

## Hydroacoustic eelgrass mapping on the Nisqually Delta

By Andrew W. Stevens

On February 15-19, 2012 a team of scientists from the USGS Pacific Coastal and Marine Science Center (PCMSC) and Washington State Department of Ecology participated in a survey (USGS Field Activity D-01-12-PS) to collect nearshore bathymetry data and map the distribution of eelgrass on the Nisqually delta (Table 1).

A detailed description of the methodology used for hydroacoustic vegetation surveys can be found in Stevens et al. (2008). In this brief cruise report, information specific to Nisqually delta survey is provided. The hydroacoustic sonar survey was performed using a Biosonics 430 kHz single-beam echosounder mounted on the R/V *George Davidson* (fig. 1). Positional information was obtained using a Trimble R7 GPS receiver operating in Real-Time Kinematic mode. Real-time corrections to the GPS receiver were transmitted via VHF radio link from a GPS base station set up on a benchmark with known geodetic control (Table 2). Positional information from the GPS and sonar data were combined to determine the elevation of the bottom. Raw elevations were computed in the WGS84 (ITRF2000) reference frame. Final data products were converted to the NAD83 (CORS96) reference frame using a 7-point Helmert transformation and elevations were calculated in the NAVD88 vertical datum using the Geoid12A model. The vertical difference between NAVD88 and MLLW at this location is approximately 1.1 m (NAVD88+1.1 m = MLLW).

A total of 128 km of single-beam sonar data were collected during the 4 operational days of the survey (fig. 2). The data were collected primarily along cross-shore transects at intervals of 12-40 m alongshore. The transects extended from roughly 10-20 m water depth to as shallow as +0.5 m (fig. 3). A total of 2.5 km of underwater video data were collected to aid in the interpretation of the acoustic data. Continuous surfaces of eelgrass cover and bathymetry were produced from the transect data using kriging and linear interpolation, respectively. The gridded data were interpolated onto a regular grid with 5-m resolution.

The classified sonar data show that eelgrass was distributed in three distinct areas along the Nisqually delta (figs. 4-5). The total area containing eelgrass within the study area was 51.7 ha based on analysis of the gridded eelgrass coverage map (Table 3). The majority of eelgrass on the delta was located between -3 m and -0.5 m, NAVD88 (fig. 6), with the largest amount of eelgrass in terms of total area located at -1.1 m.

### Reference

Stevens, A.W., Lacy, J.R., Finlayson, D.P., and Gelfenbaum, G., 2008, Evaluation of a single-beam sonar system to map seagrass at two sites in northern Puget Sound, Washington: U.S. Geological Survey Scientific Investigations Report 2008-5009, 45 p.

## Tables

**Table 1.** List of Survey Personnel

Person	Responsibility	Affiliation
Andrew Stevens	Oceanographer	USGS PCMSC
Renee Takesue	Geochemist	USGS PCMSC
Eric Grossman	Geologist	USGS PCMSC
George Kaminsky	Coastal Engineer	Wash. State Dept. of Ecology
Heather Baron	Coastal Scientist	Wash. State Dept. of Ecology
Andrew Ryan	Coastal Scientist	Wash. State Dept. of Ecology
Brian Pickering	Boat Captain	Wash. State Dept. of Ecology

