Big Bay Experimental Herring Video Survey

OceanEcology

Equipment


BIG BAY
Anchor Sh
Swallow I
One Foot Rk
Curlew Rk
Simpson Pt
SALMON

The *Moody Blue* is a 40-foot fiberglass gillnet/halibut boat which has been converted into an oceanographic research vessel.

The *Moody Blue* is equipped with a hydraulic drum with 500 feet of armored oceanographic cable, slip-rings, and a hydraulic A-frame.

The *Moody Blue* has a draft of 6 feet and is equipped with bat-wing stabilizers and a forward-scanning sonar.

The towed video system used by Ocean Ecology has two video cameras - one in a forward-looking orientation and one in a downward-looking orientation. This system is a custom-built model designed for use in the steep, rugged terrain characteristic of British Columbia fjords.

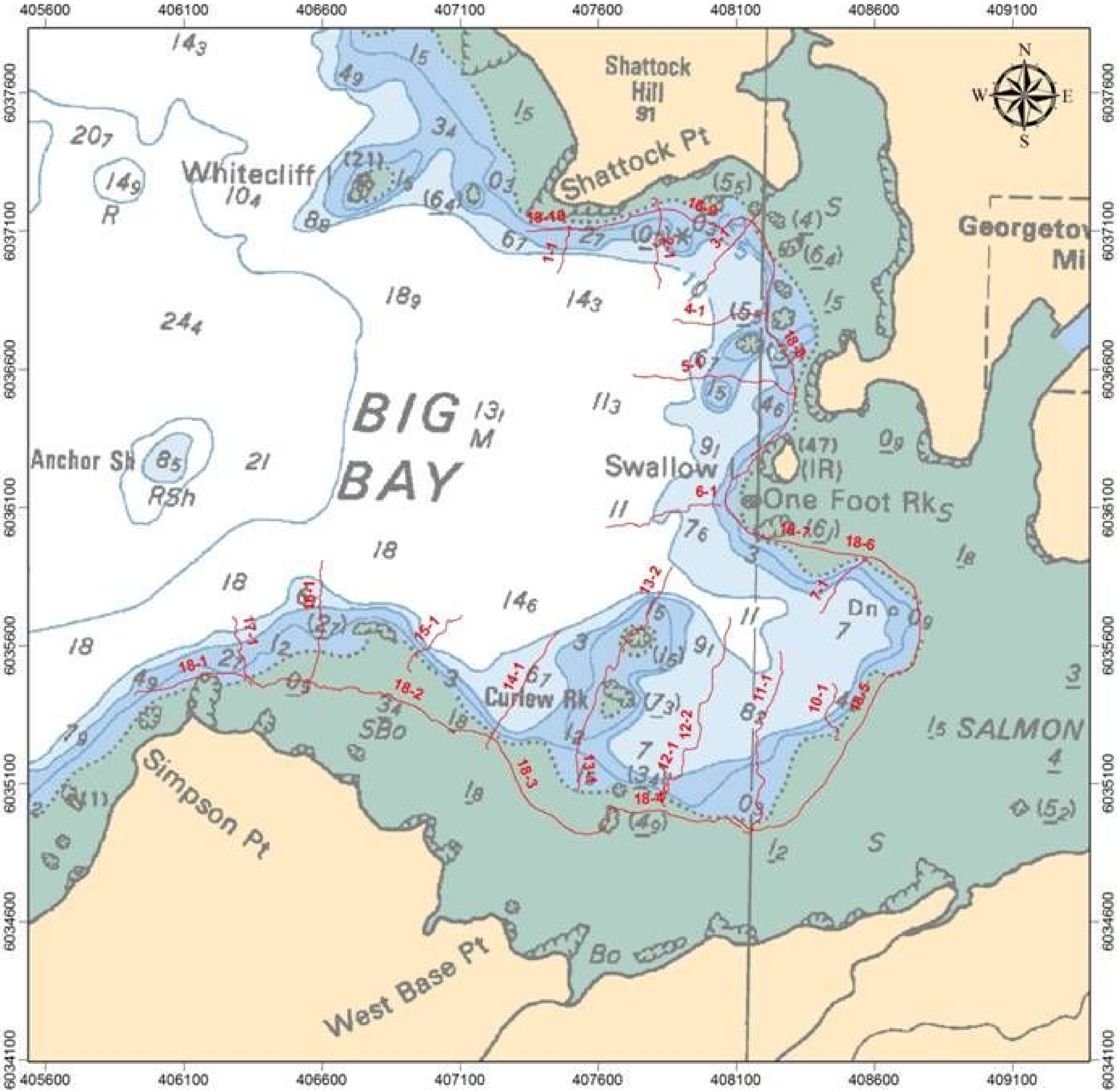
The video system is stream-lined and heavily weighted, reducing layback and allowing the unit to be towed directly below the DGPS antenna.

