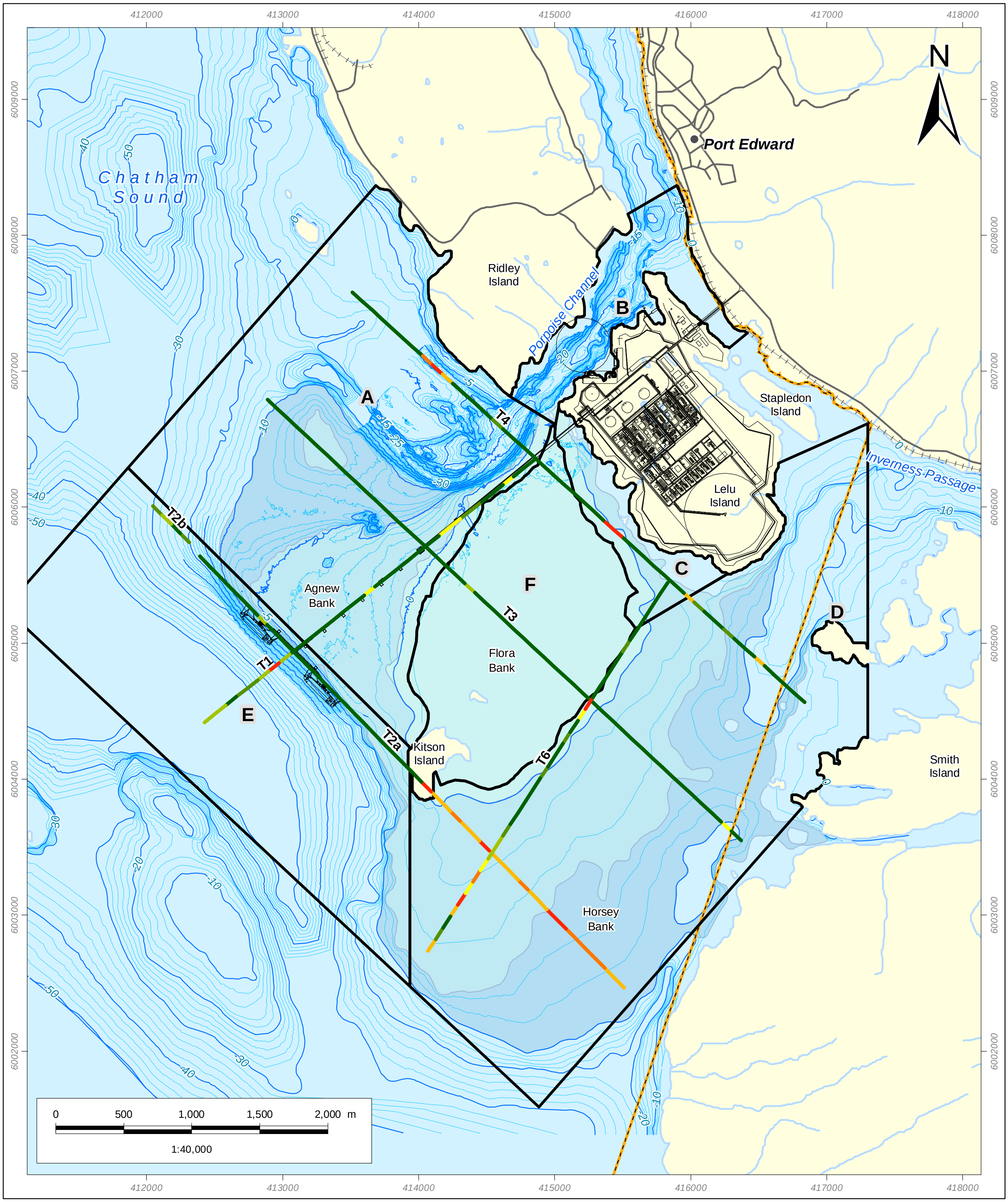


**Mean Volume Backscatter (MVBS) (dB)**

- -80 and less
- -75 to 80
- -70 to -75
- -65 to -70
- -60 to -65
- -55 to -60
- -55 and greater

Project Component

**Bathymetry (m)**

- Major Contour
- Minor Contour
- Railway
- Secondary Road
- Watercourse

- Prince Rupert Port Authority Boundary
- Survey Area
- Waterbody
- Intertidal Bank
- 0 - 5 m Shoal
- 5 - 10 m Shoal

***Pacific NorthWest LNG***

**Daytime Fish Hydroacoustic Survey 17 (February 11-17, 2016): MVBS 100 m Segments**

*MARINE FISH PROGRAM - FINAL REPORT*

*Sources: Government of British Columbia; Prince Rupert Port Authority; Government of Canada, Natural Resources Canada, Centre for Topographic Information; Progress Energy Canada Ltd.*

*Although there is no reason to believe that there are any errors associated with the data used to generate this product or in the product itself, users of these data are advised that errors in the data may be present.*

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|---|---|
| DATE: 20-APR-16 | PROJECTION: UTM - ZONE 9 |
| FIGURE ID: 123110537 | DATUM: NAD 83 |
| DRAWN BY: R. CAMPBELL | CHECKED BY: J. NELSON |

PREPARED BY: Stantec

PREPARED FOR: Pacific NorthWest LNG

FIGURE NO:

**F-15**

\\cd1186-f04\workgroup\active\123110537\gis\figures\Marine_Fish_All_Surveys\Hydroacoustic_Surveys\Marfish_100m_intervals\fig_123110537_e-15_marine_Hydroacoustic_Survey_marfish_17_100m_Biomass.mxd

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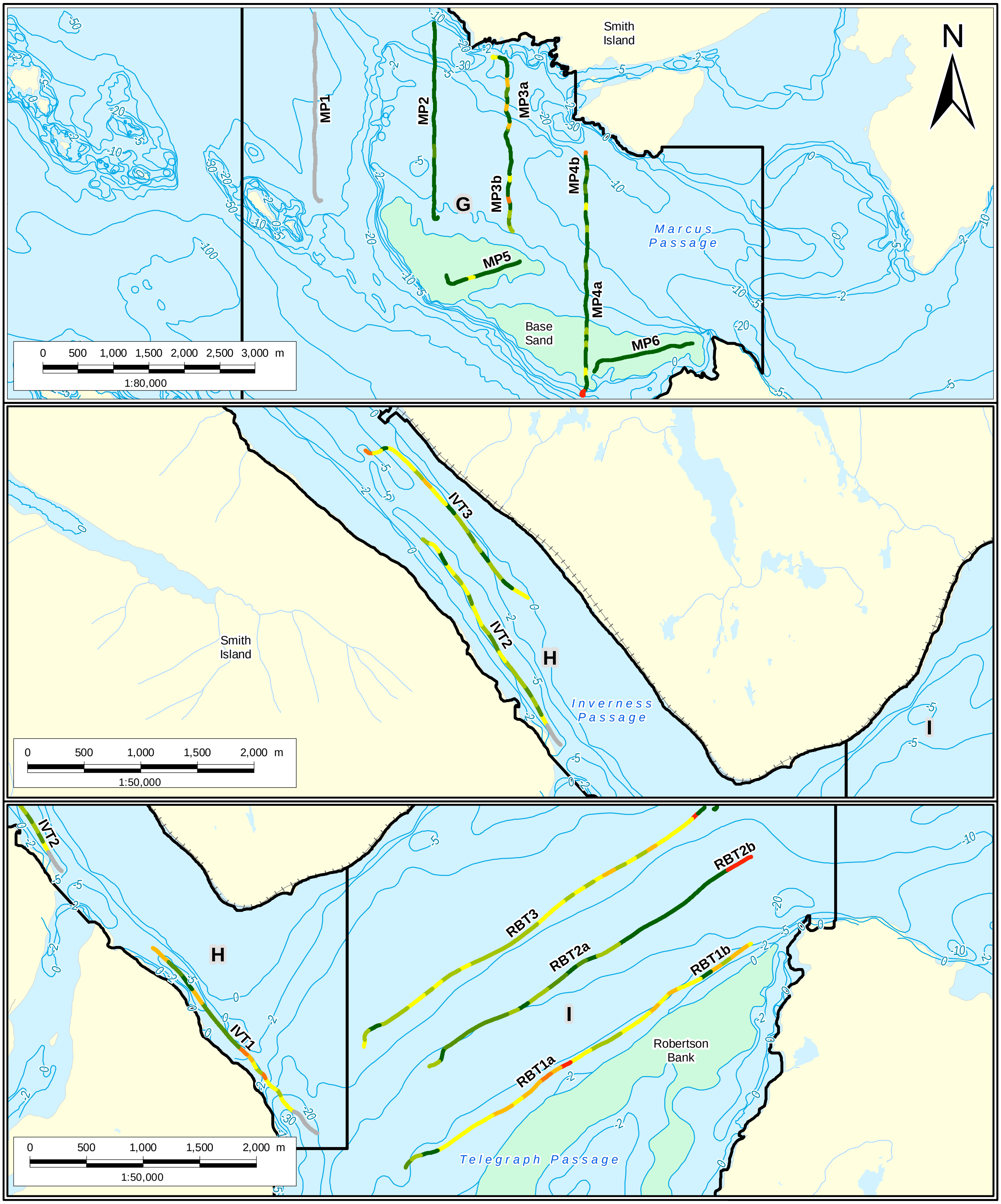


**Mean Volume Backscatter (MVBS) (dB)**

- -80 and less
- -75 to -80
- -70 to -75
- -65 to -70
- -60 to -65
- -55 to -60
- -55 and greater
- Substantial Plankton

- Depth Contour (m)
- Railway
- Watercourse
- Waterbody
- Intertidal Bank
- Survey Area

***Pacific NorthWest LNG***

**Survey Areas G, H, I**
**Daytime Fish Hydroacoustic Survey 9**
**(July 2 - 8, 2015): MVBS 100 m Segments**

*MARINE FISH PROGRAM - FINAL REPORT*

*Sources: Government of British Columbia; Prince Rupert Port Authority; Government of Canada, Natural Resources Canada, Centre for Topographic Information; Progress Energy Canada Ltd.*

*Although there is no reason to believe that there are any errors associated with the data used to generate this product or in the product itself, users of these data are advised that errors in the data may be present.*

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|---|---|
| DATE: 20-APR-16 | PROJECTION: UTM - ZONE 9 |
| FIGURE ID: 123110537 | DATUM: NAD 83 |
| DRAWN BY: R. CAMPBELL | CHECKED BY: S. O'REGAN |

PREPARED BY: Stantec

PREPARED FOR: Pacific NorthWest LNG

FIGURE NO:

**F-16**

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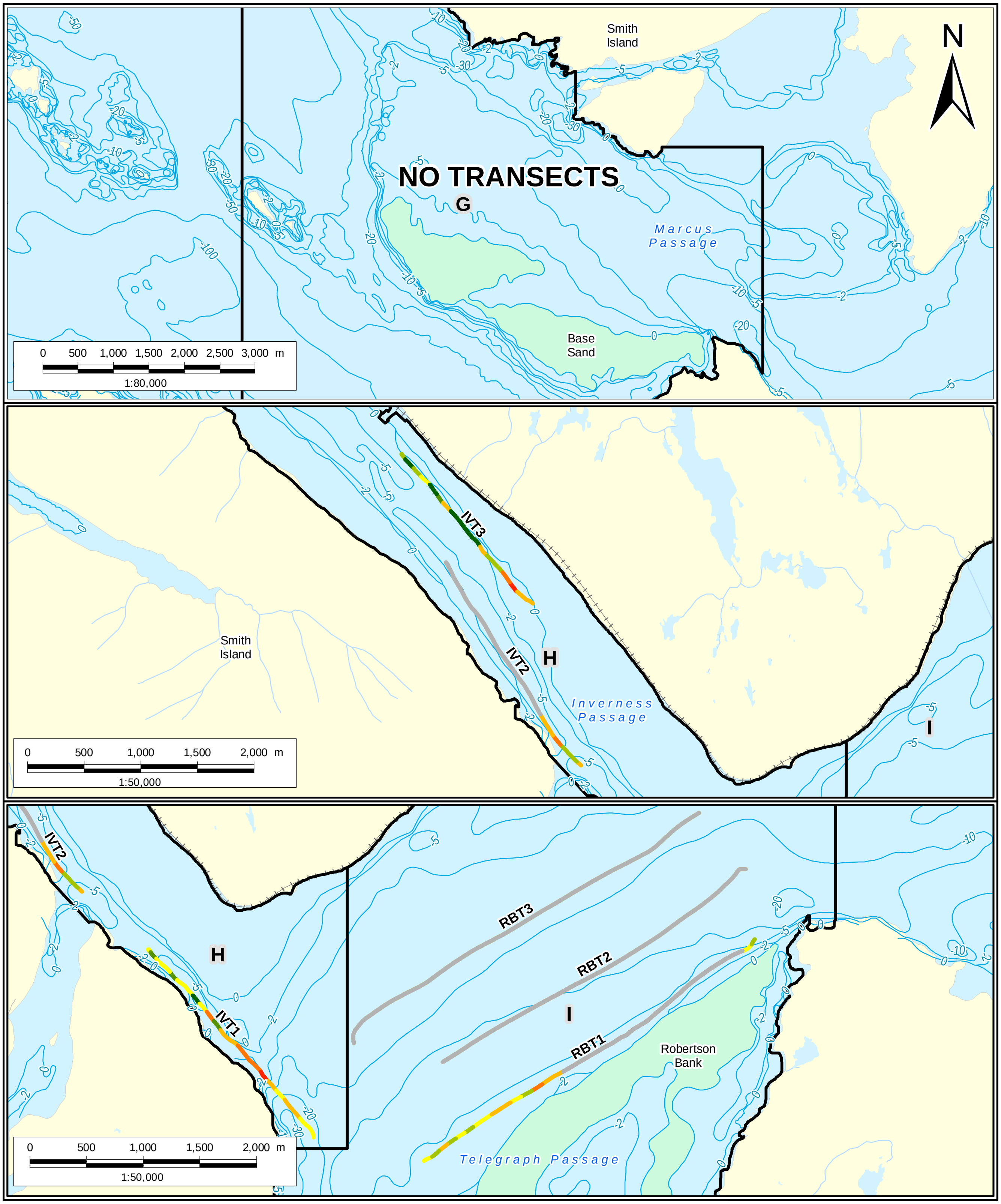


**Mean Volume Backscatter (MVBS) (dB)**

- -80 and less
- -75 to -80
- -70 to -75
- -65 to -70
- -60 to -65
- -55 to -60
- -55 and greater
- Substantial Plankton

- Depth Contour (m)
- Survey Area
- Railway
- Watercourse
- Waterbody
- Intertidal Bank

## *Pacific NorthWest LNG*
## Survey Areas G, H, I
## Daytime Fish Hydroacoustic Survey 10 (July 16 - 23, 2015): MVBS 100 m Segments

*MARINE FISH PROGRAM - FINAL REPORT*

*Sources: Government of British Columbia; Prince Rupert Port Authority; Government of Canada, Natural Resources Canada, Centre for Topographic Information; Progress Energy Canada Ltd.*

*Although there is no reason to believe that there are any errors associated with the data used to generate this product or in the product itself, users of these data are advised that errors in the data may be present.*

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|---|---|
| DATE: 20-APR-16 | PROJECTION: UTM - ZONE 9 |
| FIGURE ID: 123110537 | DATUM: NAD 83 |
| DRAWN BY: R. CAMPBELL | CHECKED BY: S. O'REGAN |

PREPARED BY: Stantec

PREPARED FOR: Pacific NorthWest LNG

FIGURE NO: **F-17**

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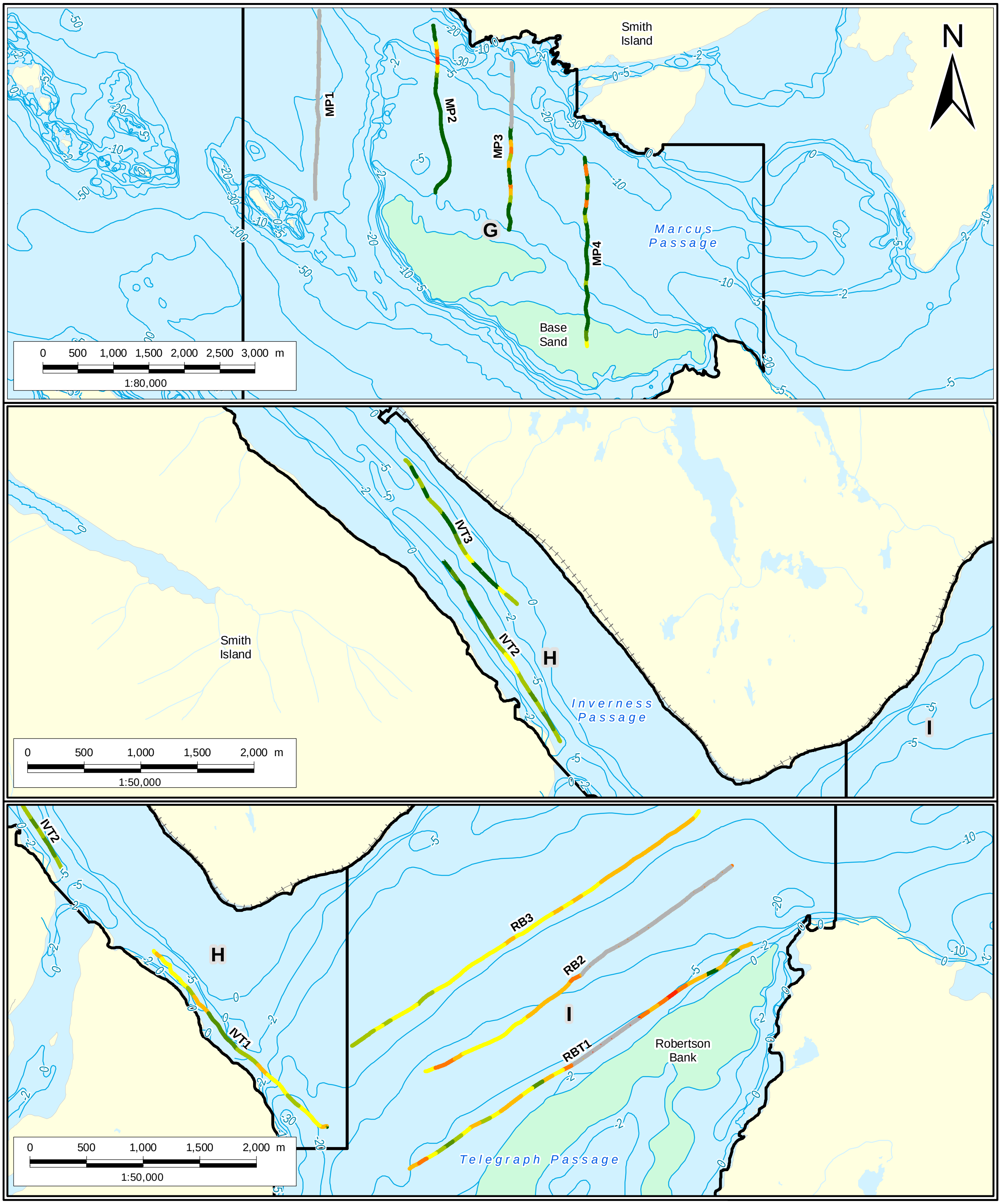


**Mean Volume Backscatter (MVBS) (dB)**

- -80 and less
- -75 to -80
- -70 to -75
- -65 to -70
- -60 to -65
- -55 to -60
- -55 and greater
- Substantial Plankton

- Depth Contour (m)
- Railway
- Watercourse
- Waterbody
- Intertidal Bank
- Survey Area

***Pacific NorthWest LNG***

**Survey Areas G, H, I**

**Daytime Fish Hydroacoustic Survey 11 (Aug 12 - 19, 2015): MVBS 100 m Segments**

*MARINE FISH PROGRAM - FINAL REPORT*

*Sources: Government of British Columbia; Prince Rupert Port Authority; Government of Canada, Natural Resources Canada, Centre for Topographic Information; Progress Energy Canada Ltd.*

*Although there is no reason to believe that there are any errors associated with the data used to generate this product or in the product itself, users of these data are advised that errors in the data may be present.*

| | |
|---|---|
| DATE: 20-APR-16 | PROJECTION: UTM - ZONE 9 |
| FIGURE ID: 123110537 | DATUM: NAD 83 |
| DRAWN BY: S. PARKER | CHECKED BY: R. CAMPBELL |

PREPARED BY: Stantec

PREPARED FOR: Pacific NorthWest LNG

FIGURE NO: **F-18**

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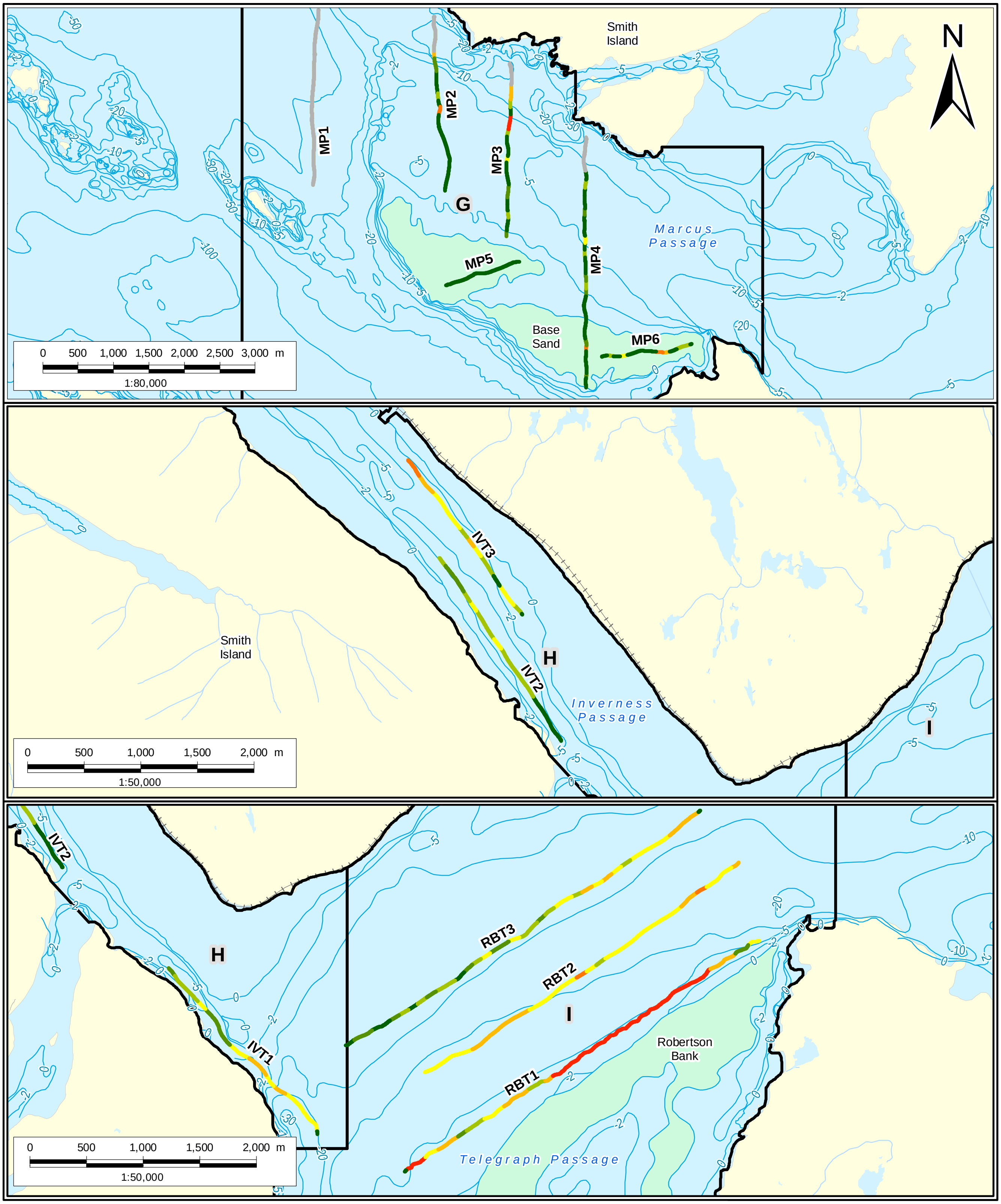


