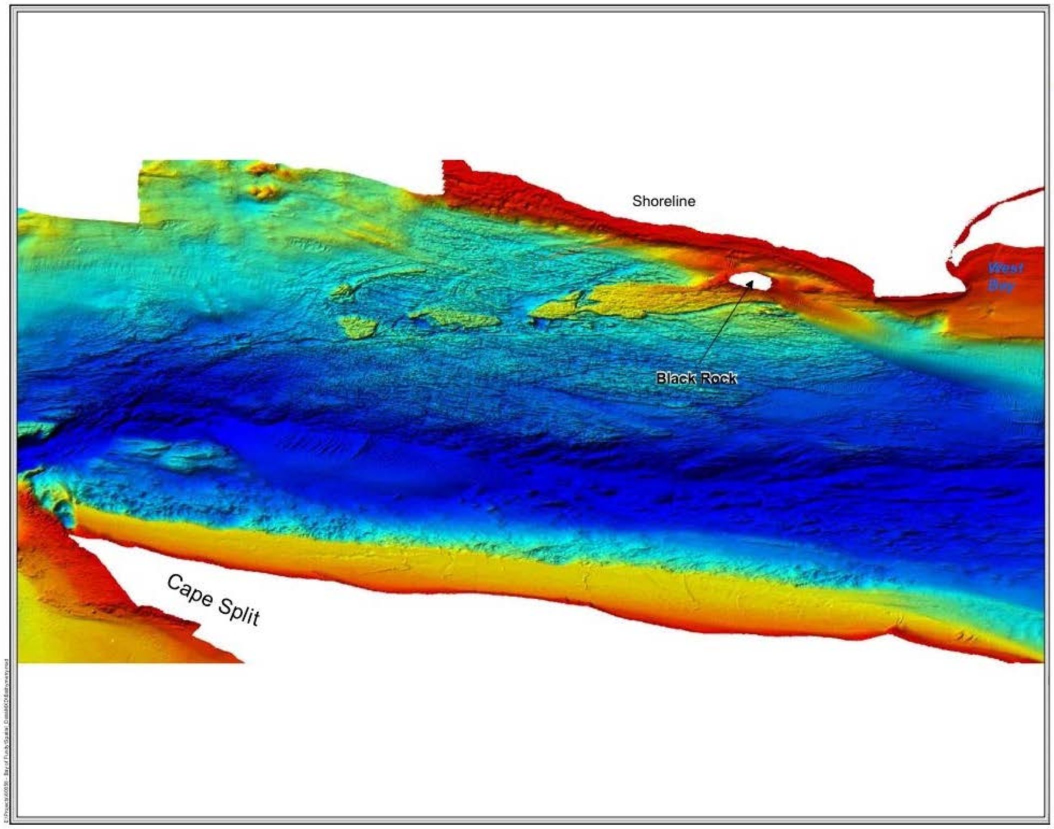
# FUNDY TIDAL ENERGY DEMONSTRATION PROJECT

# LOBSTER CATCH MONITORING

## Analysis of Results from Two Fall Surveys: September 25 - October 3 and November 5 - 18, 2009

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## EXECUTIVE SUMMARY


A pilot tidal energy program is being established in Minas Channel west of Black Rock near Parrsboro, Nova Scotia. Development of the program was being coordinated by Minas Basin Pulp and Power Inc. (MBPP), but has been transferred to FORCE, an independent body of which MBPP is a member. Three different designs of tidal power generators are to be installed within a 1.6 km crown lease area at mid-tide depths of approximately 60 m, with power and communication lines running to shore north of Black Rock. Nova Scotia Power Inc. (NSPI) installed the first prototype tidal generator on November 12, 2009.

This report describes results of an effects monitoring program focused on lobster using test and control areas within and adjacent to the crown lease area. The first survey was conducted between September 25 and October 3, 2009. The commercial fishery in the area began October 14. The second survey was carried out between November 5 and November 18, 2009 while the commercial fishery was active.

All fishing was carried out at or near slack tide. In the first survey 51 traps were set and 48 traps recovered. A total of 1387 lobsters was caught in 132 sets. Fifty-six traps were hauled at high tide and 76 at low tide. The average catch per trap was 10.7 lobster in high tide hauls and 10.4 lobster in low tide hauls. In the second survey 48 traps were set and 41 traps recovered. A total of 1135 lobsters was caught in 126 trap sets. Fifty-eight traps were hauled at low tide and 68 at high tide. The average catch per trap was 11.2 lobster in low tide hauls and 7.1 lobster in high tide hauls. Tide stage at trap retrieval was not considered a major influence on catch rates.

Smaller lobsters were found closer to shore and larger lobsters were caught in deeper water; more berried females were caught in November than in September/October. Injuries observed in trapped lobster included damaged and missing claws, broken rostrum (beak), and broken carapace shells or tail segments. The proportion of broken rostrums seemed particular to the Bay of Fundy and may be related to the high currents.

The second survey was more efficient in terms of the number of replicate samples obtained within the survey time available. Traps set in pairs tended to remain on station better than the single traps fished in the first survey.

One set of data was collected following installation and operation of the NSPI turbine. Any effect from installation and operation of the turbine was insufficient to cause all lobster to leave the vicinity or cause discernable changes in lobster distributions.

Based on analysis of catch data, the two control areas when considered together appear to adequately reflect the types of habitat and lobster distributions within the test area. Continued collection of information on lobster catchability from these areas will allow comparison over time between test and control areas for evaluating potential effects of turbine installation and operation.

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# 1 INTRODUCTION

## 1.1 Background

A pilot tidal energy program is being established in Minas Channel west of Black Rock near Parrsboro, Nova Scotia. Development of the program was being coordinated by Minas Basin Pulp and Power Inc. (MBPP), but has been transferred to FORCE, an independent body of which MBPP is a member. Three different designs of tidal power generators are to be installed within a 1.6 $km^2$ crown lease area[1] at mid-tide depths of approximately 60 m, with power and communication lines running to shore north of Black Rock. Nova Scotia Power Inc. (NSPI) installed the first prototype tidal generator on November 12, 2009, and two additional units are planned for installation by other companies within the same lease area in 2010 or 2011.

Commercial fishing for lobster is important in this area, as well as most of the Bay of Fundy. Lobster fishing is one of the few commercial fishing operations likely to occur near the turbine deployment area and a monitoring program has been implemented to assess potential changes in fishing success as result of construction and operation of the tidal energy program. The program consists of surveys within test and control areas to be carried out in late September of 2009, early November of 2009, and spring, and fall of 2010.

## 1.2 Purpose

This report summarizes results of the first two surveys. The first survey was conducted between September 25 and October 3, 2009. The commercial fishery in the area began October 14. The second survey was carried out between November 5 and November 18, 2009 while the commercial fishery was active.

The primary purpose of this report is to provide a baseline for continued monitoring of tidal power installations and operation within the test area. However, the first turbine within the test area was installed on November 12, 2009 and one set of traps was fished following this installation.

[1] The total crown lease area includes the test demonstration area of 1.6 $km^2$ plus a corridor area of 0.47 $km^2$ for cables to shore, for a total of 2.07 $km^2$.

### 1.3 Study Locations

The crown lease development area and three proposed deployment sites are shown in Figure 1-1.

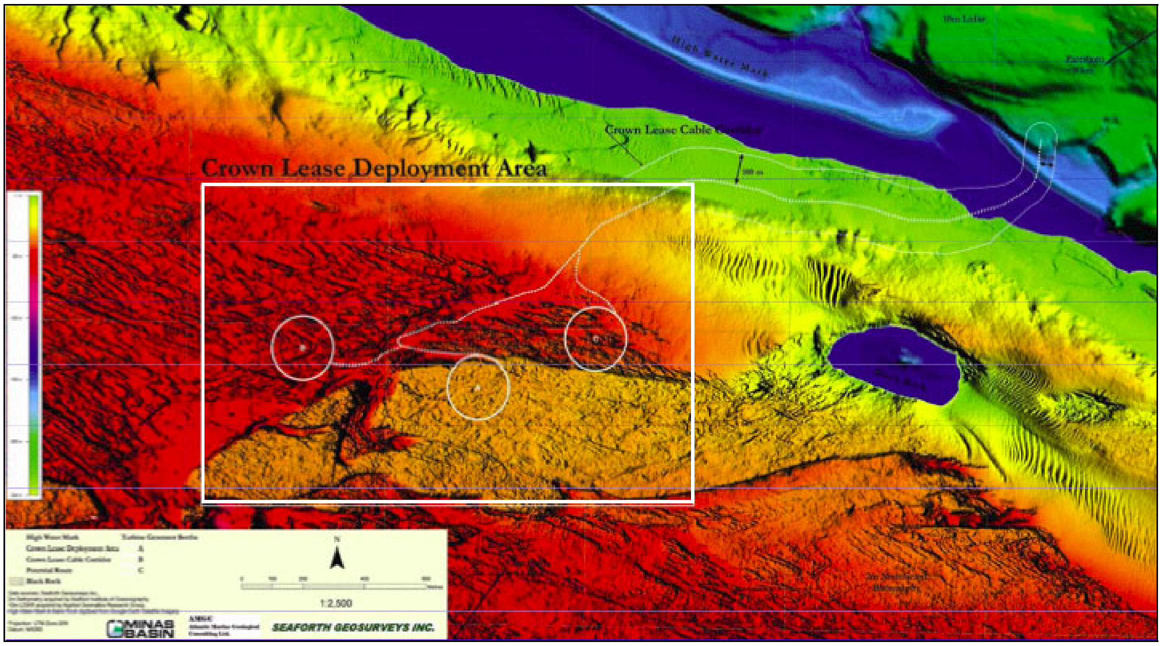


**Figure 1-1: Crown Lease Development Area**

In addition, a reference site for biological and physical monitoring has been established at 45° 21' 53" N, 64° 27' 32" W. Water depth at the site is 58 metres at mid tide.

# 2 DESIGN AND METHODOLOGY

### 2.1 Sampling Gear

Sixty standard commercial lobster traps and associated gear, including buoys, were purchased for use in this study. Traps were weighted with approximately 100 kg of concrete poured into the bottom of each trap. Traps were baited with shad and herring soaked in brine and escape vents were blocked to retain all sizes of lobster. All fishing was carried out at or near slack tide. Eight traps were equipped with thermometers to record bottom temperature.

### 2.2 Overall Test and Control Study

Design of the main effects monitoring program is based on comparison of fishing success before, during and after construction and operations within test and control areas. The design is based on random trap locations within a square covering the anticipated maximum impact area and in control areas sufficiently far from the Test Area to provide comparison data on catch parameters.

Test and control areas are illustrated in Figure 2-1.

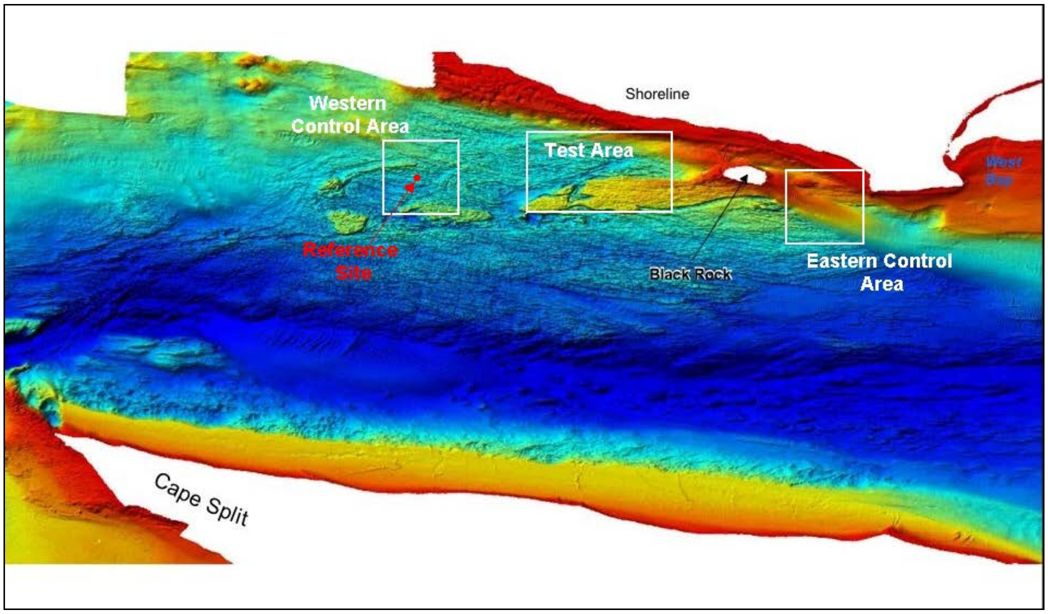


**Figure 2-1: Location of Test and Control Areas**

The crown lease deployment area was selected as the Test Area and 25 trap sampling points were selected randomly within the 1.6 $km^2$ area. Stations in the Test Area were assigned numbers beginning with the letter 'T'. In addition to the random stations, eight stations were established in a grid around the proposed NSPI turbine deployment site at 200 m and 500 m in each cardinal direction. These stations were designated by the letters 'NS' and their distance and direction from the deployment site; for example, NS500N was 500 m north of the proposed deployment site.