**Table 2.** Information about the benchmark used to establish geodetic control.

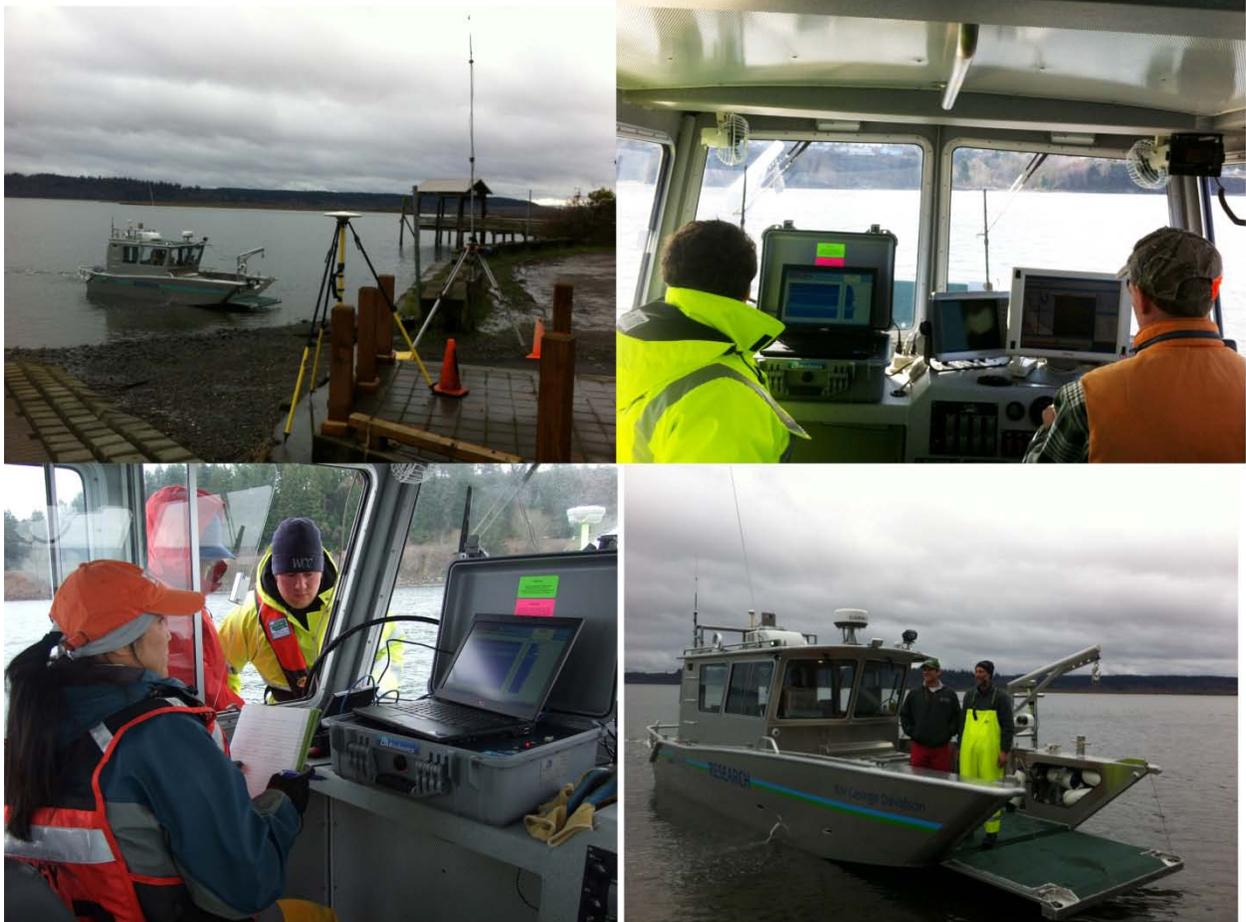
Property	Value
Designation	Luhr RM2
Reference Frame	WGS84 (ITRF2000)
Epoch	2002.00
Latitude	N 47° 06' 3.13574"
Longitude	W 122° 43' 38.02519"
Ellipsoid Height	-18.637 m

**Table 3.** Total area of bare and vegetated substrate based on the gridded eelgrass cover map. The adjusted area is calculated by multiplying the total area in each cover class by the percent of eelgrass in that class.

