

# **ROV Assessment of Rockfish Abundance, Distribution, and Habitat in Whatcom County Marine Waters.**

**Whatcom County Marine Resources Committee  
June 2008**



**Prepared By:**

**Trevor Grove and David H. Shull**



**WESTERN**  
WASHINGTON UNIVERSITY



**NORTHWEST STRAITS**  
MARINE CONSERVATION INITIATIVE

# **ROV Assessment of Rockfish Abundance, Distribution, and Habitat in Whatcom County Marine Waters**

## **Introduction**

Rockfish landings in Washington State are at 50-year lows (Palsson 1998, Dinnel et al. 2001). Fishing pressure in northern Puget Sound is largely responsible for declines in populations of rockfish and other bottom fish (Tuya et al. 2000). Rockfish populations are sensitive to over fishing in part because of their life histories. Rockfish are long-lived and mature slowly; copper rockfish, for example, do not reach sexual maturity until six to eight years of age, but can live for more than 50 years. Rockfish mate and bear live young and larger rockfish are significantly more fecund (Love 2002). Following reproduction, rockfish larvae remain in the water as plankton for several months. It is thought that starvation and predation are the primary sources of larval mortality (Berkeley, 2004). These traits make rockfish sensitive to fishing pressures since fishing tends to remove the most sexually productive fish and successful recruitment in a particular area may require a large regional supply of larvae (McConnell et al. 2001).

Rockfish are frequently caught as a by-catch when fishing for salmon or bottom fish. They are relatively easy to catch and when brought quickly to the surface from depths as shallow as 10 meters they can suffer damage to their swim bladders and die of barotrauma (Starr et al. 1999). For this reason traditional management strategies such as bag limits and fishing season restrictions are ineffective. Other promising management strategies for include habitat protection or no-take reserves that help to eliminate by-catch (Tuya et al. 2000, Eisenhart 2001). Rockfish, aptly named, are usually associated with rocky reef habitats, but different species of rockfish prefer different bottom types and

depth ranges (Love et al. 2002). In the Strait of Georgia, including Whatcom County, rockfish are primarily associated with high relief rock walls and boulder fields (Pacunski and Palsson 1998). Previous ROV surveys by Western Washington University students have identified Copper, Puget Sound, and Black rockfish (*Sebastes caurinus*, *S. emphaeus*, and *S. melanops*) inhabiting steep rock walls on the southwest portion of Lummi Island. Aside from these short surveys the size and abundance of rockfish in Whatcom County waters are not well documented. A 2002 study of the population structure and genetics of copper rockfish (*Sebastes caurinus*) found that while rockfish in the North Puget Sound region were not considered vulnerable due to a large census population estimate in the San Juan Islands in 1994, there may be evidence for a recent reduction in effective population size, possibly due to over-fishing (Buonaccorsi et al. 2002). This indicates the need for additional survey work needed to be done in this region to better determine the state of rockfish populations. The survey described in this report, supported by the Whatcom County Marine Resource Committee and the Northwest Straights Commission, is a preliminary step in assessing the abundance and spatial distribution of rockfish and critical habitat in Whatcom County. We expect the baseline data reported here will be important for assessing future changes in rockfish abundance and distribution, to determine whether rockfish populations in Whatcom County are declining or recovering, and for identifying locations of critical rockfish habitat that are worthy of conservation. To accomplish these goals we identified likely habitat based on bathymetry and reports of bottom type (Pacunski and Palsson 1998) and investigated these areas by use of an ROV.

## Methods

We assessed rockfish populations in Whatcom County marine waters by conducting surveys using a VideoRay Pro 3 XEGTO remotely operated vehicle (hereafter referred to as an ROV) equipped with 10-cm parallel lasers. Video was recorded onto DVD using a Sony VRD-MC3 DVD recorder to collect video transect data at locations throughout Whatcom county (Fig 1, & Appendix A). The R/V Zoea (WWU, Shannon Point Marine Center) was used as the survey platform. Potential survey locations were narrowed based on bathymetry and the underwater habitat survey of Pacunski and Palsson (1998). We focused our surveys on regions possessing relatively high relief and rocky substratum. The timing of the ROV surveys was chosen to correspond with long slack tides during the spring of 2008 in order to maximize visibility and ROV maneuverability. Data from five ROV transects from previous surveys on Lummi Island conducted by WWU students in the spring and fall of 2007 were also examined (Fig 2).

Specific transect locations were selected by identifying the steep bottom slopes using NOAA charts, and identifying rocky reef habitats based on the bottom-type survey (Pacunski and Palsson 1998). We also examined sites where visible shoreline morphology suggested rocky and high relief bottom offshore. The research vessel was operated without setting anchor, which made efficient use of time and allowed the boat to follow the ROV, keeping slack in the tether, extending the potential range and depth of a transect beyond the ca. 100-m length of the tether. The boat followed the ROV by comparing ROV depth readouts on the video feed to depth sounder readings on the Zoea's instruments. Dive length, depth and ROV maneuverability, however, were limited by current and wind. Even at slack tide, the areas surveyed experienced

moderately fast currents in the Strait of Georgia. Allowing the research vessel to drift with the ROV enabled us to keep tether length to a minimum, which reduced total drag on the tether on the ROV.

Bottom slopes were determined at survey sites by piloting the research vessel along the proposed transect route and taking GPS and depth sounder readings at 10 to 20 foot depth intervals until we reached the end of the proposed transect (Appendix B). This method of bottom slope determination was limited in some cases by the proximity of the shore or kelp beds. The vessel would then return to the deepest point of the transect and the ROV would be launched there, or at the deepest portion of the transect that was less than 50 m in depth. A compass bearing along the transect was taken to help guide the ROV up slope along the transect using the ROV's onboard electronic compass.

Video data including a digital display of magnetic heading and water depth (in meters) was imprinted onto the video image and recorded. Data were referenced by both "Elapsed dive time" which began as soon as the ROV reaches the bottom, and elapsed time on the video. In order to determine the area surveyed, observations of depth, screen width, and substrate were made at one minute intervals beginning with 0 minutes of elapsed dive time when the lasers on the bottom were visible and the ROV was oriented properly along the transect. If bottom conditions were not suitable for video at the start of the transect (i.e. bottom sediment stirred up, no strong slope apparent, etc.) then observations started after about 1 minute of elapsed dive time. Substrate composition was quantified using a habitat complexity index (Dinnel et al. 2003). This index assigns numerical values from 0 to 3 indicating the mean substrate particle size. A value of 0 was given to sand and mud, 1 for gravel, 2 for cobbles, and 3 for rock. Half values were

added for combination habitats, such as 2.5 for cobbles strewn with many large boulders, 1.5 for gravel scattered with rocks, and 0.5 for sand scattered with large cobbles and rocks. The 10-cm parallel lasers served three purposes. First, they were used to estimate the size of observed fish. The parallel lasers frequently did not land on the fish so the only way to estimate the size of the fish was to compare the size of the fish to an object the same distance from the ROV on the video screen. This object had to be painted with the lasers at some point either before or after the fish sighting to calculate its actual size and in turn provide an estimate of the fish length. Second, the lasers helped to estimate the size rocks, gravel, and shell on the substrate; this was essential in recording values for the habitat complexity index. Third, the lasers were used to calculate the width of the field of view at one-minute intervals. Given the measured bottom slope, we calculated the total length of our transects from the change in depth using the formula:  $L = \Delta d / \sin(\theta)$ , where L is transect length,  $\Delta d$  is the change in bottom depth, and  $\theta$  is the bottom slope. Total survey area was calculated as the product of transect length and width (determined using the parallel lasers). Survey area was not determined at transects at Point Roberts and some at Alden Bank where no suitable rockfish habitat was found.

## Results

ROV surveys were conducted in six general areas: South Beach Point Roberts, Alden Bank, Lummi Rocks, Lummi Island, Portage Island, and Eliza Island. A total of 39 video transects were surveyed, and video was recorded along 35 transects. An additional five video transects using the same ROV in 2007 were combined with this dataset for a total of 44 transects and greater than 300 minutes of bottom survey time. In

all the video transects we have collected thus far, we have observed Copper, Puget Sound, Yelloweye, Black, and Quillback rockfish (*Sebastes caurinus*, *S. emphaeus*, *S. ruberrimus*, *S. melanops*, and *S. maliger*). Our observations indicate that rockfish are strongly associated with steep rocky habitat (Fig 3, 4). Bottom slopes at sites possessing rockfish were steep. Few rockfish were observed in bottoms with a slope of less than 24 degrees and the highest number of rockfish was observed in an area with a bottom slope of 70 degrees. These habitats also possessed large boulders. In areas with low habitat complexity (below 1) we only observed flatfish and sculpins. The deepest depth surveyed was 64 m. Rockfish counts at sites ranged from 0 to 24 (Fig 5). Rockfish observed per minute of ROV bottom time ranged from 0 to 4, and rockfish densities ranged from 0 to 0.63 fish m<sup>-2</sup>.

#### *Observed habitat and rockfish abundance at different regions*

We observed no rockfish at Point Roberts. Majority of the habitat was flat and composed of sand and a few cobbles. The only significant bottom slope observed was calculated at 8 degrees. The rockiest habitat, found at the southernmost site at Point Roberts was a sandy bottom with 0.5 to 1-m diameter boulders. At two areas that had been classified as rock minor habitats by Pacunski and Palsson (1998) at the north end of Point Roberts we observed primarily sandy and relatively flat bottom.

We observed little rockfish habitat at Alden Bank. These sites were sandy, with occasional cobbles. The slope at most sites was between 5 and 11 degrees. However, there was a steep slope on the southern end of Alden Bank mentioned as a potential rockfish habitat by local divers. At 16 degrees, this area has the steepest slope on Alden

Bank judging by the NOAA charts. At this location we observed several juvenile Puget Sound rockfish (*S. emphaeus*) as well as some nearby rocky habitat. This was the shallowest slope that we observed to support rockfish in Whatcom County.

We observed more rockfish near Lummi Island than any other location in Whatcom County. The high relief walls and large boulders found near Lummi Rocks and northwest of Carter point held the highest population densities of rockfish. The steepest slopes averaged 70 degrees, and we frequently encountered sections of vertical wall during the ROV transects. Habitats here were also remarkably rocky, with maximum habitat complexity values. Observed rockfish densities dropped to zero in the region between Lummi Rocks and Carter Point along the west side of Lummi Island, where the bottom slope flattened and boulders were replaced by gravel and sand as the primary bottom type. The seafloor on the east side of Lummi Island and in area surveyed north of Eliza Island was primarily composed of sand and was shallower than the bottom west of Lummi Island. No rockfish were observed in these areas.

The habitat complexity index developed by Paul Dinnel and Andrew Weispenning (Dinnel et al. 2003) was useful for summarizing bottom type in the areas we surveyed. Our surveyed areas possessed a range of habitat complexities, from “zero” habitat complexity at Alden Bank to areas along the west side of Lummi Island which were scored as 3 (the maximum complexity). Ten different transects had habitat complexity indices of over 2.5, or rock dominant. Six transects were between 2.0 and 2.5, and were classified as rock minor. The remaining transects were classified as “sandy” or soft bottom with few or moderate numbers of cobbles. All but two transects with documented rockfish presence fell into the category of rock dominant (Fig 1, 2).

Bottom slope was correlated with rockfish abundance. All but one transect with rockfish present had a slope of over 20 degrees. Bottom slope and habitat complexity were also related; every bottom with a slope greater than 20 degrees also had a habitat complexity index of at least 2.0. We also noted that the amount of sediment visibly covering hard substrata appeared to be inversely related to bottom slope.

The depth distribution of Puget Sound rockfish peaked between 20m and 30m but the total depth range of this species documented in this survey was from 11.3m to 50.2m. The depth distribution of other rockfish ranged from 15m to 50.2m and there were many sightings between the 15m to 30m range (Fig7). However, the lower depth limit of rockfish in our surveys was likely due to changes in bottom type that occurred at the deepest portions of our transects rather than depth per se. On many deep dives at Lummi Island, even on exceptionally rocky transects, below 50 meters the bottom tended to level and transition into a bottom composed of sand or shell hash.

## **Discussion**

Rockfish abundance in Whatcom County is strongly associated with high-relief rocky-reef habitat. This is consistent with the findings of Love et al. (2002) and Pacunski and Palsson (1998). All rockfish sightings but one occurred in areas with bottom slopes greater than about 20 degrees, with most occurring at sites with slopes greater than 30 degrees. The habitats where rockfish were observed had several other features in common as well. Hard surfaces at sites occupied by Copper and Quillback rockfish in particular were comparatively devoid of sediment, which was observed to coat hard substrate surfaces in adjacent sites. The bottom was very complex at sites with high

densities of rockfish, possessing many holes, gaps and overhangs large enough to conceal a large rockfish. Because of this feature, our video transects could have underestimated rockfish abundance at the sites with highest rockfish densities.

Whereas the depth distribution of Puget Sound rockfish appeared to be roughly Gaussian or perhaps log-normal, peaking at a depth of approximately 25 m, the depth distribution of the other observed rockfish species showed greater variation. This could indicate a greater depth range by the other species, but it could be a consequence of low sample size. It appeared as though the only factor limiting the maximum depth of the other rockfish in the areas we surveyed was bottom type. During one especially deep investigation near Lummi rocks we found sand and large numbers of unbroken bivalve shells, not scattered about the bottom, but rather a huge pile at the base of the rocky reef composed of nothing but intact mollusk shells, approximately 8-cm across. We often observed the rocky reef to transition into a cobble bottom at depth.

While complex rocky reef habitat is generally accepted as prime rockfish habitat, other types of habitat are important for different life stages. As rockfish mature and increase in size they often move to steep reef habitat with caves and crevices that provide refuges (Love et al. 2002). Smaller fish can find cover on bottoms with less complexity and still avoid larger predators. This suggests that the rock minor areas we observed along Lummi Island, as well as the south point of Alden Bank and several spots around Point Roberts might be suitable habitat for juvenile rockfish or smaller species such as Puget Sound rockfish. Puget Sound rockfish was the only species found in habitats we characterized as rock minor.

One of the motivations for this survey was to assess whether Whatcom County possesses regions suitable for protection in order to help maintain or enhance rockfish populations. Marine reserves have been shown to be effective as a means of restoring populations suffering from over fishing (Baskett et al. 2006). The Edmonds Underwater Park is a marine reserve that has had tremendous success (Palsson and Pacunski 1995). The primary habitat for rockfish in Whatcom County, and hence the best candidate location for a marine reserve is clearly along the southwestern shore of Lummi Island extending northwest from Carter point, as well as the area surrounding Lummi Rocks. One unanswered question is whether rockfish populations in Whatcom County would increase if critical habitats were protected and fishing pressure were eased in these areas.

During Skagit County's assessment of rockfish populations in 8 candidate marine reserves by ROV (Dinnel et al. 2003), rockfish densities of up to 12.4 Puget Sound rockfish per minute of ROV dive time and up to 0.22 other rockfish per minute of ROV dive time were observed in areas with habitat complexity values similar to those found on Lummi Rocks. The maximum rockfish per minute of ROV dive time for the Whatcom County survey was 4 Puget Sound rockfish per minute and 1.16 other rockfish per minute. These numbers are not directly comparable because of differences travel velocity of the two different ROVs. But, the pattern suggests that Skagit County possesses relatively high densities of Puget Sound rockfish compared to Whatcom County. Comparing these the overall findings of the Dinnel et al. (2003) survey with ours indicates that there is more suitable rockfish habitat in Skagit County, especially near Hat Island and Burrows Island, compared to Whatcom County. There are also higher densities of Puget Sound rockfish in Skagit County. By comparison, the only area

surveyed that had a significant population of Puget Sound rockfish was near Carter Point. It is not clear why the available rockfish habitat in Whatcom County would have much lower Puget Sound rockfish densities compared to similar habitat in Skagit County. It is possible that the greater amount of habitat and larger rockfish populations in Skagit County provide a larger larval pool so that Skagit County habitats are not limited by recruitment to the same extent as habitats in Whatcom County. However, given the relatively long development times of planktonic rockfish larvae and the close proximity of Skagit and Whatcom Counties and San Juan County (which also has a relatively large rockfish populations), it is difficult to conclude that Puget Sound rockfish populations in Whatcom County experience more recruitment limitation than adjacent counties.

Although data on Puget Sound rockfish dispersal are limited, large genetic divergence between Copper rockfish populations in Puget Sound, in the Gulf Islands, and populations on the Pacific coast suggest relatively limited long-range larval dispersal (Buonaccorsi et al. 2002). Copper rockfish and other rockfish species living on high-relief rocky reefs have relatively small home ranges on the order of 10 to 30 m<sup>2</sup> (Love et al. 2002). This tends to limit adult migration once they have become established at a rocky reef (Lea et al. 1999). The relatively low densities of Puget Sound rockfish in Whatcom County could also be due to differences in habitat that were not readily observable by our survey methods. The other possibility is that rockfish habitat in Whatcom County is currently under populated suggesting that rockfish densities might increase in the future if the populations and critical habitat were protected.

The methods we used in this survey have limitations. All sites inspected had at least some degree of “marine snow” or settling particulate matter that hampered

visibility. Also, the ROV has limited peripheral vision. Because the ROV was flown relatively close enough to the bottom so that the lasers could be seen on the bottom and so that we could identify fish species, rockfish that remained more than a meter or so off the bottom might have escaped observation. We also occasionally observed rockfish that spotted the ROV to swim away and watch from a distance. It is not clear how this much kind of avoidance behavior might have biased our data. But, we believe we were able to observe rockfish before they exhibited avoidance behavior and thus this source of error is likely small.

### **Acknowledgements**

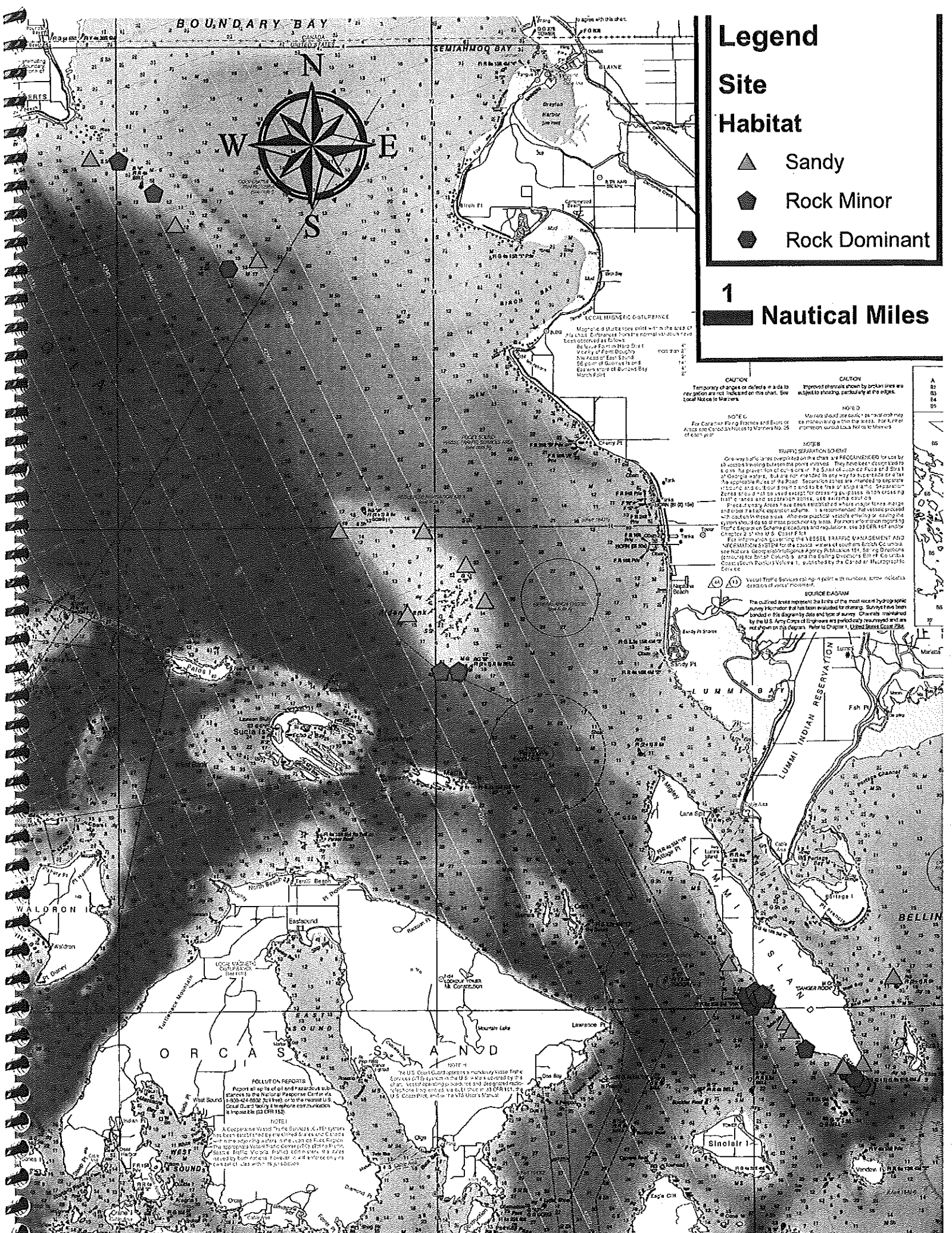
This research was supported by a grant from the Whatcom County Marine Resources Committee. We gratefully acknowledge the assistance of Nathan Schwark, skipper of the R/V Zoea and the director and staff of the Shannon Point Marine Center. We also thank Paul Dinnel for providing advice and resources.

## References

- Baskett, M.L., Yoklavich, M., and Love, M.S. 2006. Predation, competition, and the recovery of overexploited fish stocks in marine reserves. *Can. J. Fish. Aquat. Sci.* 63: 1214–1229.
- Berkeley, S., C. Chapman, and S. Sogard. 2004. Maternal age as a determinant of larval growth and survival in a marine fish, *Sebastes Melanops*. *Ecology* 85: 1258–1264.
- Buonaccorsi, V.P., Kimbrell, C.A., Lynn, E.A., and Russell D. Vetter, R.D. 2002. Population structure of copper rockfish (*Sebastes caurinus*) reflects postglacial colonization and contemporary patterns of larval dispersal. *Can. J. Fish. Aquat. Sci.* Vol. 59, 1374–1384.
- Dinnel, P, I. Dolph, J. Moorad, J. Robinette, D. Semrau, and M. McConnell. 2001. Potential for Marine Protected Areas for rocky reef bottomfish in Skagit County, Washington. Skagit County Marine Resources Committee. 8p.
- Dinnel, P., Weispfenning, A., Barsh, R., and Dolph, I. 2003. ROV Surveys of Deep Rocky Reef Habitats and Bottomfish at Eight Candidate Marine Reserve Sites in Skagit County, Washington. Skagit County Marine Resources Committee.
- Eisenhart, E. 2001. Effect of the San Juan Islands marine preserves on demographic patterns of nearshore rocky reef fish. Masters Thesis, University of Washington, Seattle, WA. 187p.
- Lea, R.N., McAllister, R.D., and VenTresca, D.A. 1999. Biological aspects of nearshore rockfishes of the genus *Sebastes* from Central California. *Calif. Dep. Fish Game Fish Bull.* 177: 1–109.
- Love, M., M. Yoklavich and L. Thorsteinson. 2002, *Rockfishes of the Northeast Pacific*. University of California Press.
- McConnell, M.L., P. Dinnel, J. Dolph, J. Robinette, and D. Semrau. 2001. Rocky reef bottomfish recovery in Skagit County: Phase 1 Final Report: Marine Protected Areas – Preliminary Assessment & Public Input, Skagit County Marine Resources Committee, WA. 77pp.
- Pacunski, R. and W. Palsson. 1998. The distribution and abundance of nearshore rocky-reef habitats and fishes in Puget Sound. *Puget Sound Research 1998*. Washington Department of Fish and Wildlife. pp. 545–554.
- Palsson, W. 1998. Monitoring the response of rockfishes to protected areas. Pp. 64– 73 in: *Marine Harvest Refugia for West Coast Rockfish: A workshop*. M.M.

- Palsson, W.A., and R.E. Pacunski. 1995. The response of rocky reef fishes to harvest refugia in Puget Sound. In: Puget Sound Research '95, Vol. 1, pages 224-234. Puget Sound Water Quality Authority, Olympia, WA.
- Starr, R.M., J.N. Heine, J.M. Felton, and G.M. Cailliet. 2002. Movements of bocaccio (*Sebastes paucispinis*) and greenspotted (*S. chlorostictus*) rockfishes in a Monterey submarine canyon: implications for the design of marine reserves. *Fishery Bulletin* 100:324-337.
- Tuya, F., M. Soboil, and J. Kido. 2000. An assessment of the effectiveness of Marine Protected Areas in the San Juan Islands, Washington, USA. *ICES Journal of Marine Sciences*. Vol. 57, pp.1218-1226.
- Ward, R.D., Woodwark, M., and Skibinski, D.O.F. 1994. A comparison of genetic diversity levels in marine, freshwater, and anadromous fish. *J. Fish Biol.* 44: 213-232.

Figure 1. Transect locations in Whatcom County. Bottom type is indicated by symbols.



# Legend

## Site

## Habitat

- ▲ Sandy
- ◆ Rock Minor
- Rock Dominant

# 1 Nautical Miles

**CAUTION**  
Temporary changes or defects in aids to navigation are not indicated on this chart. See Local Notices to Mariners.