**Mean Volume Backscatter (MVBS) (dB)**

- -80 and less
- -75 to 80
- -70 to -75
- -65 to -70
- -60 to -65
- -55 to -60
- -55 and greater
- Substantial Plankton

- Depth Contour (m)
- Survey Area
- Railway
- Watercourse
- Waterbody
- Intertidal Bank

***Pacific NorthWest LNG***

**Survey Areas G, H, I**
**Daytime Fish Hydroacoustic Survey 12 (Sept 14 - 19, 2015): MVBS 100 m Segments**

*MARINE FISH PROGRAM - FINAL REPORT*

*Sources: Government of British Columbia; Prince Rupert Port Authority; Government of Canada, Natural Resources Canada, Centre for Topographic Information; Progress Energy Canada Ltd.*

*Although there is no reason to believe that there are any errors associated with the data used to generate this product or in the product itself, users of these data are advised that errors in the data may be present.*

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|---|---|
| DATE: 20-APR-16 | PROJECTION: UTM - ZONE 9 |
| FIGURE ID: 123110537 | DATUM: NAD 83 |
| DRAWN BY: R. CAMPBELL | CHECKED BY: S. O'REGAN |

PREPARED BY: Stantec

PREPARED FOR: Pacific NorthWest LNG

FIGURE NO:

**F-19**

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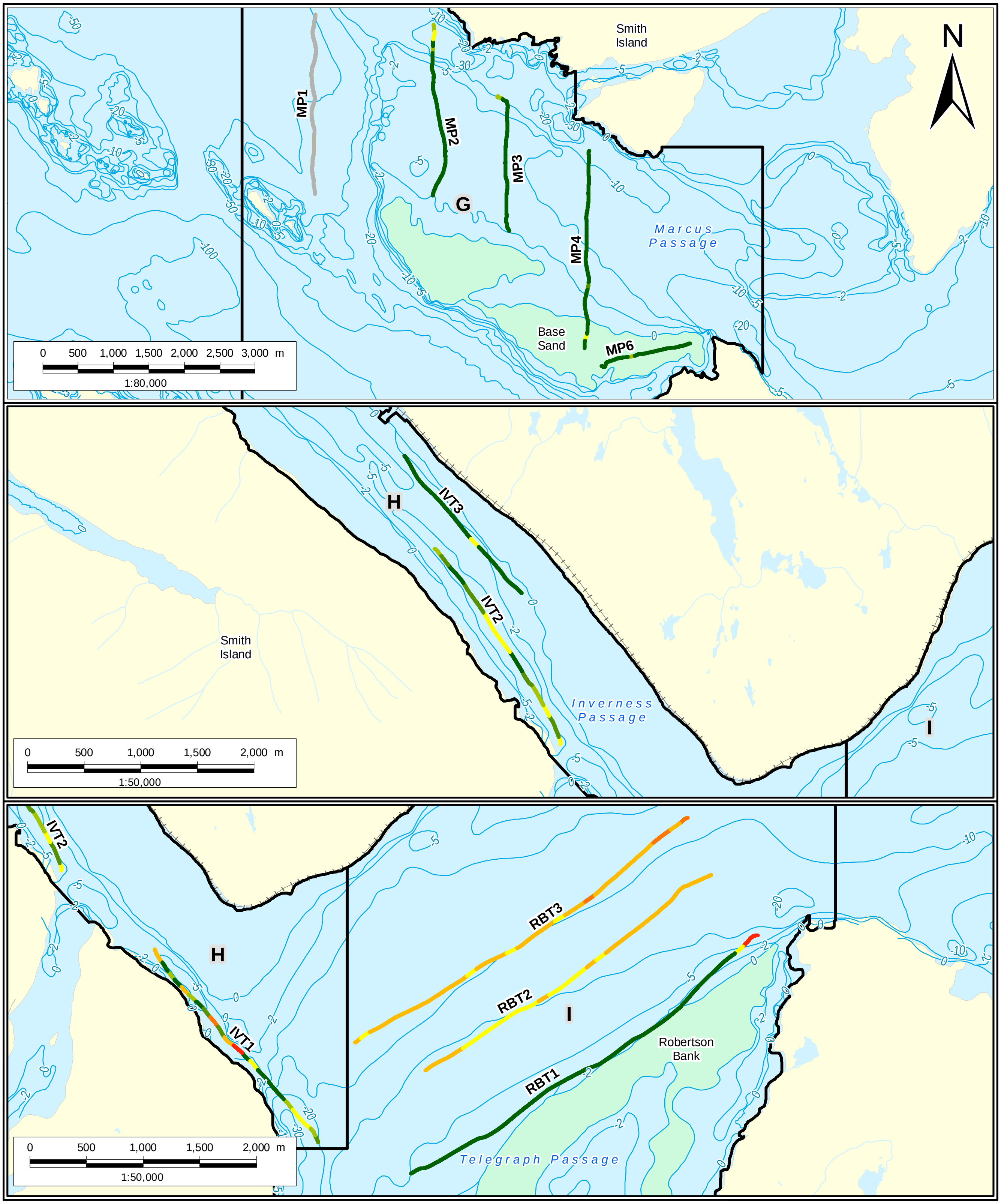


**Mean Volume Backscatter (MVBS) (dB)**

- -80 and less
- -75 to -80
- -70 to -75
- -65 to -70
- -60 to -65
- -55 to -60
- -55 and greater
- Substantial Plankton

- Depth Contour (m)
- Survey Area
- Railway
- Watercourse
- Waterbody
- Intertidal Bank

***Pacific NorthWest LNG***

**Survey Areas G, H, I**
**Daytime Fish Hydroacoustic Survey 13**
**(Oct 30 - Nov 4, 2015): MVBS 100 m Segments**

*MARINE FISH PROGRAM - FINAL REPORT*

*Sources: Government of British Columbia; Prince Rupert Port Authority; Government of Canada, Natural Resources Canada, Centre for Topographic Information; Progress Energy Canada Ltd.*

*Although there is no reason to believe that there are any errors associated with the data used to generate this product or in the product itself, users of these data are advised that errors in the data may be present.*

| | |
|---|---|
| DATE: 20-APR-16 | PROJECTION: UTM - ZONE 9 |
| FIGURE ID: 123110537 | DATUM: NAD 83 |
| DRAWN BY: K. JAMES | CHECKED BY: S. O'REGAN |

PREPARED BY: Stantec

PREPARED FOR: Pacific NorthWest LNG

FIGURE NO:

**F-20**

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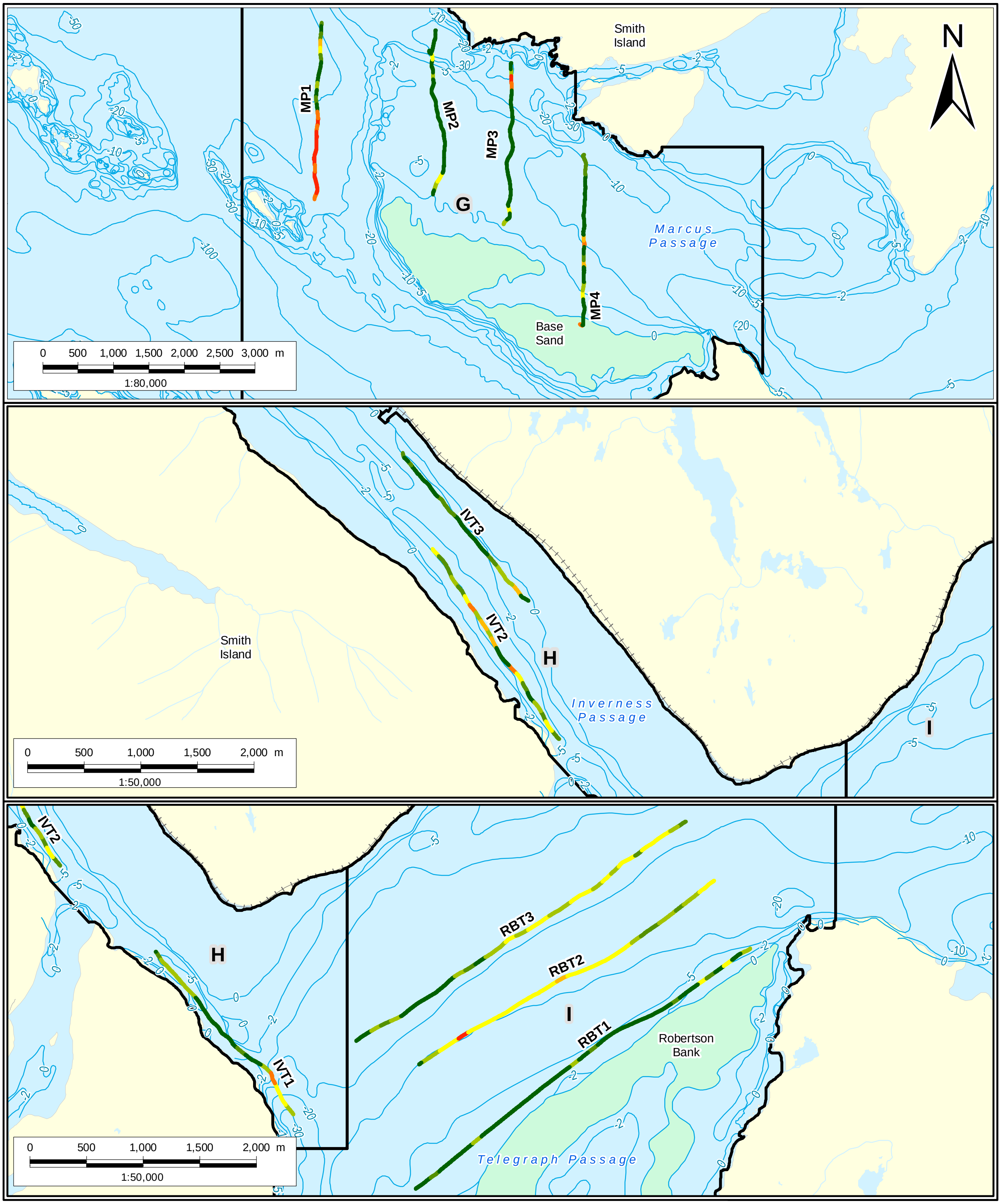


**Mean Volume Backscatter (MVBS) (dB)**

- -80 and less
- -75 to 80
- -70 to -75
- -65 to -70
- -60 to -65
- -55 to -60
- -55 and greater
- Substantial Plankton

- Depth Contour (m)
- Survey Area
- Railway
- Watercourse
- Waterbody
- Intertidal Bank

***Pacific NorthWest LNG***

**Survey Areas G, H, I**

**Daytime Fish Hydroacoustic Survey 14 (Nov 26 - Dec 3, 2015): MVBS 100 m Segments**

*MARINE FISH PROGRAM - FINAL REPORT*

*Sources: Government of British Columbia; Prince Rupert Port Authority; Government of Canada, Natural Resources Canada, Centre for Topographic Information; Progress Energy Canada Ltd.*

*Although there is no reason to believe that there are any errors associated with the data used to generate this product or in the product itself, users of these data are advised that errors in the data may be present.*

| | |
|---|---|
| DATE: 20-APR-16 | PROJECTION: UTM - ZONE 9 |
| FIGURE ID: 123110537 | DATUM: NAD 83 |
| DRAWN BY: K. JAMES | CHECKED BY: S. O'REGAN |

PREPARED BY:

Stantec

PREPARED FOR:

Pacific NorthWest LNG

FIGURE NO:

**F-21**

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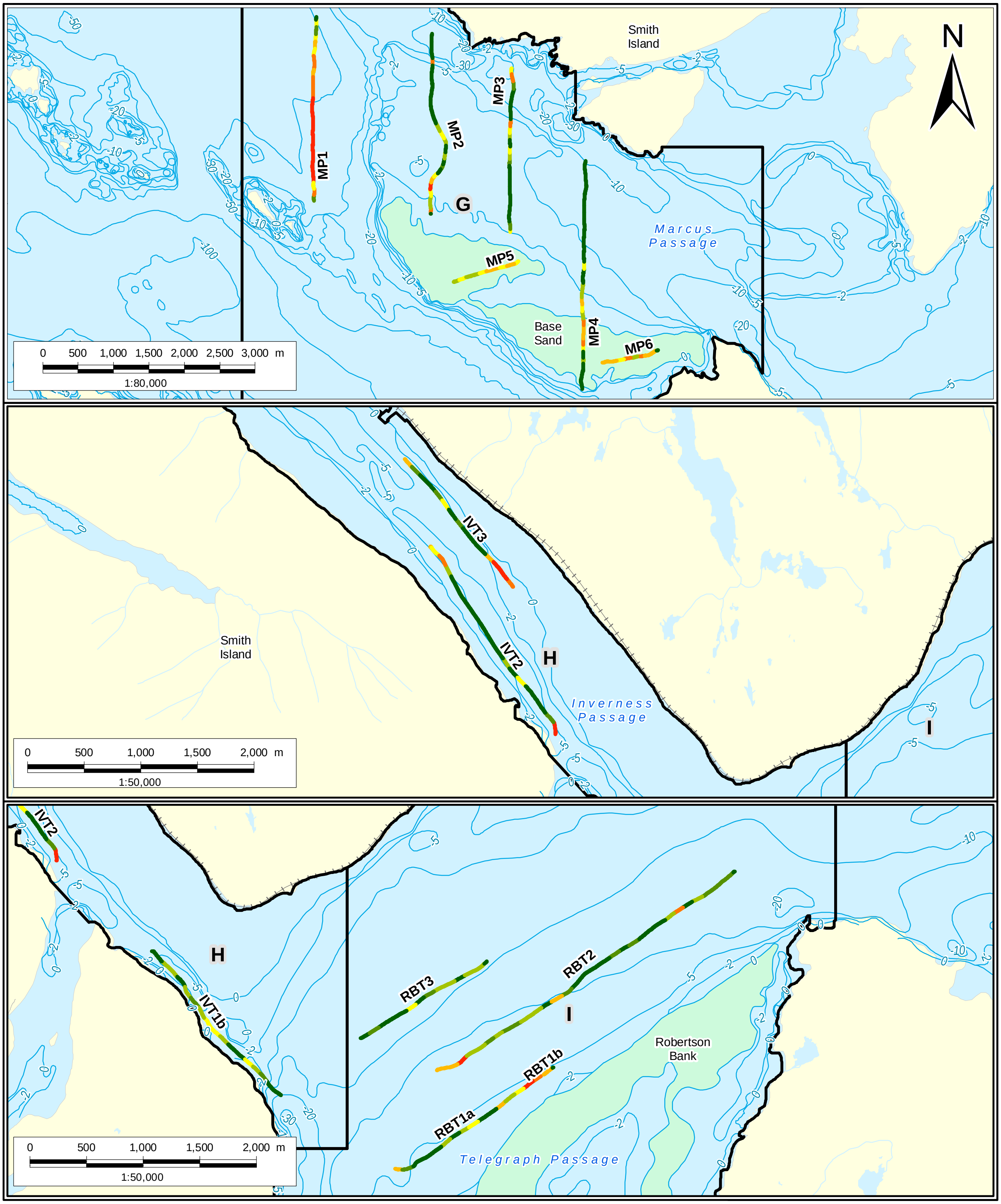


**Mean Volume Backscatter (MVBS) (dB)**

- -80 and less
- -75 to 80
- -70 to -75
- -65 to -70
- -60 to -65
- -55 to -60
- -55 and greater
- Substantial Plankton

- Depth Contour (m)
- Survey Area
- Railway
- Watercourse
- Waterbody
- Intertidal Bank

## *Pacific NorthWest LNG*
## Survey Areas G, H, I
## Daytime Fish Hydroacoustic Survey 15 (Dec 10-13, 2015): MVBS 100 m Segments

*MARINE FISH PROGRAM - FINAL REPORT*

*Sources: Government of British Columbia; Prince Rupert Port Authority; Government of Canada, Natural Resources Canada, Centre for Topographic Information; Progress Energy Canada Ltd.*

*Although there is no reason to believe that there are any errors associated with the data used to generate this product or in the product itself, users of these data are advised that errors in the data may be present.*

| | |
|---|---|
| DATE: 20-APR-16 | PROJECTION: UTM - ZONE 9 |
| FIGURE ID: 123110537 | DATUM: NAD 83 |
| DRAWN BY: S. PARKER | CHECKED BY: M.BAILEY |

PREPARED BY: Stantec

PREPARED FOR: Pacific NorthWest LNG

FIGURE NO: **F-22**

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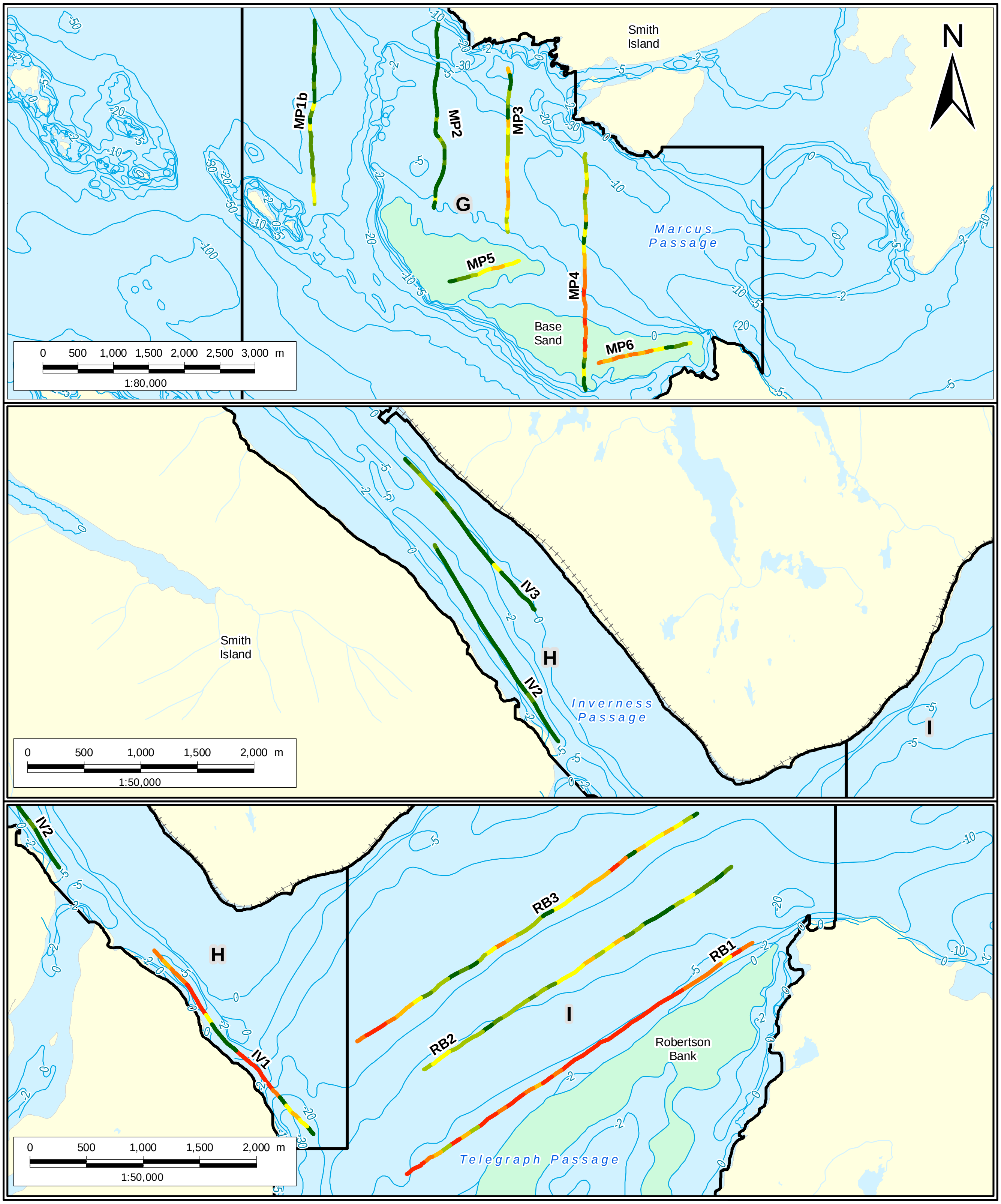


**Mean Volume Backscatter (MVBS) (dB)**
- -80 and less
- -75 to 80
- -70 to -75
- -65 to -70
- -60 to -65
- -55 to -60
- -55 and greater
- Substantial Plankton

- Depth Contour (m)
- Survey Area
- Railway
- Watercourse
- Waterbody
- Intertidal Bank

## *Pacific NorthWest LNG*
## Survey Areas G, H, I
## Daytime Fish Hydroacoustic Survey 16 (Jan 17-24, 2016): MVBS 100 m Segments

*MARINE FISH PROGRAM - FINAL REPORT*

*Sources: Government of British Columbia; Prince Rupert Port Authority; Government of Canada, Natural Resources Canada, Centre for Topographic Information; Progress Energy Canada Ltd.*

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| | |
|---|---|
| DATE: 20-APR-16 | PROJECTION: UTM - ZONE 9 |
| FIGURE ID: 123110537 | DATUM: NAD 83 |
| DRAWN BY: R.COATTA | CHECKED BY: J.NELSON |