The time required to complete sampling at all stations during the first survey was longer than anticipated because of the short period when buoys were at the surface over slack tide – during higher amplitude tides available fishing time was less than an hour – and the time required at sea because of low water conditions at the wharf. In addition, traps were moved by high tidal currents an average of 116 m between hauls during the first survey, with a maximum shift of over one kilometer. To make the survey more efficient and to reduce the movement of traps, the number of stations was reduced and traps fished in pairs, separated by 60 m of line; buoys were also doubled with the second buoy attached as a trailer buoy to shorten the time required for the buoys to rise above the water surface, thus shortening the time required to find the traps. The intent of these changes was to increase the number of replicate sets over the available survey time.

Patterns in the data, particularly the catch within different size groups, were examined to select stations that would be fished during the November survey. The relative effort between test and control areas was maintained. Fifty tagged traps were available for the November survey: 48 traps were set and two retained as spares. Initially, 10 stations were selected for fishing in the test area, four in each of the control areas, and 12 at the NSPI stations. Because of concern of entanglement with commercial traps in parts of the Eastern Control Area, stations EC 1 and EC 10 were fished as single traps. At the NSPI stations, the stations at 500 m from the deployment site were fished with single traps and the stations at 200 m were fished with double traps. Following deployment of the NSPI turbine on November 12, the 200 m stations were modified to be 300 m from the revised deployment location (45° 21.897' N, 64°25.576' W). Coordinates and depths for the new NSPI stations are provided in Table 2-1. The original coordinates for all stations are provided in Appendix A.

**Table 2-1: Coordinates (decimal degrees) and Depth (m) for NSPI Stations at 300 m**

| Station | Latitude N | Longitude W | Water Depth LLWLT (m) |
|---|---|---|---|
| NS300N | 45.36765 | 64.426335 | -43.56 |
| NS300E | 45.364998 | 64.422437 | -26.22 |
| NS300W | 45.364902 | 64. 430096 | -30.61 |
| NS300S | 45.36225 | 64. 426199 | -33.21 |

Station codes and locations for the Test Area are shown on detailed multibeam bathymetry in Figure 2-2. All stations are shown but the stations fished during the November survey are circled in red with the number of circles indicating the number of traps fished.

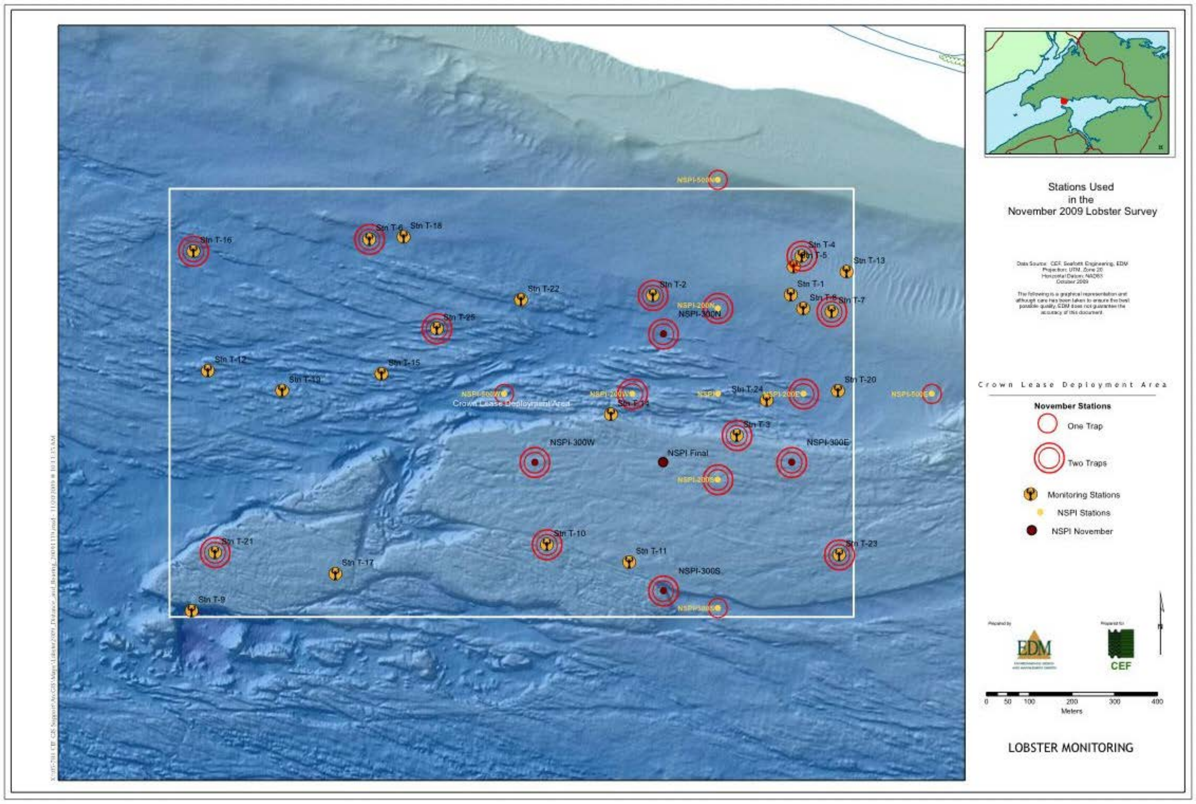


**Figure 2-2: Sampling Stations within the Test Area**

Two control areas east and west of the Test Area were selected for comparison to the Test Area. Each area is 1.0 $km^2$ and contains bottom types and depths similar to the Test Area. The Western Control Area was centered on the reference site for baseline monitoring, which is approximately 1.4 km west of the western edge of the Test Area. Station codes and locations for the Western Control Area are shown on (Figure 2-3). All stations are shown but the stations fished during the November survey are circled in red with the number of circles indicating the number of traps fished.

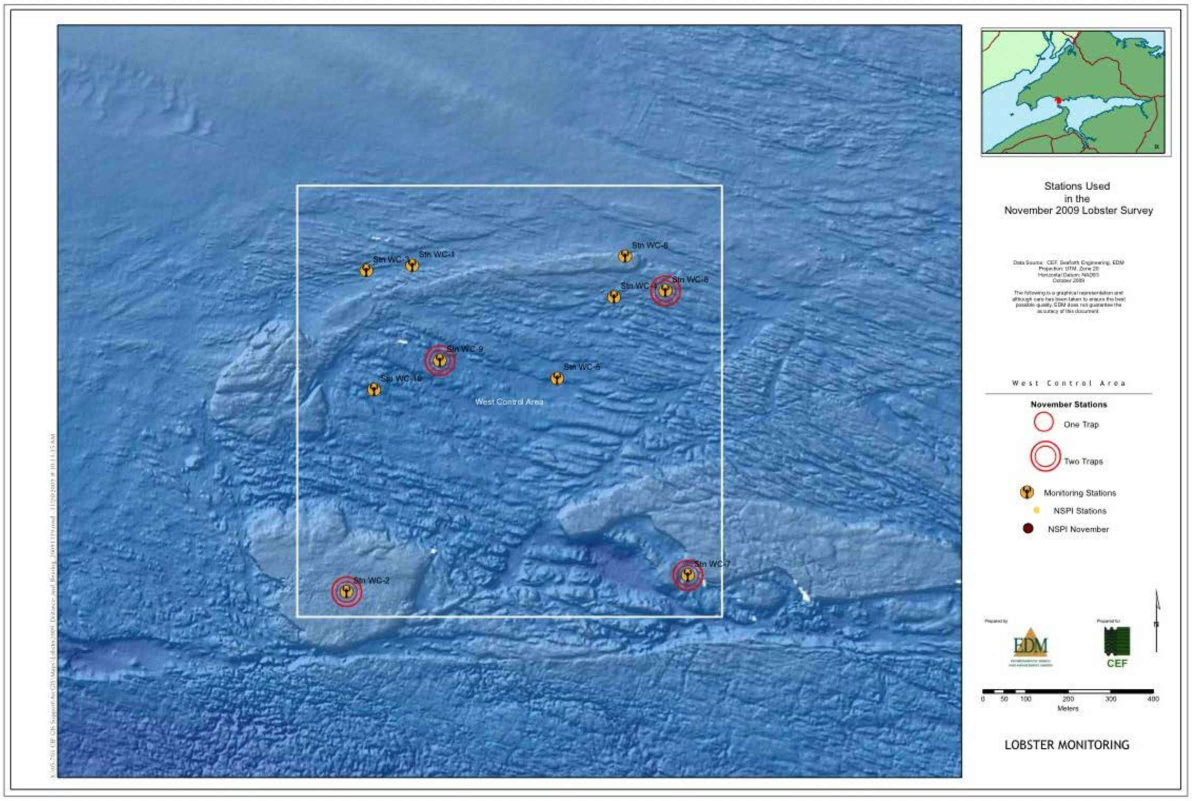


**Figure 2-3: Sampling Stations within the Western Control Area**

The Eastern Control Area was established east of Black Rock to cover an area more shielded from the Test Area by shallow water and Black Rock, and because this area was reportedly more important for commercial lobster fishing. Station codes and locations for the Eastern Control Area are shown on (Figure 2-4). All stations are shown but the stations fished during the November survey are circled in red with the number of circles indicating the number of traps fished.

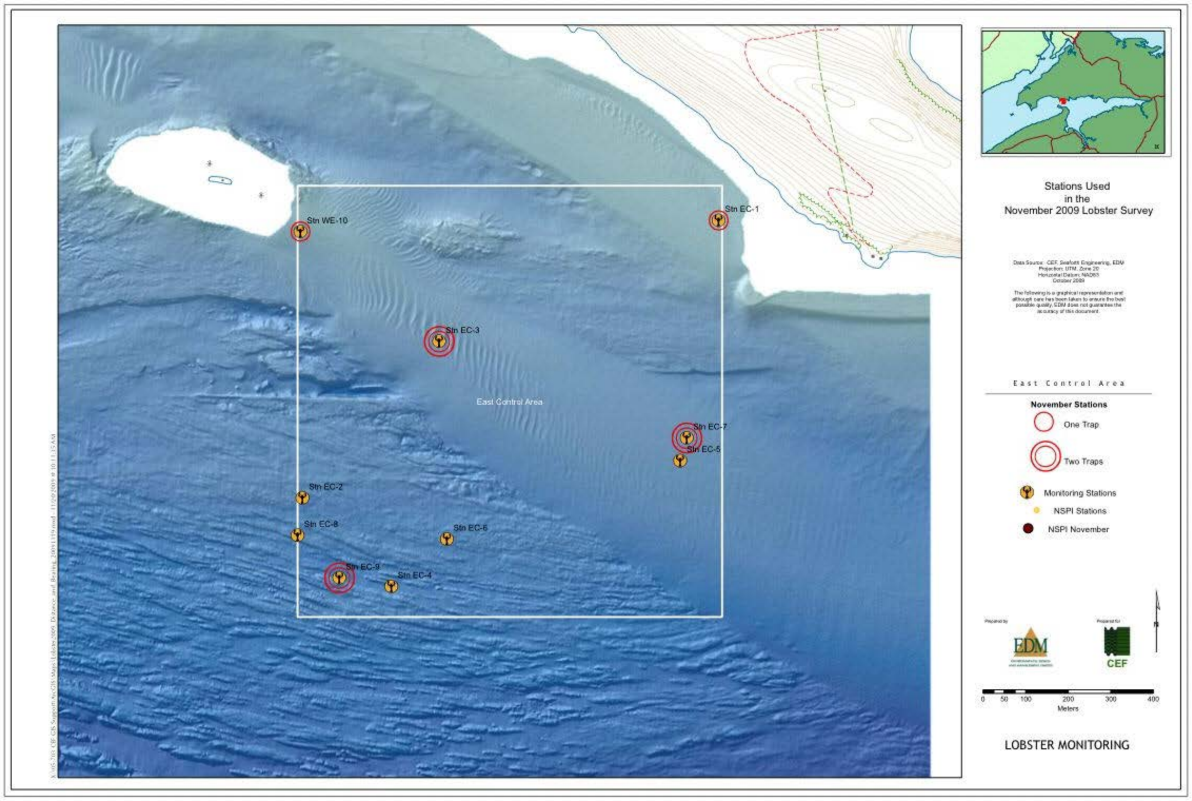


**Figure 2-4: Sampling Stations within the Eastern Control Area**

## 2.3 Methodology

Traps were set over slack and rising or falling tide whereas recovery of traps could only be done during slack high or low tide because it was only then that buoys were visible. During the first survey, two days were required to set all the traps. The reduction in number of sets allowed all traps to be set in one day during the second survey.