**NOTE**  
For Canadian Flaring Practices and Rules of Access see Canadian Notices to Mariners No. 25 of each year.

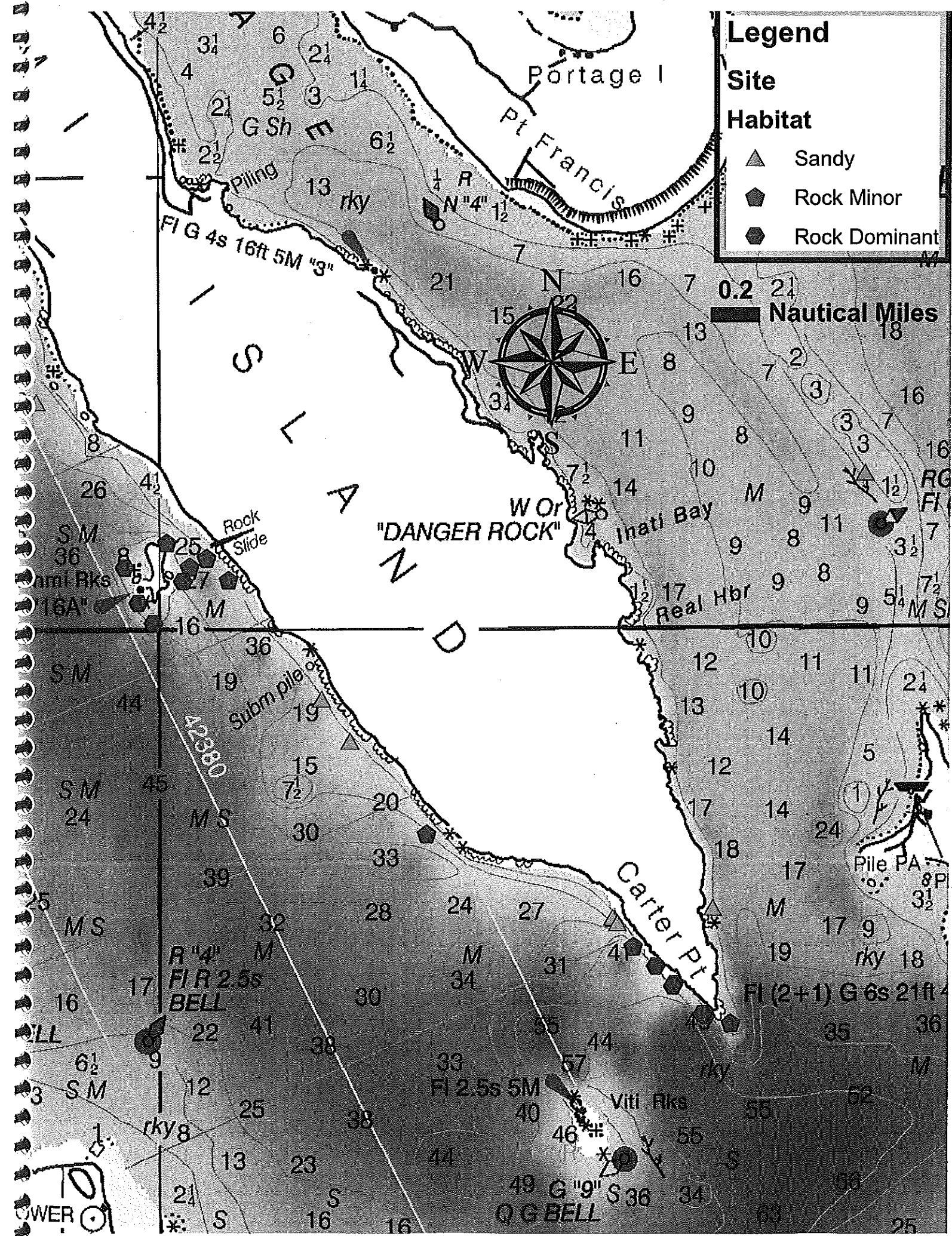
**CAUTION**  
Improved channels shown by broken lines are subject to shoaling, particularly at the edges.

**NOTE**  
Mariners should use caution as tidal currents may be misleading within the limits. For further information consult local tide tables.

**NOTES**  
**TRAFFIC SEPARATION SCHEME**  
One-way traffic is recommended on the chart as recommended by the IALA. The purpose of this scheme is to prevent collisions between ships. The purpose of this scheme is to prevent collisions between ships. The purpose of this scheme is to prevent collisions between ships.

**SOURCE DIAGRAM**  
The outlined areas represent the limits of the most recent hydrographic survey. The outlined areas represent the limits of the most recent hydrographic survey. The outlined areas represent the limits of the most recent hydrographic survey.

**Figure 2.** Transect locations on Lummi Island. Symbols represent different bottom types. Overlapping points represent multiple survey dates at a single location.



**Figure 3.** Relationship between rockfish abundance and bottom slope. Symbols represent bottom characteristics.

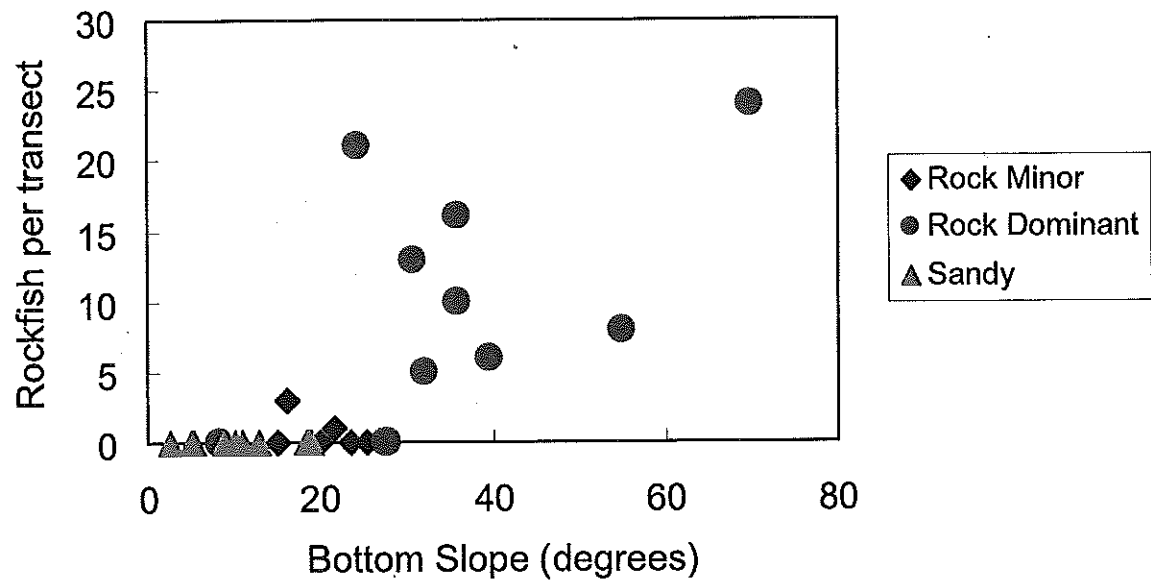


Figure 4. Relationship between rockfish abundance and habitat complexity index.

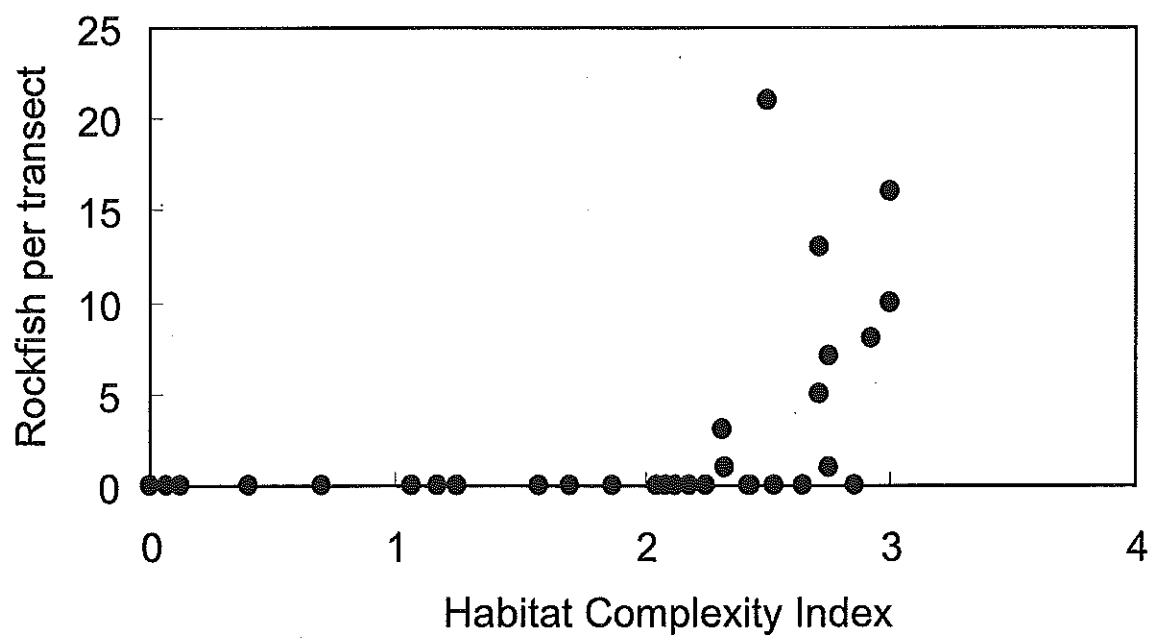


Figure 5. Rockfish counts at each surveyed location in Whatcom County

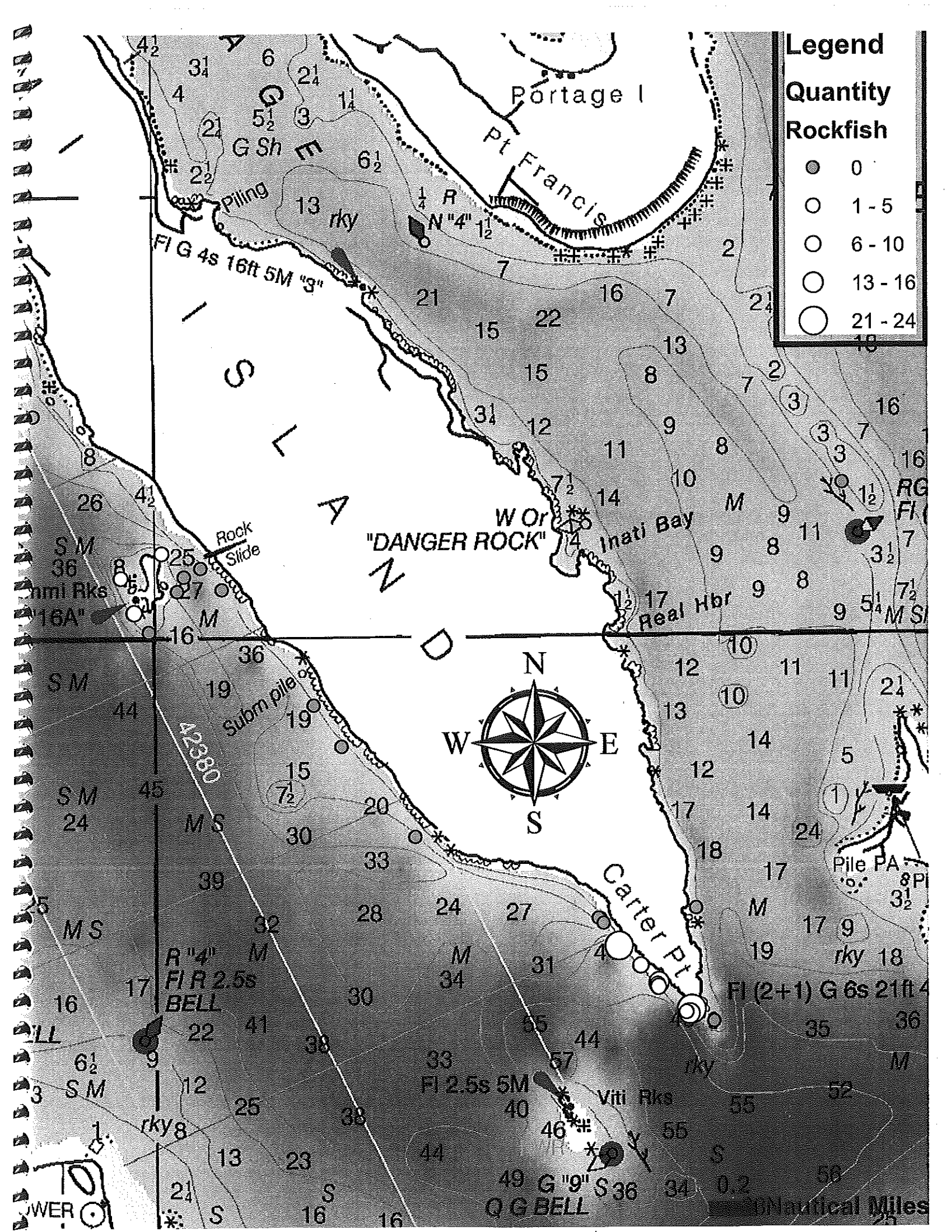
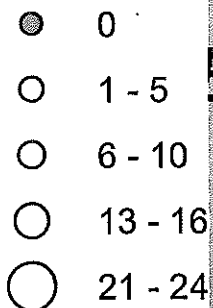


**Figure 6.** Rockfish counts per location near Lummi Island. Overlapping points represent multiple survey dates at a single location

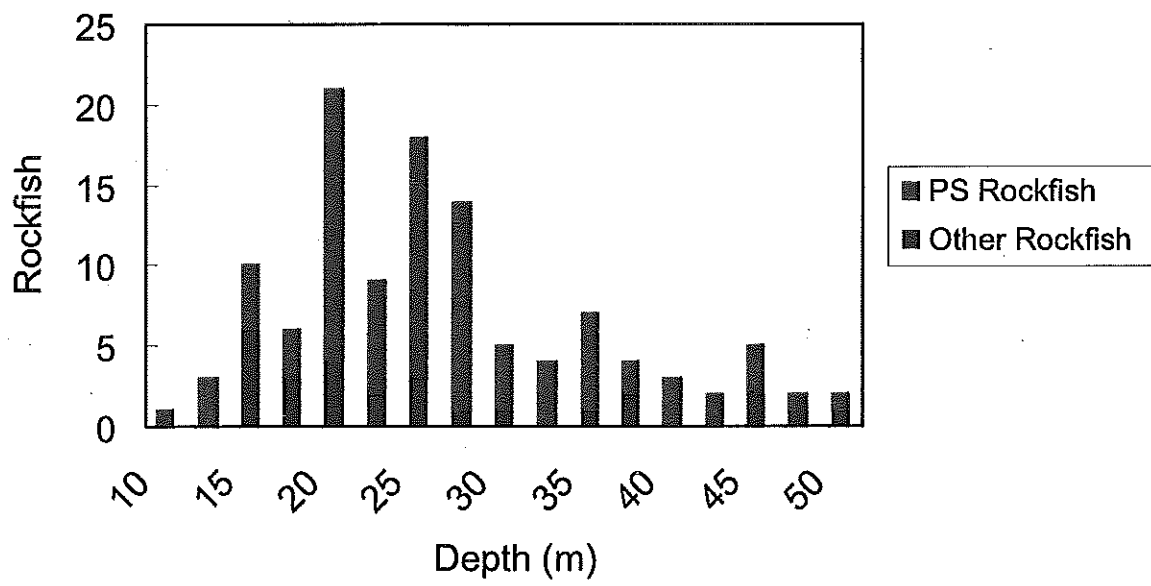
# Legend

## Quantity

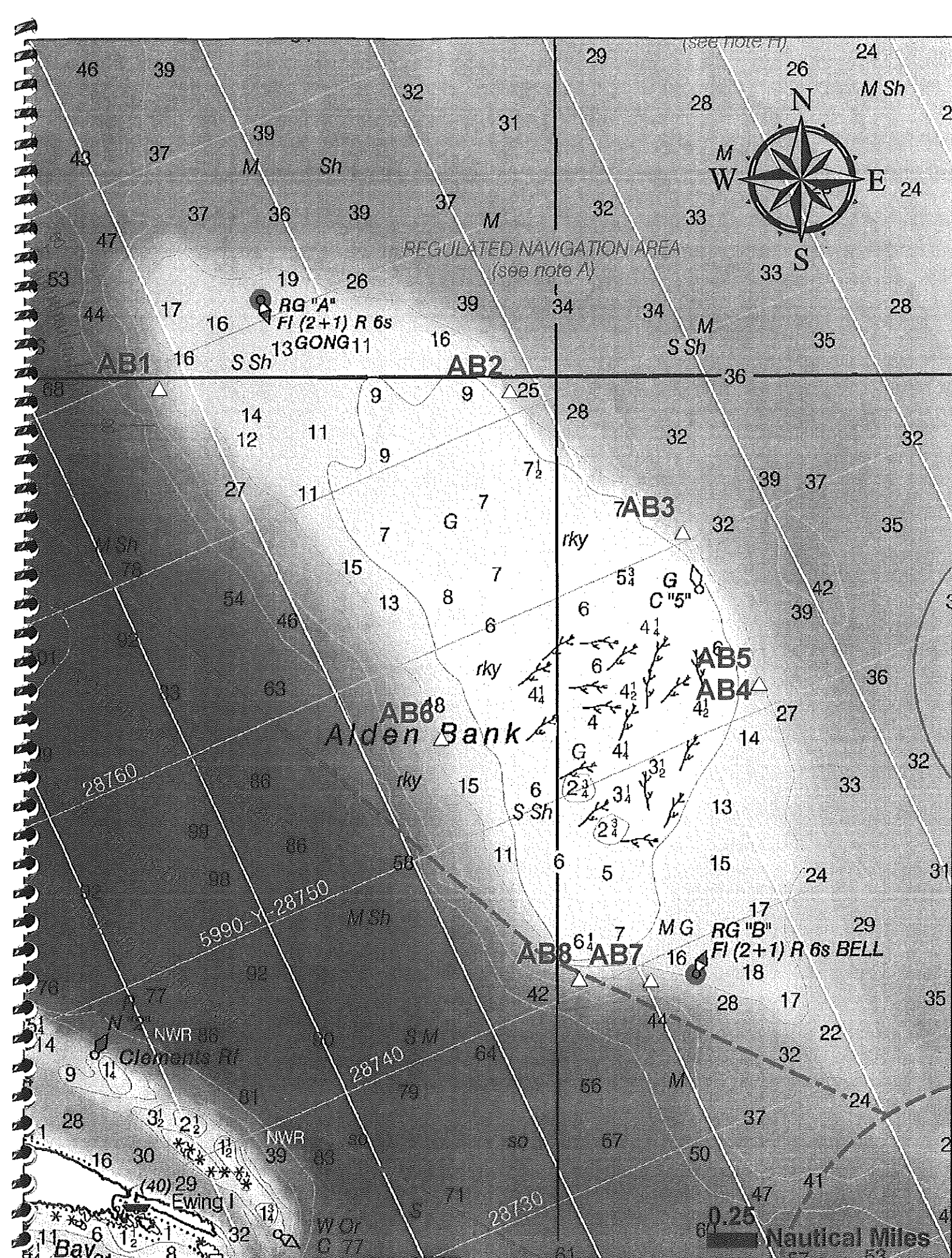
## Rockfish



**Figure 7.** Depth distribution of rockfish broken up into Puget Sound rockfish and other rockfish.



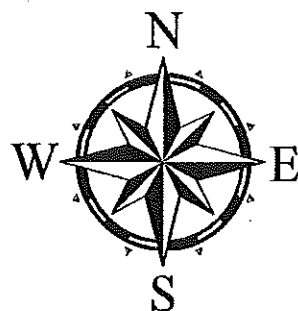
**Appendix A.** Individual transect locations labeled with location codes and transect numbers. **LIS** for Spring 2007 transects on Lummi Island, **LISH** for fall 2007 transects on Lummi Island, **LIA**, **LIB**, **LIC**, for trips A, B, and C to Lummi Island, **AB** for Alden Bank, and **PR** for Point Roberts.



W Or  
"DANGER ROCK"

Inati Bay

Real Hbr



0.1  
Nautical Miles

LIC2  
LIC1

LIB7

LIS2  
LIC3

LISH FI (2+1) G 6

LIC4  
LIB9

Viti Rks

G "9"  
Q G BELL

FI 2.5s 5M

46

S 36

LIB8

14

10

14

7 1/2

4

M

9

11

9

8

8

9

10

11

11

12

10

13

14

12

17

14

24

18

17

M

17

19

rk

35

52

55

55

S

56

63

34

44

44

49

44

33

40

55

31

27

24

28

30

38

38

23

16

16

M

34

20

33

30

15

19

5

19

15

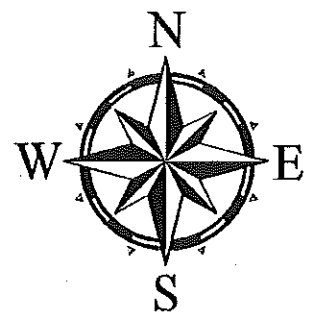
10

7 1/2

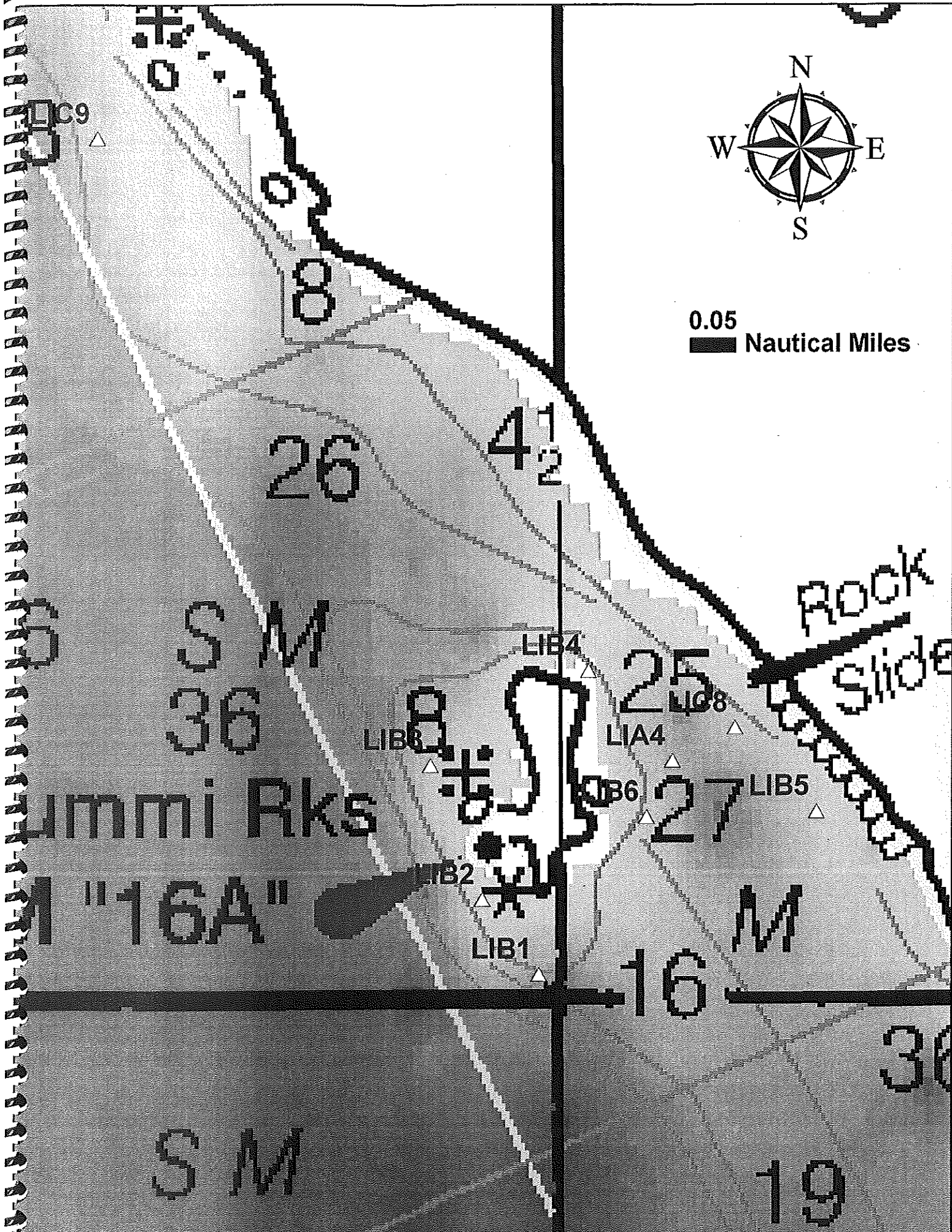
14

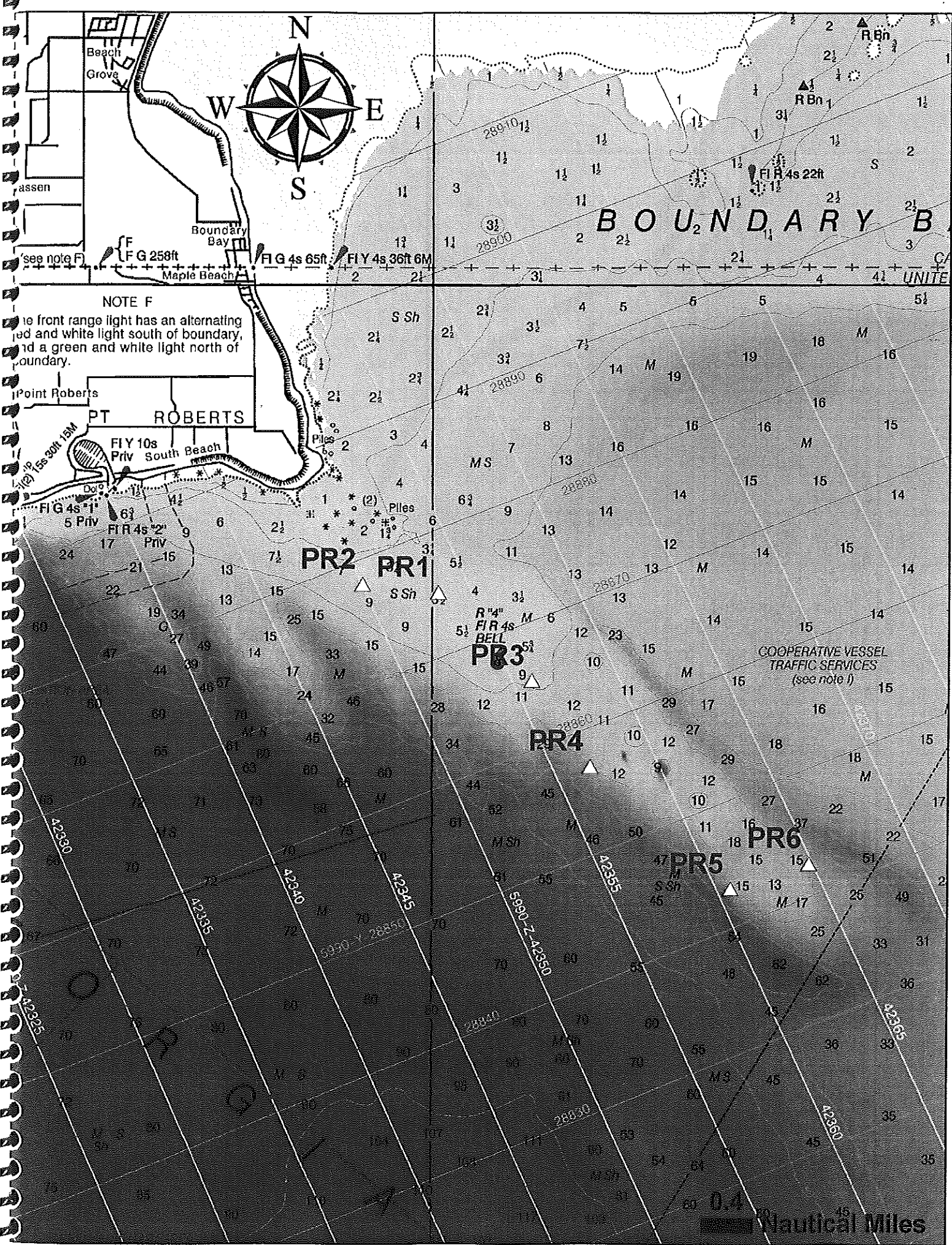
10

7 1/2



0.05  
Nautical Miles





NOTE F  
The front range light has an alternating red and white light south of boundary, and a green and white light north of boundary.