Percent Cover	Total Area (ha)	Adjusted Area (ha)
Bare	387.1	0.0
0.1	18.5	1.9
0.2	10.0	2.0
0.3	7.4	2.2
0.4	5.8	2.3
0.5	5.7	2.8
0.6	5.6	3.4
0.7	6.5	4.5
0.8	7.2	5.8
0.9	10.1	9.1
1.0	17.6	17.6

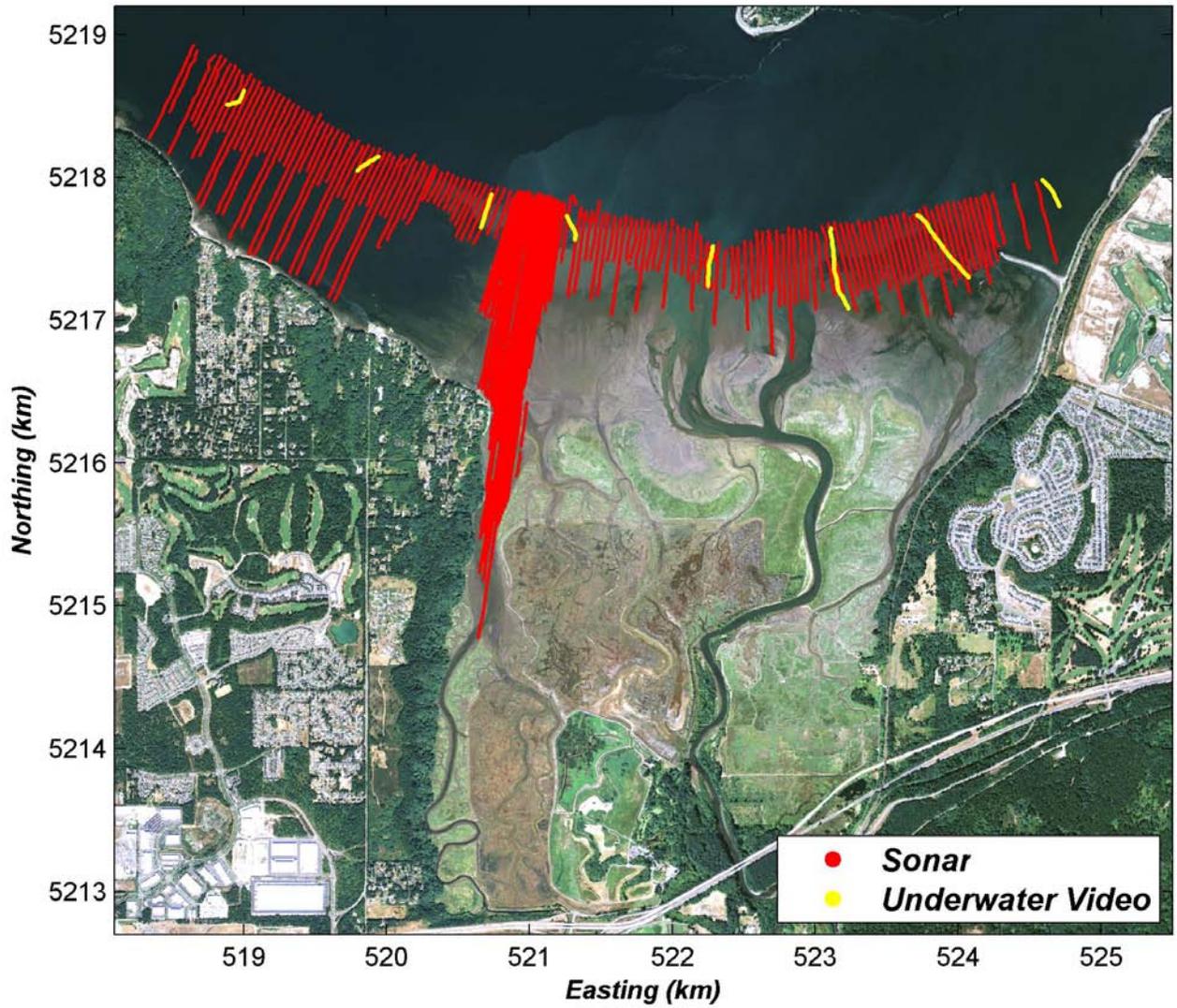
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## Figures