PREPARED BY: Stantec

PREPARED FOR: Pacific NorthWest LNG

FIGURE NO: **F-23**

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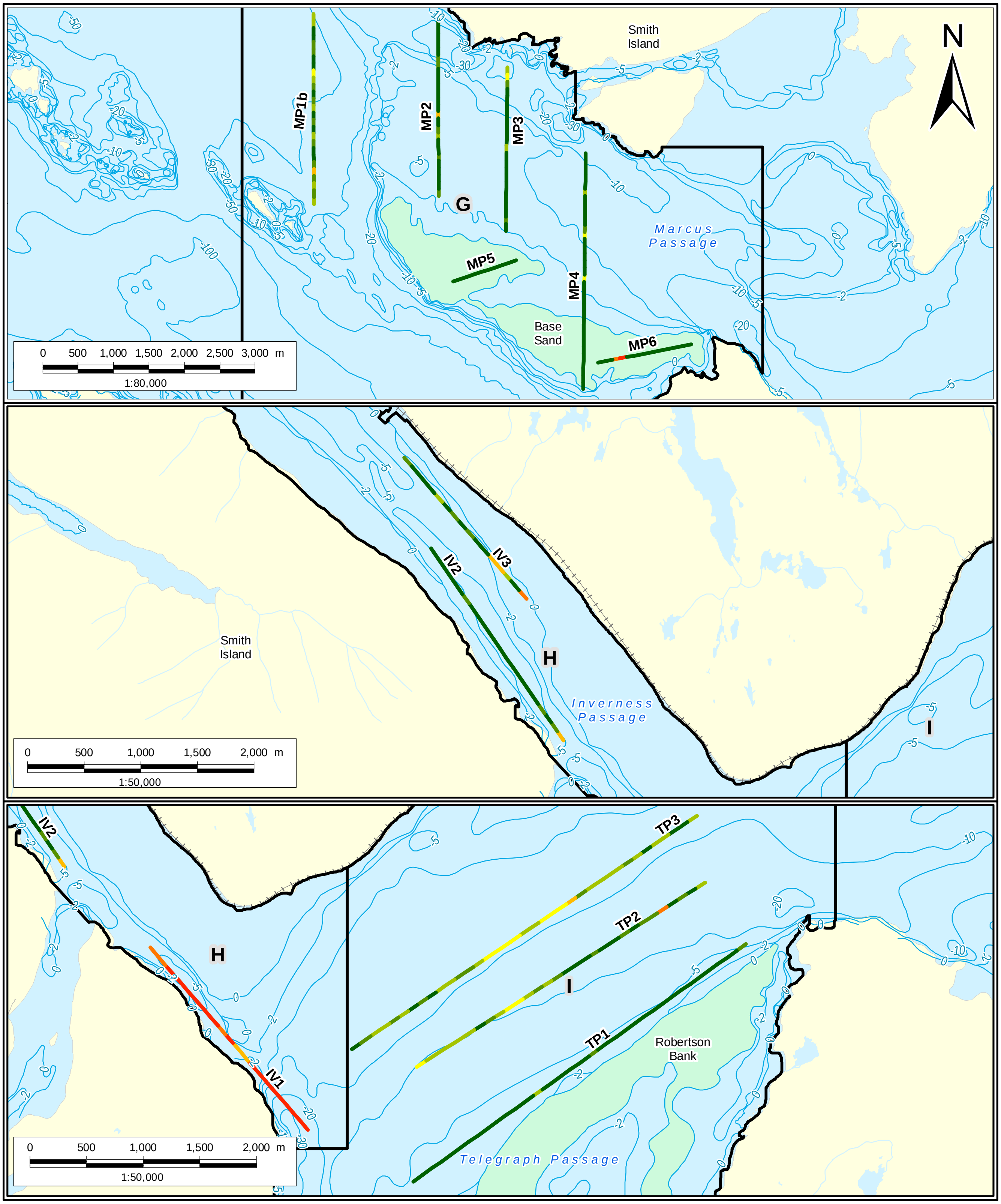


**Mean Volume Backscatter (MVBS) (dB)**

- -80 and less
- -75 to 80
- -70 to -75
- -65 to -70
- -60 to -65
- -55 to -60
- -55 and greater
- Substantial Plankton

- Depth Contour (m)
- Railway
- Watercourse
- Waterbody
- Intertidal Bank
- Survey Area

***Pacific NorthWest LNG***

**Survey Areas G, H, I**
**Daytime Fish Hydroacoustic Survey 17**
**(Feb 11-17, 2016): MVBS 100 m Segments**

*MARINE FISH PROGRAM - FINAL REPORT*

*Sources: Government of British Columbia; Prince Rupert Port Authority; Government of Canada, Natural Resources Canada, Centre for Topographic Information; Progress Energy Canada Ltd.*

*Although there is no reason to believe that there are any errors associated with the data used to generate this product or in the product itself, users of these data are advised that errors in the data may be present.*

| | |
|---|---|
| DATE: 20-APR-16 | PROJECTION: UTM - ZONE 9 |
| FIGURE ID: 123110537 | DATUM: NAD 83 |
| DRAWN BY: R.COATTA | CHECKED BY: J.NELSON |

PREPARED BY:

Stantec

PREPARED FOR:

Pacific NorthWest LNG

FIGURE NO:

**F-24**

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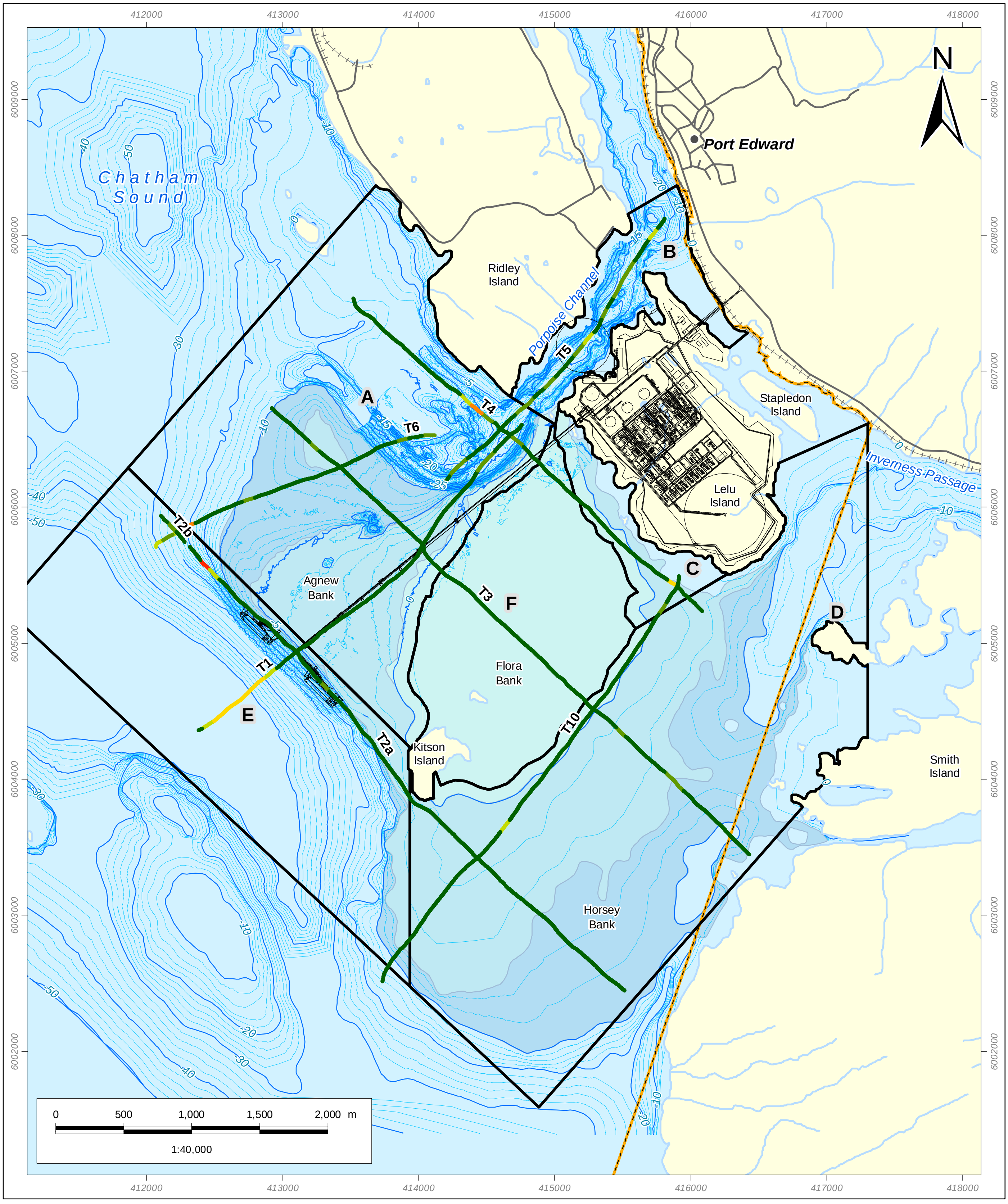



**Acoustic Fish Density Estimates (Fish/ha)**

- < 1
- 1 - 100
- 100 - 500
- 500 - 1,000
- 1,000 - 10,000
- > 10,000
- Substantial Plankton

- Project Component

**Bathymetry (m)**

- Major Contour
- Minor Contour
- Railway
- Secondary Road
- Watercourse

- Prince Rupert Port Authority Boundary
- Survey Area
- Waterbody
- Intertidal Bank
- 0 - 5 m Shoal
- 5 - 10 m Shoal

***Pacific NorthWest LNG***

**Daytime Fish Hydroacoustic Survey 2 (January 29 - 31, 2015): Fish Density 100 m Segments**

*MARINE FISH PROGRAM - FINAL REPORT*

*Sources: Government of British Columbia; Prince Rupert Port Authority; Government of Canada, Natural Resources Canada, Centre for Topographic Information; Progress Energy Canada Ltd.*

*Although there is no reason to believe that there are any errors associated with the data used to generate this product or in the product itself, users of these data are advised that errors in the data may be present.*

DATE: 20-APR-16
FIGURE ID: 123110537
DRAWN BY: S. PARKER

PROJECTION: UTM - ZONE 9
DATUM: NAD 83
CHECKED BY: R. CAMPBELL

PREPARED BY: Stantec

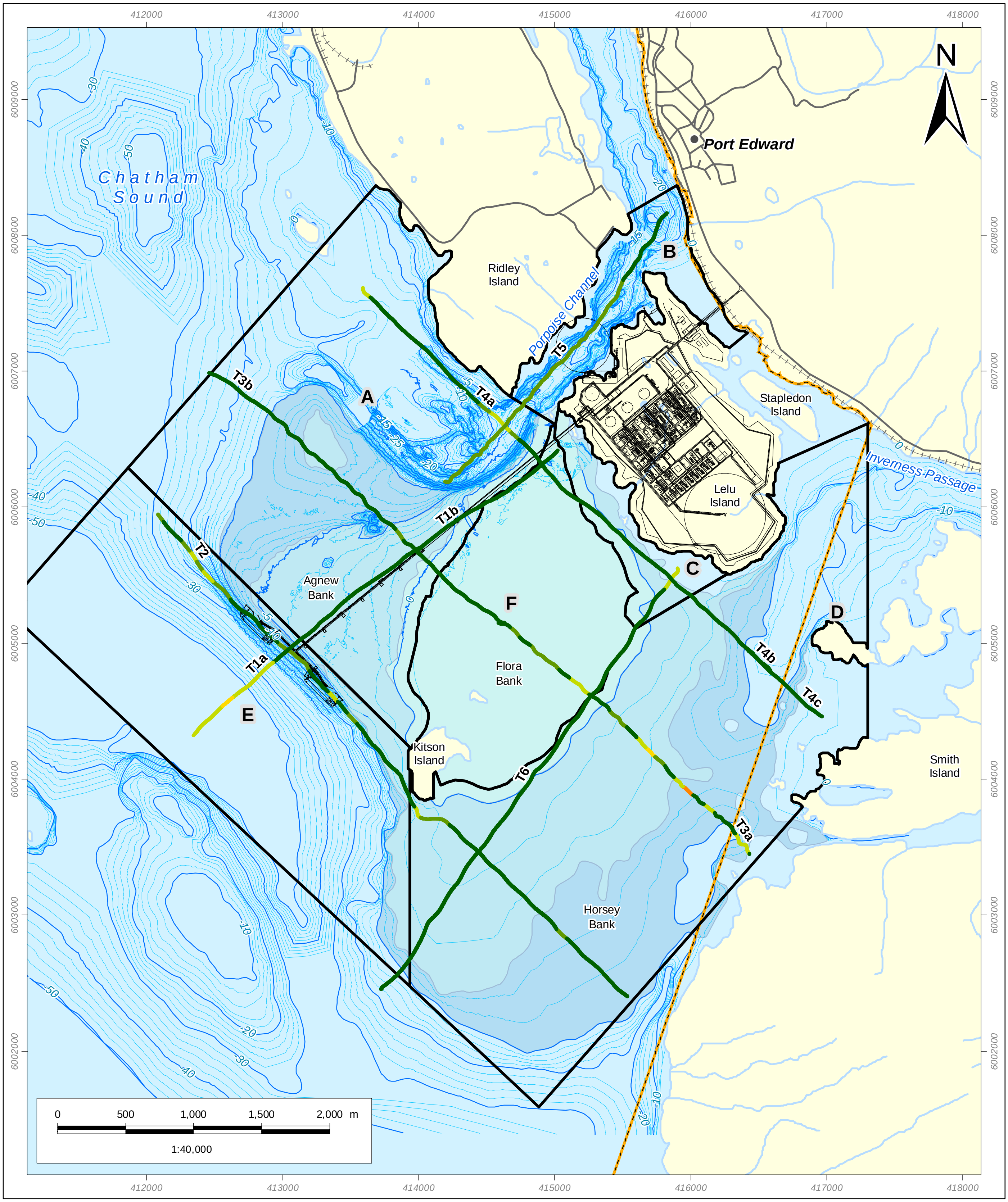
PREPARED FOR: Pacific NorthWest LNG

FIGURE NO:

**F-25**

\\cd1186-f04\workgroup\active\123110537\gis\figures\Marine_Fish_All_Surveys\Hydroacoustic_Surveys\Marfish_100m_intervals\fig_123110537_f-25_marine_Hydroacoustic_Survey_marfish_02_100m_Density.mxd

4/20/2016 - 2:48:04 PM




**Acoustic Fish Density Estimates (Fish/ha)**

- < 1
- 1 - 100
- 100 - 500
- 500 - 1,000
- 1,000 - 10,000
- > 10,000
- Substantial Plankton

Project Component

**Bathymetry (m)**

- Major Contour
- Minor Contour
- Railway
- Secondary Road
- Watercourse
- Prince Rupert Port Authority Boundary
- Survey Area
- Waterbody
- Intertidal Bank
- 0 - 5 m Shoal
- 5 - 10 m Shoal

***Pacific NorthWest LNG***

## Daytime Fish Hydroacoustic Survey 3 (February 18 - 21, 2015): Fish Density 100 m Segments

*MARINE FISH PROGRAM - FINAL REPORT*

*Sources: Government of British Columbia; Prince Rupert Port Authority; Government of Canada, Natural Resources Canada, Centre for Topographic Information; Progress Energy Canada Ltd.*

*Although there is no reason to believe that there are any errors associated with the data used to generate this product or in the product itself, users of these data are advised that errors in the data may be present.*

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| DATE: 20-APR-16 | PROJECTION: UTM - ZONE 9 |
| FIGURE ID: 123110537 | DATUM: NAD 83 |
| DRAWN BY: K. JAMES | CHECKED BY: R. CAMPBELL |

PREPARED BY: Stantec

PREPARED FOR: Pacific NorthWest LNG

FIGURE NO: **F-26**

\\cd1186-f04\workgroup\active\123110537\gis\figures\Marine_Fish_All_Surveys\Marfish_100m_intervals\fig_123110537_f-26_marine_Hydroacoustic_Survey_marfish_03_100m_Density.mxd

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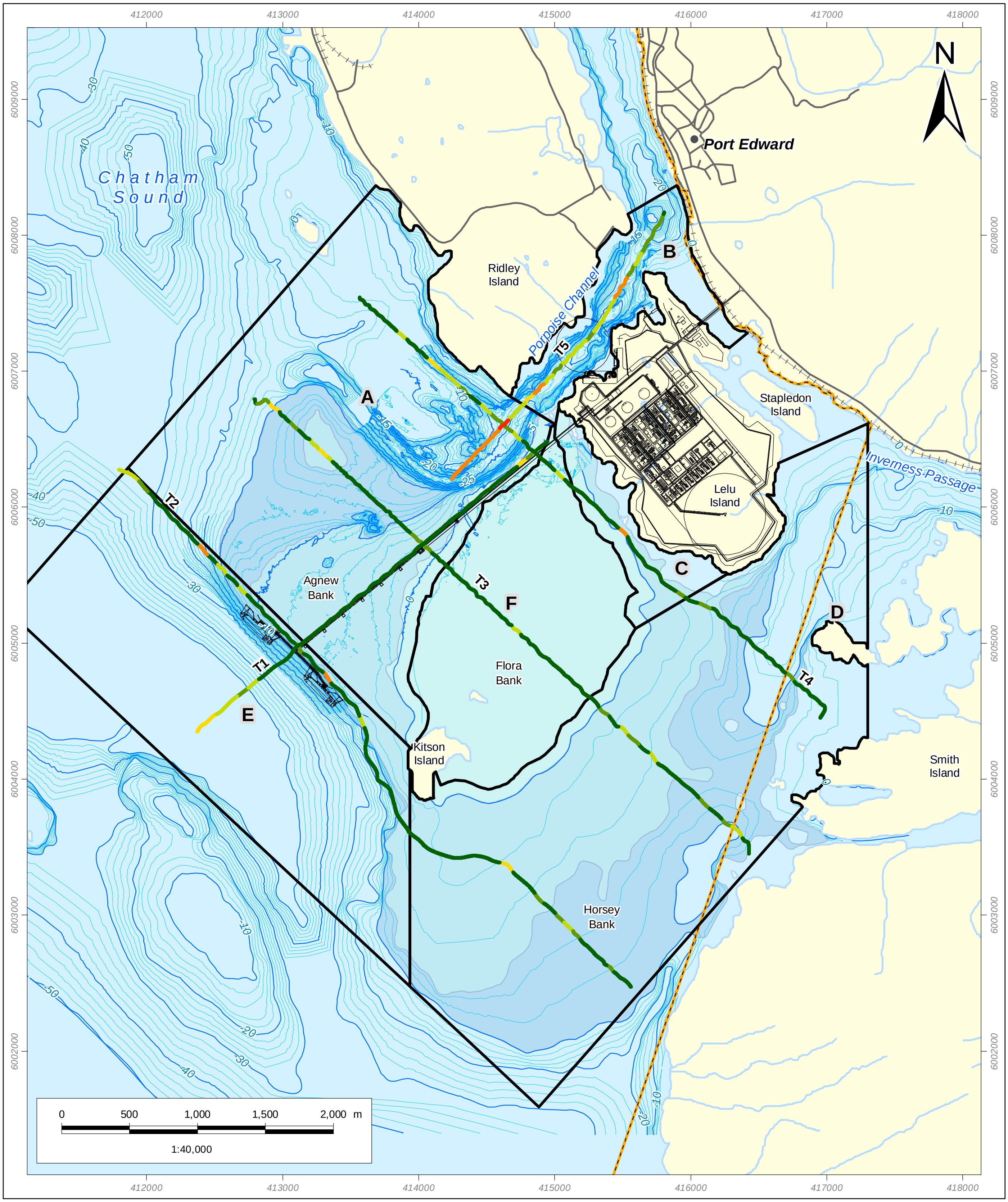


**Acoustic Fish Density Estimates (Fish/ha)**

- < 1
- 1 - 100
- 100 - 500
- 500 - 1,000
- 1,000 - 10,000
- > 10,000
- Substantial Plankton

- Project Component

**Bathymetry (m)**

- Major Contour
- Minor Contour
- Railway
- Secondary Road
- Watercourse

- Prince Rupert Port Authority Boundary
- Survey Area
- Waterbody
- Intertidal Bank
- 0 - 5 m Shoal
- 5 - 10 m Shoal

***Pacific NorthWest LNG***

**Daytime Fish Hydroacoustic Survey 4 (March 23 - 24, 2015): Fish Density 100 m Segments**

*MARINE FISH PROGRAM - FINAL REPORT*

*Sources: Government of British Columbia; Prince Rupert Port Authority; Government of Canada, Natural Resources Canada, Centre for Topographic Information; Progress Energy Canada Ltd.*

*Although there is no reason to believe that there are any errors associated with the data used to generate this product or in the product itself, users of these data are advised that errors in the data may be present.*

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|---|---|
| DATE: 20-APR-16 | PROJECTION: UTM - ZONE 9 |
| FIGURE ID: 123110537 | DATUM: NAD 83 |
| DRAWN BY: L. HOPPER | CHECKED BY: R. CAMPBELL |

PREPARED BY: Stantec

PREPARED FOR: Pacific NorthWest LNG

FIGURE NO:

**F-27**

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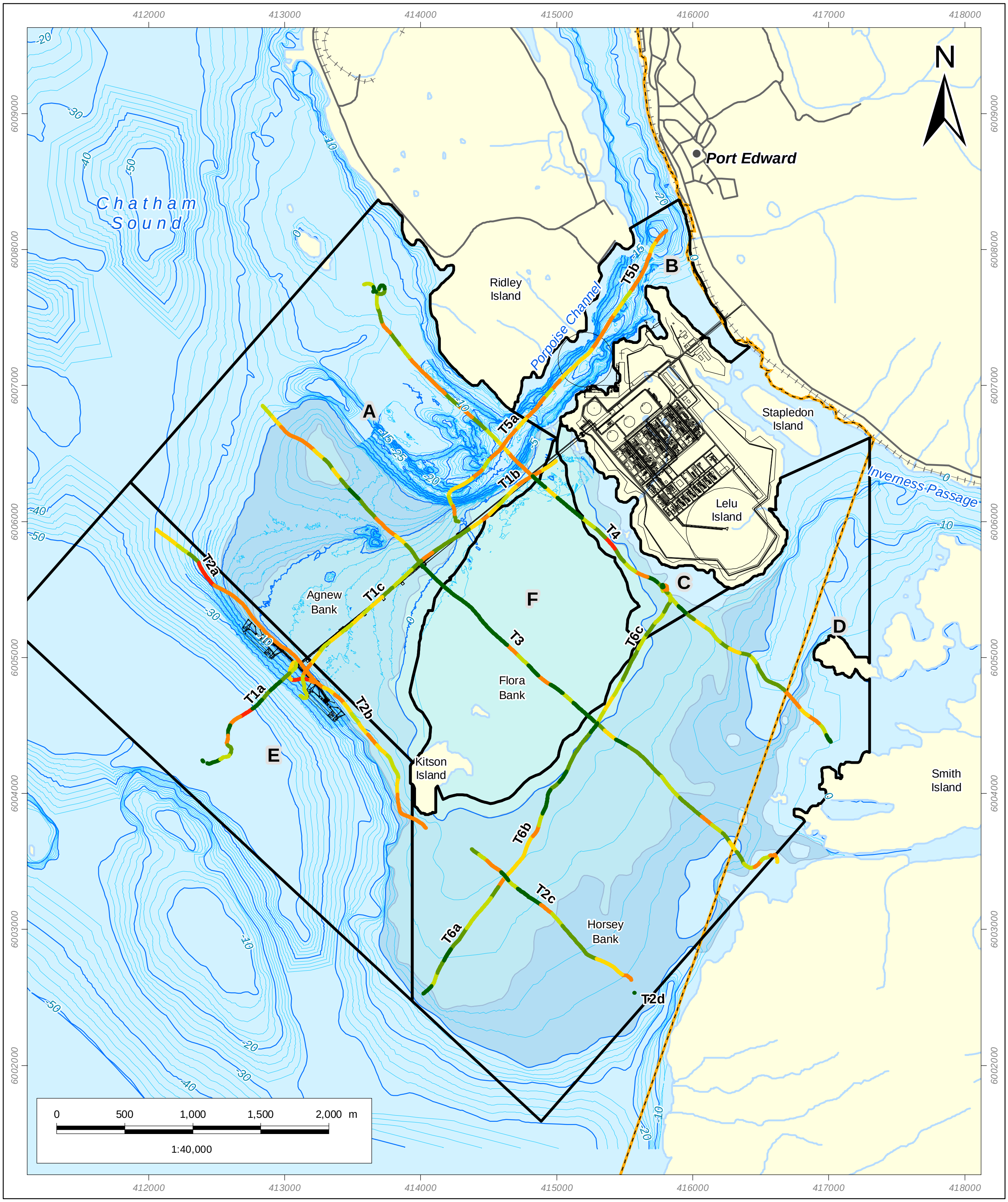


**Acoustic Fish Density Estimates (Fish/ha)**

- < 1
- 1 - 100
- 100 - 500
- 500 - 1,000
- 1,000 - 10,000
- > 10,000
- Substantial Plankton

Project Component

**Bathymetry (m)**

- Major Contour
- Minor Contour
- Railway
- Secondary Road
- Watercourse
- Prince Rupert Port Authority Boundary
- Survey Area
- Waterbody
- Intertidal Bank
- 0 - 5 m Shoal
- 5 - 10 m Shoal

***Pacific NorthWest LNG***

**Daytime Fish Hydroacoustic Survey 9 (July 2 - 8, 2015): Fish Density 100 m Segments**

*MARINE FISH PROGRAM - FINAL REPORT*

*Sources: Government of British Columbia; Prince Rupert Port Authority; Government of Canada, Natural Resources Canada, Centre for Topographic Information; Progress Energy Canada Ltd.*

*Although there is no reason to believe that there are any errors associated with the data used to generate this product or in the product itself, users of these data are advised that errors in the data may be present.*

| | |
|---|---|
| DATE: 20-APR-16 | PROJECTION: UTM - ZONE 9 |
| FIGURE ID: 123110537 | DATUM: NAD 83 |
| DRAWN BY: R. CAMPBELL | CHECKED BY: S. O'REGAN |

PREPARED BY: Stantec

PREPARED FOR: Pacific NorthWest LNG

FIGURE NO: **F-28**

\\cd1186-f04\workgroup\active\123110537\gis\figures\Marine_Fish_All_Surveys\Hydroacoustic_Surveys\Marfish_100m_intervals\fig_123110537_f-28_marine_Hydroacoustic_Survey_marfish_09_100m_Density.mxd

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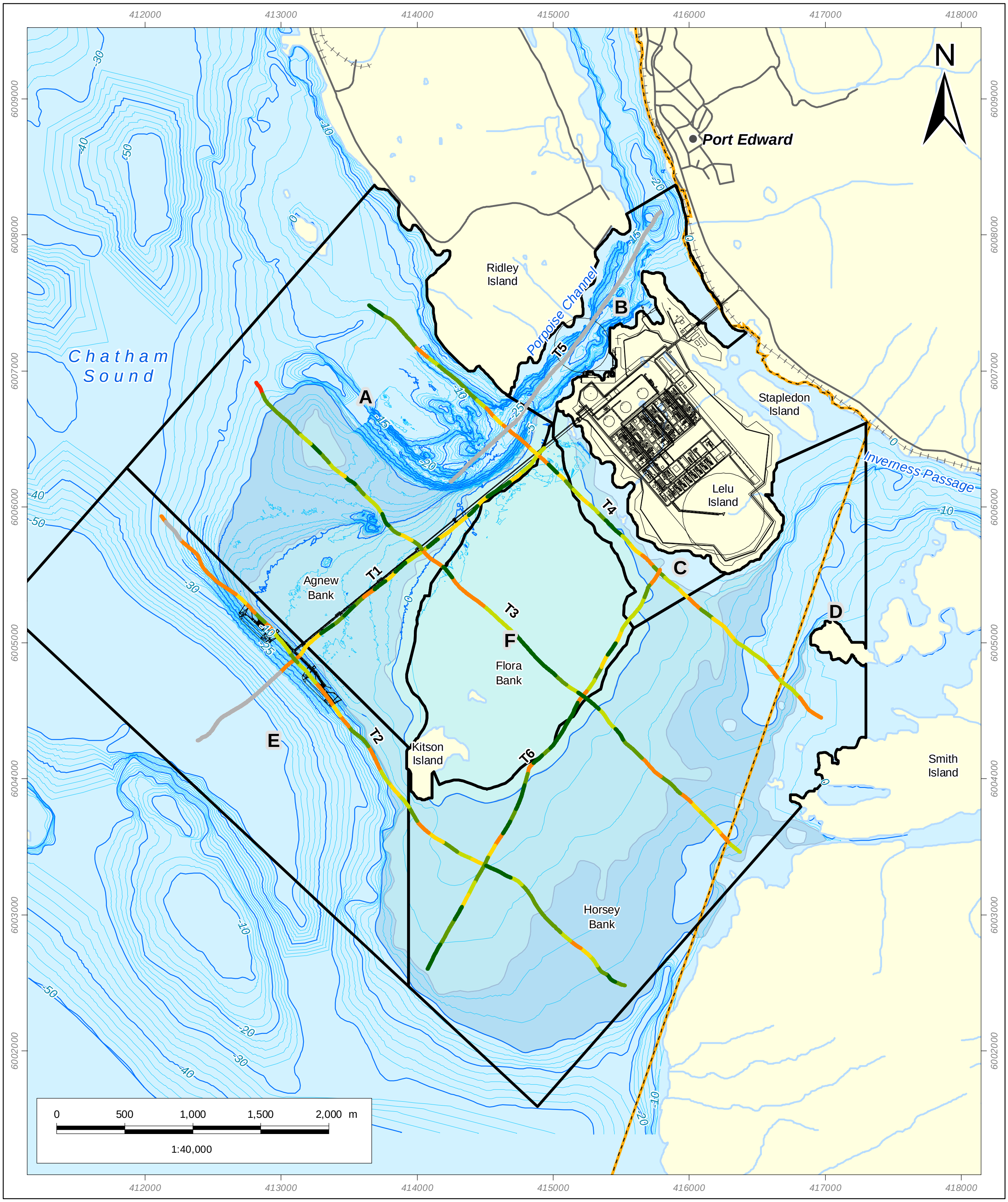


**Acoustic Fish Density Estimates (Fish/ha)**
- < 1
- 1 - 100
- 100 - 500
- 500 - 1000
- 1000 - 10000
- > 10000
- Substantial Plankton

- Project Component

**Bathymetry (m)**
- Major Contour
- Minor Contour
- Railway
- Secondary Road
- Watercourse

- Prince Rupert Port Authority Boundary
- Survey Area
- Waterbody
- Intertidal Bank
- 0 - 5 m Shoal
- 5 - 10 m Shoal

***Pacific NorthWest LNG***
**Daytime Fish Hydroacoustic Survey 10 (July 16 - 23, 2015): Fish Density 100 m Segments**

*MARINE FISH PROGRAM - FINAL REPORT*

*Sources: Government of British Columbia; Prince Rupert Port Authority; Government of Canada, Natural Resources Canada, Centre for Topographic Information; Progress Energy Canada Ltd.*

*Although there is no reason to believe that there are any errors associated with the data used to generate this product or in the product itself, users of these data are advised that errors in the data may be present.*

DATE: 20-APR-16
FIGURE ID: 123110537
DRAWN BY: R. CAMPBELL
PROJECTION: UTM - ZONE 9
DATUM: NAD 83
CHECKED BY: S. O'REGAN

PREPARED BY: Stantec

PREPARED FOR: Pacific NorthWest LNG

FIGURE NO: **F-29**

\\cd1186-f04\workgroup\active\123110537\gis\figures\Marine_Fish_All_Surveys\Hydroacoustic_Surveys\Marfish_100m_intervals\fig_123110537_f-29_marine_Hydroacoustic_Survey_marfish_10_100m_Density.mxd

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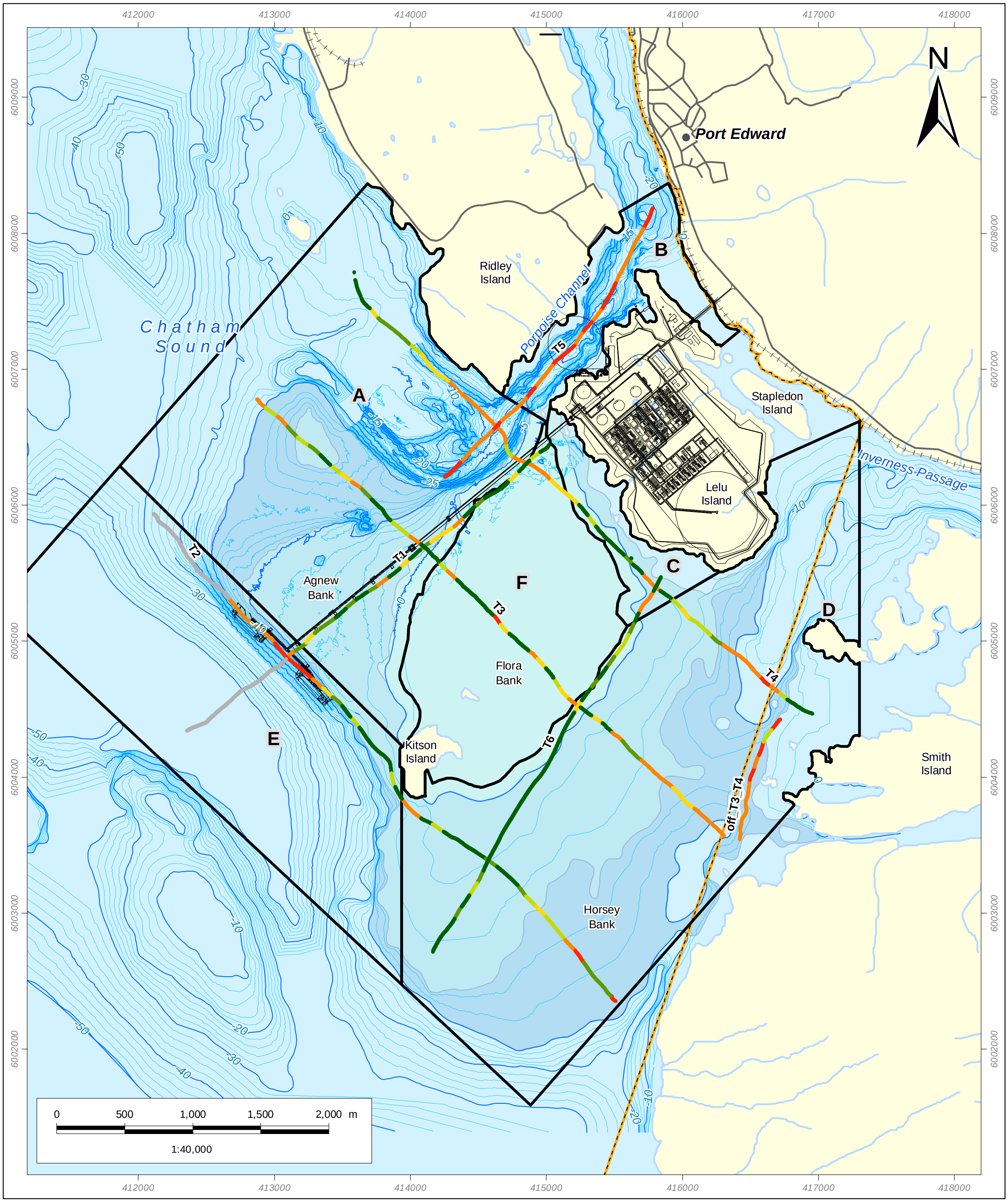


**Acoustic Fish Density Estimates (Fish/ha)**

- < 1
- 1 - 100
- 100 - 500
- 500 - 1,000
- 1,000 - 10,000
- > 10,000
- Substantial Plankton

Project Component

**Bathymetry (m)**

- Major Contour
- Minor Contour

- Railway
- Secondary Road
- Watercourse

- Prince Rupert Port Authority Boundary
- Survey Area
- Waterbody
- Intertidal Bank
- 0 - 5 m Shoal
- 5 - 10 m Shoal

## *Pacific NorthWest LNG*
## Daytime Fish Hydroacoustic Survey 11 (August 12 - 19, 2015): Fish Density 100 m Segments

*MARINE FISH PROGRAM - FINAL REPORT*

*Sources: Government of British Columbia; Prince Rupert Port Authority; Government of Canada, Natural Resources Canada, Centre for Topographic Information; Progress Energy Canada Ltd.*

*Although there is no reason to believe that there are any errors associated with the data used to generate this product or in the product itself, users of these data are advised that errors in the data may be present.*

DATE: 20-APR-16
FIGURE ID: 123110537
DRAWN BY: R. CAMPBELL

PROJECTION: UTM - ZONE 9
DATUM: NAD 83
CHECKED BY: P. REECE

PREPARED BY: Stantec

PREPARED FOR: Pacific NorthWest LNG

FIGURE NO:

**F-30**

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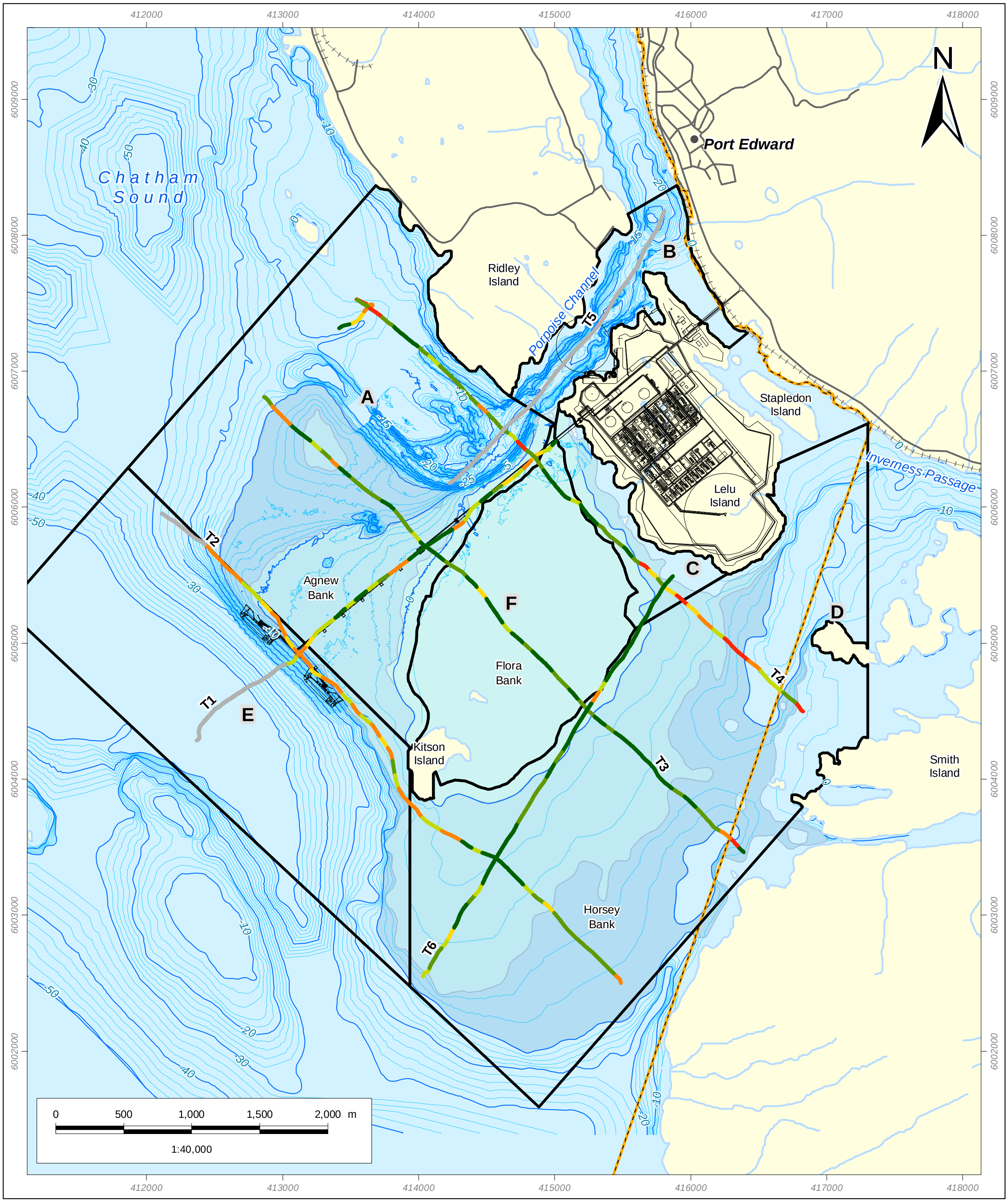


**Acoustic Fish Density Estimates (Fish/ha)**

- < 1
- 1 - 100
- 100 - 500
- 500 - 1000
- 1000 - 10000
- \> 10000
- Substantial Plankton

Project Component

**Bathymetry (m)**

- Major Contour
- Minor Contour
- Railway
- Secondary Road
- Watercourse

- Prince Rupert Port Authority Boundary
- Survey Area
- Waterbody
- Intertidal Bank
- 0 - 5 m Shoal
- 5 - 10 m Shoal

***Pacific NorthWest LNG***

**Daytime Fish Hydroacoustic Survey 12 (September 14 - 19, 2015): Fish Density 100 m Segments**

*MARINE FISH PROGRAM - FINAL REPORT*

*Sources: Government of British Columbia; Prince Rupert Port Authority; Government of Canada, Natural Resources Canada, Centre for Topographic Information; Progress Energy Canada Ltd.*

*Although there is no reason to believe that there are any errors associated with the data used to generate this product or in the product itself, users of these data are advised that errors in the data may be present.*

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|---|---|
| DATE: 20-APR-16 | PROJECTION: UTM - ZONE 9 |
| FIGURE ID: 123110537 | DATUM: NAD 83 |
| DRAWN BY: K. JAMES | CHECKED BY: R. CAMPBELL |

PREPARED BY: Stantec

PREPARED FOR: Pacific NorthWest LNG

FIGURE NO: **F-31**

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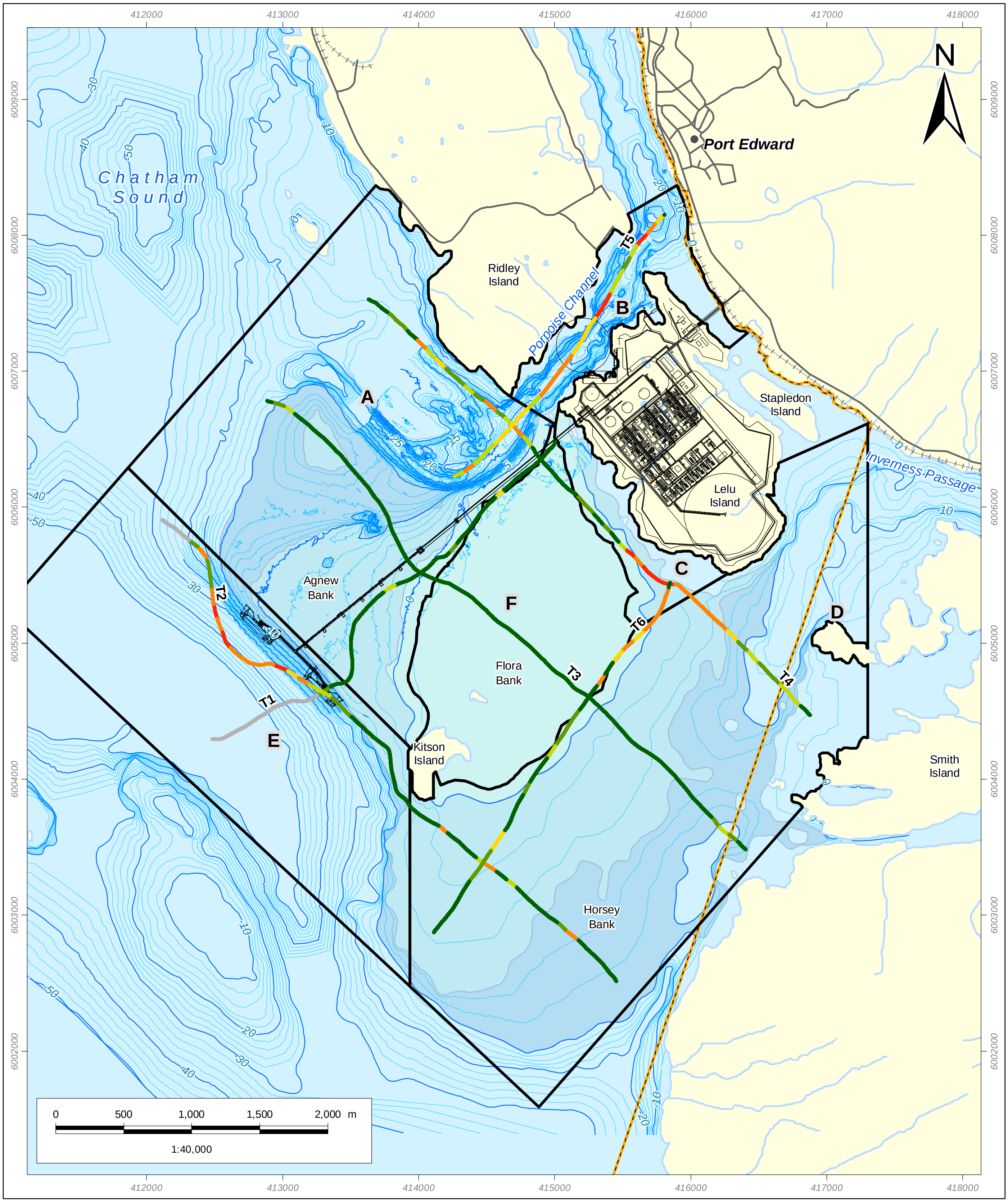
4/20/2016 - 2:54:30 PM