Point Roberts  
PT ROBERTS  
FI Y 10s Priv South Beach  
FI G 4s 1  
FI R 4s 2  
FI R 4s 22ft  
FI Y 4s 36ft 6M  
FI G 4s 65ft

BOUNDARY B

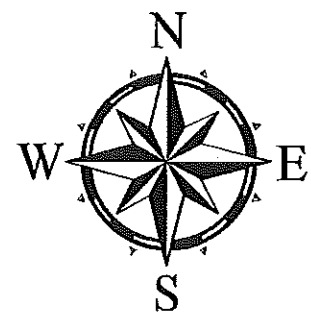
COOPERATIVE VESSEL TRAFFIC SERVICES  
(see note I)

0.4 Nautical Miles

**Appendix B.** GPS points for boat-driven transects in Whatcom County.

# BOUNDARY BAY

# SEMIAMMOQ BAY



1

Nautical Miles

## CAUTION

Temporary changes or defects in aids to navigation are not indicated on this chart. See local notices to mariners.

## CAUTION

Increased channels shown by broken lines are subject to closing temporarily at the pleasure of the local authorities.

## NOTES

1. The chart is based on the latest available information. It is subject to change without notice.

## NOTES

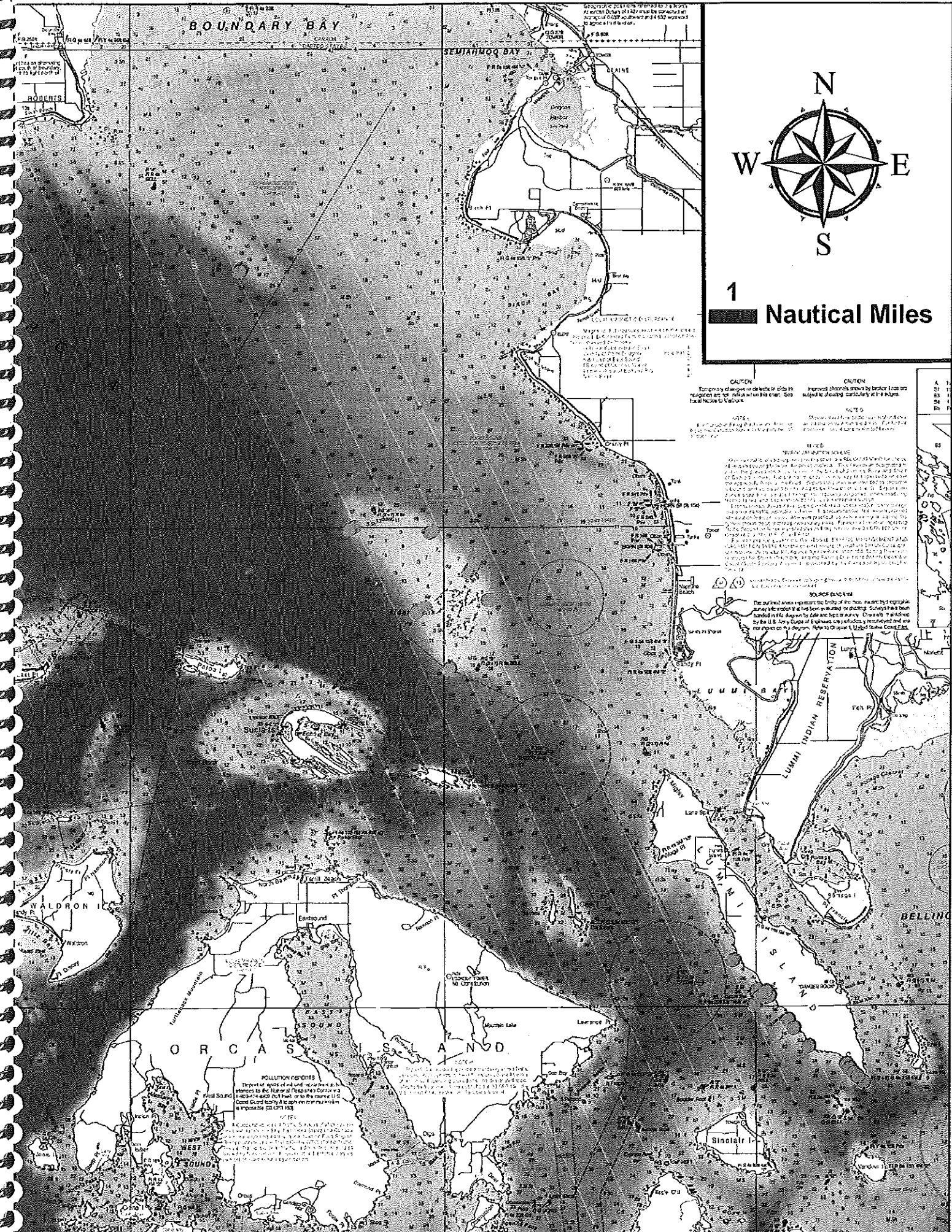
2. The chart is based on the latest available information. It is subject to change without notice.

## SOURCE DATA

The published area represents the limits of the most recent hydrographic survey information available to the U.S. Navy. It is not intended to be used for navigation purposes.

## POLLUTION REPORTS

Report of spills of oil and other pollutants to the National Pollution Center via telephone (800) 424-9333, or to the nearest U.S. Coast Guard facility. For more information, see the National Pollution Center website.



**Appendix C.** Data sheets from each transect including fish identifications, habitat assessments, ROV profiles, and bottom profiles.

|                                                                     |                 |                                                                                          |
|---------------------------------------------------------------------|-----------------|------------------------------------------------------------------------------------------|
| Location: Lumm Island Trip A                                        | Transect: #1    | Notes: Technical difficulties resulted in loss of video data. Nearby location on trip B. |
| Start GPS: 48° 39.920' N                                            | Date: 2/19/2008 |                                                                                          |
| 122° 39.299' W                                                      | Time: 10:45     |                                                                                          |
| Video Start: n/a                                                    | Visibility:     |                                                                                          |
| Video End: n/a                                                      | Depth Range:    |                                                                                          |
| Substrate Types: 3 = Rocky, 2 = Cobble, 1 = Gravel, 0 = Sand or Mud |                 |                                                                                          |

| Disc Location | Elapsed Time (min.) | Depth (m) | Habitat |
|---------------|---------------------|-----------|---------|
|               | 1                   |           |         |
|               | 2                   |           |         |
|               | 3                   |           |         |
|               | 4                   |           |         |
|               | 5                   |           |         |
|               | 6                   |           |         |
|               | 7                   |           |         |
|               | 8                   |           |         |
|               | 9                   |           |         |
|               | 10                  |           |         |
|               | 11                  |           |         |
|               | 12                  |           |         |
|               | 13                  |           |         |
|               | 14                  |           |         |
|               | 15                  |           |         |
|               | 16                  |           |         |
|               | 17                  |           |         |
|               | 18                  |           |         |
|               | 19                  |           |         |
|               | 20                  |           |         |

| Disc Location | Elapsed Time (min.) | Depth (m) | Fish Observed | Length (cm) |
|---------------|---------------------|-----------|---------------|-------------|
|---------------|---------------------|-----------|---------------|-------------|

### Summary

Target Species #

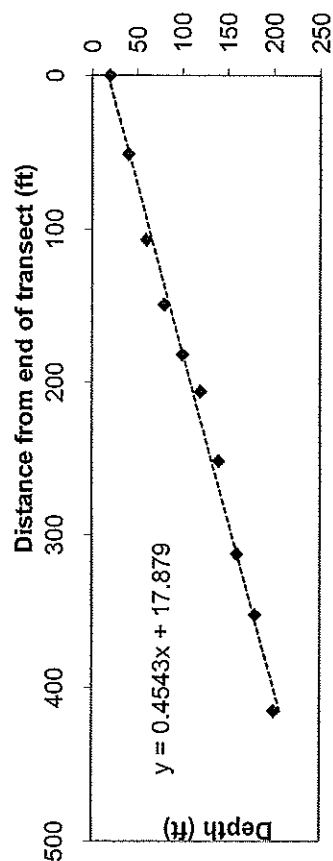
Other #

### Habitat Summary

Habitat Complexity:  
% Rock Bottom:

| Bottom Slope |             | Longitude | Depth (ft) | Distance (ft) |
|--------------|-------------|-----------|------------|---------------|
| 48°          | 39.983 122° | 39.259    | 20         | 0             |
| 48°          | 39.975 122° | 39.263    | 40         | 51.2092378    |
| 48°          | 39.966 122° | 39.266    | 60         | 107.072619    |
| 48°          | 39.96 122°  | 39.272    | 80         | 149.237597    |
| 48°          | 39.955 122° | 39.275    | 100        | 181.927536    |
| 48°          | 39.951 122° | 39.276    | 120        | 206.139735    |
| 48°          | 39.944 122° | 39.28     | 140        | 251.611409    |
| 48°          | 39.935 122° | 39.287    | 160        | 312.698729    |
| 48°          | 39.929 122° | 39.291    | 180        | 352.517489    |
| 48°          | 39.92 122°  | 39.299    | 200        | 415.317977    |

### Bottom Profile



|                                                                     |  |                 |                                                                                  |
|---------------------------------------------------------------------|--|-----------------|----------------------------------------------------------------------------------|
| Location: Lummi Rocks Trip A                                        |  | Transect: #2    | Notes: Technical difficulties resulted in loss of video data. Location Repeated. |
| Start GPS: 48° 40.217' N                                            |  | Date: 2/19/2008 |                                                                                  |
| 122° 39.571' W                                                      |  | Time: 11:45     |                                                                                  |
| Video Start: n/a                                                    |  | Visibility:     |                                                                                  |
| Video End: n/a                                                      |  | Depth Range:    |                                                                                  |
| Substrate Types: 3 = Rocky, 2 = Cobble, 1 = Gravel, 0 = Sand or Mud |  |                 |                                                                                  |

| Disc Location | Elapsed Time (min.) | Depth (m) | Habitat |
|---------------|---------------------|-----------|---------|
|               | 1                   |           |         |
|               | 2                   |           |         |
|               | 3                   |           |         |
|               | 4                   |           |         |
|               | 5                   |           |         |
|               | 6                   |           |         |
|               | 7                   |           |         |
|               | 8                   |           |         |
|               | 9                   |           |         |
|               | 10                  |           |         |
|               | 11                  |           |         |
|               | 12                  |           |         |
|               | 13                  |           |         |
|               | 14                  |           |         |
|               | 15                  |           |         |
|               | 16                  |           |         |
|               | 17                  |           |         |
|               | 18                  |           |         |
|               | 19                  |           |         |
|               | 20                  |           |         |

| Disc Location | Elapsed Time (min.) | Depth (m) | Fish Observed | Length (cm) |
|---------------|---------------------|-----------|---------------|-------------|
|---------------|---------------------|-----------|---------------|-------------|

### Summary

Target Species #

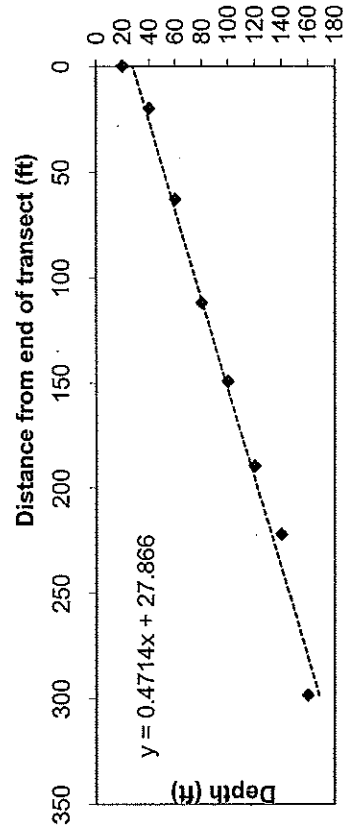
Other #

### Habitat Summary

Habitat Complexity:  
% Rock Bottom:

| Bottom Slope | Latitude | Longitude | Depth  | Distance (ft) |
|--------------|----------|-----------|--------|---------------|
| 48°          | 40.263   | 122°      | 39.545 | 20            |
| 48°          | 40.26    | 122°      | 39.547 | 40            |
| 48°          | 40.253   | 122°      | 39.549 | 60            |
| 48°          | 40.245   | 122°      | 39.551 | 80            |
| 48°          | 40.239   | 122°      | 39.553 | 100           |
| 48°          | 40.233   | 122°      | 39.558 | 120           |
| 48°          | 40.228   | 122°      | 39.561 | 140           |
| 48°          | 40.217   | 122°      | 39.571 | 160           |

### Bottom Profile



|                                                                     |                 |                                                                                  |  |
|---------------------------------------------------------------------|-----------------|----------------------------------------------------------------------------------|--|
| Location: Lummi Rocks Trip A                                        | Transect: #3    | Notes: Technical difficulties resulted in loss of video data. Location Repeated. |  |
| Start GPS: 48° 40.212' N                                            | Date: 2/19/2008 |                                                                                  |  |
| 122° 39.957' W                                                      | Time: 12:00     |                                                                                  |  |
| Video Start: n/a                                                    | Visibility:     |                                                                                  |  |
| Video End: n/a                                                      | Depth Range:    |                                                                                  |  |
| Substrate Types: 3 = Rocky, 2 = Cobble, 1 = Gravel, 0 = Sand or Mud |                 |                                                                                  |  |

| Disc Location | Elapsed Time (min.) | Depth (m) | Habitat |
|---------------|---------------------|-----------|---------|
|               | 1                   |           |         |
|               | 2                   |           |         |
|               | 3                   |           |         |
|               | 4                   |           |         |
|               | 5                   |           |         |
|               | 6                   |           |         |
|               | 7                   |           |         |
|               | 8                   |           |         |
|               | 9                   |           |         |
|               | 10                  |           |         |
|               | 11                  |           |         |
|               | 12                  |           |         |
|               | 13                  |           |         |
|               | 14                  |           |         |
|               | 15                  |           |         |
|               | 16                  |           |         |
|               | 17                  |           |         |
|               | 18                  |           |         |
|               | 19                  |           |         |
|               | 20                  |           |         |

| Disc Location | Elapsed Time (min.) | Depth (m) | Fish Observed | Length (cm) |
|---------------|---------------------|-----------|---------------|-------------|
|---------------|---------------------|-----------|---------------|-------------|

### Habitat Summary

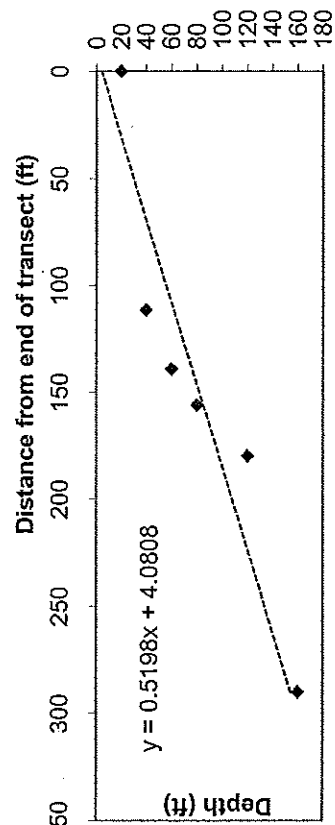
Habitat Complexity:  
% Rock Bottom:

Target Species #

Other #

| Latitude | Longitude   | Depth  | Distance (ft) |
|----------|-------------|--------|---------------|
| 48°      | 40.22 122°  | 39.928 | 20            |
| 48°      | 40.216 122° | 39.901 | 40            |
| 48°      | 40.216 122° | 39.894 | 60            |
| 48°      | 40.215 122° | 39.89  | 80            |
| 48°      | 40.215 122° | 39.884 | 120           |
| 48°      | 40.212 122° | 39.857 | 160           |
|          |             |        | 290.0469      |

### Bottom Profile



Location: Lummi Rocks Trip A Transect: #4  
 Start GPS: 48° 40.273' N Date: 2/19/2008  
 122° 39.813' W Time: 12:45  
 Video Star Ch 1 00:37 Title 1 Visibility: fair  
 Video End Ch 1 17:30 Title 1 Depth Range 26' - 148.2'  
 Substrate Types: 3 = Rocky, 2 = Cobble, 1 = Gravel, 0 = Sand or Mud

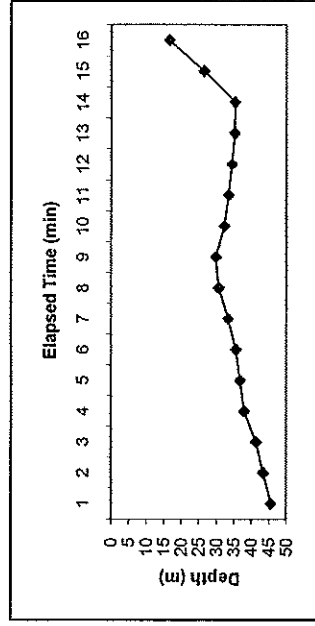
| Disc Location | Elapsed Time (min.) | Depth (m) | Habitat | Lasers (cm) |
|---------------|---------------------|-----------|---------|-------------|
| 1:30          | 1                   | 45.6      | 2       | 5.3         |
| 2:30          | 2                   | 43.4      | 2.5     | 3.8         |
| 3:30          | 3                   | 41.4      | 2       | 3.3         |
| 4:30          | 4                   | 37.9      | 2       | 4.1         |
| 5:30          | 5                   | 36.7      | 2       | 7.7         |
| 6:30          | 6                   | 35.5      | 2       | 4.5         |
| 7:30          | 7                   | 33.2      | 2       | 4.2         |
| 8:30          | 8                   | 30.5      | 1.5     | 7.5         |
| 9:30          | 9                   | 29.7      | 1.5     | 5           |
| 10:30         | 10                  | 32.1      | 3       | 5           |
| 11:30         | 11                  | 33.3      | 2       | 5.5         |
| 12:30         | 12                  | 34.3      | 1.5     | 2.6         |
| 13:30         | 13                  | 35.1      | 2       | 3           |
| 14:30         | 14                  | 35.2      | 3       | 2.5         |
| 15:30         | 15                  | 26.4      | 3       | 2.7         |
| 16:30         | 16                  | 16.5      | 3       | 2.1         |

| Disc Location | Depth (m) | Fish Observed        | Length (cm) |
|---------------|-----------|----------------------|-------------|
| 1:45          | 45        | Flatfish             | 10          |
| 2:25          | 43.4      | Sculpin or Cabezon   | 20          |
| 8:55          | 29.4      | Kelp Greenling (f)   | 25          |
| 15:14         | 26.6      | 2 Kelp Greenling (m) | 40          |

Estimated transect area  
142.4869068 m^2

#### Habitat Summary

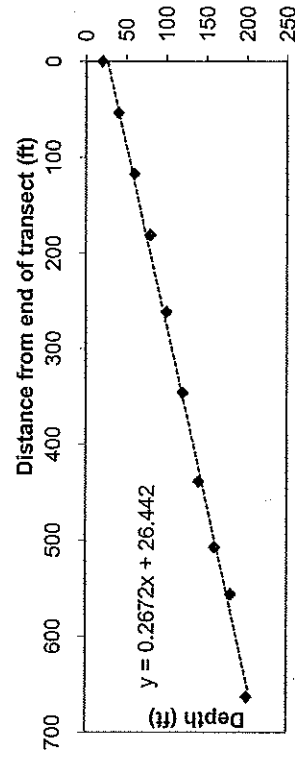
Target Species: Kelp Greenling  
 # 3  
 Habitat Complexity: 2.1875  
 % Rock Bottom: 75% (#2 or greater)



| Bottom Slope | Latitude | Longitude | Depth  | Distance (ft) |
|--------------|----------|-----------|--------|---------------|
| 48°          | 40.283   | 122°      | 39.977 | 20            |
| 48°          | 40.281   | 122°      | 39.964 | 40            |
| 48°          | 40.281   | 122°      | 39.948 | 60            |
| 48°          | 40.282   | 122°      | 39.932 | 80            |
| 48°          | 40.282   | 122°      | 39.912 | 100           |
| 48°          | 40.283   | 122°      | 39.891 | 120           |
| 48°          | 40.283   | 122°      | 39.868 | 140           |
| 48°          | 40.281   | 122°      | 39.851 | 160           |
| 48°          | 40.279   | 122°      | 39.839 | 180           |
| 48°          | 40.273   | 122°      | 39.813 | 200           |

Slope  
 0.26722922  
 0.26112752  
 14.9615048 degrees

#### Bottom Profile



|                                                                     |  |                            |
|---------------------------------------------------------------------|--|----------------------------|
| Location: Lummi Island Trip A                                       |  | Transect: #5               |
| Start GPS: 48° 39.723' N                                            |  | Date: 2/19/2008            |
| 122° 38.986' W                                                      |  | Time: 13:20                |
| Video Start: Ch 2 23:16 Title 1                                     |  | Visibility: good           |
| Video End: Ch 2 31:45 Title 1                                       |  | Depth Range: 12.7' - 75.4' |
| Substrate Types: 3 = Rocky, 2 = Cobble, 1 = Gravel, 0 = Sand or Mud |  |                            |

Notes: sandy flats with scattered cobbles, minimal 'marine snow'

| Disc Location | Elapsed Time (min.) | Depth (m) | Habitat | Lasers (cm) |
|---------------|---------------------|-----------|---------|-------------|
| 24            | 1                   | 23.2      | 1.5     | 2.6         |
| 25            | 2                   | 19.8      | 1.5     | 2.2         |
| 26            | 3                   | 17.1      | 1.5     | 2.5         |
| 27            | 4                   | 15.2      | 1.5     | 3           |
| 28            | 5                   | 12.6      | 1       | 2.4         |
| 29            | 6                   | 10.2      | 1.5     | 2.9         |
| 30            | 7                   | 4         | 0       |             |
| 31            | 8                   | 4         | 0       |             |

| Disc Location | Depth (m)         | Fish Observed | Length (cm) |
|---------------|-------------------|---------------|-------------|
| 27:47:00      | derelict crab pot | 12.5          |             |