High intensity white LEDs are mounted on each camera to provide additional illumination.

The downward-looking camera (upper left) is equipped with a pair of scaling lasers with a center-to-center distance of 4 cm.

The altitude of the camera is controlled using the drum which is operated from the bridge while monitoring the real-time video feed from the camera.

Survey Results



Big Bay Experimental Herring Video Survey

Figure 4. Completed survey showing transects.

Chart used for navigation: CHS 396301 (Work Channel)

Chart datum: LNT

Projection: WGS 1984 UTM Zone 9N

Scale: 1:19,500

Legend

Completed transects

0 125 250 500 Meters

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Herring roe on flat kelp.

Herring roe on flat kelp.

Herring roe on flat kelp.

Herring roe on stringy kelp.

Herring roe on stringy kelp.

Herring roe on eelgrass.

Big Bay Experimental Herring Video Survey

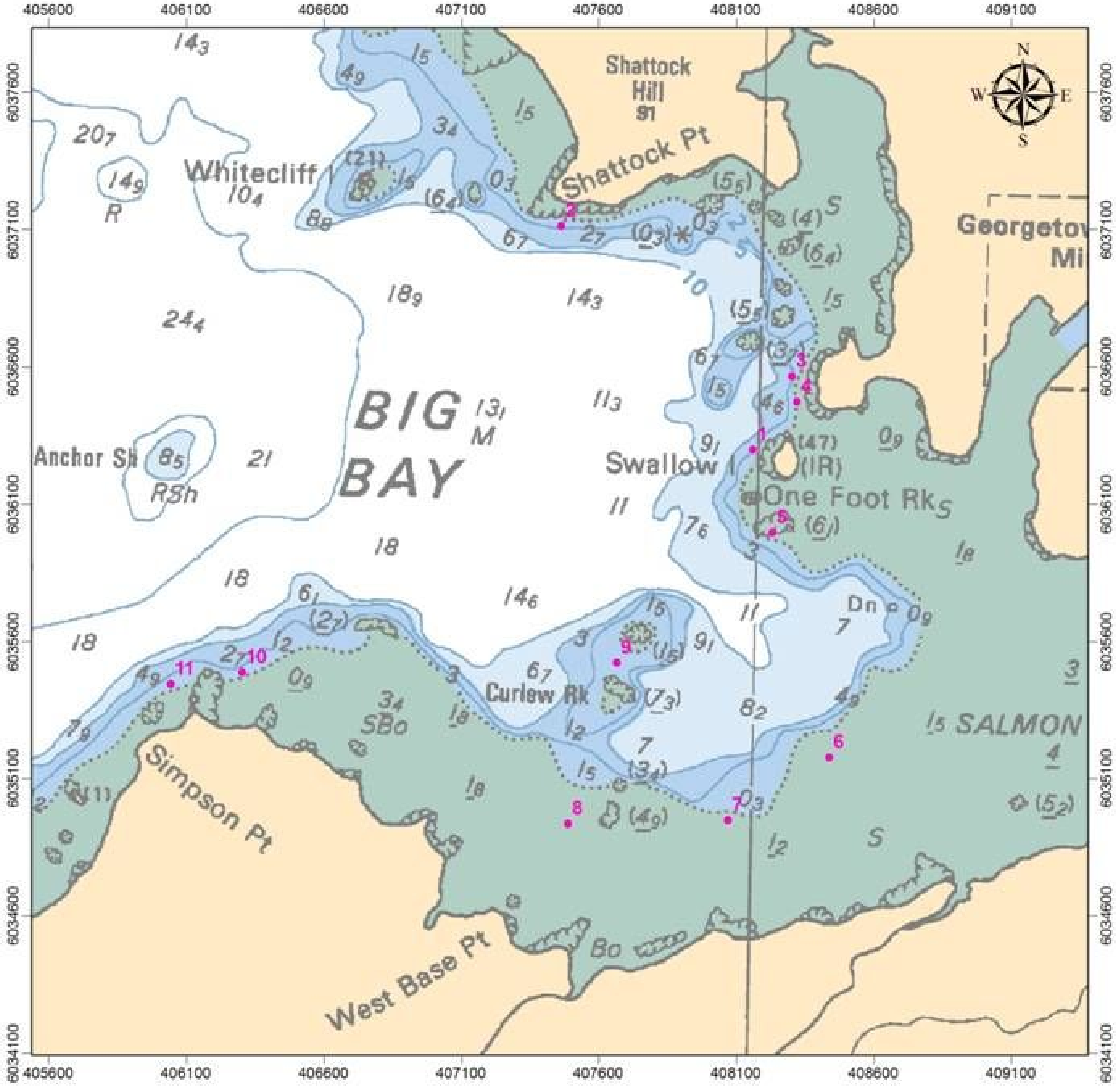


Figure 3. Bottom sampling locations.

Chart used for navigation: CHS 396301 (Work Channel)

Chart datum: LNT

Projection: WGS 1984 UTM Zone 9N

Scale: 1:19,500

Legend

● Bottom samples

0 125 250 500 Meters

OCEAN ECOLOGY

Grab samples were representative of the survey site as seen during the video survey.

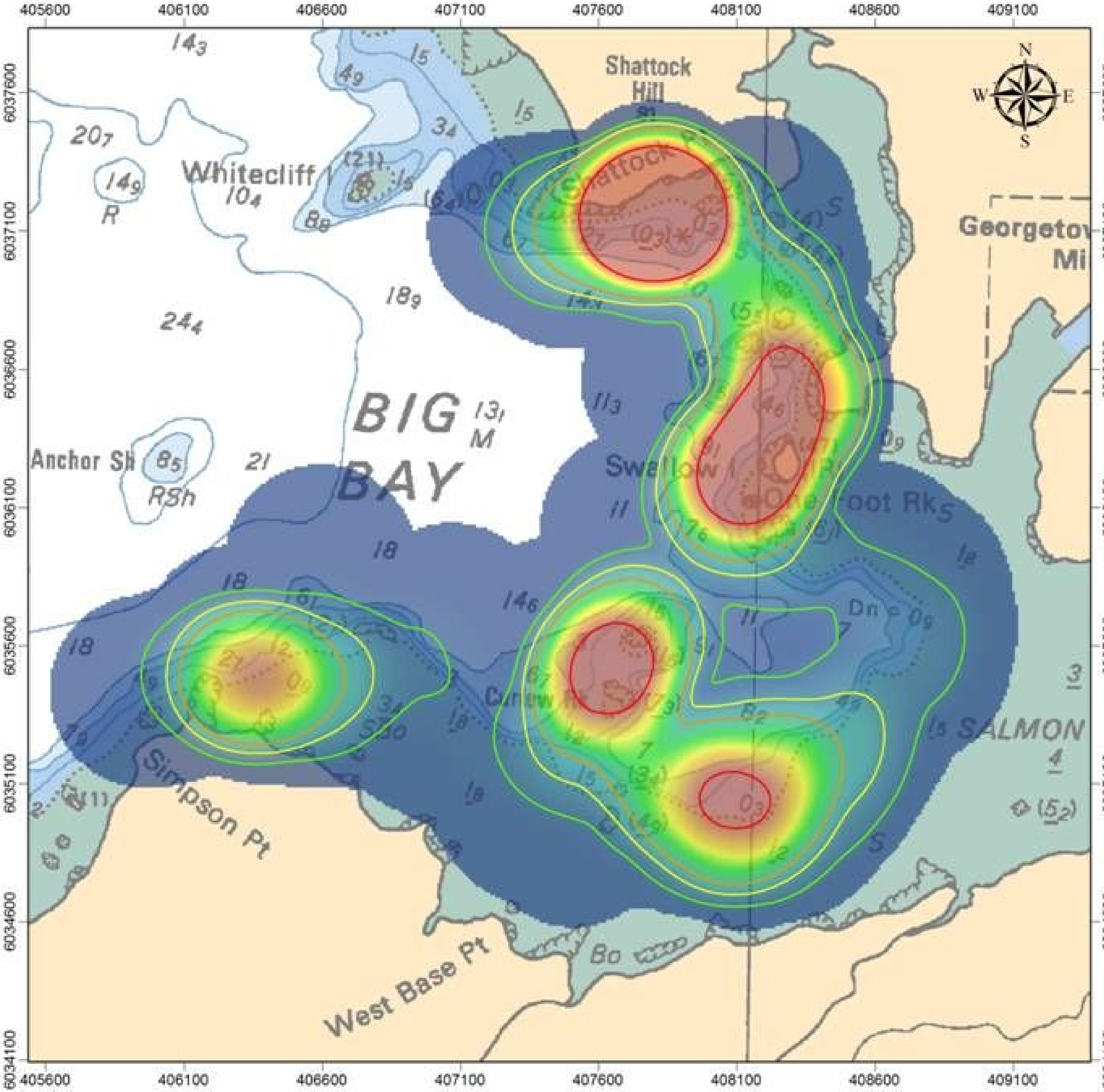
Herring roe on flat kelp.