All fishing was carried out by the fishing vessel Cape Rose (CFV 3089) from the Parrsboro wharf (Photo 2-1). Fishing was conducted under DFO Scientific Licence #324435 issued November 2, 2009. The licence number was the same as that issued for the first survey in September/October. All traps were hauled and returned to the wharf by November 18. The permit expired on November 30, 2009.

**Photo 2-1: Fishing Vessel Cape Rose at the Passboro Wharf at Low Tide**

Following each trap haul, all lobster caught were sexed, measured, and shell condition and damage determined. Damage was recorded as missing, cracked or incised claw, broken rostrum or beak, or breaks in the back or tail shell. It was not considered possible to accurately determine whether the injury occurred in the trap or previous to trapping; in only a few cases was regrowth of a lost claw or limb observed. A noticeably soft shell was also noted. Erosion of tail segments from an apparent fungus infection was also noted when deterioration of the shell was obvious. All lobster were temporarily tagged with elastic bands to identify recapture in successive trap hauls, and returned to the water as quickly and as close to the catch location as possible.

Trap location for setting was determined by the vessel's GPS and station coordinates approached as closely as possible before dropping the trap overboard. When traps were recovered, the position was noted on a handheld GPS as close to the actual trap location on the bottom as possible. When traps were set in pairs, only the location of the first trap haul could be marked reliably. All data were recorded in a notebook and transferred to a laptop computer as soon as possible.

A preliminary report of each survey and a spreadsheet of all data were provided to DFO within the time required by the permit.

# 3 RESULTS

## 3.1 Trap Setting, Recovery and Numbers

### 3.1.1 First Survey

Between September 25 and October 3, 51 traps were set and 48 traps recovered. The trap at Station T-9, the deepest water station, was searched for but not found until September 30. The trap was either wedged into a crevice or filled with sediment and the buoy rope broke during the attempt to haul it. Station T-9 was thus lost from the set of Test Area stations. The buoy marking the trap at Station EC 2 was never observed during numerous searches of the area where it was set, and this trap was considered lost. The trap at Station WC 2 was retrieved successfully twice but could not be located on the last day of fishing and was left in the water. This trap was not recovered.

Tables 3-1 to 3-4 provide the tide conditions when the traps were set and hauled, and the numbers of lobster caught for the Test Area, the NSPI stations, the Eastern Control Area, and the Western Control Area, respectively. Detailed catch records with individual carapace lengths, sex, condition, water temperature, and trap haul coordinates are available in a spreadsheet file on request.

Traps were set on the high slack tide the first day and on the low slack tide the second day. An effort was made to haul the traps in each of the areas during each tide to avoid introducing a bias into the catch results. Traps could only be hauled when the buoys were visible, which only occurred during slack tides, but fishing at both low and high tides appeared similarly successful. However, both high and low slack tides over two days were required to haul all the traps. The slack tide period when fishing was possible decreased during the end of the survey as tidal amplitude increased. Wind conditions also affected fishing success and resulted in variations of where buoys first surfaced from one day to the next. Thus, a specific order of fishing the traps could not be maintained, nor could the time required to fish all the traps be reliably estimated from one day to the next.

A total of 1387 lobsters was caught in 132 sets. Fifty-six traps were hauled at high tide and 76 at low tide. The average catch per trap was 10.7 lobster in high tide hauls and 10.4 lobster in low tide hauls indicating little difference in fishing success.

Lobsters were marked with an elastic on the back of their claw when released and only 9 were recaptured during the study. The low recapture rate from fishing in the same area over a few days is comparable to that found in similar studies done by CEF in different Nova Scotia coastal environments.

### 3.1.2 Second Survey

Between November 5 and 18, 48 traps were set and 41 traps recovered. Most traps lost were a result of rope failure, which appeared to be the result of weak spots in the rope. The trap for station NS500W was thought to be lost because the buoy rope was accidentally cut by another vessel. The traps at Station T21 were simply not found upon searching. Seven spare traps remain to provide a total of 48 traps for subsequent surveys; however, these seven spare traps do not have tags.

Tables 3-5 and 3-6 provide the tide conditions when the traps were set and hauled, and the numbers of lobster caught for the Test Area and NSPI stations, and the two Control Areas, respectively.

**Table 3-1: Trap Set and Catch for the Test Area by Date and Tide, Survey 1**

| **Date** | 25-Sep | 26-Sep | 28-Sep | | 29-Sep | | 30-Sep | | 1-Oct | 2-Oct | | 3-Oct | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Tide** | H | L | H | L | H | L | H | L | L | H | L | H | L |
| **Station** | | | | | | | | | | | | | |
| T1 | | | | | | | | | | | | | |
| T2 | SET | | | 20 | | | 11 | | | | 11 | | |
| T3 | | SET | 6 | | | | | 9 | | | | 7 | |
| T4 | SET | | | | | | | 8 | * | | | | |
| T5 | | | | | | | | | | | | | |
| T6 | | SET | | 6 | | | | 10 | | 7 | | | |
| T7 | SET | | | 21 | | | 11 | | | | 9 | | |
| T8 | SET | | | 23 | | | 13 | | | | 10 | | |
| T9 | | SET | | | | | trap lost | | | | | | |
| T10 | | SET | | 9 | | | | | 9 | | | | 4 |
| T11 | | SET | 5 | | | | | | 3 | | 5 | | |
| T12 | | SET | | | | | | 12 | * | | | | |
| T13 | SET | | | | 14 | | 4 | | | 7 | | | |
| T14 | | SET | | | | | | | | | | | 10 |
| T15 | | SET | | | | | 14 | * | | | | | |
| T16 | | SET | | | | 9 | | 4 | | 9 | | | |
| T17 | | SET | | 14 | | | | | 3 | 3 | | | |
| T18 | | SET | | | | 8 | 7 | | | 10 | | | |
| T19 | | SET | | | | 14 | 6 | | | | 19 | | |
| T20 | | | | 16 | | | 12 | | | | | | 11 |
| T21 | | SET | | 6 | | | | 7 | | 4 | | | |
| T22 | SET | | | 15 | | | | 19 | | 10 | | | |
| T23 | | SET | | | | | | 13 | | | | 12 | |
| T24 | | SET | | | | 13 | | 6 | | | | | 11 |
| T25 | SET | | | 13 | | | | 16 | | 9 | | | |

**Table 3-2: Trap Set and Haul Catch for the NSPI Stations by Date and Tide, Survey 1**

| Date | 25-Sep | 26-Sep | 28-Sep | | 29-Sep | | 30-Sep | | 1-Oct | 2-Oct | | 3-Oct | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Tide** | H | L | H | L | H | L | H | L | L | H | L | H | L |
| **Station** | | | | | | | | | | | | | |
| NS500N | | SET | | 12 | | | | 13 | | 9 | | | |
| NS200N | | SET | | 17 | | | 8 | | | | 16 | | |
| NS200S | | SET | 2 | | | | | 3 | | | | 3 | |
| NS500S | | SET | | | | 12 | | 1 | | | | 11 | |
| NS500E | | SET | 15 | | | | 17 | | | | 23 | | |
| NS200E | | SET | | | | 14 | 1 | | | | 10 | | |
| NS200W | | SET | | | 1 | | | 11 | | 9 | | | |
| NS500W | | SET | | | | 21 | | 8 | | | 10 | | |

**Table 3-3: Trap Set and Catch for the Eastern Control Area by Date and Tide, Survey 1**

| Date | 25-Sep | 26-Sep | 28-Sep | | 29-Sep | | 30-Sep | | 1-Oct | 2-Oct | | 3-Oct | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Tide** | H | L | H | L | H | L | H | L | L | H | L | L | H |
| **Station** | | | | | | | | | | | | | |
| EC1 | SET | | 31 | | | | 26 | | | 25 | | | |
| EC2 | SET | | | | | | | | | | | | |
| EC3 | SET | | 13 | | | | 14 | | | | | 14 | |
| EC4 | SET | | 20 | | | | | | | | | 12 | |
| EC5 | SET | | 11 | | | | 17 | | | | | 16 | |
| EC6 | SET | | 17 | | | | | | | | | 10 | |
| EC7 | SET | | 13 | | | | 9 | | | | | 22 | |
| EC8 | SET | | | | 25 | | | | | | | 15 | |
| EC9 | SET | | | | 19 | | | | | | | 19 | |
| EC10 | SET | | 15 | | | | 14 | | | 8 | | | |

**Table 3-4: Trap Set and Catch for the Western Control Area by Date and Tide, Survey 1**

| **Date** | 25-Sep | 26-Sep | 28-Sep | | 29-Sep | | 30-Sep | | 1-Oct | 2-Oct | | 3-Oct | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Tide** | H | L | H | L | H | L | H | L | L | H | L | L | H |
| **Station** | | | | | | | | | | | | | |
| WC1 | | SET | | 4 | | | | | 13 | 4 | | | |
| WC2 | | SET | | 3 | | | | 1 | | | | | |
| WC3 | | SET | | 5 | | | | 9 | | | | | 4 |
| WC4 | | SET | | 12 | | | | | 13 | | * | | |
| WC5 | | SET | | 10 | | | | | 7 | | | | 6 |
| WC6 | | SET | | 8 | | | 9 | | | 4 | | | |
| WC7 | | SET | | 4 | | | | 1 | | | | 4 | |
| WC8 | | SET | | 1 | | | 7 | | | 13 | | | |
| WC9 | | SET | | 8 | | | | 8 | | | | | 9 |
| WC10 | | SET | | 1 | | | | 5 | | | | | 5 |

**Table 3-5: Trap Set and Catch in the Test Area by Date and Tide, Survey 2**

| Date | 5-Nov | 6-Nov | 7-Nov | | 10-Nov | | 11-Nov | 14-Nov | 16-Nov | 17-Nov | 18-Nov |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Tide** | H | H | L | H | L | H | L | L | H | H | H |
| **Station** | | | | | | | | | | | |
| T2 | SET | 2, 3 | | | | | | | 10, 11 | | |
| T3 | SET | | | | 13, 10 | * | | SET | | 3, 7 | |
| T4 | SET | 5, 7 | | | | | 18, 15 | 19, 22 | 5, 0 | | |
| T6 | SET | | | 3, 7 | | | 12, 20 | | | | 9, 10 |
| T7 | SET | 7, 3 | | | 19, 27 | | | 18, 18 | 7, 4 | | |
| T10 | SET | | 2, 6 | | | 14, 8 | * | SET | 3, 7 | | |
| T16 | SET | | | 2, 4 | | | 6, 13 | | | | 8, 5 |
| T21 | SET | | 2, 0 | | | | 1, 4 | * | | not recovered | |
| T23 | SET | 5, 1 | | | 7, 10 | * | | SET | | 0, 3 | |
| T25 | SET | | | | 9, 7 | * | | SET | 6, 8 | | |
| | | | | | | | | | | | |
| NS500N | SET | | 23 | | | 36 | | 29 | 17 | | |
| NS200N | SET | | | 9, 8 | | 18, 28 | * | SET | lost | | |
| NS200S | SET | | 4, 4 | | 3, 8 | * | | SET | | 3, 2 | |
| NS500S | SET | 2 | | | 10 | * | | SET | | 9 | |
| NS500E | SET | 4 | | | 20 | * | | SET | 11 | | |
| NS200E | SET | | | | 10, 6 | * | | SET | | 2, 2 | |
| NS200W | SET | | | | | 14, 17 | * | SET | | 0, 3 | |
| NS500W | SET | | | | | 15 | * | | | | |

Note: *indicates trap was removed from station location.