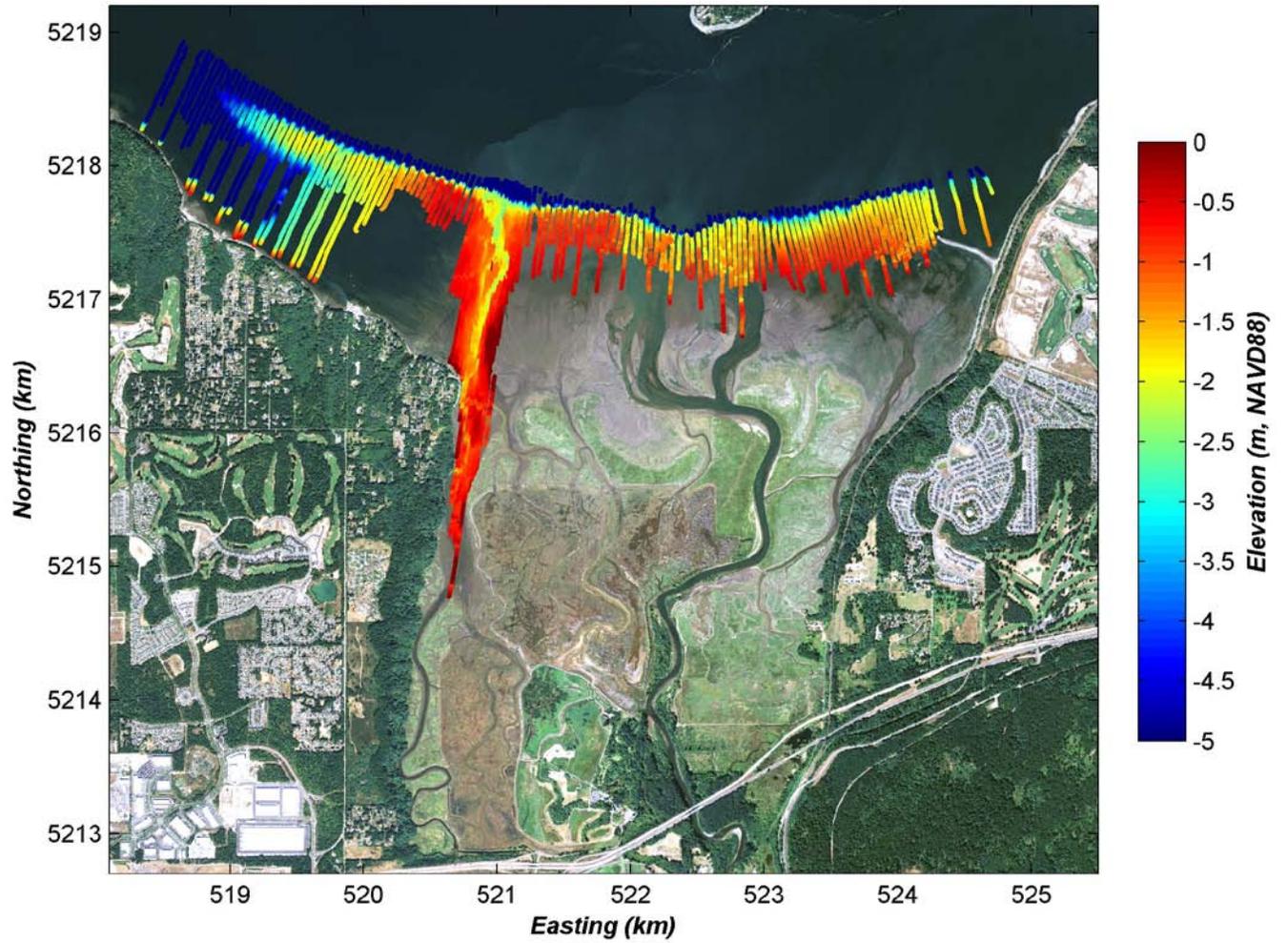
**Figure 1.** Photos of equipment used during the Nisqually delta hydroacoustic vegetation survey.

