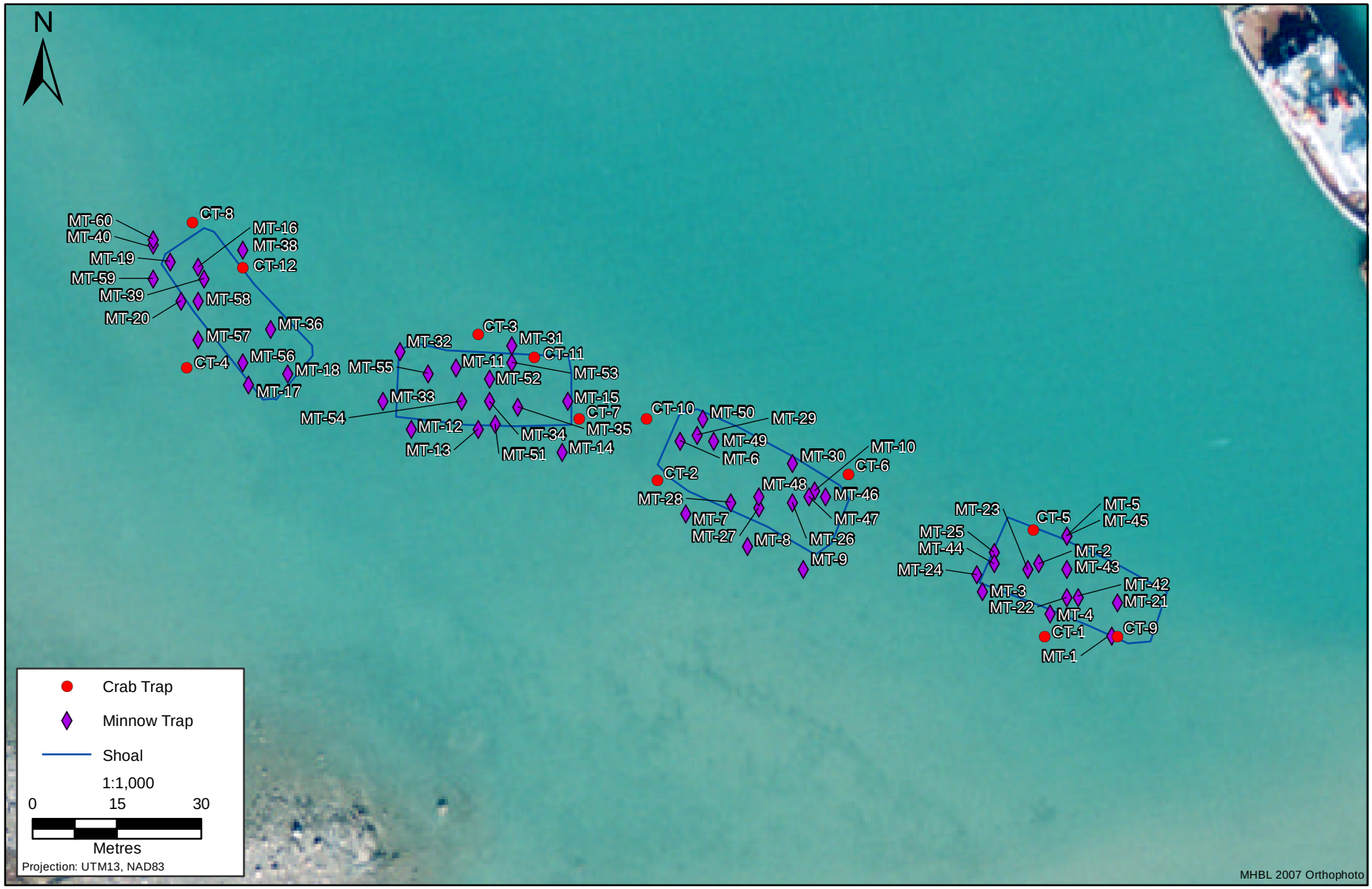


Figure 2.2-4

NEWMONT The Gold Company

Minnow Trap and Crab Trap Locations in Roberts Bay during the August Fish Community Survey of the Compensation Shoals, Doris North Project, 2010

Figure 2.2-4

Rescan Engineers & Scientists

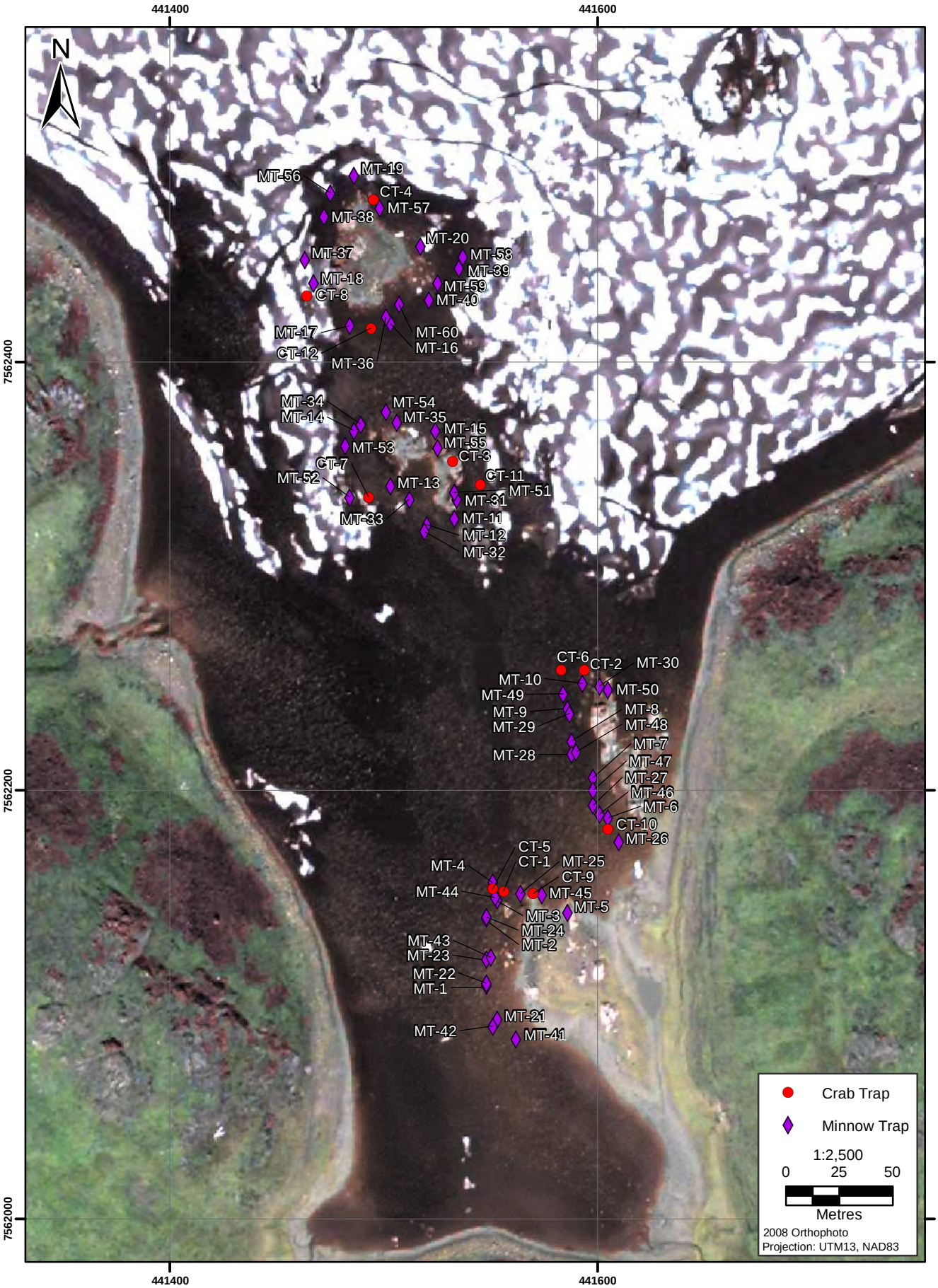
Figure 2.2-5

NEWMONT NORTH AMERICA

Minnow Trap and Crab Trap Locations in Roberts Bay during the July Fish Community Survey of the Jetty, Doris North Project, 2010

Figure 2.2-5

Rescan Engineers & Scientists

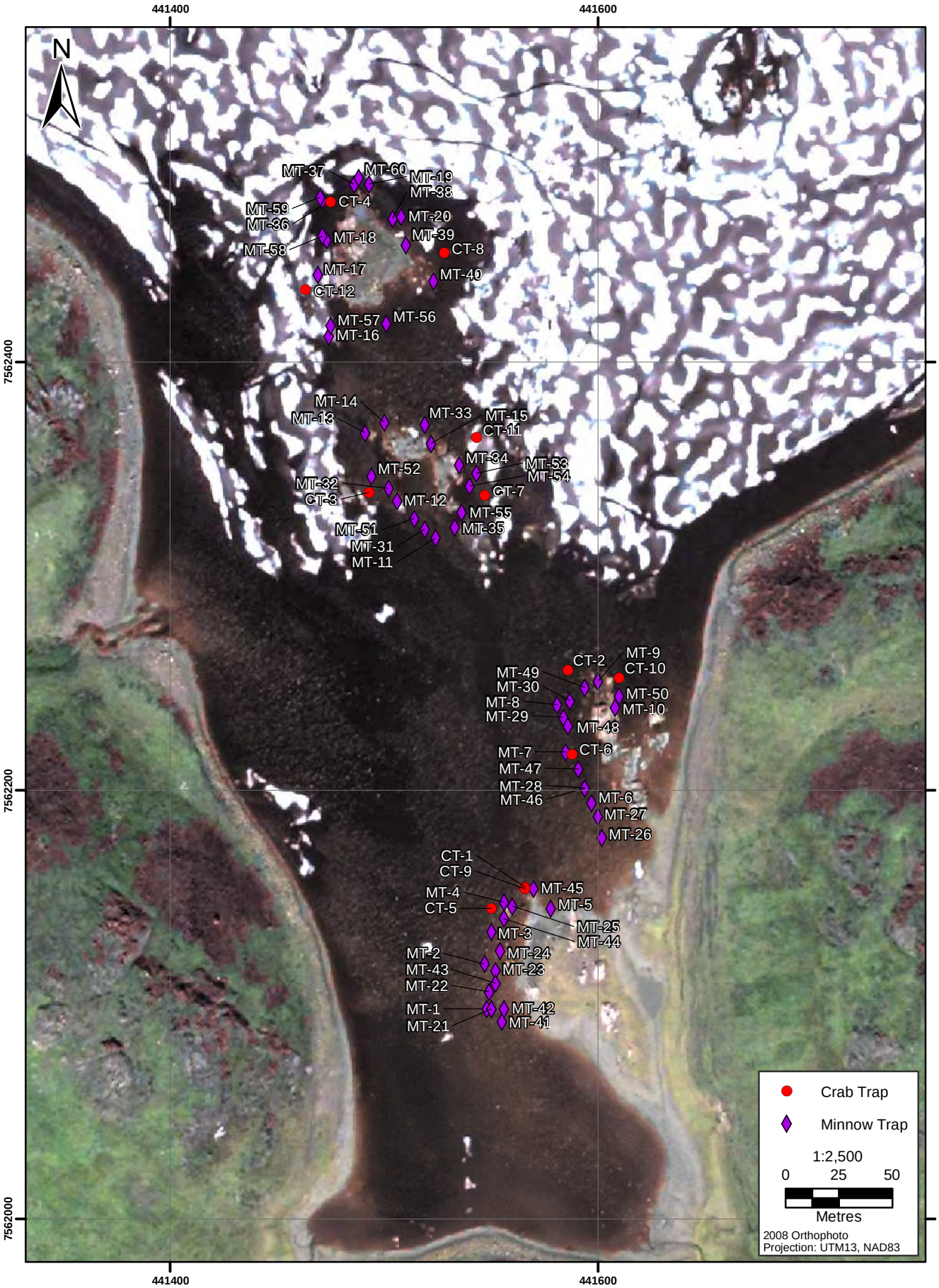


NEWMONT The Gold Company

Minnow Trap and Crab Trap Locations in Reference Bay during the July Fish Community Survey of the Reference Shoals, Doris North Project, 2010

Figure 2.2-6

Rescan Engineers & Scientists



NEWMONT The Gold Company

Minnow Trap and Crab Trap Locations in Reference Bay during the August Fish Community Survey of the Reference Shoals, Doris North Project, 2010

Figure 2.2-7

Rescan Engineers & Scientists

2.2.1.5 Aging

Age was estimated by counting the number of annuli (or yearly rings) from each structure (fin rays or scales). Scales were attached to plastic fiches and annuli were counted with a microfiche reader. The fin rays were air-dried and then mounted in a 50:50 epoxy medium. Microsections were cut using a Beuler Isomet diamond saw and mounted on slides for the counting of annuli with a compound microscope. When more than one structure was used for aging, the structure with the highest confidence, based on professional opinion, was used.

2.2.2 Snorkel Survey

Snorkel surveys were conducted in Roberts Bay and Reference Bay to qualitatively and quantitatively assess the direct habitat use and stability of the compensation structures relative to the references shoals (Plate 2.2-4). Surveys were conducted concurrently with fish community assessments in July and August. The number of surveys conducted at each site increased relative to 2009 because it was found that snorkel surveys were the most effective means of assessing direct habitat use of the compensation structures by marine fish.

Survey patterns consisted of two divers swimming parallel to each other, in a slow methodical manner. The swimmers divided the survey area into two, with each diver being responsible for counting fish overtop their area of habitat. At the Roberts Bay shoals, where observers could swim overtop of the habitat in question, survey patterns consisted of a zig-zag pattern over the entire shoal for a period of about 15–20 minutes (Plate 2.2-4). However, in Reference Bay, where substrates breached the surface of the water, snorkelers swam in a parallel fashion around the perimeter of the shoals, again for a period of about 15–20 minutes. The Roberts Bay Jetty survey was conducted in a similar manner as the Reference Bay shoals, but for a period of 25–30 minutes, so as to survey the entire habitat.

Plate 2.2-4. Snorkel survey of the shoals in Reference Bay, Doris North Project, 2010.

All fish and invertebrates encountered were identified to the lowest possible taxonomic level and enumerated. Additionally, the species composition and percent cover of macroalgae were estimated. Representative samples of algae were collected and sent to Dr. Sandra Lindstrom (North Saanich, BC) for identification. An estimate of substrate types, recorded as percent cover was also conducted. Upon the completion of the survey, snorkelers estimated the relative abundance of sediment types: fines (> 0 to 2 mm diameter), gravel (2 to 64 mm), cobble (64 to 256 mm), boulder (256 to 4,000 mm), and bedrock (> 4,000 mm diameter). All data were recorded on a waterproof dive slate and transcribed into a field notebook upon completion of the survey. Sampling date, location, and visibility estimates were also noted.

Three snorkel surveys were conducted during the July sampling period on the Roberts Bay shoals, jetty and Reference Bay shoals. In August, however, safety concerns over barge offloading, significant weather delays and reduced visibility limited the ability of crews to conduct snorkel surveys. Instead, only two surveys were conducted on each structure. Snorkel survey data are presented in Appendix 3.2-9.

All surveys were conducted during standard daylight hours (0900–1700); however, weather conditions and visibility varied greatly. Visibility at the Roberts Bay shoals and jetty was moderate during the July surveys (3 to 8 m), but was lower in August (2 to 2.5 m). Decreased visibility in August was largely due to increased wind speeds and barge traffic that stirred up shallow water sediments. Reference Bay visibility consistently ranged between 3 and 5 m during both July and August snorkel surveys.

2.3 DATA ANALYSIS

2.3.1 Primary and Secondary Producers

Results of the taxonomic identification and enumeration of periphyton and benthic invertebrate samples were used to calculate two indices of diversity: genus richness and Simpson's diversity index.

Richness is defined as the number of genera present in a sample. To determine genus richness, multiple species belonging to the same genus were pooled. In the few instances that organisms belonging to the same order or family could not be identified to the genus level, a single genus was assumed to be present within this order or family for the purposes of calculating genus richness and diversity. Species richness of periphyton was expressed as the number of genera per plate. Species richness of benthos was expressed as the number of genera per trap.

Simpson's diversity index ranges from 0 (no diversity) to 1 (maximum diversity) and represents the probability that two individuals sampled from a population will belong to different genera. The formula used to calculate Simpson's diversity index (for genus diversity) is:

$$\text{Simpson's diversity index} = 1 - \sum_{i\ 1}^{G} [n_i(n_i\text{-}1)] \ / \ [N(N\text{-}1)]$$

where G is the number of genera, n_i is the number of individuals in the i^{th} genera, and N is the total number of individuals.

A nested ANOVA was used to compare mean biomass, density, richness and diversity between the compensation and reference shoals for both primary and secondary producers. The model design incorporated site effects as well as within-site variation among shoals. Differences between sites or shoals were considered significant at an alpha significance level of 0.05 (i.e., p-value of <0.05). The SYSTAT 11 software package was used for all statistical analyses (SYSTAT 2006).

2.3.2 Fish Community

Fish communities were characterized using relative abundance, mean length (mm), mean weight (g), mean age, and catch-per-unit-effort (CPUE). Key species and life history stages that use the constructed habitat directly were identified. Mean CPUE was compared between the constructed structures and reference shoals.

CPUE is an index of relative abundance that can be used to compare fish populations among different areas. A key factor that allows comparison of CPUE data is the standardization of sampling effort. The same traps and amount of bait were used in all locations, allowing comparisons of CPUE data to be made.

For minnow traps and crap traps, CPUE was calculated from the number of fish caught per trap per 24 hours.

$$\text{CPUE} = \text{number of fish} \times [24 \text{ (hrs)} / \text{set time (hrs)}]$$

Length-frequency distributions were plotted to visualize the distribution of fish lengths. One of the assumptions of the distributions is that fish of all size classes have an equal probability of being captured, which is often not the case. Also, a large sample size is needed to ensure that all size classes are represented (Johnson et al. 2007). Therefore, length-frequencies were plotted only if the sample size was adequate ($n \geq 7$).

Condition and weight-length regressions are indicators of the relative health of fish. Condition factor was based on the following formula from Ricker (1975):

$$\text{Condition} = \text{weight (g)} \times 10^5 / \text{length}^3 \text{ (mm)}$$

Length was multiplied by a factor of 10^5 to avoid fractional values, and a weight-length exponent of exactly 3 was assumed to apply to all species of fish.

Weight-length relationships were calculated for fish species captured in adequate numbers (i.e., ≥7). Analysis of Covariance (ANCOVA) tests were not conducted on the respective relationships due to low sample sizes for this statistical method. Logarithmic transformations were performed on the data prior to conducting the regression in order to linearized the relationship and to homogenize the variances.

$$\ln(\text{weight}) = \ln(a) + b[\ln(\text{length})]$$

where a is a coefficient and b is the slope of the regression.

Statistical analyses were conducted according to Zar (1984) using the SYSTAT library of computer programs (SYSTAT 2006).

2.4 QA/QC

A quality assurance and quality control program (QA/QC) was included in the design of this study. The program included the use of chain of custody forms, taxonomic and laboratory QA/QC procedures and data review.

Field notes were transcribed onto electronic spreadsheets, and all transcriptions were checked visually against the field forms and any errors were corrected. The data were also plotted (e.g., weight vs. length) to identify any outliers that may have resulted from transcription errors that occurred in the field.

For periphyton taxonomy data, EcoAnalysts took high quality digital images of each taxon encountered to verify identification. Additionally, a minimum of 10% of all samples were analyzed by an independent phycologist to ensure taxonomic accuracy and reproducibility of the analysis methods. With respect to periphyton biomass, ALS Environmental Group operates a formal quality control program which includes the use of reagent blanks, standard quality control samples, and periodic calibration. All results from standards and blanks, as well as calibration, are recorded.

Multiple aging structures were sampled and read whenever possible. Both scale and fin ray readings were compared. In the event of a discrepancy, the clearest and most reliable structure was selected based on the professional opinion of North Shore Environmental staff.

3. Results and Discussion

3. Results and Discussion

3.1 SEDIMENT TRANSPORT AND DEPOSITION

3.1.1 Bathymetry of Southern Roberts Bay in 2010

Figure 3.1-1 shows the bathymetry of southern Roberts Bay as of July 2010. Additional bathymetry transects were conducted near shore during 2010 surveys, therefore providing greater detail along the southern shoreline of Roberts Bay than was available in 2008 or 2009. Overall, the contour patterns observed in 2010 were similar to those observed in previous years (Golder 2008; Rescan 2009).

3.1.2 Comparison of Bathymetry Pre- to Post-Jetty Construction

Figure 3.1-2 shows a comparison of depths between 2006 and 2010. These results were similar to comparisons between 2006 and 2008 (Golder 2008) and 2006 to 2009 (Rescan 2009), which indicate an accumulation of sediment north of the jetty. In this area, depths decreased between 0.75 and 1.0 m from 2006 to 2010. These changes were expected as barge activity has been observed to cause sediment disturbance in shallow waters adjacent to the jetty.

The steep slope region to the east of the jetty has continued to lose substrate, resulting in an increase in depth by 0.75 to 1.0 m (Figure 3.1-2). Three pockets to the east of this area showed signs of sediment accumulation. These pockets of accumulation cover a larger area than what was observed in previous years (Rescan 2009). Immediately below this area, signs of sediment depletion continue to be present, though to a lesser extent than in previous years. Changes observed in 2010 may be related to the steep slopes in the area (Figure 3.1-1), which make analyses very sensitive to small changes in depth.

To the west of the jetty, the most notable changes in depth observed between 2006 and 2010 are related to shoal construction. Around each of the four shoals, signs of sediment accumulation are evident, ranging from 0.25 to 0.50 m (Figure 3.1-2). Zones of sediment depletion observed immediately north of the eastern most shoals may be related to the steep slopes in the area, which make analyses very sensitive to small changes (Figure 3.1-1).

3.1.3 Year-1, Year-2 and Year-3 Post-Jetty Construction Comparisons

Figures 3.1-3 and 3.1-4 show a comparison of Roberts Bay bathymetry between Year-1 and Year-3 post-jetty construction (i.e., between 2008 and 2010) and between Year-2 and Year-3 post-jetty construction (i.e., between 2009 and 2010), respectively.

Depth comparisons between 2008 and 2010 show pockets of sediment depletion at the west-northwest and east-northeast areas of the jetty (Figure 3.1-3). This pattern was more prominent in the 2008 to 2009 comparison (Rescan 2009). The steep slope region to the east of the jetty has continued to displace substrate from the area, decreasing depths from 0.75 to 1.0 m near the jetty and 0.25 to 0.50 m further east. To the west of the jetty, the pattern of decreased bed elevation on and around the shoals may be an artifact of bathymetric analysis which extrapolates results where data was limited. Minimal accumulation of sediment may have occurred around the margins of each shoal though observed changes are known to be extrapolated because depths did not decrease over the constructed habitat.

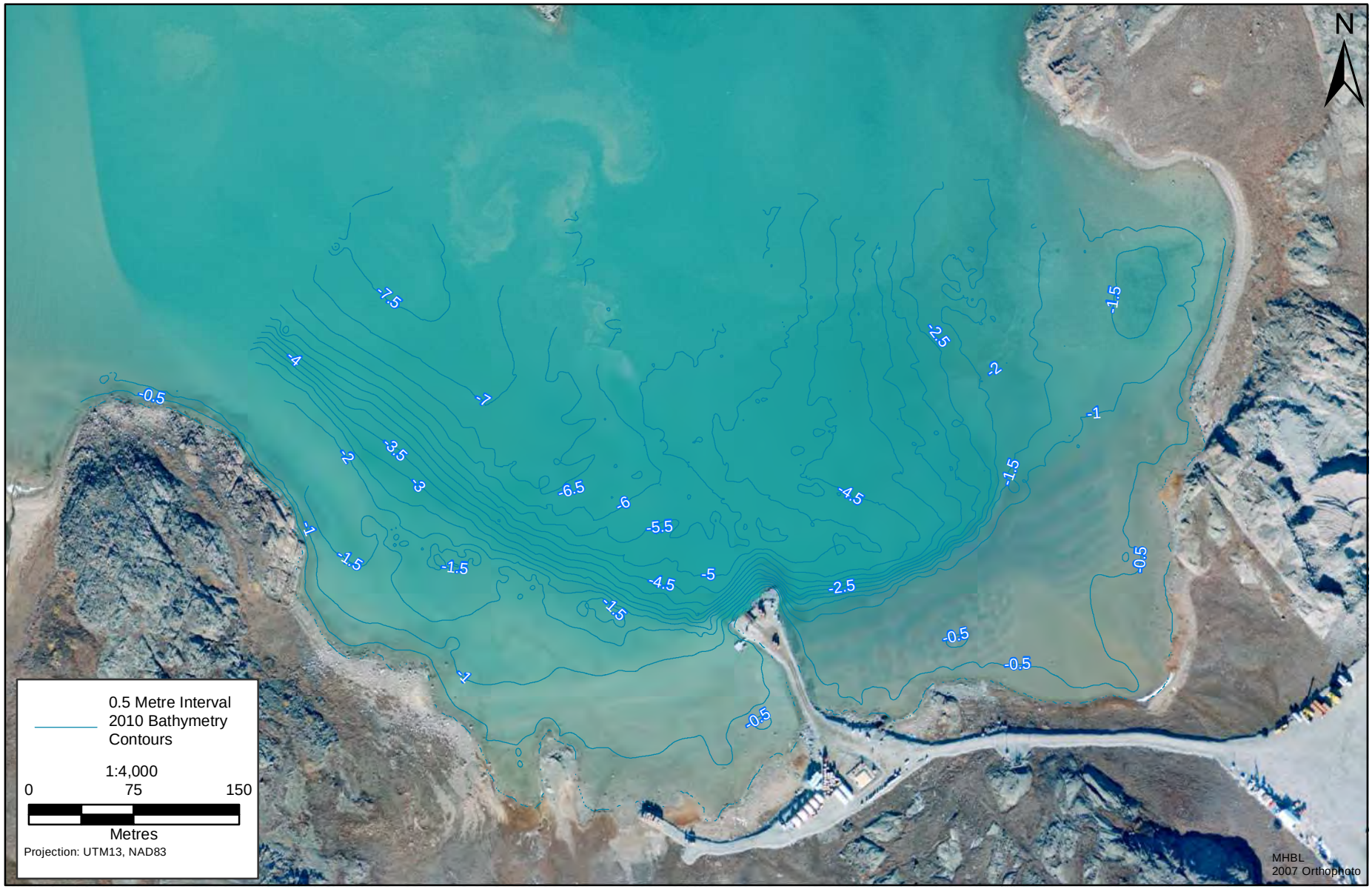


Figure 3.1-1

NEWMONT NORTH AMERICA

Roberts Bay Bathymetry, Doris North Project, 2010

Figure 3.1-1

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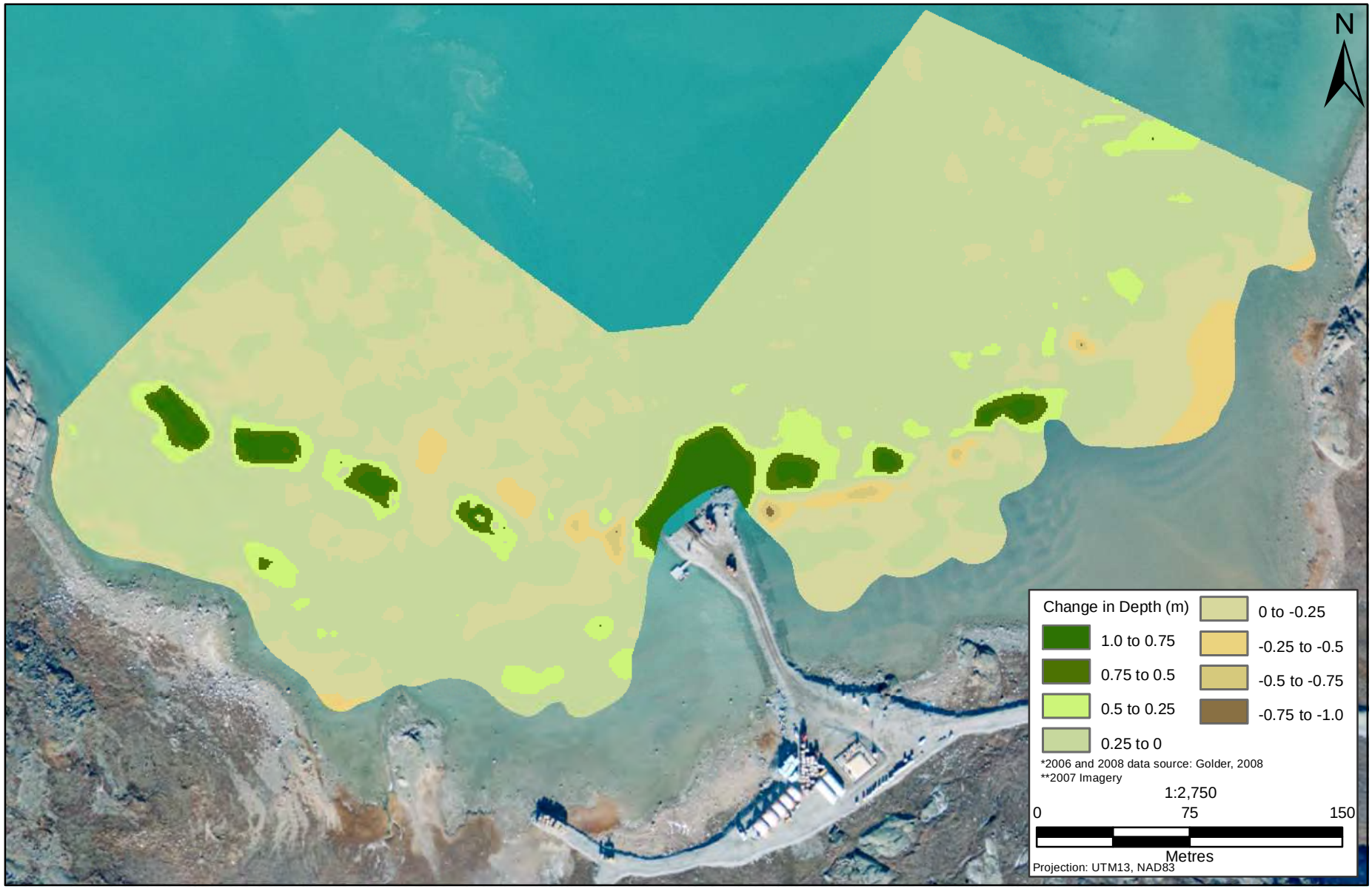

Figure 3.1-2

NEWMONT NORTH AMERICA

Depth Comparisons between 2006 and 2010

Figure 3.1-2

Rescan Engineers & Scientists

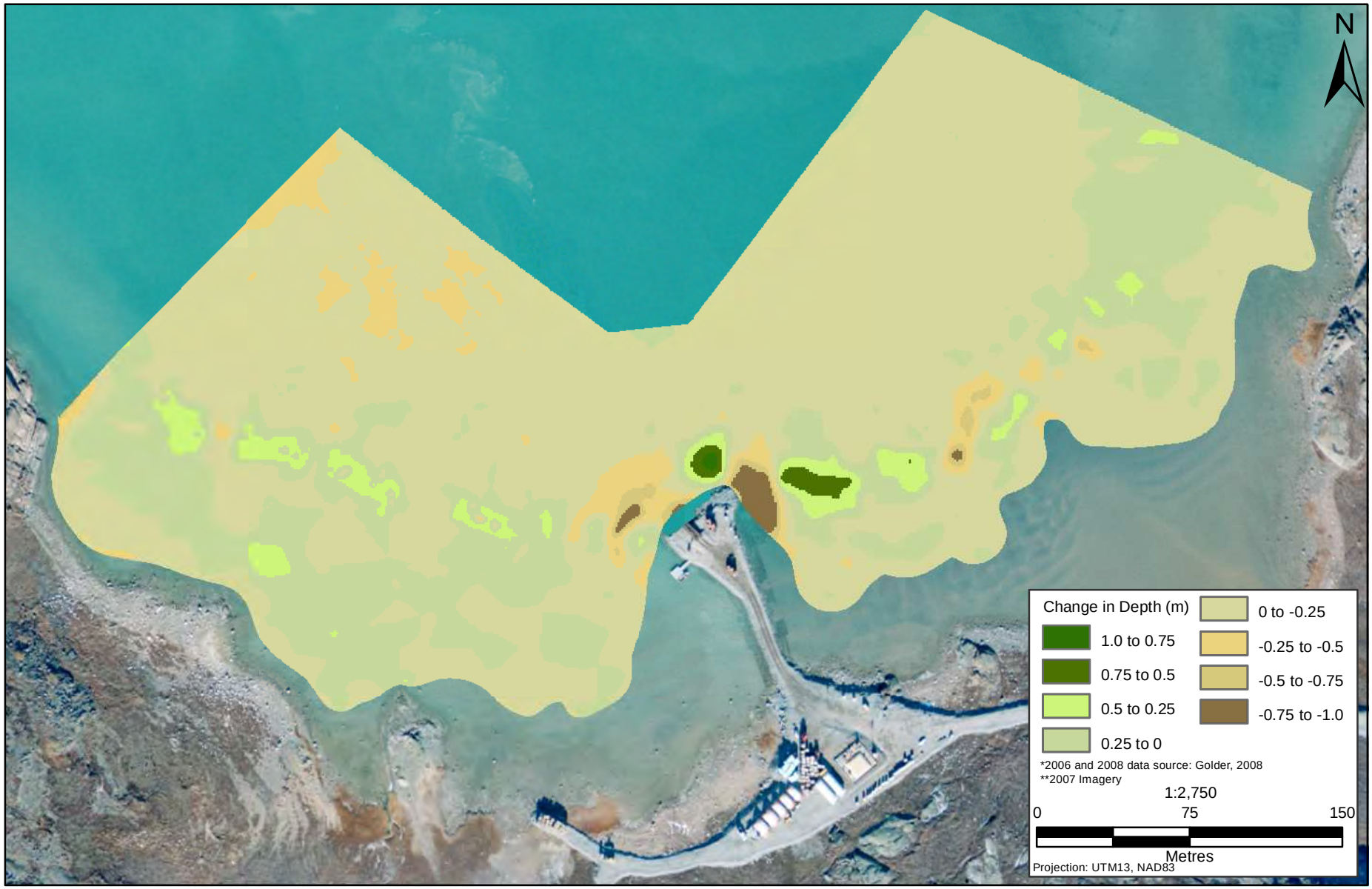

Figure 3.1-3

NEWMONT NORTH AMERICA

Depth Comparisons between 2008 and 2010

Figure 3.1-3

Rescan Engineers & Scientists

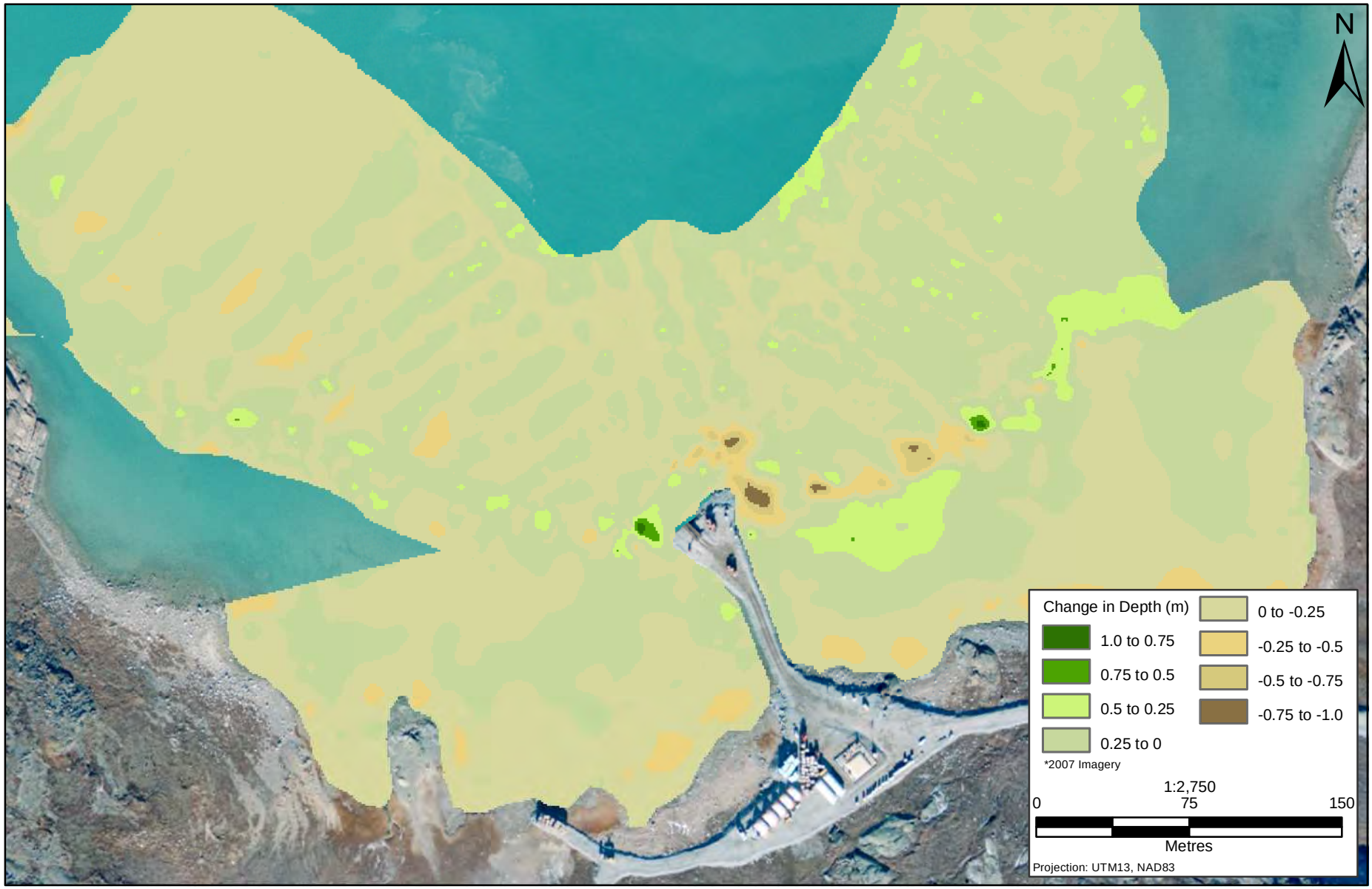

Figure 3.1-4

NEWMONT NORTH AMERICA

Depth Comparisons between 2009 and 2010

Figure 3.1-4

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Depth comparisons between 2009 and 2010 data show very minimal change (Figure 3.1-4). Minimal change has occurred to the north of the jetty, suggesting stabilization of substrate in this region. Pockets of sediment depletion are restricted to the steep slope region on the eastern side of the jetty. Analyses in this region are known to be sensitive to small change. South of this steep slope region, sediment accumulation continues to persist with depths decreasing 0.25 to 0.50 m. Small pockets of sediment accumulation follow the steep slope region to the west of the jetty (Figure 3.1-1). This observed change can again be related to the sensitivity of the analyses to small change.