Herring roe on stringy kelp.

Some general observations about the Big Bay site:

- The vegetation type which had the greatest occurrences of herring spawn was flat kelps. Seagrasses had the second greatest occurrences of herring spawn.

- Flat kelps and stringy algae were associated with the rocky outcrops and points, in regions with mostly cobble substrate and high bottom hardness values



Big Bay Experimental Herring Video Survey

Figure 13. Statistical map of distribution of herring spawn intensity.

Chart used for navigation:
CHS 396301
(Work Channel)

Chart datum: LNT

Projection: WGS 1984 UTM Zone 9N

Scale: 1:19,500

Legend

Spawn density distribution

446

0

99% total spawn

95% total spawn

90% total spawn

50% total spawn

0 125 250 500 Meters

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Big Bay Experimental Herring Video Survey

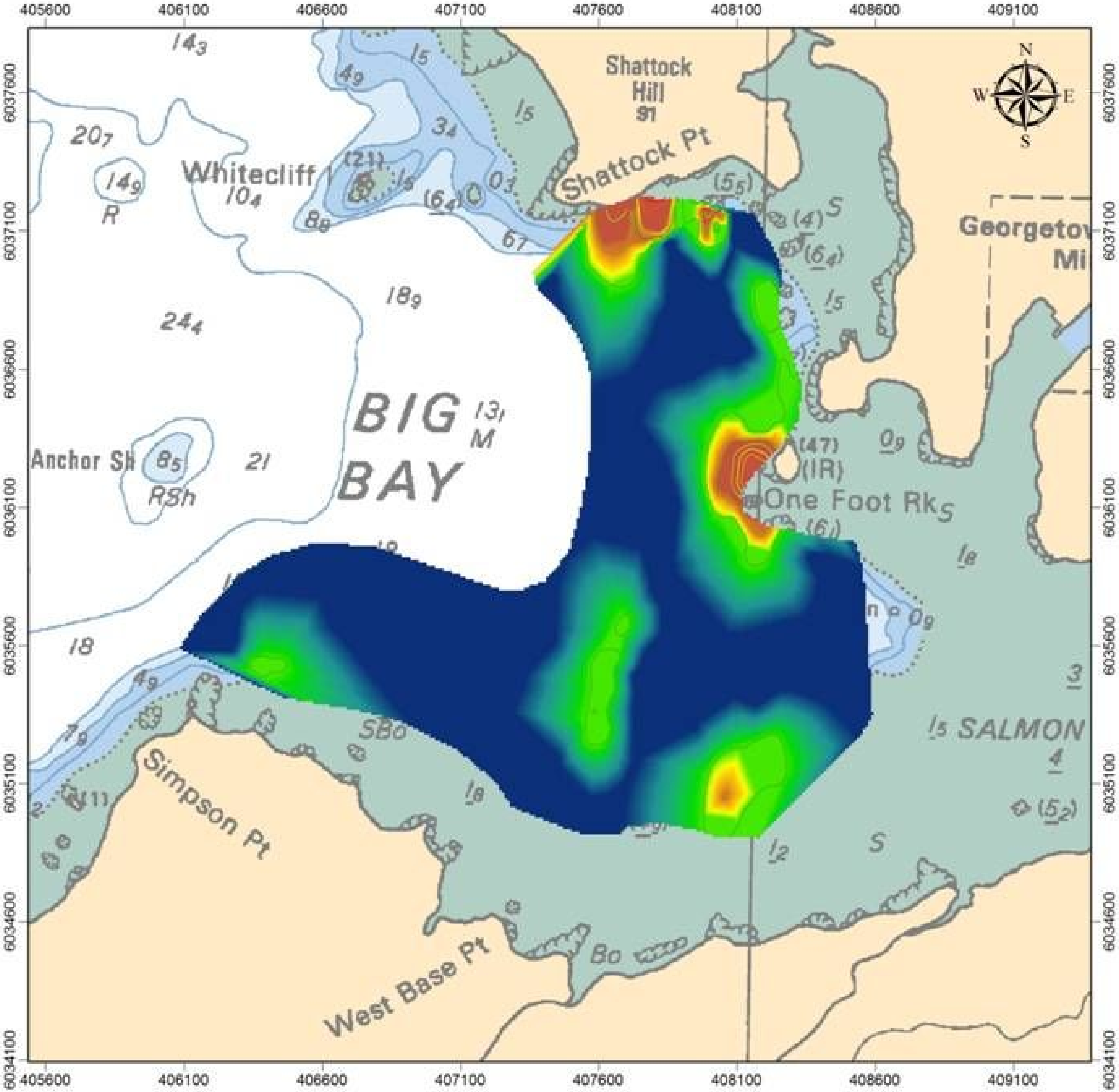

Figure 14. Contour map of distribution of herring spawn intensity.

Chart used for navigation: CHS 396301 (Work Channel)