**Table 3-6: Trap Set and Catch in the Control Areas by Date and Tide, Survey 2**

| **Date** | 5-Nov | 6-Nov | 7-Nov | | 10-Nov | | 11-Nov | 14-Nov | 16-Nov | 17-Nov | 18-Nov |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Tide** | H | H | L | H | L | H | L | L | H | H | H |
| **Station** | | | | | | | | | | | |
| EC1 | SET | 6 | | | 32 | | | 18 | 4 | | |
| EC3 | SET | 5, 4 | | | 19, 12 | | 4, 5 | 14, 14 | 3, 6 | | |
| EC7 | SET | 2, 1 | | | | | 5, 6 | | 9, 2 | | |
| EC9 | SET | | | | 8, 12 | * | | | | | |
| EC10 | SET | | 18 | | 18 | | | 22 | | 24 | |
| | | | | | | | | | | | |
| WC2 | SET | | 0, 1 | | | | | | lost | | |
| WC7 | SET | | 8, 9 | | | | 5** | | 7, 3 | | |
| WC8 | SET | | 3, 3 | | | | | | 15, 3 | | |
| WC9 | SET | | 10, 8 | | | | | | 6, 9 | | |

Note: *indicates trap was removed from station location. **rope to second trap broke, both traps replaced with spares.

Attempts were made to fish all traps in a single day, but this was not accomplished. On one day (November 16) almost half the traps (23) were successfully fished during a single high slack tide, indicating that it could be possible under ideal conditions to fish all stations in one day of fishing. Frequently, however, a rope tangle or unusual eddy conditions would increase the time required to haul a trap. Overall, test and control areas were fished relatively uniformly over the survey, but fewer traps were successfully fished in the Western Control Area than in other areas because the deeper water restricted available fishing time the most.

A total of 1135 lobsters was caught in 126 trap sets. Fifty-eight traps were hauled at low tide and 68 at high tide. The average catch per trap was 11.2 lobster in low tide hauls and 7.1 lobster in high tide hauls. Traps were hauled only on high slack tides near the end of the second survey when catches were generally declining, lowering the average catch in high tide hauls.

Twenty-four lobster marked upon capture were recaptured during the November survey compared to 9 during the first survey; one was marked as captured twice in November. Croyden Wood Jr., the fisher conducting the survey, reported he caught seven lobster marked during the first survey in his commercial traps prior to the start of the November survey.

### 3.1.3 Total Catch by Area and Size Class

Factors potentially affecting catch between the September-early October survey and the mid-November survey were:

- removal of larger lobster by the commercial fishery, which began October 14$^{th}$;
- seasonal migration out of the inner Bay of Fundy in the later fall; and
- installation of the NSPI turbine on November 12$^{th}$, prior to the completion of the November survey.

In the first survey, 1387 lobsters were caught in 132 trap sets compared to 1135 lobsters caught in 126 sets in the second survey, for a drop from 10.5 lobster/trap set in the first survey to 9.0 in the second. Table 3-7 provides the number of lobster caught by size class within each sampling area for both surveys.

**Table 3-7: Lobster Catch by Size Class and Sampling Area**

| | | Carapace Length (cm) Group | | | | |
|---|---|---|---|---|---|---|
| **Area** | **Survey** | **<6.6** | **6.6 - 8.2** | **8.3 - 10** | **>10** | **Totals** |
| Test | First | 9 | 136 | 265 | 167 | 577 |
| Test | Second | 30 | 135 | 165 | 128 | 458 |
| NSPI | First | 7 | 49 | 123 | 68 | 247 |
| NSPI | Second | 12 | 80 | 125 | 101 | 318 |
| Eastern Control | First | 9 | 90 | 139 | 147 | 385 |
| Eastern Control | Second | 22 | 93 | 96 | 62 | 273 |
| Western Control | First | 0 | 17 | 64 | 97 | 178 |
| Western Control | Second | 2 | 5 | 24 | 60 | 91 |

The decline in catch between surveys was primarily in the market size lobster and may be due to removal from the local population by the commercial fishery. The number of small lobster (<6.6 cm) increased in all areas between the first and second surveys.

Figure 3-1 shows the average catch per trap by size class and sampling area. The Test and Eastern Control Areas show similar declines in catch of market-size lobsters between the first and second surveys. Both of these survey blocks include areas considered more likely to be fished commercially, particularly around Black Rock where the most commercial buoys were noted. Only the NSPI stations showed an overall increase in average catch per trap, and this increase was predominately in the pre-market and largest size group of lobster. The lowest average catch per trap occurred in the Western Control Area, which is deeper and further from shore – larger lobster predominated in the catch from this area.

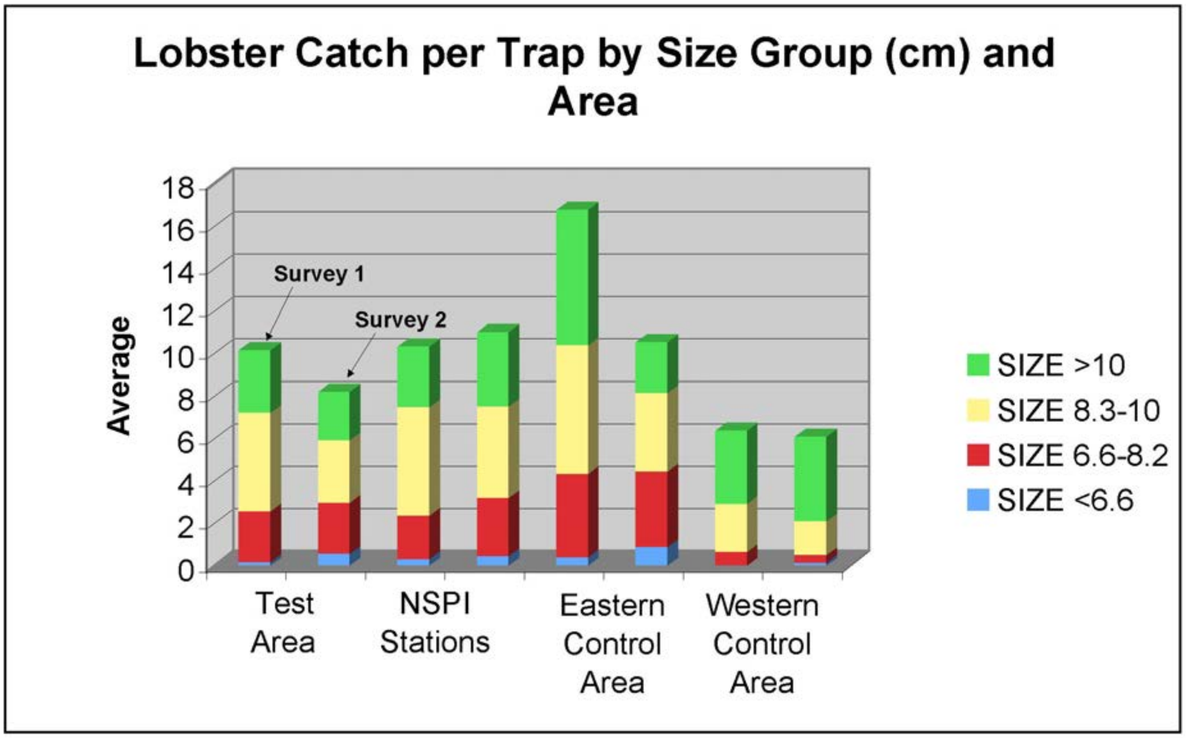


**Figure 3-1: Average Catch per Trap by Size Group and Sampling Area**

### 3.1.4 Soak Time

The amount of time between setting and hauling of the trap is referred to as soak time. The number of lobster caught in a trap is expected to increase initially as lobster perceive the bait and move towards the trap, and then likely decrease as the bait effectiveness decreases and lobster escape. Soak time was determined in number of tides and ranged from two (i.e., one high and one low tide between the set and hauling of the trap) to 37 with a mode of 7. Soak time was significantly longer in the second survey ($p<0.001$) than in the first, averaging 11.6 tides compared to 8.0 in the first survey.

## 3.2 Lobster Condition

Observations were made on shell condition and shell damage. In the first survey, only one female lobster was caught that had a soft shell indicative of recent moulting; one other lobster had a slightly soft shell. By the second survey in November, lobster with particularly soft shells were not observed.

The most noticeable damage that appeared unusual was broken rostrums or beaks. In the first survey, this particular damage occurred in approximately 1 or 2 % of the lobster and did not appear to be damage solely within the trap – signs of regrowth were observed in a number of cases. More damage was observed during the second survey (Table 3-8) and more of the damage appeared to be recent, probably a result of longer soak times.

During the second survey, two lobster were dead when the trap was hauled and had apparently been scavenged by other lobster in the trap (Photo 3-2). These two unusual cases were not related to extremely long soak times, but in the case of Station NS500N, the numbers of lobster caught were unusually high. It is most likely that aggressiveness of the lobsters, soak time and numbers of lobster in the trap contributed to increased damage in the trap.

**Photo 3-2: Dead and Scavenged Lobster from Survey 2**

**Table 3-8: Lobster Condition and Type of Injury by Survey and Area**

| Station Group | Nose | No Claws | One Claw | Carapace Damage | Tail Damage | Claw Damage | Shell Fungus | Shell Soft |
|---|---|---|---|---|---|---|---|---|
| First Survey – September 25 to October 3 | | | | | | | | |
| Test Area | 0.5% | 0.3% | 2.0% | 0.4% | 0.3% | 0.1% | 0.0% | 0.0% |
| NSPI Stations | 0.2% | 0.1% | 0.6% | 0.1% | 0.0% | 0.1% | 0.0% | 0.0% |
| Eastern Control | 0.4% | 0.2% | 1.4% | 0.7% | 0.6% | 0.1% | 0.1% | 0.1% |
| Western Control | 0.0% | 0.0% | 0.5% | 0.1% | 0.1% | 0.1% | 0.1% | 0.0% |
| Second Survey – November 5 to 18 | | | | | | | | |
| Test Area | 1.9% | 0.4% | 3.4% | 0.1% | 1.3% | 0.0% | 0.2% | 0.0% |
| NSPI Stations | 1.4% | 0.2% | 2.0% | 0.3% | 0.1% | 0.0% | 0.2% | 0.0% |
| Eastern Control | 1.0% | 0.3% | 1.6% | 0.1% | 0.2% | 0.0% | 0.1% | 0.0% |
| Western Control | 0.1% | 0.7% | 1.2% | 0.1% | 0.4% | 0.0% | 0.1% | 0.0% |

A fungal shell disease was noticed on two lobster caught in the first survey and six in the second survey.

**Photo 3-3: Badly Corroded Lobster Tail from Fungus Infection**

## 3.3 Trap Movement By Currents

In the first survey, traps were moved by high tidal currents an average of 116 m between hauls, with a maximum shift greater than one kilometer. Figure 3-2 representing trap hauls on September 28, 2009 provides an example of the type of movement observed between the setting and hauling of traps.

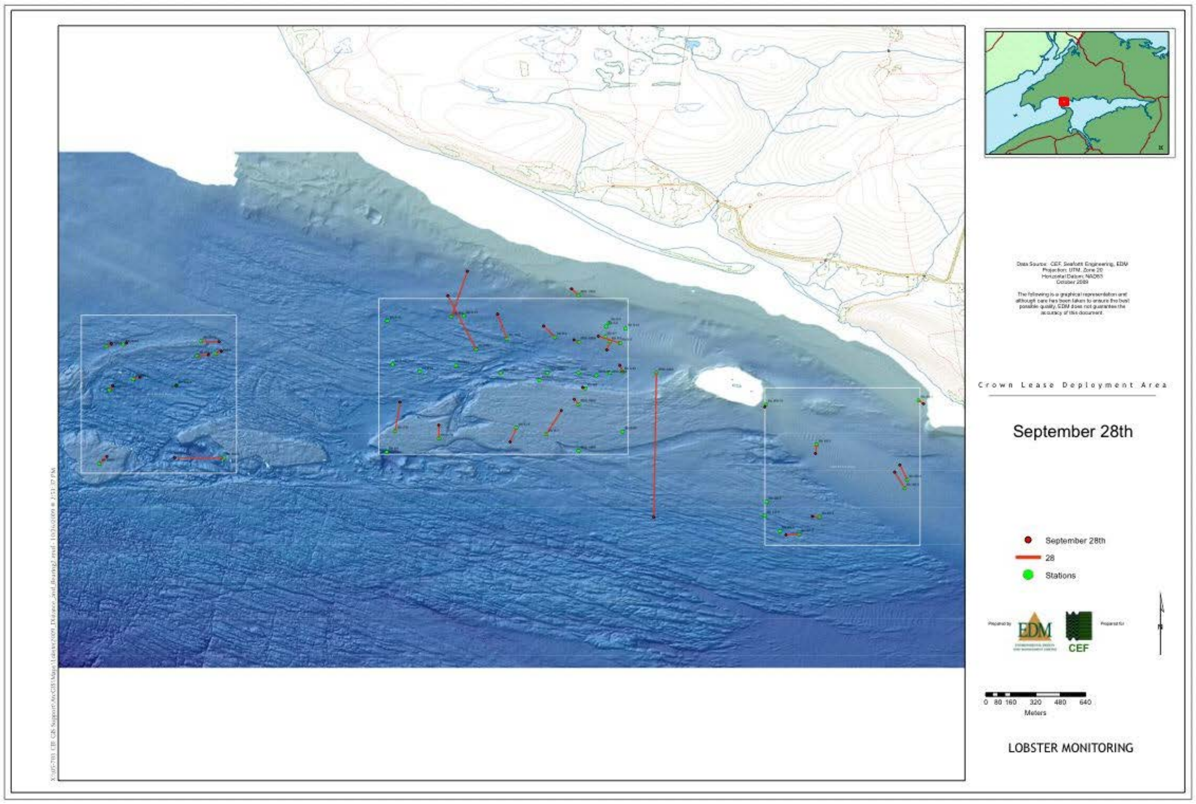


**Figure 3-2: Location of Trap Haul Compared to Set Location for September 28, 2009**

In the second survey, traps were set in pairs separated by 60 m of line in an attempt to reduce this movement. The pairing of traps provided better replication in the sets and increased efficiency in the survey, but trap movement was similar with an average shift of 135 m between set and haul locations. The movement between setting and hauling of traps may have been greater if traps had not been set in pairs because more time elapsed between the setting and hauling of traps in the second survey. In addition, tidal amplitude was higher during the second survey, potentially increasing the strength of bottom currents.