Overall, changes observed between Year-1 and Year-3 post-jetty construction are more prominent than those observed between Year-2 and Year-3 post-jetty construction. This is to be expected given that the greatest change would be observed Year-1 post construction; sediment transport and deposition effects should be limited to natural effects thereafter (e.g. coastal erosion due to storm surges, etc.). Trends comparing pre- to post-jetty construction are similar between 2009 and 2010. Certain areas along the steep bed slope region to the east of the jetty are more sensitive to small change, thus patches of higher and lower elevations have been recorded. Overall, the area surrounding the jetty and rock shoals shows little change in bed elevation between 2009 and 2010.

3.2 FISH HABITAT MONITORING

3.2.1 Primary and Secondary Producers

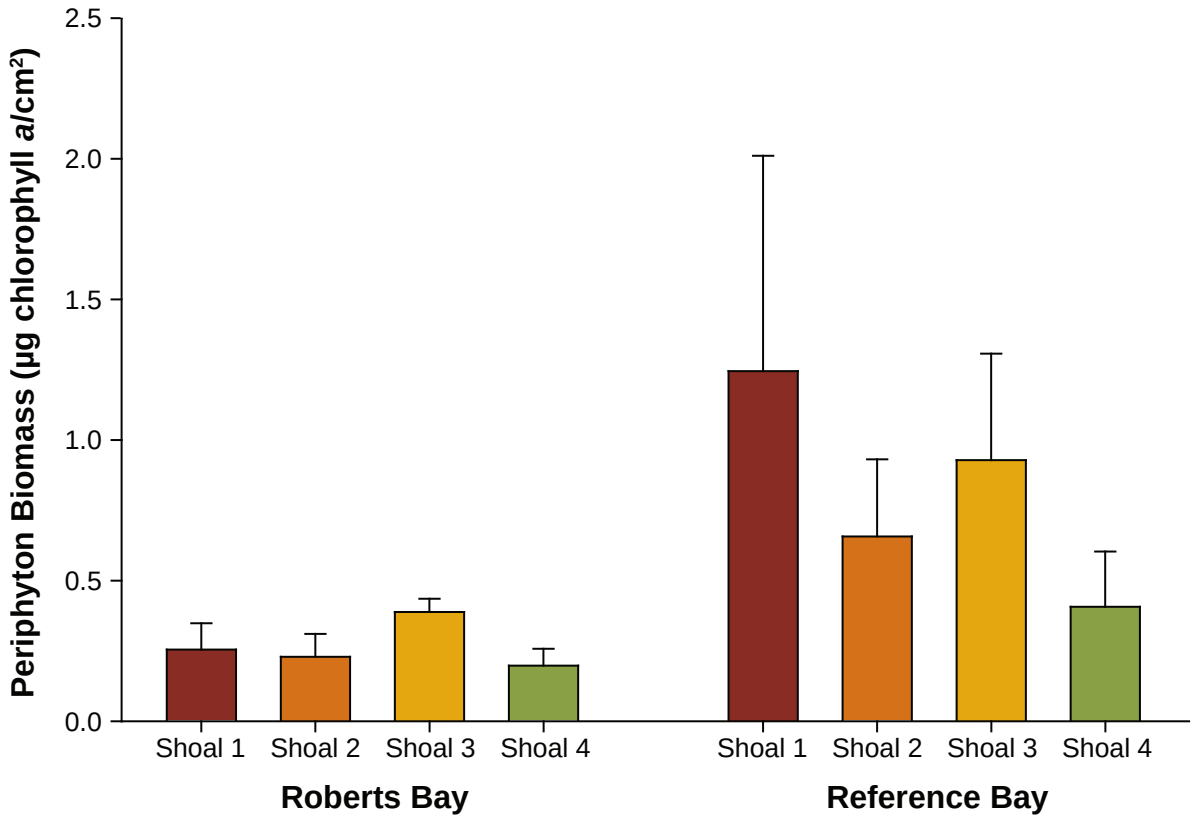
3.2.1.1 Periphyton

Periphyton communities were sampled from Roberts Bay and the Reference Bay in 2010. In each location, periphyton was sampled from five replicates on each of four shoals. Appendix 3.2-1 shows the data on the location, setting and retrieval times for artificial substrate samplers used in Roberts Bay and Reference Bay. Appendices 3.2-2 and 3.2-3 show all periphyton biomass data (as µg chlorophyll *a*/cm^2) and taxonomic results, respectively.

Biomass

Mean periphyton biomass in 2010 was significantly higher on the plates installed on the reference shoals than on the compensation shoals (p=0.026; Figure 3.2-1). In Roberts Bay, mean biomass ranged from 0.197 to 0.388 µg chl *a*/cm^2, while in Reference Bay, mean biomass ranged from 0.407 to 1.25 µg chl *a*/cm^2. In 2009, mean biomass was similar on the reference and compensation shoals, though overall biomass levels were much lower than those measured in 2010. In Reference Bay, mean biomass increased by an order of magnitude from 2009 to 2010, suggesting that periphyton biomass may naturally be highly variable (Rescan 2009).

Several factors could have contributed to the observed differences in mean biomass between Roberts Bay and Reference Bay in 2010. These include the higher marine vessel traffic in Roberts Bay, differences in water turbulence and wave energy, and differences in light regime due to the depth of plate installation. Periphyton plates installed in Roberts Bay were more likely to be scoured or disturbed by turbulence because of the high marine vessel traffic near the shoals. The average depth of plate installation among all replicates was also deeper (1.2 m) in Roberts Bay compared to the Reference Bay (0.7 m) (Appendix 3.2-1). Therefore, periphyton in Roberts Bay may have been exposed to lower light levels than periphyton in the Reference Bay, resulting in less growth. Furthermore, the shallow water surrounding Reference Shoal 1 and 2 led to increased temperatures, which likely boosted growth. As the bathymetry surrounding Reference Shoal 1 and 2 do not provide substrates in comparable depths to the Roberts Bay shoals, these differences will likely continue and need to be accounted for in future monitoring.



Note: Error bars represent the standard error of the mean of five replicates collected at each shoal.

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Periphyton Biomass in Roberts Bay and Reference Bay, Doris North Project, 2010

Figure 3.2-1

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Density and Taxonomic Composition

Mean periphyton densities were similar between Roberts Bay and Reference Bay in 2010, ranging from 81,000 to 234,000 cells/cm^2 in Roberts Bay and 82,000 to 194,000 cells/cm^2 in Reference Bay (Figure 3.2-2). There was no statistically significant difference in mean cell density between sites (p=0.43). The variability among shoals and among replicates was high.

Periphyton taxonomic composition was also similar between Roberts Bay and Reference Bay. In the compensation shoals, the periphyton community consisted of cyanobacteria (blue-green algae; 65–79%) and diatoms (Bacillariophyta; 20–34%), as well as a few rare phyla that never exceeded 1% of the population (Figure 3.2-2). In the reference shoals, the periphyton community was composed of cyanobacteria (54–69%), diatoms (26–43%), and several rare phyla including dinoflagellates (1–2%), chlorophytes (green algae; 0–2%), and cryptophytes (0–2%). The filamentous, nitrogen-fixing cyanobacterium, *Anabaena cylindrica*, was the most abundant periphyton species in both Roberts Bay and Reference Bay shoals (Plate 3.2-1). The diatom genus *Nitzschia* was also common in both sites.

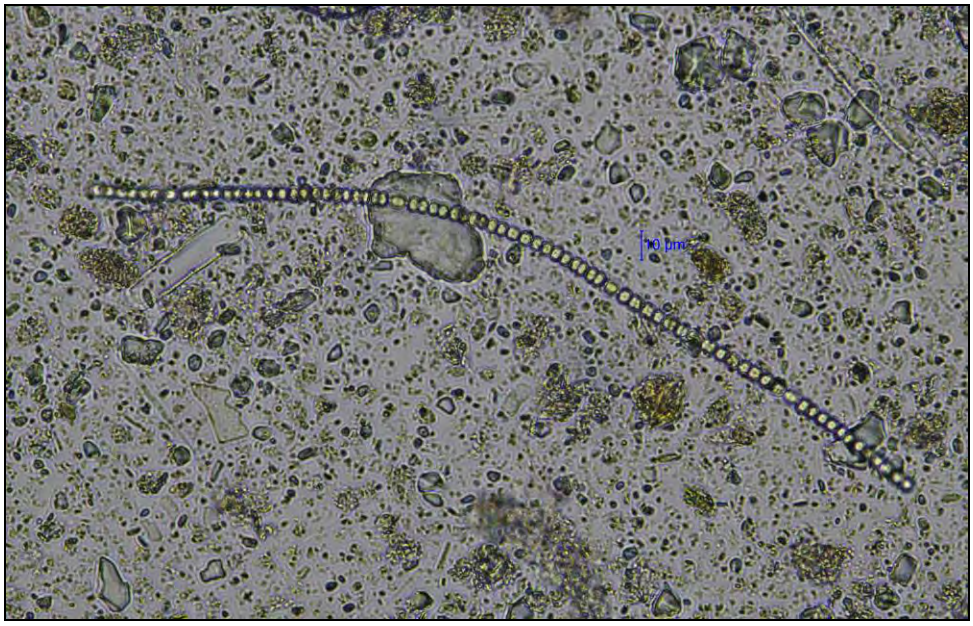
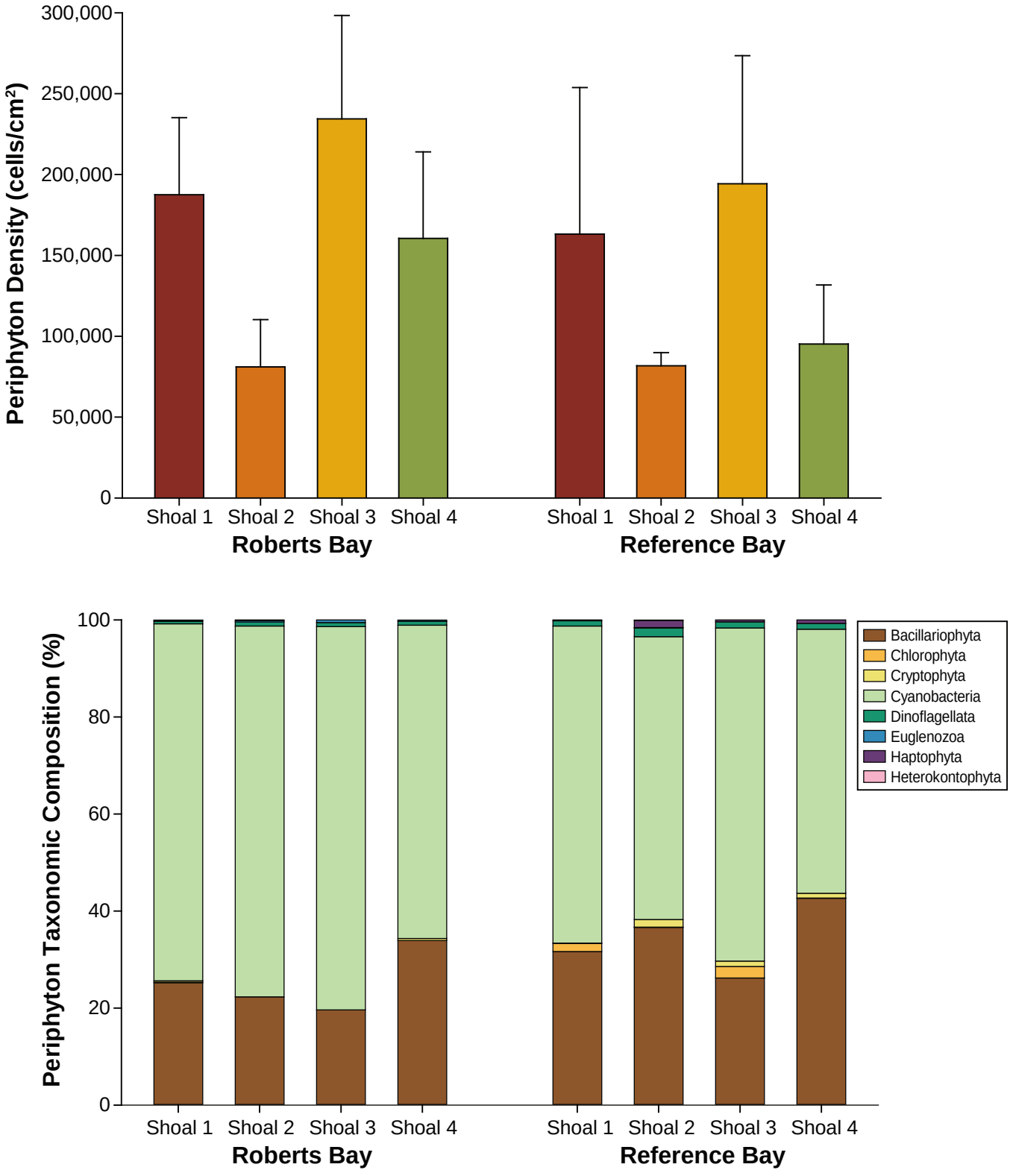


Plate 3.2-1. The filamentous cyanobacterium, Anabaena cylindrica.

Richness and Diversity

Mean periphyton genus richness was similar between sites, ranging from 11 to 15 genera/plate in Roberts Bay and 12 to 16 genera/plate in Reference Bay (Figure 3.2-3; Table 3.2-1). There was no statistically significant difference in mean richness between sites (p=0.15).

Mean Simpson's diversity index ranged from 0.39 to 0.53 in the compensation shoals and 0.52 to 0.59 in the reference shoals, indicating that the periphyton community was moderately diverse at both sites (Figure 3.2-3; Table 3.2-1). Mean Simpson's diversity was significantly higher in the reference shoals than in the compensation shoals (p=0.043). This is likely attributable to the slightly higher relative abundance of *Anabaena cylindrica* and the lower relative abundance of rare phyla in the compensation shoals than in the reference shoals (Figure 3.2-2).



Note: Error bars represent the standard error of the mean of five replicates collected at each shoal.

NEWMONT NORTH AMERICA

Periphyton Density and Taxonomic Composition in Roberts Bay and Reference Bay, Doris North Project, 2010

Figure 3.2-2

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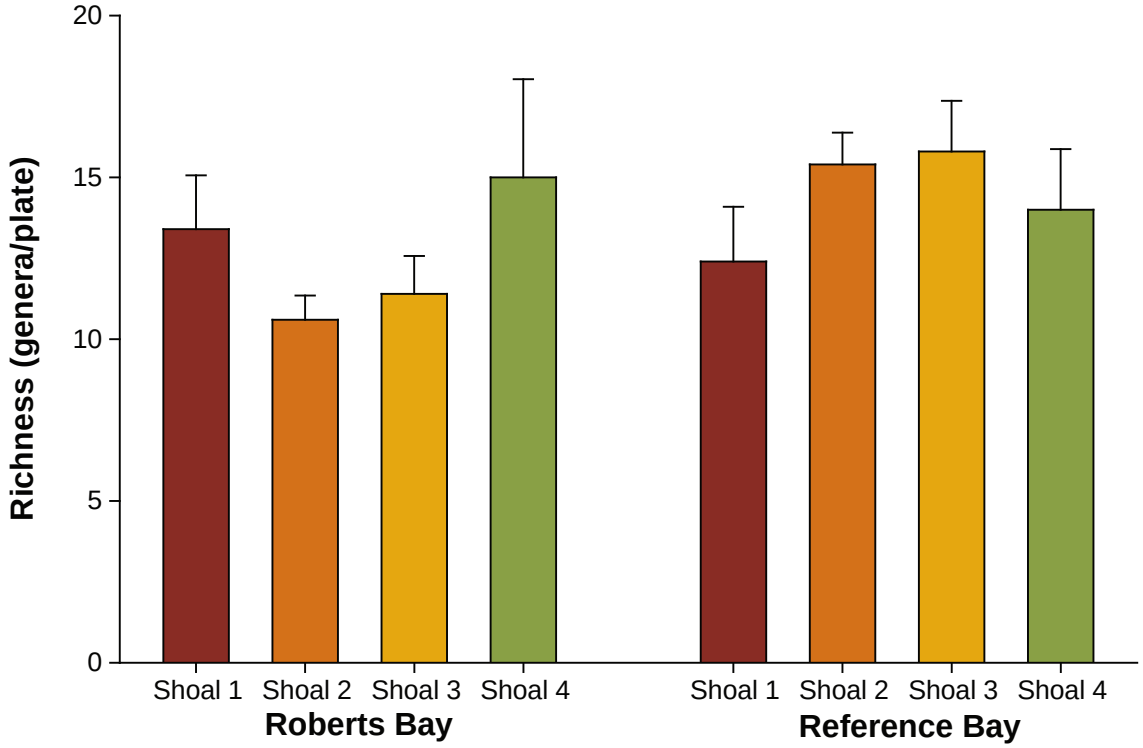

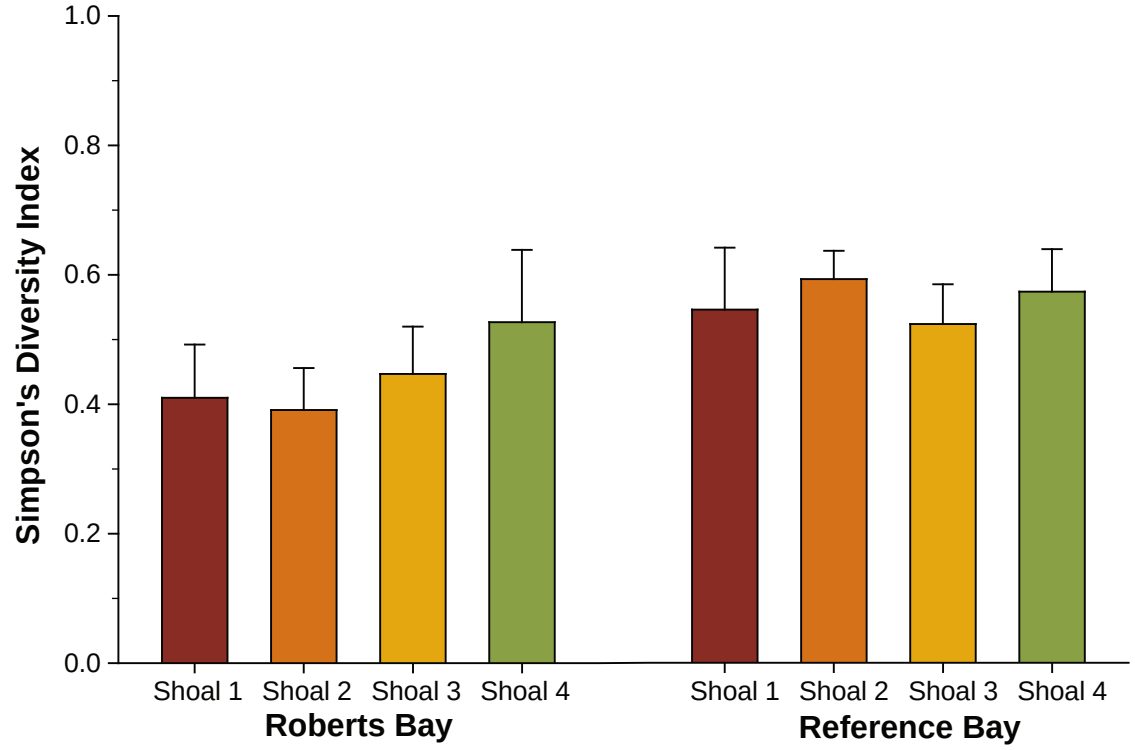

Notes: Error bars represent the standard error of the mean of five replicates collected at each shoal.

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Periphyton Richness and Diversity in Roberts Bay and Reference Bay, Doris North Project, 2010

Figure 3.2-3

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Table 3.2-1. Summary of Periphyton Richness and Diversity in Roberts Bay and Reference Bay, Doris North Project, 2010

	Genus Richness		Simpson's Diversity Index		
	Mean	SE	Mean	SE	Dominant Species
Roberts Bay					
Shoal 1	13.4	1.7	0.41	0.08	*Anabaena cylindrica*
Shoal 2	10.6	0.8	0.39	0.06	*Anabaena cylindrica*
Shoal 3	11.4	1.2	0.45	0.07	*Anabaena cylindrica*
Shoal 4	15.0	3.0	0.53	0.11	*Anabaena cylindrica*
Reference Bay					
Shoal 1	12.4	1.7	0.55	0.10	*Anabaena cylindrica*
Shoal 2	15.4	1.0	0.59	0.04	*Anabaena cylindrica*
Shoal 3	15.8	1.6	0.52	0.06	*Anabaena cylindrica*
Shoal 4	14.0	1.9	0.57	0.07	*Anabaena cylindrica*

Notes:
The mean value represents the average of five replicates.
SE = standard error of the mean.
Genus richness is the average number of genera on each 100 cm^2 plate.
Dominant species is the most abundant species numerically in the pooled total of 5 replicates.

3.2.1.2 Benthic Invertebrates

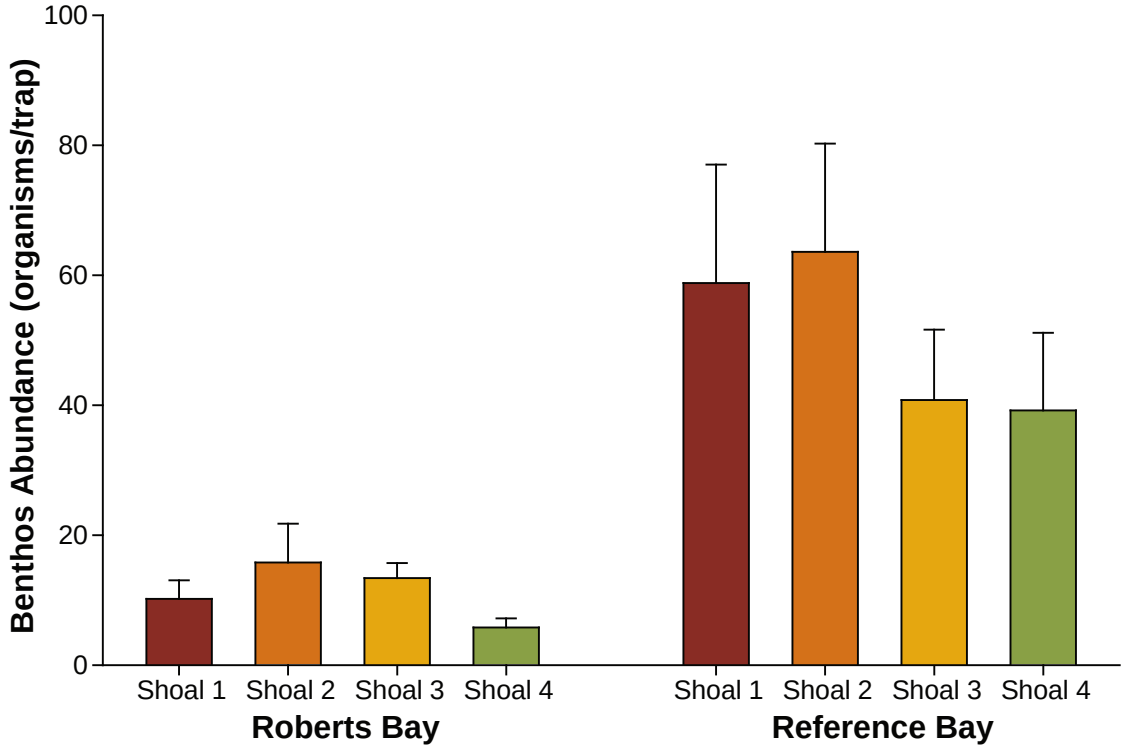
Benthic invertebrates (benthos) were sampled from Roberts Bay and the Reference Bay in 2010. In each bay, five replicate artificial substrate samplers were installed at each of four shoals. Benthic invertebrate data are presented in Appendix 3.2-4.

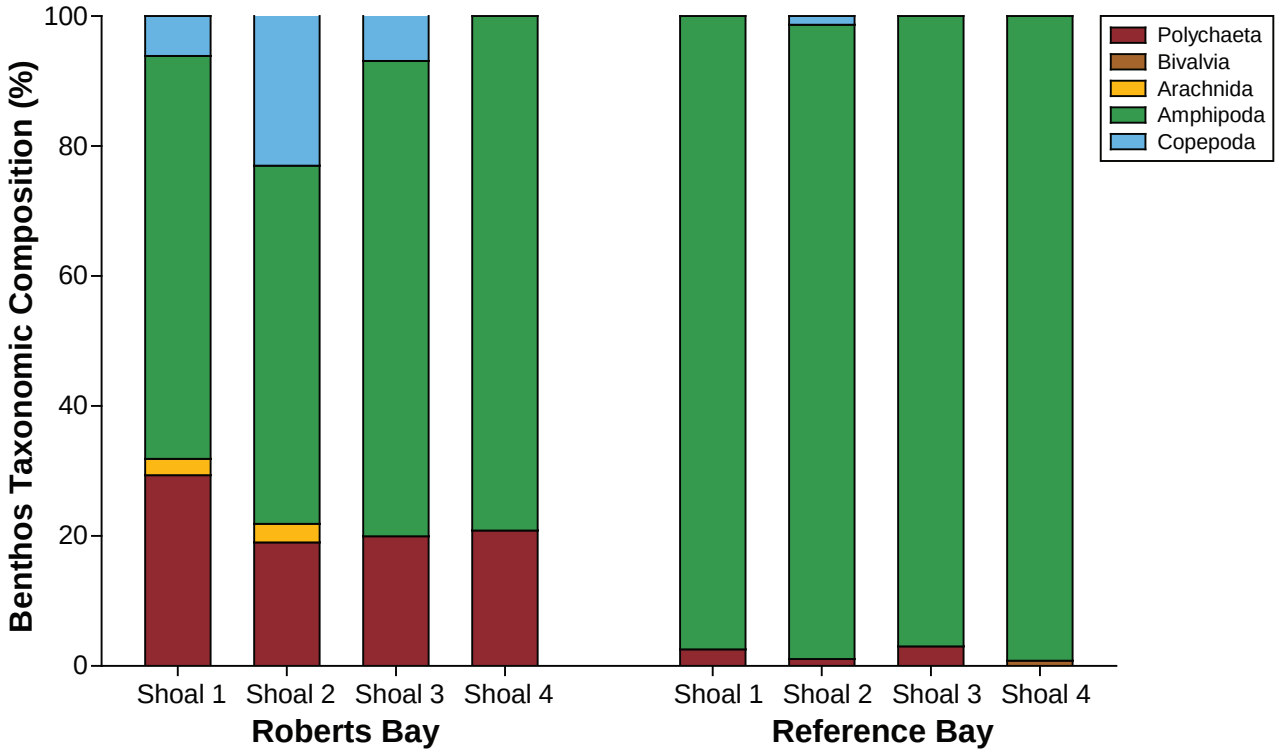
Abundance and Taxonomic Composition

Mean benthos abundance at the compensation shoals ranged from 6 to 16 organisms/trap. Mean benthos abundance was higher at the Reference Bay shoals, ranging from 39 to 64 organisms/trap (Figure 3.2-4). The difference in mean abundance between sites was statistically significant ($p<0.001$).

The benthic invertebrate community composition was dominated by amphipods in both Roberts Bay and Reference Bay (Figure 3.2-4). However, the benthic assemblage in Reference Bay was almost uniformly composed of amphipods (97–99%), while the community composition in Roberts Bay consisted of a more heterogeneous assemblage of amphipods (55–79%), polychaetes (19–29%), copepods (6–23%), and arachnids (<3%).

A single amphipod species, *Lagunogammarus setosus*, accounted for more than 90% of benthic organisms found in Reference Bay rock traps. Although this amphipod species was also abundant in Roberts Bay (10–26%), several other benthic species were also common, including *Ischyrocerus anguipes* (amphipod) (32–61%) and *Harmothoe imbricata* Cmplx. (polychaete) (11–25%). Harpacticoid copepods were particularly abundant on Shoal 2 in Roberts Bay (23%). In general, even though some benthos occurred in very low numbers, most of the taxonomic groups that were present at the reference shoals were also observed at the compensation shoals (Table 3.2-2).





Note: Error bars represent the standard error of the mean of five replicates collected at each shoal.

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Benthic Invertebrate Abundance and Taxonomic Composition in Roberts Bay and Reference Bay, Doris North Project, 2010

Figure 3.2-4

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Table 3.2-2. Summary of Pooled Benthic Invertebrate Taxa Captured at Roberts Bay and Reference Bay Shoals, Doris North Project, 2010

Taxa	Roberts Bay	Reference Bay
ANNELIDA		
Polychaeta Errantia		
Harmothoe imbricata Cmplx.	X	X
Nephtys sp.	X	-
Polychaeta Sedentaria		
Spio sp.	X	-
MOLLUSCA		
Bivalvia		
Ennucula tenuis	-	X
ARTHROPODA		
Arachnida		
Halacaridae	X	-
Amphipoda		
Gammaracanthus loricatus	X	X
Ischyrocerus anguipes	X	-
Lagunogammarus setosus	X	X
Copepoda		
Harpacticoida	X	X
Total	**8**	**5**

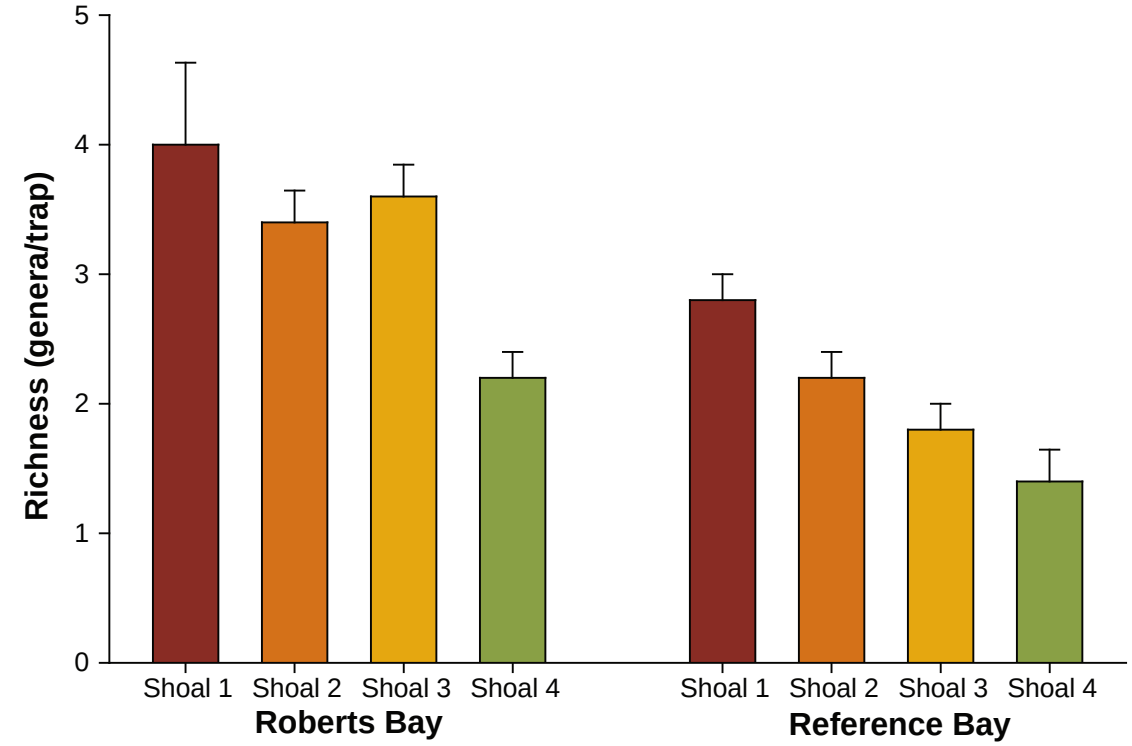
Notes: Several juvenile ray-finned fish (teleosts) were identified in benthos samples from both compensation and reference shoals. These organisms were excluded from the taxonomic analysis because they are not benthic invertebrates.