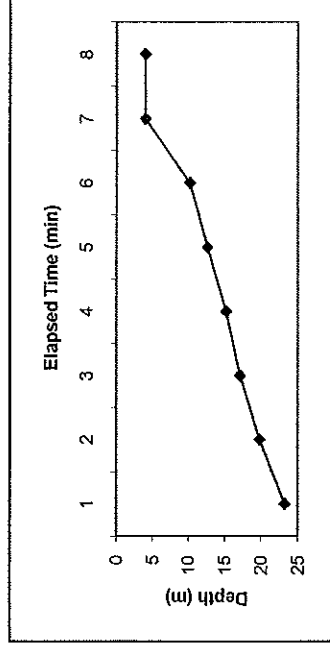
### Summary

|                |   |
|----------------|---|
| Target Species | # |
|                | 0 |

### Habitat Summary

|                     |        |
|---------------------|--------|
| Habitat Complexity: | 1.0625 |
| % Rock Bottom:      | 0      |

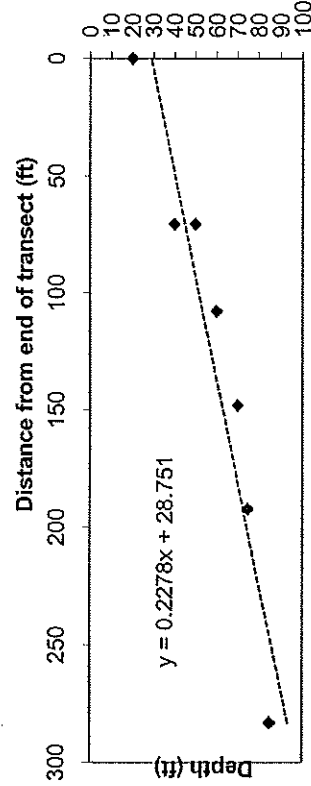
Estimated transect area  
94.52835914 m^2



| Bottom Slope | Latitude | Longitude | Depth  | Distance (ft) |
|--------------|----------|-----------|--------|---------------|
| 48°          | 39.752   | 122°      | 38.931 | 20            |
| 48°          | 39.745   | 122°      | 38.945 | 40            |
| 48°          | 39.745   | 122°      | 38.945 | 50            |
| 48°          | 39.741   | 122°      | 38.952 | 60            |
| 48°          | 39.737   | 122°      | 38.96  | 70            |
| 48°          | 39.732   | 122°      | 38.968 | 75            |
| 48°          | 39.723   | 122°      | 38.986 | 85            |

Slope  
0.22776029  
0.22394016  
12.8308263 degrees

### Bottom Profile



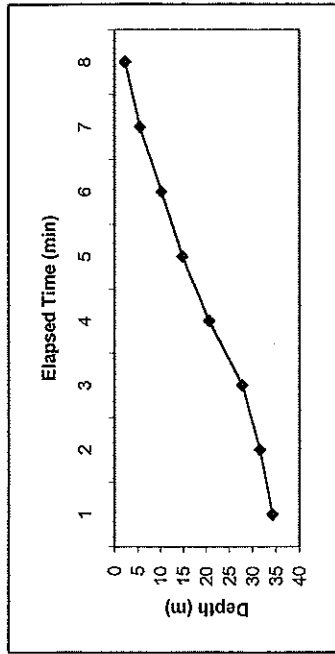
Location: Lummi Island Trip A  
 Start GPS: 48° 39.548' N  
 122° 38.807' W  
 Date: 2/19/2008  
 Time: 13:40  
 Notes: moderate to minimal marine snow  
 Video Start Ch 2 03:21 Title 2  
 Video End: Ch 2 11:05 Title 2  
 Depth Range 7.5' - 111.5'  
 Substrate Types: 3 = Rocky, 2 = Cobble, 1 = Gravel, 0 = Sand or Mud

| Disc Location | Habitat | Elapsed Time (min.) | Depth (m) | Habitat | Lasers (cm) |
|---------------|---------|---------------------|-----------|---------|-------------|
| 4             |         | 1                   | 34.3      | 0       | 2           |
| 5             |         | 2                   | 31.6      | 0       | 6           |
| 6             |         | 3                   | 27.8      | 0       | 4.6         |
| 7             |         | 4                   | 20.6      | 0       | 2.3         |
| 8             |         | 5                   | 14.8      | 0.5     | 3           |
| 9             |         | 6                   | 10.2      | 0.5     | 4           |
| 10            |         | 7                   | 5.5       | 0       |             |
| 11            |         | 8                   | 2.3       | 0       |             |

\* Lasers covered by kelp.

| Disc Location | Depth (m) | Fish Observed | Length (cm) |
|---------------|-----------|---------------|-------------|
|---------------|-----------|---------------|-------------|

Estimated transect area  
105.4088376 m<sup>2</sup>



#### Habitat Summary

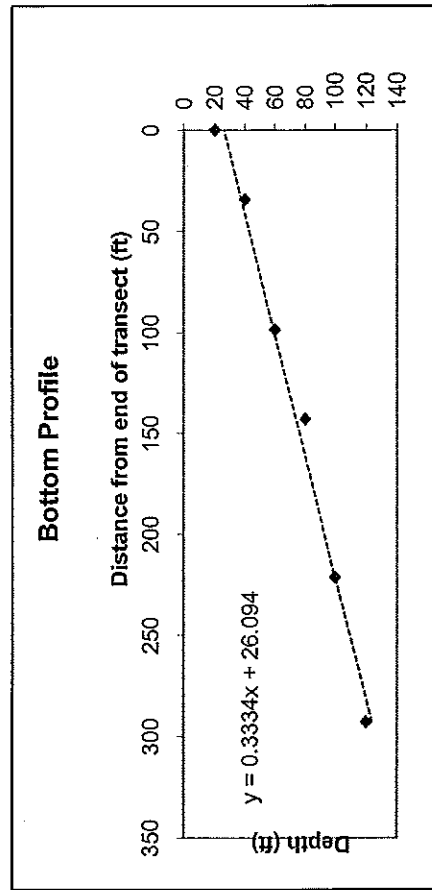
Habitat Complexity: 0.125  
% Rock Bottom: 0

#### Summary

Target Species #

| Bottom Slope | Latitude    | Longitude | Depth | Distance (ft) |
|--------------|-------------|-----------|-------|---------------|
| 48°          | 39.581 122° | 38.754    | 20    | 0             |
| 48°          | 39.577 122° | 38.76     | 40    | 34.27634      |
| 48°          | 39.57 122°  | 38.772    | 60    | 98.61383      |
| 48°          | 39.565 122° | 38.78     | 80    | 142.9008      |
| 48°          | 39.556 122° | 38.794    | 100   | 221.4442      |
| 48°          | 39.548 122° | 38.807    | 120   | 292.8935      |

Slope  
0.33340831  
0.32181803  
18.4388152 degrees



|                               |                                                                     |                                                              |
|-------------------------------|---------------------------------------------------------------------|--------------------------------------------------------------|
| Location: Lummi Island Trip A | Transect: #7                                                        | Date: 2/19/2008                                              |
| Start GPS: 48° 39.262' N      | Time: 14:00                                                         | Notes: technical difficulties resulted in loss of video data |
| 122° 38.422' W                | Visibility:                                                         |                                                              |
| Video Start:                  | Depth Range:                                                        |                                                              |
| Video End:                    | Substrate Types: 3 = Rocky, 2 = Cobble, 1 = Gravel, 0 = Sand or Mud |                                                              |

| Disc Location | Elapsed Time (min.) | Depth (m) | Habitat |
|---------------|---------------------|-----------|---------|
|---------------|---------------------|-----------|---------|

- 1
- 2
- 3
- 4
- 5
- 6
- 7
- 8
- 9
- 10
- 11
- 12
- 13

| Disc Location | Elapsed Time (min.) | Depth (m) | Fish Observed | Length (cm) |
|---------------|---------------------|-----------|---------------|-------------|
|---------------|---------------------|-----------|---------------|-------------|

### Summary

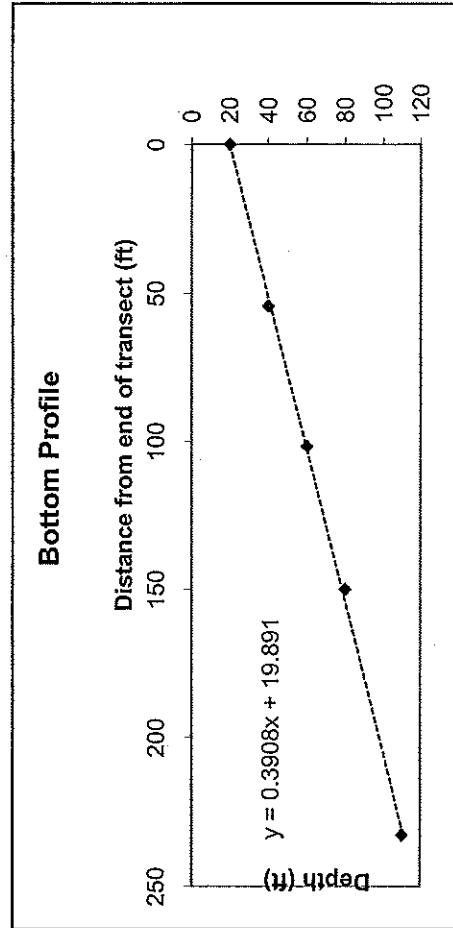
### Habitat Summary

Target Species #

Habitat Complexity:  
% Rock Bottom:

Other #

| Bottom Slope | Latitude | Longitude | Depth  | Distance (ft) |
|--------------|----------|-----------|--------|---------------|
| 48°          | 39.289   | 122°      | 38.381 | 20            |
| 48°          | 39.283   | 122°      | 38.391 | 40            |
| 48°          | 39.278   | 122°      | 38.4   | 60            |
| 48°          | 39.272   | 122°      | 38.408 | 80            |
| 48°          | 39.262   | 122°      | 38.422 | 110           |
|              |          |           |        | 232.8021      |



|                                                                     |                            |                                                   |
|---------------------------------------------------------------------|----------------------------|---------------------------------------------------|
| Location: Lummi Island Trip B                                       | Transect: #1 (W.R.s.)      | Notes: moderate marine snow                       |
| Start GPS: 48° 40' 040" N                                           | Date: 3/19/2008            | 12:15 large boulders and rock - no sand below 20m |
| 122° 40' 040" W                                                     | Time: 12:15                |                                                   |
| Video Start Ch 1 01:10 Title 1                                      | Visibility: fair           |                                                   |
| Video End: Ch 1 08:50 Title 1                                       | Depth Range 58.5' - 145.3' |                                                   |
| Substrate Types: 3 = Rocky, 2 = Cobble, 1 = Gravel, 0 = Sand or Mud |                            |                                                   |

| Disc Location | Depth (m) | Fish Observed      | Length (cm) |
|---------------|-----------|--------------------|-------------|
| 1:50          | 45.4      | Kelp Greenling (f) | 30          |
| 2:11          | 42.5      | Lingcod?           | 40          |
| 5:49          | 24        | Kelp Greenling (f) | 25          |
| 6:25          | 21.5      | Kelp Greenling (?) | 30          |

### Summary

| Target Species | # |
|----------------|---|
| Kelp Greenling | 3 |
| Lingcod        | 1 |

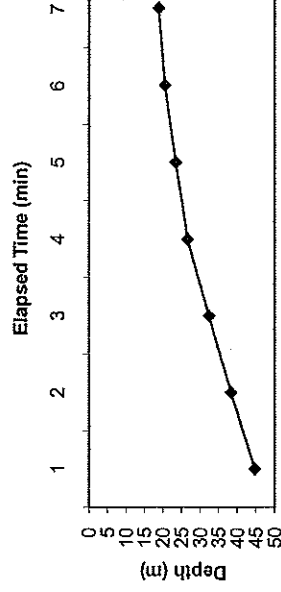
### Habitat Summary

Habitat Complexity: 2.857143  
 % Rock Bottom: 100% \*2.5 or greater

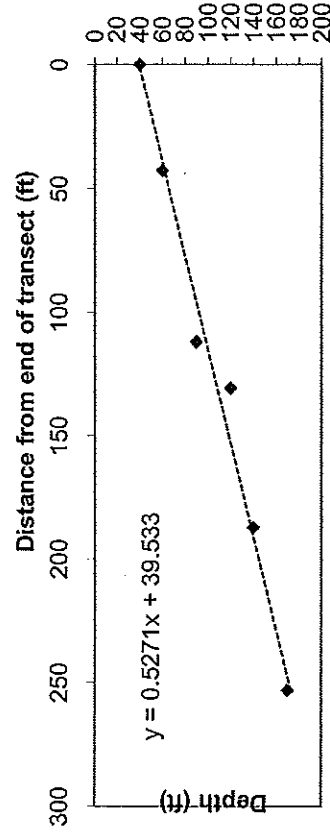
| Disc Location | Habitat | Elapsed Time (min.) | Depth (m) | Habitat | Lasers (cm) |
|---------------|---------|---------------------|-----------|---------|-------------|
| 2             | 2       | 1                   | 44.7      | 3       | 3           |
| 3             | 3       | 2                   | 38.4      | 3       | 4           |
| 4             | 4       | 3                   | 32.4      | 3       | 4.5         |
| 5             | 5       | 4                   | 26.6      | 3       | 3.5         |
| 6             | 6       | 5                   | 23.5      | 3       | 4.7         |
| 7             | 7       | 6                   | 20.6      | 2.5     | 4           |
| 8             | 8       | 7                   | 18.9      | 2.5     | 2.5         |

screen: 40.5cm

Estimated transect area  
 54.45102868 m^2



### Bottom Profile



| Bottom Slope | Latitude | Longitude | Depth  | Distance (ft) |
|--------------|----------|-----------|--------|---------------|
| 48°          | 40.077   | 122°      | 40.069 | 40            |
| 48°          | 40.07    | 122°      | 40.068 | 60            |
| 48°          | 40.059   | 122°      | 40.063 | 90            |
| 48°          | 40.057   | 122°      | 40.057 | 120           |
| 48°          | 40.054   | 122°      | 40.038 | 140           |
| 48°          | 40.04    | 122°      | 40.04  | 170           |

slope 0.52708802  
 0.48508245  
 27.7931774 degrees

Location: Lummi Island Trip B Transect: #2 (NW rks.)  
 Start GPS: 48° 40' 122" N Date: 3/19/2008  
 122° 40' 135" W Time: 12:30  
 Video Start: Ch 2 15:44 Title 1 Visibility: fair  
 Video End: Ch 2 29:40 Title 1 Depth Range 44.5' - 210'  
 Substrate Types: 3 = Rocky, 2 = Cobble, 1 = Gravel, 0 = Sand or Mud

Notes: deepest dive (210') large  
 derelict gill net

| Disc Location              | Depth (m) | Fish Observed                   | Length (cm) |
|----------------------------|-----------|---------------------------------|-------------|
| 17:37                      | 56.9      | unidentified small              | 10          |
| 20:00                      | 47.6      | Copper Rockfish                 | 20          |
|                            |           | Puget Sound Rockfish            | 12          |
| 20:21 Derelict hand net    | 46.6      |                                 |             |
| 20:28                      | 46.2      | 2 Puget Sound Rockfis           | 10          |
| 20:52                      | 44.6      | 5 unidentified juveniles        | 10          |
| 21:53                      | 40.9      | Puget Sound Rockfish            | 12          |
| 22:11                      | 39.7      | Copper Rockfish?                | 20          |
| 25:39:00                   | 20.4      | Copper Rockfish                 | 20          |
| 25:58:00                   | 19.7      | Lingcod                         | 35          |
| 26:33:00 Derelict gill net | 18.7      | previous two fish sighted again |             |

#### Summary

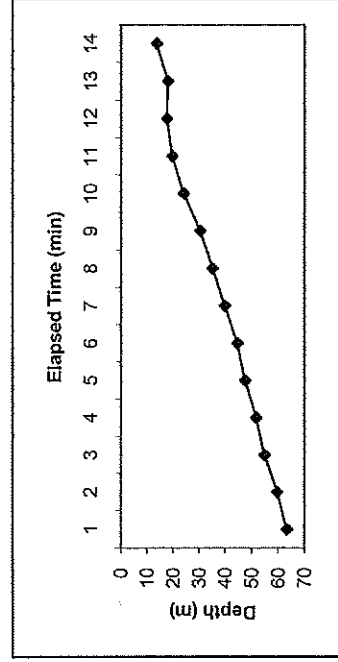
| Target Species       | #  |
|----------------------|----|
| Copper Rockfish      | 3  |
| Puget Sound Rockfish | 4+ |
| Lingcod              | 1  |

#### Habitat Summary

Habitat Complexity: 2.75  
 % Rock Bottom: 100% (greater than 2.5)

| Habitat       |                     | screen: 40.5cm |                     |
|---------------|---------------------|----------------|---------------------|
| Disc Location | Elapsed Time (min.) | Depth (m)      | Habitat Lasers (cm) |
| 16            | 1                   | 63.3           | 2 5                 |
| 17            | 2                   | 59.6           | 2 5.1               |
| 18            | 3                   | 55             | 2.5 5               |
| 19            | 4                   | 51.8           | 2.5 4.5             |
| 20            | 5                   | 47.6           | 3 8                 |
| 21            | 6                   | 44.7           | 3 3.8               |
| 22            | 7                   | 39.9           | 3 3.7               |
| 23            | 8                   | 35.2           | 2.5 3.3             |
| 24            | 9                   | 30.5           | 3 4.5               |
| 25            | 10                  | 24.1           | 3 6                 |
| 26            | 11                  | 19.7           | 3 4                 |
| 27            | 12                  | 17.6           | 3 4.2               |
| 28            | 13                  | 18             | 3 3                 |
| 29            | 14                  | 13.7           | 3 3.5               |

Total Rockfish 7  
 Rockfish/min 0.5



Location: Lumm Island Trip B    Transect: #3 (N.R.K.)    Notes:   
 Start GPS: 48° 40.269' N    Date: 3/19/2008      
 122° 40.220' W    Time: 12:50      
 Video Start Ch 3 31:42 Title 1    Visibility: good      
 Video End: Ch 3 39:40 Title 1    Depth Range 68.3' - 120.3'      
 Substrate Types: 3 = Rocky, 2 = Cobble, 1 = Gravel, 0 = Sand or Mud

| Disc Location | Depth (m) | Fish Observed      | Length (cm) |
|---------------|-----------|--------------------|-------------|
| 33:50:00      | 29.3      | Copper Rockfish    | 40          |
| 38:16:00      | 23.4      | Kelp Greenling (?) | 25          |

| Habitat       |                     | screen: 40.5cm |                        |
|---------------|---------------------|----------------|------------------------|
| Disc Location | Elapsed Time (min.) | Depth (m)      | Habitat    Lasers (cm) |
| 32            | 1                   | 36.3           | 3    4                 |
| 33            | 2                   | 33.2           | 2.5    6               |
| 34            | 3                   | 27.2           | 3    6                 |
| 35            | 4                   | 24.1           | 3    4.5               |
| 36            | 5                   | 23.2           | 2.5    3.7             |
| 37            | 6                   | 22.4           | 2.5    3               |
| 38            | 7                   | 23.4           | 2.5    3               |
| 39            | 8                   | 21.1           | 3    3                 |

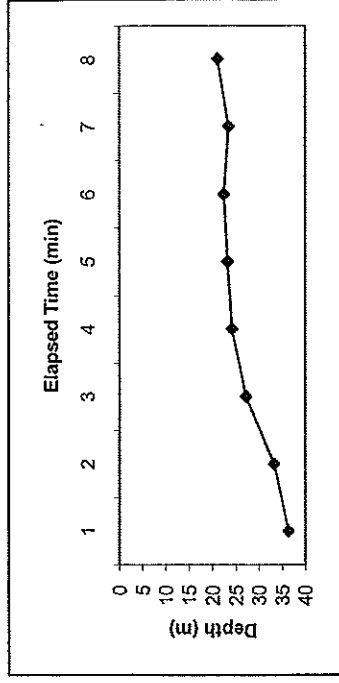
Total Rockfish/min  
 1    0.125

#### Summary

Target Species    #  
 Copper Rockfish    1

#### Habitat Summary

Habitat Complexity:    2.75  
 % Rock Bottom:    100% (at least 2.5)



|                                                                     |  |                           |  |
|---------------------------------------------------------------------|--|---------------------------|--|
| Location: Lummi Island Trip B                                       |  | Transect: #4 (NE rks.)    |  |
| Start GPS: 48° 40.372' N                                            |  | Date: 3/19/2008           |  |
| 122° 39.955' W                                                      |  | Time: 13:10               |  |
| Video Start Ch 4 43:29 Title 1                                      |  | Visibility: good          |  |
| Video End: Ch 4 49:50 Title 1                                       |  | Depth Range 9.8' - 141.7' |  |
| Substrate Types: 3 = Rocky, 2 = Cobble, 1 = Gravel, 0 = Sand or Mud |  |                           |  |

Notes: Bow of boat up to shore at shallow end of transect.

| Disc Location | Depth (m) | Fish Observed        | Length (cm) |
|---------------|-----------|----------------------|-------------|
| 44:25:00      | 42.7      | gunnel               | 35          |
| 45:40:00      | 39.5      | Puget Sound Rockfish | 15          |

| Disc Location | Elapsed Time (min.) | Depth (m) | Habitat | Lasers (cm) |
|---------------|---------------------|-----------|---------|-------------|
| 44            | 1                   | 43        | 2.5     | 7           |
| 45            | 2                   | 41.8      | 2.5     | 5           |
| 46            | 3                   | 38.2      | 3       | 3.5         |
| 47            | 4                   | 33.3      | 2.5     | 6.5         |
| 48            | 5                   | 24.4      | 0.5     | 3.6         |
| 49            | 6                   | 15.3      | 3       | 6           |

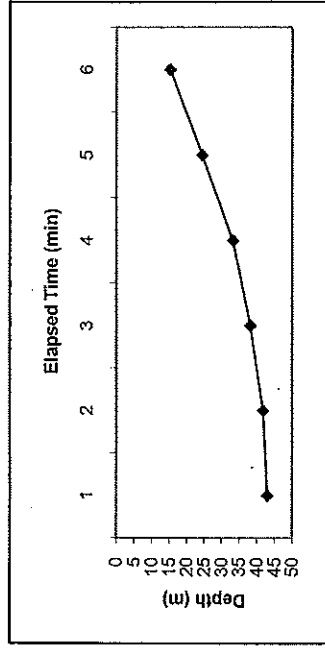
Total Rockfish/Rockfish/min  
1 0.166666667  
Rockfish/m<sup>2</sup>  
0.024058  
Estimated transect area  
41.56672507 m<sup>2</sup>

#### Summary

Target Species #  
Puget Sound Rockfish 1

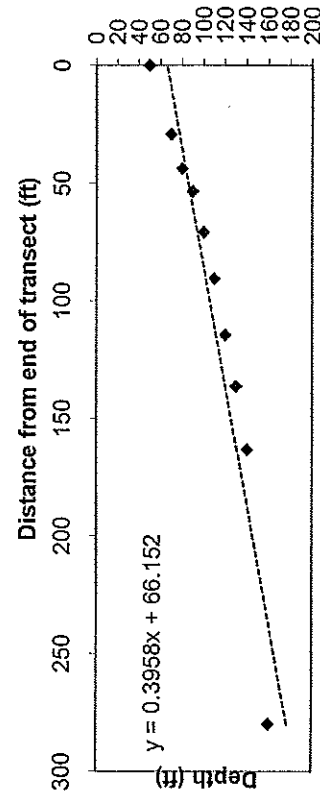
#### Habitat Summary

Habitat Complexity: 2.333333  
% Rock Bottom: 66% (at least 2.5)



#### Bottom Profile

| Latitude        | Longitude | Depth | Distance (ft) |
|-----------------|-----------|-------|---------------|
| 48° 40.333 122° | 39.992    | 50    | 0             |
| 48° 40.337 122° | 39.988    | 70    | 29.15825      |
| 48° 40.339 122° | 39.986    | 80    | 43.73736      |
| 48° 40.34 122°  | 39.984    | 90    | 53.35751      |
| 48° 40.343 122° | 39.983    | 100   | 70.75036      |
| 48° 40.346 122° | 39.981    | 110   | 90.56363      |
| 48° 40.349 122° | 39.977    | 120   | 114.4572      |
| 48° 40.352 122° | 39.974    | 130   | 136.3179      |
| 48° 40.356 122° | 39.971    | 140   | 163.3479      |
| 48° 40.372 122° | 39.955    | 160   | 279.9227      |