**Acoustic Fish Density Estimates (Fish/ha)**

- < 1
- 1 - 100
- 100 - 500
- 500 - 1000
- 1000 - 10000
- > 10000
- Substantial Plankton

Project Component

**Bathymetry (m)**

- Major Contour
- Minor Contour
- Railway
- Secondary Road
- Watercourse

- Prince Rupert Port Authority Boundary
- Survey Area
- Waterbody
- Intertidal Bank
- 0 - 5 m Shoal
- 5 - 10 m Shoal

***Pacific NorthWest LNG***

**Daytime Fish Hydroacoustic Survey 13 (October 30 - November 4, 2015): Fish Density 100 m Segments**

*MARINE FISH PROGRAM - FINAL REPORT*

*Sources: Government of British Columbia; Prince Rupert Port Authority; Government of Canada, Natural Resources Canada, Centre for Topographic Information; Progress Energy Canada Ltd.*

*Although there is no reason to believe that there are any errors associated with the data used to generate this product or in the product itself, users of these data are advised that errors in the data may be present.*

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|---|---|
| DATE: 20-APR-16 | PROJECTION: UTM - ZONE 9 |
| FIGURE ID: 123110537 | DATUM: NAD 83 |
| DRAWN BY: K. JAMES | CHECKED BY: R. CAMPBELL |

PREPARED BY: Stantec

PREPARED FOR: Pacific NorthWest LNG

FIGURE NO: **F-32**

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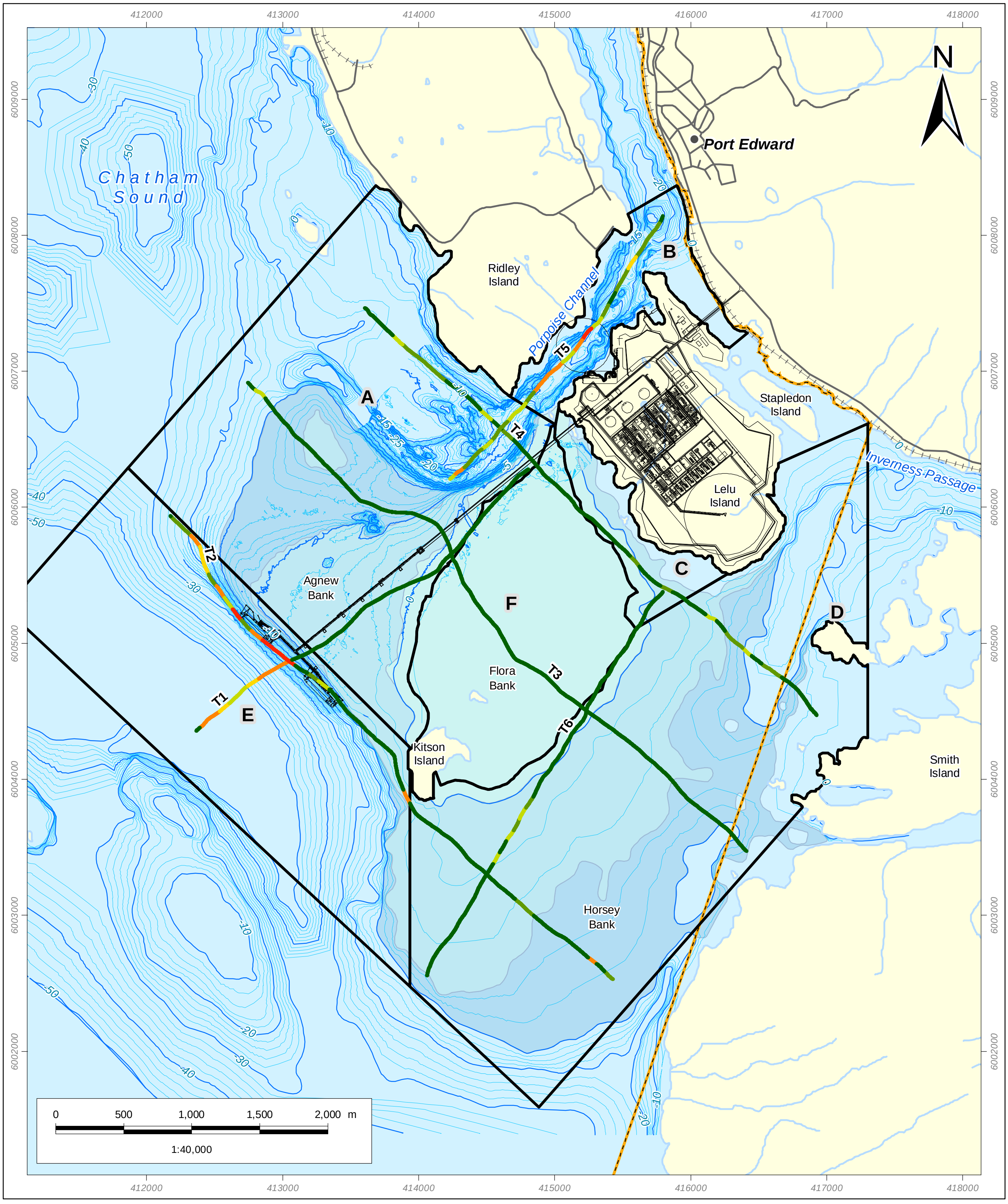


**Acoustic Fish Density Estimates (Fish/ha)**
- < 1
- 1 - 100
- 100 - 500
- 500 - 1000
- 1000 - 10000
- > 10000
- Substantial Plankton

- Project Component

**Bathymetry (m)**
- Major Contour
- Minor Contour
- Railway
- Secondary Road
- Watercourse

- Prince Rupert Port Authority Boundary
- Survey Area
- Waterbody
- Intertidal Bank
- 0 - 5 m Shoal
- 5 - 10 m Shoal

***Pacific NorthWest LNG***
**Daytime Fish Hydroacoustic Survey 14 (November 26 - December 3, 2015): Fish Density 100 m Segments**

*MARINE FISH PROGRAM - FINAL REPORT*

*Sources: Government of British Columbia; Prince Rupert Port Authority; Government of Canada, Natural Resources Canada, Centre for Topographic Information; Progress Energy Canada Ltd.*

*Although there is no reason to believe that there are any errors associated with the data used to generate this product or in the product itself, users of these data are advised that errors in the data may be present.*

DATE: 20-APR-16
FIGURE ID: 123110537
DRAWN BY: K. JAMES
PROJECTION: UTM - ZONE 9
DATUM: NAD 83
CHECKED BY: R. CAMPBELL

PREPARED BY: Stantec

PREPARED FOR: Pacific NorthWest LNG

FIGURE NO: **F-33**

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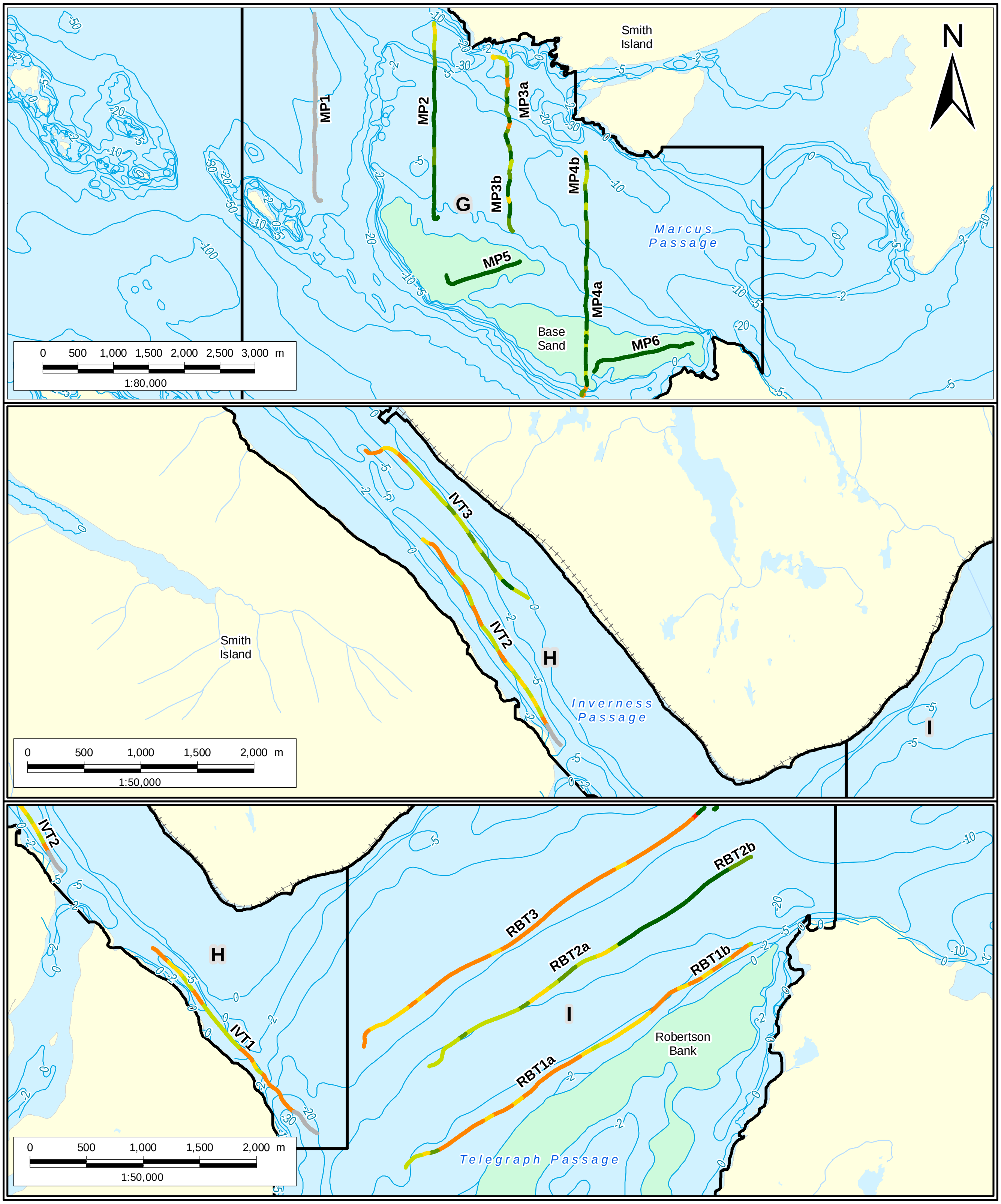


**Acoustic Fish Density Estimates (Fish/ha)**

- < 1
- 1 - 100
- 100 - 500
- 500 - 1,000
- 1,000 - 10,000
- > 10,000
- Substantial Plankton

- Depth Contour (m)
- Survey Area
- Railway
- Watercourse
- Waterbody
- Intertidal Bank

***Pacific NorthWest LNG***

**Survey Areas G, H, I**
**Daytime Fish Hydroacoustic Survey 9**
**(July 2 - 8, 2015): Fish Density 100 m Segments**

*MARINE FISH PROGRAM - FINAL REPORT*

*Sources: Government of British Columbia; Prince Rupert Port Authority; Government of Canada, Natural Resources Canada, Centre for Topographic Information; Progress Energy Canada Ltd.*

*Although there is no reason to believe that there are any errors associated with the data used to generate this product or in the product itself, users of these data are advised that errors in the data may be present.*

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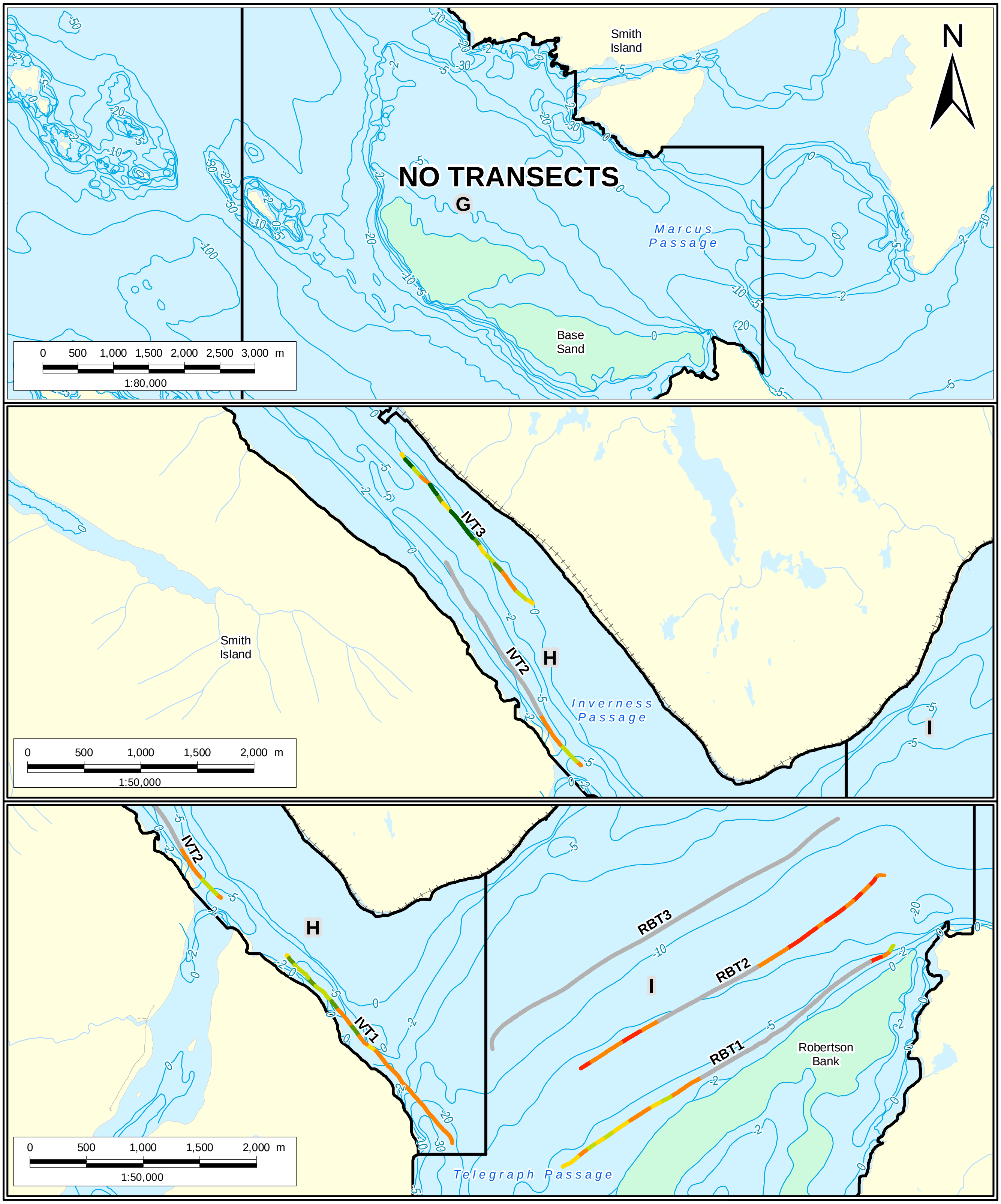
|---|---|
| DATE: 20-APR-16 | PROJECTION: UTM - ZONE 9 |
| FIGURE ID: 123110537 | DATUM: NAD 83 |
| DRAWN BY: R. CAMPBELL | CHECKED BY: S. O'REGAN |

PREPARED BY: Stantec

PREPARED FOR: Pacific NorthWest LNG

FIGURE NO:

**F-34**




**Acoustic Fish Density Estimates (Fish/ha)**

- < 1
- 1 - 100
- 100 - 500
- 500 - 1000
- 1000 - 10000
- > 10000
- Substantial Plankton

- Depth Contour (m)
- Survey Area
- Railway
- Watercourse
- Waterbody
- Intertidal Bank

## *Pacific NorthWest LNG*

### Survey Areas G, H, I
### Daytime Fish Hydroacoustic Survey 10 (July 16 - 23, 2015): Fish Density 100 m Segments

*MARINE FISH PROGRAM - FINAL REPORT*

*Sources: Government of British Columbia; Prince Rupert Port Authority; Government of Canada, Natural Resources Canada, Centre for Topographic Information; Progress Energy Canada Ltd.*

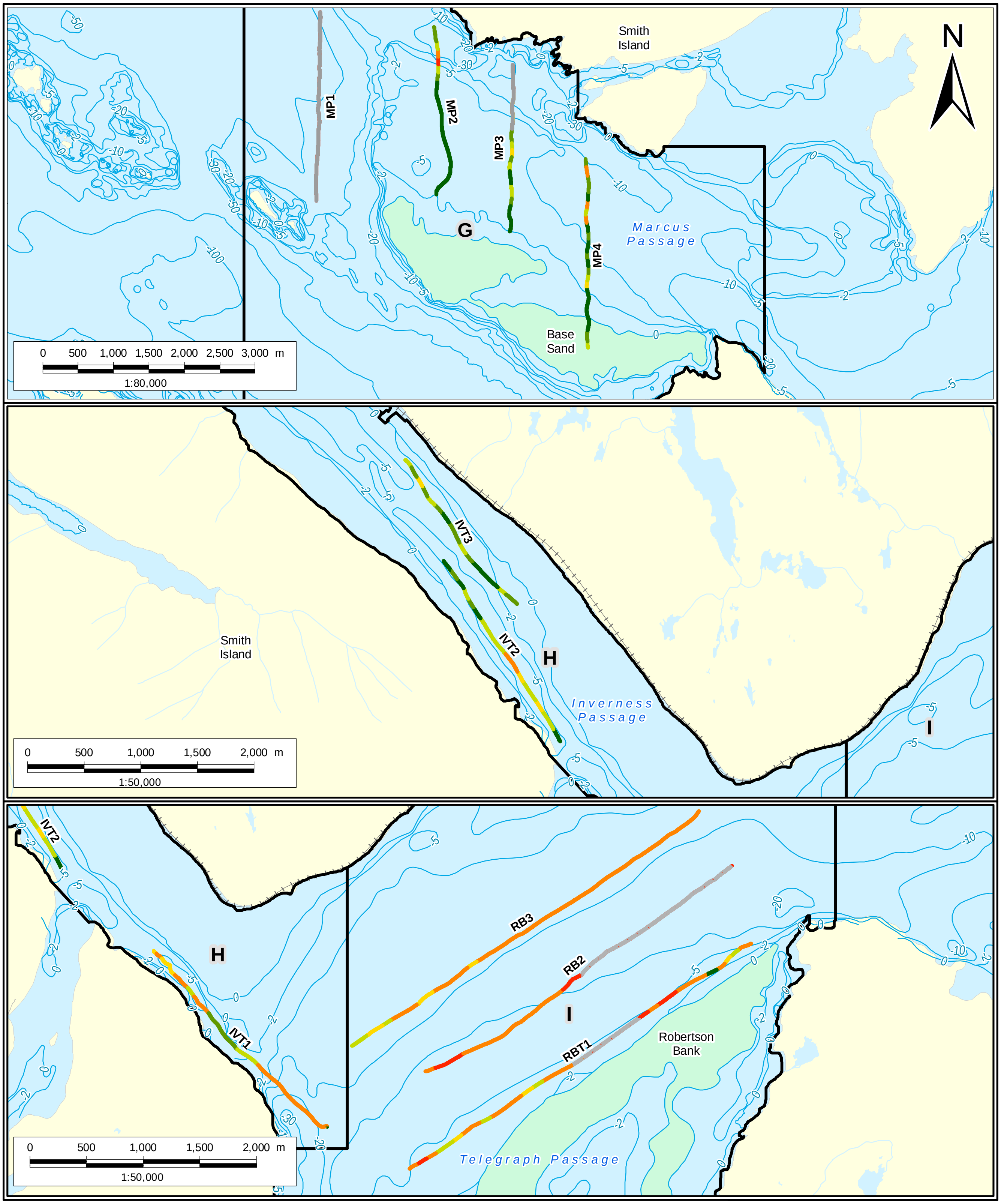
*Although there is no reason to believe that there are any errors associated with the data used to generate this product or in the product itself, users of these data are advised that errors in the data may be present.*

| | |
|---|---|
| DATE: 20-APR-16 | PROJECTION: UTM - ZONE 9 |
| FIGURE ID: 123110537 | DATUM: NAD 83 |
| DRAWN BY: R. CAMPBELL | CHECKED BY: S. O'REGAN |

PREPARED BY: Stantec

PREPARED FOR: Pacific NorthWest LNG

FIGURE NO: **F-35**




**Acoustic Fish Density Estimates (Fish/ha)**

- < 1
- 1 - 100
- 100 - 500
- 500 - 1,000
- 1,000 - 10,000
- > 10,000
- Substantial Plankton

- Depth Contour (m)
- Survey Area
- Railway
- Watercourse
- Waterbody
- Intertidal Bank

***Pacific NorthWest LNG***

**Survey Areas G, H, I**
**Daytime Fish Hydroacoustic Survey 11**
**(Aug 12 - 19, 2015): Fish Density 100 m Segments**

*MARINE FISH PROGRAM - FINAL REPORT*

*Sources: Government of British Columbia; Prince Rupert Port Authority; Government of Canada, Natural Resources Canada, Centre for Topographic Information; Progress Energy Canada Ltd.*

*Although there is no reason to believe that there are any errors associated with the data used to generate this product or in the product itself, users of these data are advised that errors in the data may be present.*