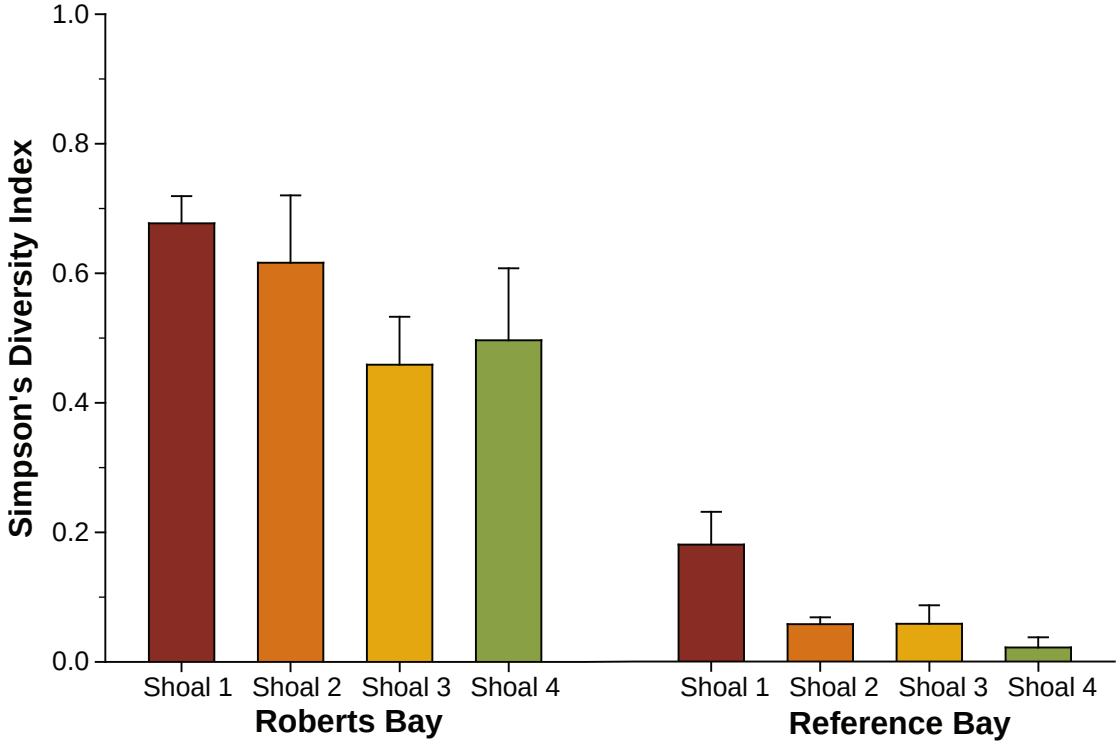
Richness and Diversity

Mean benthos genus richness in rock traps ranged from 2.2 to 4.0 in Roberts Bay and from 1.4 to 2.8 in Reference Bay (Figure 3.2-5, Table 3.2-3). Mean genus richness was significantly higher at the compensation shoals than at the reference shoals ($p<0.001$); however, richness was also significantly different among the shoals within each bay ($p=0.001$). This suggests that genus richness is highly variable even on a small spatial scale.

Mean Simpson's diversity index ranged from 0.46 to 0.68 in Roberts Bay, suggesting that the benthic community at the compensation shoals was moderately diverse. In contrast, the mean benthic diversity at the reference shoals was very low, with a diversity index ranging from 0.02 to 0.18 (Figure 3.2-5, Table 3.2-3). The difference in mean diversity between sites was highly significant ($p<0.001$).

The lower level of community diversity in Reference Bay than in Roberts Bay can be explained by the high relative abundance a single species, *Lagunogammarus setosus*, which accounted for more than 90% of benthic organisms in the reference shoals. In comparison, the higher level of diversity in Roberts Bay reflects the more even taxa distribution within the compensation shoals.





Notes: Error bars represent the standard error of the mean of five replicates collected at each shoal.

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Benthic Invertebrate Richness and Diversity in Roberts Bay and Reference Bay, Doris North Project, 2010

Figure 3.2-5

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Table 3.2-3. Summary of Benthic Invertebrate Richness and Diversity in Roberts Bay and Reference Bay, Doris North Project, 2010

	Genus Richness		Simpson's Diversity Index		
	Mean	SE	Mean	SE	Dominant Species
Roberts Bay					
Shoal 1	4.0	0.6	0.68	0.04	*Lagunogammarus setosus*
Shoal 2	3.4	0.2	0.61	0.10	*Ischyrocerus anguipes*
Shoal 3	3.6	0.2	0.46	0.07	*I. anguipes*
Shoal 4	2.2	0.2	0.50	0.11	*L. setosus* & *I. anguipes*
Reference Bay					
Shoal 1	2.8	0.2	0.18	0.05	*L. setosus*
Shoal 2	2.2	0.2	0.06	0.01	*L. setosus*
Shoal 3	1.8	0.2	0.06	0.03	*L. setosus*
Shoal 4	1.4	0.2	0.02	0.02	*L. setosus*

Notes:
The mean value represents the average of five replicates.
SE = standard error of the mean.
Genus richness is the average number of genera in each artificial sampler.
Dominant species is the most abundant species numerically in the pooled total of 5 replicates.

3.2.2 Fish Community

3.2.2.1 Community Composition

Data on the location, setting and retrieval times, and summary catch for all gear are presented in Appendix 3.2-5 and Appendix 3.2-6. Biological data for fish sampled in Roberts Bay and Reference Bay are presented in Appendix 3.2-7.

The fish community in Roberts Bay and Reference Bay had 3 species in common, including fourhorn sculpin, saffron cod, and snailfish (Liparis sp.). The Reference Bay fish community also included Greenland cod and ninespine stickleback (Table 3.2-4).

The majority of the five fish species prefer brackish or marine habitat, although some are known to enter low-salinity habitats (Coad and Reist 2004). Ninespine stickleback has three distinct life-history types: freshwater, brackish and anadromous (Arai and Goto 2005). The stickleback captured in this study followed either an anadromous or brackish water life history.

Fourhorn sculpin, Greenland cod and snailfish are benthic fish, meaning they live mostly in contact with the sea bed. Ninespine stickleback and saffron cod are nerito-pelagic (inhabit coastal waters) and epibenthic-pelagic (inhabit inshore and intertidal waters) fish, respectively, and inhabit shallow coastal waters (Coad and Reist 2004). None of the fish species listed in Table 3.2-4 are endangered or threatened (COSEWIC 2009).

A total of 19 fish from two species were captured in the minnow and crab traps at the compensation shoals in Roberts Bay (Table 3.2-5). Note that Liparis sp. are excluded from further analyses as their occurrence was the result of settlement on passive substrate traps and therefore are not comparable to data for other species. In Reference Bay, a total of 26 fish from four species were captured at the reference shoals. A total of 16 fish from two species were captured at the jetty, which was only sampled during the July sampling period due to barge traffic.

Table 3.2-4. Marine Fish Species Captured at Compensation Shoals in Roberts Bay and Natural Shoals in Reference Bay, Doris North Project, 2010

Common Name	Abbreviation	Scientific Name	Habitat	Depth Range	Species Presence	
					Roberts Bay	Reference Bay
Fourhorn Sculpin	FS	*Triglopsis quadricornis**	Marine/Brackish	Benthic	X	X
Greenland Cod	GC	*Gadus ogac*	Marine/Brackish	Benthic	-	X
Ninespine Stickleback	NS	*Pungitius pungitius*	Anadromous; Marine/ Brackish/Freshwater	Nerito-pelagic	-	X
Saffron Cod	SC	*Eleginus gracilis*	Marine/Brackish	Epibenthic-pelagic	X	X
Snailfish	-	*Liparis* sp.	Marine	Benthic	X†	X†

Note:
Habitat types, spatial distributions and migration patterns were taken from Coad and Reist (2004).
** Scientific synonym: Myoxocephalus quadricornis.*
† Collected in benthos samples.

Table 3.2-5. Total Number of Fish Captured from Compensation and Reference Shoals during July and August Fisheries Surveys, 2010

Fish Species	Roberts Bay				Reference Bay		
	Shoals			Jetty	Shoals		
	July	August	Total	July	July	August	Total
Fourhorn Sculpin	1	0	1	7	9	9	18
Greenland Cod	0	0	0	0	0	1	1
Ninespine Stickleback	0	0	0	0	4	1	5
Saffron Cod	7	11	18	9	1	1	2
Total	**8**	**11**	**19**	**16**	**14**	**12**	**26**

Dominant species varied between sites but remained consistent between sampling periods (Table 3.2-5). Saffron cod was the dominant species by number for the shoal habitat in Roberts Bay, making up 95% of the catch, followed by fourhorn sculpin (5%). In Reference Bay, fourhorn sculpin (69%) dominated the catch followed by ninespine stickleback (19%), saffron cod (8%) and Greenland cod (4%). Along the Roberts Bay jetty, saffron cod (56%) and fourhorn sculpin (44%) made up the catch during the July sampling period.

Fewer fish and fewer fish species were captured in 2010 than in 2009. A total of 203 fish from nine species were captured in Roberts Bay and Reference Bay in 2009 (Rescan 2009). The main reason was a modification to the fish community sampling methods after the first year of monitoring the compensation structures. Floating gillnets, sinking gillnets and long lines were used in 2009 but not in 2010 because they did not sample fish that were associated with the compensation shoals in Roberts Bay. Instead, gillnets and longlines were sampling the surrounding environment. As such, species commonly captured with these types of gear such as Arctic char (Salvelinus alpinus), Arctic flounder (Liopsetta glacialis), Greenland cod, lake trout (Salvelinus namaycush), Pacific herring (Clupea pallasi), and starry flounder (Platichthys stellatus) were either not captured or were captured in very limited numbers in 2010 as part of the Jetty Authorization Program.

3.2.2.2 Catch-per-Unit-Effort

Minnow Traps

A total of 60 minnow traps were set at the shoals in Roberts Bay and Reference Bay and 30 minnow traps at the Roberts Bay jetty. Total effort at the shoals ranged from 1,438 hours in Roberts Bay to 1,875 hours in Reference Bay (Appendix 3.2-8). Total effort at the Roberts Bay jetty was 748 hours.

During the July sampling period, fourhorn sculpin and saffron cod were captured using minnow traps in Roberts Bay and Reference Bay (Figure 3.2-6). The jetty in Roberts Bay had the highest mean minnow trap CPUE for both fourhorn sculpin (0.22 fish/24 hours) and saffron cod (0.31 fish/24 hours). Ninespine stickleback were also captured in Reference Bay. During the August sampling period, only saffron cod were captured at the shoals in Roberts Bay (0.17 fish/24 hours). Minnow traps in Reference Bay captured fourhorn sculpin (0.14 fish/24 hours) and individual specimens of Greenland cod (0.01 fish/24 hours), ninespine stickleback and saffron cod (0.02 fish/24 hours).

Crab Traps

A total of 12 crab traps were set at the shoals in Roberts Bay and Reference Bay and 15 crab traps at the Roberts Bay jetty. Total effort ranged from 130 to 375 hours in Roberts Bay and Reference Bay (Appendix 3.2-8).

Few fish were captured using crab traps. During the July sampling period, only fourhorn sculpin were captured at the Roberts Bay jetty (mean trap CPUE of 0.06 fish/24 hours) and Reference Bay shoals (0.42 fish/24 hours) (Figure 3.2-7). No fish were captured in crab traps set on the shoals in Roberts Bay. During the August sampling period, a single saffron cod (0.08 fish/ 24 hours) was captured in a crab trap set at the Roberts Bay shoals.

3.2.2.3 Length, Weight and Condition

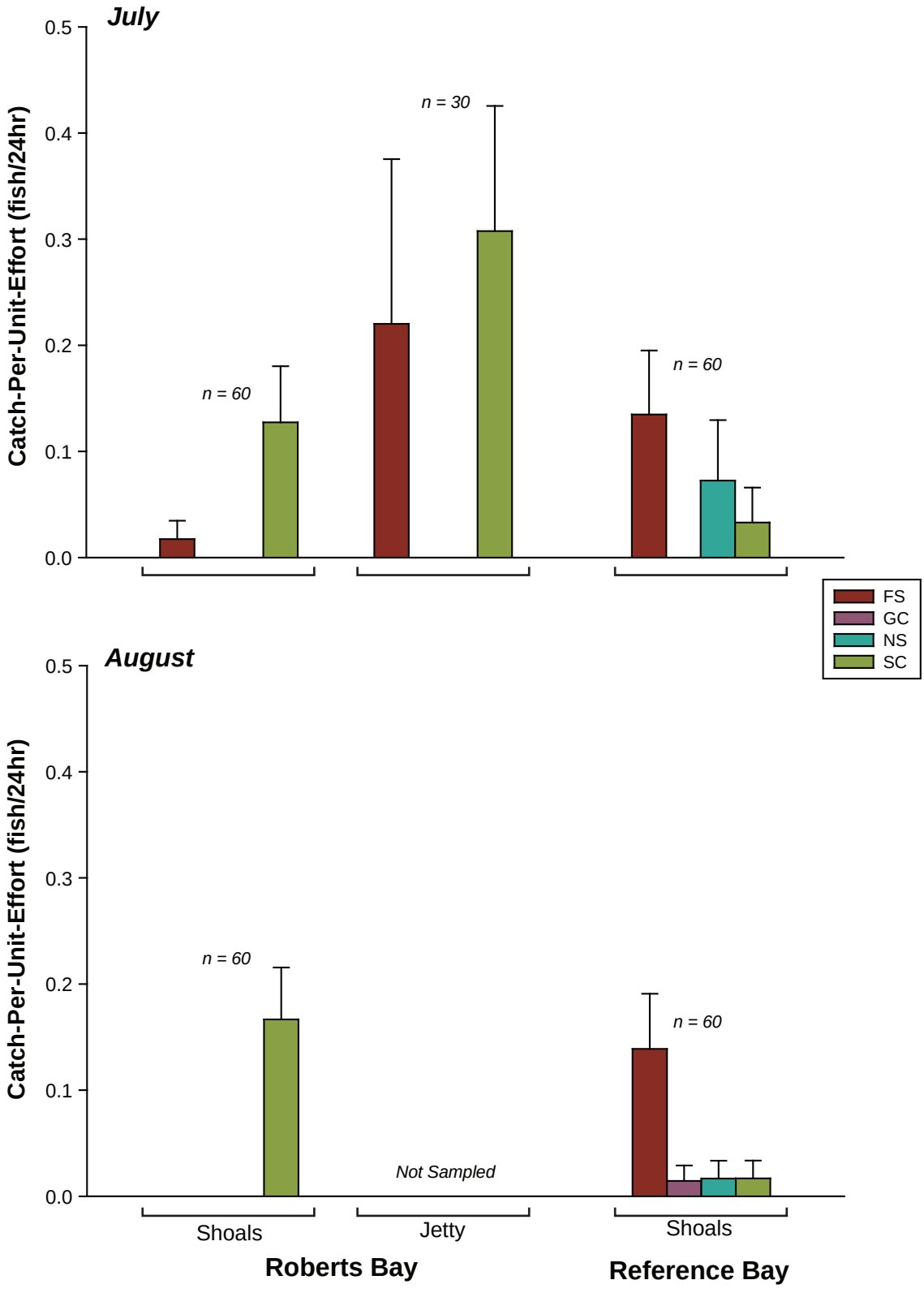
Only morphometric data collected from fish captured in minnow traps was analysed because of low number of fish captured in crab traps. Weight-length relationships were plotted only for fourhorn sculpin and saffron cod because they were the only two species captured in both Roberts Bay and Reference Bay.

Table 3.2-6 summarizes the length, weight and condition of all fish captured in minnow traps from Roberts Bay and Reference Bay. The two fish species captured in Roberts Bay minnow traps were similar in both length and weight (Table 3.2-6). In Reference Bay, the largest fish species captured was the individual specimen of Greenland cod, with a length of 130 mm and weight of 27.1 g, followed by saffron cod and fourhorn sculpin.

Length-frequency distributions were plotted for fourhorn sculpin and saffron cod caught in Roberts Bay and Reference Bay (Figure 3.2-8). Only two saffron cod were captured in the Reference Bay, therefore data were not plotted.

Fourhorn sculpin captured in minnow traps from Roberts Bay ranged in length from 61 to 120 mm with a dominant length class of 101 to 120 mm (Figure 3.2-8). In Reference Bay, fourhorn sculpin had a wider range of length classes (21 to 120 mm) and a smaller dominant length class (61 to 80 mm).

Saffron cod captured in minnow traps from Roberts Bay ranged in length from 61 to 140 mm, with a dominant length class of 81 to 100 mm (Figure 3.2-8).



Note: FS = Fourhorn sculpin; GC = Greenland cod; NS = Ninespine Stickleback; SC = Saffron Cod.
Error bars represent one standard error of the mean.
n = total nuber of traps set.

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Mean Catch-per-Unit-Effort of Fish Captured in Minnow Traps in Roberts Bay and Reference Bay, Doris North Project, 2010

Figure 3.2-6

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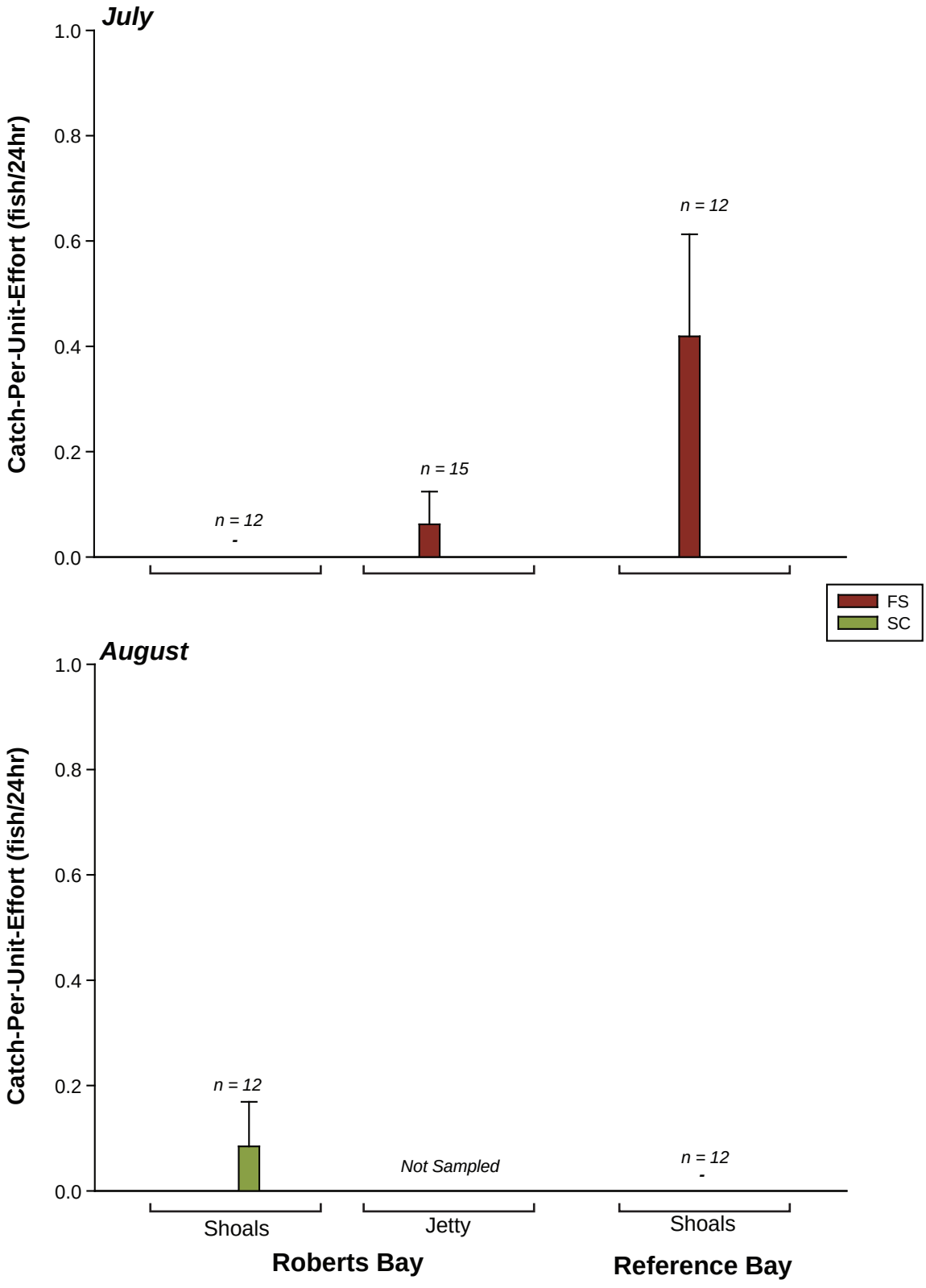

Note: FS = Fourhorn sculpin; SC = Saffron Cod.
Error bars represent one standard error of the mean.
n = total nuber of traps set.

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Mean Catch-per-Unit-Effort of Fish Captured in Crab Traps in Roberts Bay and Reference Bay, Doris North Project, 2010

Figure 3.2-7

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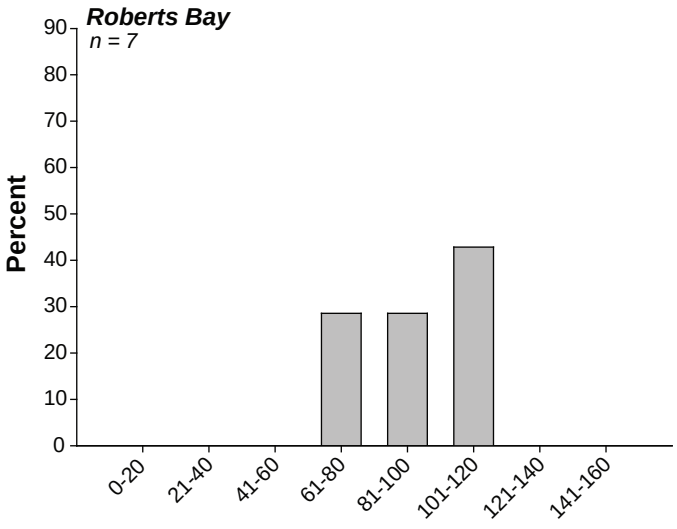
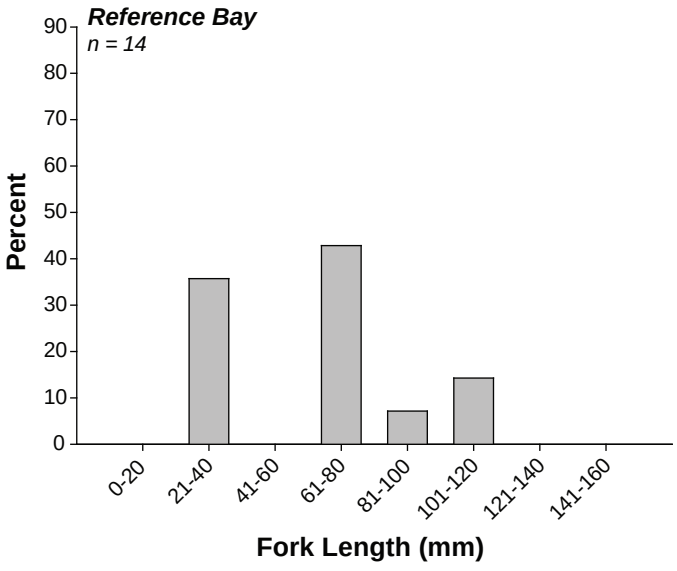
Table 3.2-6. Mean Length, Weight and Condition of Fish Captured in Minnow Traps from Roberts Bay and Reference Bay, Doris North Project, 2010

	Length (mm)					Weight (g)					Condition				
Species	**n**	**Mean**	**SE**	**Min**	**Max**	**n**	**Mean**	**SE**	**Min**	**Max**	**n**	**Mean**	**SE**	**Min**	**Max**
Roberts Bay															
FS	7	92	6.3	71	112	7	6.7	1.5	2.9	12.0	7	0.78	0.03	0.70	0.89
SC	26	94	3.1	68	132	26	7.7	0.8	2.5	16.6	26	0.88	0.07	0.55	2.10
Reference Bay															
FS	14	65	7.4	33	117	14	3.9	1.1	0.6	13.9	14	1.38	0.30	0.36	4.45
GC	1	130	-	-	-	1	27.1	-	-	-	1	1.23	-	-	-
NS	5	47	5.1	34	61	5	0.7	0.3	0.2	1.6	5	0.55	0.12	0.27	0.76
SC	2	70	15.0	55	85	2	3.0	1.4	1.6	4.4	2	0.84	0.12	0.72	0.96

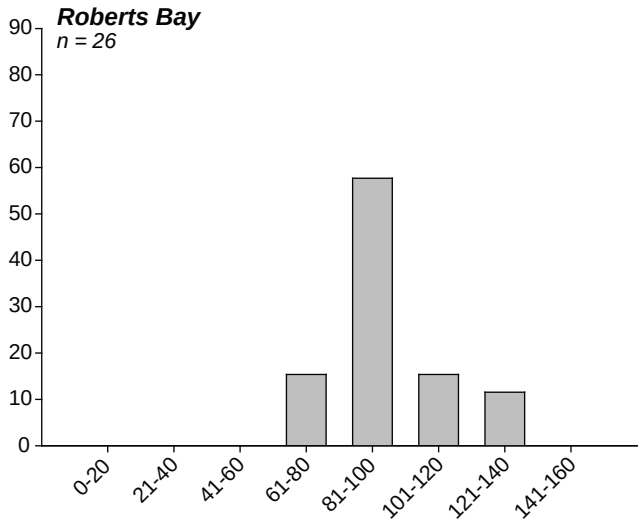
Note:
FS = Fourhorn sculpin; GC = Greenland cod; NS = Ninespine stickleback; SC = Saffron cod.
SE = Standard error of the mean.

Fourhorn Sculpin





Saffron Cod



Reference Bay
n = 2

Data not plotted due to insufficient sample size.

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Length-Frequency Distribution of Fourhorn Sculpin and Saffron Cod Captured in Minnow Traps from Roberts Bay and Reference Bay, Doris North Project, 2010

Figure 3.2-8

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Weight-length regressions for fourhorn sculpin and saffron cod were conducted for fish captured in minnow traps from Roberts Bay and Reference Bay (Figure 3.2-9). Regressions of ln(weight) versus ln(length) for both compensation and reference shoals were highly significant ($p \leq 0.001$) and explained between 72% and 98% of the variation in weight. The slope of regressions from these sites was close to the expected value of 3.0, typical for the length-weight geometry of healthy fish.

Condition was calculated from length and weight data for all fish captured in Roberts Bay and Reference Bay (Appendix 3.2-7). Mean condition of fish captured in minnow traps from both Roberts Bay and Reference Bay was close to the expected value of 1.0, except for ninespine stickleback captured in Reference Bay (Table 3.2-6).

3.2.2.4 Age

Age data for all fish sampled for age analysis in Roberts Bay and Reference Bay are presented in Appendix 3.2-7 and summarized in Table 3.2-7.

Table 3.2-7. Age of Saffron Cod Sampled in Roberts Bay and Reference Bay, Doris North Project, 2010

			Age (years)			
Location	Site	n	Mean	SE	Min	Max
Roberts Bay	Shoals	6	1	-	1	2
Roberts Bay	Jetty	9	1	-	1	1
Reference Bay	Shoals	1	1	-	-	-

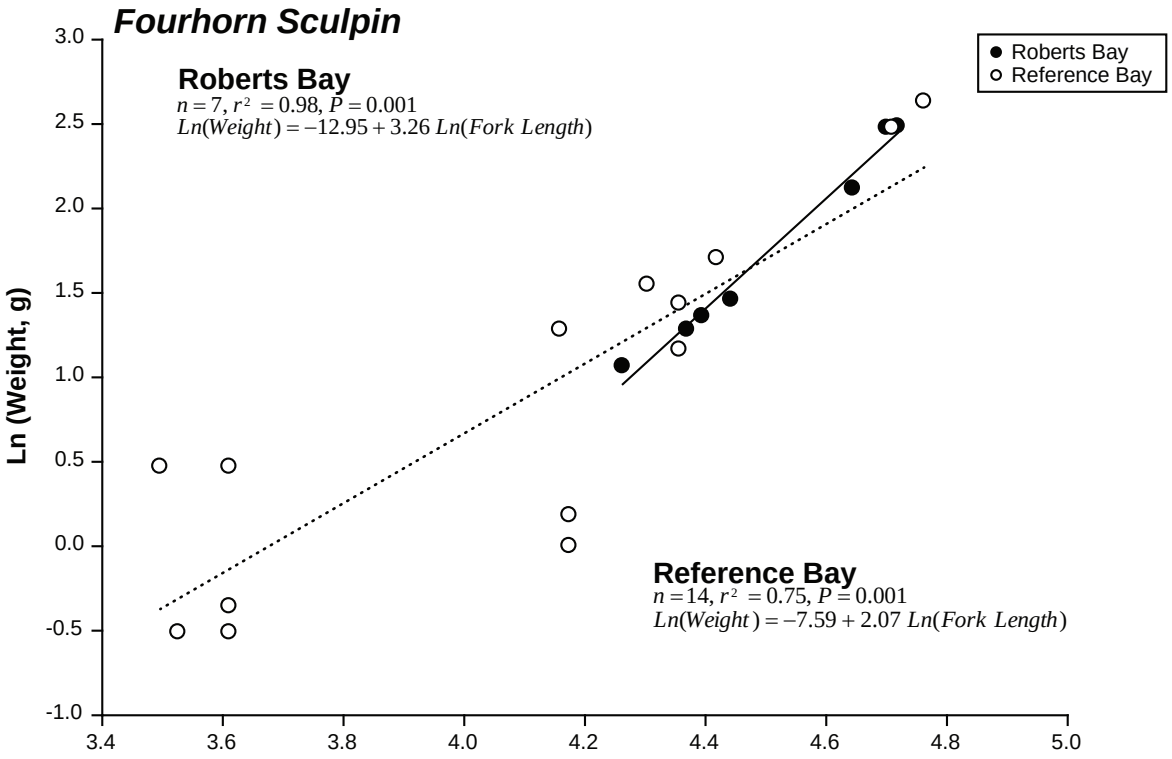
Note:
SE = Standard error of the mean.

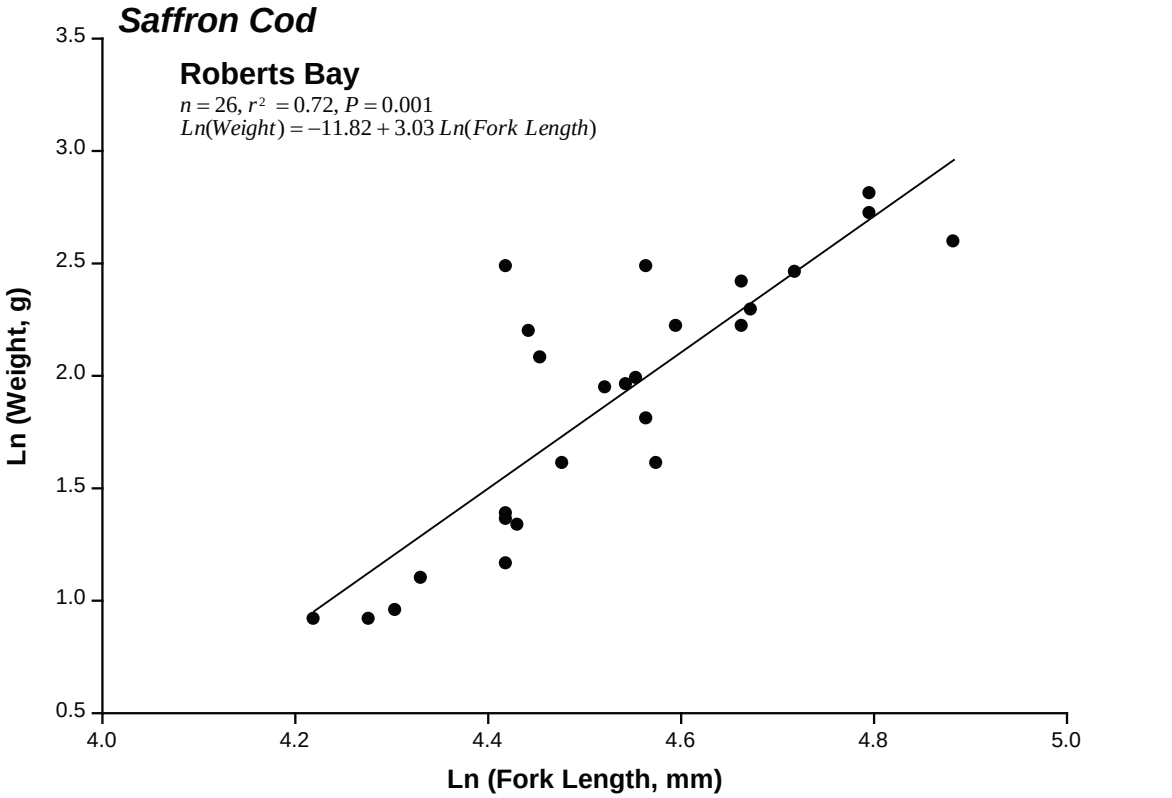
The majority of saffron cod captured during this monitoring program one year in age. This limited age distribution was due to the selectivity of minnow traps for juvenile and small forage fish. The results show that the compensation structures are providing suitable habitat for juvenile fish species, specifically saffron cod.

3.2.3 Shoal Ecology

The structural stability of the compensation structures in Roberts Bay was visually assessed during snorkel surveys. No obvious signs of instability were observed at the Roberts Bay shoals. Larger materials appeared stable with smaller materials lying evenly among the shoals. The Roberts Bay jetty however, showed signs of instability. The jetty walls contained small sections devoid of larger materials and dominated by loose gravel material. In these sections, the gravel material often reached downwards towards a less acute section where larger rocks were often piled up. The constant wave and swell actions likely scoured these sections close to the waterline, leading to erosion of the larger materials. Modifications of the jetty are planned for winter 2011/2012, authorized in the Fisheries Authorization granted by DFO (DFO File No: NU-10-0028).

Five discernable species of macroalgae were identified inhabiting the compensation structures in Roberts Bay and the shoals in Reference Bay (Appendix 3.2-9). A filamentous brown algae, Stictyosiphon tortilis, was dominant during both sampling periods at both locations (Plate 3.2-2). Other species, in descending order of dominance, included a filamentous blue-green algae (possibly *Oscillatoria submembranacea*), *Fucus distichus*, *Sphacelaria arctica*, and *Chorda filum* (Plate 3.2-2).