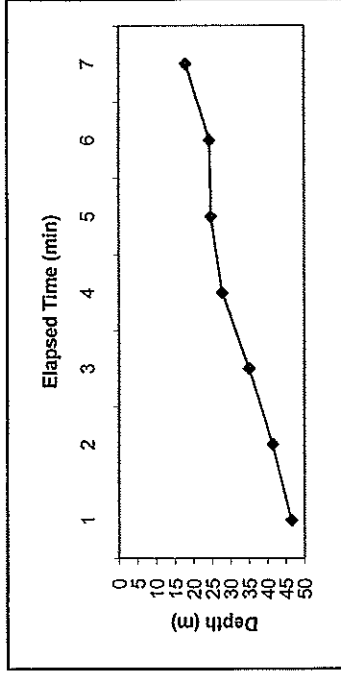
slope  
0.39576016  
0.37684601  
21.5916857 degrees

|                                                                     |  |                            |  |                                  |  |
|---------------------------------------------------------------------|--|----------------------------|--|----------------------------------|--|
| Location: Lummi Island Trip B                                       |  | Transect: #5               |  | Notes: Repeat of trip A, site #2 |  |
| Start GPS: 48° 40.217' N                                            |  | Date: 3/19/2008            |  |                                  |  |
| 122° 39.571' W                                                      |  | Time: 13:30                |  |                                  |  |
| Video Start Ch 1 03:21 Title 1                                      |  | Visibility: Good           |  |                                  |  |
| Video End: Ch 1 10:25 Title 1                                       |  | Depth Range 55.6' - 163.8' |  |                                  |  |
| Substrate Types: 3 = Rocky, 2 = Cobble, 1 = Gravel, 0 = Sand or Mud |  |                            |  |                                  |  |

| Habitat       |                     | screen: 40.5cm |                     |
|---------------|---------------------|----------------|---------------------|
| Disc Location | Elapsed Time (min.) | Depth (m)      | Habitat Lasers (cm) |
| 4             | 1                   | 46.4           | 2                   |
| 5             | 2                   | 41.3           | 2.5                 |
| 6             | 3                   | 35             | 2.5                 |
| 7             | 4                   | 27.7           | 3                   |
| 8             | 5                   | 24.7           | 2                   |
| 9             | 6                   | 24.3           | 3                   |
| 10            | 7                   | 17.9           | 2                   |

| Disc Location | Depth (m) | Fish Observed | Length (cm) |
|---------------|-----------|---------------|-------------|
|---------------|-----------|---------------|-------------|

Estimated transect area  
88.36123427 m^2



**Summary**

Target Species # 0

**Habitat Summary**

Habitat Complexity: 2.428571

% Rock Bottom: 50

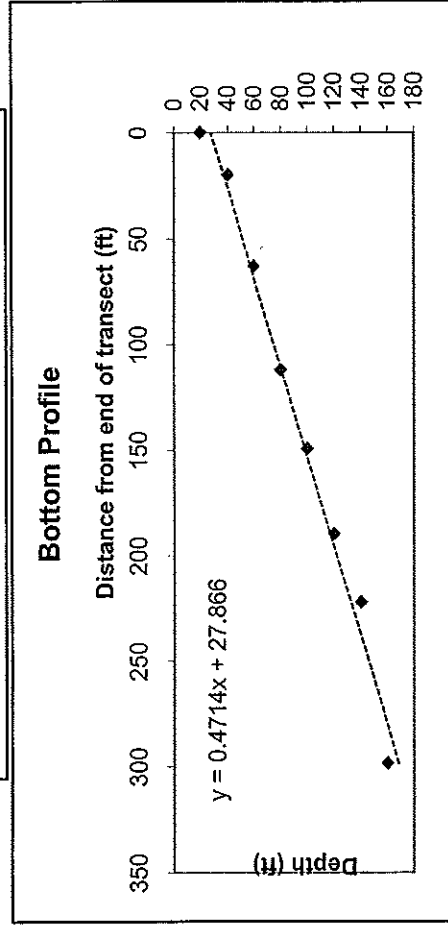
| Bottom Slope |             | Longitude | Depth | Distance (ft) |
|--------------|-------------|-----------|-------|---------------|
| 48°          | 40.263 122° | 39.545    | 20    | 0             |
| 48°          | 40.26 122°  | 39.547    | 40    | 19.92862      |
| 48°          | 40.253 122° | 39.549    | 60    | 62.86039      |
| 48°          | 40.245 122° | 39.551    | 80    | 112.0077      |
| 48°          | 40.239 122° | 39.553    | 100   | 149.3436      |
| 48°          | 40.233 122° | 39.558    | 120   | 189.6533      |
| 48°          | 40.228 122° | 39.561    | 140   | 222.2121      |
| 48°          | 40.217 122° | 39.571    | 160   | 298.4721      |

Slope

0.47139029

0.44049902

25.2387345 degrees



Location: Lummi Island Trip B
Transect: #6
Notes: Repeat of trip A, site #3

Start GPS: 48° 40.212' N
Date: 3/19/2008

122° 39.857' W
Time: 13:50

Video Start: Ch 2 12:00 Title 1
Visibility: good

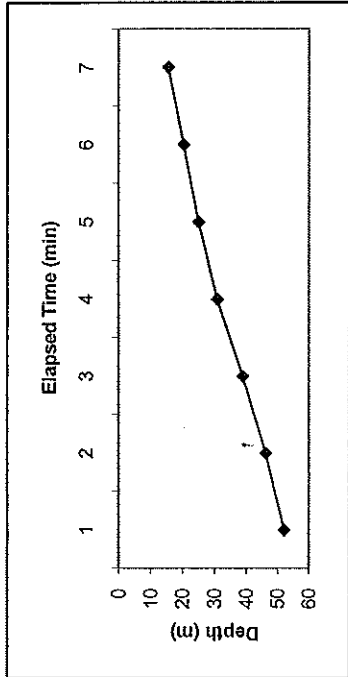
Video End: Ch 2 18:15 Title 1
Depth Range: 50.7 - 169.3

Substrate Types: 3 = Rocky, 2 = Cobble, 1 = Gravel, 0 = Sand or Mud

| Disc Location | Depth (m) | Fish Observed       | Length (cm) |
|---------------|-----------|---------------------|-------------|
| 12:44         | 48        | unidentified gunnel |             |
| 14:15         | 36.8      | unidentified ling?  |             |

| Habitat       |                     | screen: 40.5cm |                     |
|---------------|---------------------|----------------|---------------------|
| Disc Location | Elapsed Time (min.) | Depth (m)      | Habitat Lasers (cm) |
| 12            | 1                   | 52.1           | 3                   |
| 13            | 2                   | 46.2           | 2.5                 |
| 14            | 3                   | 38.9           | 3                   |
| 15            | 4                   | 30.9           | 2.5                 |
| 16            | 5                   | 25.1           | 2.5                 |
| 17            | 6                   | 20.4           | 2.5                 |
| 18            | 7                   | 15.6           | 2.5                 |

Estimated transect area  
44.5703338 m^2



### Summary

| Target Species | # |
|----------------|---|
|                | 0 |

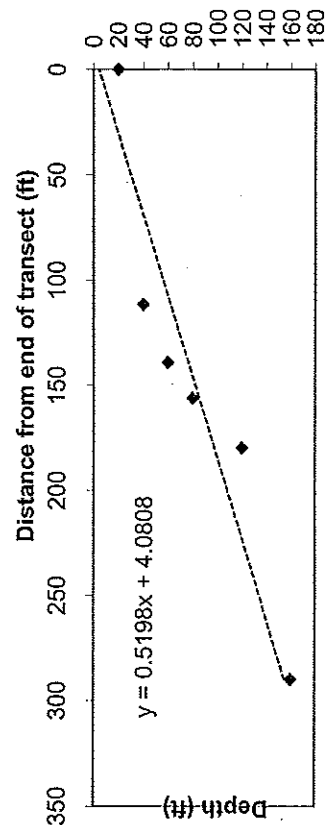
### Habitat Summary

Habitat Complexity: 2.642857  
% Rock Bottom: 100% (at least 2.5)

| Bottom Slope |        | Longitude | Depth  | Distance (ft) |
|--------------|--------|-----------|--------|---------------|
| 48°          | 40.22  | 122°      | 39.928 | 20            |
| 48°          | 40.216 | 122°      | 39.901 | 40            |
| 48°          | 40.216 | 122°      | 39.894 | 60            |
| 48°          | 40.215 | 122°      | 39.89  | 80            |
| 48°          | 40.215 | 122°      | 39.884 | 120           |
| 48°          | 40.212 | 122°      | 39.857 | 160           |

slope  
0.51978228  
0.4793479  
27.4646115 degrees

### Bottom Profile



|                                                                     |                            |                        |
|---------------------------------------------------------------------|----------------------------|------------------------|
| Location: Lummi Island Trip B                                       | Transect: #7 (E Lummi)     | Notes: steep and sandy |
| Start GPS: 48° 38.855' N                                            | Date: 3/19/2008            |                        |
| 122° 36.527' W                                                      | Time: 14:20                |                        |
| Video Start: Ch 1 02:24 Title 2                                     | Visibility: good           |                        |
| Video End: Ch 1 05:45 Title 2                                       | Depth Range 16.3' - 114.7' |                        |
| Substrate Types: 3 = Rocky, 2 = Cobble, 1 = Gravel, 0 = Sand or Mud |                            |                        |

| Habitat       |                     | screen: 40.5cm |                     |
|---------------|---------------------|----------------|---------------------|
| Disc Location | Elapsed Time (min.) | Depth (m)      | Habitat Lasers (cm) |
| 3             | 1                   | 35.3           | 0                   |
| 4             | 2                   | 27.3           | 0                   |
| 5             | 3                   | 10.9           | 0                   |
|               |                     |                | 6                   |
|               |                     |                | 6                   |
|               |                     |                | 3                   |

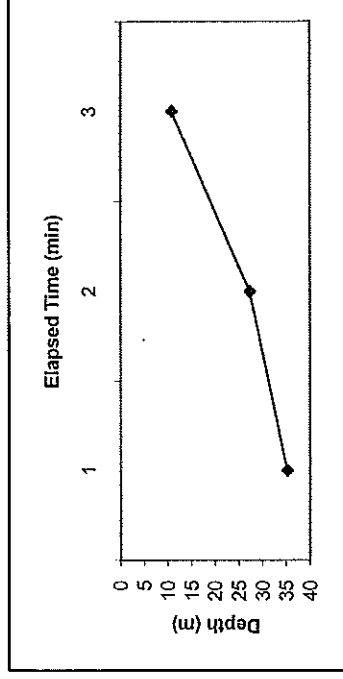
| Disc Location              | Depth (m) | Fish Observed | Length (cm) |
|----------------------------|-----------|---------------|-------------|
| 2:24                       | 35.3      | Snow Crab     | 12 (body)   |
| 2:28 abundant goby at >28m | 36        | Goby (sp?)    | 10          |
| 4:20                       | 23.2      | sculpin       | 20          |
| 5:19                       | 9         | Snow Crab     | 8 (body)    |

### Summary

Target Species # 0

### Habitat Summary

Habitat Complexity: 0  
% Rock Bottom: 0%



Location: Lummi Island Trip B    Transect: #8 (NW Eliza)  
 Start GPS: 48° 40.651' N    Date: 3/19/2008  
 122° 35.584' W    Time: 14:40  
 Video Start Ch 2 07:44 Title 2    Visibility: fair  
 Video End: Ch 2 10:45 Title 2    Depth Range 26.3' - 31.9'  
 Substrate Types: 3 = Rocky, 2 = Cobble, 1 = Gravel, 0 = Sand or Mud

Notes: sandy with large cobbles spread out

| Habitat       |                     | screen: 40.5cm |                     |
|---------------|---------------------|----------------|---------------------|
| Disc Location | Elapsed Time (min.) | Depth (m)      | Habitat Lasers (cm) |
| 8             | 1                   | 9.8            | 1.5                 |
| 9             | 2                   | 8.9            | 1.5                 |
| 10            | 3                   | 8.4            | 0.5                 |
|               |                     |                | 4.1                 |
|               |                     |                | 6.5                 |
|               |                     |                | 4.3                 |

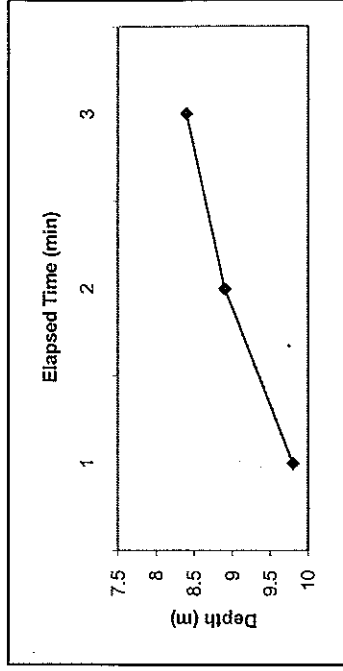
| Disc Location | Depth (m) | Fish Observed | Length (cm) |
|---------------|-----------|---------------|-------------|
|---------------|-----------|---------------|-------------|

### Summary

Target Species    #    0

### Habitat Summary

Habitat Complexity: 1.166667  
 % Rock Bottom: 0%



Location: Lummi Island Trip B  
 Start GPS: 48° 38.377' N  
 122° 36.413' W  
 Transect: #9 (Carter Pt.)  
 Date: 3/19/2008  
 Time: 15:05  
 Video Start Ch 1 00:46 Title 3  
 Video End: Ch 1 09:37 Title 3  
 Depth Range 29.9' - 128.7'  
 Substrate Types: 3 = Rocky, 2 = Cobble, 1 = Gravel, 0 = Sand or Mud

| Notes         |                     | Habitat   |         | screen: 40.5cm |     |
|---------------|---------------------|-----------|---------|----------------|-----|
| Disc Location | Elapsed Time (min.) | Depth (m) | Habitat | Lasers (cm)    |     |
| 1             | 1                   | 39.6      | 2       | 2              | 6   |
| 2             | 2                   | 37.4      | 2       | 2              | 4.8 |
| 3             | 3                   | 34.7      | 2.5     | 2.5            | 6   |
| 4             | 4                   | 32.5      | 1       | 1              | 5.5 |
| 5             | 5                   | 33.9      | 2       | 2              | 4.7 |
| 6             | 6                   | 27.9      | 1.5     | 1.5            | 5.5 |
| 7             | 7                   | 23.2      | 1.5     | 1.5            | 3.2 |
| 8             | 8                   | 15.7      | 3       | 3              | 6   |
| 9             | 9                   | 9.2       | 3       | 3              | 8   |

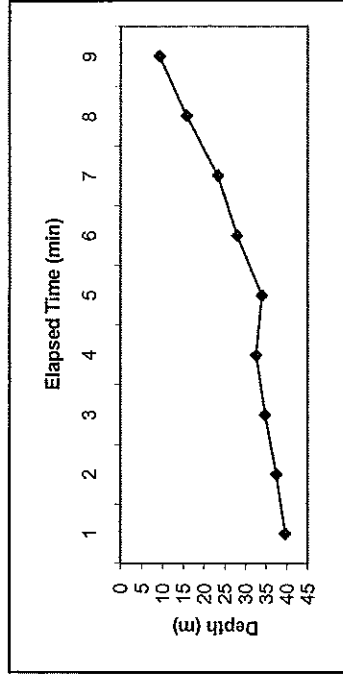
| Disc Location | Depth (m) | Fish Observed        | Length (cm) |
|---------------|-----------|----------------------|-------------|
| 1:51          | 37.8      | gunnel               | 15          |
| 7:05          | 22.5      | unidentified         | 15          |
| 7:22          | 19.8      | unidentified (same?) | 15          |
| 7:45          | 16.2      | Kelp Greenling (f)   | 20          |
| 9:12          | 7.8       | unidentified         | 15          |

# Summary

## Habitat Summary

Target Species      #  
 \_\_\_\_\_      0

Habitat Complexity: 2.055556  
 % Rock Bottom: 30% (at least 2.5)



|                                                                     |  |                        |  |                                 |  |
|---------------------------------------------------------------------|--|------------------------|--|---------------------------------|--|
| Location: Lummi Island Trip C                                       |  | Transect: #1           |  | Notes: Shull #4 moderate marine |  |
| Start GPS: 48°38.812'N                                              |  | Date: 5/29/2008        |  | Time: 11:00                     |  |
| 122°37.147'W                                                        |  | Time: 11:00            |  | Slow Cable feather in function  |  |
| Video Start Title 1 00:00                                           |  | Visibility: fair       |  | aborted dive at 2:40            |  |
| Video End Title 1 02:40                                             |  | Depth Range 21.3 - 7.7 |  |                                 |  |
| Substrate Types: 3 = Rocky, 2 = Cobble, 1 = Gravel, 0 = Sand or Mud |  |                        |  |                                 |  |

| Habitat | Disc Location | Elapsed Time (min.) | Depth (m) | Habitat | Lasers (cm) |
|---------|---------------|---------------------|-----------|---------|-------------|
| 0       | 0             | 0                   | 21.3      | 0       | 3.4         |
| 1       | 1             | 1                   | 13.6      | 0       | 3.4         |
| 2       | 2             | 2                   | 11.6      | 0       | 8.5         |
| 2:39    | 2:39          | 2:39                | 7.7       | 0       | 3.6         |

| Disc Location | Depth (m) | Fish Observed      | Length (cm) |
|---------------|-----------|--------------------|-------------|
| 1:28          | 12.4      | unidentified small | n/a         |
| 1:57          | 12        | sculpin            | 25          |

# Summary

Target Species #

# Habitat Summary

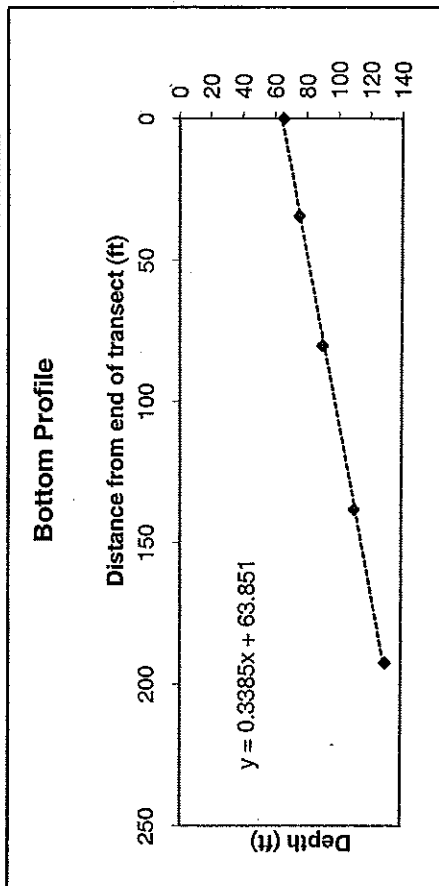
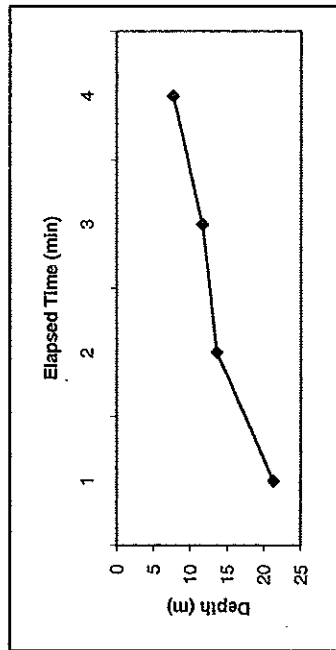
Habitat Complexity:

% Rock Bottom:

| Bottom Slope | Latitude    | Longitude | Depth | Distance (ft) |
|--------------|-------------|-----------|-------|---------------|
| 48°          | 38.821 122° | 37.104    | 65    | 0             |
| 48°          | 38.817 122° | 37.11     | 75    | 34.28062      |
| 48°          | 38.811 122° | 37.117    | 90    | 80.22228      |
| 48°          | 38.803 122° | 37.125    | 110   | 138.2803      |
| 48°          | 38.794 122° | 37.129    | 130   | 192.5123      |

Slope  
0.33853355  
0.32642342  
18.7026844 degrees

Estimated transect area  
53.60297719 m^2

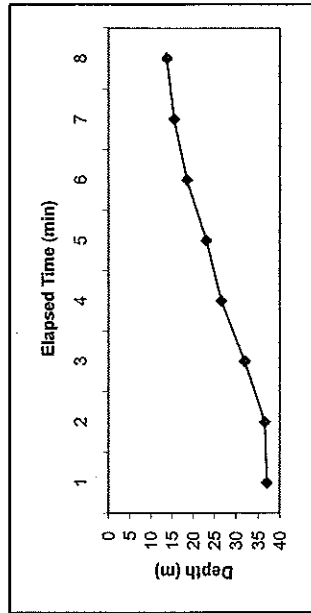


Location: Lumm Island Trip C Transect #2 Date: 5/29/2008  
 Start GPS: 48° 38.815' N Time: 11:10 Notes: Shull #4 Moderate marine snow  
 Video Star Title: 200.00 Visibility: fair  
 Video End: Title: 207.34 Depth Range: 37 - 13.8  
 Substrate Types: 3 = Rocky, 2 = Cobble, 1 = Gravel, 0 = Sand or Mud

| Disc Location | Depth (m) | Fish Observed | Length (cm) |
|---------------|-----------|---------------|-------------|
| 2:08          | 31.6      | Flatfish      | 15          |
| 4:57          | 18.5      | goby          | 18          |
| 5:26          | 17.1      | sculpin       | 28          |

| Habitat | Disc Location | Elapsed Time (min.) | Depth (m) | Habitat | Lasers (cm) |
|---------|---------------|---------------------|-----------|---------|-------------|
|         | 0:20          | 0                   | 37        | 0       | 2.5         |
| 1       | 1             | 1                   | 36.5      | 0       | 4.5         |
| 2       | 2             | 2                   | 32        | 0       | 4.7         |
| 3       | 3             | 3                   | 26.6      | 0.5     | 9.7         |
| 4       | 4             | 4                   | 23.1      | 0       | 3.3         |
| 5       | 5             | 5                   | 18.5      | 0       | 11.8        |
| 6       | 6             | 6                   | 15.5      | 0       | 5           |
| 7       | 7             | 7                   | 13.8      | 0       | 3           |

Estimated transect area  
 45.53241658 m^2



### Habitat Summary

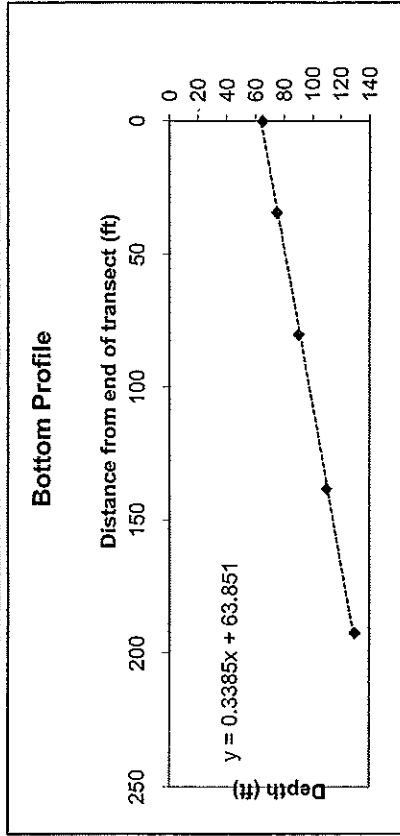
Habitat Complexity: 0.0625  
 % Rock Bottom:

### Summary

Target Species #

| Bottom Slope | Latitude | Longitude | Depth  | Distance (ft) |
|--------------|----------|-----------|--------|---------------|
| 48°          | 38.821   | 122°      | 37.104 | 65            |
| 48°          | 38.817   | 122°      | 37.11  | 75            |
| 48°          | 38.811   | 122°      | 37.117 | 90            |
| 48°          | 38.803   | 122°      | 37.125 | 110           |
| 48°          | 38.794   | 122°      | 37.129 | 130           |
|              |          |           |        | 192.5123      |

Slope  
 0.33853355  
 0.32642342  
 18.7026844 degrees



Location: Lummi Island Trip C Transect: #3  
 Start GPS: 48° 38.540' N Date: 5/29/2008  
 122° 36.770' W Time: 11:20  
 Video Start Title: 3 00:00 Visibility: fair Notes: Shull #2  
 Video End Title: 3 05:36 Depth Range: 36.1 - surface  
 Substrate Types: 3 = Rocky, 2 = Cobble, 1 = Gravel, 0 = Sand or Mud

| Disc Location | Depth (m) | Fish Observed         | Length (cm) |
|---------------|-----------|-----------------------|-------------|
| 0:06          | 36.1      | PS Rockfish           | 8           |
| 0:26          | 35.7      | 2 PS Rockfish         | n/a         |
| 1:06          | 32.8      | PS Rockfish           | n/a         |
| 1:30          | 30.5      | Whitespotted or Kelp? | 60          |
| 1:55          | 28.5      | PS Greenling          | 8           |
| 2:15          | 26.1      | 4 PS Rockfish         | n/a         |
| 2:28          | 25.2      | Blackeye Goby         | n/a         |
| 2:40          | 24        | 2 PS Rockfish         | n/a         |
| 3:00          | 21.5      | Copper Rockfish       | n/a         |
| 3:26          | 19.1      | PS Rockfish           | 6           |
| 3:36          | 17.8      | Blackeye Goby         | 8           |
| 3:34          | 17.4      | PS Rockfish           | n/a         |
| 3:47          | 16.9      | Copper Rockfish       | 30          |
| 4:07          | 14.9      | PS Rockfish           | 6           |

Total Rockfish/ Rockfish/min  
 16  
 Estimated transect area  
 49.92145864 m<sup>2</sup>  
 Rockfish/m<sup>2</sup>  
 0.320503