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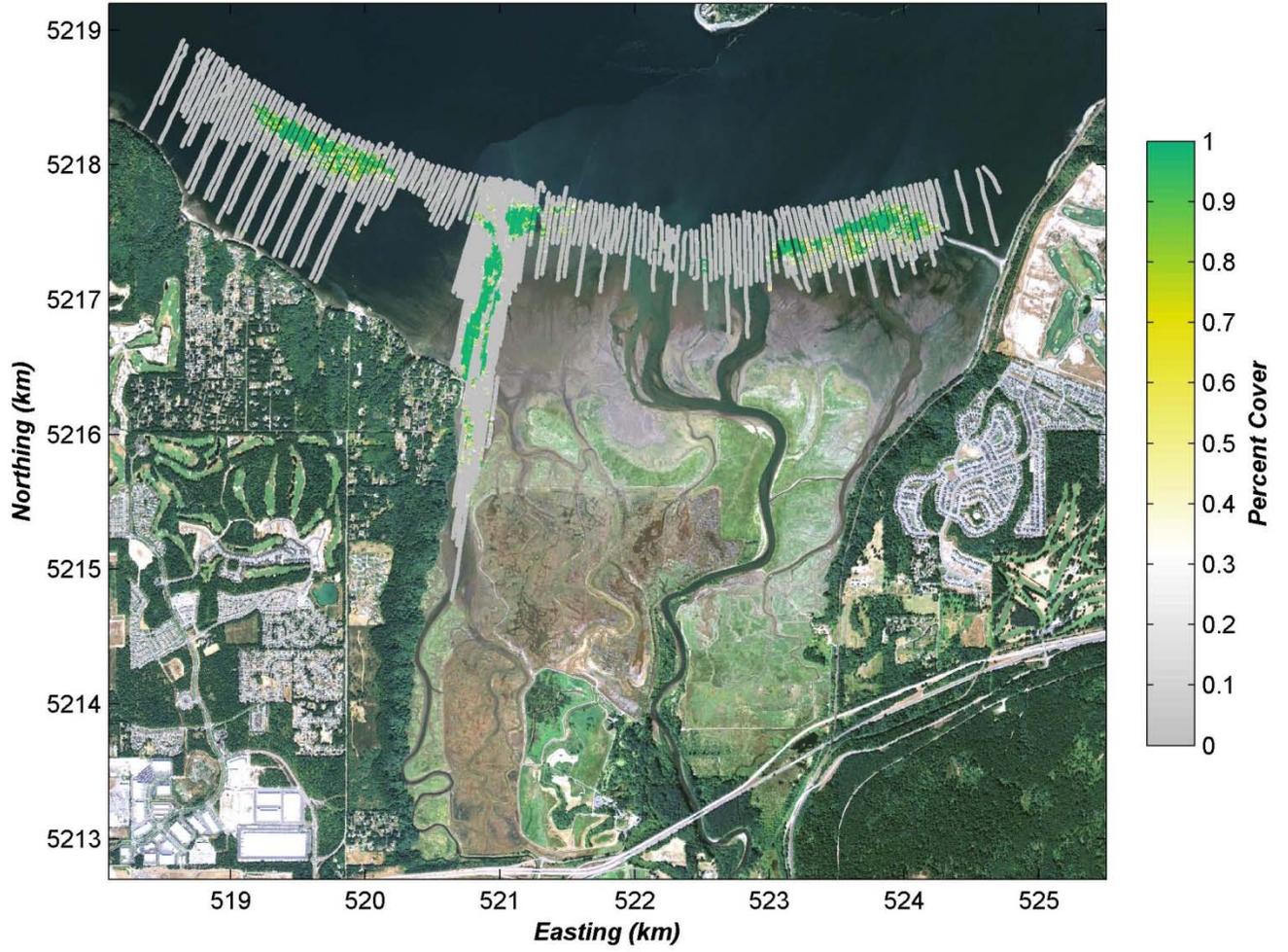
**Figure 2.** Map showing the track lines of acoustic (red) and underwater video (yellow) data collected during the Nisqually delta hydroacoustic vegetation survey.