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Weight-Length Regression for Fourhorn Sculpin and Saffron Cod Captured in Minnow Traps from Roberts Bay, Doris North Project, 2010

Figure 3.2-9

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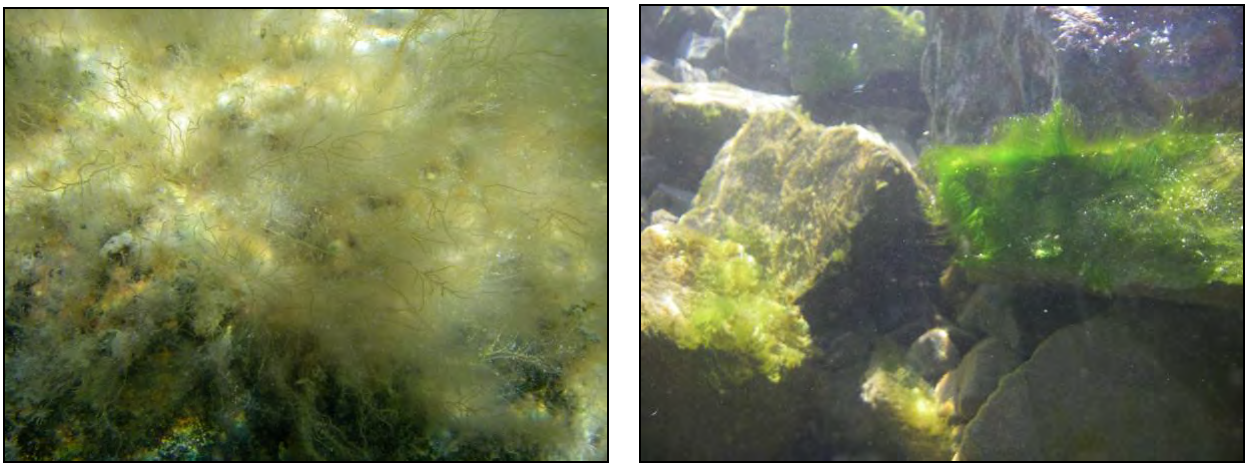


(A) (B)

(C)

Plate 3.2-2. Macroalgae observed on the rock shoals and jetty of Roberts Bay during August snorkel surveys including (A) Stictyosiphon tortilis, (B) a filamentous blue-green algae and (C) Fucus distichus (red material in photograph).

Between surveys, the most notable change observed was the dramatic increase in the percent cover of blue-green algae and Chorda filum (Appendix 3.2-9). The increased algae growth was observed in both Roberts Bay and Reference Bay during August snorkel surveys and was likely related to the elevated solar radiation and water temperatures that occurred as summer progressed.

Similar to 2009 snorkel survey results, algae were plentiful and diverse on the shoals in Reference Bay compared to those found on the shoals or jetty in Roberts Bay. These observed differences may be related to differences in water turbulence, wave energy, and differences in light regime due to water column clarity. Snorkel surveys confirmed that Roberts Bay water were more turbid than that of Reference Bay, which suggests that there was greater turbulence or wave energy in Roberts Bay (Appendix 3.2-9). In addition, the compensation structures in Roberts Bay are relatively new habitat and the natural succession of certain algal species would be expected to take several years. Of important note, the presence of established *Stictyosiphon tortilis* during the July surveys indicate that this species may have colonized the Roberts Bay shoals and may be present during winter in the ice-free depths.

Eight different invertebrate taxa were observed during the snorkel surveys conducted in Roberts Bay and Reference Bay (Table 3.2-8). A total of 2,322 invertebrates from eight taxa were observed in

Roberts Bay, and a total of 4,106 invertebrates from six taxa were observed in Reference Bay. Invertebrates of the Order Euphausiacea (shrimp-like marine crustaceans) were the most abundant invertebrates observed throughout the visual surveys with 1,712 individuals observed in Roberts Bay and 3,688 individuals observed in Reference Bay (Plate 3.2-3; Appendix 3.2-9). Amphipods and sea angels (Clione limacine) were observed only in Roberts Bay.

Table 3.2-8. Summary of Invertebrates Observed During Snorkel Surveys in Roberts Bay and Reference Bay, Doris North Project, 2010

Common Name	Scientific Name			Roberts Bay				Reference Bay	
				July		August		July	August
	Phylum	Class	Order	Shoals	Jetty	Shoals	Jetty	Shoals	Shoals
Amphipod	*Arthropoda*	*Malacostracan*	*Amphipoda*	X	X	X	-	-	-
Clam	*Mollusca*	*Bivalvia*	-	-	-	X	-	X	-
Euphausiid	*Arthropoda*	*Malacostracan*	*Euphausiacea*	X	X	-	-	X	X
Isopod	*Arthropoda*	*Malacostracan*	*Isopoda*	X	X	-	X	X	X
Jellyfish	*Cnidarians*	*Scyphozoans*	-	X	X	X	X	X	X
Mussel	*Mollusca*	*Bivalvia*	-	X	X	X	X	X	X
Sea Angel	*Mollusca*	*Gastropoda*	-	X	-	-	-	-	-
Tunicate	*Tunicata*	*Ascidian*	-	X	X	-	-	X	X

Plate 3.2-3. Euphausiids were abundant in both Roberts Bay and Reference Bay, Doris North Project, 2010.

The total number of invertebrates observed during each snorkel survey varied between sites and sampling periods (Figure 3.2-10). Snorkel surveys conducted in July observed more invertebrates using the compensation structures in Roberts Bay than surveys conducted later in the summer. In July, the Roberts Bay jetty (n = 1,777) and Reference Bay shoals (n = 1,757) dominated with respect to the total number of invertebrates observed. The total number of invertebrates observed during August snorkel surveys decreased dramatically in Roberts Bay but increased in Reference Bay. The decline in invertebrate numbers observed during the August snorkel surveys in Roberts Bay may have been partly due to visual limitations experienced during the surveys.

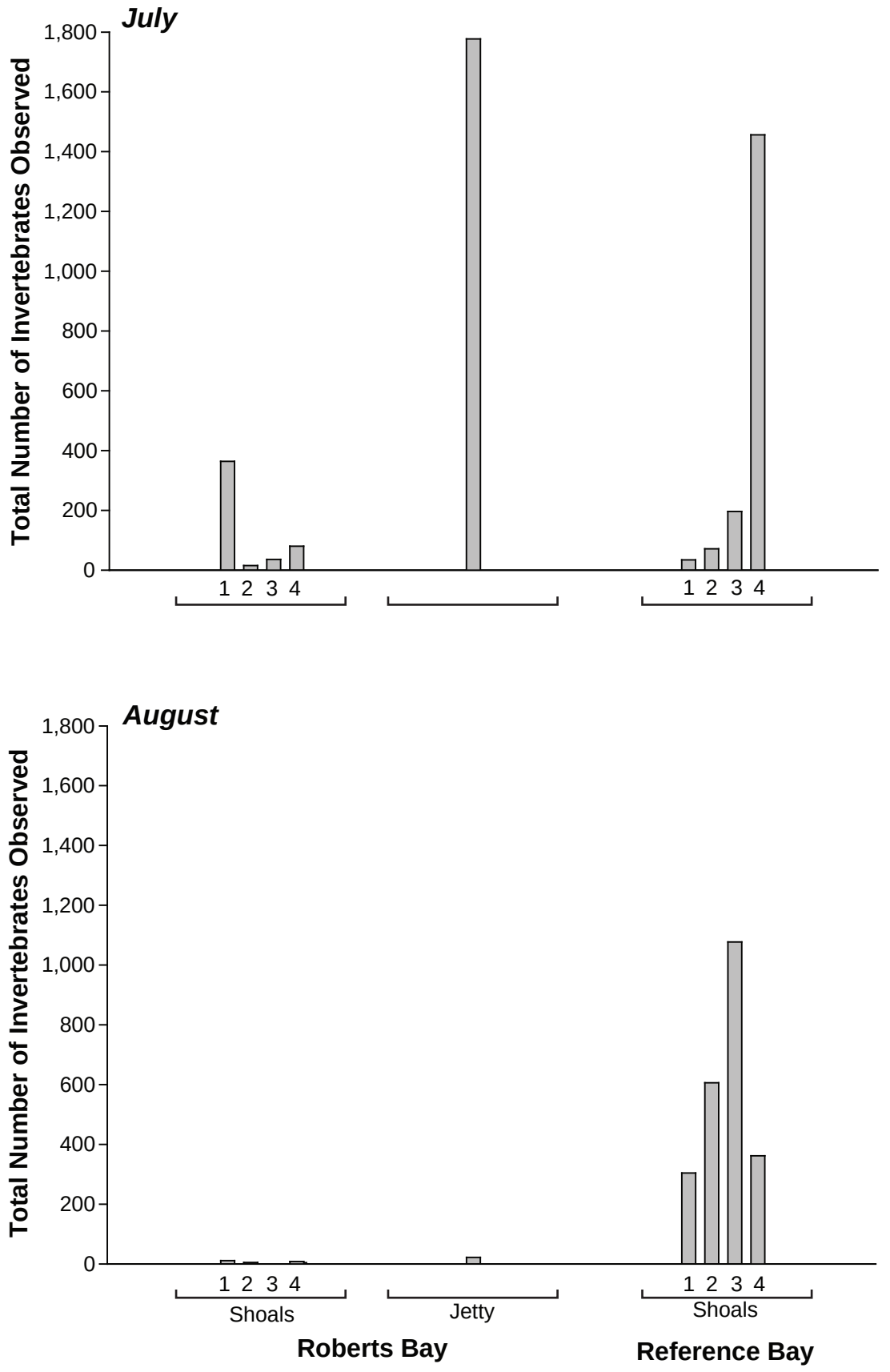
During July surveys, Euphausiids were the dominant invertebrate observed at both the Roberts Bay jetty (51%), Roberts Bay shoals (36%) and Reference Bay shoals (92%; Figure 3.2-11). At the shoals in Roberts Bay, dominant invertebrates observed during snorkel surveys included tunicates (51%) and mussels (36%). Other invertebrates observed in Roberts Bay and Reference Bay included amphipods, clams, isopods and jellyfish. A single sea angel (a pelagic marine opisthobranch gastropod mollusc) was observed at the Roberts Bay shoals during July snorkel surveys (Plate 3.2-4).

In August, Euphausiids (89%) continued to dominate in Reference Bay, followed by jellyfish (10%). In Roberts Bay, the dominant species observed at the compensation structures included jellyfish and mussels, making up 89% and 95% of the observed invertebrates utilizing the shoals and jetty of Roberts Bay, respectively (Figure 3.2-11). During August surveys, jellyfish (Plate 3.2-5) and salps (barrel-shaped, free-floating tunicates from the Class Thaliacea) were consistently observed in greater numbers on structures in both Roberts Bay and Reference Bay (Figure 3.2-11). An unusually high density of jellyfish (n = 231) was observed at Reference Bay on August 30, 2010 (Appendix 3.2-8).

The invertebrate communities observed at the Roberts Bay and Reference Bay shoald during 2010 snorkel surveys were more diverse than those observed during the 2009 snorkel surveys. Total numbers could not be compared between years because more surveys were conducted in 2010 than in 2009. However, trends of species dominance were similar between years. In 2009, tunicates were abundant on the compensation shoals in Roberts Bay and euphausiids were the dominant invertebrates observed on the reference shoals in Reference Bay (Rescan 2009).

Young-of-the-year, juvenile, and adult fish were observed during snorkel surveys at both the compensation structures in Roberts Bay and shoals in Reference Bay (Plate 3.2-6). Species observed included Arctic flounder, fourhorn sculpin, Greenland cod, ninespine stickleback, saffron cod, starry flounder, sandlance (Ammodytes sp.), sculpin species and unidentified fish including young-of- the-year, juveniles and adult life stages (Table 3.2-9).

In total, 38 fish from five species were observed at the compensation shoals in Roberts Bay, 334 fish from five species were observed around the jetty and 205 fish from six species were observed at the reference shoals in Reference Bay (Table 3.2-9; Appendix 3.2-9). Note that the number of fish species stated above excludes unidentified young-of-the-year and juvenile/adult fish. Accurate identification of these fish could not be made due to their small size and because some fish swam away before they could be identified.



Note: July data presents a total of three snorkel surveys per site; August data presents a total of two snorkel surveys per site.

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Total Number of Invertebrates Observed during Snorkel Surveys in Roberts Bay and Reference Bay, Doris North Project, 2010

Figure 3.2-10

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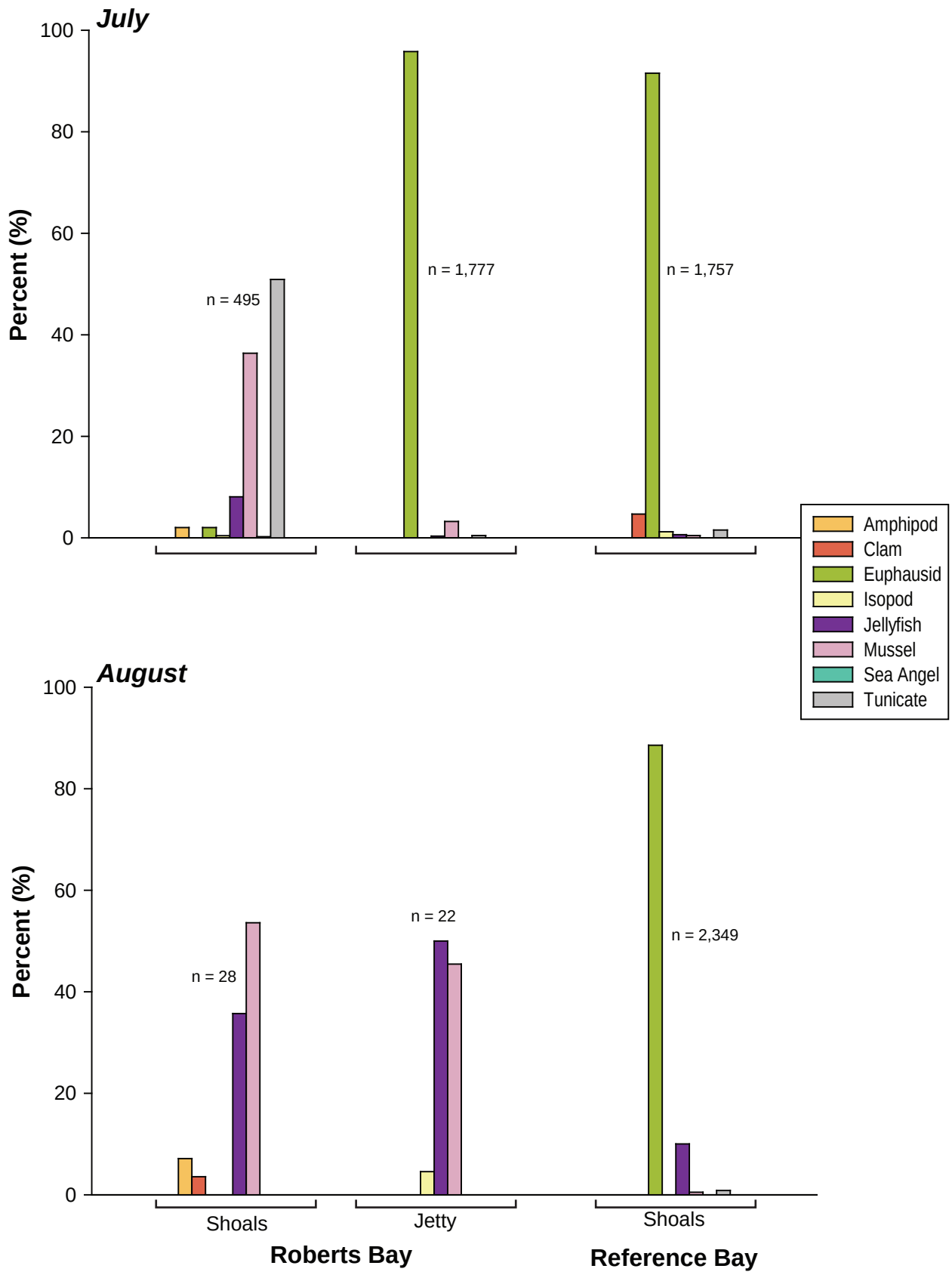

Note: n is the total number of invertebrates observed.
July data presents a total of three snorkel surveys per site; August data presents a total of two snorkel surveys per site.

Percent Composition of Invertebrates Observed during Snorkel Surveys in Roberts Bay and Reference Bay, Doris North Project, 2010

Figure 3.2-11

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Plate 3.2-4. A single sea angel observed on a shoal in Roberts Bay during July snorkel surveys, Doris North Project, 2010.

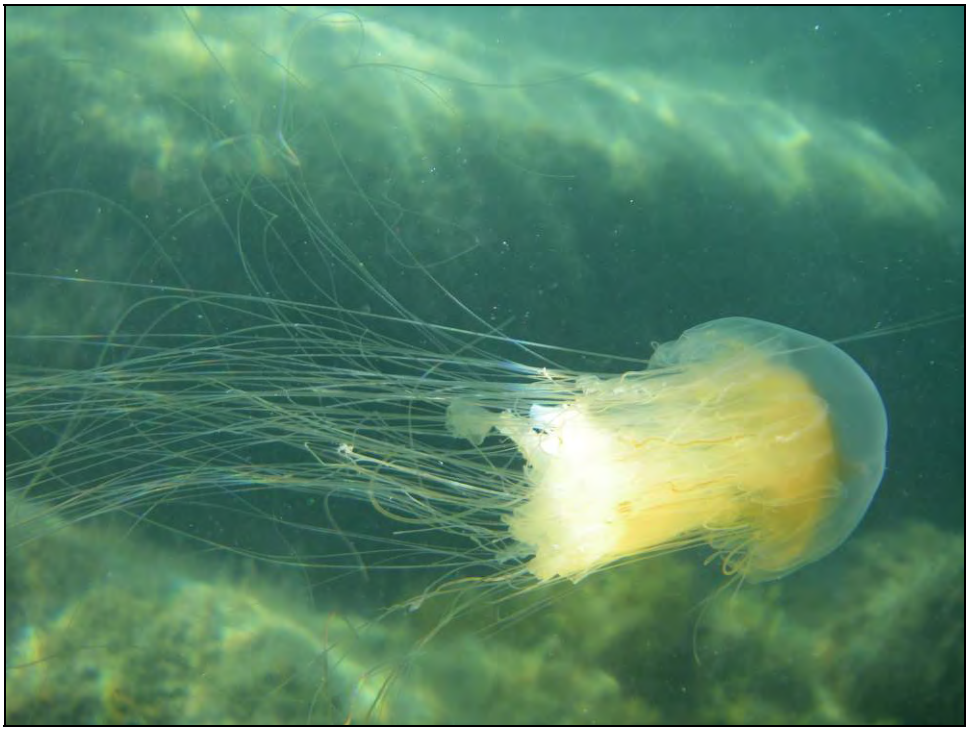
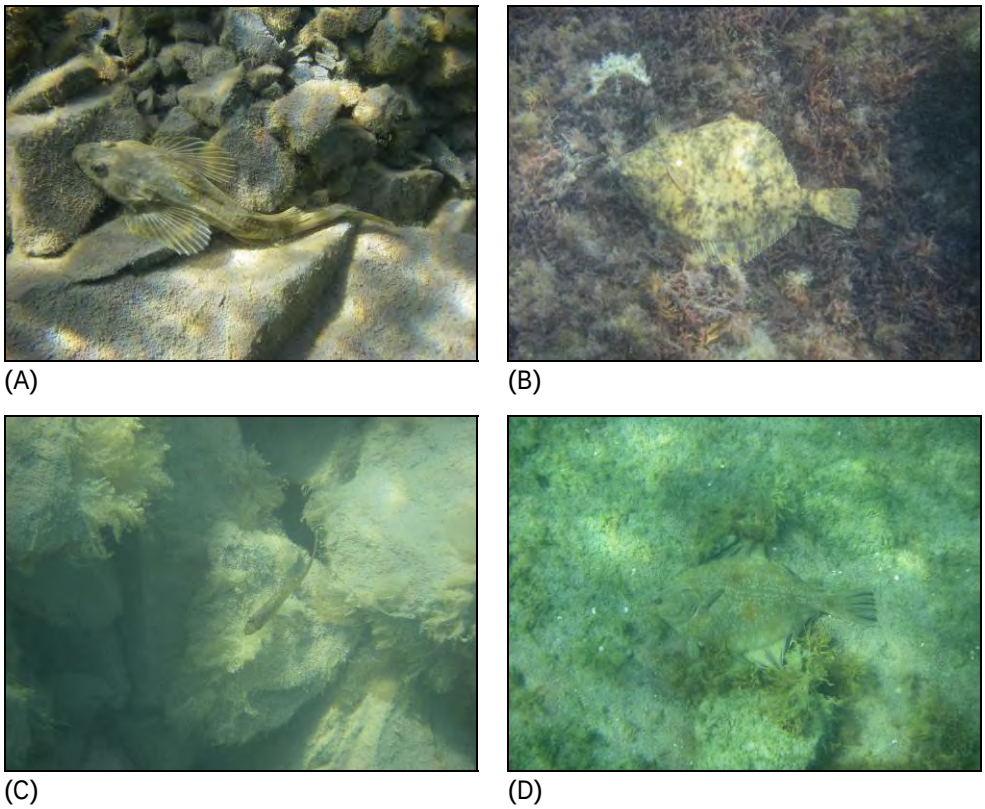


Plate 3.2-5. A jellyfish observed during the August snorkel surveys in Reference Bay, Doris North Project, 2010.



(A) (B)

(C) (D)

Plate 3.2-6. (A) A juvenile fourhorn sculpin, (B) Arctic flounder, (C) juvenile saffron cod and (D) starry flounder observed during snorkel surveys conducted in Roberts Bay and Reference Bay, Doris North Project, 2010.

Table 3.2-9. Summary of Fish Species Observed during Snorkel Surveys in Roberts Bay and Reference Bay, Doris North Project, 2010

	Roberts Bay				Reference Bay	
	Shoals		Jetty		Shoals	
Fish Species	July	August	July	August	July	August
Arctic flounder	X	-	-	-	X	X
Fourhorn sculpin	X	X	X	X	X	X
Greenland cod	-	X	X	-	-	-
Ninespine stickleback	-	X	-	-	-	X
Saffron cod	X	X	X	X	X	-
Starry flounder	-	-	X	-	X	X
Sand lance (*Ammodytes* sp.)	-	-	X	-	-	-
Sculpin sp.	-	-	-	-	X	X
Young-of-the-Year (*unid.*)	X	X	X	-	X	-
Juvenile/Adult Fish (*unid.*)	-	-	-	X	X	-

Note:
unid. = identification to genus and/or species level could not be made.

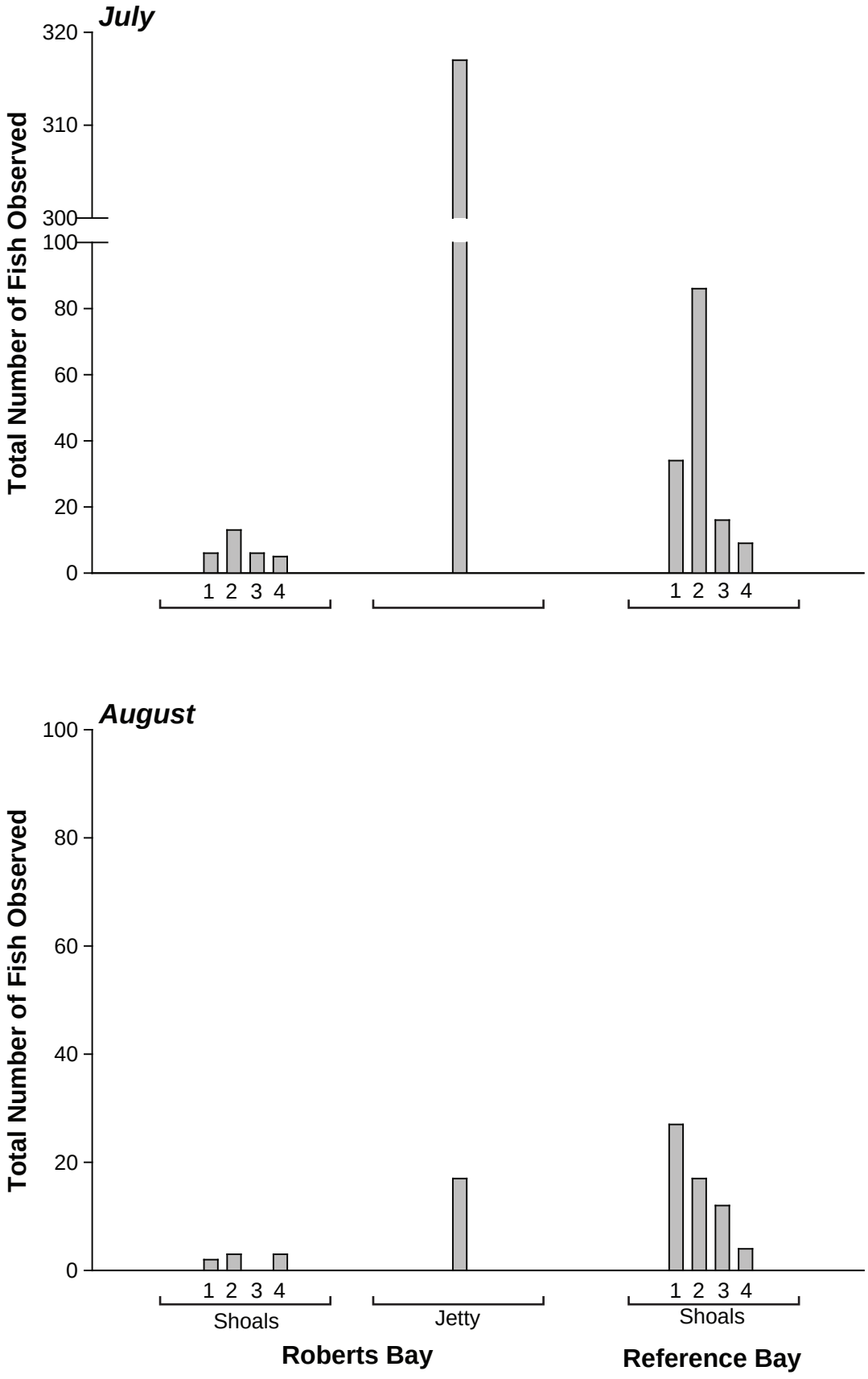
The total number of fish observed during each snorkel survey varied between sites and sampling periods (Figure 3.2-12). July snorkel surveys observed a greater number of fish using the structures in Roberts Bay and Reference Bay than surveys conducted in August. In July, the jetty had the greatest number of fish observed, followed by the Reference Bay shoals and Roberts Bay shoals. The total number of fish observed at each structure during the August snorkel surveys decreased dramatically. During this August sampling, the shoals in the Reference Bay possessed the highest number of fish, followed by the jetty and shoals in Roberts Bay. The most notable difference observed between July and August snorkel surveys was the absence of young-of-the-year fish during the August surveys (except for one individual observed on the shoals of Roberts Bay). This seasonal shift is undoubtedly related to the natural life cycles of fish (i.e., larval dispersal in the early summer).

Dominant species observed during snorkel surveys were consistent between sites but varied between sampling periods (Figure 3.2-13). Young-of-the-year fish were the dominant fish observed during the July snorkel surveys at the Roberts Bay shoals (43%), jetty (56%) and Reference Bay shoals (81%). Fourhorn sculpin and saffron cod were regularly observed at all sites during July surveys, with greater numbers observed at the Roberts Bay shoals (Figure 3.2-13). Greenland cod, Arctic flounder and starry flounder were also observed during July surveys, typically in the deeper transition habitat between rocky and sandy substrates. Greenland cod, in particular, were present in higher numbers along the deeper toe of the Roberts Bay jetty. A school of sand lance were also observed in particularly high numbers at the toe of the Roberts Bay jetty. All sand lance (n = 100) were observed on July 19, 2010 (Appendix 3.2-9).

In August, the dominant species observed on the shoals in Roberts Bay was Greenland cod, making up 38% of the fish observed (Figure 3.2-13). For the Roberts Bay jetty and Reference Bay shoals, the dominant species observed was fourhorn sculpin, making up 76% and 85% of the fish species observed during August snorkel surveys, respectively. Fourhorn sculpin and saffron cod were regularly observed at the compensation structures in Roberts Bay. Flatfish, such as Arctic flounder and starry flounder, were only observed at the Reference Bay shoals during August surveys. The decline in fish numbers and species diversity observed during the August snorkel surveys may be due to visual limitations experienced during the surveys.

Similar trends in the fish community were observed between 2009 and 2010 snorkel surveys of Roberts Bay and Reference Bay (Rescan 2009). Adult, juvenile and young-of-the-year fish were observed utilising both compensation and reference sites during both years. Most notably, young-of-the-year fish were the most plentiful fish observed on the compensation structures in Roberts Bay in both 2009 (Rescan 2009) and 2010. Their abundance shows that these structures are continuing to provide shelter and/or a food source for this life stage. Species diversity and species abundance were greater during the 2010 surveys, though this is more than likely attributed to the increased number of snorkel surveys conducted during the 2010 season.

In general, snorkel surveys conducted in Roberts Bay and Reference Bay during the 2010 field season showed the presence of established primary producers (i.e. algae) at all survey sites both in July and August. Some differences in percent cover were observed between the two sampling periods, which were expected due to greater macroalgae establishment and growth during the periods of high light levels and water temperature (i.e., August). Furthermore, the compensation structures in Roberts Bay were shown to provide usable habitat for various invertebrate and fish taxa. The jetty, in particular, has been shown to provide high quality habitat to invertebrates and fish, likely because of its deep vertical profile and variety of substrate sizes.



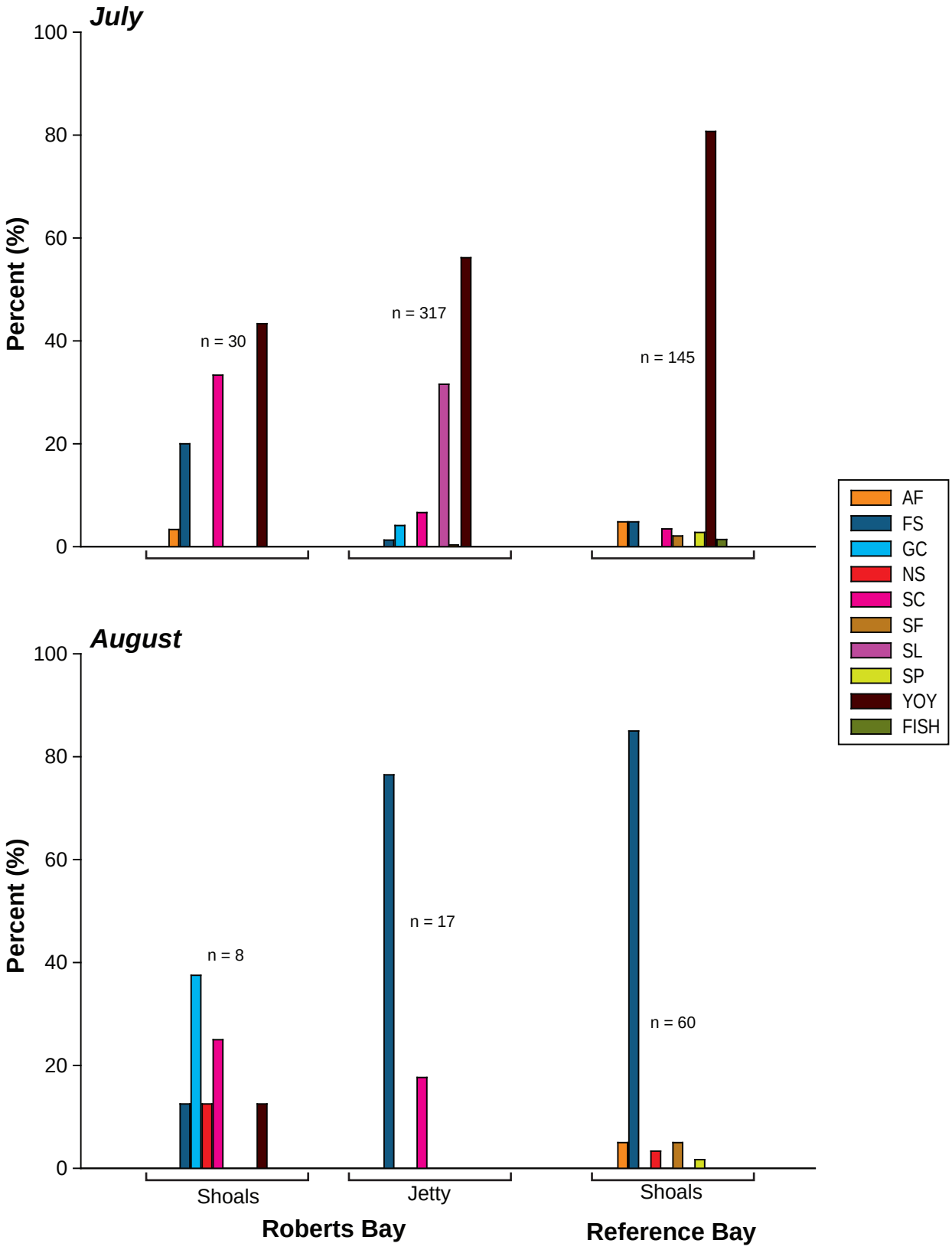
Note: July data presents a total of three snorkel surveys per site; August data presents a total of two snorkel surveys per site.

NEWMONT NORTH AMERICA

Total Number of Fish Observed during Snorkel Surveys in Roberts Bay and Reference Bay, Doris North Project, 2010

Figure 3.2-12

Rescan™ Engineers & Scientists



Notes: n is the total number of fish observed.
July data presents a total of three snorkel surveys per site; August data presents a total of two snorkel surveys per site.
AF = Arctic flounder, FS = Fourhorn sculpin, GC = Greenland cod, NS = Ninespine stickleback, SC = Saffron cod, SL = Sandlance (Ammodytes sp.), SP = Sculpin (unidenitifed), SF = Saffron cod, YOY = Unidentified Young-of-the-Year, FISH = Unidentiifed Juvenile and/or Adult Fish.

NEWMONT The Gold Company

Percent Composition of Fish Observed during Snorkel Surveys in Roberts Bay and Reference Bay, Doris North Project, 2010

Figure 3.2-13

Rescan Engineers & Scientists

4. Summary

4. Summary

4.1 SEDIMENT TRANSPORT AND DEPOSITION

Bathymetric comparisons of Roberts Bay pre-construction and Year-3 post-jetty construction showed similar patterns to what was observed during Year-2 post-jetty comparisons. Changes in bed elevation in Roberts Bay were observed to the north and east of the jetty.

4.2 FISH HABITAT MONITORING

Periphyton chlorophyll *a* concentrations from Plexiglas plates immersed on the shoals ranged from 0.197 to 0.388 µg chl *a*/cm^2 in Roberts Bay and 0.407 to 1.25 µg chl *a*/cm^2 in Reference Bay. Average periphyton density was similar between sites, ranging from 81,000 to 234,000 cells/cm^2 in Roberts Bay and 82,000 to 194,000 cells/cm^2 in Reference Bay. In both the compensation and the reference shoals, the periphyton community was dominated by cyanobacteria (54–79%) and diatoms (20–43%). The filamentous cyanobacterium, *Anabaena cylindrica*, was the most abundant species observed in both Roberts Bay and Reference Bay shoals.

Periphyton genus richness was similar between sites, ranging from 11 to 15 genera/plate in Roberts Bay and 12 to 16 genera/plate in Reference Bay. Simpson's diversity index ranged from 0.39 to 0.53 in the compensation shoals and 0.52 to 0.59 in the reference shoals, indicating that the periphyton community was moderately diverse at both sites.

In the Roberts Bay shoals, benthic invertebrate abundance ranged from 6 to 16 organisms/trap and averaged 11 organisms/trap. At the Reference Bay shoals, abundance ranged from 39 to 64 organisms/trap and averaged 51 organisms/trap. The benthic invertebrate community composition was dominated by amphipods in both the compensation and reference shoals. *Lagunogammarus setosus* was the dominant species in Reference Bay, and *Lagunogammarus setosus* and *Ischyrocerus anguipes* were the most abundant species in Roberts Bay.