#### Summary

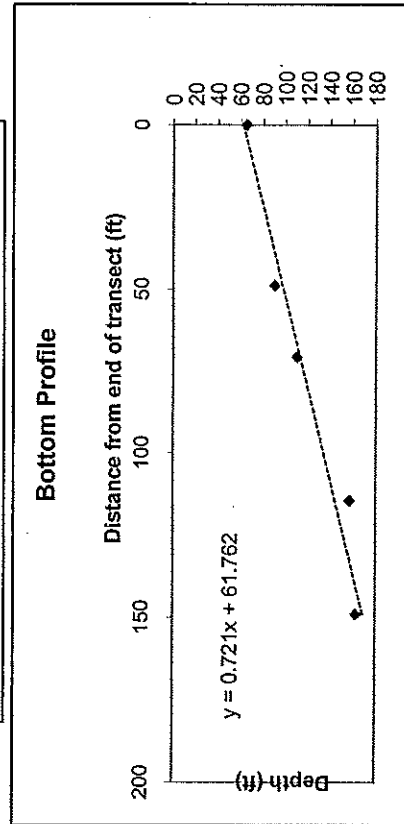
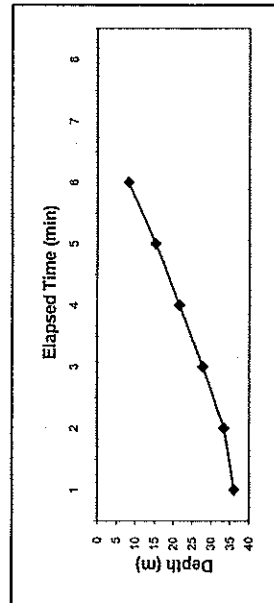
| Target Species  | #  |
|-----------------|----|
| PS Rockfish     | 14 |
| Copper Rockfish | 2  |

#### Habitat Summary

Habitat Complexity:  
 % Rock Bottom:

| Latitude | Longitude | Depth | Distance (ft) |
|----------|-----------|-------|---------------|
| 48°      | 38.546    | 122°  | 65            |
| 48°      | 38.539    | 122°  | 90            |
| 48°      | 38.536    | 122°  | 110           |
| 48°      | 38.532    | 122°  | 157           |
| 48°      | 38.53     | 122°  | 163           |

Slope  
 0.72099672  
 0.62467917  
 35.7914801 degrees



Location: Lummi Island Trip C Transect: #4  
 Start GPS: 48° 38.408' N Date: 5/29/2008  
 122° 36.571' W Time: 11:35  
 Video Start Title 4 01:00 Visibility: fair to poor  
 Video End: Title 4 07:15 Depth Range: 38.1' - surface  
 Substrate Types: 3 = Rocky, 2 = Cobble, 1 = Gravel, 0 = Sand or Mud

| Disc Location | Elapsed Time (min.) | Depth (m) | Habitat | Lasers (cm) |
|---------------|---------------------|-----------|---------|-------------|
| 1             | 0                   | 38.1      | 3       | 3.7         |
| 2             | 1                   | 32.3      | 3       | 4.2         |
| 3             | 2                   | 24.9      | 3       | 4.6         |
| 4             | 3                   | 18.1      | 3       | 7           |
| 5             | 4                   | 15.2      | 3       | 4           |
| 6             | 5                   | 11.2      | 3       | 12          |
| 7             | 6                   | 2.2       | 1 n/a   |             |

| Disc Location | Depth (m) | Fish Observed                                  | Length (cm) |
|---------------|-----------|------------------------------------------------|-------------|
| 2:24          | 29        | Gunnel                                         | 10          |
| 2:48          |           | 2 unidentified small (possibly black rockfish) | 8           |
| 3:12          |           | 26.4 3 PS Rockfish                             | 7           |
| 3:23          |           | 23.2 Copper Rockfish                           | 46          |
| 4:13          |           | 22.9 PS Rockfish                               | 12          |
|               |           | 16.5 Copper Rockfish                           | 30          |
|               |           | 2 PS Rockfish                                  | 15          |
| 4:44          |           | 15.2 2 Copper Rockfish                         | 28          |
| 5:14          |           | 14.8 PS Rockfish                               | 12          |
| 5:44          |           | 12.6 PS Rockfish                               | 7           |
| 5:54          |           | 11.3 PS Rockfish                               | 6           |

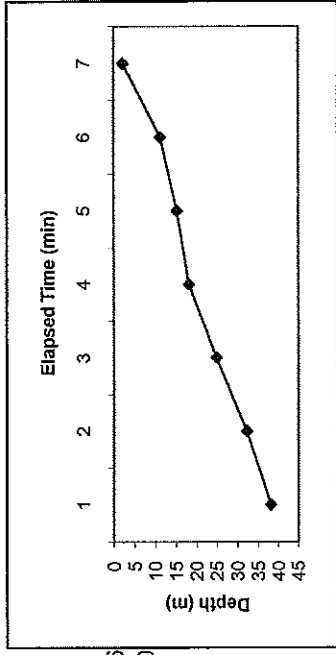
Total Rockfish/min 13  
 Rockfish/m<sup>2</sup> 0.36675  
 2.16666667  
 Estimated transect area 35.44647506 m<sup>2</sup>

### Summary

| Target Species  | # |
|-----------------|---|
| PS Rockfish     | 9 |
| Copper Rockfish | 4 |

### Habitat Summary

Habitat Complexity: 2.714286  
 % Rock Bottom:

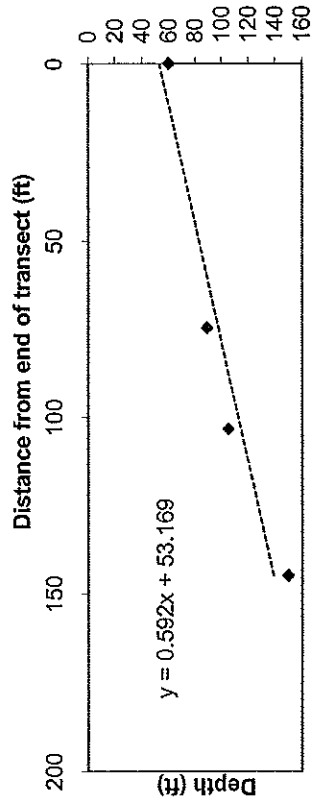


### Bottom Slope

| Latitude | Longitude | Depth | Distance (ft) |
|----------|-----------|-------|---------------|
| 48°      | 38.436    | 122°  | 60            |
| 48°      | 38.424    | 122°  | 88.8          |
| 48°      | 38.419    | 122°  | 103.3725      |
| 48°      | 38.415    | 122°  | 144.8256      |

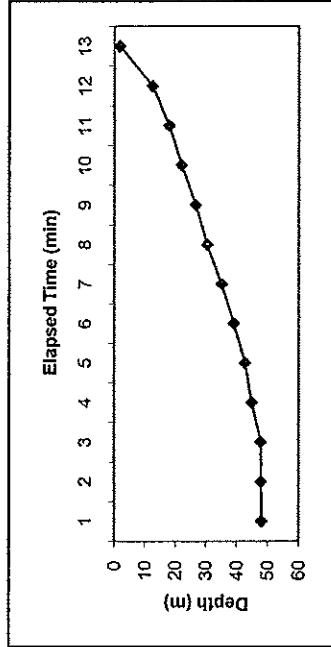
Slope 0.59195538  
 0.53448334  
 30.6236398 degrees

### Bottom Profile



Location: Lumm Island Trip C Transect: #5  
 Start GPS: 48° 38.696' N Date: 5/29/2008  
 122° 37.028' W Time: 12:00  
 Video Start Title 5:00:00 Visibility: fair  
 Video End Title 5:12:25 Depth Range 48.1 - surface  
 Substrate Types: 3 = Rocky, 2 = Cobble, 1 = Gravel, 0 = Sand or Mud

| Disc Location             | Depth (m)               | Fish Observed | Length (cm) | Disc Location                | Elapsed Time (min.) | Depth (m) | Habitat | Lasers (cm) |
|---------------------------|-------------------------|---------------|-------------|------------------------------|---------------------|-----------|---------|-------------|
| 0:16 Derelict net (large) | 48.1                    |               |             | 0                            | 0                   | 48.1      | 3       | 7           |
| 3:31                      | 44.1 Kelp Greenling (f) | 30            |             | 1                            | 1                   | 47.9      | 2       | 6           |
| 5:26                      | 37.9 Copper Rockfish    | 25            |             | 2                            | 2                   | 47.8      | 2       | 4.2         |
| 6:45                      | 31.2 Kelp Greenling (f) | 30            |             | 3                            | 3                   | 44.9      | 2       | 3.5         |
| 6:57                      | 30.8 Copper Rockfish    | 25            |             | 4                            | 4                   | 42.7      | 2       | 6.5         |
| 7:54                      | 26.5 Copper Rockfish    | 20            |             | 5                            | 5                   | 39.1      | 2.5     | 4           |
| 8:19                      | 25.1 4 PS Rockfish      | n/a           |             | 6                            | 6                   | 35.2      | 3       | 4.5         |
| 8:21                      | 25 Copper Rockfish      | 20            |             | 7                            | 7                   | 30.5      | 3       | 7           |
| 8:42                      | 23.7 Kelp Greenling (m) | 30            |             | 8                            | 8                   | 26.7      | 3       | 6           |
| 8:47                      | 23.6 PS Rockfish        | n/a           |             | 9                            | 9                   | 22.1      | 3       | 6.5         |
| 9:08 small school         | 21.2 6 PS Rockfish      | n/a           |             | 10                           | 10                  | 18.1      | 2.5     | 2.6         |
| 9:31 small school         | 20.1 5 PS Rockfish      | n/a           |             | 11                           | 11                  | 12.6      | 2.5     | 4.5         |
| 10:29                     | 15.8 PS Rockfish        | n/a           |             | 12                           | 12                  | 1.8       | 2 n/a   |             |
| Summary                   |                         |               |             | Total Rockfish/ Rockfish/min |                     |           |         |             |
|                           |                         |               |             | 21 1.75                      |                     |           |         |             |
|                           |                         |               |             | Estimated transect area      |                     |           |         |             |
|                           |                         |               |             | 65.22350232 m^2              |                     |           |         |             |
|                           |                         |               |             | Rockfish/m^2                 |                     |           |         |             |
|                           |                         |               |             | 0.32197                      |                     |           |         |             |



Habitat Complexity:  
% Rock Bottom:

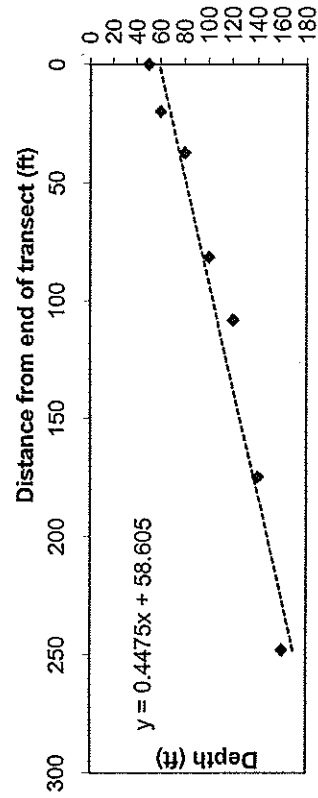
Habitat Complexity:  
% Rock Bottom:

| Target Species  | #  |
|-----------------|----|
| PS Rockfish     | 17 |
| Copper Rockfish | 4  |

| Bottom Slope | Latitude | Longitude | Depth  | Distance (ft) |
|--------------|----------|-----------|--------|---------------|
| 48°          | 38.733   | 122°      | 37.002 | 50            |
| 48°          | 38.73    | 122°      | 37     | 60            |
| 48°          | 38.727   | 122°      | 37     | 80            |
| 48°          | 38.72    | 122°      | 37.007 | 100           |
| 48°          | 38.716   | 122°      | 37.01  | 120           |
| 48°          | 38.706   | 122°      | 37.017 | 140           |
| 48°          | 38.696   | 122°      | 37.028 | 160           |

Slope  
 0.44750771  
 0.4207794  
 24.1088839 degrees

Bottom Profile



|                                                                     |  |                            |
|---------------------------------------------------------------------|--|----------------------------|
| Location: Lummi Island Trip C                                       |  | Transsect #6               |
| Start GPS: 48° 38.613' N                                            |  | Date: 5/29/2008            |
| 122° 36.888' W                                                      |  | Time: 12:30                |
| Video Start Title 6 00:00                                           |  | Visibility: fair           |
| Video End: Title 6 06:32                                            |  | Depth Range 50.1 - surface |
| Substrate Types: 3 = Rocky, 2 = Cobble, 1 = Gravel, 0 = Sand or Mud |  |                            |

| Disc Location | Elapsed Time (min.) | Depth (m) | Habitat | Lasers (cm) |
|---------------|---------------------|-----------|---------|-------------|
| 0             | 0                   | 50.3      | 2.5     | 7.6         |
| 1             | 1                   | 47.7      | 3       | 5.2         |
| 2             | 2                   | 42.5      | 3       | 4.5         |
| 3             | 3                   | 31.9      | 3       | 4           |
| 4             | 4                   | 25.6      | 3       | 4.2         |
| 5             | 5                   | 17.1      | 3       | 6           |
| 6             | 6                   | 11.2      | 3       | 4.4         |

| Disc Location | Depth (m) | Fish Observed      | Length (cm) |
|---------------|-----------|--------------------|-------------|
| 1:17          | 46.2      | Quillback Rockfish | 20          |
| 1:32          | 45.2      | Quillback Rockfish | 18          |
| 1:56          | 42.7      | PS Rockfish        | 12          |
| 3:41          | 26.4      | Yelloweye Rockfish | 10          |
| 4:32          | 20.5      | 2 Copper Rockfish  | 30          |
| 4:53          | 18.9      | Copper Rockfish    | 25          |
| 5:27          | 16        | Copper Rockfish    | 28          |

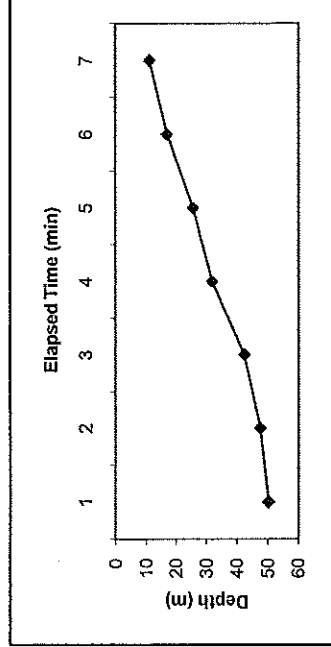
Total Rockfish 8  
 Rockfish/min 1.333333333  
 Rockfish/m<sup>2</sup> 0.168077  
 Estimated transect area 47.59714932 m<sup>2</sup>

#### Summary

| Target Species     | # |
|--------------------|---|
| Quillback Rockfish | 2 |
| PS Rockfish        | 1 |
| Yelloweye Rockfish | 1 |
| Copper Rockfish    | 4 |

#### Habitat Summary

Habitat Complexity: 2.928571  
 % Rock Bottom: 95



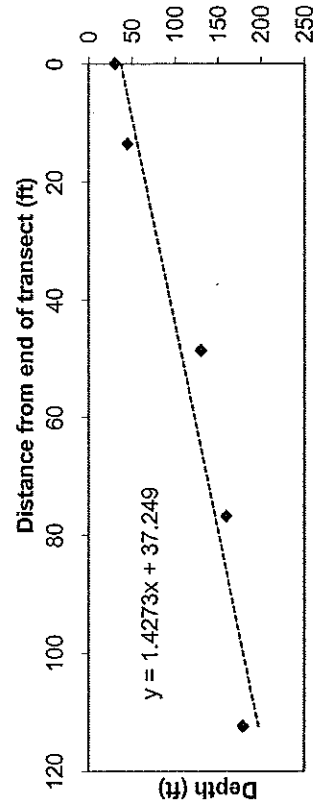
#### Bottom Slope

| Latitude        | Longitude | Depth | Distance (ft) |
|-----------------|-----------|-------|---------------|
| 48° 38.63 122°  | 36.877    | 30    | 0             |
| 48° 38.629 122° | 36.874    | 45    | 13.52962      |
| 48° 38.622 122° | 36.877    | 130   | 48.60892      |
| 48° 38.618 122° | 36.883    | 160   | 76.81727      |
| 48° 38.613 122° | 36.888    | 180   | 112.4025      |

Slope

1.42727102  
 0.95964245  
 54.9834622 degrees

#### Bottom Profile



Location: Lummi Island Trip C  
 Start GPS: 48° 39.164' N  
 122° 38.331' W  
 Date: 5/29/2008  
 Time: 13:00  
 Video Start Title: 7:00:00  
 Video End Title: 7:08:35  
 Substrate Types: 3 = Rocky, 2 = Cobble, 1 = Gravel, 0 = Sand or Mud  
 Notes: tons of prawns following ROV, school of herring. Dive ended due to boat drag.

| Disc Location | Elapsed Time (min.) | Depth (m) | Habitat | Lasers (cm) |
|---------------|---------------------|-----------|---------|-------------|
| 0             | 0                   | 40.7      | 1.5     | 6           |
| 1             | 1                   | 39.8      | 1.5     | 6           |
| 2             | 2                   | 36.8      | 1.5     | 6.5         |
| 3             | 3                   | 34.1      | 2.5     | 7.5         |
| 4             | 4                   | 31.8      | 2.5     | 6.5         |
| 5             | 5                   | 28.7      | 2.5     | 6           |
| 6             | 6                   | 24.9      | 2.5     | 5           |
| 7             | 7                   | 22.3      | 2       | 5           |
| 8             | 8                   | 21.9      | 2       | 4           |

| Disc Location | Depth (m) | Fish Observed | Length (cm) |
|---------------|-----------|---------------|-------------|
|---------------|-----------|---------------|-------------|

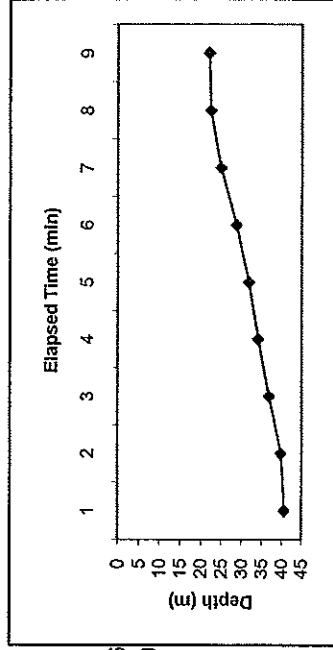
### Summary

Target Species #

### Habitat Summary

Habitat Complexity: 2.055556  
% Rock Bottom: 50

Estimated transect area  
71,9178746 m²



### Bottom Slope

| Latitude        | Longitude | Depth | Distance (ft) |
|-----------------|-----------|-------|---------------|
| 48° 39.203 122° | 38.279    | 20    | 0             |
| 48° 39.199 122° | 38.284    | 40    | 31.56699      |
| 48° 39.195 122° | 38.291    | 60    | 68.55697      |
| 48° 39.192 122° | 38.302    | 80    | 114.2511      |
| 48° 39.187 122° | 38.308    | 100   | 151.9916      |
| 48° 39.182 122° | 38.316    | 120   | 217.204       |
| 48° 39.177 122° | 38.321    | 130   | 291.1799      |
| 48° 39.164 122° | 38.331    | 140   | 316.2957      |

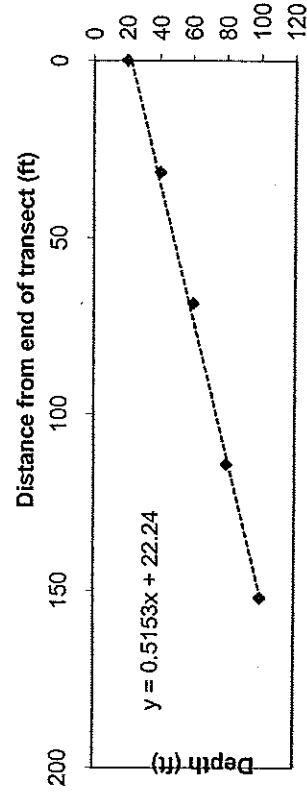
Slope

0.36450359

0.34953673

20.0269796 degrees

### Bottom Profile



Location: Lummi Island Trip C  
 Start GPS: 48° 40.309' N  
 122° 39.708' W  
 Date: 5/29/2008  
 Time: 13:30  
 Video Start Title: 1 00:40  
 Video End Title: 1 07:35  
 Visibility: fair to poor  
 Depth Range: 46.3 - surface  
 Substrate Types: 3 = Rocky, 2 = Cobble, 1 = Gravel, 0 = Sand or Mud

| Disc Location | Elapsed Time (min.) | Depth (m) | Habitat | Lasers (cm) |
|---------------|---------------------|-----------|---------|-------------|
| 0:40          | 1                   | 46.3      | 1.5     | 6           |
| 2             | 2                   | 42.1      | 1       | 3.5         |
| 3             | 3                   | 37.3      | 3       | 7           |
| 4             | 4                   | 29.1      | 2.5     | 4           |
| 5             | 5                   | 22.2      | 3       | 9           |
| 6             | 6                   | 13.7      | 2.5     | 3.3         |

| Disc Location | Depth (m) | Fish Observed | Length (cm) |
|---------------|-----------|---------------|-------------|
|---------------|-----------|---------------|-------------|

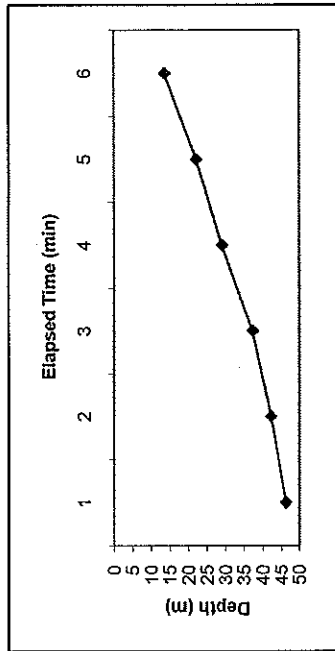
# Summary

Target Species #

# Habitat Summary

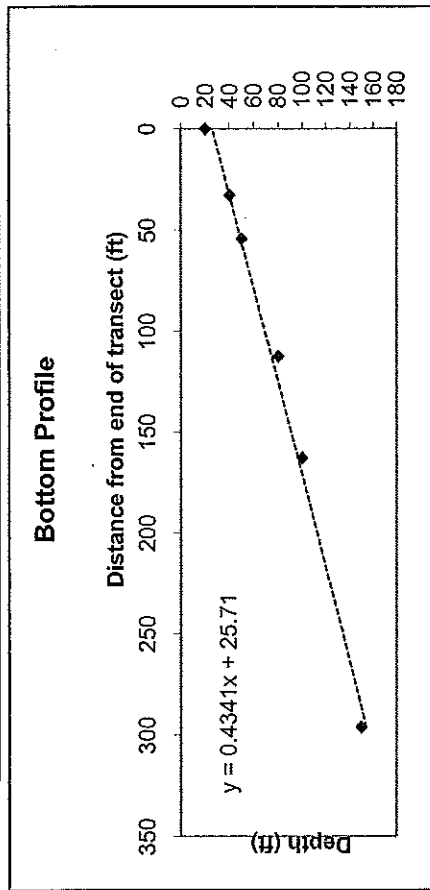
Habitat Complexity: 2.25  
 % Rock Bottom: 40

Estimated transect area  
 73.56377866 m^2



| Bottom Slope | Latitude | Longitude | Depth  | Distance (ft) |
|--------------|----------|-----------|--------|---------------|
| 48°          | 40.347   | 122°      | 39.662 | 20            |
| 48°          | 40.342   | 122°      | 39.665 | 40            |
| 48°          | 40.339   | 122°      | 39.668 | 50            |
| 48°          | 40.33    | 122°      | 39.673 | 80            |
| 48°          | 40.323   | 122°      | 39.68  | 100           |
| 48°          | 40.309   | 122°      | 39.708 | 150           |

Slope  
 0.43409099  
 0.40954553  
 23.4652305 degrees



Location: Lummi Island Trip C  
 Start GPS: 48° 40.958' N  
 122° 40.775' W  
 Date: 5/29/2008  
 Time: 13:45  
 Video Start Title 2:00:00  
 Video End: Title 2:07:00  
 Substrate Types: 3 = Rocky, 2 = Cobble, 1 = Gravel, 0 = Sand or Mud  
 Visibility: fair  
 Depth Range 27.4 - 11.1  
 Notes: dive ended due to boat drag

| Disc Location | Elapsed Time (min.) | Depth (m) | Habitat | Lasers (cm) |
|---------------|---------------------|-----------|---------|-------------|
| 0             | 0                   | 27.4      | Habitat | 5           |
| 1             | 1                   | 25.5      | 2       | 8           |
| 2             | 2                   | 21.5      | 2       | 5           |
| 3             | 3                   | 17.3      | 2       | 3           |
| 4             | 4                   | 15.6      | 1       | 3           |
| 5             | 5                   | 14.3      | 1       | 4           |
| 6             | 6                   | 13.4      | 1       | 12          |

| Disc Location | Depth (m) | Fish Observed | Length (cm) |
|---------------|-----------|---------------|-------------|
| 6:05          | 13.4      | Sculpin       | 20          |