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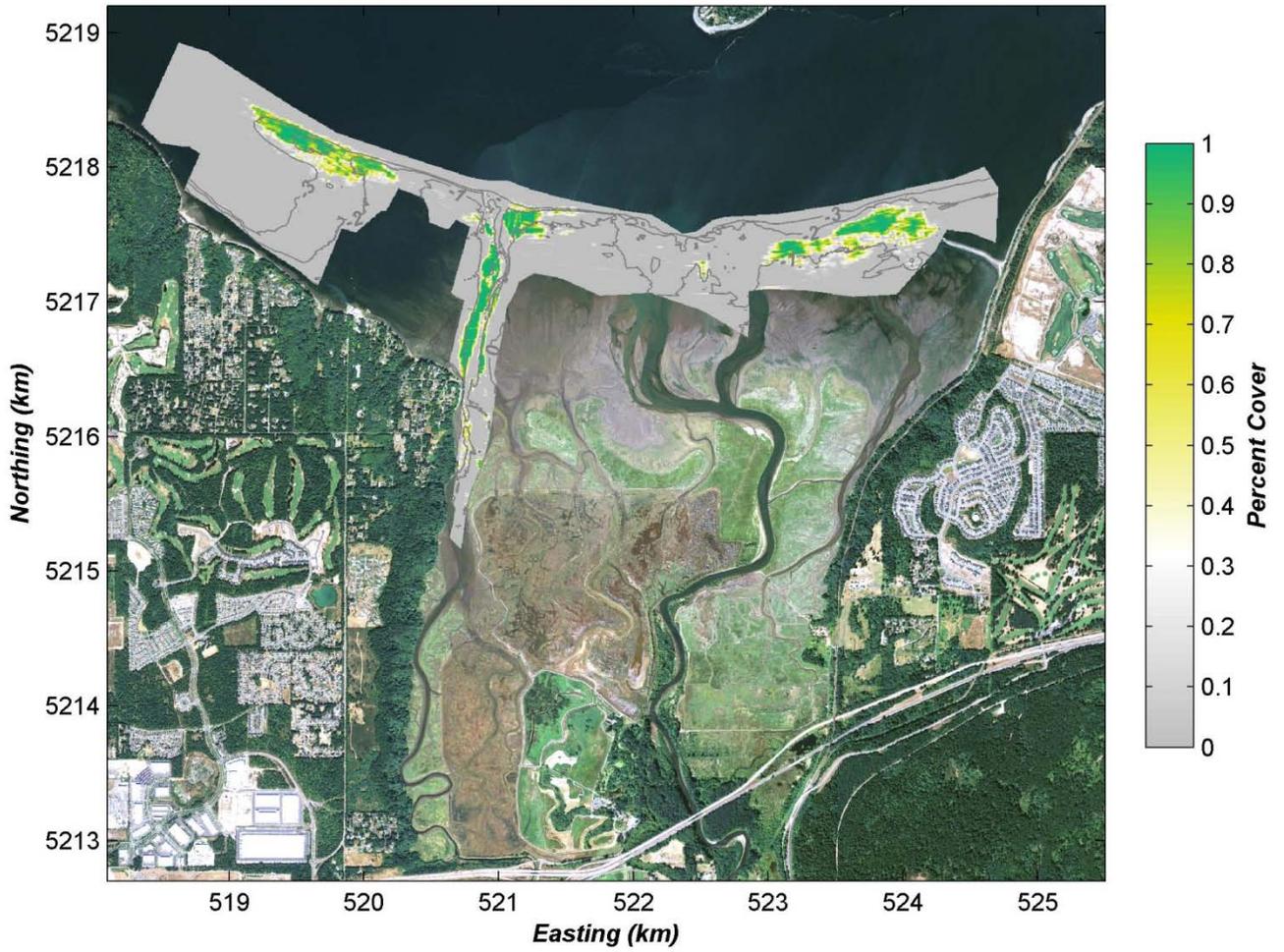
**Figure 3.** Hydroacoustic survey results showing the location of data collected (track lines) and the elevation of the bottom (color scale).