DATE: 20-APR-16
FIGURE ID: 123110537
DRAWN BY: S. PARKER

PROJECTION: UTM - ZONE 9
DATUM: NAD 83
CHECKED BY: R. CAMPBELL

PREPARED BY: Stantec

PREPARED FOR: Pacific NorthWest LNG

FIGURE NO:
**F-36**

\\cd1186-f04\workgroup\active\123110537\gis\figures\Marine_Fish_All_Surveys\Hydroacoustic_Surveys\Marfish_100m_intervals\fig_123110537_f-36_marine_Comparison_Survey_Area_Hydroacoustic_Survey_marfish_11_100m_Density.mxd
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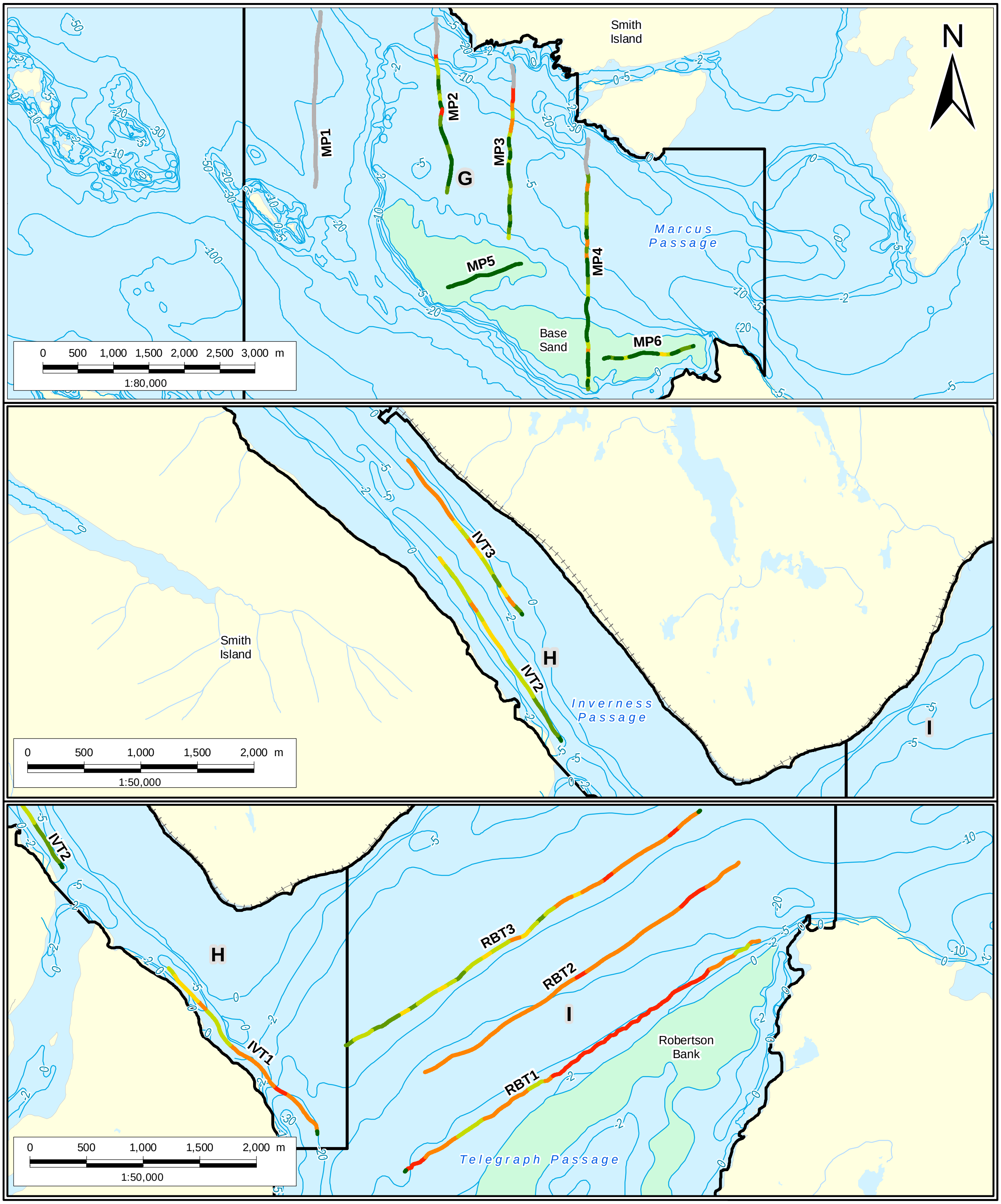


**Acoustic Fish Density Estimates (Fish/ha)**

- < 1
- 1 - 100
- 100 - 500
- 500 - 1000
- 1000 - 10000
- > 10000
- Substantial Plankton

- Depth Contour (m)
- Survey Area
- Railway
- Watercourse
- Waterbody
- Intertidal Bank

***Pacific NorthWest LNG***

**Survey Areas G, H, I**
**Daytime Fish Hydroacoustic Survey 12**
**(Sep 14 - 19, 2015): Fish Density 100 m Segments**

*MARINE FISH PROGRAM - FINAL REPORT*

*Sources: Government of British Columbia; Prince Rupert Port Authority; Government of Canada, Natural Resources Canada, Centre for Topographic Information; Progress Energy Canada Ltd.*

*Although there is no reason to believe that there are any errors associated with the data used to generate this product or in the product itself, users of these data are advised that errors in the data may be present.*

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| DATE: 20-APR-16 | PROJECTION: UTM - ZONE 9 |
| FIGURE ID: 123110537 | DATUM: NAD 83 |
| DRAWN BY: R. CAMPBELL | CHECKED BY: S. O'REGAN |

PREPARED BY:

Stantec

PREPARED FOR:

Pacific NorthWest LNG

FIGURE NO:

**F-37**

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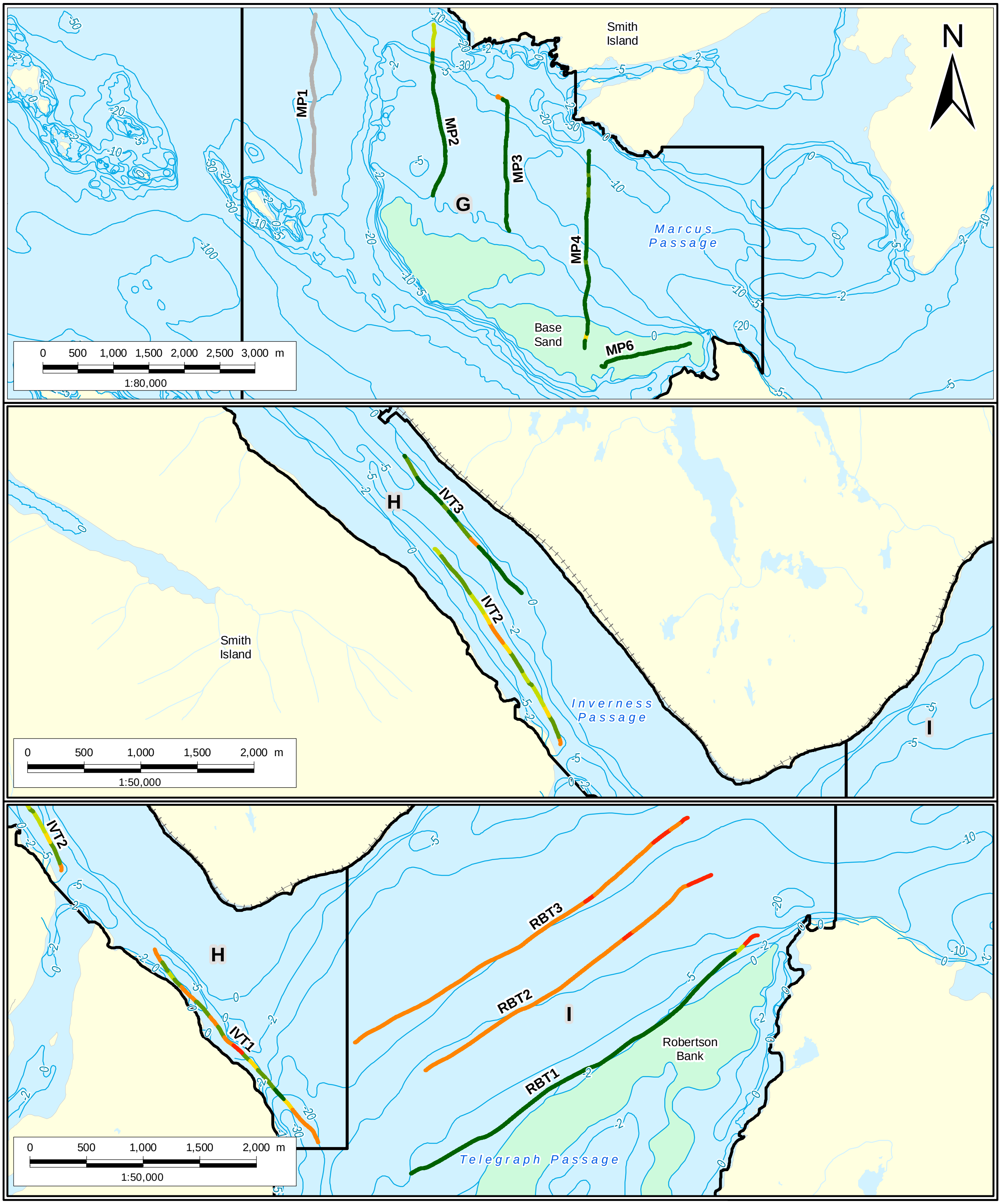


**Acoustic Fish Density Estimates (Fish/ha)**

- < 1
- 1 - 100
- 100 - 500
- 500 - 1,000
- 1,000 - 10,000
- > 10,000
- Substantial Plankton

- Depth Contour (m)
- Survey Area
- Railway
- Watercourse
- Waterbody
- Intertidal Bank

***Pacific NorthWest LNG***

**Survey Areas G, H, I**
**Daytime Fish Hydroacoustic Survey 13**
**(Oct. 30 - Nov. 4, 2015): Fish Density 100 m Segmnt**

*MARINE FISH PROGRAM - FINAL REPORT*

*Sources: Government of British Columbia; Prince Rupert Port Authority; Government of Canada, Natural Resources Canada, Centre for Topographic Information; Progress Energy Canada Ltd.*

*Although there is no reason to believe that there are any errors associated with the data used to generate this product or in the product itself, users of these data are advised that errors in the data may be present.*

| | |
|---|---|
| DATE: 20-APR-16 | PROJECTION: UTM - ZONE 9 |
| FIGURE ID: 123110537 | DATUM: NAD 83 |
| DRAWN BY: K. JAMES | CHECKED BY: S. O'REGAN |

PREPARED BY:
Stantec

PREPARED FOR:
Pacific NorthWest LNG

FIGURE NO:
**F-38**

\\cd1186-f04\workgroup\active\123110537\gis\figures\Marine_Fish_All_Surveys\Hydroacoustic_Surveys\Marfish_100m_intervals\fig_123110537_f-38_marine_Comparison_Survey_Area_Hydroacoustic_Survey_marfish_13_100m_Density.mxd
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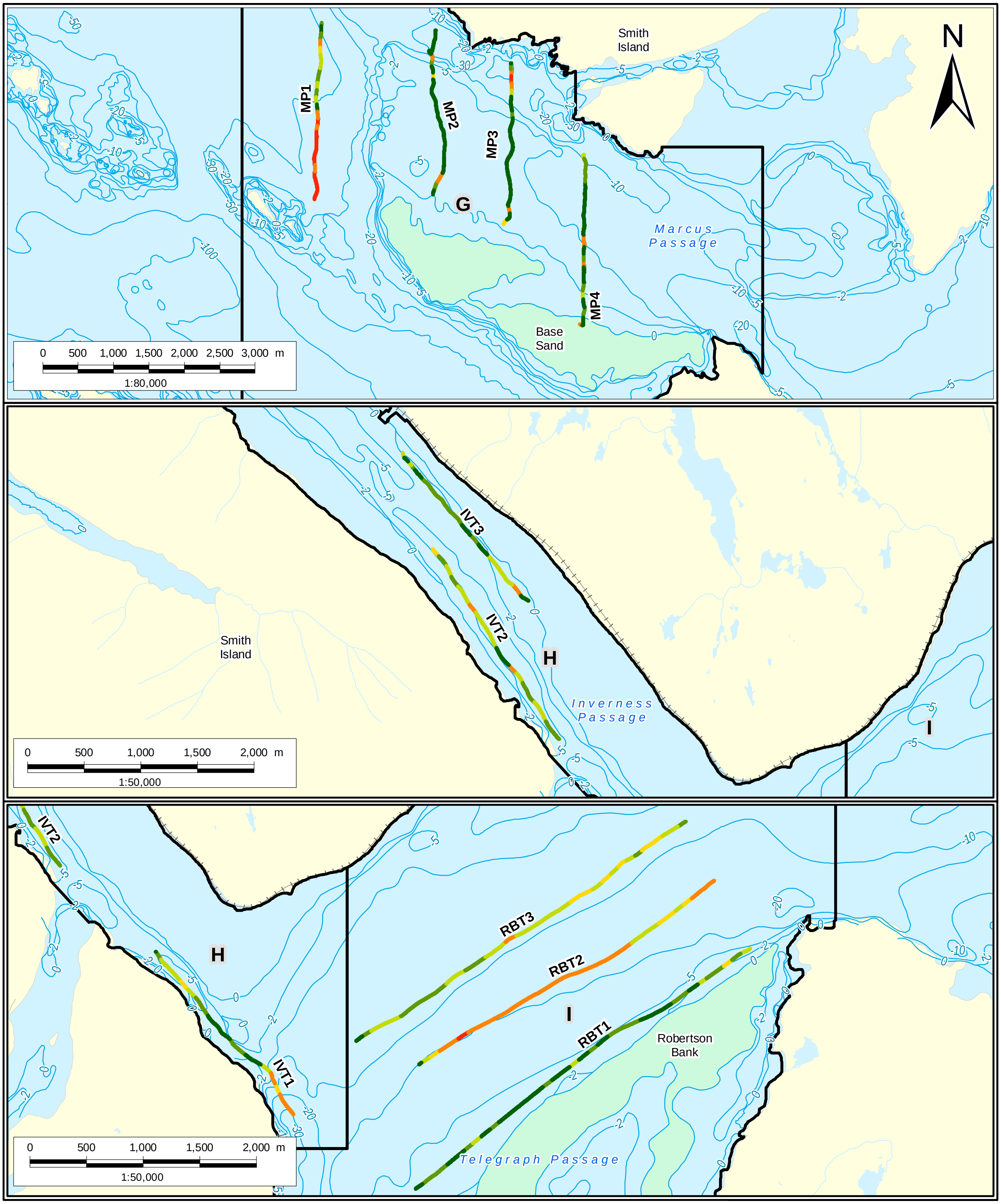


**Acoustic Fish Density Estimates (Fish/ha)**

- < 1
- 1 - 100
- 100 - 500
- 500 - 1,000
- 1,000 - 10,000
- > 10,000
- Substantial Plankton

- Depth Contour (m)
- Survey Area
- Railway
- Watercourse
- Waterbody
- Intertidal Bank

***Pacific NorthWest LNG***

**Survey Areas G, H, I**
**Daytime Fish Hydroacoustic Survey 14**
**(Nov. 26 - Dec. 3, 2015): Fish Density 100 m Segmnt**

*MARINE FISH PROGRAM - FINAL REPORT*

*Sources: Government of British Columbia; Prince Rupert Port Authority; Government of Canada, Natural Resources Canada, Centre for Topographic Information; Progress Energy Canada Ltd.*

*Although there is no reason to believe that there are any errors associated with the data used to generate this product or in the product itself, users of these data are advised that errors in the data may be present.*

| | |
|---|---|
| DATE: 20-APR-16 | PROJECTION: UTM - ZONE 9 |
| FIGURE ID: 123110537 | DATUM: NAD 83 |
| DRAWN BY: K. JAMES | CHECKED BY: S. O'REGAN |

PREPARED BY: Stantec

PREPARED FOR: Pacific NorthWest LNG

FIGURE NO: **F-39**

\\cd1186-f04\workgroup\active\123110537\gis\figures\Marine_Fish_All_Surveys\Hydroacoustic_Surveys\Marfish_100m_intervals\fig_123110537_f-39_marine_Comparison_Survey_Area_Hydroacoustic_Survey_marfish_14_100m_Density.mxd

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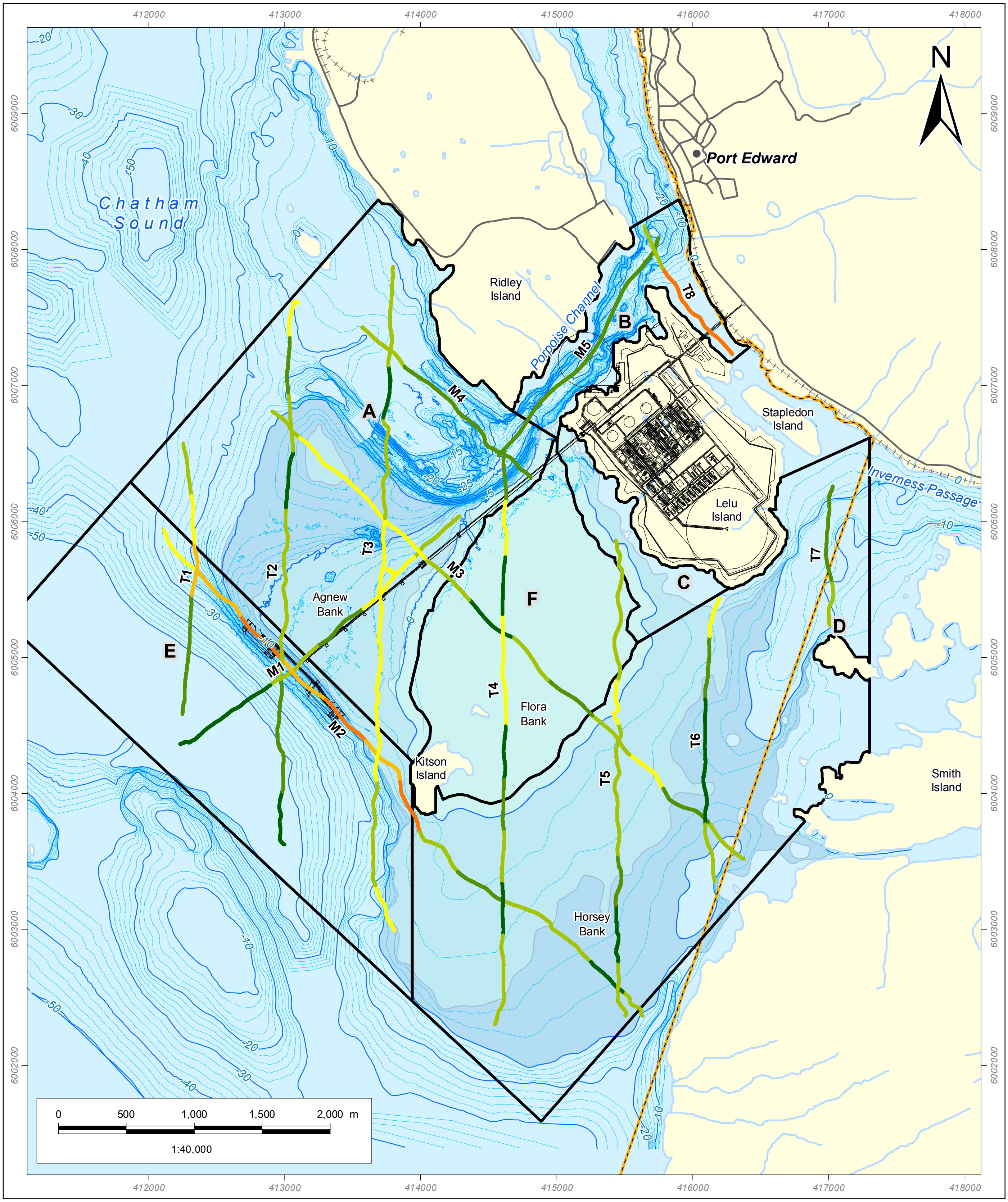



Mean Volume Backscatter (MVBS) (dB)

- -80 and less
- -75 to -80
- -70 to -75
- -65 to -70
- -60 to -65
- -55 to -60
- -55 and greater
- Substantial Plankton

- Project Component
- Prince Rupert Port Authority Boundary
- Survey Area

Bathymetry (m)

- Major Contour
- Minor Contour
- Railway
- Secondary Road
- Watercourse
- Waterbody
- Intertidal Bank
- 0 - 5 m Shoal
- 5 - 10 m Shoal

***Pacific NorthWest LNG***

**Nighttime Fish Hydroacoustic Survey 1 (May 1 - 3, 2015): MVBS 500 m Segments**

*MARINE FISH PROGRAM - FINAL REPORT*

*Sources: Government of British Columbia; Prince Rupert Port Authority; Government of Canada, Natural Resources Canada, Centre for Topographic Information; Progress Energy Canada Ltd.*

*Although there is no reason to believe that there are any errors associated with the data used to generate this product or in the product itself, users of these data are advised that errors in the data may be present.*

DATE: 20-APR-16
FIGURE ID: 123110537
DRAWN BY: R. CAMPBELL

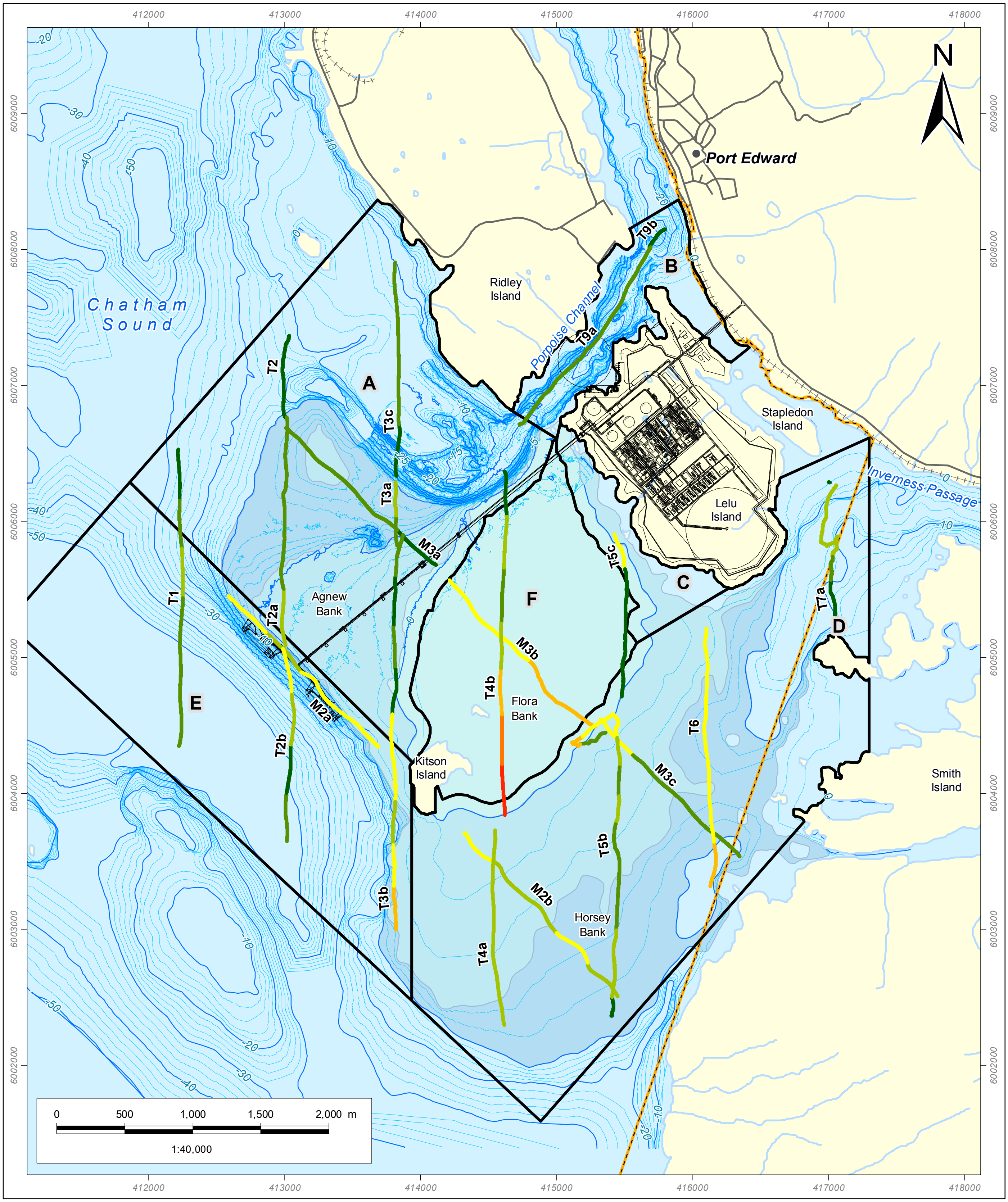
PROJECTION: UTM - ZONE 9
DATUM: NAD 83
CHECKED BY: S. O'REGAN