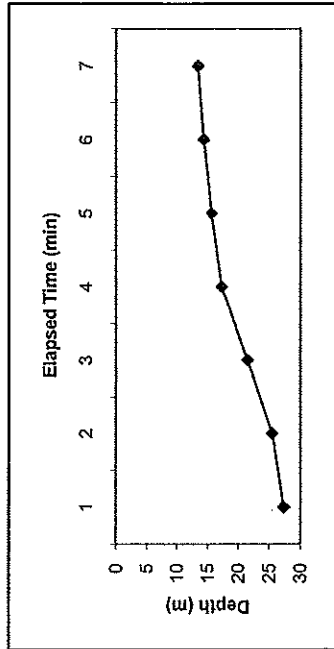
### Summary

Target Species #

### Habitat Summary

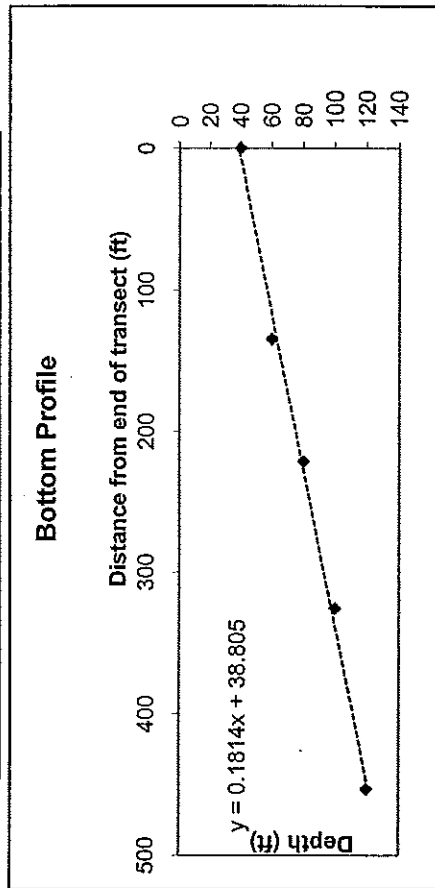
Habitat Complexity: 1.571429  
% Rock Bottom: 0

Estimated transect area  
72,192,578.26 m<sup>2</sup>



| Bottom Slope | Latitude | Longitude | Depth  | Distance (ft) |
|--------------|----------|-----------|--------|---------------|
| 48°          | 41.001   | 122°      | 40.683 | 40            |
| 48°          | 40.987   | 122°      | 40.709 | 60            |
| 48°          | 40.98    | 122°      | 40.728 | 80            |
| 48°          | 40.97    | 122°      | 40.749 | 100           |
| 48°          | 40.958   | 122°      | 40.775 | 120           |
|              |          |           |        | 453.3         |

Slope  
 0.1813931  
 0.17944199  
 10.2812685 degrees



|                                                                     |  |                         |  |
|---------------------------------------------------------------------|--|-------------------------|--|
| Location: Alden Bank                                                |  | Transsect: #1           |  |
| Start GPS: 48° 49.963' N                                            |  | Date: 2/20/2008         |  |
| 122° 53.012' W                                                      |  | Time: 11:30             |  |
| Video Start: Ch 1 00:30 Title 1                                     |  | Visibility: Low         |  |
| Video End: Ch 1 08:20 Title 1                                       |  | Depth Range 34.2 - 29.8 |  |
| Substrate Types: 3 = Rocky, 2 = Cobble, 1 = Gravel, 0 = Sand or Mud |  |                         |  |

| Disc Location | Elapsed Time (min.) | Depth (m) | Habitat |
|---------------|---------------------|-----------|---------|
| CH 1 00:30    | 1                   | 34.2      | 0.5     |
| CH 1 01:30    | 2                   | 32.7      | 1.5     |
| CH 1 05:30    | 3                   | 31.7      | 0.5     |
| CH 1 06:30    | 4                   | 30.2      | 0.5     |
| CH 1 07:30    | 5                   | 29.8      | 0.5     |

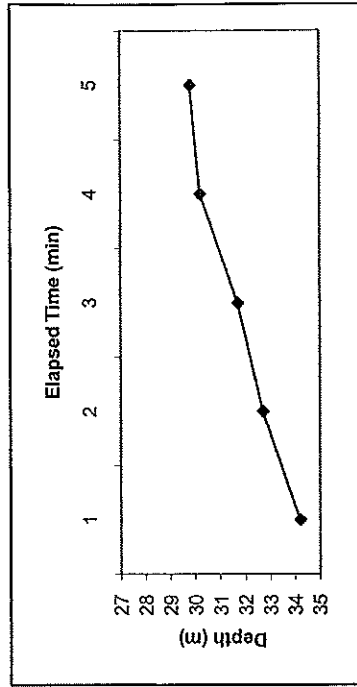
| Disc Location | Elapsed Time (min.) | Depth (m) | Fish Observed | Length (cm) |
|---------------|---------------------|-----------|---------------|-------------|
|---------------|---------------------|-----------|---------------|-------------|

### Summary

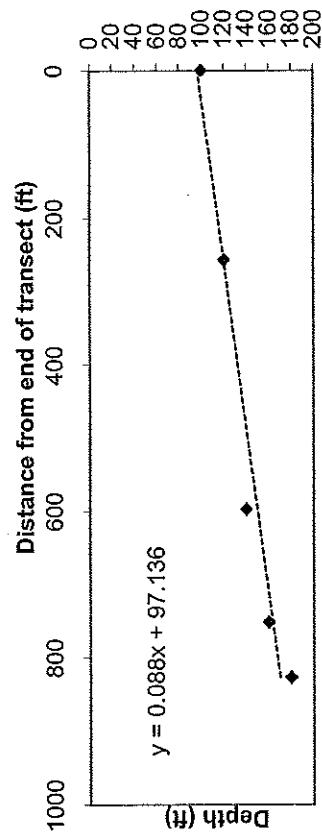
Target Species # 0

### Habitat Summary

Habitat Complexity: 0.7  
% Rock Bottom: 0



### Bottom Profile



| Bottom Slope | Latitude | Longitude | Depth  | Distance (ft) |
|--------------|----------|-----------|--------|---------------|
| 48°          | 50.023   | 122°      | 52.827 | 100           |
| 48°          | 50.025   | 122°      | 52.891 | 120           |
| 48°          | 49.998   | 122°      | 52.971 | 140           |
| 48°          | 49.974   | 122°      | 52.999 | 160           |
| 48°          | 49.963   | 122°      | 53.012 | 180           |
|              |          |           |        | 827.3227      |

Slope  
0.08804641  
0.08781994  
5.03171205 degrees

Location: Alden Bank  
 Start GPS: 48° 49.943' N  
 122° 50.359' W  
 Video Start: Ch 1 00:00 Title 2  
 Video End: Ch 2 34:00 Title 2  
 Substrate Types: 3 = Rocky, 2 = Cobble, 1 = Gravel, 0 = Sand or Mud

|                                                                     |  |                         |                                                                                                |  |
|---------------------------------------------------------------------|--|-------------------------|------------------------------------------------------------------------------------------------|--|
| Location: Alden Bank                                                |  | Transect: #2            | Notes: moderate marine snow; 2 dives on video 06:22 - 11:15 last bottom 20:30 to 25:00 surface |  |
| Start GPS: 48° 49.943' N                                            |  | Date: 2/20/2008         | divisor interval                                                                               |  |
| 122° 50.359' W                                                      |  | Time: 12:05             |                                                                                                |  |
| Video Start: Ch 1 00:00 Title 2                                     |  | Visibility: fair        |                                                                                                |  |
| Video End: Ch 2 34:00 Title 2                                       |  | Depth Range 50.6 - 19.3 |                                                                                                |  |
| Substrate Types: 3 = Rocky, 2 = Cobble, 1 = Gravel, 0 = Sand or Mud |  |                         |                                                                                                |  |

| Disc Location | Depth (m) | Fish Observed      | Length (cm) | Disc Location | Elapsed Time (min.) | Depth (m) | Habitat |
|---------------|-----------|--------------------|-------------|---------------|---------------------|-----------|---------|
| Ch 2 00:30    | 50.4      | Sculpin (Bonehead) | 30          | Ch 2 00:30    | 1                   | 50.4      | 0       |
|               |           | Flatfish           | 10          | Ch 2 01:30    | 2                   | 50.1      | 0       |
| Ch 2 01:49    | 50.1      | Sculpin            | 15          | Ch 2 02:30    | 3                   | 49.3      | 0       |
| Ch 2 12:12    | 51.3      | Flatfish           | 14          | Ch 2 03:30    | 4                   | 47.4      | 0       |
|               |           | Goby               | 10          | Ch 2 04:30    | 5                   | 45.2      | 0       |
| Ch 2 12:48    | 51.3      | 2 Flatfish         | 20, 10      | Ch 2 05:30    | 6                   | 42.8      | 0       |
| Ch 2 13:20    | 50.6      | Flatfish           | 8           | Ch 2 11:30    | 7                   | 50.8      | 0       |
| Ch 2 18:57    | 38.4      | Flatfish           | 20          | Ch 2 12:30    | 8                   | 51.2      | 0       |
|               |           |                    |             | Ch 2 13:30    | 9                   | 50.6      | 0       |
|               |           |                    |             | Ch 2 14:30    | 10                  | 47.8      | 0       |
|               |           |                    |             | Ch 2 15:30    | 11                  | 45.1      | 0       |
|               |           |                    |             | Ch 2 16:30    | 12                  | 41.1      | 0       |
|               |           |                    |             | Ch 2 17:30    | 13                  | 39.2      | 0       |
|               |           |                    |             | Ch 2 18:30    | 14                  | 37.5      | 0       |
|               |           |                    |             | Ch 2 19:30    | 15                  | 35.2      | 0       |
|               |           |                    |             | Ch 2 20:30    | 16                  | 37.2      | 0       |
|               |           |                    |             | surface       |                     |           |         |
|               |           |                    |             | Ch 2 25:30    | 17                  | 24.3      | 0       |
|               |           |                    |             | Ch 2 26:30    | 18                  | 19.6      | 0       |
|               |           |                    |             | Ch 2 27:30    | 19                  | 19.3      | 0       |
|               |           |                    |             | Ch 2 28:30    | 20                  | 18.6      | 0       |
|               |           |                    |             | Ch 2 29:30    | 21                  | 21        | 0       |
|               |           |                    |             | Ch 2 30:30    | 22                  | 18.8      | 0       |
|               |           |                    |             | Ch 2 31:30    | 23                  | 21.8      | 0       |
|               |           |                    |             | Ch 2 32:30    | 24                  | 19.4      | 0       |

| Summary        |   | Habitat Summary     |   |
|----------------|---|---------------------|---|
| Target Species | # | Habitat Complexity: | 0 |
|                | 0 | % Rock Bottom:      | 0 |

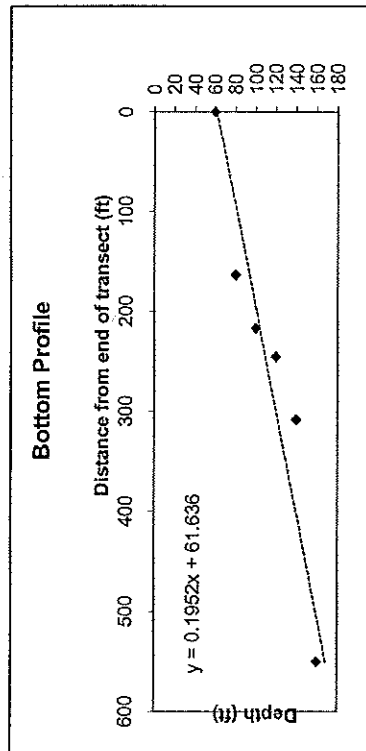
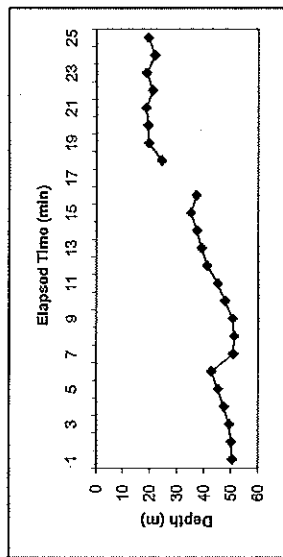
### Summary

Target Species # 0  
 Habitat Complexity: 0  
 % Rock Bottom: 0

### Habitat Summary

| Bottom Slope | Latitude | Longitude | Depth  | Distance (ft) |
|--------------|----------|-----------|--------|---------------|
| 48°          | 49.888   | 122°      | 50.478 | 60            |
| 48°          | 49.906   | 122°      | 50.439 | 80            |
| 48°          | 49.908   | 122°      | 50.426 | 100           |
| 48°          | 49.911   | 122°      | 50.42  | 120           |
| 48°          | 49.919   | 122°      | 50.408 | 140           |
| 48°          | 49.943   | 122°      | 50.359 | 160           |

Slope  
 0.19524244  
 0.19281683  
 11.0475904 degrees



Location: Alden Bank  
 Start GPS: 48° 49.242' N  
 122° 49.045' W  
 Video Start: Ch 1 02:00 Title 3  
 Video End: Ch 1 09:05 Title 3  
 Substrate Types: 3 = Rocky, 2 = Cobble, 1 = Gravel, 0 = Sand or Mud

| Disc Location | Disc Location | Elapsed Time (min.) | Depth (m) | Habitat |
|---------------|---------------|---------------------|-----------|---------|
| Ch 1 07:00    | Ch 1 02:30    | 1                   | 46.2      | 0       |
|               | Ch 1 03:30    | 2                   | 43.7      | 0       |
|               | Ch 1 04:40    | 3                   | 40.6      | 0       |
|               | Ch 1 05:30    | 4                   | 39.8      | 0       |
|               | Ch 1 06:30    | 5                   | 39        | 0       |
|               | Ch 1 07:30    | 6                   | 37.9      | 0       |
|               | Ch 1 08:30    | 7                   | 36.7      | 0       |

| Disc Location | Depth (m) | Fish Observed | Length (cm) |
|---------------|-----------|---------------|-------------|
| Ch 1 07:00    | 38.4      | Flatfish      | 20          |

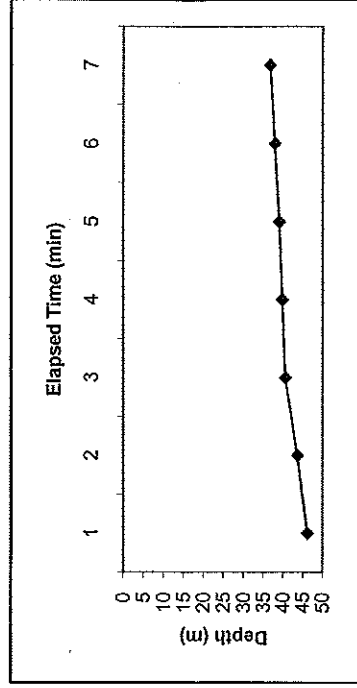
Notes: moderate "marine snow"  
 Date: 2/20/2008  
 Time: 13:50  
 Visibility: fair  
 Depth Range 46.2 - 36.7

# Summary

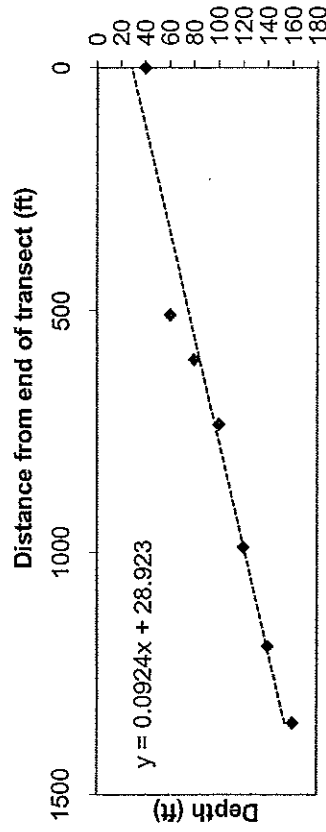
| Target Species | # |
|----------------|---|
|                | 0 |

# Habitat Summary

|                     |   |
|---------------------|---|
| Habitat Complexity: | 0 |
| % Rock Bottom:      | 0 |



# Bottom Profile



| Bottom Slope | Latitude | Longitude | Depth  | Distance (ft) |
|--------------|----------|-----------|--------|---------------|
| 48°          | 49.059   | 122°      | 49.237 | 40            |
| 48°          | 49.124   | 122°      | 49.157 | 60            |
| 48°          | 49.135   | 122°      | 49.141 | 80            |
| 48°          | 49.151   | 122°      | 49.118 | 100           |
| 48°          | 49.184   | 122°      | 49.079 | 120           |
| 48°          | 49.219   | 122°      | 49.064 | 140           |
| 48°          | 49.242   | 122°      | 49.045 | 160           |

Slope  
 0.09241756  
 0.09215578  
 5.28013745 degrees

Location: Alden Bank  
Start GPS: 48° 48.494' N  
122° 48.464' W

Transect: #4  
Date: 2/20/2008  
Time: 14:00

Notes: minimal "marine snow"

Video Start Ch 1 00:00 Title 1  
Video End: Ch 1 06:00 Title 1  
Substrate Types: 3 = Rocky, 2 = Cobble, 1 = Gravel, 0 = Sand or Mud

| Disc Location | Elapsed Time (min.) | Depth (m) | Habitat |
|---------------|---------------------|-----------|---------|
| Ch 1 00:30    | 1                   | 27.9      | 1       |
| Ch 1 01:30    | 2                   | 21.3      | 1       |
| Ch 1 02:30    | 3                   | 15.1      | 1       |
| Ch 1 03:30    | 4                   | 13        | 1.5     |
| Ch 1 04:30    | 5                   | 13        | 1.5     |
| Ch 1 05:30    | 6                   | 12        | 1.5     |

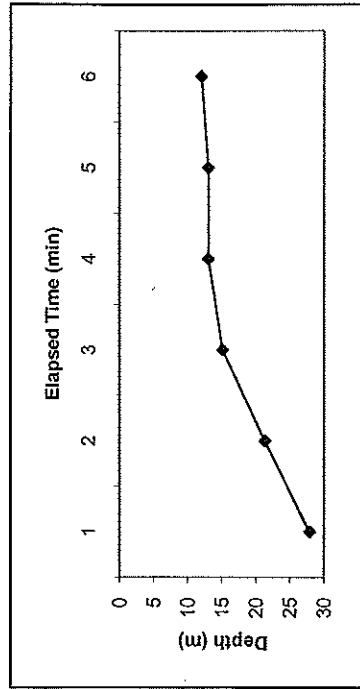
| Disc Location | Elapsed Time (min.) | Depth (m) | Fish Observed | Length (cm) |
|---------------|---------------------|-----------|---------------|-------------|
|---------------|---------------------|-----------|---------------|-------------|

# Summary

|                |   |
|----------------|---|
| Target Species | # |
|                | 0 |

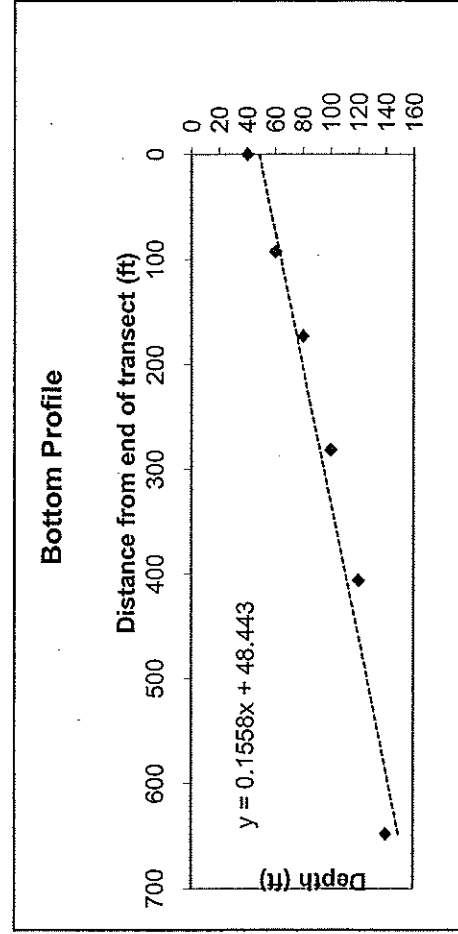
# Habitat Summary

|                     |      |
|---------------------|------|
| Habitat Complexity: | 1.25 |
| % Rock Bottom:      | 0    |



| Latitude | Longitude   | Depth  | Distance (ft) |
|----------|-------------|--------|---------------|
| 48°      | 48.487 122° | 48.625 | 40            |
| 48°      | 48.487 122° | 48.602 | 60            |
| 48°      | 48.487 122° | 48.582 | 80            |
| 48°      | 48.489 122° | 48.555 | 100           |
| 48°      | 48.491 122° | 48.524 | 120           |
| 48°      | 48.494 122° | 48.464 | 140           |

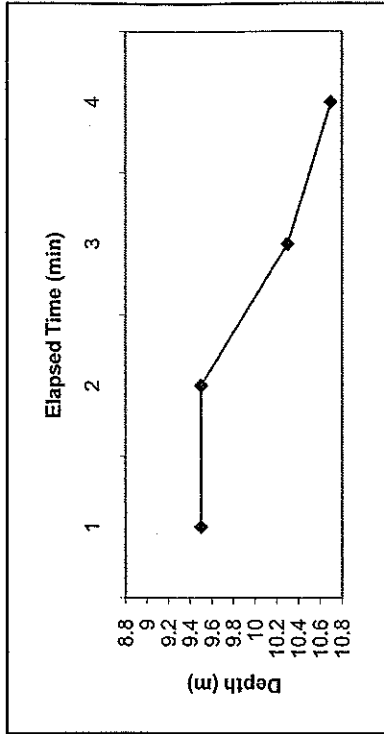
Slope 0.15575202  
0.1545106  
8.85280511 degrees



|                                                                     |  |                        |       |
|---------------------------------------------------------------------|--|------------------------|-------|
| Location: Aiden Bank                                                |  | Transect: #5           | Notes |
| Start GPS: 48° 48.494' N                                            |  | Date: 2/20/2008        |       |
| 122° 48.464' W                                                      |  | Time: 14:10            |       |
| Video Start: Ch 2 07:52 Title 1                                     |  | Visibility: good       |       |
| Video End: Ch 2 12:10 Title 1                                       |  | Depth Range 9.5 - 10.7 |       |
| Substrate Types: 3 = Rocky, 2 = Cobble, 1 = Gravel, 0 = Sand or Mud |  |                        |       |

| Disc Location | Elapsed Time (min.) | Depth (m) | Habitat |
|---------------|---------------------|-----------|---------|
| Ch 2 08:30    | 1                   | 9.5       | 0       |
| Ch 2 09:30    | 2                   | 9.5       | 0       |
| Ch 2 10:30    | 3                   | 10.3      | 0       |
| Ch 2 11:30    | 4                   | 10.7      | 0       |

| Disc Location | Elapsed Time (min.) | Depth (m) | Fish Observed | Length (cm) |
|---------------|---------------------|-----------|---------------|-------------|
|---------------|---------------------|-----------|---------------|-------------|



### Summary

Target Species      #      0

### Habitat Summary

Habitat Complexity:      0  
 % Rock Bottom:      0

|                                                                     |  |                        |  |
|---------------------------------------------------------------------|--|------------------------|--|
| Location: Alden Bank                                                |  | Transect: #6           |  |
| Start GPS: 48° 48.231' N                                            |  | Date: 2/20/2008        |  |
| 122° 50.881' W                                                      |  | Time: 14:30            |  |
| Video Start: Ch 1 01:30 Title 2                                     |  | Visibility: fair       |  |
| Video End: Ch 1 12:56 Title 2                                       |  | Depth Range: 43.5 - 32 |  |
| Substrate Types: 3 = Rocky, 2 = Cobble, 1 = Gravel, 0 = Sand or Mud |  |                        |  |

Notes: minimal "marine snow"

| Disc Location | Depth (m) | Fish Observed | Length (cm) |
|---------------|-----------|---------------|-------------|
| Ch 1 06:50    | 36.3      | Flatfish      | 25          |
| Ch 1 07:25    | 36.9      | Flatfish      | 20          |
| Ch 1 11:16    | 31.9      |               |             |

Derelict crab pot and line

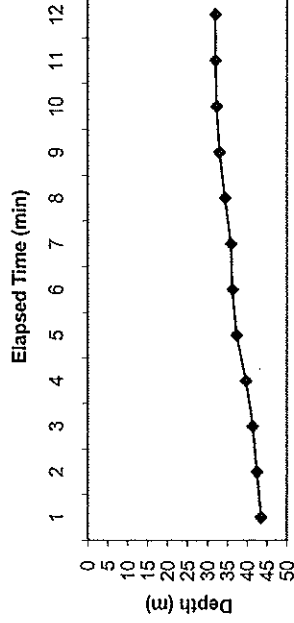
### Summary

Target Species #

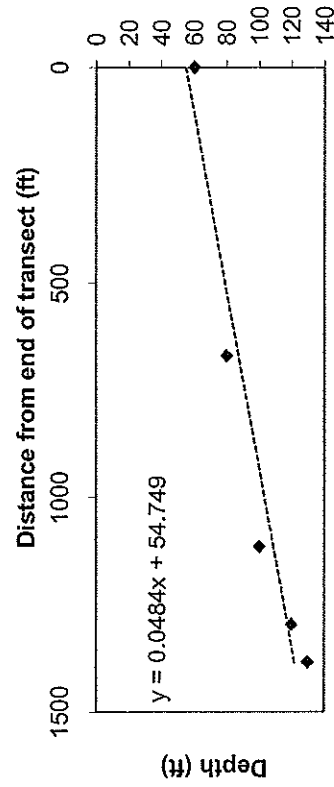
### Habitat Summary

Habitat Complexity: 0  
% Rock Bottom: 0

| Disc Location | Elapsed Time (min.) | Depth (m) | Habitat |
|---------------|---------------------|-----------|---------|
| Ch 1 01:30    | 1                   | 43.5      | 0       |
| Ch 1 02:30    | 2                   | 42.5      | 0       |
| Ch 1 03:30    | 3                   | 41.4      | 0       |
| Ch 1 04:30    | 4                   | 39.7      | 0       |
| Ch 1 05:30    | 5                   | 37.3      | 0       |
| Ch 1 06:30    | 6                   | 36.3      | 0       |
| Ch 1 07:30    | 7                   | 35.9      | 0       |
| Ch 1 08:30    | 8                   | 34.4      | 0       |
| Ch 1 09:30    | 9                   | 33        | 0       |
| Ch 1 10:30    | 10                  | 32.3      | 0       |
| Ch 1 11:30    | 11                  | 32        | 0       |
| Ch 1 12:30    | 12                  | 32        | 0       |