The direction of trap movement was sporadic even though tide runs in a general east-west direction through Minas Channel. Table 3-9 summarizes the percent of movement in different directions for the two surveys.

**Table 3-9: Proportion of Traps Moved by Direction in Each Survey**

| Survey | Northeast to Southeast | Southeast to Southwest | Southwest to Northwest | Northwest to Northeast |
|---|---|---|---|---|
| First | 25.0% | 25.8% | 33.3% | 15.9% |
| Second | 21.9% | 32.9% | 39.7% | 5.5% |

The most prevalent directions of trap movement were to the west and south. The least frequent direction of movement was to the north, towards shallower water along the coast. The pattern of movement was similar between both surveys.

## 3.4 Water Temperature

Bottom water temperature ranged from 14.4° to 16.1°C during the first survey and 10.0° to 11.1°C during the second survey. Very little temperature variation was observed as was expected as a result of the strong tidal mixing. Normally the bottom temperature closely matched the temperature indicated on the fishing vessel's sounder. However, one day during the November survey the vessel transducer indicated a surface temperature of 16°C compared to a bottom temperature of 10°C, indicating that at times more variation in temperature can occur in these waters.

## 3.5 By-Catch

By-catch was relatively uncommon, variable and different between the first and second surveys. During the first survey by-catch consisted of dogfish, tomcod, sculpin and rock crab. In the second survey more tomcod were caught, along with a few sculpin and rock crab, one cunner, one hermit crab, but no dogfish.

## 3.6 Trap Damage

In the first survey, trap damage was only obvious on one trap (Photo 3-4). The vinyl-coated wire was abraded in spots and bent along edges and on the top of the trap. The damage indicated the trap may be been tumbled by the current or hit against a rock.

**Photo 3-4: Minor Trap Damage, Survey 1**

Trap damage was more extensive during the November survey (Photo 3-5) and more traps were lost. The most damage resulted in a trap compressed to about half its original height on one side. However, trap damage did not appear sufficient to affect catch rates or allow escape from the trap.

**Photo 3-5: Survey 2 Trap Damage**

Tidal amplitude was generally higher during the second survey, increasing currents, and weather conditions were less ideal for fishing. Repair, including addition of vertical risers will be required in a number of traps before the next survey. Consideration will also need to be given to replacing the rope used to connect buoys and traps to reduce future trap loss.

# 4 ANALYSIS

## 4.1 Distribution by Size

For analysis, lobsters were divided into four size classes based on carapace length (CL). The smallest size group, less than 6.6 cm carapace length, represents juvenile lobster that won't recruit to the fishery for a number of years. The next size group, between 6.6 cm and 8.25 cm represents lobster that will enter the commercial fishery in a year or a few years. Market size lobster, those greater than 8.25 cm were divided into two size groups at 10 cm to separate the larger, older lobster from those closer to market size.

Distribution maps are presented for each size group of lobster in Figures 4-1 to 4-4. Data from the two surveys are indicated in different colours to allow potential seasonal trends to be identified.