PREPARED BY: Stantec

PREPARED FOR: Pacific NorthWest LNG

FIGURE NO: **F-40**

\\cd1186-f04\workgroup\active\123110537\gis\figures\Marine_Fish_All_Surveys\Hydroacoustic_Surveys\Smolt_500m_intervals\fig_123110537_f-40_marine_Hydroacoustic_Survey_Smolt_01_Biomass.mxd
20/04/2016 - 1:34:25 PM




**Mean Volume Backscatter (MVBS) (dB)**

- -80 and less
- -75 to -80
- -70 to -75
- -65 to -70
- -60 to -65
- -55 to -60
- -55 and greater
- Substantial Plankton

- Project Component

**Bathymetry (m)**

- Major Contour
- Minor Contour
- Railway
- Secondary Road
- Watercourse

- Prince Rupert Port Authority Boundary
- Survey Area
- Waterbody
- Intertidal Bank
- 0 - 5 m Shoal
- 5 - 10 m Shoal

***Pacific NorthWest LNG***

**Nighttime Fish Hydroacoustic Survey 2 (May 12 - 14, 2015): MVBS 500 m Segments**

*MARINE FISH PROGRAM - FINAL REPORT*

*Sources: Government of British Columbia; Prince Rupert Port Authority; Government of Canada, Natural Resources Canada, Centre for Topographic Information; Progress Energy Canada Ltd.*

*Although there is no reason to believe that there are any errors associated with the data used to generate this product or in the product itself, users of these data are advised that errors in the data may be present.*

| | |
|---|---|
| DATE: 20-APR-16 | PROJECTION: UTM - ZONE 9 |
| FIGURE ID: 123110537 | DATUM: NAD 83 |
| DRAWN BY: R. CAMPBELL | CHECKED BY: S. O'REGAN |

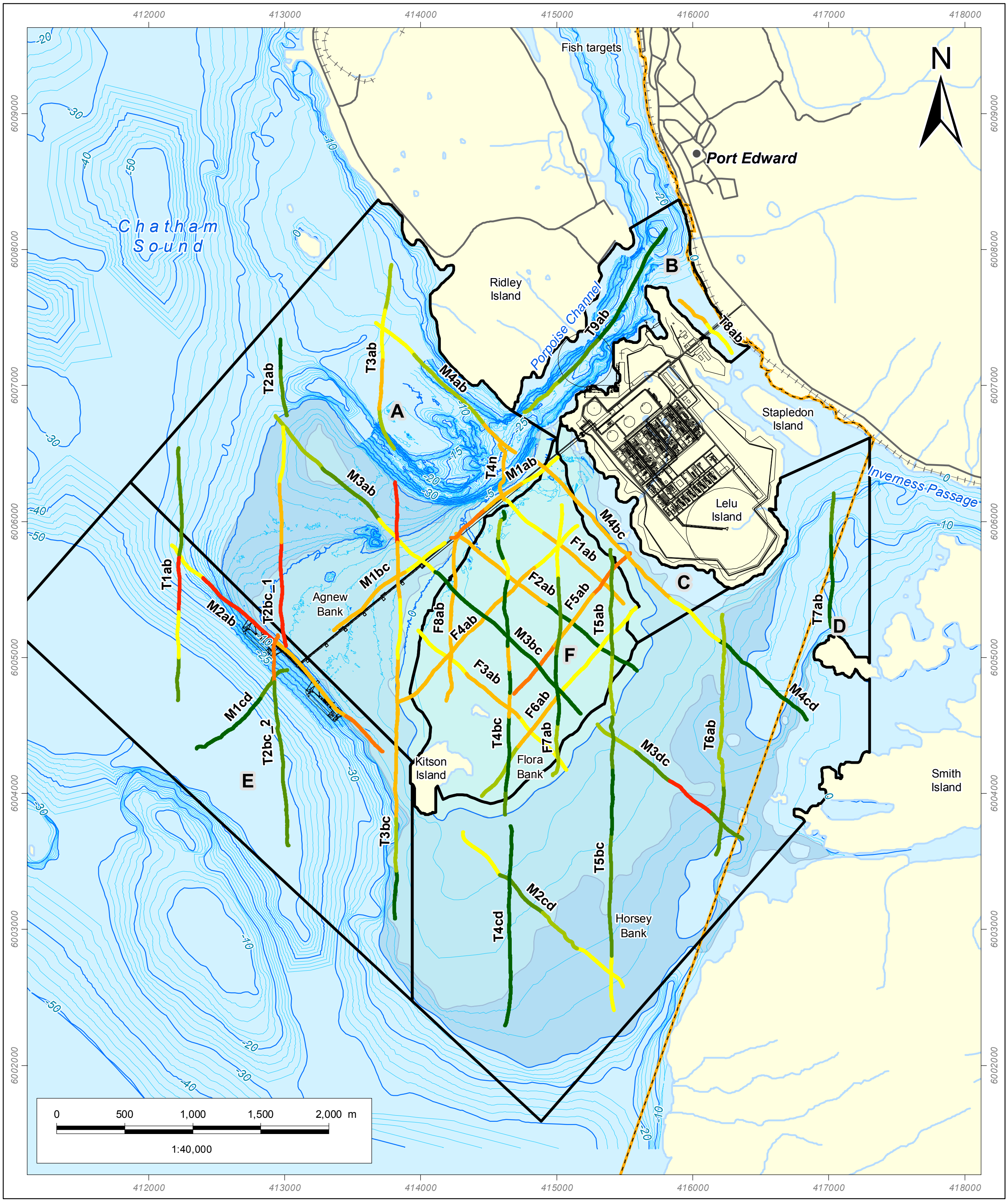
PREPARED BY: Stantec

PREPARED FOR: Pacific NorthWest LNG

FIGURE NO:

**F-41**

20/04/2016 - 1:33:40 PM \\cd1186-f04\workgroup\active\123110537\gis\figures\Marine_Fish_All_Surveys\Hydroacoustic_Surveys\Smolt_500m_intervals\fig_123110537_f41_marine_Hydroacoustic_Survey_Smolt_02_Biomass.mxd




**Mean Volume Backscatter (MVBS) (dB)**

- -80 and less
- -75 to -80
- -70 to -75
- -65 to -70
- -60 to -65
- -55 to -60
- -55 and greater
- Substantial Plankton

Project Component

**Bathymetry (m)**

- Major Contour
- Minor Contour
- Railway
- Secondary Road
- Watercourse

- Prince Rupert Port Authority Boundary
- Survey Area
- Waterbody
- Intertidal Bank
- 0 - 5 m Shoal
- 5 - 10 m Shoal

***Pacific NorthWest LNG***

**Nighttime Fish Hydroacoustic Survey 3 (May 25 - 29, 2015): MVBS 500 m Segments**

*MARINE FISH PROGRAM - FINAL REPORT*

*Sources: Government of British Columbia; Prince Rupert Port Authority; Government of Canada, Natural Resources Canada, Centre for Topographic Information; Progress Energy Canada Ltd.*

*Although there is no reason to believe that there are any errors associated with the data used to generate this product or in the product itself, users of these data are advised that errors in the data may be present.*

DATE: 20-APR-16
FIGURE ID: 123110537
DRAWN BY: R. CAMPBELL

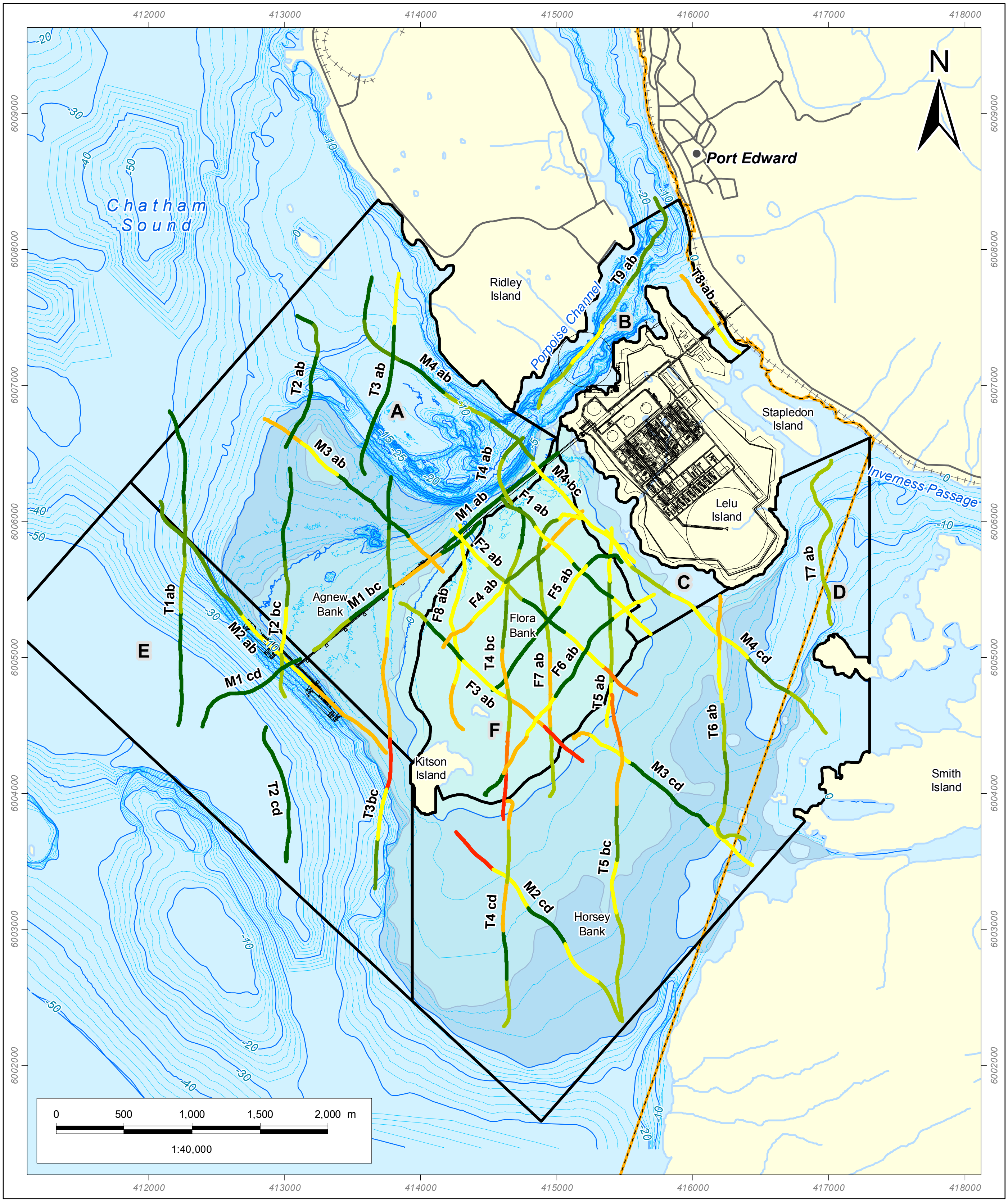
PROJECTION: UTM - ZONE 9
DATUM: NAD 83
CHECKED BY: S. O'REGAN

PREPARED BY: Stantec

PREPARED FOR: Pacific NorthWest LNG

FIGURE NO: **F-42**

20/04/2016 - 1:34:15 PM \\cd1186-f04\workgroup\active\123110537\gis\figures\Marine_Fish_All_Surveys\Hydroacoustic_Surveys\Smolt_500m_intervals\fig_123110537_f-42_marine_Hydroacoustic_Survey_Smolt_03_Biomass.mxd




**Mean Volume Backscatter (MVBS) (dB)**

- -80 and less
- -75 to -80
- -70 to -75
- -65 to -70
- -60 to -65
- -55 to -60
- -55 and greater
- Substantial Plankton

- Project Component

**Bathymetry (m)**

- Major Contour
- Minor Contour
- Railway
- Secondary Road
- Watercourse

- Prince Rupert Port Authority Boundary
- Survey Area
- Waterbody
- Intertidal Bank
- 0 - 5 m Shoal
- 5 - 10 m Shoal

***Pacific NorthWest LNG***

**Nighttime Fish Hydroacoustic Survey 4 (June 3 - 6, 2015): MVBS 500 m Segments**

*MARINE FISH PROGRAM - FINAL REPORT*

*Sources: Government of British Columbia; Prince Rupert Port Authority; Government of Canada, Natural Resources Canada, Centre for Topographic Information; Progress Energy Canada Ltd.*

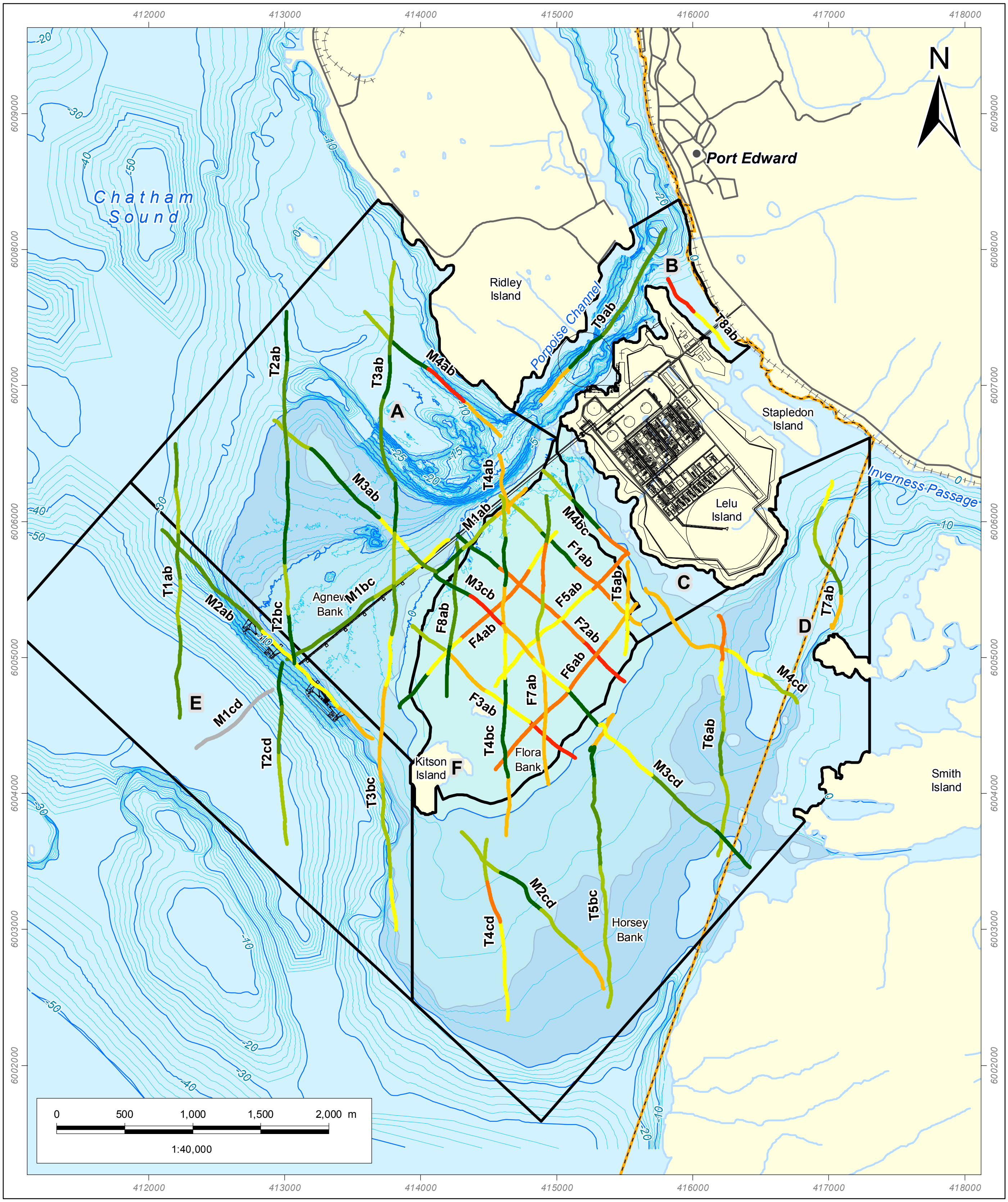
*Although there is no reason to believe that there are any errors associated with the data used to generate this product or in the product itself, users of these data are advised that errors in the data may be present.*

| | |
|---|---|
| DATE: 20-APR-16 | PROJECTION: UTM - ZONE 9 |
| FIGURE ID: 123110537 | DATUM: NAD 83 |
| DRAWN BY: R. CAMPBELL | CHECKED BY: S. O'REGAN |

PREPARED BY: Stantec

PREPARED FOR: Pacific NorthWest LNG

FIGURE NO: **F-43**




**Mean Volume Backscatter (MVBS) (dB)**

- -80 and less
- -75 to -80
- -70 to -75
- -65 to -70
- -60 to -65
- -55 to -60
- -55 and greater
- Substantial Plankton

Project Component

**Bathymetry (m)**

- Major Contour
- Minor Contour
- Railway
- Secondary Road
- Watercourse

- Prince Rupert Port Authority Boundary
- Survey Area
- Waterbody
- Intertidal Bank
- 0 - 5 m Shoal
- 5 - 10 m Shoal

***Pacific NorthWest LNG***
**Nighttime Fish Hydroacoustic Survey 7 (June 24 - 28, 2015): MVBS 500 m Segments**

*MARINE FISH PROGRAM - FINAL REPORT*

*Sources: Government of British Columbia; Prince Rupert Port Authority; Government of Canada, Natural Resources Canada, Centre for Topographic Information; Progress Energy Canada Ltd.*

*Although there is no reason to believe that there are any errors associated with the data used to generate this product or in the product itself, users of these data are advised that errors in the data may be present.*

DATE: 20-APR-16
FIGURE ID: 123110537
DRAWN BY: R. CAMPBELL

PROJECTION: UTM - ZONE 9
DATUM: NAD 83
CHECKED BY: S. O'REGAN

PREPARED BY: Stantec

PREPARED FOR: Pacific NorthWest LNG

FIGURE NO:

**F-44**

\\cd1186-f04\workgroup\active\123110537\gis\figures\Marine_Fish_All_Surveys\Hydroacoustic_Surveys\Smolt_500m_intervals\fig_123110537_f-44_marine_Hydroacoustic_Survey_Smolt_07_Biomass.mxd

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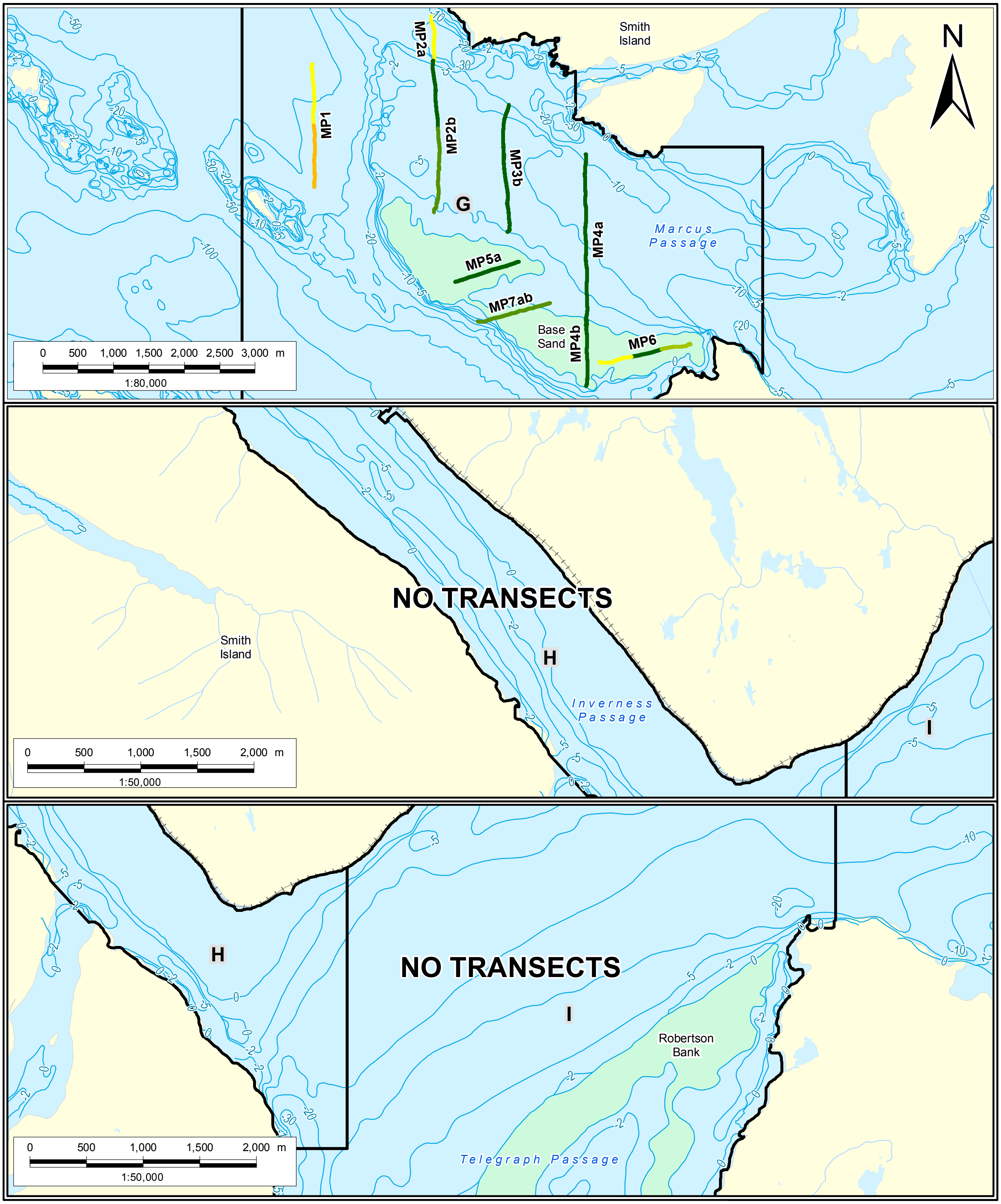