The average benthic invertebrate genus richness was three genera/trap in Roberts Bay and two genera/trap in Reference Bay. Taxonomic diversity was much higher in Roberts Bay than in Reference Bay. This is attributable to the high relative abundance of a single species (*Lagunogammarus setosus*) in the reference shoals, compared to the more even taxonomic distribution in Roberts Bay.

A total of 19 fish from two species and 26 fish from four species were captured on the shoals in Roberts Bay and Reference Bay, respectively. The jetty, which was only sampled during the July sampling period, yielded a total of 16 fish from two species. Fish species captured included fourhorn sculpin, Greenland cod, ninespine stickleback and saffron cod. In addition, young-of-the-year snailfish were captured in benthos samples collected from rock traps set on the shoals of both Roberts Bay and Reference Bay.

Dominant species varied between sites but remained consistent between sampling periods. Overall, saffron cod and fourhorn sculpin were the dominant species by number for the shoal habitat and side-slopes of the jetty in Roberts Bay. In Reference Bay, fourhorn sculpin dominated the catch.

Fish species captured in Roberts Bay were of similar size and age (1 year). The limited size and age of fish captured is a result of the gear type used to sample the fish community in 2010.

Snorkel surveys of the compensations shoals showed no obvious signs of instability as larger materials appeared stable with smaller materials lying evenly among the shoals. The Roberts Bay jetty however, continued to show signs of instability. The jetty walls contained sections devoid of larger materials and dominated by loose gravel material. In these sections, the gravel material often reached downwards towards a less acute section where larger rocks were often piled up. The constant wave and swell actions have likely scoured these sections close to the waterline, leading to erosion of the larger materials.

Five species of macro-algae were identified to inhabit the compensation structures in Roberts Bay and the shoals in Reference Bay. Although similar species were present between the Roberts Bay and Reference Bay shoals, the overall dominance by organisms (number, percent cover) were different. A filamentous brown algae, *Stictyosiphon tortilis*, was dominant during both sampling periods at both locations. Multiple species were observed at both locations, though often in smaller quantities at Roberts Bay. As the compensation structures in Roberts Bay are new habitat, the natural succession of the algal communities is expected to take several years. Therefore, the observed differences observed among algal communities inhabiting Roberts Bay and Reference Bay is anticipated.

Invertebrates belonging to eight different taxa were observed during snorkel surveys conducted in Roberts Bay and Reference Bay. Invertebrates observed included amphipods, clams, euphausiids, isopods, jellyfish, mussels, salps, sea angels and tunicates. In July, euphausiids were the most abundant invertebrate taxon observed at the jetty in Roberts Bay and shoals in Reference Bay; tunicates and mussels were the dominant taxa observed on the shoals in Roberts Bay. In August, euphausiids continued to dominate in Reference Bay while jellyfish and mussels dominated in Roberts Bay.

Adult, juvenile and young-of-the-year fish of multiple species were observed during snorkel surveys in Roberts Bay and Reference Bay. The young-of-the-year fish (unknown species) were the most plentiful fish observed on the compensation structures in Roberts Bay during July surveys. Their abundance shows that the structures continue to provide shelter and/or a food source for these small fish. Their absence from August surveys is likely related to the natural life cycles of fish (i.e., larval dispersal in early summer). Other fish that were observed during snorkel surveys included Arctic flounder, fourhorn sculpin, Greenland cod, ninespine stickleback, saffron cod, sand lance, sculpin sp. and starry flounder.

Overall, the monitoring program has demonstrated that the constructed shoals are continuing to provide a food source and habitat for fish similar to natural habitat in the area. The constructed shoals are also providing viable fish habitat as multiple genera of fish in various life stages are actively using the constructed habitats.

Monitoring conducted in 2010 fulfilled the requirement to monitor during the year of mine construction, as stated in the Fisheries Authorization (DFO File No: NU-02-0117). Year-2 of monitoring the compensation features in Roberts Bay continued to show enhancement success as defined in the Doris North No Net Loss Plan. Primary and secondary producers have established themselves on the rock shoals and the side-slopes of the jetty and multiple genera of fish have been observed using the rock shoal and jetty area.

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Appendix 1.1-1

DFO Authorization for Works or Undertakings Affecting Fish Habitat – Doris North Jetty Construction
(DFO File No: NU-02-0117)

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DFO File No.: NU-02-0117
Referral File No.: 02-HCAA-CA7-000-000117
Authorization No.: 2

AUTHORIZATION FOR WORKS OR UNDERTAKINGS AFFECTING FISH HABITAT

Authorization issued to:

Hope Bay Mining Ltd.
300-889 Harbourside Drive
North Vancouver, British Columbia
V7P 3S1

Tel: (604) 985-2572
Fax: (604) 980-0731

Location of Project

The jetty associated with the Hope Bay Mining Ltd. underground gold mine ("Doris North Project") is located on the southeastern shore of Roberts Bay in the West Kitikmeot Region of Nunavut. (UTM Zone 48, UTM Easting 541803, UTM Northing 7543202). Fish habitat compensation involves the creation of four (4) nearshore rock shoals located on the southeastern shore of Roberts Bay, just west of the jetty.

Valid Authorization Period

The valid authorization period for the harmful alteration, disruption or destruction of fish habitat associated with the construction of the jetty is:

From:	To:
Date of Issuance	December 30, 2009

The valid periods for other conditions of the authorization are as set out below.

Description of Works or Undertakings (Type of work, schedule, etc.)

The harmful alteration, disruption or destruction hereby authorized is the infilling of fish habitat, as a result of the jetty (95 metres long by 5 to 35 metres wide) construction to facilitate tugs and barges operating for the Doris North Project, affecting 1,760 square metres of fish habitat in Roberts Bay.

Conditions of Authorization

1. The conditions of this Authorization notwithstanding, should the above works or undertakings, due to weather conditions, different soil or other natural conditions, or for any other reason, appear, in the opinion of the Department of Fisheries and Oceans ("DFO") likely to cause greater impacts than the parties previously contemplated, then DFO may direct Hope Bay Mining Ltd. (hereafter referred to as the "Proponent"), and its agents, and contractors, to suspend or alter works and activities associated with the project, to avoid or mitigate adverse impacts to fisheries resources. DFO may also direct the Proponent and its agents, and contractors, to carry out at the Proponent's expense any works or activities deemed necessary by DFO to avoid or mitigate further adverse impacts to fisheries resources. In circumstances where DFO is of the view that greater impacts may occur than were contemplated by the parties DFO may also modify or rescind this authorization. If the authorization is to be changed the Proponent will be given an opportunity to discuss any proposed modifications or rescission.

2. Conditions that relate to the Proponent plan:

   2.1. The Proponent confirms that all plans and specifications relating to this authorization have been duly prepared and reviewed by appropriate professionals working on behalf of the Proponent. The Proponent acknowledges that they are solely responsible for all design, safety and workmanship aspects of all the works associated with this Authorization.

   2.2. The construction of the jetty shall comply with those criteria as identified within this Authorization. Harmful alteration, disruption or destruction of fish habitat other than that specifically identified within this Authorization is prohibited.

   2.3. Works and undertakings shall be conducted in accordance with the practices outlined in the following reports, and as approved by DFO:

      2.3.1. Jetty As-Built, Figure A7, prepared by SRK Consulting, dated September 2007.

      2.3.2. Doris North Project "No-Net-Loss" Plan (NNLP), Revision 6, December 2007 Final Report, prepared by Golder Associates Limited,

dated December 20, 2007.

2.3.3. Roberts Bay Fish Habitat Compensation Shoal Design, Project Number 07-1373-0018, Figure D11, signed and stamped by Nathan Schmidt (Golder Associates Limited), dated January 8, 2008.

2.3.4. Email regarding marine construction blackout, addressed to Tania Gordanier (Fisheries and Oceans Canada), prepared by Terri Maloof (Miramar Hope Bay Limited), dated April 14, 2007.

2.3.5. Revised Water License Application Support Document – Doris North Project, Nunavut, Canada, prepared by Miramar Hope Bay Limited, dated April 2007.

2.3.6. Supporting Documents S10m Supplemental to Revised Water License Application Support Document– Doris North Project, Nunavut, Canada, prepared by Miramar Hope Bay Limited, dated April 2007.

2.3.7. Memorandum regarding Miramar Doris North Project – Jetty Construction Timing and Monitoring, prepared by Golder Associates Limited, Gary Ash, dated June 21, 2007.

2.3.8. Letter regarding Extension of Authorization for Works or Undertakings Affecting Fish Habitat Nu-02-0117 (the Authorization), signed by Chris Hanks (Hope Bay Mining Ltd.), dated June 12, 2008.

2.3.9. The above documents and drawings are hereafter referred to as the "Plan". Where contradictions exist, the most recent version shall apply.

3. Conditions that relate to the mitigation of potential harmful alteration, disruption or destruction ("HADD") of fish habitat. The following measures shall be implemented to avoid the unauthorized HADD of fish habitat:

3.1. No in-water work shall occur between July 15 and August 30 of any year to protect critical spawning and rearing periods for all fish species in Roberts Bay.

3.2. A qualified biologist or environmental inspector shall be on site during all in-water construction, compensation and restoration works to ensure implementation of the designs as intended in the Plan and conditions of this Authorization.

3.3. All materials and equipment used for the purpose of all work phases shall be operated and stored in a manner that prevents any deleterious substance (e.g. petroleum products, debris, etc.) from entering the water.

3.3.1. Any stockpiled materials shall be stored and stabilized above the ordinary high water mark of any water body.

3.3.2. Vehicle and equipment re-fuelling and maintenance shall be conducted above the ordinary high water mark of any water body.

3.3.3. Any part of equipment entering the water shall be free of fluid leaks and externally cleaned/degreased to prevent any deleterious substance from entering the water.

3.4. Only clean, competent, certified non-acid generating rock and material free of fine particulate matter shall be placed in the water.

3.5. Material used for habitat compensation features shall not be taken from below the ordinary high water mark or shoreline of any water body.

3.6. Sediment and erosion control measures shall be implemented prior to work, and maintained during the work phases, to mitigate impacts to fish and fish habitat.

3.6.1. All disturbed areas shall be stabilized upon completion of work and restored to a pre-disturbed state or better.

3.6.2. Sediment and erosion control measures shall be left in place and maintained until all disturbed areas have been stabilized.

4. Conditions that relate to the compensation for the loss of 1,760 square metres of fish habitat as defined in the Plan.

4.1. The amount of fish habitat compensation gained shall equate to 3143 square metres.

4.1.1. Four (4) rock shoals (31.25 metres long by 12.00 metres wide with a minimum depth of 1 metre below mean water level) shall be constructed nearshore, just west of the jetty.

5. Conditions that relate to Monitoring.

5.1. The approved Monitoring Plan shall be implemented in the following years: 2009, the year prior to mine construction, Year of mine construction, Year-2 of mine operation, Year-2 of active mine post-closure (i.e. year prior to jetty lowering to below high water level), Year-

1 post-lowering of jetty, and Year-2 post-lowering of jetty. The detailed Monitoring Plan shall include, but not be limited to, the following:

5.1.1. The stability and successful utilization of all compensation features shall be assessed according to the schedule in 5.1 above.

5.1.1.1. The use of rock shoal structures as rearing and feeding habitat for fish shall be monitored using a Control/Impact (CI) design study as described in the Plan and according to the schedule in 5.1 above.

5.1.1.2. Fish presence shall be monitored using sampling methods as described in the Plan and according to the schedule in 5.1 above.

5.1.2. If at any time during the monitoring period, compensation features are not functioning as intended, measures shall be identified to reduce the risk of future failure and additional compensation shall be created to meet the No-Net-Loss guiding principle using an adaptive management approach.

5.2. A photographic record of before, during and after construction, showing that all works and undertakings have been completed according to the approved Plan and conditions of this Authorization, shall be submitted to the Iqaluit, NU office of the Department of Fisheries and Oceans, Fish Habitat Management, Eastern Arctic Area, on or before, **December 31, 2008** and according to the schedule in 5.1 above.

5.2.1. The photographic record shall include, but not be limited to, a record of the sediment and erosion control measures and compensation measures (i.e. the nearshore rock shoals).

5.2.2. The photographs for each pre-construction, during construction, post-construction time periods shall be taken from the same vantage point(s) and general direction.

5.2.3. All photographs shall be clearly labelled as to date and vantage points. The photographic vantage points and viewing directions shall be indicated, and clearly indexed to the photographs, on a plan view drawing of the construction site(s).

5.3. A written report summarizing the above monitoring results shall be submitted to the Iqaluit, NU office of the Department of Fisheries and Oceans – Fish Habitat Management, Eastern Arctic Area on, or before, **December 31, 2008** and according to the schedule in 5.1 above.

5.4. The effects of the jetty on nearshore sediment transport shall be monitored during the following years: 2008, 2009, Year of mine construction, Year-2 of mine operation, Year-2 of active mine post-closure (i.e. year prior to jetty lowering to below high water level), Year-1 post-lowering of jetty.

5.4.1. Annual bathymetric surveys shall be conducted to determine the extent of sediment deposition adjacent to the jetty.

5.4.2. A written report summarizing the results of the bathymetric surveys shall be submitted to the Iqaluit, NU office of the Department of Fisheries and Oceans – Fish Habitat Management, Eastern Arctic Area on, or before, **December 31** of each year, according to the schedule in 5.4 above.

6. Any deviation from the approved plans, the construction schedule, mitigation, compensation and/or monitoring measures stated above must be discussed with, and approved in writing by the Iqaluit, NU office of the Department of Fisheries and Oceans, Fish Habitat Management, Eastern Arctic Area.

7. All mitigation, compensation and monitoring measures shall be implemented to the satisfaction of the Iqaluit, NU office of the Department of Fisheries and Oceans, Habitat Management, Eastern Arctic Area.

8. Conditions that relate to the financial security as indicated in the irrevocable Letter of Credit in the amount of $67,608.00 dated June 28, 2007.

8.1. Miramar Mining Corporation on behalf of Hope Bay Mining Ltd. shall amend the Letter of Credit issued on June 28, 2007 (Reference No. LGHCV073179) and submit the amended irrevocable standby letter of credit in the amount of sixty-seven thousand six hundred and eight dollars ($67,608.00) to Fisheries and Oceans Canada – Eastern Arctic Area P.O. Box 358 Iqaluit, Nunavut X0A 0H0, no later than **September 5, 2008**.

8.2. The letter of credit from a Canadian Bank in the amount of $67,608.00 shall automatically renew each year and may be used in any manner deemed appropriate to DFO in relation to this Authorization. The letter of credit shall be returned upon satisfactory completion of the above noted habitat compensation works and monitoring program.

8.3. Upon successful completion of Hope Bay Mining Limited responsibilities under the **compensation and monitoring conditions** of this Authorization, as determined by Fisheries and Oceans Canada, the original Letter of Credit shall be returned to the financial institution, referred to on the Letter of Credit, for cancellation.

8.4. Where at any time DFO determines that the amount of security deposit it holds falls below an amount which, in DFO's view, is necessary to satisfy the Proponent's obligations under this Authorization, DFO may request, in writing, that the Proponent deposit with DFO additional security in an amount and form determined at that time by DFO. The Proponent shall comply with DFO's request within 30 (thirty) days from the date it receives the request.

9. Written notification of the commencement of works or undertakings shall be provided to the Iqaluit, NU office of the Department of Fisheries and Oceans, Habitat Management, Eastern Arctic Area, by e-mail to Amy.Liu@dfo-mpo.gc.ca or fax at (867) 979-8039 prior to the initiation of said works or undertakings.

The holder of this authorization is hereby authorized under the authority of section 35(2) of the *Fisheries Act*. R.S.C., 1985, c.F. 14, to carry out the work or undertaking described herein. This authorization is valid only with respect to fish habitat and for no other purposes. It does not purport to release the applicant from any obligation to obtain permission from or to comply with the requirements of any other regulatory agencies.

Failure to comply with any condition of this authorization may result in charges being laid under the *Fisheries Act*.

This authorization form shall be held on site and work crews shall be made familiar with the conditions therein.

Date of Issuance: August 28, 2008

Approved by:

Robert Lambe

Title: Regional Director General,
Central and Arctic Region
Fisheries and Oceans Canada

Appendix 1.1-2

DFO Authorization for Works or Undertakings Affecting Fish Habitat – Doris North Jetty Improvements (DFO File No: NU-10-0028)

Rescan™
Engineers and Scientists

Fisheries and Oceans Canada
Pêches et Océans Canada

Eastern Arctic Area
P.O. Box 358
Iqaluit, Nunavut X0A 0H0
Tel: (867) 979-8000
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Secteur de l'Arctique de l'est
Boite postale 358
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Tél: (867) 979-8000
Téléc: (867) 979-8039

Our file *Notre référence*
10-HCAA-CA7-00028

May 14, 2010

Chris Hanks
Hope Bay Mining Ltd.
300-889 Harbourside Drive
North Vancouver, British Columbia
V7P 3S1

Dear C. Hanks:

SUBJECT: Authorization for the harmful alteration, disruption or destruction of fish habitat pursuant to subsection 35(2) of the *Fisheries Act*

The harmful alteration, disruption or destruction of fish habitat arising from the infilling of fish habitat as a result of an expansion to an existing jetty on the southern shore of Roberts Bay in the West Kitikmeot Region of Nunavut for the Doris North Gold mine is hereby authorized pursuant to subsection 35(2) of the *Fisheries Act*. This Authorization shall be conditional upon implementation of measures specified in the attached document.

Failure to comply with any of the conditions specified on the attached Authorization may result in a contravention of section 35 of the *Fisheries Act.*

NOTE: None of the foregoing should be taken to imply Authorization of this undertaking in accordance with any section of the *Fisheries Act* **other** than section 35. Also note that Authorization under the *Fisheries Act* does not release the proponent from the requirements of any other federal, provincial or municipal legislation.

Please contact Loriena Melnick at (204) 983-2632, by fax (867) 979-8039, or by e-mail at Loriena.Melnick@dfo-mpo.gc.ca.

Yours sincerely,

Eric Kan.

Eric Kan
Area Director
Eastern Arctic Area
Fisheries and Oceans Canada

Copy: Nunavut Impact Review Board – Via Email: info@nirb.ca

Canada

Fisheries and Oceans Canada | Pêches et Océans Canada

DFO File No.: NU-10-0028
Referral File No.: 10-HCAA-CA7-00028

AUTHORIZATION FOR WORKS OR UNDERTAKINGS AFFECTING FISH HABITAT

Authorization issued to:

Hope Bay Limited
300-889 Harbourside Drive
North Vancouver, British Columbia
V7P 3S1

Tel: (604) 985-2572
Fax: (604) 980-0731

Location of Project

The jetty associated with the Hope Bay Limited underground gold mine ("Doris North Project") is located on the southern shore of Roberts Bay in the West Kitikmeot Region of Nunavut. (UTM Zone 48, UTM Easting 541803, UTM Northing 7543202).

Valid Authorization Period

The valid authorization period for the harmful alteration, disruption or destruction of fish habitat associated with the construction of the jetty is:

From:	To:
Date of Issuance	July 14, 2011

The valid periods for other conditions of the authorization are as set out below.

Description of Works or Undertakings (Type of work, schedule, etc.)

The harmful alteration, disruption or destruction hereby authorized is the destruction of 685 square meters of fish habitat due to infilling for the expansion of the jetty in Roberts Bay.

Conditions of Authorization

1. The conditions of this Authorization notwithstanding, should the above works or undertakings, due to weather conditions, different soil or other natural conditions, or for any other reason, appear, in the opinion of the Department of Fisheries and Oceans ("DFO") likely to cause greater impacts than the parties previously contemplated, then DFO may direct Hope Bay Limited (hereafter referred to as the "Proponent"), and its agents, and contractors, to suspend or alter works and activities associated with the project, to avoid or mitigate adverse impacts to fisheries resources. DFO may also direct the Proponent and its agents, and contractors, to carry out at the Proponent's expense any works or activities deemed necessary by DFO to avoid or mitigate further adverse impacts to fisheries resources. In circumstances where DFO is of the view that greater impacts may occur than were contemplated by the parties DFO may also modify or rescind this authorization. If the authorization is to be changed the Proponent will be given an opportunity to discuss any proposed modifications or rescission.
2. Conditions that relate to the Proponent plan:

    2.1. The Proponent confirms that all plans and specifications relating to this authorization have been duly prepared and reviewed by appropriate professionals working on behalf of the Proponent. The Proponent acknowledges

that they are solely responsible for all design, safety and workmanship aspects of all the works associated with this Authorization.

2.2. The construction of the jetty shall comply with those criteria as identified within this Authorization. Harmful alteration, disruption or destruction of fish habitat other than that specifically identified within this Authorization is prohibited.

2.3. Works and undertakings shall be conducted in accordance with the practices outlined in the following reports, and as approved by DFO:

2.3.1. Application for Authorization for Works or Undertakings Affecting Fish Habitat – Doris North Jetty Improvements, prepared by Rescan Environmental Services for Hope Bay Mining Limited, dated February 2010.

2.3.2. Jetty Repair – Existing Conditions – Sheet 1of 4, designed by PND Engineers Inc., dated February 2010.

2.3.3. Jetty Repair – Site Plan – Sheet 2 of 4, designed by PND Engineers Inc., dated February 2010.

2.3.4. Jetty Repair – Proposed Riprap Shoal Sections – Sheet 3 of 4, designed by PND Engineers Inc., dated February 2010.

2.3.5. Jetty Repair – Jetty Typical Sections – Sheet 4 of 4, designed by PND Engineers Inc., dated February 2010.

2.3.6. The above documents and drawings are hereafter referred to as the "Proponent Plan". Where contradictions exist, the most recent version shall apply.

3. Conditions that relate to the mitigation of potential harmful alteration, disruption or destruction ("HADD") of fish habitat. The following measures shall be implemented to avoid the unauthorized HADD of fish habitat:

3.1. No in-water work shall occur between July 15 and August 15 to protect critical spawning and rearing periods for all fish species in Roberts Bay.

3.2. A qualified biologist or environmental inspector shall be on site during all in-water construction, compensation and restoration works to ensure implementation of the designs as intended in the Plan and conditions of this Authorization.

3.3. All materials and equipment used for the purpose of all work phases shall be operated and stored in a manner that prevents any deleterious substance (e.g. petroleum products, silt, debris, etc.) from entering the water.

3.3.1. Any stockpiled materials shall be stored and stabilized above the ordinary high water mark of any water body.

3.3.2. Vehicle and equipment re-fuelling and maintenance shall be conducted above the ordinary high water mark of any water body.

3.3.3. Any part of equipment entering the water shall be free of fluid leaks and externally cleaned/degreased to prevent any deleterious substance from entering the water.

3.4. Only clean, competent, certified non-acid generating rock and material free of fine particulate matter shall be placed in the water.

3.5. Material used for habitat compensation features shall not be taken from below the ordinary high water mark or shoreline of any water body.

3.6. Sediment and erosion control measures shall be implemented prior to work, and maintained during the work phases, to prevent entry of sediment into the water or the movement of re-suspended sediment.

3.6.1. All disturbed areas shall be stabilized upon completion of work and restored to a pre-disturbed state or better.

3.6.2. Sediment and erosion control measures shall be left in place and maintained until all disturbed areas have been stabilized.

3.6.3. A sediment and erosion control plan shall be submitted to the Iqaluit, NU office of the Department of Fisheries and Oceans, Fish Habitat Management, Eastern Arctic Area, at least 10 days prior to the start of construction.

4. Conditions that relate to the compensation for the loss of 685 square meters of fish habitat.

4.1. As described in the Proponent Plan, approximately 1553 square meters of fish habitat shall be created, by:

4.1.1. Constructing two (2) underwater rock shoals (32 meters long by 12 meters wide with a minimum depth of 1 meter below mean water level) near shore, west of the jetty and north of the existing four shoals.

4.1.2. Constructing a rock apron at the base of the toe of the jetty slope.

5. Conditions that relate to the monitoring of the Proponent Plan, the mitigation and the compensation, the "Monitoring Program".

5.1. A Construction Monitoring Program shall be implemented to ensure the works were conducted within the schedule of the Proponent plan and whether the mitigation measures outlined in the Proponent Plan and this Authorization were followed, by:

5.1.1. Providing a photographic record of before, during and after construction, showing that all works and undertakings have been completed according to the approved Proponent Plan and conditions of this Authorization.

5.1.2. Providing dated photographs of the sediment control works and details of how they functioned to mitigate impacts to fish habitat.

5.1.3. Providing details of any contingency measures that were followed in the event that mitigation measures did not function as described in the Proponent Plan.

5.1.4. The photographs for each period of documentation shall be taken from the same vantage point(s), direction and angle of view.

5.1.5. All photographs shall be clearly labelled with the date, location and viewing direction. The photographic locations and viewing directions shall be indicated on a plan view drawing of the work site and clearly indexed to the photographs.

5.1.6. A written report summarizing the above monitoring results shall be submitted to the Iqaluit, NU office of the Department of Fisheries & Oceans – Fish Habitat Management, Eastern Arctic Area by December 31, 2011.

5.2. A Compensation Monitoring Program shall be implemented as outlined in the "Application for Authorization for Works or Undertakings Affecting Fish Habitat – Doris North Jetty Improvements, prepared by Rescan Environmental Services for Hope Bay Mining Limited, dated February 2010".

5.2.1. The Compensation Monitoring Program shall be implemented in the following years: 2012- Year-1 after construction; 2013 - Year-2 after construction; and Year-3 of monitoring shall occur in 2015.

5.2.2. A written report summarizing the above monitoring results shall be submitted to the Iqaluit, NU office of

the Department of Fisheries & Oceans – Fish Habitat Management, Eastern Arctic Area by December 31 of each year of the program (i.e. 2012, 2013 and 2015).

5.3. At mine closure, the Proponent shall develop a Jetty Lowering Monitoring Program incorporating the monitoring and reporting requirements of the original authorization (NU-02-0117).

5.3.1. The Jetty Lowering Monitoring Program shall be implemented in the first year of active mine post-closure (i.e. year of jetty lowering to below high water level), year-1 post-lowering of jetty and year-2 post-lowering of jetty.

6. Any deviation from the approved plans, the construction schedule, mitigation, compensation and/or monitoring measures stated above must be discussed with, and approved in writing by the Iqaluit, NU office of the Department of Fisheries and Oceans, Fish Habitat Management, Eastern Arctic Area.

7. All mitigation, compensation and monitoring measures shall be implemented to the satisfaction of the Iqaluit, NU office of the Department of Fisheries and Oceans, Habitat Management, Eastern Arctic Area.

8. Written notification of the commencement of works or undertakings shall be provided to the Iqaluit, NU office of the Department of Fisheries and Oceans, Habitat Management, Eastern Arctic Area, by e-mail to Loriena.Melnick@dfo-mpo.gc.ca or fax at (867) 979-8039 not less than 10 days prior to the initiation of said works or undertakings.

The holder of this authorization is hereby authorized under the authority of section 35(2) of the *Fisheries Act*. R.S.C., 1985, c.F. 14, to carry out the work or undertaking described herein. This authorization is valid only with respect to fish habitat and for no other purposes. It does not purport to release the applicant from any obligation to obtain permission from or to comply with the requirements of any other regulatory agencies.

Failure to comply with any condition of this authorization may result in charges being laid under the *Fisheries Act*.

This authorization form shall be held on site and work crews shall be made familiar with the conditions therein.

Date of Issuance: May 13, 2010

Approved by: David Burden

David Burden
Title: A/Regional Director General, Central and Arctic Region
Fisheries and Oceans Canada

Appendix 3.2-1

Set, Retrieval and Location Information for Rock Traps Used in Roberts Bay and Reference Bay, Doris North Project, 2010

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Appendix 3.2-1. Set, Retrieval and Location Information for Rock Traps Used in Roberts Bay and Reference Bay, Doris North Project, 2010

			Gear		Set		Retrieval		Depth & UTM			Samples Collected		
Location	Site	Site #	Method	#	Date In	Time In	Date Out	Time Out	Depth	Easting	Northing	Periphyton	Chlorophyl *a*	Benthos
Roberts Bay	Shoal	1	RT	1	11-Jul-10	13:40	26-Aug-10	12:39	1.0	432426	7563314	√	√	√
Roberts Bay	Shoal	1	RT	2	11-Jul-10	13:42	26-Aug-10	13:30	1.2	432409	7563324	√	√	√
Roberts Bay	Shoal	1	RT	3	11-Jul-10	13:44	26-Aug-10	13:44	2.3	432418	7563325	√	√	√
Roberts Bay	Shoal	1	RT	4	11-Jul-10	13:45	26-Aug-10	14:05	0.7	432405	7563324	√	√	√
Roberts Bay	Shoal	1	RT	5	11-Jul-10	13:46	26-Aug-10	14:20	1.0	432420	7563319	√	√	√
Roberts Bay	Shoal	2	RT	1	11-Jul-10	13:49	26-Aug-10	14:39	1.2	432366	7563336	√	√	√
Roberts Bay	Shoal	2	RT	2	11-Jul-10	13:50	26-Aug-10	14:55	1.1	432372	7563343	√	√	√
Roberts Bay	Shoal	2	RT	3	11-Jul-10	13:52	26-Aug-10	15:11	1.1	432361	7563347	√	√	√
Roberts Bay	Shoal	2	RT	4	11-Jul-10	13:53	26-Aug-10	15:27	1.0	432354	7563346	√	√	√
Roberts Bay	Shoal	2	RT	5	11-Jul-10	13:54	26-Aug-10	15:40	2.0	432350	7563355	√	√	√
Roberts Bay	Shoal	3	RT	1	11-Jul-10	13:57	26-Aug-10	16:50	1.1	432322	7563357	√	√	√
Roberts Bay	Shoal	3	RT	2	11-Jul-10	13:58	26-Aug-10	17:01	1.1	432304	7563364	√	√	√
Roberts Bay	Shoal	3	RT	3	11-Jul-10	14:01	27-Aug-10	14:58	0.9	432310	7563357	√	√	√
Roberts Bay	Shoal	3	RT	4	11-Jul-10	14:02	27-Aug-10	15:08	1.0	432311	7563353	√	√	√
Roberts Bay	Shoal	3	RT	5	11-Jul-10	14:04	27-Aug-10	15:20	0.9	432322	7563356	√	√	√
Roberts Bay	Shoal	4	RT	1	11-Jul-10	14:06	26-Aug-10	15:45	1.2	432268	7563377	√	√	√
Roberts Bay	Shoal	4	RT	2	11-Jul-10	14:08	26-Aug-10	16:01	1.2	432270	7563368	√	√	√
Roberts Bay	Shoal	4	RT	3	11-Jul-10	14:09	26-Aug-10	16:10	1.4	432258	7563382	√	√	√
Roberts Bay	Shoal	4	RT	4	11-Jul-10	14:11	26-Aug-10	16:24	1.1	432258	7563378	√	√	√
Roberts Bay	Shoal	4	RT	5	11-Jul-10	14:15	26-Aug-10	16:37	0.9	432262	7563373	√	√	√
Reference Bay	Shoal	1	RT	1	12-Jul-10	10:30	30-Aug-10	11:33	0.3	441550	7562113	√	√	√
Reference Bay	Shoal	1	RT	2	12-Jul-10	10:32	30-Aug-10	11:50	0.4	441548	7562132	√	√	√
Reference Bay	Shoal	1	RT	3	12-Jul-10	10:34	30-Aug-10	16:38	0.8	441561	7562161	√	√	√
Reference Bay	Shoal	1	RT	4	12-Jul-10	10:36	30-Aug-10	12:08	0.5	441573	7562147	√	√	√
Reference Bay	Shoal	1	RT	5	12-Jul-10	10:38	30-Aug-10	12:24	0.3	441583	7562142	√	√	√
Reference Bay	Shoal	2	RT	1	12-Jul-10	10:39	30-Aug-10	9:50	0.2	441606	7562182	√	√	√
Reference Bay	Shoal	2	RT	2	12-Jul-10	10:40	30-Aug-10	10:10	0.3	441604	7562188	√	√	√
Reference Bay	Shoal	2	RT	3	12-Jul-10	10:41	30-Aug-10	10:25	0.6	441595	7562211	√	√	√
Reference Bay	Shoal	2	RT	4	12-Jul-10	10:42	30-Aug-10	10:43	0.7	441584	7562236	√	√	√
Reference Bay	Shoal	2	RT	5	12-Jul-10	10:43	30-Aug-10	11:01	1.0	441599	7562252	√	√	√
Reference Bay	Shoal	3	RT	1	12-Jul-10	10:44	28-Aug-10	13:32	1.0	441529	7562322	√	√	√
Reference Bay	Shoal	3	RT	2	12-Jul-10	10:45	28-Aug-10	13:48	0.8	441513	7562338	√	√	√
Reference Bay	Shoal	3	RT	3	12-Jul-10	10:46	28-Aug-10	14:10	0.9	441491	7562356	√	√	√
Reference Bay	Shoal	3	RT	4	12-Jul-10	10:47	28-Aug-10	14:32	1.0	441516	7562372	√	√	√
Reference Bay	Shoal	3	RT	5	12-Jul-10	10:49	28-Aug-10	13:17	0.7	441528	7562354	√	√	√
Reference Bay	Shoal	4	RT	1	12-Jul-10	10:52	28-Aug-10	11:50	1.2	441473	7562427	√	√	√
Reference Bay	Shoal	4	RT	2	12-Jul-10	10:53	28-Aug-10	12:09	0.9	441471	7562453	√	√	√
Reference Bay	Shoal	4	RT	3	12-Jul-10	10:54	28-Aug-10	11:30	1.2	441482	7562484	√	√	√
Reference Bay	Shoal	4	RT	4	12-Jul-10	10:55	28-Aug-10	11:07	1.1	441510	7562463	√	√	√
Reference Bay	Shoal	4	RT	5	12-Jul-10	10:57	28-Aug-10	12:29	0.8	441540	7562445	√	√	√

Note: RT = Rock Trap

Appendix 3.2-2

Periphyton Chlorophyll *a* Data for Roberts Bay and Reference Bay, Doris North Project, 2010

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Appendix 3.2-2. Periphyton Chlorophyll *a* Data for Roberts Bay and Reference Bay, Doris North Project, 2010