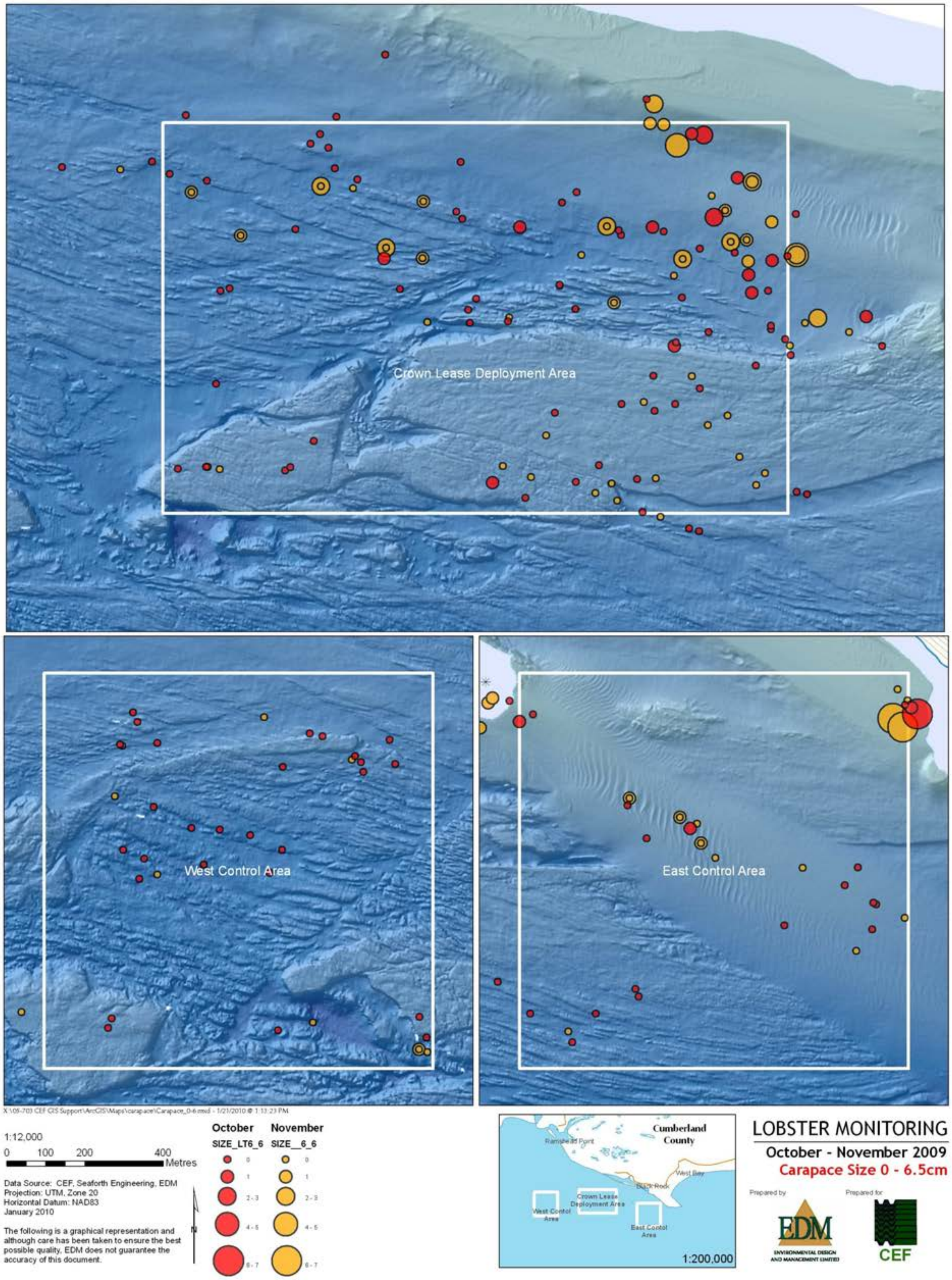


**Figure 4-1: Catch Distribution for Small Lobster (<6.6 cm CL) by Survey**

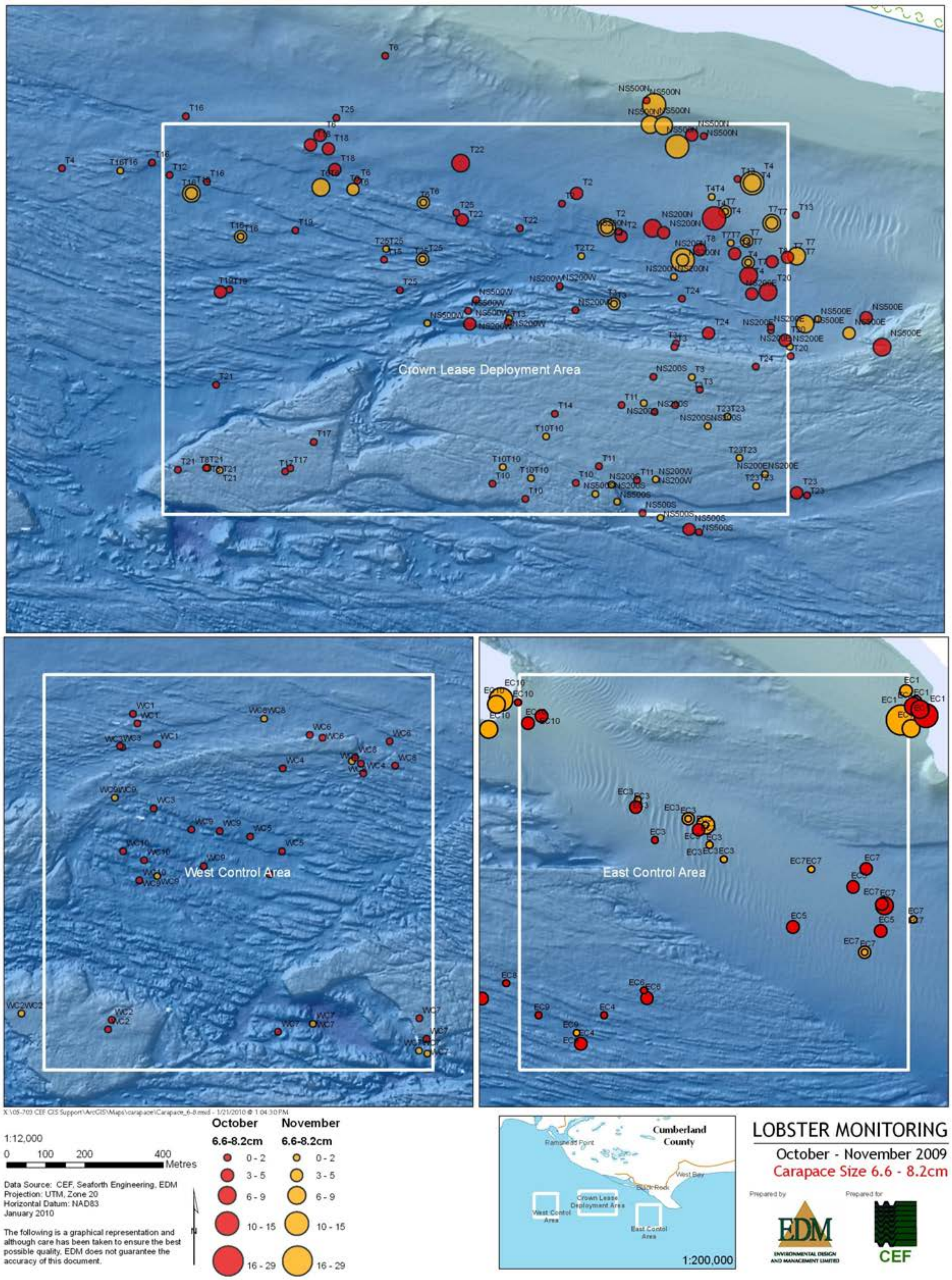


**Figure 4-2: Catch Distribution for Near Market Size Lobster (≥6.6 and <8.25 cm CL) by Survey**

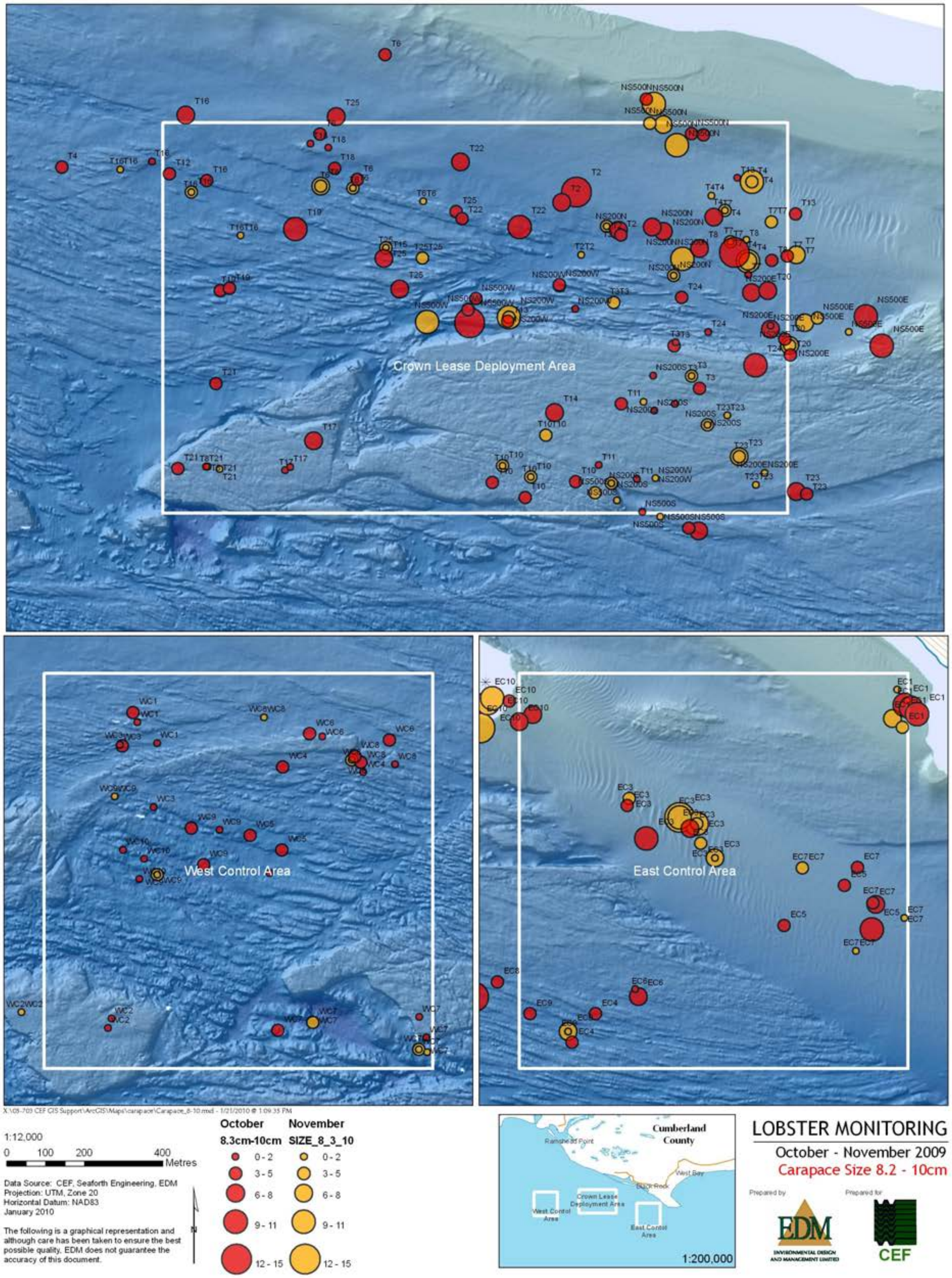


**Figure 4-3: Catch Distribution for Market Size Lobster (≥8.25 and ≤10 cm CL) by Survey**

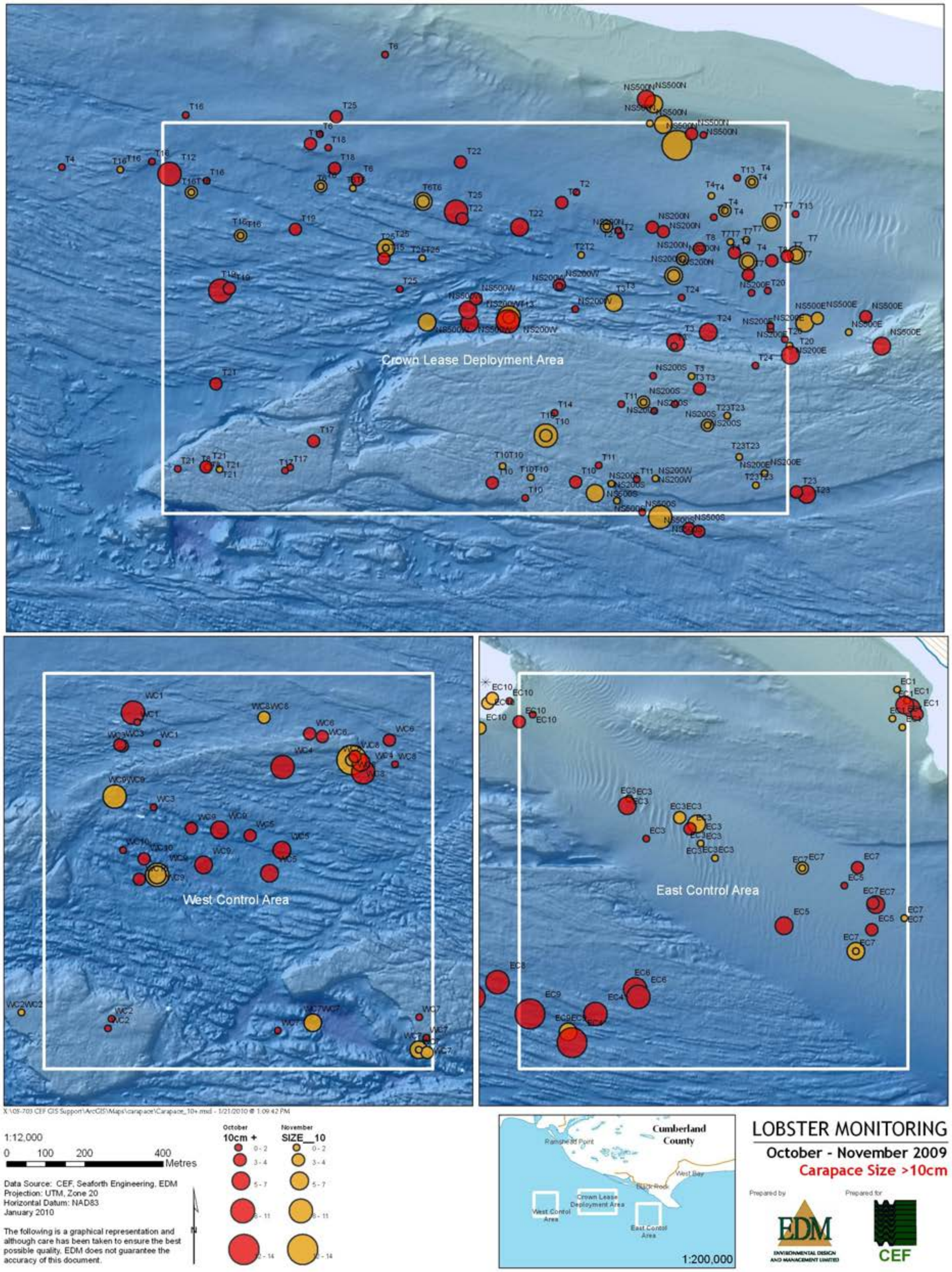


**Figure 4-4: Catch Distribution for Large Lobster (>10 cm CL) by Survey**

In the first survey, 1070 lobsters, or 77.1% of the catch, were market size (>8.25 cm carapace length). In the second survey, 762 of the lobsters or 67.1% were market size.

The distribution of all size groups of lobster remained consistent in both surveys. Under market-size lobsters were found closer to shore than larger lobsters. Market-size lobsters were the most evenly distributed of all size groups throughout test and control areas. Larger lobster were less abundant in shallower waters and more predominant in the Western Control Area.

The commercial fishery had little effect on the where lobster of different sizes were found within test or control areas. The greatest drop in catch from Survey 1 to Survey 2 occurred within the Eastern Control Area in market-size lobster. This area coincides with the area believed to be most heavily fished commercially of the three areas surveyed.

Comparison of the size distributions suggests that the two control areas together represent similar size distributions of lobster to the test area prior to deployment of turbines. In addition, the Western Control Area appears less influenced by commercial fishing than the Test Area, whereas the Eastern Control Area is more affected.

## 4.2 Distribution by Sex

Male lobster made up 55.1% in the first survey and 41.1% of the catch in the second survey. Most berried females were market size or greater. Almost double the number of the females were berried in the second survey with 67 or 10.3% berried compared to 5.6% in the first survey. Two of the females in the second survey may have had less than a full complement of eggs.

The distribution of lobsters by sex and egg presence are shown for all sizes by survey in Figures 4-5 and 4-6. The distribution of sexes and location of berried females remained similar during both surveys suggesting higher proportion of males were taken by the commercial fishery. Since berried females cannot be retained in the commercial fishery, removal of more males than females would be expected.