### Bottom Profile



### Bottom Slope

| Latitude        | Longitude | Depth | Distance (ft) |
|-----------------|-----------|-------|---------------|
| 48° 48.35 122°  | 50.587    | 60    | 0             |
| 48° 48.319 122° | 50.747    | 80    | 669.6913      |
| 48° 48.273 122° | 50.839    | 100   | 1115.097      |
| 48° 48.245 122° | 50.868    | 120   | 1296.527      |
| 48° 48.231 122° | 50.881    | 130   | 1384.693      |

slope

0.04842273  
0.04838494  
2.77225294 degrees

Location: Alden Bank  
 Start GPS: 48° 47' 036" N  
 122° 49' 295" W  
 Video Start: Ch 1 02:41 Title 3  
 Video End: Ch 1 23:53 Title 3  
 Substrate Types: 3 = Rocky, 2 = Cobble, 1 = Gravel, 0 = Sand or Mud

Transect: #7  
 Date: 3/18/2008  
 Time: 14:30  
 Visibility: low  
 Depth Range: 41.4 - 30.1

Notes: Return from Pt. Roberts  
 cobble with sand and boulder areas,  
 some 'marine snow'

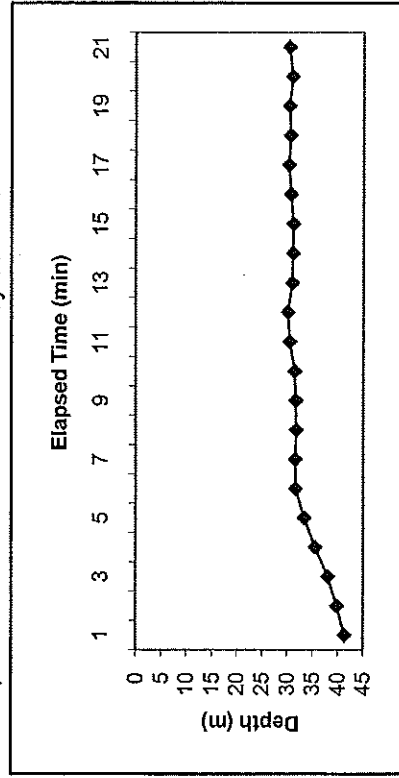
| Disc Location | Elapsed Time (min.) | Depth (m) | Habitat |
|---------------|---------------------|-----------|---------|
| 3:30          | 1                   | 41.4      | 0.5     |
| 4:30          | 2                   | 39.9      | 2       |
| 5:30          | 3                   | 38.1      | 2       |
| 6:30          | 4                   | 35.6      | 2.5     |
| 7:30          | 5                   | 33.4      | 1.5     |
| 8:30          | 6                   | 31.7      | 1.5     |
| 9:30          | 7                   | 31.6      | 2       |
| 10:30         | 8                   | 31.8      | 2.5     |
| 11:30         | 9                   | 31.7      | 2.5     |
| 12:30         | 10                  | 31.5      | 1.5     |
| 13:30         | 11                  | 30.5      | 2.5     |
| 14:30         | 12                  | 30.1      | 2.5     |
| 15:30         | 13                  | 31        | 2.5     |
| 16:30         | 14                  | 31.1      | 2.5     |
| 17:30         | 15                  | 31.2      | 2.5     |
| 18:30         | 16                  | 30.7      | 2       |
| 19:30         | 17                  | 30.3      | 2.5     |
| 20:30         | 18                  | 30.6      | 2       |
| 21:30         | 19                  | 30.4      | 2       |
| 22:30         | 20                  | 31        | 2       |
| 23:30         | 21                  | 30.4      | 2.5     |

### Summary

Target Species # 0

### Habitat Summary

Habitat Complexity: 2.095238  
 % Rock Bottom: 20 \*Estimate, cobbles and boulders with sandy bottom.



Location: Alden Bank    Transect: #8    Date: 5/29/2008    Time: 14:25    Notes: End of Lummi Trip C - many PS Rockfish?

Start GPS: 48° 47.042' N    122° 49.842' W    Visibility: fair to poor    Depth Range 47.9m - 26.8m

Video Start Title 4 01:00    Video End: Title 4 11:14    Substrate Types: 3 = Rocky, 2 = Cobble, 1 = Gravel, 0 = Sand or Mud

| Disc Location | Depth (m) | Fish Observed | Length (cm) |
|---------------|-----------|---------------|-------------|
| 7:38          | 30.8      | PS Rockfish   | 6           |
| 8:04          | 30.2      | PS Rockfish   | 8           |

\*\*\*possible other juvenile PS Rockfish school sightings not clear on video.\*\*\*

#### Summary

Target Species #  
PS Rockfish >3

#### Habitat Summary

Habitat Complexity: 2.318182  
% Rock Bottom: 15

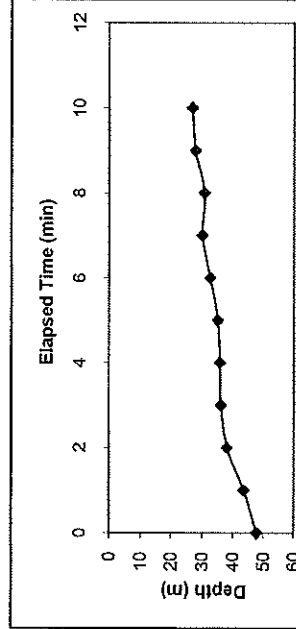
#### Bottom Slope

| Latitude | Longitude   | Depth  | Distance (ft) |
|----------|-------------|--------|---------------|
| 48°      | 47.037 122° | 49.81  | 50            |
| 48°      | 47.084 122° | 49.813 | 60            |
| 48°      | 47.071 122° | 49.821 | 80            |
| 48°      | 47.062 122° | 49.829 | 100           |
| 48°      | 47.057 122° | 49.832 | 120           |
| 48°      | 47.042 122° | 49.842 | 150           |

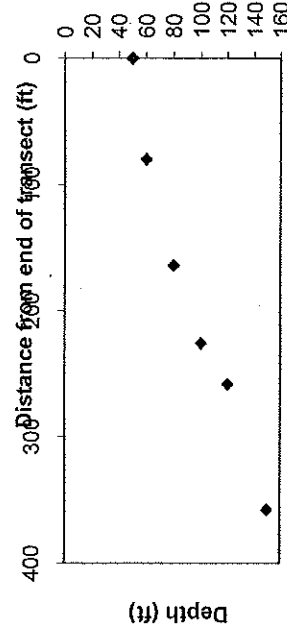
Slope  
0.28841417  
0.28079399  
16.0883107 degrees

| Disc Location | Elapsed Time (min.) | Depth (m) | Habitat | Lasers (cm) |
|---------------|---------------------|-----------|---------|-------------|
| 1             | 0                   | 47.9      | 2       | 3           |
| 2             | 1                   | 43.6      | 2       | 3           |
| 3             | 2                   | 38.1      | 2       | 4.5         |
| 4             | 3                   | 36.1      | 2       | 4           |
| 5             | 4                   | 35.8      | 2       | 3           |
| 6             | 5                   | 35.1      | 2       | 3           |
| 7             | 6                   | 32.6      | 2.5     | 3.4         |
| 8             | 7                   | 30        | 2.5     | 8           |
| 9             | 8                   | 30.7      | 2.5     | 5.5         |
| 10            | 9                   | 27.8      | 3       | 4           |
| 11            | 10                  | 26.8      | 3       | 3           |

Total Rockfish/ Rockfish/min    0.3    Rockfish/m<sup>2</sup>  
3    0.026075  
Estimated transect area  
115.053867 m<sup>2</sup>



#### Bottom Profile



|                                                                     |                        |           |                                                      |
|---------------------------------------------------------------------|------------------------|-----------|------------------------------------------------------|
| Location: Point Roberts                                             | Transect: #1           | 3/18/2008 | Notes: sandy with 2' boulders, current still present |
| Start GPS: 48° 57' 657" N                                           | Date:                  | 11:30     |                                                      |
| 122° 59' 944" W                                                     | Time:                  |           |                                                      |
| Video Start Ch 1 01:22 Title 2                                      | Visibility: low        |           |                                                      |
| Video End: Ch 1 16:20 Title 2                                       | Depth Range: 11 - 12.3 |           |                                                      |
| Substrate Types: 3 = Rocky, 2 = Cobble, 1 = Gravel, 0 = Sand or Mud |                        |           |                                                      |

| Disc Location | Depth (m) | Fish Observed | Length (cm) |
|---------------|-----------|---------------|-------------|
|---------------|-----------|---------------|-------------|

| Disc Location | Elapsed Time (min.) | Depth (m) | Habitat |
|---------------|---------------------|-----------|---------|
| 1:30          | 1                   | 11.7      | 2.5     |
| 2:30          | 2                   | 11.1      | 2.5     |
| 3:30          | 3                   | 11.4      | 2.5     |
| 4:30          | 4                   | 12.3      | 2.5     |
| 5:30          | 5                   | 11.4      | 2       |
| 6:30          | 6                   | 11.6      | 2.5     |
| 7:30          | 7                   | 11.9      | 2.5     |
| 8:30          | 8                   | 11.8      | 2.5     |
| 9:30          | 9                   | 11.2      | 2.5     |
| 10:30         | 10                  | 11.6      | 2.5     |
| 11:30         | 11                  | 12        | 2.5     |
| 12:30         | 12                  | 11        | 2       |
| 13:30         | 13                  | 11.6      | 2.5     |
| 14:30         | 14                  | 11.5      | 2.5     |
| 15:30         | 15                  | 11.5      | 2.5     |

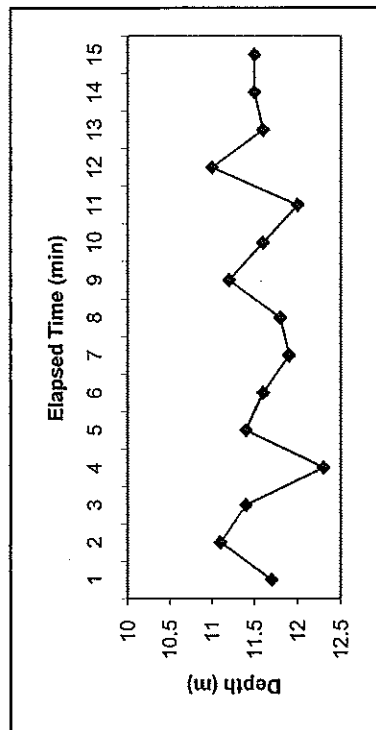
### Summary

Target Species # 0

### Habitat Summary

Habitat Complexity: 2.433333  
 % Rock Bottom: 25%

\*Estimate, all 1' to 3' boulders were spread out in sand.



|                                                                     |                       |
|---------------------------------------------------------------------|-----------------------|
| Location: Point Roberts                                             | Transect: #2          |
| Start GPS: 48° 57.718' N                                            | Date: 3/18/2008       |
| 123° 00.834' W                                                      | Time: 12:00           |
| Video Start: Ch 2 23:28 Title 2                                     | Visibility: low       |
| Video End: Ch 2 32:45 Title 2                                       | Depth Range 11 - 13.8 |
| Substrate Types: 3 = Rocky, 2 = Cobble, 1 = Gravel, 0 = Sand or Mud |                       |

| Habitat       |                     | Habitat   |         |
|---------------|---------------------|-----------|---------|
| Disc Location | Elapsed Time (min.) | Depth (m) | Habitat |
| Ch 2 23:30    | 1                   | 13.3      | 2       |
| Ch 2 24:30    | 2                   | 13.8      | 1.5     |
| Ch 2 25:30    | 3                   | 13.5      | 1.5     |
| Ch 2 26:30    | 4                   | 13        | 1.5     |
| Ch 2 27:30    | 5                   | 12.4      | 2       |
| Ch 2 28:30    | 6                   | 12.1      | 1.5     |
| Ch 2 29:30    | 7                   | 12.3      | 1.5     |
| Ch 2 30:30    | 8                   | 11.5      | 2       |
| Ch 2 31:30    | 9                   | 11        | 2       |
| Ch 2 32:30    | 10                  | 11.2      | 1.5     |

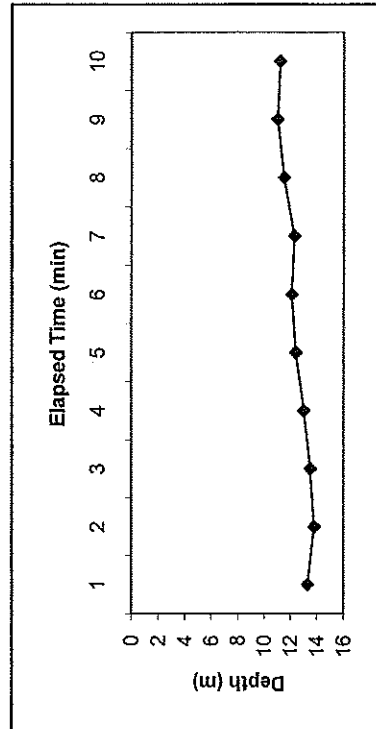
| Disc Location | Depth (m) | Fish Observed | Length (cm) |
|---------------|-----------|---------------|-------------|
|---------------|-----------|---------------|-------------|

### Summary

Target Species # 0

### Habitat Summary

Habitat Complexity: 1.7  
% Rock Bottom: 0



Location: Point Roberts  
 Start GPS: 48° 56.985' N  
 122° 58.831' W  
 Video Start: Ch 1 01:04 Title 3  
 Video End: Ch 1 14:15 Title 3  
 Substrate Types: 3 = Rocky, 2 = Cobble, 1 = Gravel, 0 = Sand or Mud

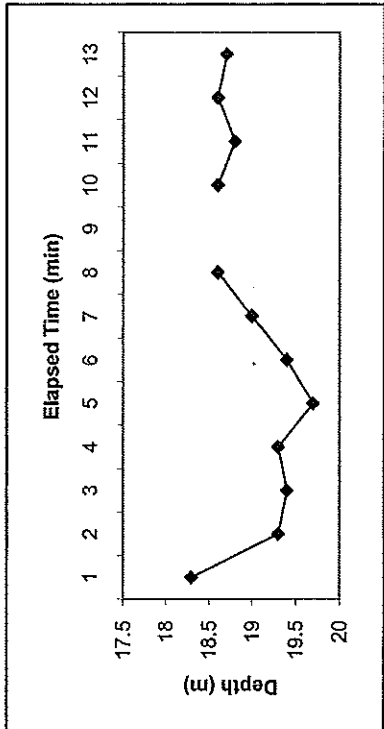
| Habitat |                        | Disc Location | Elapsed Time (min.) | Depth (m) | Habitat |
|---------|------------------------|---------------|---------------------|-----------|---------|
|         | Ch 1                   | 01:30         | 1                   | 18.3      | 2.5     |
|         | Ch 1                   | 02:30         | 2                   | 19.3      | 2       |
|         |                        | 3:30          | 3                   | 19.4      | 2       |
|         |                        | 4:30          | 4                   | 19.3      | 1.5     |
|         |                        | 5:30          | 5                   | 19.7      | 2.5     |
|         |                        | 6:30          | 6                   | 19.4      | 2       |
|         |                        | 7:30          | 7                   | 19        | 2.5     |
|         |                        | 8:30          | 8                   | 18.6      | 2.5     |
|         | * Lost Bottom, Contact |               |                     |           |         |
|         |                        | 10:30         | 10                  | 18.6      | 2       |
|         |                        | 11:30         | 11                  | 18.8      | 2       |
|         |                        | 12:30         | 12                  | 18.6      | 1.5     |
|         |                        | 13:30         | 13                  | 18.7      | 2.5     |

Summary

Target Species # 0

Habitat Summary

Habitat Complexity: 2.125  
 % Rock Bottom: 15% \*Estimate, larger boulders spaced out in sand.



|                                                                     |                       |
|---------------------------------------------------------------------|-----------------------|
| Location: Point Roberts                                             | Transect: #4          |
| Start GPS: 48° 56.333' N                                            | Date: 3/18/2008       |
| 122° 58.141' W                                                      | Time: 13:00           |
| Video Start: Ch 2 18:30 Title 3                                     | Visibility: fair      |
| Video End: Ch 2 26:26 Title 3                                       | Depth Range 35 - 43.2 |
| Substrate Types: 3 = Rocky, 2 = Cobble, 1 = Gravel, 0 = Sand or Mud |                       |

# Habitat

| Disc Location | Elapsed Time (min.) | Depth (m) | Habitat |
|---------------|---------------------|-----------|---------|
| Ch 2 18:30    | 1                   | 43.2      | 1.5     |
| Ch 2 19:30    | 2                   | 41.5      | 1.5     |
| Ch 2 20:30    | 3                   | 39.9      | 2       |
| Ch 2 21:30    | 4                   | 37.9      | 1.5     |
| Ch 2 22:30    | 5                   | 37        | 1.5     |
| Ch 2 23:30    | 6                   | 37        | 2       |
| Ch 2 24:30    | 7                   | 36        | 2.5     |
| Ch 2 25:30    | 8                   | 35        | 2.5     |

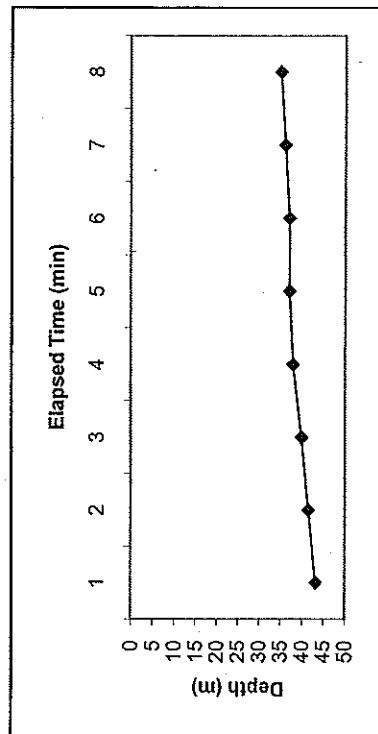
| Disc Location | Fish Observed | Length (cm) |
|---------------|---------------|-------------|
| Ch 2 19:15    | 42.3 Sculpin  | 20          |

## Summary

Target Species # 0

## Habitat Summary

Habitat Complexity: 1.875  
 % Rock Bottom: 10% \* Estimate, 1' to 3' boulders spaced out in sand



|                                                                     |                         |                             |
|---------------------------------------------------------------------|-------------------------|-----------------------------|
| Location: Point Roberts                                             | Transect: #5            | Date: 3/18/2008             |
| Start GPS: 48° 55.397' N                                            | Time: 13:30             | Notes: moderate marine snow |
| 122° 56.479' W                                                      | Visibility: low         | heavy current               |
| Video Start Ch 1 02:51 Title 1                                      | Depth Range 35.4 - 42.7 |                             |
| Video End: Ch 1 17:20 Title 1                                       |                         |                             |
| Substrate Types: 3 = Rocky, 2 = Cobble, 1 = Gravel, 0 = Sand or Mud |                         |                             |

| Disc Location | Elapsed Time (min.) | Depth (m) | Fish Observed | Length (cm) |
|---------------|---------------------|-----------|---------------|-------------|
| Ch 1 03:30    | 1                   | 42.7      |               | 2.5         |
| 4:30          | 2                   | 39.7      |               | 2.5         |
| 5:30          | 3                   | 36.8      |               | 2.5         |
| 6:30          | 4                   | 36.5      |               | 3           |
| 7:30          | 5                   | 35.4      |               | 3           |
| 8:30          | 6                   | 35.6      |               | 3           |
| 9:30          | 7                   | 36.2      |               | 2.5         |
| 10:30         | 8                   | 36        |               | 3           |
| 11:30         | 9                   | 37.2      |               | 1.5         |
| 12:30         | 10                  | 39        |               | 2           |
| 13:30         | 11                  | 38.1      |               | 2.5         |
| 14:30         | 12                  | 37.7      |               | 2.5         |
| 15:30         | 13                  | 38.1      |               | 2.5         |
| 16:30         | 14                  | 38.3      |               | 2.5         |

# Summary

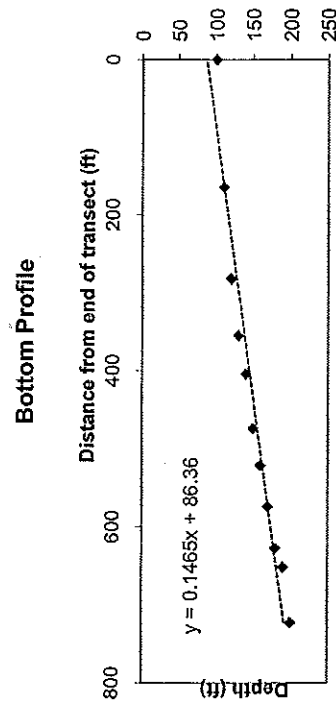
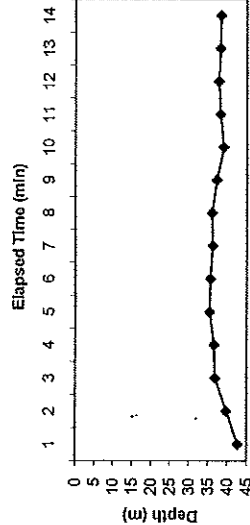
Target Species # 0

# Habitat Summary

Habitat Complexity: 2.535714  
 % Rock Bottom: 40 \*Estimate, many large boulders but sandy bottom

| Bottom Slope | Latitude    | Longitude | Depth | Distance (ft) |
|--------------|-------------|-----------|-------|---------------|
| 48°          | 55.441 122° | 56.374    | 100   | 0             |
| 48°          | 55.428 122° | 56.41     | 110   | 164.4672      |
| 48°          | 55.412 122° | 56.429    | 120   | 282.1747      |
| 48°          | 55.402 122° | 56.44     | 130   | 355.1062      |
| 48°          | 55.395 122° | 56.447    | 140   | 404.5882      |
| 48°          | 55.386 122° | 56.458    | 150   | 474.3239      |
| 48°          | 55.379 122° | 56.464    | 160   | 521.5216      |
| 48°          | 55.372 122° | 56.472    | 170   | 574.4486      |
| 48°          | 55.365 122° | 56.48     | 180   | 627.4323      |
| 48°          | 55.362 122° | 56.484    | 190   | 651.7001      |
| 48°          | 55.354 122° | 56.497    | 200   | 722.7603      |

slope 0.14649702  
 0.14546231  
 8.33437624 degrees



|                                                                     |                 |                          |                                                                   |
|---------------------------------------------------------------------|-----------------|--------------------------|-------------------------------------------------------------------|
| Location: Point Roberts                                             | Transect: #6    | Date: 3/18/2008          | Notes: heavy "marine snow", wind pushing boat and influencing ROV |
| Start GPS: 48° 55.590' N                                            | Time: 14:00     | Time: 14:00              | Sandy bottom with misc. cobbles                                   |
| 122° 55.555' W                                                      | Visibility: low | Depth Range: 33.8 - 43.4 |                                                                   |
| Video Start Ch 1 05:00 Title 2                                      |                 |                          |                                                                   |
| Video End: Ch 1 13:45 Title 2                                       |                 |                          |                                                                   |
| Substrate Types: 3 = Rocky, 2 = Cobble, 1 = Gravel, 0 = Sand or Mud |                 |                          |                                                                   |

| Habitat       |                     | Habitat   |         |
|---------------|---------------------|-----------|---------|
| Disc Location | Elapsed Time (min.) | Depth (m) | Habitat |
| 5:30          | 1                   | 43.4      | 0.5     |
| 6:30          | 2                   | 42.3      | 0.5     |
| 7:30          | 3                   | 40.5      | 0.5     |
| 8:30          | 4                   | 38        | 0.5     |
| 9:30          | 5                   | 37        | 0.5     |
| 10:30         | 6                   | 35.4      | 0.5     |
| 11:30         | 7                   | 34        | 0.5     |
| 12:30         | 8                   | 33.8      | 0.5     |
| 13:30         | 9                   | 34        | 0.5     |

| Disc Location | Fish Observed | Depth (m) | Length (cm) |
|---------------|---------------|-----------|-------------|
| Ch 1 05:05    | 43.6 Goby     | 9         |             |
| 5:55          | 43.4 Goby     | 10        |             |
| 6:15          | Sculpin       | 20        |             |
|               | 43 Goby       | 8         |             |

### Summary

Target Species # 0

### Habitat Summary

Habitat Complexity: 0.4  
% Rock Bottom: 0