Site	Plate Installation Date	Plate Retrieval Date	ALS Sample ID	Chlorophyll *a* (µg)	Chlorophyll *a* Biomass (µg/cm^2)
Roberts Bay					
Shoal 1 - Rep. 1	July 11, 2010	August 26, 2010	L930846-21	4.99	0.100
Shoal 1 - Rep. 2	July 11, 2010	August 26, 2010	L930846-22	28.1	0.562
Shoal 1 - Rep. 3	July 11, 2010	August 26, 2010	L930846-23	9.41	0.188
Shoal 1 - Rep. 4	July 11, 2010	August 26, 2010	L930846-24	2.85	0.057
Shoal 1 - Rep. 5	July 11, 2010	August 26, 2010	L930846-25	18.4	0.368
Mean					**0.255**
SE					**0.093**
Shoal 2 - Rep. 1	July 11, 2010	August 26, 2010	L930846-26	4.03	0.081
Shoal 2 - Rep. 2	July 11, 2010	August 26, 2010	L930846-27	18.9	0.378
Shoal 2 - Rep. 3	July 11, 2010	August 26, 2010	L930846-28	9.05	0.181
Shoal 2 - Rep. 4	July 11, 2010	August 26, 2010	L930846-29	2.38	0.048
Shoal 2 - Rep. 5	July 11, 2010	August 26, 2010	L930846-30	22.9	0.458
Mean					**0.229**
SE					**0.081**
Shoal 3 - Rep. 1	July 11, 2010	August 26, 2010	L930846-31	23.1	0.462
Shoal 3 - Rep. 2	July 11, 2010	August 26, 2010	L930846-32	18.3	0.366
Shoal 3 - Rep. 3	July 11, 2010	August 27, 2010	L930846-33	21.6	0.432
Shoal 3 - Rep. 4	July 11, 2010	August 27, 2010	L930846-34	23.4	0.468
Shoal 3 - Rep. 5	July 11, 2010	August 27, 2010	L930846-35	10.7	0.214
Mean					**0.388**
SE					**0.047**
Shoal 4 - Rep. 1	July 11, 2010	August 26, 2010	L930846-36	6.89	0.138
Shoal 4 - Rep. 2	July 11, 2010	August 26, 2010	L930846-37	16.9	0.338
Shoal 4 - Rep. 3	July 11, 2010	August 26, 2010	L930846-38	17.2	0.344
Shoal 4 - Rep. 4	July 11, 2010	August 26, 2010	L930846-39	5.45	0.109
Shoal 4 - Rep. 5	July 11, 2010	August 26, 2010	L930846-40	2.85	0.057
Mean					**0.197**
SE					**0.060**
Reference Bay					
Shoal 1 - Rep. 1	July 12, 2010	August 30, 2010	L930846-1	21.1	0.422
Shoal 1 - Rep. 2	July 12, 2010	August 30, 2010	L930846-2	207	4.140
Shoal 1 - Rep. 3	July 12, 2010	August 30, 2010	L930846-3	1.08	0.022
Shoal 1 - Rep. 4	July 12, 2010	August 30, 2010	L930846-4	9.07	0.181
Shoal 1 - Rep. 5	July 12, 2010	August 30, 2010	L930846-5	72.9	1.458
Mean					**1.245**
SE					**0.766**

Appendix 3.2-2. Periphyton Chlorophyll *a* Data for Roberts Bay and Reference Bay, Doris North Project, 2010

Site	Plate Installation Date	Plate Retrieval Date	ALS Sample ID	Chlorophyll *a* (µg)	Chlorophyll *a* Biomass (µg/cm^2)
Reference Bay *(continued)*					
Shoal 2 - Rep. 1	July 12, 2010	August 30, 2010	L930846-6	86.8	1.736
Shoal 2 - Rep. 2	July 12, 2010	August 30, 2010	L930846-7	26.6	0.532
Shoal 2 - Rep. 3	July 12, 2010	August 30, 2010	L930846-8	21.7	0.434
Shoal 2 - Rep. 4	July 12, 2010	August 30, 2010	L930846-9	10.9	0.218
Shoal 2 - Rep. 5	July 12, 2010	August 30, 2010	L930846-10	18.2	0.364
Mean					**0.657**
SE					**0.275**
Shoal 3 - Rep. 1	July 12, 2010	August 28, 2010	L930846-11	45.8	0.916
Shoal 3 - Rep. 2	July 12, 2010	August 28, 2010	L930846-12	117	2.340
Shoal 3 - Rep. 3	July 12, 2010	August 28, 2010	L930846-13	41.7	0.834
Shoal 3 - Rep. 4	July 12, 2010	August 28, 2010	L930846-14	17.9	0.358
Shoal 3 - Rep. 5	July 12, 2010	August 28, 2010	L930846-15	9.57	0.191
Mean					**0.928**
SE					**0.379**
Shoal 4 - Rep. 1	July 12, 2010	August 28, 2010	L930846-16	23.1	0.462
Shoal 4 - Rep. 2	July 12, 2010	August 28, 2010	L930846-17	54.7	1.094
Shoal 4 - Rep. 3	July 12, 2010	August 28, 2010	L930846-18	0.28	0.006
Shoal 4 - Rep. 4	July 12, 2010	August 28, 2010	L930846-19	21.7	0.434
Shoal 4 - Rep. 5	July 12, 2010	August 28, 2010	L930846-20	1.98	0.040
Mean					**0.407**
SE					**0.196**

Note: SE = Standard error of the mean

Appendix 3.2-3

Periphyton Taxonomy Data for Roberts Bay and Reference Bay, Doris North Project, 2010

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Appendix 3.2-3. Periphyton Taxonomy Data for Roberts Bay and Reference Bay, Doris North Project, 2010

Site/Shoal #	Roberts Bay - Shoal 1					Roberts Bay - Shoal 2				
Replicate	1	2	3	4	5	1	2	3	4	5
Collection Date	08-26-2010	08-26-2010	08-26-2010	08-26-2010	08-26-2010	08-26-2010	08-26-2010	08-26-2010	08-26-2010	08-26-2010
Taxa										
Bacillariophyta										
Achnanthes sp.	2,723.8	221.2	642.5	-	-	-	-	-	-	-
Amphora sp.	1,361.9	1,327.0	642.5	-	-	-	7.0	197.2	-	-
Asterionella sp.	-	-	-	-	-	-	-	-	-	-
Aulacoseira sp.	-	-	-	-	-	-	27.9	-	-	-
Chaetoceros sp.	2,723.8	-	3,855.2	-	2,723.8	-	-	-	-	-
Cocconeis sp.	454.0	2,211.6	2,570.2	-	1,815.9	119.7	14.0	986.0	-	738.3
Cymatopleura sp.	-	-	-	-	-	-	-	-	-	-
Cymbella sp.	-	-	321.3	-	907.9	-	-	197.2	949.8	-
Entomoneis sp.	907.9	-	642.5	-	-	-	-	197.2	-	-
Gyrosigma sp.	454.0	-	321.3	-	-	-	14.0	-	-	-
Licmophora sp.	454.0	663.5	321.3	-	-	-	-	197.2	-	-
Manguinea sp.	-	-	-	-	-	-	-	15,184.3	-	2,584.1
Mastogloia sp.	1,361.9	1,769.3	1,927.6	873.0	907.9	359.2	34.9	591.6	1,424.8	2,215.0
Melosira sp.	-	-	1,606.3	3,492.1	6,355.6	957.8	-	788.8	-	4,060.8
Navicula sp.	4,539.7	3,538.6	8,031.7	2,619.0	4,539.7	478.9	14.0	1,774.8	1,424.8	1,845.8
Nitzschia sp.	12,711.1	10,615.9	34,697.1	20,079.4	31,777.8	5,028.6	384.1	11,437.5	8,073.7	11,813.2
Plagiogramma sp.	1,361.9	-	-	-	-	-	-	-	-	-
Pleurosigma sp.	454.0	-	-	1,746.0	-	-	-	-	474.9	738.3
Porosira sp.	-	-	-	873.0	-	119.7	-	-	1,899.7	-
Striatella sp.	-	-	-	-	-	-	-	-	-	-
Surirella sp.	-	-	-	-	-	-	-	-	-	-
Thalassiosira sp.	907.9	221.2	963.8	-	907.9	-	7.0	-	-	-
Triceratium sp.	-	884.7	963.8	-	1,815.9	-	7.0	-	-	-
Chlorophyta										
Chlorococcum infusionum	-	221.2	-	-	907.9	-	-	-	-	-
Monoraphidium contortum	-	-	321.3	-	-	-	-	-	-	-
Pyramimonas disomata	-	-	-	-	-	-	-	-	-	-
Ulothrix sp.	-	-	-	-	-	-	-	-	-	-
Cryptophyta										
Hemiselmis rufescens	-	-	1,606.3	-	-	-	-	-	-	-
Teleaulax acuta	-	-	-	-	-	-	-	-	-	-
Cyanobacteria										
Anabaena cylindrica	110,314.3	52,637.0	58,149.8	287,222.2	229,707.9	29,333.3	1,655.2	45,158.5	148,650.2	92,659.4
Chroococcus sp.	-	-	-	-	-	-	-	-	-	-
Merismopedia punctata	-	-	-	-	-	-	-	-	-	-
Phormidium limosum	-	-	-	-	-	-	-	-	-	4,429.9
Phormidium nigro-viride	-	-	-	-	-	-	-	-	-	-
Spirulina subsalsa	-	-	-	-	-	-	-	-	-	-
Dinoflagellata										
Ceratium horridum	-	-	-	-	-	-	-	-	-	-
Dinophysis acuminata	-	-	-	-	-	-	-	-	-	-
Gymnodinium gracilentum	454.0	-	-	-	-	-	-	-	-	-
Gymnodinium sp. (large)	454.0	-	-	-	-	-	-	-	-	-
Gyrodinium undulans	-	-	-	-	-	-	-	-	-	-
Mesoporos perforatus	-	221.2	1,606.3	873.0	-	119.7	7.0	197.2	2,374.6	2,215.0
Prorocentrum compressum	-	-	-	-	-	-	-	-	-	-
Prorocentrum gracile	-	-	-	-	-	-	-	-	-	-
Scrippsiella sp.	-	-	-	-	-	-	-	-	-	-
Euglenozoa										
Eutreptiella gymnastica	-	663.5	-	-	907.9	359.2	7.0	-	-	369.2
Trachelomonas abrupta	-	-	-	-	-	-	-	-	-	-
Haptophyta										
Chrysochromulina sp.	-	-	-	-	-	-	-	-	-	-
Corymbellus aureus	-	-	-	-	-	-	-	-	-	-
Phaeocystis globosa	-	-	-	-	-	-	-	-	-	-
Heterokontophyta	-	-	-	-	-	-	-	-	-	-
Dictyocha speculum	-	221.2	-	-	-	239.5	-	-	-	-
TOTAL	**141,638**	**75,417**	**119,191**	**317,778**	**283,276**	**37,116**	**2,179**	**76,908**	**165,272**	**123,669**

Note: Units are cells/cm²

Appendix 3.2-3. Periphyton Taxonomy Data for Roberts Bay and Reference Bay, Doris North Project, 2010

Site/Shoal #	Roberts Bay - Shoal 3					Roberts Bay - Shoal 4				
Replicate	1	2	3	4	5	1	2	3	4	5
Collection Date	08-26-2010	08-26-2010	08-27-2010	08-27-2010	08-27-2010	08-26-2010	08-26-2010	08-26-2010	08-26-2010	08-27-2010
Taxa										
Bacillariophyta										
Achnanthes sp.	721.7	-	-	-	-	-	214.9	-	-	419.0
Amphora sp.	-	-	-	-	-	-	214.9	1,117.5	-	139.7
Asterionella sp.	-	-	-	-	-	-	-	1,862.4	-	-
Aulacoseira sp.	-	-	-	3,182.8	-	-	-	-	2,514.3	1,257.1
Chaetoceros sp.	-	-	-	-	-	-	644.7	372.5	2,514.3	2,374.6
Cocconeis sp.	1,443.4	1,350.3	-	868.0	-	1,117.5	644.7	-	1,885.7	419.0
Cymatopleura sp.	-	-	-	-	-	-	-	-	-	-
Cymbella sp.	-	-	-	-	1,117.5	-	-	-	628.6	419.0
Entomoneis sp.	-	675.1	357.9	-	-	-	429.8	-	-	419.0
Gyrosigma sp.	-	-	-	-	-	-	214.9	-	-	139.7
Licmophora sp.	1,443.4	1,350.3	357.9	868.0	1,117.5	-	429.8	745.0	3,142.9	838.1
Manguinea sp.	10,825.4	-	-	8,390.9	25,701.6	-	1,719.2	-	4,400.0	1,676.2
Mastogloia sp.	1,443.4	1,350.3	2,147.6	1,446.7	3,352.4	1,117.5	-	372.5	1,257.1	838.1
Melosira sp.	-	4,050.8	5,727.0	5,208.2	6,704.8	-	214.9	2,607.4	1,885.7	1,396.8
Navicula sp.	-	4,050.8	4,653.2	3,182.8	14,527.0	8,939.7	3,223.4	5,587.3	7,542.9	4,469.8
Nitzschia sp.	31,032.8	12,152.4	5,011.1	11,863.0	32,406.3	10,057.1	17,406.6	26,446.6	32,685.7	14,666.7
Plagiogramma sp.	-	-	-	-	-	-	-	-	-	-
Pleurosigma sp.	-	-	-	-	-	-	-	-	-	-
Porosira sp.	-	-	-	-	-	-	-	-	628.6	-
Striatella sp.	-	-	-	-	-	-	-	-	-	139.7
Surirella sp.	-	-	-	-	-	-	-	1,117.5	-	419.0
Thalassiosira sp.	-	-	357.9	289.3	-	-	-	1,117.5	1,257.1	139.7
Triceratium sp.	-	675.1	357.9	868.0	-	-	429.8	745.0	1,257.1	139.7
Chlorophyta										
Chlorococcum infusionum	-	-	-	-	-	-	-	-	-	-
Monoraphidium contortum	-	-	-	-	-	-	-	-	-	-
Pyramimonas disomata	-	-	-	-	-	-	-	-	-	-
Ulothrix sp.	-	-	-	-	-	-	-	-	-	-
Cryptophyta										
Hemiselmis rufescens	-	-	-	-	-	-	214.9	-	1,257.1	558.7
Teleaulax acuta	-	-	-	-	-	-	-	-	-	-
Cyanobacteria										
Anabaena cylindrica	176,814.8	186,336.5	86,262.7	59,025.9	379,936.5	324,063.5	41,904.8	82,692.1	135,142.9	13,130.2
Chroococcus sp.	-	-	-	-	-	-	-	-	-	-
Merismopedia punctata	-	-	-	-	-	-	-	-	-	-
Phormidium limosum	-	-	-	-	-	-	4,297.9	11,547.1	-	-
Phormidium nigro-viride	23,094.2	-	32,214.3	3,472.1	-	-	-	-	-	-
Spirulina subsalsa	-	-	-	-	-	-	-	1,862.4	-	-
Dinoflagellata										
Ceratium horridum	-	-	357.9	-	-	-	-	-	-	-
Dinophysis acuminata	-	-	-	-	-	-	-	-	-	-
Gymnodinium gracilentum	-	-	-	289.3	-	-	-	-	-	139.7
Gymnodinium sp. (large)	-	-	-	-	-	-	-	-	-	-
Gyrodinium undulans	-	-	-	-	-	-	-	-	-	-
Mesoporos perforatus	1,443.4	1,350.3	1,431.7	578.7	3,352.4	-	1,074.5	-	2,514.3	419.0
Prorocentrum compressum	-	-	-	-	-	-	-	-	-	-
Prorocentrum gracile	-	-	-	-	-	-	-	-	-	-
Scrippsiella sp.	-	-	-	-	-	-	-	-	-	-
Euglenozoa										
Eutreptiella gymnastica	-	675.1	357.9	2,314.7	-	-	-	-	-	558.7
Trachelomonas abrupta	-	-	-	-	-	-	-	-	-	139.7
Haptophyta										
Chrysochromulina sp.	-	-	-	-	-	-	-	-	-	-
Corymbellus aureus	-	-	-	-	-	-	-	-	-	-
Phaeocystis globosa	-	-	-	-	-	-	-	-	-	-
Heterokontophyta										
Dictyocha speculum	-	-	-	-	-	-	-	-	-	-
TOTAL	**248,262**	**214,017**	**139,595**	**101,849**	**468,216**	**345,295**	**73,280**	**138,193**	**200,514**	**45,257**

Note: Units are cells/cm²

Appendix 3.2-3. Periphyton Taxonomy Data for Roberts Bay and Reference Bay, Doris North Project, 2010

Site/Shoal #	Reference Bay - Shoal 1					Reference Bay - Shoal 2				
Replicate	1	2	3	4	5	1	2	3	4	5
Collection Date	08-30-2010	08-30-2010	08-30-2010	08-30-2010	08-30-2010	08-30-2010	08-30-2010	08-30-2010	08-30-2010	08-30-2010
Taxa										
Bacillariophyta										
Achnanthes sp.	-	698.4	880.0	663.5	628.6	-	217.3	349.2	1,147.4	279.4
Amphora sp.	-	2,095.2	1,564.4	221.2	-	1,070.9	1,521.0	349.2	459.0	279.4
Asterionella sp.	-	-	-	-	-	-	-	-	-	-
Aulacoseira sp.	-	-	-	-	-	-	-	-	-	-
Chaetoceros sp.	-	-	-	221.2	-	-	-	-	-	-
Cocconeis sp.	-	4,539.7	3,031.1	1,769.3	942.9	1,874.1	3,259.3	1,396.8	2,294.8	13,409.5
Cymatopleura sp.	-	-	-	-	-	-	-	-	229.5	-
Cymbella sp.	-	-	880.0	663.5	314.3	1,606.3	651.9	1,222.2	229.5	3,073.0
Entomoneis sp.	-	-	-	221.2	-	267.7	-	1,047.6	-	838.1
Gyrosigma sp.	-	-	-	-	-	-	-	-	-	-
Licmophora sp.	-	349.2	97.8	221.2	-	-	-	174.6	-	-
Manguinea sp.	-	-	-	-	-	-	1,738.3	-	-	-
Mastogloia sp.	-	349.2	1,075.6	-	628.6	-	651.9	349.2	1,376.9	-
Melosira sp.	-	-	782.2	2,875.1	-	-	1,521.0	-	-	1,117.5
Navicula sp.	1,552.0	2,095.2	3,813.3	2,432.8	3,928.6	2,409.5	6,084.0	3,666.7	3,212.7	3,911.1
Nitzschia sp.	20,176.4	9,777.8	10,266.7	12,606.3	16,185.7	23,827.5	23,901.2	11,873.0	11,703.4	7,822.2
Plagiogramma sp.	-	-	-	-	-	-	-	-	-	-
Pleurosigma sp.	-	349.2	-	-	-	-	-	-	-	-
Porosira sp.	-	698.4	-	-	-	-	-	523.8	-	-
Striatella sp.	-	-	-	-	-	-	-	-	-	279.4
Surirella sp.	-	1,746.0	195.6	-	157.1	-	-	-	-	1,676.2
Thalassiosira sp.	1,552.0	-	-	-	-	-	217.3	-	229.5	-
Triceratium sp.	-	349.2	-	-	-	-	-	-	-	-
Chlorophyta										
Chlorococcum infusionum	-	-	-	-	-	-	-	-	-	-
Monoraphidium contortum	-	-	-	221.2	-	-	-	174.6	-	-
Pyramimonas disomata	-	-	-	-	-	-	-	-	-	-
Ulothrix sp.	41,904.8	-	-	-	-	-	-	-	-	-
Cryptophyta										
Hemiselmis rufescens	-	349.2	-	-	-	1,338.6	1,521.0	523.8	688.4	1,117.5
Teleaulax acuta	-	-	-	-	-	-	-	-	688.4	558.7
Cyanobacteria										
Anabaena cylindrica	437,672.0	101,269.8	10,168.9	46,886.8	26,085.7	59,970.4	22,814.8	35,968.3	56,222.2	65,092.1
Chroococcus sp.	-	-	195.6	-	-	-	-	-	-	-
Merismopedia punctata	-	349.2	-	2,654.0	314.3	535.4	869.1	873.0	-	-
Phormidium limosum	-	-	-	-	-	-	-	-	-	-
Phormidium nigro-viride	17,072.3	-	880.0	6,856.1	-	-	-	-	-	-
Spirulina subsalsa	-	3,142.9	-	-	2,671.4	-	-	-	-	-
Dinoflagellata										
Ceratium horridum	-	-	-	-	-	-	-	-	-	-
Dinophysis acuminata	-	-	-	-	-	-	-	698.4	-	-
Gymnodinium gracilentum	-	-	-	-	-	-	-	-	-	-
Gymnodinium sp. (large)	-	-	-	-	-	-	-	-	-	-
Gyrodinium undulans	-	-	-	-	-	-	-	-	-	-
Mesoporos perforatus	-	-	391.1	1,327.0	1,414.3	-	1,086.4	174.6	1,606.3	3,352.4
Prorocentrum compressum	-	-	-	-	-	-	-	174.6	-	-
Prorocentrum gracile	-	-	-	-	-	-	-	174.6	-	-
Scrippsiella sp.	-	-	-	-	-	267.7	-	-	-	-
Euglenozoa										
Eutreptiella gymnastica	-	-	-	-	-	-	-	-	229.5	-
Trachelomonas abrupta	-	-	-	-	-	-	-	-	-	-
Haptophyta										
Chrysochromulina sp.	-	-	-	-	-	-	-	-	-	838.1
Corymbellus aureus	-	-	-	-	-	-	1,086.4	-	-	-
Phaeocystis globosa	-	-	-	-	-	1,338.6	869.1	698.4	459.0	558.7
Heterokontophyta										
Dictyocha speculum	-	-	-	-	471.4	535.4	-	-	-	-
TOTAL	**519,929**	**128,159**	**34,222**	**79,840**	**53,743**	**95,042**	**68,010**	**60,413**	**80,776**	**104,203**

Note: Units are cells/cm²

Appendix 3.2-3. Periphyton Taxonomy Data for Roberts Bay and Reference Bay, Doris North Project, 2010

Site/Shoal #	Reference Bay - Shoal 3					Reference Bay - Shoal 4				
Replicate	1	2	3	4	5	1	2	3	4	5
Collection Date	08-28-2010	08-28-2010	08-28-2010	08-28-2010	08-28-2010	08-28-2010	08-28-2010	08-28-2010	08-28-2010	08-28-2010
Taxa										
Bacillariophyta										
Achnanthes sp.	-	942.9	-	-	1,005.7	-	-	531.7	314.3	712.4
Amphora sp.	3,422.2	-	-	279.4	377.1	1,606.3	-	-	-	59.4
Asterionella sp.	-	-	-	-	-	-	-	-	-	-
Aulacoseira sp.	-	-	-	-	-	-	-	-	-	-
Chaetoceros sp.	-	-	-	-	125.7	-	-	-	942.9	-
Cocconeis sp.	1,140.7	1,257.1	9,219.0	2,234.9	502.9	9,236.5	-	4,152.1	4,400.0	2,968.3
Cymatopleura sp.	-	-	-	-	-	-	-	-	-	-
Cymbella sp.	9,125.9	5,971.4	2,048.7	2,793.7	502.9	-	-	151.9	3,457.1	59.4
Entomoneis sp.	-	1,257.1	1,024.3	838.1	125.7	401.6	-	-	-	118.7
Gyrosigma sp.	-	-	1,024.3	-	-	-	-	-	-	-
Licmophora sp.	1,140.7	-	-	-	-	-	-	25.3	628.6	59.4
Manguinea sp.	-	-	6,658.2	-	2,137.1	-	18,228.6	-	-	-
Mastogloia sp.	2,281.5	628.6	512.2	1,117.5	251.4	-	675.1	151.9	1,885.7	59.4
Melosira sp.	-			838.1	502.9	2,007.9	3,375.7	126.6	1,257.1	356.2
Navicula sp.	22,814.8	3,771.4	3,585.2	1,117.5	2,891.4	3,614.3	6,751.3	405.1	3,457.1	474.9
Nitzschia sp.	60,459.3	16,342.9	16,901.6	17,879.4	6,662.9	24,898.4	6,751.3	1,189.9	29,857.1	3,383.8
Plagiogramma sp.	-	-	-	-	-	-	-	-	-	-
Pleurosigma sp.	-	-	-	-	-	-	-	-	314.3	-
Porosira sp.	-	-	-	-	-	-	-	-	1,571.4	-
Striatella sp.	-	-	-	-	377.1	-	-	76.0		-
Surirella sp.	-	628.6	-	-	125.7	1,204.8	1,350.3	-	314.3	-
Thalassiosira sp.	-	314.3	-	1,955.6	-	-	2,025.4	-	-	-
Triceratium sp.	1,140.7	314.3	-	-	125.7	-	-	25.3	314.3	-
Chlorophyta										
Chlorococcum infusionum	-	-	-	-	-	-	-	-	-	-
Monoraphidium contortum	-	-	512.2	-	251.4	-	-	-	314.3	-
Pyramimonas disomata	-	-	1,024.3	279.4	502.9	-	-	-	-	-
Ulothrix sp.	-	-	-	-	4,148.6	-	-	-	-	-
Cryptophyta										
Hemiselmis rufescens	1,140.7	2,828.6	1,536.5	1,396.8	251.4	-	-	76.0	942.9	178.1
Teleaulax acuta	1,140.7	-	-	-	-	401.6	-	-	942.9	237.5
Cyanobacteria										
Anabaena cylindrica	375,303.7	75,742.9	175,674.1	58,387.3	22,880.0	-	168,107.9	1,493.7	58,457.1	12,822.9
Chroococcus sp.	-	-	-	-	-	-	-	-	-	-
Merismopedia punctata	5,703.7	942.9	-	-	502.9	-	-	-	-	-
Phormidium limosum	-	-	-	-	-	-	-	-	-	-
Phormidium nigro-viride	-	-	-	8,660.3	-	79,514.3	-	-	-	-
Spirulina subsalsa	-	-	-	-	-	-	-	-	-	-
Dinoflagellata										
Ceratium horridum	-	-	-	-	-	-	-	-	-	-
Dinophysis acuminata	1,140.7	-	-	-	-	-	-	-	-	-
Gymnodinium gracilentum	-	-	-	-	-	-	-	-	-	-
Gymnodinium sp. (large)	-	-	-	-	-	-	-	-	-	-
Gyrodinium undulans	-	-	-	-	-	401.6	-	25.3	-	-
Mesoporos perforatus	-	1,257.1	5,633.9	838.1	754.3	2,811.1	-	177.2	-	118.7
Prorocentrum compressum	-	-	-	-	-	-	-	25.3	-	-
Prorocentrum gracile	-	-	-	-	-	-	-	25.3	-	-
Scrippsiella sp.	-	-	-	-	-	-	-	-	-	-
Euglenozoa										
Eutreptiella gymnastica	-	-	-	-	-	-	-	-	-	-
Trachelomonas abrupta	-	-	-	-	-	-	-	-	-	-
Haptophyta										
Chrysochromulina sp.	-	942.9	-	-	-	-	-	-	314.3	118.7
Corymbellus aureus	-	-	-	-	125.7	401.6	-	-	-	-
Phaeocystis globosa	2,281.5	-	1,024.3	-	-	-	-	-	1,885.7	178.1
Heterokontophyta										
Dictyocha speculum	-	-	-	-	-	-	-	-	-	-
TOTAL	**488,237**	**113,143**	**226,379**	**98,616**	**45,131**	**126,500**	**207,266**	**8,659**	**111,571**	**21,906**

Note: Units are cells/cm²

Appendix 3.2-4

Benthic Invertebrate Data Collected from Roberts Bay and Reference Bay, Doris North Project, 2010

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Appendix 3.2-4. Benthic Invertebrate Data Collected from Roberts Bay and Reference Bay, Doris North Project, 2010

Site	Reference Bay										Reference Bay										Reference Bay									
Shoal #	Shoal 1										Shoal 2										Shoal 3									
Sampling Date (m/d/y)	8/30/10										8/30/10										8/28/10									
Replicate #	1		2		3		4		5		1		2		3		4		5		1		2		3		4		5	
Stage (Adult or Juvenile)	A	J	A	J	A	J	A	J	A	J	A	J	A	J	A	J	A	J	A	J	A	J	A	J	A	J	A	J	A	J
TAXA																														
ANNELIDA																														
Polychaeta Errantia																														
Harmothoe imbricata Cmplx	1	-	3	-	-	-	1	-	1	-	-	-	-	-	1	-	1	-	-	-	1	-	-	-	1	-	1	-	2	-
Nephtys sp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Polychaeta Sedentaria																														
Spio sp.	-	-	-	-	-	-	-	-	-	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
MOLLUSCA																														
Bivalvia																														
Ennucula tenuis	-	-	-	-	-	-	-	-	-	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
ARTHROPODA																														
Arachnida																														
Halacaridae	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Amphipoda																														
Gammaracanthus loricatus	2	-	2	-	1	-	4	-	3	1	1	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-
Ischyrocerus anguipes	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Lagunogammarus setosus	53	2	27	2	5	-	96	6	82	2	56	1	42	1	60		27		121	1	74	4	19	-	28	6	46	1	20	1
Copepoda																														
Harpacticoida	-	-	-	-	-	-	-	-	-	-	-	-	2	-	-	-	-	-	3	-	-	-	-	-	-	-	-	-	-	-
CHORDATA																														
Teleostei																														
Liparis sp.	-	-	-	1	-	-	-	2	-	-	-	1	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-

Notes:

A = Adult, J = Juvenile

Units are organisms per rock trap.

Halacaridae and Harpacticoida were each assumed to comprise a single genus in order to calculate genera richness and diversity because individuals belonging to these taxa could not be identified to the genus level.

Teleostei (ray-finned fish) were not included in the analysis because they are not benthic invertebrates.

Appendix 3.2-4. Benthic Invertebrate Data Collected from Roberts Bay and Reference Bay, Doris North Project, 2010

Site	Reference Bay										Roberts Bay										Roberts Bay									
Shoal #	Shoal 4										Shoal 1										Shoal 2									
Sampling Date (m/d/y)	8/28/10										26/8/10										26/8/10									
Replicate #	1		2		3		4		5		1		2		3		4		5		1		2		3		4		5	
Stage (Adult or Juvenile)	A	J	A	J	A	J	A	J	A	J	A	J	A	J	A	J	A	J	A	J	A	J	A	J	A	J	A	J	A	J
TAXA																														
ANNELIDA																														
Polychaeta Errantia																														
Harmothoe imbricata Cmplx	-	-	-	-	-	-	-	-	-	-	1	-	1	-	5	-	-	-	2	-	-	-	1	-	1	-	-	-	8	-
Nephtys sp.	-	-	-	-	-	-	-	-	-	-	-	-	1	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Polychaeta Sedentaria																														
Spio sp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2	-	1	-	-	-
MOLLUSCA																														
Bivalvia																														
Ennucula tenuis	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
ARTHROPODA																														
Arachnida																														
Halacaridae	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	3	-
Amphipoda																														
Gammaracanthus loricatus	1	-	-	-	-	-	-	-	-	-	1	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ischyrocerus anguipes	-	-	-	-	-	-	-	-	-	-	3	-	4	-	4	-	5	-	-	-	3	-	33	-	1	-	2	-	1	-
Lagunogammarus setosus	64	5	23	1	25	1	9	1	62	3	13	-	-	-	1	-	2	-	1	-	3	-	-	-	4	-	-	-	-	-
Copepoda																														
Harpacticoida	-	-	-	-	-	-	-	-	-	-	2	-	1	-	1	-	-	-	-	-	1	-	3	-	-	-	3	-	9	-
CHORDATA																														
Teleostei																														
Liparis sp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-

Notes:

A = Adult, J = Juvenile

Units are organisms per rock trap.

Halacaridae and Harpacticoida were each assumed to comprise a single genus in order to calculate genera richness and diversity because individuals belonging to these taxa could not be identified to the genus level.

Teleostei (ray-finned fish) were not included in the analysis because they are not benthic invertebrates.

Appendix 3.2-4. Benthic Invertebrate Data Collected from Roberts Bay and Reference Bay, Doris North Project, 2010

Site	Roberts Bay										Roberts Bay									
Shoal #	Shoal 3										Shoal 4									
Sampling Date (m/d/y)	26/8/10										26/8/10									
Replicate #	1		2		3		4		5		1		2		3		4		5	
Stage (Adult or Juvenile)	A	J	A	J	A	J	A	J	A	J	A	J	A	J	A	J	A	J	A	J
TAXA																				
ANNELIDA																				
Polychaeta Errantia																				
Harmothoe imbricata Cmplx	-	-	1	-	1	-	1	-	6	-	1	-	1	-	1	-	1	-	1	-
Nephtys sp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Polychaeta Sedentaria																				
Spio sp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
MOLLUSCA																				
Bivalvia																				
Ennucula tenuis	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
ARTHROPODA																				
Arachnida																				
Halacaridae	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Amphipoda																				
Gammaracanthus loricatus	-	-	-	-	-	-	-	-	1	-	-	-								-
Ischyrocerus anguipes	17	-	14	-	5	-	8	1	1	-	3	-	5	-	-	-	2	-	2	-
Lagunogammarus setosus	1	-	1	-	2	-	2	-	-	-	-	-	-	-	10	-	2	-	-	-
Copepoda																				
Harpacticoida	2	-	1	-	1	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-
CHORDATA																				
Teleostei																				
Liparis sp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Notes:

A = Adult, J = Juvenile

Units are organisms per rock trap.

Halacaridae and Harpacticoida were each assumed to comprise a single genus in order to calculate genera richness and diversity because individuals belonging to these taxa could not be identified to the genus level.

Teleostei (ray-finned fish) were not included in the analysis because they are not benthic invertebrates.