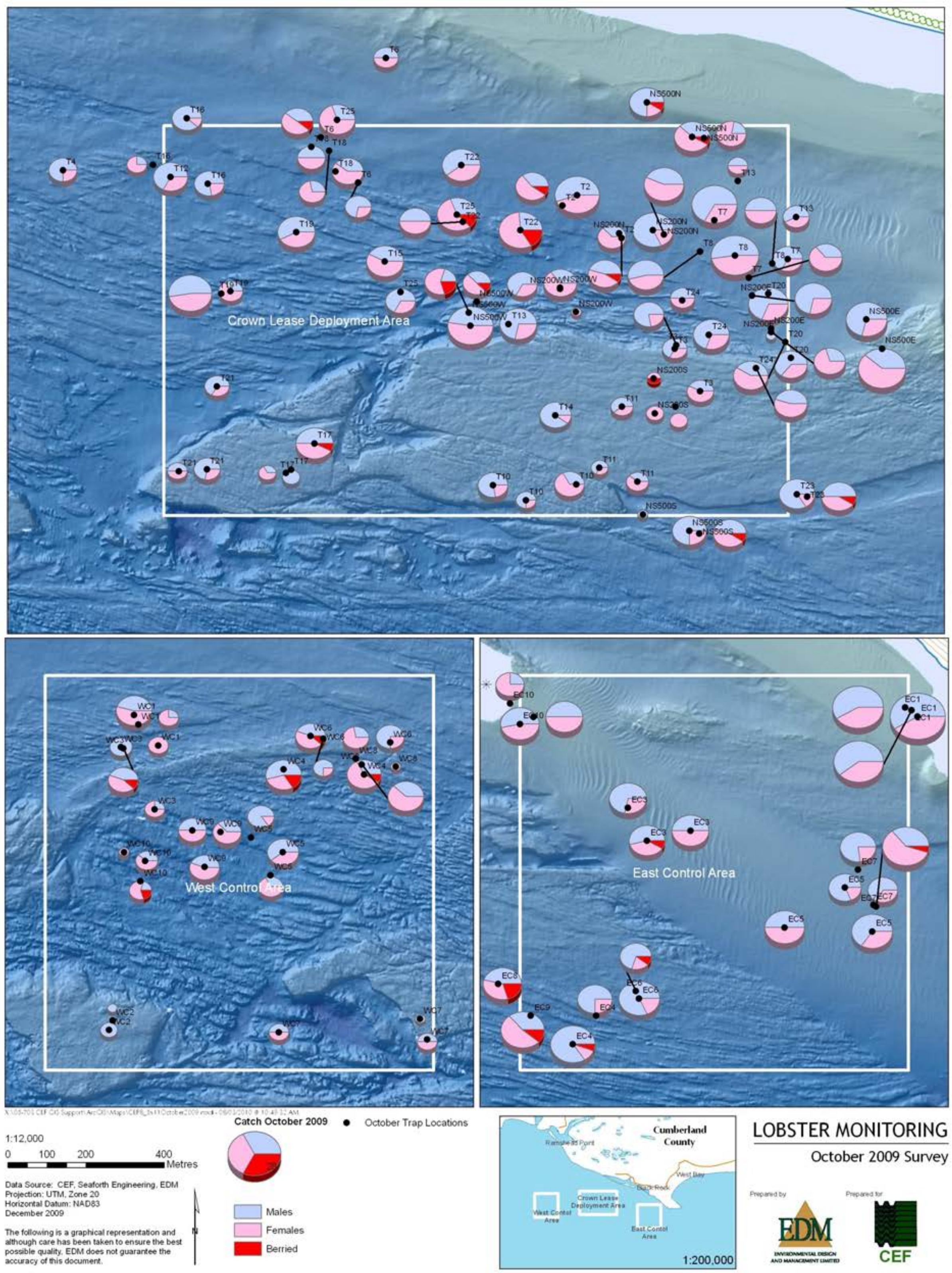


**Figure 4-5: Distribution of Catch by Sex and Berried Lobster During Survey 1**

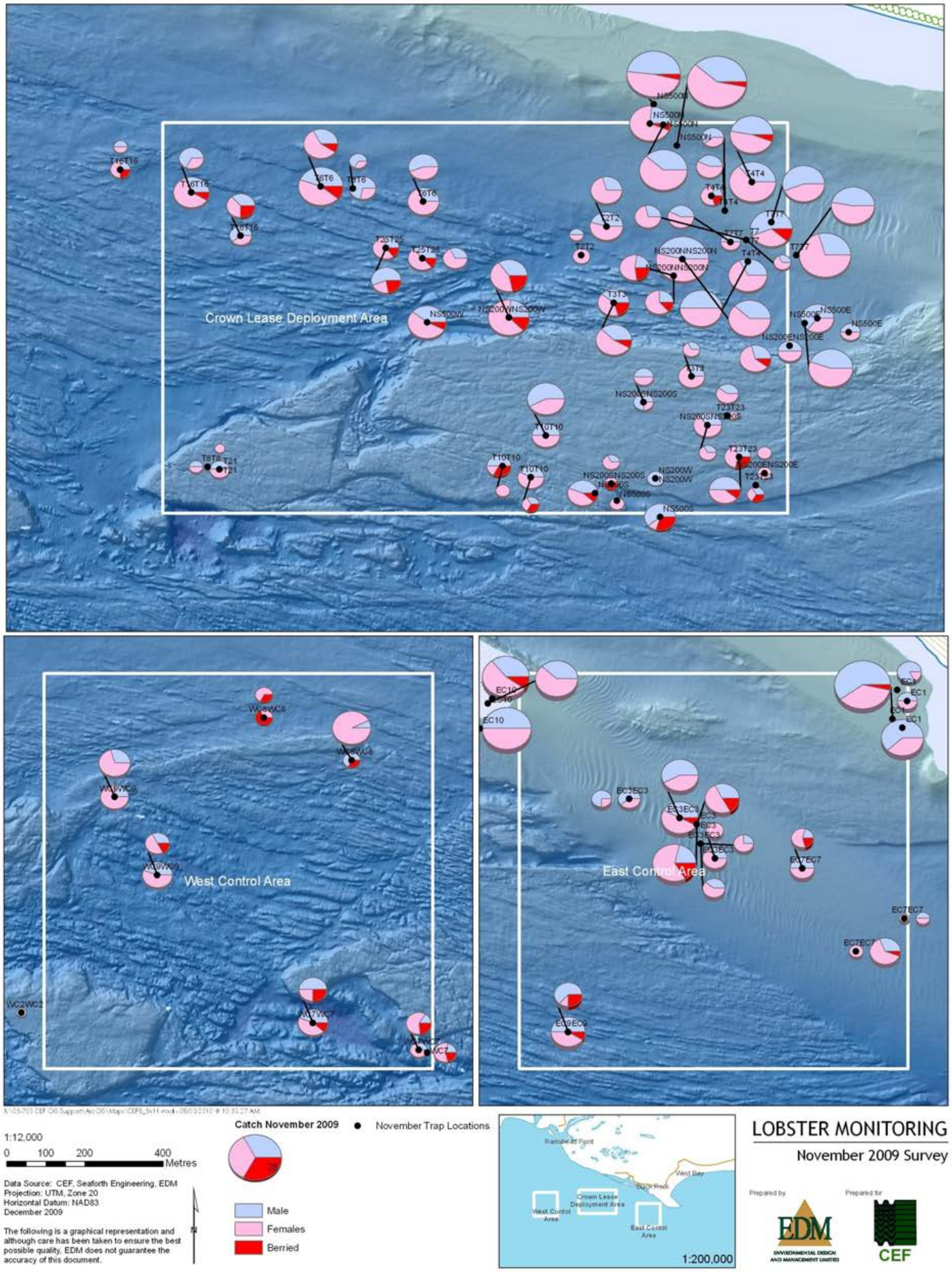


**Figure 4-6: Distribution of Catch by Sex and Berried Lobster During Survey 2**

## 4.3 NSPI Stations

Eight stations were established around the proposed deployment location for the NSPI turbine. Stations were set at 200 m and 500 m along each cardinal direction. The deployment site was adjusted by about 200 m at installation and once the turbine was in place a *safety zone* of 300 m was established. This required shifting the location of the original 200 m stations. Only one set of data was collected following turbine installation. The 500 m stations were maintained in the same location throughout the study for continuity.

Figures 4-7 and 4-8 illustrate the average catch in the NSPI traps from north to south and east to west, respectively. Average catch increased between surveys in some cases and decreased in others. The largest increase between Survey 1 and 2 was at station NS500N (Figure 4-7) where numbers increased in all size classes even though this was an area where commercial fishing was expected. At the same time, a similar decrease between surveys occurred at station NS500 E and NS200E (Figure 4-8), closer to Black Rock, also an area where heavier commercial fishing would be expected. The biggest decrease in catch at the two eastern stations was in market-size lobster. A relatively consistent change in the catch of small lobster, less than market size and particularly less than 6.6 cm (CL), was observed between surveys in north to south and east to west directions. The catch of small lobster increased between surveys at north to south stations, but decreased at east to west stations.

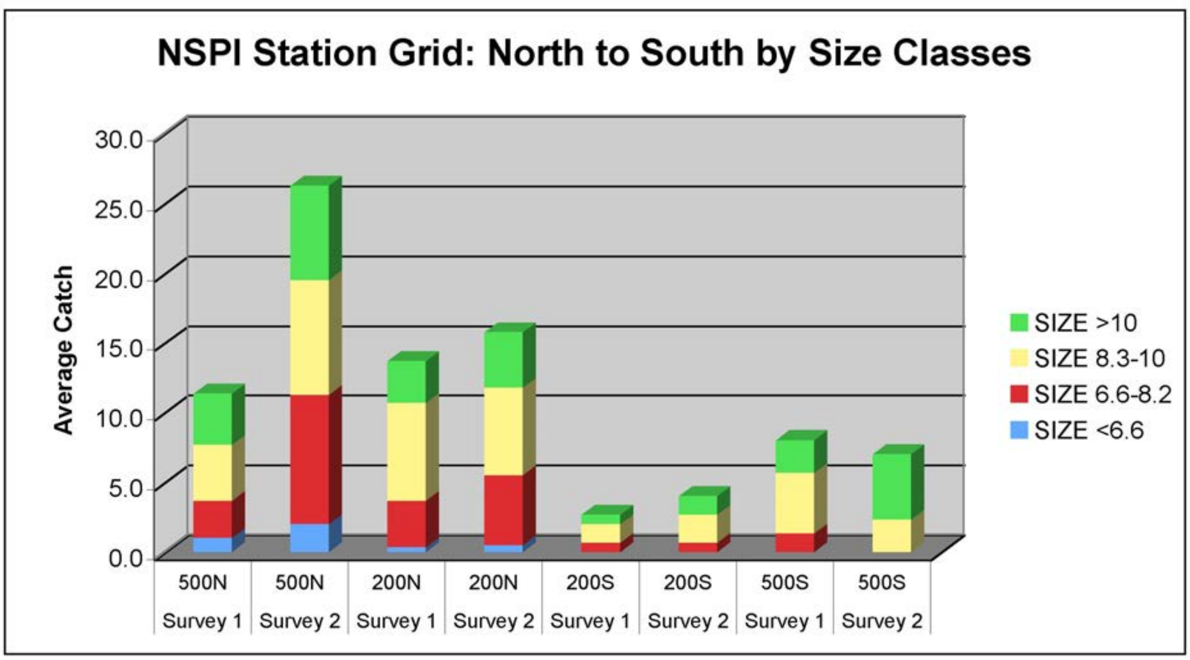


**Figure 4-7: Average Catch in NSPI Traps from North to South by Size Class**

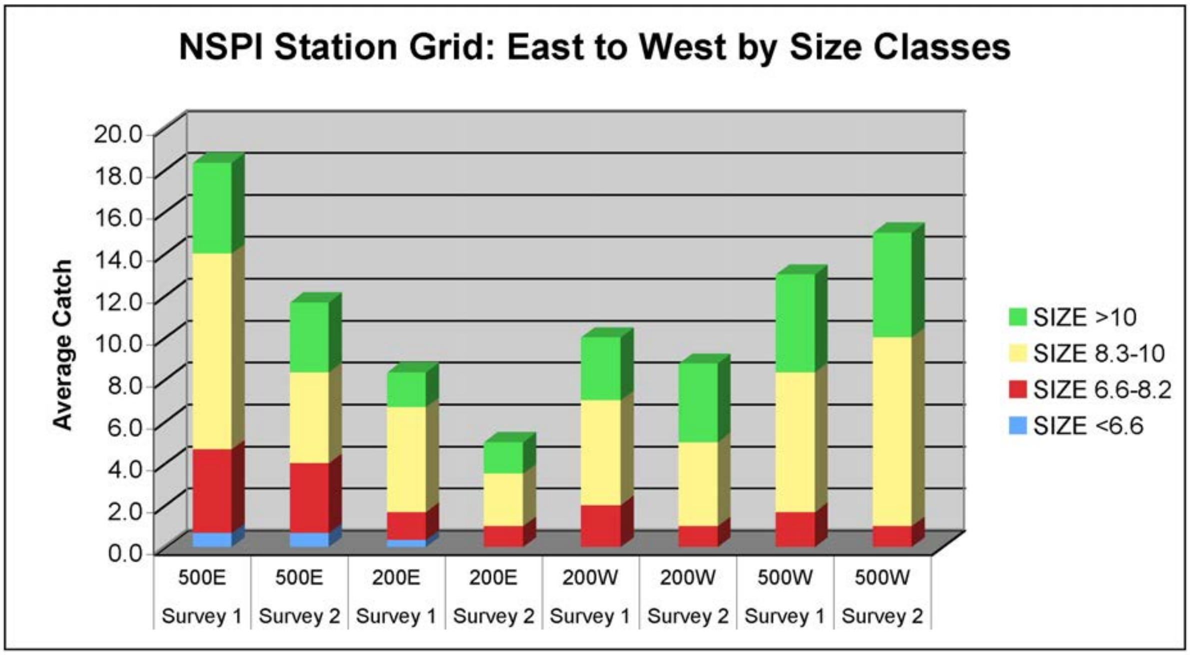


**Figure 4-8: Average Catch in NSPI Traps from East to West by Size Class**

Average catch also tended to decrease towards the deployment site, suggesting that the site may be less important than surrounding areas in terms of lobster habitat and particularly juvenile habitat.

Only one dataset was obtained after installation of the NSPI turbine (see Table 3-5) making it impossible to determine trends in catch following installation. These data showed a decline in catch from previous trap hauls during the same survey, but the decline was similar to that found at other stations during the same period. Only one trap at the NSPI stations did not contain lobster. If there was an effect from installation and operation of the turbine, it was insufficient to cause all lobster to leave the vicinity or result in discernable changes in distribution. Additional surveys will be required to clarify if there was an effect and its magnitude, but good baseline has been established for comparison with future results.

## 4.4 Effect of Soak Time

A significant linear correlation ($p=0.025$, $R^2=0.019$) was found between numbers caught and soak time when all data were combined from both surveys, but not with the first survey data alone ($p=0.303$, $R^2=0.008$). A second order polynomial regression explained a larger amount of variation in catch during the second survey ($p<0.001$, $R^2=0.139$) than a simple linear regression ($p=0.012$, $R^2=0.050$). Catch appeared to begin decline after a soak time of between 15 and 20 tides, 4 or 5 days.