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**Figure 4.** Map showing the percent cover along track lines of eelgrass within the Nisqually delta survey area.

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**Figure 5.** Map showing interpolated eelgrass cover (color scale, 5 m-resolution grid) and shallow bathymetry (contours). The contour interval is 1 m.

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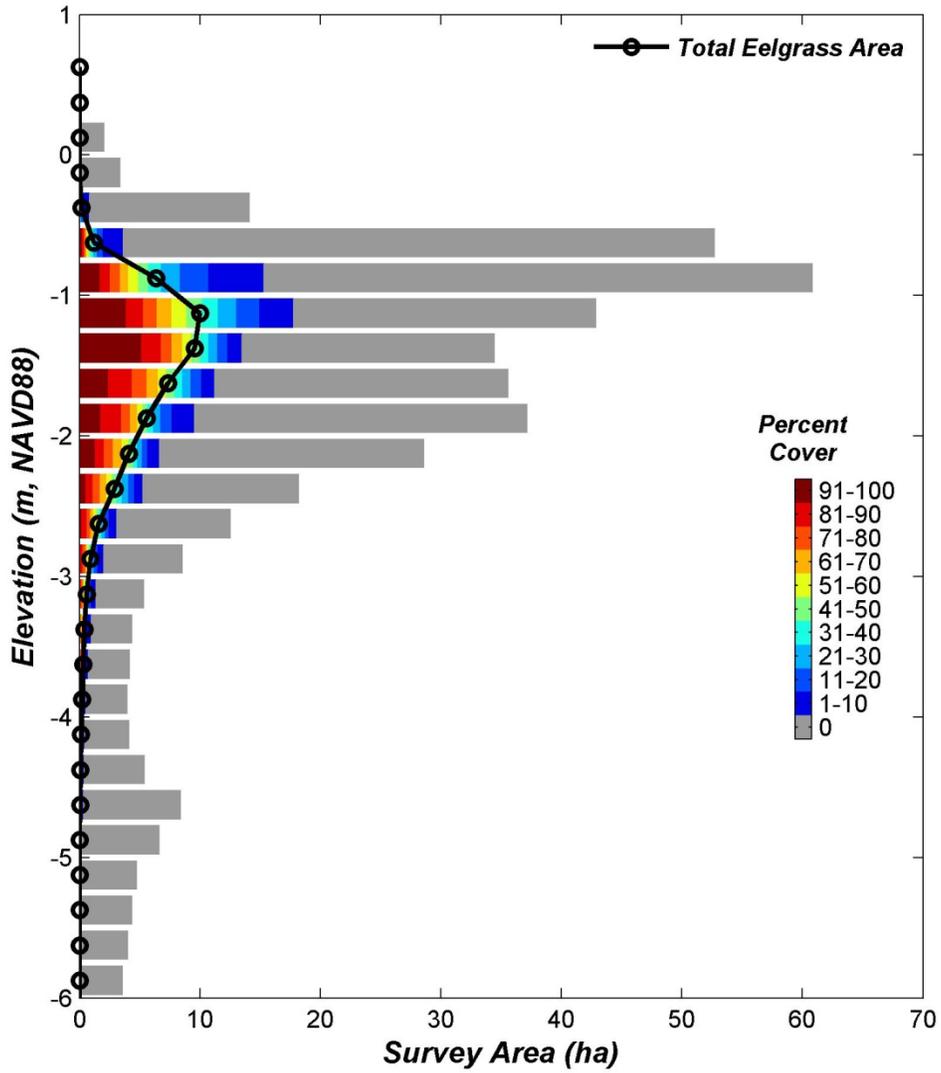


Figure 6. Depth distribution of eelgrass relative to NAVD88 within the Nisqually delta survey area.