Appendix 3.2-5

Set Times, Retrieval Times and Locations of Minnow Traps Used in Roberts Bay and Reference Bay, Doris North Project, 2010

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Appendix 3.2-5. Set Times, Retrieval Times and Locations of Minnow Traps Used in Roberts Bay and Reference Bay, Hope Bay Belt Project, 2010

			Gear		Set		Retrieval		Depth & UTM			Catch
Location	Site	Site #	Method	#	Date In	Time In	Date Out	Time Out	Depth	Easting	Northing	Summary
Roberts Bay	Shoals	1	MT	1	17-Jul-10	10:42	18-Jul-10	8:56	1.2	432429	7563314	NFC
Roberts Bay	Shoals	1	MT	2	17-Jul-10	10:42	18-Jul-10	8:57	0.8	432427	7563320	NFC
Roberts Bay	Shoals	1	MT	3	17-Jul-10	10:43	18-Jul-10	8:58	0.9	432423	7563322	NFC
Roberts Bay	Shoals	1	MT	4	17-Jul-10	10:43	18-Jul-10	8:59	1.2	432412	7563326	NFC
Roberts Bay	Shoals	1	MT	5	17-Jul-10	10:43	18-Jul-10	9:00	0.9	432400	7563327	NFC
Roberts Bay	Shoals	2	MT	6	17-Jul-10	10:44	18-Jul-10	9:07	1.5	432369	7563347	NFC
Roberts Bay	Shoals	2	MT	7	17-Jul-10	10:44	18-Jul-10	9:09	1.2	432355	7563352	NFC
Roberts Bay	Shoals	2	MT	8	17-Jul-10	10:45	18-Jul-10	9:10	1.2	432344	7563351	NFC
Roberts Bay	Shoals	2	MT	9	17-Jul-10	10:46	18-Jul-10	9:11	0.8	432341	7563341	NFC
Roberts Bay	Shoals	2	MT	10	17-Jul-10	10:46	18-Jul-10	9:11	0.8	432364	7563333	NFC
Roberts Bay	Shoals	3	MT	11	17-Jul-10	10:48	18-Jul-10	9:16	0.8	432320	7563360	NFC
Roberts Bay	Shoals	3	MT	12	17-Jul-10	10:48	18-Jul-10	9:17	1.0	432316	7563364	NFC
Roberts Bay	Shoals	3	MT	13	17-Jul-10	10:49	18-Jul-10	9:18	0.8	432304	7563367	NFC
Roberts Bay	Shoals	3	MT	14	17-Jul-10	10:50	18-Jul-10	9:18	1.1	432299	7563361	NFC
Roberts Bay	Shoals	3	MT	15	17-Jul-10	10:51	18-Jul-10	9:19	1.1	432312	7563352	NFC
Roberts Bay	Shoals	4	MT	16	17-Jul-10	10:53	18-Jul-10	9:23	1.5	432268	7563376	NFC
Roberts Bay	Shoals	4	MT	17	17-Jul-10	10:54	18-Jul-10	9:23	0.9	432259	7563380	NFC
Roberts Bay	Shoals	4	MT	18	17-Jul-10	10:55	18-Jul-10	9:24	1.2	432264	7563388	NFC
Roberts Bay	Shoals	4	MT	19	17-Jul-10	10:55	18-Jul-10	9:25	0.8	432257	7563375	NFC
Roberts Bay	Shoals	4	MT	20	17-Jul-10	10:55	18-Jul-10	9:26	1.1	432262	7563370	NFC
Roberts Bay	Shoals	1	MT	21	18-Jul-10	9:05	19-Jul-10	10:03	1.6	432423	7563333	1 FS
Roberts Bay	Shoals	1	MT	22	18-Jul-10	9:05	19-Jul-10	10:10	1.6	432414	7563332	NFC
Roberts Bay	Shoals	1	MT	23	18-Jul-10	9:05	19-Jul-10	10:12	1.3	432403	7563332	NFC
Roberts Bay	Shoals	1	MT	24	18-Jul-10	9:05	19-Jul-10	10:14	0.7	432411	7563319	NFC
Roberts Bay	Shoals	1	MT	25	18-Jul-10	9:06	19-Jul-10	10:16	0.7	432425	7563317	NFC
Roberts Bay	Shoals	2	MT	26	18-Jul-10	9:13	19-Jul-10	10:23	0.9	432369	7563332	1 SC
Roberts Bay	Shoals	2	MT	27	18-Jul-10	9:13	19-Jul-10	10:27	1.0	432367	7563345	NFC
Roberts Bay	Shoals	2	MT	28	18-Jul-10	9:14	19-Jul-10	10:28	0.7	432363	7563341	1 SC
Roberts Bay	Shoals	2	MT	29	18-Jul-10	9:14	19-Jul-10	10:32	1.0	432359	7563346	NFC
Roberts Bay	Shoals	2	MT	30	18-Jul-10	9:14	19-Jul-10	10:34	1.0	432342	7563348	1 SC
Roberts Bay	Shoals	3	MT	31	18-Jul-10	9:21	19-Jul-10	10:44	1.0	432314	7563363	NFC
Roberts Bay	Shoals	3	MT	32	18-Jul-10	9:21	19-Jul-10	10:45	1.0	432305	7563366	NFC
Roberts Bay	Shoals	3	MT	33	18-Jul-10	9:21	19-Jul-10	10:46	1.1	432293	7563362	NFC
Roberts Bay	Shoals	3	MT	34	18-Jul-10	9:22	19-Jul-10	10:47	1.0	432308	7563353	NFC
Roberts Bay	Shoals	3	MT	35	18-Jul-10	9:22	19-Jul-10	10:48	0.8	432316	7563353	NFC

Appendix 3.2-5. Set Times, Retrieval Times and Locations of Minnow Traps Used in Roberts Bay and Reference Bay, Hope Bay Belt Project, 2010

			Gear		Set		Retrieval		Depth & UTM			Catch
Location	Site	Site #	Method	#	Date In	Time In	Date Out	Time Out	Depth	Easting	Northing	Summary
Roberts Bay	Shoals	4	MT	36	18-Jul-10	9:30	19-Jul-10	10:52	1.5	432275	7563364	NFC
Roberts Bay	Shoals	4	MT	37	18-Jul-10	9:30	19-Jul-10	10:53	1.0	432268	7563371	NFC
Roberts Bay	Shoals	4	MT	38	18-Jul-10	9:30	19-Jul-10	10:54	1.0	432264	7563378	NFC
Roberts Bay	Shoals	4	MT	39	18-Jul-10	9:31	19-Jul-10	10:55	2.0	432259	7563387	NFC
Roberts Bay	Shoals	4	MT	40	18-Jul-10	9:31	19-Jul-10	10:56	0.9	432262	7563367	NFC
Roberts Bay	Shoals	1	MT	41	19-Jul-10	10:19	20-Jul-10	13:30	1.6	432435	7563317	NFC
Roberts Bay	Shoals	1	MT	42	19-Jul-10	10:20	20-Jul-10	13:31	1.6	432424	7563326	NFC
Roberts Bay	Shoals	1	MT	43	19-Jul-10	10:20	20-Jul-10	13:32	1.5	432416	7563329	NFC
Roberts Bay	Shoals	1	MT	44	19-Jul-10	10:20	20-Jul-10	13:33	0.9	432402	7563330	NFC
Roberts Bay	Shoals	1	MT	45	19-Jul-10	10:21	20-Jul-10	13:34	1.0	432415	7563317	NFC
Roberts Bay	Shoals	2	MT	46	19-Jul-10	10:36	20-Jul-10	13:37	1.5	432370	7563341	NFC
Roberts Bay	Shoals	2	MT	47	19-Jul-10	10:37	20-Jul-10	13:38	1.1	432362	7563346	NFC
Roberts Bay	Shoals	2	MT	48	19-Jul-10	10:37	20-Jul-10	13:39	1.0	432345	7563350	NFC
Roberts Bay	Shoals	2	MT	49	19-Jul-10	10:37	20-Jul-10	13:40	0.9	432349	7563342	NFC
Roberts Bay	Shoals	2	MT	50	19-Jul-10	10:38	20-Jul-10	13:41	0.9	432360	7563334	NFC
Roberts Bay	Shoals	3	MT	51	19-Jul-10	10:49	20-Jul-10	13:43	2.0	432326	7563365	NFC
Roberts Bay	Shoals	3	MT	52	19-Jul-10	10:49	20-Jul-10	13:44	1.1	432318	7563366	NFC
Roberts Bay	Shoals	3	MT	53	19-Jul-10	10:49	20-Jul-10	13:45	1.4	432307	7563366	NFC
Roberts Bay	Shoals	3	MT	54	19-Jul-10	10:50	20-Jul-10	13:45	1.6	432294	7563368	NFC
Roberts Bay	Shoals	3	MT	55	19-Jul-10	10:50	20-Jul-10	13:46	0.7	432300	7563351	1 SC
Roberts Bay	Shoals	4	MT	56	19-Jul-10	10:59	20-Jul-10	13:54	1.4	432274	7563368	NFC
Roberts Bay	Shoals	4	MT	57	19-Jul-10	11:00	20-Jul-10	13:55	1.5	432268	7563376	1 SC
Roberts Bay	Shoals	4	MT	58	19-Jul-10	11:00	20-Jul-10	13:57	1.2	432260	7563387	2 SC
Roberts Bay	Shoals	4	MT	59	19-Jul-10	11:00	20-Jul-10	14:08	1.0	432256	7563384	NFC
Roberts Bay	Shoals	4	MT	60	19-Jul-10	11:01	20-Jul-10	14:10	1.2	432256	7563372	NFC
Roberts Bay	Jetty	-	MT	1	17-Jul-10	11:00	18-Jul-10	9:32	1.9	432544	7563334	NFC
Roberts Bay	Jetty	-	MT	2	17-Jul-10	11:00	18-Jul-10	9:37	0.7	432516	7563305	NFC
Roberts Bay	Jetty	-	MT	3	17-Jul-10	11:01	18-Jul-10	9:46	1.2	432508	7563306	NFC
Roberts Bay	Jetty	-	MT	4	17-Jul-10	11:01	18-Jul-10	9:47	0.7	432511	7563319	NFC
Roberts Bay	Jetty	-	MT	5	17-Jul-10	11:02	18-Jul-10	9:48	0.9	432514	7563327	1 SC
Roberts Bay	Jetty	-	MT	6	17-Jul-10	11:03	18-Jul-10	9:50	0.9	432516	7563332	NFC
Roberts Bay	Jetty	-	MT	7	17-Jul-10	11:03	18-Jul-10	9:51	0.8	432522	7563339	NFC
Roberts Bay	Jetty	-	MT	8	17-Jul-10	11:04	18-Jul-10	9:52	0.8	432542	7563315	NFC
Roberts Bay	Jetty	-	MT	9	17-Jul-10	11:04	18-Jul-10	9:53	0.7	432546	7563307	NFC
Roberts Bay	Jetty	-	MT	10	17-Jul-10	11:05	18-Jul-10	9:54	0.7	432549	7563295	3 SC

Appendix 3.2-5. Set Times, Retrieval Times and Locations of Minnow Traps Used in Roberts Bay and Reference Bay, Hope Bay Belt Project, 2010

			Gear		Set		Retrieval		Depth & UTM			Catch
Location	Site	Site #	Method	#	Date In	Time In	Date Out	Time Out	Depth	Easting	Northing	Summary
Roberts Bay	Jetty	-	MT	11	18-Jul-10	10:08	19-Jul-10	11:21	0.4	432548	7563300	1 SC
Roberts Bay	Jetty	-	MT	12	18-Jul-10	10:09	19-Jul-10	11:24	0.3	432546	7563308	NFC
Roberts Bay	Jetty	-	MT	13	18-Jul-10	10:10	19-Jul-10	11:31	1.3	432528	7563338	NFC
Roberts Bay	Jetty	-	MT	14	18-Jul-10	10:11	19-Jul-10	11:33	1.5	432521	7563333	NFC
Roberts Bay	Jetty	-	MT	15	18-Jul-10	10:12	19-Jul-10	11:34	0.6	432515	7563325	NFC
Roberts Bay	Jetty	-	MT	16	18-Jul-10	10:13	19-Jul-10	11:35	0.5	432510	7563320	1 FS
Roberts Bay	Jetty	-	MT	17	18-Jul-10	10:14	19-Jul-10	11:37	1.0	432512	7563302	NFC
Roberts Bay	Jetty	-	MT	18	18-Jul-10	10:15	19-Jul-10	11:41	0.6	432528	7563293	1 SC
Roberts Bay	Jetty	-	MT	19	18-Jul-10	10:15	19-Jul-10	11:42	0.4	432537	7563283	1 FS
Roberts Bay	Jetty	-	MT	20	18-Jul-10	10:16	19-Jul-10	11:49	0.7	432506	7563309	NFC
Roberts Bay	Jetty	-	MT	21	19-Jul-10	11:52	20-Jul-10	14:16	0.3	432554	7563284	1 SC
Roberts Bay	Jetty	-	MT	22	19-Jul-10	11:52	20-Jul-10	14:18	0.4	432548	7563296	NFC
Roberts Bay	Jetty	-	MT	23	19-Jul-10	11:53	20-Jul-10	14:21	0.9	432543	7563315	1 SC
Roberts Bay	Jetty	-	MT	24	19-Jul-10	11:54	20-Jul-10	14:27	0.7	432540	7563327	NFC
Roberts Bay	Jetty	-	MT	25	19-Jul-10	11:54	20-Jul-10	14:28	1.0	432528	7563331	NFC
Roberts Bay	Jetty	-	MT	26	19-Jul-10	11:54	20-Jul-10	14:30	3.9	432522	7563336	NFC
Roberts Bay	Jetty	-	MT	27	19-Jul-10	11:55	20-Jul-10	14:39	3.5	432498	7563325	1 SC
Roberts Bay	Jetty	-	MT	28	19-Jul-10	11:56	20-Jul-10	14:48	4.0	432510	7563329	NFC
Roberts Bay	Jetty	-	MT	29	19-Jul-10	11:56	20-Jul-10	14:51	0.4	432504	7563319	NFC
Roberts Bay	Jetty	-	MT	30	19-Jul-10	11:57	20-Jul-10	14:53	0.3	432545	7563266	4 FS
Roberts Bay	Shoals	1	MT	1	23-Aug-10	10:09	24-Aug-10	13:22	1.4	432422	7563313	NFC
Roberts Bay	Shoals	1	MT	2	23-Aug-10	10:09	24-Aug-10	13:23	1.1	432409	7563326	1 SC
Roberts Bay	Shoals	1	MT	3	23-Aug-10	10:10	24-Aug-10	13:30	0.9	432399	7563321	NFC
Roberts Bay	Shoals	1	MT	4	23-Aug-10	10:11	24-Aug-10	13:31	0.9	432411	7563317	1 SC
Roberts Bay	Shoals	1	MT	5	23-Aug-10	10:11	24-Aug-10	13:32	1.1	432414	7563331	NFC
Roberts Bay	Shoals	2	MT	6	23-Aug-10	10:15	24-Aug-10	13:09	1.0	432345	7563348	1 SC
Roberts Bay	Shoals	2	MT	7	23-Aug-10	10:15	24-Aug-10	13:10	1.0	432346	7563335	NFC
Roberts Bay	Shoals	2	MT	8	23-Aug-10	10:15	24-Aug-10	13:11	1.2	432357	7563329	NFC
Roberts Bay	Shoals	2	MT	9	23-Aug-10	10:16	24-Aug-10	13:12	0.8	432367	7563325	NFC
Roberts Bay	Shoals	2	MT	10	23-Aug-10	10:16	24-Aug-10	13:13	1.3	432369	7563339	NFC
Roberts Bay	Shoals	3	MT	11	23-Aug-10	10:18	24-Aug-10	12:55	0.9	432305	7563361	NFC
Roberts Bay	Shoals	3	MT	12	23-Aug-10	10:18	24-Aug-10	12:56	1.1	432297	7563350	NFC
Roberts Bay	Shoals	3	MT	13	23-Aug-10	10:19	24-Aug-10	12:57	1.0	432309	7563350	NFC
Roberts Bay	Shoals	3	MT	14	23-Aug-10	10:19	24-Aug-10	12:58	1.4	432324	7563346	NFC
Roberts Bay	Shoals	3	MT	15	23-Aug-10	10:19	24-Aug-10	12:58	1.0	432325	7563355	1 SC

Appendix 3.2-5. Set Times, Retrieval Times and Locations of Minnow Traps Used in Roberts Bay and Reference Bay, Hope Bay Belt Project, 2010

			Gear		Set		Retrieval		Depth & UTM			Catch
Location	Site	Site #	Method	#	Date In	Time In	Date Out	Time Out	Depth	Easting	Northing	Summary
Roberts Bay	Shoals	4	MT	16	23-Aug-10	10:25	24-Aug-10	12:41	1.2	432259	7563379	NFC
Roberts Bay	Shoals	4	MT	17	23-Aug-10	10:25	24-Aug-10	12:44	1.0	432268	7563358	NFC
Roberts Bay	Shoals	4	MT	18	23-Aug-10	10:25	24-Aug-10	12:45	1.3	432275	7563360	NFC
Roberts Bay	Shoals	4	MT	19	23-Aug-10	10:26	24-Aug-10	12:47	1.0	432254	7563380	NFC
Roberts Bay	Shoals	4	MT	20	23-Aug-10	10:30	24-Aug-10	12:48	0.8	432256	7563373	NFC
Roberts Bay	Shoals	1	MT	21	24-Aug-10	12:50	25-Aug-10	9:36	0.7	432423	7563319	1 SC
Roberts Bay	Shoals	1	MT	22	24-Aug-10	12:50	25-Aug-10	9:40	0.8	432414	7563320	1 SC
Roberts Bay	Shoals	1	MT	23	24-Aug-10	12:50	25-Aug-10	9:41	0.8	432407	7563325	1 SC
Roberts Bay	Shoals	1	MT	24	24-Aug-10	12:51	25-Aug-10	9:42	1.2	432398	7563324	1 SC
Roberts Bay	Shoals	1	MT	25	24-Aug-10	12:51	25-Aug-10	9:45	1.5	432401	7563328	NFC
Roberts Bay	Shoals	2	MT	26	24-Aug-10	13:01	25-Aug-10	9:59	0.6	432365	7563337	NFC
Roberts Bay	Shoals	2	MT	27	24-Aug-10	13:01	25-Aug-10	10:00	0.8	432359	7563336	NFC
Roberts Bay	Shoals	2	MT	28	24-Aug-10	13:02	25-Aug-10	10:01	0.8	432354	7563337	NFC
Roberts Bay	Shoals	2	MT	29	24-Aug-10	13:02	25-Aug-10	10:02	0.9	432348	7563349	NFC
Roberts Bay	Shoals	2	MT	30	24-Aug-10	13:02	25-Aug-10	10:03	0.8	432365	7563344	NFC
Roberts Bay	Shoals	3	MT	31	24-Aug-10	13:15	25-Aug-10	10:07	1.2	432315	7563365	NFC
Roberts Bay	Shoals	3	MT	32	24-Aug-10	13:16	25-Aug-10	10:08	0.9	432295	7563364	NFC
Roberts Bay	Shoals	3	MT	33	24-Aug-10	13:16	25-Aug-10	10:09	1.1	432292	7563355	NFC
Roberts Bay	Shoals	3	MT	34	24-Aug-10	13:16	25-Aug-10	10:10	0.9	432311	7563355	NFC
Roberts Bay	Shoals	3	MT	35	24-Aug-10	13:15	25-Aug-10	10:12	0.9	432316	7563354	NFC
Roberts Bay	Shoals	4	MT	36	24-Aug-10	13:34	25-Aug-10	10:16	0.9	432272	7563368	NFC
Roberts Bay	Shoals	4	MT	37	24-Aug-10	13:35	25-Aug-10	10:18	0.9	732266	7563371	NFC
Roberts Bay	Shoals	4	MT	38	24-Aug-10	13:35	25-Aug-10	10:19	1.2	432267	7563382	NFC
Roberts Bay	Shoals	4	MT	39	24-Aug-10	13:35	25-Aug-10	10:20	0.9	432260	7563377	NFC
Roberts Bay	Shoals	4	MT	40	24-Aug-10	13:36	25-Aug-10	10:21	1.0	432251	7563383	NFC
Roberts Bay	Shoals	1	MT	41	25-Aug-10	9:50	26-Aug-10	10:06	0.8	432544	7563306	NFC
Roberts Bay	Shoals	1	MT	42	25-Aug-10	9:51	26-Aug-10	10:07	0.8	432416	7563320	NFC
Roberts Bay	Shoals	1	MT	43	25-Aug-10	9:51	26-Aug-10	10:09	0.8	432414	7563325	NFC
Roberts Bay	Shoals	1	MT	44	25-Aug-10	9:51	26-Aug-10	10:09	0.9	432401	7563326	1 SC
Roberts Bay	Shoals	1	MT	45	25-Aug-10	9:52	26-Aug-10	10:11	0.9	432414	7563331	1 SC
Roberts Bay	Shoals	2	MT	46	25-Aug-10	10:05	26-Aug-10	10:21	1.0	432371	7563338	NFC
Roberts Bay	Shoals	2	MT	47	25-Aug-10	10:05	26-Aug-10	10:22	0.9	432368	7563338	NFC
Roberts Bay	Shoals	2	MT	48	25-Aug-10	10:06	26-Aug-10	10:24	0.8	432359	7563338	NFC
Roberts Bay	Shoals	2	MT	49	25-Aug-10	10:06	26-Aug-10	10:24	0.7	432351	7563348	NFC
Roberts Bay	Shoals	2	MT	50	25-Aug-10	10:06	26-Aug-10	10:25	0.9	432349	7563352	NFC

Appendix 3.2-5. Set Times, Retrieval Times and Locations of Minnow Traps Used in Roberts Bay and Reference Bay, Hope Bay Belt Project, 2010

			Gear		Set		Retrieval		Depth & UTM			Catch
Location	Site	Site #	Method	#	Date In	Time In	Date Out	Time Out	Depth	Easting	Northing	Summary
Roberts Bay	Shoals	3	MT	51	25-Aug-10	10:14	26-Aug-10	10:28	0.9	432312	7563351	NFC
Roberts Bay	Shoals	3	MT	52	25-Aug-10	10:14	26-Aug-10	10:29	1.1	432311	7563359	NFC
Roberts Bay	Shoals	3	MT	53	25-Aug-10	10:15	26-Aug-10	10:30	0.9	432315	7563362	NFC
Roberts Bay	Shoals	3	MT	54	25-Aug-10	10:15	26-Aug-10	10:31	0.8	432306	7563355	NFC
Roberts Bay	Shoals	3	MT	55	25-Aug-10	10:15	26-Aug-10	10:32	0.9	432300	7563360	NFC
Roberts Bay	Shoals	4	MT	56	25-Aug-10	10:24	26-Aug-10	10:34	1.1	432267	7563362	NFC
Roberts Bay	Shoals	4	MT	57	25-Aug-10	10:24	26-Aug-10	10:35	1.1	432259	7563366	NFC
Roberts Bay	Shoals	4	MT	58	25-Aug-10	10:25	26-Aug-10	10:36	0.8	432259	7563373	NFC
Roberts Bay	Shoals	4	MT	59	25-Aug-10	10:25	26-Aug-10	10:37	0.8	432251	7563377	NFC
Roberts Bay	Shoals	4	MT	60	25-Aug-10	10:26	26-Aug-10	10:38	0.9	432251	7563384	NFC
Reference Bay	Shoals	1	MT	1	12-Jul-10	11:09	14-Jul-10	9:52	0.3	441548	7562109	NFC
Reference Bay	Shoals	1	MT	2	12-Jul-10	11:10	14-Jul-10	9:56	0.4	441548	7562140	NFC
Reference Bay	Shoals	1	MT	3	12-Jul-10	11:11	14-Jul-10	9:58	0.8	441553	7562149	1 FS
Reference Bay	Shoals	1	MT	4	12-Jul-10	11:12	14-Jul-10	10:05	0.8	441551	7562157	NFC
Reference Bay	Shoals	1	MT	5	12-Jul-10	11:13	14-Jul-10	10:10	0.3	441586	7562143	NFC
Reference Bay	Shoals	2	MT	6	12-Jul-10	11:14	14-Jul-10	10:22	0.3	441605	7562187	NFC
Reference Bay	Shoals	2	MT	7	12-Jul-10	11:15	14-Jul-10	10:24	0.2	441598	7562206	NFC
Reference Bay	Shoals	2	MT	8	12-Jul-10	11:16	14-Jul-10	10:25	0.5	441588	7562223	NFC
Reference Bay	Shoals	2	MT	9	12-Jul-10	11:17	14-Jul-10	10:28	0.8	441586	7562238	NFC
Reference Bay	Shoals	2	MT	10	12-Jul-10	11:18	14-Jul-10	10:28	0.9	441593	7562250	NFC
Reference Bay	Shoals	3	MT	11	12-Jul-10	11:19	14-Jul-10	10:34	1.2	441533	7562327	NFC
Reference Bay	Shoals	3	MT	12	12-Jul-10	11:20	14-Jul-10	10:35	0.6	441520	7562324	NFC
Reference Bay	Shoals	3	MT	13	12-Jul-10	11:21	14-Jul-10	10:36	1.2	441503	7562342	1 FS
Reference Bay	Shoals	3	MT	14	12-Jul-10	11:22	14-Jul-10	10:41	1.3	441486	7562368	NFC
Reference Bay	Shoals	3	MT	15	12-Jul-10	11:23	14-Jul-10	10:43	0.8	441524	7562368	NFC
Reference Bay	Shoals	4	MT	16	12-Jul-10	11:24	14-Jul-10	10:48	0.6	441503	7562418	1 FS
Reference Bay	Shoals	4	MT	17	12-Jul-10	11:25	14-Jul-10	10:51	0.4	441484	7562417	NFC
Reference Bay	Shoals	4	MT	18	12-Jul-10	11:26	14-Jul-10	10:52	1.1	441467	7562437	NFC
Reference Bay	Shoals	4	MT	19	12-Jul-10	11:27	14-Jul-10	10:54	1.2	441486	7562487	1 SC
Reference Bay	Shoals	4	MT	20	12-Jul-10	11:28	14-Jul-10	11:16	0.6	441517	7562454	NFC
Reference Bay	Shoals	1	MT	21	14-Jul-10	10:16	15-Jul-10	12:20	0.3	441553	7562093	3 NS
Reference Bay	Shoals	1	MT	22	14-Jul-10	10:17	15-Jul-10	12:32	0.4	441548	7562110	NFC
Reference Bay	Shoals	1	MT	23	14-Jul-10	10:17	15-Jul-10	12:33	0.4	441548	7562121	NFC
Reference Bay	Shoals	1	MT	24	14-Jul-10	10:18	15-Jul-10	12:34	0.6	441548	7562141	NFC
Reference Bay	Shoals	1	MT	25	14-Jul-10	10:19	15-Jul-10	12:35	0.6	441564	7562152	NFC

Appendix 3.2-5. Set Times, Retrieval Times and Locations of Minnow Traps Used in Roberts Bay and Reference Bay, Hope Bay Belt Project, 2010

			Gear		Set		Retrieval		Depth & UTM			Catch
Location	Site	Site #	Method	#	Date In	Time In	Date Out	Time Out	Depth	Easting	Northing	Summary
Reference Bay	Shoals	2	MT	26	14-Jul-10	10:30	15-Jul-10	12:47	0.4	441610	7562176	1 NS
Reference Bay	Shoals	2	MT	27	14-Jul-10	10:30	15-Jul-10	12:51	0.5	441598	7562193	NFC
Reference Bay	Shoals	2	MT	28	14-Jul-10	10:31	15-Jul-10	12:52	0.8	441588	7562217	1 FS
Reference Bay	Shoals	2	MT	29	14-Jul-10	10:32	15-Jul-10	12:59	1.0	441587	7562236	NFC
Reference Bay	Shoals	2	MT	30	14-Jul-10	10:33	15-Jul-10	13:00	0.8	441601	7562249	NFC
Reference Bay	Shoals	3	MT	31	14-Jul-10	10:45	15-Jul-10	13:10	1.1	441534	7562336	NFC
Reference Bay	Shoals	3	MT	32	14-Jul-10	10:46	15-Jul-10	13:11	0.8	441519	7562321	NFC
Reference Bay	Shoals	3	MT	33	14-Jul-10	10:46	15-Jul-10	13:13	0.8	441512	7562336	NFC
Reference Bay	Shoals	3	MT	34	14-Jul-10	10:47	15-Jul-10	13:15	1.2	441489	7562371	NFC
Reference Bay	Shoals	3	MT	35	14-Jul-10	10:47	15-Jul-10	13:16	0.9	441506	7562372	NFC
Reference Bay	Shoals	4	MT	36	14-Jul-10	11:18	15-Jul-10	13:30	0.6	441501	7562421	NFC
Reference Bay	Shoals	4	MT	37	14-Jul-10	11:18	15-Jul-10	13:32	1.4	441463	7562448	NFC
Reference Bay	Shoals	4	MT	38	14-Jul-10	11:18	15-Jul-10	13:33	1.1	441472	7562468	NFC
Reference Bay	Shoals	4	MT	39	14-Jul-10	11:20	15-Jul-10	13:34	1.0	441535	7562444	1 FS
Reference Bay	Shoals	4	MT	40	14-Jul-10	11:21	15-Jul-10	13:35	0.8	441521	7562429	NFC
Reference Bay	Shoals	1	MT	41	15-Jul-10	12:40	16-Jul-10	9:14	0.2	441562	7562084	NFC
Reference Bay	Shoals	1	MT	42	15-Jul-10	12:41	16-Jul-10	9:15	0.4	441551	7562090	NFC
Reference Bay	Shoals	1	MT	43	15-Jul-10	12:42	16-Jul-10	9:16	0.5	441550	7562122	NFC
Reference Bay	Shoals	1	MT	44	15-Jul-10	12:43	16-Jul-10	9:17	0.8	441552	7562150	NFC
Reference Bay	Shoals	1	MT	45	15-Jul-10	12:44	16-Jul-10	9:18	0.6	441574	7562151	NFC
Reference Bay	Shoals	2	MT	46	15-Jul-10	13:06	16-Jul-10	9:24	0.6	441601	7562189	NFC
Reference Bay	Shoals	2	MT	47	15-Jul-10	13:06	16-Jul-10	9:25	0.6	441598	7562200	NFC
Reference Bay	Shoals	2	MT	48	15-Jul-10	13:07	16-Jul-10	9:26	0.9	441590	7562218	NFC
Reference Bay	Shoals	2	MT	49	15-Jul-10	13:07	16-Jul-10	9:27	1.7	441584	7562245	NFC
Reference Bay	Shoals	2	MT	50	15-Jul-10	13:08	16-Jul-10	9:28	1.2	441605	7562247	NFC
Reference Bay	Shoals	3	MT	51	15-Jul-10	13:21	16-Jul-10	9:29	1.0	441533	7562339	NFC
Reference Bay	Shoals	3	MT	52	15-Jul-10	13:24	16-Jul-10	9:31	1.3	441484	7562337	NFC
Reference Bay	Shoals	3	MT	53	15-Jul-10	13:24	16-Jul-10	9:32	1.6	441482	7562361	NFC
Reference Bay	Shoals	3	MT	54	15-Jul-10	13:25	16-Jul-10	9:33	1.0	441501	7562377	NFC
Reference Bay	Shoals	3	MT	55	15-Jul-10	13:26	16-Jul-10	9:34	1.0	441525	7562360	NFC
Reference Bay	Shoals	4	MT	56	15-Jul-10	13:46	16-Jul-10	9:42	1.3	441475	7562479	NFC
Reference Bay	Shoals	4	MT	57	15-Jul-10	13:47	16-Jul-10	9:43	0.8	441498	7562472	NFC
Reference Bay	Shoals	4	MT	58	15-Jul-10	13:48	16-Jul-10	9:44	0.9	441537	7562449	NFC
Reference Bay	Shoals	4	MT	59	15-Jul-10	13:50	16-Jul-10	9:46	0.8	441525	7562437	NFC
Reference Bay	Shoals	4	MT	60	15-Jul-10	13:50	16-Jul-10	9:47	1.0	441507	7562427	NFC

Appendix 3.2-5. Set Times, Retrieval Times and Locations of Minnow Traps Used in Roberts Bay and Reference Bay, Hope Bay Belt Project, 2010

			Gear		Set		Retrieval		Depth & UTM			Catch
Location	Site	Site #	Method	#	Date In	Time In	Date Out	Time Out	Depth	Easting	Northing	Summary
Reference Bay	Shoals	1	MT	1	28-Aug-10	10:08	29-Aug-10	16:37	0.4	441548	7562098	NFC
Reference Bay	Shoals	1	MT	2	28-Aug-10	10:08	29-Aug-10	16:39	0.4	441547	7562119	NFC
Reference Bay	Shoals	1	MT	3	28-Aug-10	10:09	29-Aug-10	16:39	0.5	441550	7562134	NFC
Reference Bay	Shoals	1	MT	4	28-Aug-10	10:09	29-Aug-10	16:40	0.6	441556	7562148	NFC
Reference Bay	Shoals	1	MT	5	28-Aug-10	10:10	29-Aug-10	16:41	0.5	441578	7562145	NFC
Reference Bay	Shoals	2	MT	6	28-Aug-10	10:15	29-Aug-10	16:46	0.7	441597	7562194	NFC
Reference Bay	Shoals	2	MT	7	28-Aug-10	10:15	29-Aug-10	16:46	1.0	441585	7562218	NFC
Reference Bay	Shoals	2	MT	8	28-Aug-10	10:15	29-Aug-10	16:47	1.2	441581	7562240	NFC
Reference Bay	Shoals	2	MT	9	28-Aug-10	10:16	29-Aug-10	16:47	1.1	441600	7562251	NFC
Reference Bay	Shoals	2	MT	10	28-Aug-10	10:17	29-Aug-10	16:49	0.8	441608	7562239	NFC
Reference Bay	Shoals	3	MT	11	28-Aug-10	10:21	29-Aug-10	16:53	0.9	441524	7562318	NFC
Reference Bay	Shoals	3	MT	12	28-Aug-10	10:21	29-Aug-10	16:54	0.7	441506	7562335	NFC
Reference Bay	Shoals	3	MT	13	28-Aug-10	10:22	29-Aug-10	16:55	0.4	441491	7562367	NFC
Reference Bay	Shoals	3	MT	14	28-Aug-10	10:22	29-Aug-10	16:55	1.1	441500	7562372	NFC
Reference Bay	Shoals	3	MT	15	28-Aug-10	10:22	29-Aug-10	16:56	0.5	441522	7562362	NFC
Reference Bay	Shoals	4	MT	16	28-Aug-10	10:28	29-Aug-10	17:00	0.9	441474	7562412	NFC
Reference Bay	Shoals	4	MT	17	28-Aug-10	10:29	29-Aug-10	17:00	1.0	441469	7562441	NFC
Reference Bay	Shoals	4	MT	18	28-Aug-10	10:29	29-Aug-10	17:01	0.8	441473	7562457	NFC
Reference Bay	Shoals	4	MT	19	28-Aug-10	10:29	29-Aug-10	17:02	1.3	441493	7562483	NFC
Reference Bay	Shoals	4	MT	20	28-Aug-10	10:30	29-Aug-10	17:03	1.4	441508	7562468	NFC
Reference Bay	Shoals	1	MT	21	29-Aug-10	16:30	30-Aug-10	13:01	0.3	441550	7562098	NFC
Reference Bay	Shoals	1	MT	22	29-Aug-10	16:30	30-Aug-10	13:04	0.2	441549	7562106	NFC
Reference Bay	Shoals	1	MT	23	29-Aug-10	16:30	30-Aug-10	13:05	0.3	441552	7562116	1 FS
Reference Bay	Shoals	1	MT	24	29-Aug-10	16:31	30-Aug-10	13:06	0.4	441554	7562125	2 FS
Reference Bay	Shoals	1	MT	25	29-Aug-10	16:31	30-Aug-10	13:09	0.2	441560	7562146	2 FS
Reference Bay	Shoals	2	MT	26	29-Aug-10	16:41	30-Aug-10	13:28	0.4	441602	7562178	NFC
Reference Bay	Shoals	2	MT	27	29-Aug-10	16:41	30-Aug-10	13:29	0.5	441600	7562188	NFC
Reference Bay	Shoals	2	MT	28	29-Aug-10	16:42	30-Aug-10	13:30	0.4	441594	7562201	NFC
Reference Bay	Shoals	2	MT	29	29-Aug-10	16:43	30-Aug-10	13:33	0.9	441584	7562234	NFC
Reference Bay	Shoals	2	MT	30	29-Aug-10	16:43	30-Aug-10	13:34	1.1	441587	7562242	NFC
Reference Bay	Shoals	3	MT	31	29-Aug-10	16:50	30-Aug-10	13:41	1.0	441519	7562322	NFC
Reference Bay	Shoals	3	MT	32	29-Aug-10	16:50	30-Aug-10	13:44	1.2	441502	7562341	NFC
Reference Bay	Shoals	3	MT	33	29-Aug-10	16:51	30-Aug-10	13:46	0.8	441519	7562371	NFC
Reference Bay	Shoals	3	MT	34	29-Aug-10	16:51	30-Aug-10	13:47	0.7	441535	7562352	NFC
Reference Bay	Shoals	3	MT	35	29-Aug-10	16:53	30-Aug-10	13:49	0.5	441533	7562323	1 GC

Appendix 3.2-5. Set Times, Retrieval Times and Locations of Minnow Traps Used in Roberts Bay and Reference Bay, Hope Bay Belt Project, 2010

			Gear		Set		Retrieval		Depth & UTM			Catch
Location	Site	Site #	Method	#	Date In	Time In	Date Out	Time Out	Depth	Easting	Northing	Summary
Reference Bay	Shoals	4	MT	36	29-Aug-10	17:01	30-Aug-10	13:57	1.3	441471	7562476	NFC
Reference Bay	Shoals	4	MT	37	29-Aug-10	17:02	30-Aug-10	13:59	0.8	441486	7562483	NFC
Reference Bay	Shoals	4	MT	38	29-Aug-10	17:02	30-Aug-10	14:00	0.7	441504	7562467	NFC
Reference Bay	Shoals	4	MT	39	29-Aug-10	17:02	30-Aug-10	14:01	0.4	441510	7562455	NFC
Reference Bay	Shoals	4	MT	40	29-Aug-10	17:03	30-Aug-10	14:03	0.3	441523	7562438	NFC
Reference Bay	Shoals	1	MT	41	30-Aug-10	13:12	31-Aug-10	13:27	0.3	441555	7562092	NFC
Reference Bay	Shoals	1	MT	42	30-Aug-10	13:12	31-Aug-10	13:28	0.3	441556	7562098	1 FS
Reference Bay	Shoals	1	MT	43	30-Aug-10	13:14	31-Aug-10	13:29	0.4	441552	7562110	1 FS, 1 SC
Reference Bay	Shoals	1	MT	44	30-Aug-10	13:14	31-Aug-10	13:32	0.4	441556	7562140	1 FS
Reference Bay	Shoals	1	MT	45	30-Aug-10	13:15	31-Aug-10	13:33	0.6	441570	7562154	NFC
Reference Bay	Shoals	2	MT	46	30-Aug-10	13:38	31-Aug-10	13:47	0.5	441594	7562201	1 NS
Reference Bay	Shoals	2	MT	47	30-Aug-10	13:39	31-Aug-10	13:49	0.4	441591	7562210	1 FS
Reference Bay	Shoals	2	MT	48	30-Aug-10	13:39	31-Aug-10	13:51	0.5	441586	7562230	NFC
Reference Bay	Shoals	2	MT	49	30-Aug-10	13:40	31-Aug-10	13:52	0.4	441594	7562248	NFC
Reference Bay	Shoals	2	MT	50	30-Aug-10	13:40	31-Aug-10	13:53	0.5	441610	7562244	NFC
Reference Bay	Shoals	3	MT	51	30-Aug-10	13:52	31-Aug-10	14:01	0.6	441514	7562327	NFC
Reference Bay	Shoals	3	MT	52	30-Aug-10	13:52	31-Aug-10	14:02	1.3	441494	7562347	NFC
Reference Bay	Shoals	3	MT	53	30-Aug-10	13:53	31-Aug-10	14:04	0.8	441543	7562348	NFC
Reference Bay	Shoals	3	MT	54	30-Aug-10	13:53	31-Aug-10	14:05	1.0	441540	7562342	NFC
Reference Bay	Shoals	3	MT	55	30-Aug-10	13:53	31-Aug-10	14:06	1.4	441536	7562330	NFC
Reference Bay	Shoals	4	MT	56	30-Aug-10	14:05	31-Aug-10	14:09	0.7	441501	7562418	NFC
Reference Bay	Shoals	4	MT	57	30-Aug-10	14:06	31-Aug-10	14:10	0.8	441475	7562417	NFC
Reference Bay	Shoals	4	MT	58	30-Aug-10	14:06	31-Aug-10	14:12	0.9	441471	7562459	NFC
Reference Bay	Shoals	4	MT	59	30-Aug-10	14:07	31-Aug-10	14:13	1.0	441470	7562477	NFC
Reference Bay	Shoals	4	MT	60	30-Aug-10	14:07	31-Aug-10	14:14	1.2	441488	7562486	NFC

Note:

FS = Fourhorn sculpin; GC = Greenland cod; NFC = No Fish Captured; NS = Ninespine stickleback; SC = Saffron cod.