## 4.5 Effect of Depth

Depth was an important variable influencing catch rates. Results of linear regression on numbers per trap within size group by depth are summarized in Table 4-1. A significant ($p<0.05$) correlation exists between catch and depth within all size classes. However, as indicated by the regression slope, catch increases with decreasing depth for the three smaller size groups and increases with increasing depth for the largest, lobster >10 cm CL

**Table 4-1: Results of Linear Regression of Catch within Size Groups by Depth**

| | Size Group (cm Carapace Length) | | | |
|---|---|---|---|---|
| **Statistic/Probability** | **<6.6 cm** | **6.6 – 8.2 cm** | **8.3 – 10 cm** | **>10 cm** |
| R | 0.37 | 0.42 | 0.159 | 0.162 |
| Regression Slope | 0.033 | 0.109 | 0.045 | -0.042 |
| Adjusted $R^2$ | 0.134 | 0.173 | 0.022 | 0.022 |
| Probability (p) | <0.001 | <0.001 | 0.011 | 0.009 |

As indicated by the $R^2$, the relationship between depth and size group is strongest for lobster less than market size, possibly indicating stronger habitat preferences.

## 4.6 Comparison of Catch by Area

Comparison of the variance between sets within test and control areas is the primary test to determine possible effects from turbine installation or operation. Table 4-2 summarizes the means and variance for the test, control and NSPI stations during the two surveys and both surveys combined.

**Table 4-2: Mean and Variance by Set for Test and Control Areas by Survey**

| Parameter | Area | First Survey | Second Survey | Surveys Combined |
|---|---|---|---|---|
| Mean | Eastern Control | 16.74 | 10.50 | 13.43 |
| | Western Control | 6.36 | 6.00 | 6.23 |
| | Test | 10.12 | 8.13 | 9.13 |
| | NSPI | 10.29 | 10.93 | 10.64 |
| Variance | Eastern Control | 34.93 | 64.98 | 59.75 |
| | Western Control | 13.79 | 15.86 | 14.18 |
| | Test | 22.25 | 38.33 | 30.96 |
| | NSPI | 39.00 | 87.35 | 64.39 |

In both surveys, the mean catch for the Eastern Control Area traps was higher than that for the Test and NSPI traps, and the mean catch for the Western Control Area traps was lower (Table 4-2). These differences were consistent over time and are presumed to reflect the differences in habitat.

The variation was higher in the second survey than in the first and consistently highest in the Eastern Control Area and NSPI traps (Table 4-2). The higher variance in the second survey may have been due to the high tides and longer soak times, but also may be due to greater impact of the commercial fishery in some areas compared to others.

The least difference in catch was between the NSPI and Test Area traps in the first survey (mean difference = 0.17 lobster) and between the NSPI and Eastern Control Area traps in the second survey (mean difference = 0.43) lobster. The difference between the two surveys could have been due to changes in environmental conditions or an effect of the commercial fishery; it is believed the commercial fishery sets traps more frequently near Black Rock, which is closer to parts of the NSPI and Eastern Control areas.

The mean catch between control and test areas was compared to see if the difference was significant when the control areas were combined. Analysis was carried out with NSPI traps considered as part of the Test A rea and also with NSPI data excluded from the analysis. No significant difference ($p<0.05$) was found in the mean catch between test and control areas whether NSPI stations were included as Test Area stations or not (Table 4-3).

**Table 4-3: Comparison of Means Between Test and Control Areas by Survey**

| Parameter | Area | First Survey | Second Survey | Surveys Combined |
|---|---|---|---|---|
| Mean | Control Areas | 11.04 | 8.885 | 10.07 |
| | Test Area Only | 10.12 | 8.13 | 9.13 |
| | Test & NSPI | 10.17 | 9.08 | 9.61 |
| Probability Difference = 0 | Control versus Test | p=0.43 | p=0.59 | p=0.29 |
| | Control versus Test & NSPI | p=0.42 | p=0.87 | p=.61 |

The variance for the combined Control Areas was very similar between surveys – the variance was 50.04 in the first survey and 50.98 in the second. The variance in the Test Area, however, differed markedly, especially when the NSPI stations were included, increasing from 26.80 in the first survey to 56.00 in the second.

Analysis of Variance was used to compare catch rates within the test and control areas (Table 4-4. Analysis was carried with NSPI traps excluded from the analysis.

**Table 4-4: Analysis of Variance Between Test and Control Areas by Survey**

| Parameter | First Survey | Second Survey | Surveys Combined |
|---|---|---|---|
| Mean Square | 22.61 | 12.57 | 44.10 |
| Residual | 35.36 | 43.66 | 39.98 |
| Probability | p=0.43 | p=0.59 | p=0.29 |

In no case, including if NSPI stations were included as Test Area stations, was a significant difference ($p<0.05$) in variance found when catches in test and control areas were compared.

# 5 CONCLUSIONS

The second survey was more efficient in terms of the number of replicate samples obtained within the survey time available. The distribution of lobster by size was similar to that seen during the first survey, with smaller lobster found closer to shore and larger lobster caught in deeper water. More berried females were caught in November than in September/October. Traps set in pairs tended to remain on station better than the single traps fished in the first survey.

Injuries observed in trapped lobster included damaged and missing claws, broken rostrums or beaks, and broken carapace shells or tail segments. The high proportion of broken rostrums seemed particular to the Bay of Fundy and may be related to the high currents present. The proportion of lobster with missing claws or shell damage was higher in the second survey, but clearly not related to installation or operation of the NSPI turbine.

Catch over the last few days of the November survey may have reflected the beginning of a seasonal decline in lobster abundance but insufficient data were available to predict a reliable trend. Croyden Wood Jr., the fisher who helped carry out the survey, reported his catches in other areas also began to drop at this time. In previous meetings, fishers from the area had indicated that lobster move out of the area late in the fall, about this time of year.

One set of data was collected following installation and operation of the NSPI turbine. Any effect from installation and operation of the turbine was insufficient to cause all lobster to leave the vicinity or cause discernable changes in lobster distributions. Additional surveys will be required to clarify if there was an effect and its magnitude, but good baseline has been established for comparison with future survey results.

Based on analysis of catch data, the two control areas when considered together appear to adequately reflect the types of habitat and lobster distributions within the test area. Continued collection of information on lobster catchability from these areas will allow comparison over time between test and control areas for evaluating potential effects of turbine installation and operation.

# APPENDIX A - Original Station Positions

**Minas Channel Stations Ordered by Station Number**

| Station | Lat (Deg,min,sec) | | | Long (Deg,min,sec) | | | Depth LLWLT (ft) |
|---|---|---|---|---|---|---|---|
| Stn T-1 | 45 | 22 | 6.66 | -64 | 25 | 21.16 | -95.39 |
| Stn T-2 | 45 | 22 | 6.43 | -64 | 25 | 35.98 | -132.53 |
| Stn T-3 | 45 | 21 | 55.95 | -64 | 25 | 26.70 | -106.79 |
| Stn T-4 | 45 | 22 | 9.62 | -64 | 25 | 20.06 | -91.47 |
| Stn T-5 | 45 | 22 | 8.80 | -64 | 25 | 20.93 | -91.24 |
| Stn T-6 | 45 | 22 | 10.31 | -64 | 26 | 6.54 | -151.30 |
| Stn T-7 | 45 | 22 | 5.46 | -64 | 25 | 16.76 | -87.94 |
| Stn T-8 | 45 | 22 | 5.64 | -64 | 25 | 19.82 | -99.61 |
| Stn T-9 | 45 | 21 | 41.95 | -64 | 26 | 24.93 | -214.87 |
| Stn T-10 | 45 | 21 | 47.43 | -64 | 25 | 46.88 | -101.31 |
| Stn T-11 | 45 | 21 | 46.23 | -64 | 25 | 38.01 | -100.99 |
| Stn T-12 | 45 | 22 | 0.14 | -64 | 26 | 23.65 | -154.07 |
| Stn T-13 | 45 | 22 | 8.49 | -64 | 25 | 15.21 | -85.78 |
| Stn T-14 | 45 | 21 | 57.37 | -64 | 25 | 40.26 | -120.78 |
| Stn T-15 | 45 | 22 | 0.13 | -64 | 26 | 4.97 | -150.08 |
| Stn T-16 | 45 | 22 | 9.17 | -64 | 26 | 25.43 | -160.18 |
| Stn T-17 | 45 | 21 | 44.95 | -64 | 26 | 9.56 | -109.81 |
| Stn T-18 | 45 | 22 | 10.52 | -64 | 26 | 2.87 | -141.98 |
| Stn T-19 | 45 | 21 | 58.74 | -64 | 26 | 15.64 | -156.88 |
| Stn T-20 | 45 | 21 | 59.46 | -64 | 25 | 15.92 | -124.02 |
| Stn T-21 | 45 | 21 | 46.39 | -64 | 26 | 22.53 | -108.01 |
| Stn T-22 | 45 | 22 | 5.93 | -64 | 25 | 50.13 | -146.52 |
| Stn T-23 | 45 | 21 | 47.07 | -64 | 25 | 15.48 | -99.74 |
| Stn T-24 | 45 | 21 | 58.67 | -64 | 25 | 23.56 | -136.15 |
| Stn T-25 | 45 | 22 | 3.63 | -64 | 25 | 59.14 | -151.94 |
| Stn WC-1 | 45 | 22 | 3.30 | -64 | 27 | 43.14 | -154.76 |
| Stn WC-2 | 45 | 21 | 38.46 | -64 | 27 | 49.56 | -122.38 |
| Stn WC-3 | 45 | 22 | 2.86 | -64 | 27 | 48.08 | -157.98 |
| Stn WC-4 | 45 | 22 | 1.18 | -64 | 27 | 21.32 | -152.74 |
| Stn WC-5 | 45 | 21 | 54.93 | -64 | 27 | 27.29 | -175.60 |
| Stn WC-6 | 45 | 22 | 4.29 | -64 | 27 | 20.22 | -121.06 |
| Stn WC-7 | 45 | 21 | 40.17 | -64 | 27 | 12.85 | -161.56 |
| Stn WC-8 | 45 | 22 | 1.74 | -64 | 27 | 15.81 | -145.27 |
| Stn WC-9 | 45 | 21 | 56.13 | -64 | 27 | 39.98 | -164.98 |
| Stn WC-10 | 45 | 21 | 53.81 | -64 | 27 | 47.01 | -173.30 |

| Station | Lat (Deg,min,sec) | | | Long (Deg,min,sec) | | | Depth LLWLT (ft) |
|---|---|---|---|---|---|---|---|
| Stn EC-1 | 45 | 21 | 54.63 | -64 | 23 | 48.37 | -18.17 |
| Stn EC-2 | 45 | 21 | 33.01 | -64 | 24 | 32.70 | -133.43 |
| Stn EC-3 | 45 | 21 | 45.08 | -64 | 24 | 18.26 | -79.99 |
| Stn EC-4 | 45 | 21 | 26.41 | -64 | 24 | 22.93 | -161.12 |
| Stn EC-5 | 45 | 21 | 36.34 | -64 | 23 | 52.04 | -102.87 |
| Stn EC-6 | 45 | 21 | 30.08 | -64 | 24 | 17.05 | -141.78 |
| Stn EC-7 | 45 | 21 | 38.07 | -64 | 23 | 51.38 | -99.63 |
| Stn EC-8 | 45 | 21 | 30.16 | -64 | 24 | 33.15 | -144.03 |
| Stn EC-9 | 45 | 21 | 27.00 | -64 | 24 | 28.58 | -163.02 |
| Stn WE-10 | 45 | 21 | 53.22 | -64 | 24 | 33.42 | -33.16 |
| NSPI (NO TRAP) | 45 | 21 | 59.07 | -64 | 25 | 28.82 | -138.11 |
| NSPI-200E | 45 | 21 | 59.18 | -64 | 25 | 19.62 | -125.50 |
| NSPI-200W | 45 | 21 | 58.95 | -64 | 25 | 38.01 | -141.11 |
| NSPI-500W | 45 | 21 | 58.78 | -64 | 25 | 51.79 | -146.21 |
| NSPI-500E | 45 | 21 | 59.35 | -64 | 25 | 5.84 | -101.49 |
| NSPI-200N | 45 | 22 | 5.55 | -64 | 25 | 28.98 | -124.29 |
| NSPI-500N | 45 | 22 | 15.27 | -64 | 25 | 29.22 | -45.05 |
| NSPI-200S | 45 | 21 | 52.59 | -64 | 25 | 28.65 | -94.61 |
| NSPI-500S | 45 | 21 | 42.87 | -64 | 25 | 28.41 | -128.93 |