**Mean Volume Backscatter (MVBS) (dB)**
- -80 and less
- -75 to -80
- -70 to -75
- -65 to -70
- -60 to -65
- -55 to -60
- -55 and greater
- Substantial Plankton

- Depth Contour (m)
- Survey Area
- Railway
- Watercourse
- Waterbody
- Intertidal Bank

***Pacific NorthWest LNG***

**Survey Areas G, H, I**
**Nighttime Fish Hydroacoustic Survey 7**
**(June 29, 2015): MVBS 500 m Segments**

*MARINE FISH PROGRAM - FINAL REPORT*

*Sources: Government of British Columbia; Prince Rupert Port Authority; Government of Canada, Natural Resources Canada, Centre for Topographic Information; Progress Energy Canada Ltd.*

*Although there is no reason to believe that there are any errors associated with the data used to generate this product or in the product itself, users of these data are advised that errors in the data may be present.*

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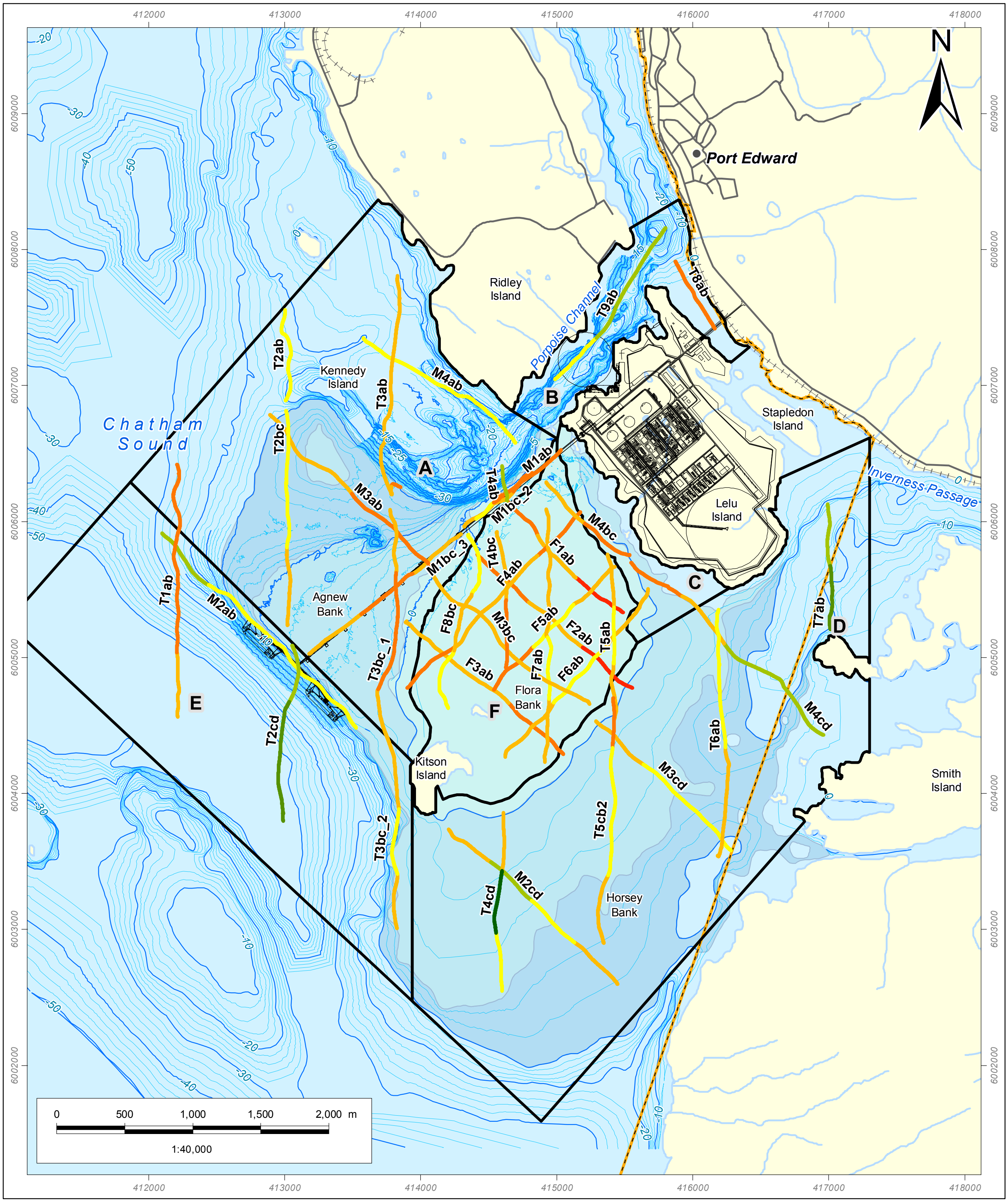
|---|---|
| DATE: 20-APR-16 | PROJECTION: UTM - ZONE 9 |
| FIGURE ID: 123110537 | DATUM: NAD 83 |
| DRAWN BY: R. CAMPBELL | CHECKED BY: S. O'REGAN |

PREPARED BY: Stantec

PREPARED FOR: Pacific NorthWest LNG

FIGURE NO:

**F-45**




**Mean Volume Backscatter (MVBS) (dB)**
- -80 and less
- -75 to -80
- -70 to -75
- -65 to -70
- -60 to -65
- -55 to -60
- -55 and greater
- Substantial Plankton

- Project Component

**Bathymetry (m)**
- Major Contour
- Minor Contour
- Railway
- Secondary Road
- Watercourse

- Prince Rupert Port Authority Boundary
- Survey Area
- Waterbody
- Intertidal Bank
- 0 - 5 m Shoal
- 5 - 10 m Shoal

***Pacific NorthWest LNG***

**Nighttime Fish Hydroacoustic Survey 8 (July 2 - 8, 2015): MVBS 500 m Segments**

*MARINE FISH PROGRAM - FINAL REPORT*

*Sources: Government of British Columbia; Prince Rupert Port Authority; Government of Canada, Natural Resources Canada, Centre for Topographic Information; Progress Energy Canada Ltd.*

*Although there is no reason to believe that there are any errors associated with the data used to generate this product or in the product itself, users of these data are advised that errors in the data may be present.*

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|---|---|
| DATE: 20-APR-16 | PROJECTION: UTM - ZONE 9 |
| FIGURE ID: 123110537 | DATUM: NAD 83 |
| DRAWN BY: R. CAMPBELL | CHECKED BY: S. O'REGAN |

PREPARED BY: Stantec

PREPARED FOR: Pacific NorthWest LNG

FIGURE NO:

**F-46**

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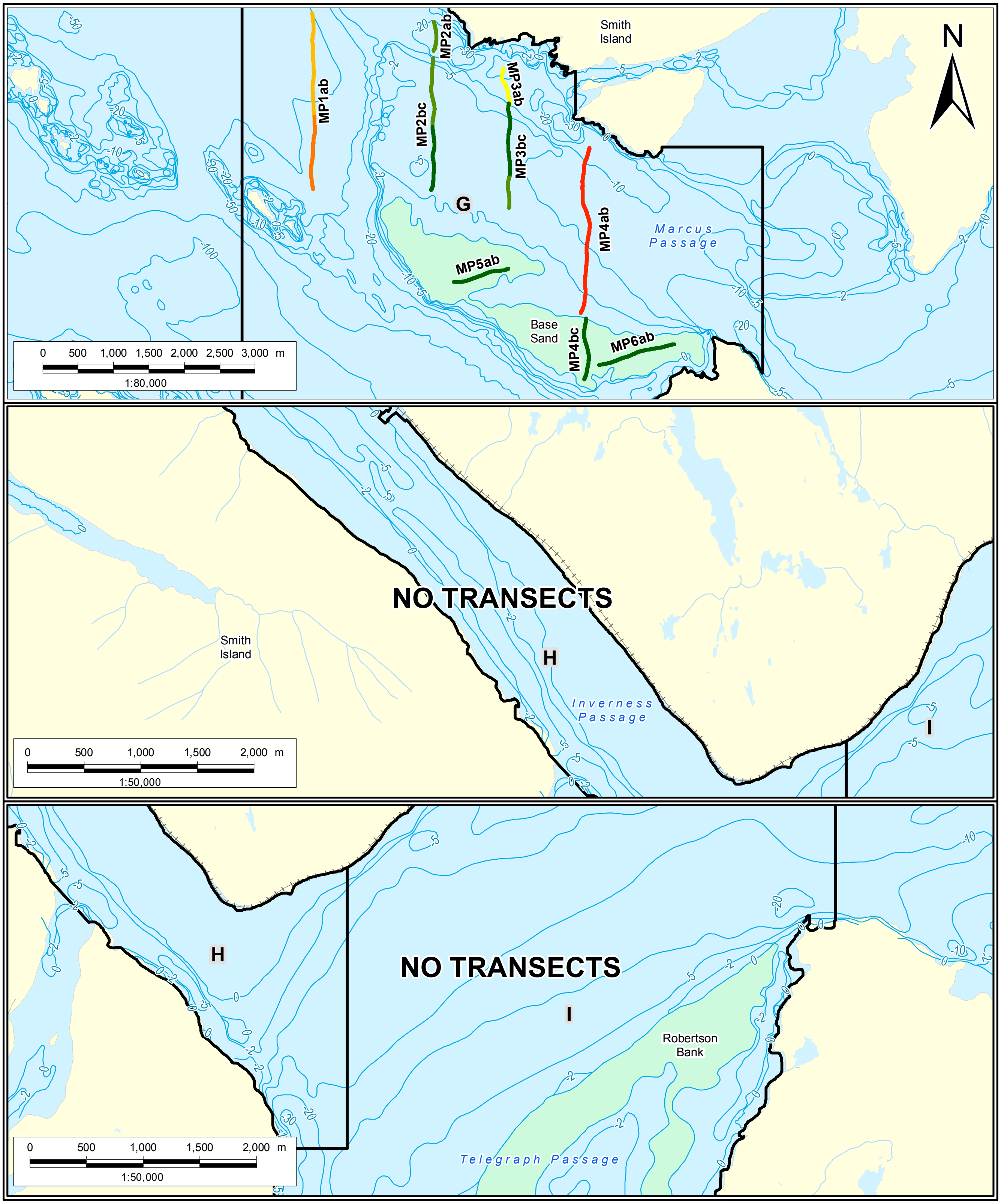


**Mean Volume Backscatter (MVBS) (dB)**

- -80 and less
- -75 to -80
- -70 to -75
- -65 to -70
- -60 to -65
- -55 to -60
- -55 and greater
- Substantial Plankton

- Depth Contour (m)
- Survey Area
- Railway
- Watercourse
- Waterbody
- Intertidal Bank

## *Pacific NorthWest LNG*

### Survey Areas G, H, I
### Nighttime Fish Hydroacoustic Survey 8 (July 8-9, 2015): MVBS 500 m Segments

*MARINE FISH PROGRAM - FINAL REPORT*

*Sources: Government of British Columbia; Prince Rupert Port Authority; Government of Canada, Natural Resources Canada, Centre for Topographic Information; Progress Energy Canada Ltd.*

*Although there is no reason to believe that there are any errors associated with the data used to generate this product or in the product itself, users of these data are advised that errors in the data may be present.*

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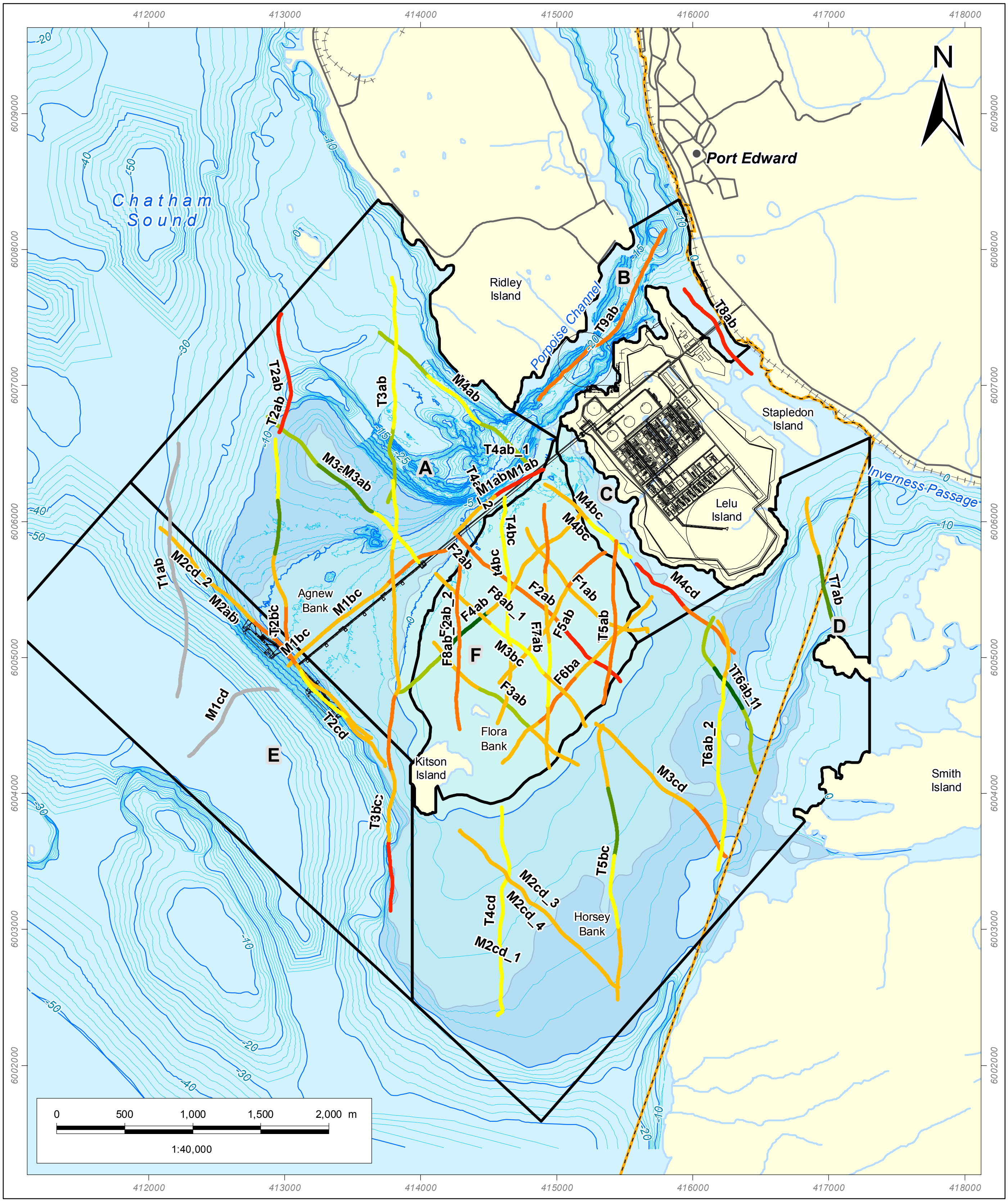
|---|---|
| DATE: 20-APR-16 | PROJECTION: UTM - ZONE 9 |
| FIGURE ID: 123110537 | DATUM: NAD 83 |
| DRAWN BY: R. CAMPBELL | CHECKED BY: S. O'REGAN |

PREPARED BY: Stantec

PREPARED FOR: Pacific NorthWest LNG

FIGURE NO: **F-47**

20/04/2016 - 1:44:02 PM \\cd1186-f04\workgroup\active\123110537\gis\figures\Marine_Fish_All_Surveys\Hydroacoustic_Surveys\Smolt_500m_intervals\fig_123110537_f-47_marine_Comparison_Survey_Area_Hydroacoustic_Survey_Smolt_08_Biomass.mxd




**Mean Volume Backscatter (MVBS) (dB)**

- -80 and less
- -75 to -80
- -70 to -75
- -65 to -70
- -60 to -65
- -55 to -60
- -55 and greater
- Substantial Plankton

Project Component

**Bathymetry (m)**

- Major Contour
- Minor Contour
- Railway
- Secondary Road
- Watercourse

- Prince Rupert Port Authority Boundary
- Survey Area
- Waterbody
- Intertidal Bank
- 0 - 5 m Shoal
- 5 - 10 m Shoal

## *Pacific NorthWest LNG*

## Nighttime Fish Hydroacoustic Survey 9 (July 10 - 14, 2015): MVBS 500 m Segments

*MARINE FISH PROGRAM - FINAL REPORT*

*Sources: Government of British Columbia; Prince Rupert Port Authority; Government of Canada, Natural Resources Canada, Centre for Topographic Information; Progress Energy Canada Ltd.*

*Although there is no reason to believe that there are any errors associated with the data used to generate this product or in the product itself, users of these data are advised that errors in the data may be present.*

DATE: 20-APR-16
FIGURE ID: 123110537
DRAWN BY: R. CAMPBELL

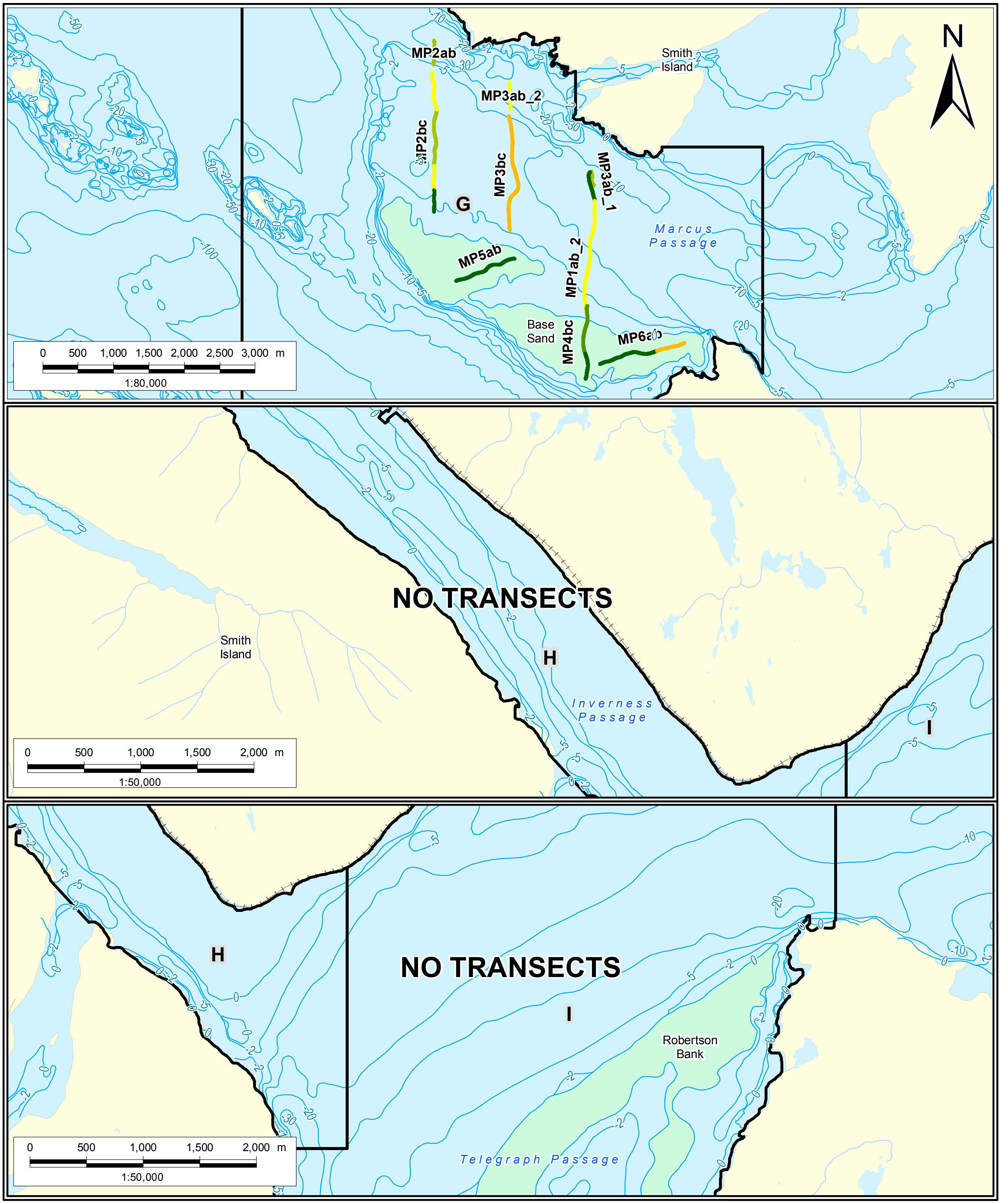
PROJECTION: UTM - ZONE 9
DATUM: NAD 83
CHECKED BY: S. O'REGAN

PREPARED BY: Stantec

PREPARED FOR: Pacific NorthWest LNG

FIGURE NO: **F-48**

20/04/2016 - 1:43:45 PM \\cd1186-f04\workgroup\active\123110537\gis\figures\Marine_Fish_All_Surveys\Hydroacoustic_Surveys\Smolt_500m_intervals\fig_123110537_f-48_marine_Hydroacoustic_Survey_Smolt_09_Biomass.mxd




**Mean Volume Backscatter (MVBS) (dB)**

- -80 and less
- -75 to -80
- -70 to -75
- -65 to -70
- -60 to -65
- -55 to -60
- -55 and greater
- Substantial Plankton

- Depth Contour (m)
- Survey Area
- Railway
- Watercourse
- Waterbody
- Intertidal Bank

***Pacific NorthWest LNG***

**Survey Areas G, H, I**
**Nighttime Fish Hydroacoustic Survey 9**
**(July 15-16, 2015): MVBS 500 m Segments**

*MARINE FISH PROGRAM - FINAL REPORT*

*Sources: Government of British Columbia; Prince Rupert Port Authority; Government of Canada, Natural Resources Canada, Centre for Topographic Information; Progress Energy Canada Ltd.*

*Although there is no reason to believe that there are any errors associated with the data used to generate this product or in the product itself, users of these data are advised that errors in the data may be present.*

| | |
|---|---|
| DATE: 20-APR-16 | PROJECTION: UTM - ZONE 9 |
| FIGURE ID: 123110537 | DATUM: NAD 83 |
| DRAWN BY: R. CAMPBELL | CHECKED BY: S. O'REGAN |

PREPARED BY: Stantec

PREPARED FOR: Pacific NorthWest LNG

FIGURE NO:

**F-49**

20/04/2016 - 1:43:56 PM \\cd1186-f04\workgroup\active\123110537\gis\figures\Marine_Fish_All_Surveys\Hydroacoustic_Surveys\Smolt_500m_intervals\fig_123110537_f-49_marine_Comparison_Survey_Area_Hydroacoustic_Survey_Smolt_09_Biomass.mxd