MT = Minow Trap.

Appendix 3.2-6

Set Times, Retrieval Times and Locations of Crab Traps Used in Roberts Bay and Reference Bay, Doris North Project, 2010

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Appendix 3.2-6. Set Times, Retrieval Times and Locations of Crab Traps Used in Roberts Bay and Reference Bay, Hope Bay Belt Project, 2010

			Gear		Set		Retrieval		Depth & UTM			
Location	Site	Site #	Method	#	Date In	Time In	Date Out	Time Out	Depth	Easting	Northing	Catch Summary
Roberts Bay	Shoals	1	CT	1	17-Jul-10	11:05	18-Jul-10	9:02	1.5	432402	7563333	NFC
Roberts Bay	Shoals	2	CT	2	17-Jul-10	11:01	18-Jul-10	9:12	2	432366	7563351	NFC
Roberts Bay	Shoals	3	CT	3	17-Jul-10	10:59	18-Jul-10	9:20	1.3	432309	7563366	NFC
Roberts Bay	Shoals	4	CT	4	17-Jul-10	10:58	18-Jul-10	9:27	1.6	432268	7563380	NFC
Roberts Bay	Shoals	1	CT	5	18-Jul-10	9:06	19-Jul-10	10:17	1.5	432419	7563313	NFC
Roberts Bay	Shoals	2	CT	6	18-Jul-10	9:15	19-Jul-10	10:35	1.5	432353	7563339	NFC
Roberts Bay	Shoals	3	CT	7	18-Jul-10	9:22	19-Jul-10	10:43	2.3	432322	7563367	NFC
Roberts Bay	Shoals	4	CT	8	18-Jul-10	9:32	19-Jul-10	10:57	1.3	432250	7563383	NFC
Roberts Bay	Shoals	1	CT	9	19-Jul-10	10:21	20-Jul-10	13:36	2.4	432417	7563337	NFC
Roberts Bay	Shoals	2	CT	10	19-Jul-10	10:38	20-Jul-10	13:42	1.8	432355	7563360	NFC
Roberts Bay	Shoals	3	CT	11	19-Jul-10	10:50	20-Jul-10	13:48	1.4	432310	7563347	NFC
Roberts Bay	Shoals	4	CT	12	19-Jul-10	11:01	20-Jul-10	13:53	1.9	432280	7563368	NFC
Roberts Bay	Jetty	-	CT	1	17-Jul-10	11:18	18-Jul-10	9:33	2.4	432530	7563347	NFC
Roberts Bay	Jetty	-	CT	2	17-Jul-10	11:19	18-Jul-10	9:39	0.7	432523	7563298	NFC
Roberts Bay	Jetty	-	CT	3	17-Jul-10	11:20	18-Jul-10	9:40	0.7	432531	7563290	1FS
Roberts Bay	Jetty	-	CT	4	17-Jul-10	11:21	18-Jul-10	9:51	0.7	432541	7563321	NFC
Roberts Bay	Jetty	-	CT	5	17-Jul-10	11:22	18-Jul-10	9:53	0.7	432546	7563305	NFC
Roberts Bay	Jetty	-	CT	6	18-Jul-10	10:16	19-Jul-10	11:20	0.3	432561	7563300	NFC
Roberts Bay	Jetty	-	CT	7	18-Jul-10	10:17	19-Jul-10	11:23	0.5	432546	7563306	NFC
Roberts Bay	Jetty	-	CT	8	18-Jul-10	10:17	19-Jul-10	11:29	2.1	432544	7563327	NFC
Roberts Bay	Jetty	-	CT	9	18-Jul-10	10:17	19-Jul-10	11:32	4.2	432527	7563337	NFC
Roberts Bay	Jetty	-	CT	10	18-Jul-10	10:20	19-Jul-10	11:39	1	432525	7563296	NFC
Roberts Bay	Jetty	-	CT	11	19-Jul-10	11:57	20-Jul-10	14:20	0.5	432544	7563304	NFC
Roberts Bay	Jetty	-	CT	12	19-Jul-10	11:58	20-Jul-10	14:23	1.2	432539	7563318	NFC
Roberts Bay	Jetty	-	CT	13	19-Jul-10	11:59	20-Jul-10	14:25	3..4	432542	7563324	NFC
Roberts Bay	Jetty	-	CT	14	19-Jul-10	11:59	20-Jul-10	14:29	3.7	432523	7563338	NFC
Roberts Bay	Jetty	-	CT	15	19-Jul-10	12:00	20-Jul-10	14:41	4	432504	7563320	NFC
Roberts Bay	Shoals	1	CT	1	23-Aug-10	10:45	24-Aug-10	13:21	1.4	432410	7563313	NFC
Roberts Bay	Shoals	2	CT	2	23-Aug-10	10:36	24-Aug-10	13:07	1.2	432341	7563341	NFC
Roberts Bay	Shoals	3	CT	3	23-Aug-10	10:35	24-Aug-10	12:54	1.9	432309	7563367	NFC
Roberts Bay	Shoals	4	CT	4	23-Aug-10	10:31	24-Aug-10	12:42	1	432257	7563361	NFC
Roberts Bay	Shoals	1	CT	5	24-Aug-10	12:49	25-Aug-10	9:46	1.5	432408	7563332	NFC
Roberts Bay	Shoals	2	CT	6	24-Aug-10	13:00	25-Aug-10	10:05	1.4	432375	7563342	NFC
Roberts Bay	Shoals	3	CT	7	24-Aug-10	13:15	25-Aug-10	10:13	1.4	432327	7563352	NFC
Roberts Bay	Shoals	4	CT	8	24-Aug-10	13:33	25-Aug-10	10:23	1.4	432258	7563387	NFC

Appendix 3.2-6. Set Times, Retrieval Times and Locations of Crab Traps Used in Roberts Bay and Reference Bay, Hope Bay Belt Project, 2010

			Gear		Set		Retrieval		Depth & UTM			
Location	Site	Site #	Method	#	Date In	Time In	Date Out	Time Out	Depth	Easting	Northing	Catch Summary
Roberts Bay	Shoals	1	CT	9	25-Aug-10	9:54	26-Aug-10	10:12	0.9	432423	7563313	NFC
Roberts Bay	Shoals	2	CT	10	25-Aug-10	10:06	26-Aug-10	10:26	1.1	432339	7563352	1 SC
Roberts Bay	Shoals	3	CT	11	25-Aug-10	10:15	26-Aug-10	10:33	1	432319	7563363	NFC
Roberts Bay	Shoals	4	CT	12	25-Aug-10	10:26	26-Aug-10	10:38	1	432267	7563379	NFC
Reference Bay	Shoals	1	CT	1	12-Jul-10	11:38	14-Jul-10	10:14	0.8	441556	7562153	NFC
Reference Bay	Shoals	2	CT	2	12-Jul-10	11:35	14-Jul-10	10:28	1.4	441594	7562256	NFC
Reference Bay	Shoals	3	CT	3	12-Jul-10	11:34	14-Jul-10	10:44	1.1	441532	7562354	NFC
Reference Bay	Shoals	4	CT	4	12-Jul-10	11:29	14-Jul-10	11:06	1.1	441495	7562476	1 FS
Reference Bay	Shoals	1	CT	5	14-Jul-10	10:18	15-Jul-10	12:36	1	441551	7562154	NFC
Reference Bay	Shoals	2	CT	6	14-Jul-10	10:31	15-Jul-10	13:01	1.7	441583	7562256	NFC
Reference Bay	Shoals	3	CT	7	14-Jul-10	10:46	15-Jul-10	13:18	1.5	441493	7562337	1 FS
Reference Bay	Shoals	4	CT	8	14-Jul-10	11:19	15-Jul-10	13:38	1.3	441464	7562431	1 FS
Reference Bay	Shoals	1	CT	9	15-Jul-10	12:44	16-Jul-10	9:20	0.7	441570	7562152	NFC
Reference Bay	Shoals	2	CT	10	15-Jul-10	13:05	16-Jul-10	9:21	0.5	441605	7562182	NFC
Reference Bay	Shoals	3	CT	11	15-Jul-10	13:23	16-Jul-10	9:35	1.4	441545	7562343	1 FS
Reference Bay	Shoals	4	CT	12	15-Jul-10	13:45	16-Jul-10	9:48	1	441494	7562416	NFC
Reference Bay	Shoals	1	CT	1	28-Aug-10	10:10	29-Aug-10	16:42	1	441566	7562155	NFC
Reference Bay	Shoals	2	CT	2	28-Aug-10	10:17	29-Aug-10	16:49	1.8	441586	7562256	NFC
Reference Bay	Shoals	3	CT	3	28-Aug-10	10:23	29-Aug-10	16:57	2	441493	7562339	NFC
Reference Bay	Shoals	4	CT	4	28-Aug-10	10:30	29-Aug-10	17:04	2.1	441475	7562475	NFC
Reference Bay	Shoals	1	CT	5	29-Aug-10	16:32	30-Aug-10	13:11	1	441550	7562145	NFC
Reference Bay	Shoals	2	CT	6	29-Aug-10	16:44	30-Aug-10	13:36	1.6	441588	7562217	NFC
Reference Bay	Shoals	3	CT	7	29-Aug-10	16:53	30-Aug-10	13:51	1.1	441547	7562338	NFC
Reference Bay	Shoals	4	CT	8	29-Aug-10	17:02	30-Aug-10	14:04	0.9	441528	7562451	NFC
Reference Bay	Shoals	1	CT	9	30-Aug-10	13:15	31-Aug-10	13:34	0.5	441566	7562154	NFC
Reference Bay	Shoals	2	CT	10	30-Aug-10	13:40	31-Aug-10	13:55	1.3	441610	7562253	NFC
Reference Bay	Shoals	3	CT	11	30-Aug-10	13:54	31-Aug-10	14:08	2	441543	7562365	NFC
Reference Bay	Shoals	4	CT	12	30-Aug-10	14:07	31-Aug-10	14:16	2.3	441463	7562434	NFC

Note:

FS = Fourhorn sculpin; NFC = No Fish Captured; SC = Saffron cod.

CT = Crab Trap.

Appendix 3.2-7

Biological Data for Fish Sampled in Roberts Bay and Reference Bay, Doris North Project, 2010

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Appendix 3.2-7. Biological Data for Fish Sampled in Roberts Bay and Reference Bay, Doris North Project, 2010

Location	Site	Site #	Gear		Date	Field Sample	Species	Length (mm)	Weight (g)	Condition Factor	Aging Structures			Age (years)	Comments
			Method	#							Otolith	Scales	Fin Clip		
Reference Bay	Shoals	1	MT	3	14-Jul-10	1	FS	111	11.9	0.87	-	-	-	-	-
Reference Bay	Shoals	3	MT	13	14-Jul-10	2	FS	117	13.9	0.87	-	-	-	-	-
Reference Bay	Shoals	4	MT	16	14-Jul-10	3	FS	78	4.2	0.89	-	-	-	-	-
Reference Bay	Shoals	4	MT	19	14-Jul-10	4	SC	85	4.4	0.72	-	X	X	1	-
Reference Bay	Shoals	4	CT	4	14-Jul-10	5	FS	320	305.0	0.93	-	-	-	-	-
Reference Bay	Shoals	1	MT	21	15-Jul-10	6	NS	61	1.6	0.70	-	-	-	-	-
Reference Bay	Shoals	1	MT	21	15-Jul-10	7	NS	42	0.2	0.27	-	-	-	-	-
Reference Bay	Shoals	1	MT	21	15-Jul-10	8	NS	42	0.2	0.27	-	-	-	-	-
Reference Bay	Shoals	2	MT	26	15-Jul-10	9	NS	57	1.4	0.76	-	-	-	-	-
Reference Bay	Shoals	2	MT	28	15-Jul-10	10	FS	65	1.2	0.44	-	-	-	-	-
Reference Bay	Shoals	3	CT	7	15-Jul-10	11	FS	249	156.0	1.01	-	-	-	-	-
Reference Bay	Shoals	4	MT	39	15-Jul-10	12	FS	65	1.0	0.36	-	-	-	-	-
Reference Bay	Shoals	4	CT	8	15-Jul-10	13	FS	277	184.0	0.87	-	-	-	-	-
Reference Bay	Shoals	3	CT	11	16-Jul-10	14	FS	320	264.0	0.81	-	-	-	-	-
Roberts Bay	Jetty	-	CT	3	18-Jul-10	15	FS	167	38.0	0.82	-	-	-	-	-
Roberts Bay	Jetty	-	MT	5	18-Jul-10	16	SC	88	5.0	0.73	-	X	X	1	-
Roberts Bay	Jetty	-	MT	10	18-Jul-10	17	SC	97	5.0	0.55	-	X	X	1	-
Roberts Bay	Jetty	-	MT	10	18-Jul-10	18	SC	83	4.0	0.70	-	X	X	1	-
Roberts Bay	Jetty	-	MT	10	18-Jul-10	19	SC	84	3.8	0.64	-	X	X	1	-
Roberts Bay	Shoals	1	MT	21	19-Jul-10	20	FS	112	12.0	0.85	-	-	-	-	-
Roberts Bay	Shoals	2	MT	26	19-Jul-10	21	SC	83	12.0	2.10	-	-	-	-	-
Roberts Bay	Shoals	2	MT	28	19-Jul-10	22	SC	85	9.0	1.47	-	X	X	1	-
Roberts Bay	Shoals	2	MT	30	19-Jul-10	23	SC	96	12.0	1.36	-	X	X	1	-
Roberts Bay	Jetty	-	MT	12	19-Jul-10	24	SC	83	3.2	0.56	-	X	X	1	-
Roberts Bay	Jetty	-	MT	16	19-Jul-10	25	FS	110	11.9	0.89	-	-	-	-	-
Roberts Bay	Jetty	-	MT	18	19-Jul-10	26	SC	96	6.1	0.69	-	X	X	1	-
Roberts Bay	Jetty	-	MT	19	19-Jul-10	27	FS	71	2.9	0.81	-	-	-	-	-
Roberts Bay	Shoals	3	MT	55	20-Jul-10	28	SC	92	7.0	0.90	-	X	X	1	-
Roberts Bay	Shoals	4	MT	57	20-Jul-10	29	SC	76	3.0	0.68	-	X	X	1	-
Roberts Bay	Shoals	4	MT	58	20-Jul-10	30	SC	83	3.9	0.68	-	X	X	1	-
Roberts Bay	Shoals	4	MT	58	20-Jul-10	31	SC	132	13.4	0.58	-	X	X	2	-
Roberts Bay	Jetty	-	MT	21	20-Jul-10	32	SC	74	2.6	0.64	-	X	X	1	-
Roberts Bay	Jetty	-	MT	23	20-Jul-10	33	SC	68	2.5	0.80	-	X	X	1	-
Roberts Bay	Jetty	-	MT	27	20-Jul-10	34	SC	72	2.5	0.67	-	X	X	1	-
Roberts Bay	Jetty	-	MT	30	20-Jul-10	35	FS	104	8.3	0.74	-	-	-	-	-
Roberts Bay	Jetty	-	MT	30	20-Jul-10	36	FS	85	4.3	0.70	-	-	-	-	-
Roberts Bay	Jetty	-	MT	30	20-Jul-10	37	FS	81	3.9	0.73	-	-	-	-	-
Roberts Bay	Jetty	-	MT	30	20-Jul-10	38	FS	79	3.6	0.73	-	-	-	-	-
Roberts Bay	Shoals	3	MT	15	24-Aug-10	39	SC	106	11.2	0.94	-	-	-	-	-

Appendix 3.2-7. Biological Data for Fish Sampled in Roberts Bay and Reference Bay, Doris North Project, 2010

Location	Site	Site #	Gear		Date	Field Sample	Species	Length (mm)	Weight (g)	Condition Factor	Aging Structures			Age (years)	Comments
			Method	#							Otolith	Scales	Fin Clip		
Roberts Bay	Shoals	2	MT	6	24-Aug-10	40	SC	94	7.1	0.85	-	-	-	-	-
Roberts Bay	Shoals	1	MT	2	24-Aug-10	41	SC	121	15.2	0.86	-	-	-	-	-
Roberts Bay	Shoals	1	MT	4	24-Aug-10	42	SC	107	9.9	0.81	-	-	-	-	-
Roberts Bay	Shoals	1	MT	21	25-Aug-10	43	SC	112	11.7	0.83	-	-	-	-	-
Roberts Bay	Shoals	1	MT	22	25-Aug-10	44	SC	121	16.6	0.94	-	-	-	-	-
Roberts Bay	Shoals	1	MT	23	25-Aug-10	45	SC	95	7.3	0.85	-	-	-	-	-
Roberts Bay	Shoals	1	MT	24	25-Aug-10	46	SC	106	9.2	0.77	-	-	-	-	-
Roberts Bay	Shoals	1	MT	44	26-Aug-10	47	SC	99	9.2	0.95	-	-	-	-	-
Roberts Bay	Shoals	1	MT	45	26-Aug-10	48	SC	86	8.0	1.26	-	-	-	-	-
Roberts Bay	Shoals	2	CT	10	26-Aug-10	49	SC	89	7.3	1.04	-	-	-	-	-
Reference Bay	Shoals	1	MT	23	30-Aug-10	50	FS	83	5.5	0.96	-	-	-	-	-
Reference Bay	Shoals	1	MT	24	30-Aug-10	51	FS	64	3.6	1.37	-	-	-	-	-
Reference Bay	Shoals	1	MT	24	30-Aug-10	52	FS	37	1.6	3.16	-	-	-	-	-
Reference Bay	Shoals	1	MT	25	30-Aug-10	53	FS	74	4.7	1.16	-	-	-	-	-
Reference Bay	Shoals	1	MT	25	30-Aug-10	54	FS	33	1.6	4.45	-	-	-	-	-
Reference Bay	Shoals	2	MT	30	30-Aug-10	55	GC	130	27.1	1.23	-	-	-	-	-
Reference Bay	Shoals	1	MT	42	31-Aug-10	56	FS	34	0.6	1.53	-	-	-	-	-
Reference Bay	Shoals	1	MT	43	31-Aug-10	57	FS	78	3.2	0.67	-	-	-	-	-
Reference Bay	Shoals	1	MT	43	31-Aug-10	58	SC	55	1.6	0.96	-	-	-	-	-
Reference Bay	Shoals	1	MT	44	31-Aug-10	59	FS	37	0.6	1.18	-	-	-	-	-
Reference Bay	Shoals	2	MT	46	31-Aug-10	60	NS	34	0.3	0.76	-	-	-	-	-
Reference Bay	Shoals	2	MT	47	31-Aug-10	61	FS	37	0.7	1.38	-	-	-	-	-

Appendix 3.2-8

Summary Statistics of Effort, Catch and CPUE for Minnow Traps and Crab Traps Used in Roberts Bay and Reference Bay, Doris North Project, 2010

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Appendix 3.2-8. Summary Statistics of Effort, Catch and CPUE for Minnow Traps and Crab Traps Used in Roberts Bay and Reference Bay, Doris North Project, 2010

Location	Site	Sampling Period	Number of Traps Set	Total Effort (hrs)	Total Species Catch					Mean CPUE (fish/trap/24 hrs)									
										FS		GC		NS		SC		All Species	
					FS	GC	NS	SC	All Species	Mean	SE	Mean	SE	Mean	SE	Mean	SE	Mean	SE
Minnow Traps																			
Roberts Bay	Shoals	July	60	1,495	1	0	0	7	8	0.02	0.02	0.00	0.00	0.00	0.00	0.13	0.05	0.14	0.05
Roberts Bay	Shoals	August	60	1,438	0	0	0	10	10	0.00	0.00	0.00	0.00	0.00	0.00	0.17	0.05	0.17	0.05
Roberts Bay	Jetty	July	30	748	6	0	0	9	15	0.22	0.16	0.00	0.00	0.00	0.00	0.31	0.12	0.53	0.18
Reference Bay	Shoals	July	60	1,875	5	0	4	1	10	0.13	0.06	0.00	0.00	0.07	0.06	0.03	0.03	0.24	0.09
Reference Bay	Shoals	August	60	1,511	9	1	1	1	12	0.14	0.05	0.01	0.01	0.02	0.02	0.02	0.02	0.19	0.06
Crab Traps																			
Roberts Bay	Shoals	July	12	298	0	0	0	0	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Roberts Bay	Shoals	August	12	287	0	0	0	1	1	0.00	0.00	0.00	0.00	0.00	0.00	0.08	0.08	0.08	0.08
Roberts Bay	Jetty	July	15	370	1	0	0	0	1	0.06	0.06	0.00	0.00	0.00	0.00	0.00	0.00	0.06	0.06
Reference Bay	Shoals	July	12	375	4	0	0	0	4	0.42	0.19	0.00	0.00	0.00	0.00	0.00	0.00	0.42	0.19
Reference Bay	Shoals	August	12	130	0	0	0	0	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Appendix 3.2-9

Snorkel Data from July and August Surveys in Roberts Bay and Reference Bay, Doris North Project, 2010

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Appendix 3.2-9. Snorkel Data from July and August Surveys in Roberts Bay and Reference Bay, Doris North Project, 2010

A. July Snorkel Survey

Location	Roberts Bay								
Site	**Shoal 1**			**Shoal 2**			**Shoal 3**		
Date	**17-Jul-10**	**19-Jul-10**	**21-Jul-10**	**17-Jul-10**	**19-Jul-10**	**21-Jul-10**	**17-Jul-10**	**19-Jul-10**	**21-Jul-10**
Visability (m)	**3.0**	**5.0**	**8.0**	**3.0**	**5.0**	**8.0**	**3.0**	**5.0**	**8.0**
Fish (n)									
Arctic flounder	-	-	-	-	-	-	1	-	-
Fourhorn sculpin	-	-	-	-	-	-	1	-	2
Greenland cod	-	-	-	-	-	-	-	-	-
Ninespine stickleback	-	-	-	-	-	-	-	-	-
Saffron cod	-	1	3	-	-	3	-	-	1
Starry flounder	-	-	-	-	-	-	-	-	-
Sandlance (unidintified)	-	-	-	-	-	-	-	-	-
Sculpin (unidientified)	-	-	-	-	-	-	-	-	-
Unknown Young-of-the-Year fish	-	2	-	-	10	-	-	1	-
Unknown juvenile/adult fish	-	-	-	-	-	-	-	-	-
Invertebrates (n)									
Amphipod	-	-	1	-	1	1	-	-	5
Clam	-	-	-	-	-	-	-	-	-
Euphausiacea	1	2	4	1	-	-	-	-	-
Isopod	-	-	-	-	-	-	-	-	2
Jellyfish	-	2	8	-	3	5	-	3	9
Mussels	16	35	50	2	2	-	1	3	5
Sea Angel	-	-	1	-	-	-	-	-	-
Tunicate	-	100	144	-	-	-	2	-	6
Algae (%)									
Fucus distichus Linnaeus	trace	trace	trace	trace	-	-	trace	trace	trace
Blue-Green Algae	-	-	-	-	trace	-	trace	-	-
Chorda filum (Linnaeus) Stackhouse	-	-	-	-	-	-	-	-	-
Sphacelaria arctica Harvey	-	trace	trace	-	trace	trace	-	trace	trace
Stictyosiphon tortilis (Areschoug) Reinke	15-30	15-20	5-40	15-30	5-30	10-20	15-30	5-20	10-25

Appendix 3.2-9. Snorkel Data from July and August Surveys in Roberts Bay and Reference Bay, Doris North Project, 2010

A. July Snorkel Survey

Location	Roberts Bay						Reference Bay		
Site	Shoal 4			Jetty			Shoal 1		
Date	17-Jul-10	19-Jul-10	21-Jul-10	17-Jul-10	19-Jul-10	21-Jul-10	12-Jul-10	14-Jul-10	16-Jul-10
Visability (m)	3.0	5.0	8.0	3.0	5.0	8.0	5.0	2.5	1.5
Fish (n)									
Arctic flounder	-	-	-	-	-	-	1	1	-
Fourhorn sculpin	2	-	1	1	2	1	1	-	-
Greenland cod	-	-	-	5	5	3	-	-	-
Ninespine stickleback	-	-	-	-	-	-	-	-	-
Saffron cod	-	1	1	8	8	5	-	-	-
Starry flounder	-	-	-	-	-	1	-	-	-
Sandlance (unidintified)	-	-	-	-	100	-	-	-	-
Sculpin (unidientified)	-	-	-	-	-	-	-	-	-
Unknown Young-of-the-Year fish	-	-	-	-	175	3	12	18	-
Unknown juvenile/adult fish	-	-	-	-	-	-	-	-	1
Invertebrates (n)									
Amphipod	1	1	-	-	2	-	-	-	-
Clam	-	-	-	-	-	-	-	-	2
Euphausiacea	-	1	1	-	1102	600	9	2	-
Isopod	-	-	-	-	1	1	4	1	1
Jellyfish	1	4	5	1	4	1	-	-	-
Mussels	23	22	21	2	-	55	-	-	-
Sea Angel	-	-	-	-	-	-	-	-	-
Tunicate	-	-	-	-	-	8	-	15	-
Algae (%)									
Fucus distichus Linnaeus	trace	trace	trace	-	trace	trace	5-10	5-10	trace
Blue-Green Algae	-	-	-	-	trace	trace	-	Trace	-
Chorda filum (Linnaeus) Stackhouse	-	-	-	-	-	-	-	-	-
Sphacelaria arctica Harvey	trace	trace	trace	-	-	-	-	-	-
Stictyosiphon tortilis (Areschoug) Reinke	20-50	10-30	15-20	20	15-20	15-30	25	60	20-30

Appendix 3.2-9. Snorkel Data from July and August Surveys in Roberts Bay and Reference Bay, Doris North Project, 2010

A. July Snorkel Survey

Location	Reference Bay								
Site	**Shoal 2**			**Shoal 3**			**Shoal 4**		
Date	**12-Jul-10**	**14-Jul-10**	**16-Jul-10**	**12-Jul-10**	**14-Jul-10**	**16-Jul-10**	**12-Jul-10**	**14-Jul-10**	**16-Jul-10**
Visability (m)	**5.0**	**4.0**	**2.0**	**5.0**	**4.0**	**2.0**	**5.0**	**4.0**	**2.0**
Fish (n)									
Arctic flounder	-	2	2	-	-	-	-	-	1
Fourhorn sculpin	1	1	-	1	-	-	3	-	-
Greenland cod	-	-	-	-	-	-	-	-	-
Ninespine stickleback	-	-	-	-	-	-	-	-	-
Saffron cod	-	-	1	1	1	-	1	-	1
Starry flounder	-	1	2	-	-	-	-	-	-
Sandlance (unidintified)	-	-	-	-	-	-	-	-	-
Sculpin (unidientified)	-	-	-	2	-	1	1	-	-
Unknown Young-of-the-Year fish	21	1	54	5	5	-	1	-	-
Unknown juvenile/adult fish	-	-	-	-	-	-	1	-	-
Invertebrates (n)									
Amphipod									
Clam	25	20	10	-	10	-	-	5	10
Euphausiacea	9	5	1	15	150	-	1007	407	3
Isopod	-	-	-	10	-	1	-	3	1
Jellyfish	-	1	-	1	6	-	-	3	-
Mussels	-	-	-	-	1	-	-	5	2
Sea Angel	-	-	-	-	-	-	-	-	
Tunicate	-	-	-	-	2	-	-	-	10
Algae (%)									
Fucus distichus Linnaeus	10-25	5-10	20-40	20-30	25-30	5-20	10-20	10-20	5-30
Blue-Green Algae	-	-	-	-	-	-	5	trace	-
Chorda filum (Linnaeus) Stackhouse	-	-	-	-	-	-	-	-	-
Sphacelaria arctica Harvey	-	-	10	-	Trace	-	-	-	trace
Stictyosiphon tortilis (Areschoug) Reinke	50-60	40-70	50	50	50-60	40	50-60	50	35-60

Appendix 3.2-9. Snorkel Data from July and August Surveys in Roberts Bay and Reference Bay, Doris North Project, 2010

B. August Snorkel Survey

Location	Roberts Bay									
Site	Shoal 1		Shoal 2		Shoal 3		Shoal 4		Jetty	
Date	22-Aug-10	24-Aug-10	22-Aug-10	24-Aug-10	22-Aug-10	24-Aug-10	22-Aug-10	24-Aug-10	22-Aug-10	24-Aug-10
Visability (m)	2.0	2.5	2.0	2.5	2.0	2.5	2.0	2.5	3.0	2.5
Fish (n)										
Arctic flounder	-	-	-	-	-	-	-	-	-	-
Fourhorn sculpin	-	-	-	1	-	-	-	-	1	12
Greenland cod	1	-	-	-	-	-	-	2	-	-
Ninespine stickleback	-	1	-	-	-	-	-	-	-	-
Saffron cod	-	-	-	1	-	-	-	1	2	1
Starry flounder	-	-	-	-	-	-	-	-	-	-
Sandlance (unidintified)	-	-	-	-	-	-	-	-	-	-
Sculpin (unidientified)	-	-	-	-	-	-	-	-	-	-
Unknown Young-of-the-Year fish	-	-	-	1	-	-	-	-	-	-
Unknown juvenile/adult fish	-	-	-	-	-	-	-	-	1	-
Invertebrates (n)										
Amphipod	-	-	-	-	-	-	2	-	-	-
Clam	-	-	-	-	-	-	1	-	-	-
Euphausiacea	-	-	-	-	-	-	-	-	-	-
Isopod	-	-	-	-	-	-	-	-	1	-
Jellyfish	-	1	-	-	1	3	1	4	2	9
Mussels	10	-	5	-	-	-	-	-	-	10
Sea Angel	-	-	-	-	-	-	-	-	-	-
Tunicate	-	-	-	-	-	-	-	-	-	-
Algae (%)										
Fucus distichus Linnaeus	-	5	-	trace	trace	5	5	5	trace	trace
Blue-Green Algae	80	35	70	35	65	55	50	50	-	10
Chorda filum (Linnaeus) Stackhouse	5	20	5	10	10	10	10	5	5	10
Sphacelaria arctica Harvey	-	5	-	10	-	10	-	10	-	-
Stictyosiphon tortilis (Areschoug) Reinke	10	5	10	15	10	10	25	15	20	10

Appendix 3.2-9. Snorkel Data from July and August Surveys in Roberts Bay and Reference Bay, Doris North Project, 2010

B. August Snorkel Survey

Location	Reference Bay							
Site	**Shoal 1**		**Shoal 2**		**Shoal 3**		**Shoal 4**	
Date	**29-Aug-10**	**30-Aug-10**	**29-Aug-10**	**30-Aug-10**	**29-Aug-10**	**30-Aug-10**	**28-Aug-10**	**30-Aug-10**
Visability (m)	**4.0**	**4.0**	**4.0**	**4.0**	**4.0**	**4.0**	**2.5**	**4.0**
Fish (n)								
Arctic flounder	-	1	-	-	-	1	1	-
Fourhorn sculpin	1	25	4	10	7	3	-	1
Greenland cod	-	-	-	-	-	-	-	-
Ninespine stickleback	-	-	2	-	-	-	-	-
Saffron cod	-	-	-	-	-	-	-	-
Starry flounder	-	-	1	-	-	1	-	1
Sandlance (unidintified)	-	-	-	-	-	-	-	-
Sculpin (unidientified)	-	-	-	-	-	-	-	1
Unknown Young-of-the-Year fish	-	-	-	-	-	-	-	-
Unknown juvenile/adult fish	-	-	-	-	-	-	-	-
Invertebrates (n)								
Amphipod								
Clam	-	-	-	-	-	-	-	-
Euphausiacea	175	120	350	235	350	630	20	200
Isopod	-	1	-	-	-	-	1	-
Jellyfish	-	8	3	18	1	67	-	138
Mussels	-	-	-	-	-	9	2	1
Sea Angel	-	-	-	-	-	-	-	-
Tunicate	-	-	-	-	20	-	-	-
Algae (%)								
Fucus distichus Linnaeus	25	5	20	25	30	20	30	15
Blue-Green Algae	20	10	25	10	15	20	10	30
Chorda filum (Linnaeus) Stackhouse	trace	5	trace	trace	trace	5	trace	10
Sphacelaria arctica Harvey	15	20	10	20	15	10	15	15
Stictyosiphon tortilis (Areschoug) Reinke	20	25	20	25	30	20	40	10