Chart datum: LNT

Projection: WGS 1984 UTM Zone 9N

Scale: 1:19,500

Legend

Spawn map

1000 eggs/m2

3800

0

Spawn contours

200
400
600
800
1000
2000
3000

0 125 250 500 Meters

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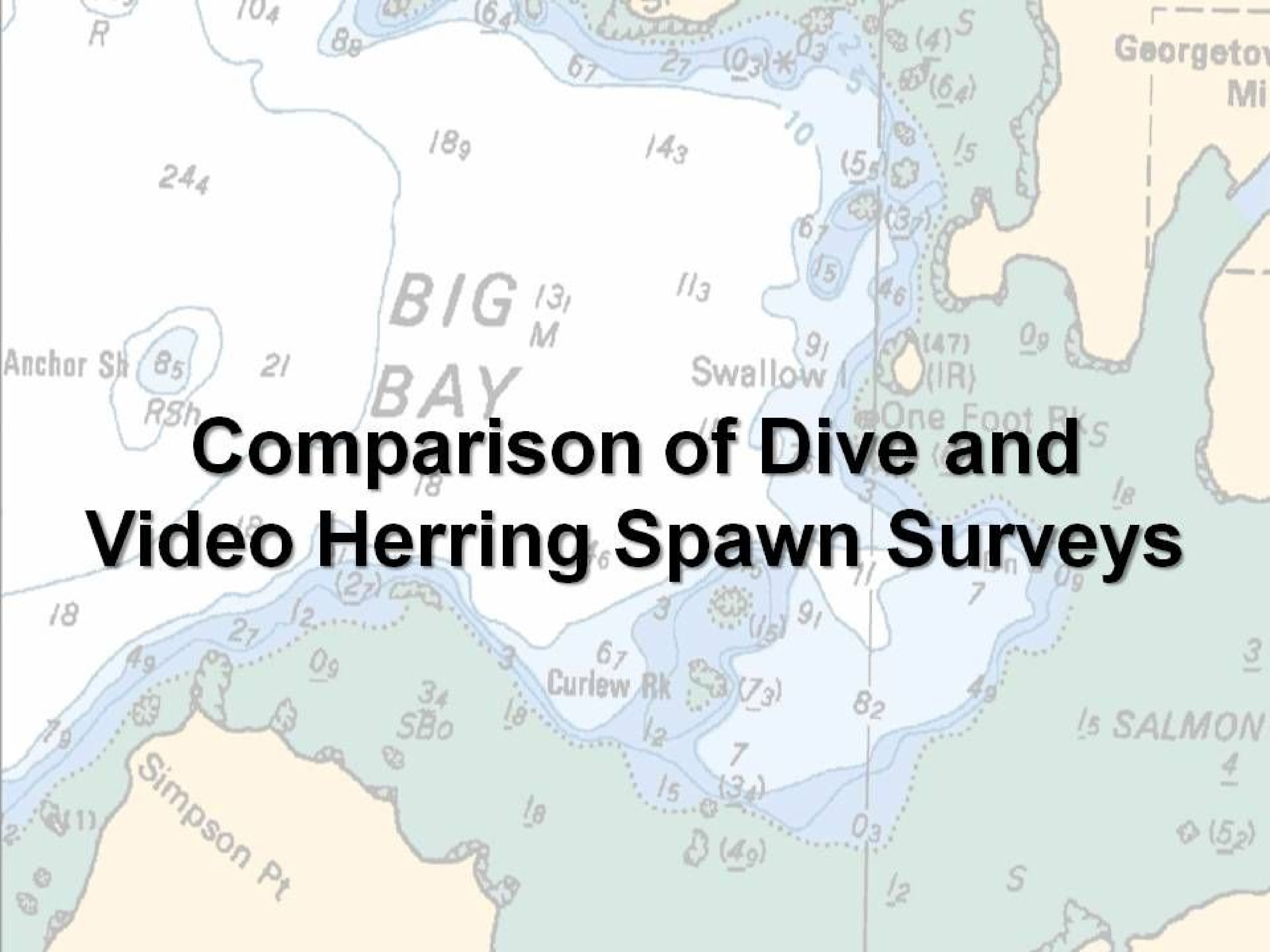
Comparison of Dive and Video Herring Spawn Surveys



Concept #1:

Comparison of video and dive data was to be performed by towing the video camera along one or more dive transects shortly after the dive survey was completed and while the lead line was still in place. This concept was dropped due to several insurmountable issues:

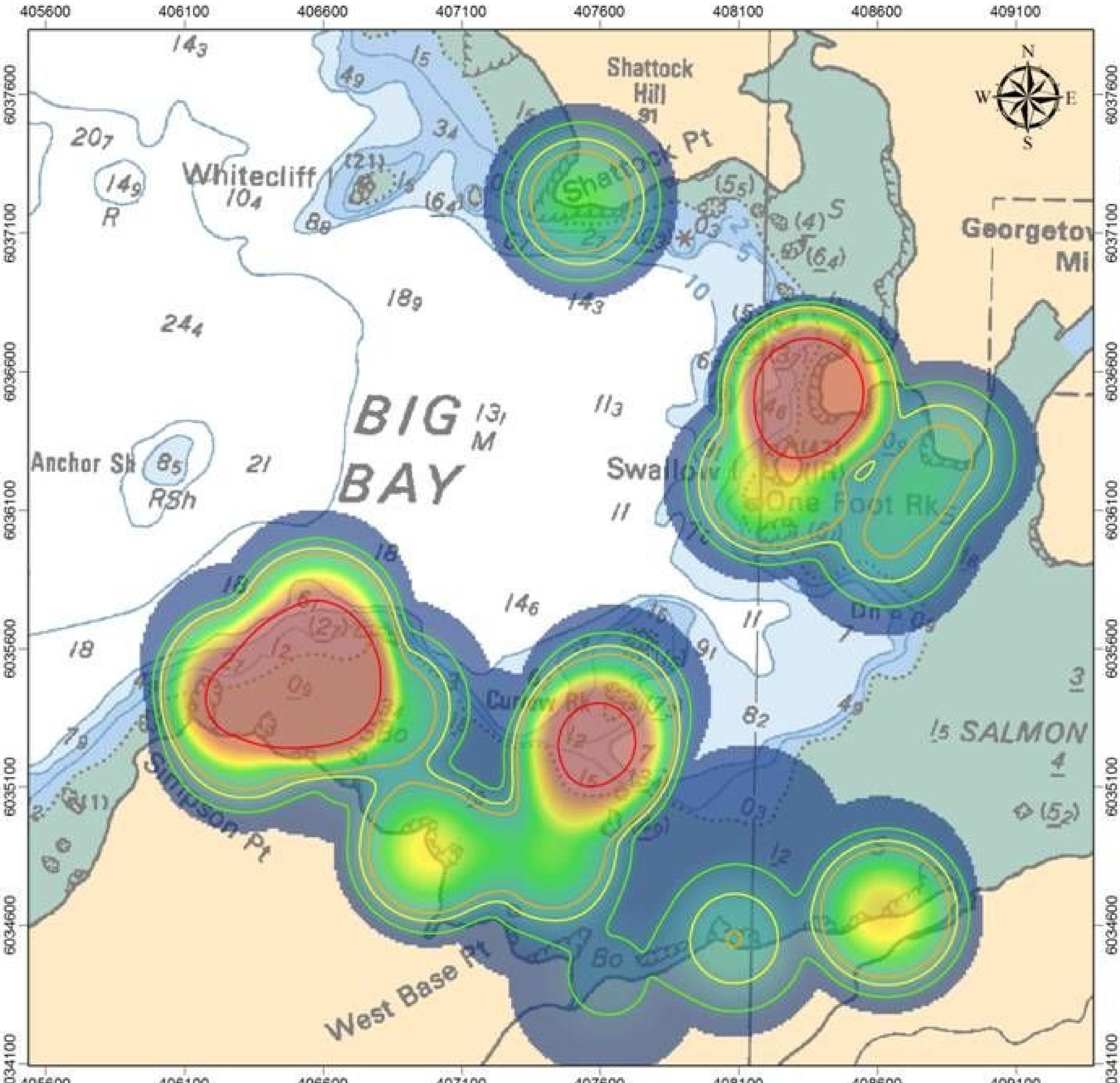
- Even if the *Moody Blue* had been equipped with bow and stern thrusters, it would have been virtually impossible to navigate to a precision of $\pm$ 0.5 m under conditions of tidal currents and winds.

- Safety issues as a result of boat operation while divers were in the water nearby, entanglement from buoys attached to the lead line, and possible grounding at the shallow end of the dive transect.

Concept #2:

Ocean Ecology would process the dive survey data using the same methodology as used for the video survey data, and then compare the results from the two data sets. This concept was used; however it suffered from several problems:

- Initial concerns regarding data sharing.
- Lack of georeferencing for the dive survey data. Based on the approximate dive transect locations provided by DFO and the information on the dive transect data sheets, "best guess" estimates were made for the locations of the dive transect data.



Big Bay Experimental Herring Video Survey

Figure 16. Statistical map of distribution of herring spawn intensity from dive data.

Chart used for navigation:
CHS 396301
(Work Channel)

Chart datum: LNT

Projection: WGS 1984 UTM Zone 9N

Scale: 1:19,500

Legend

Spawn density distribution

105

0

99% total spawn

95% total spawn

90% total spawn

50% total spawn

0 125 250 500 Meters

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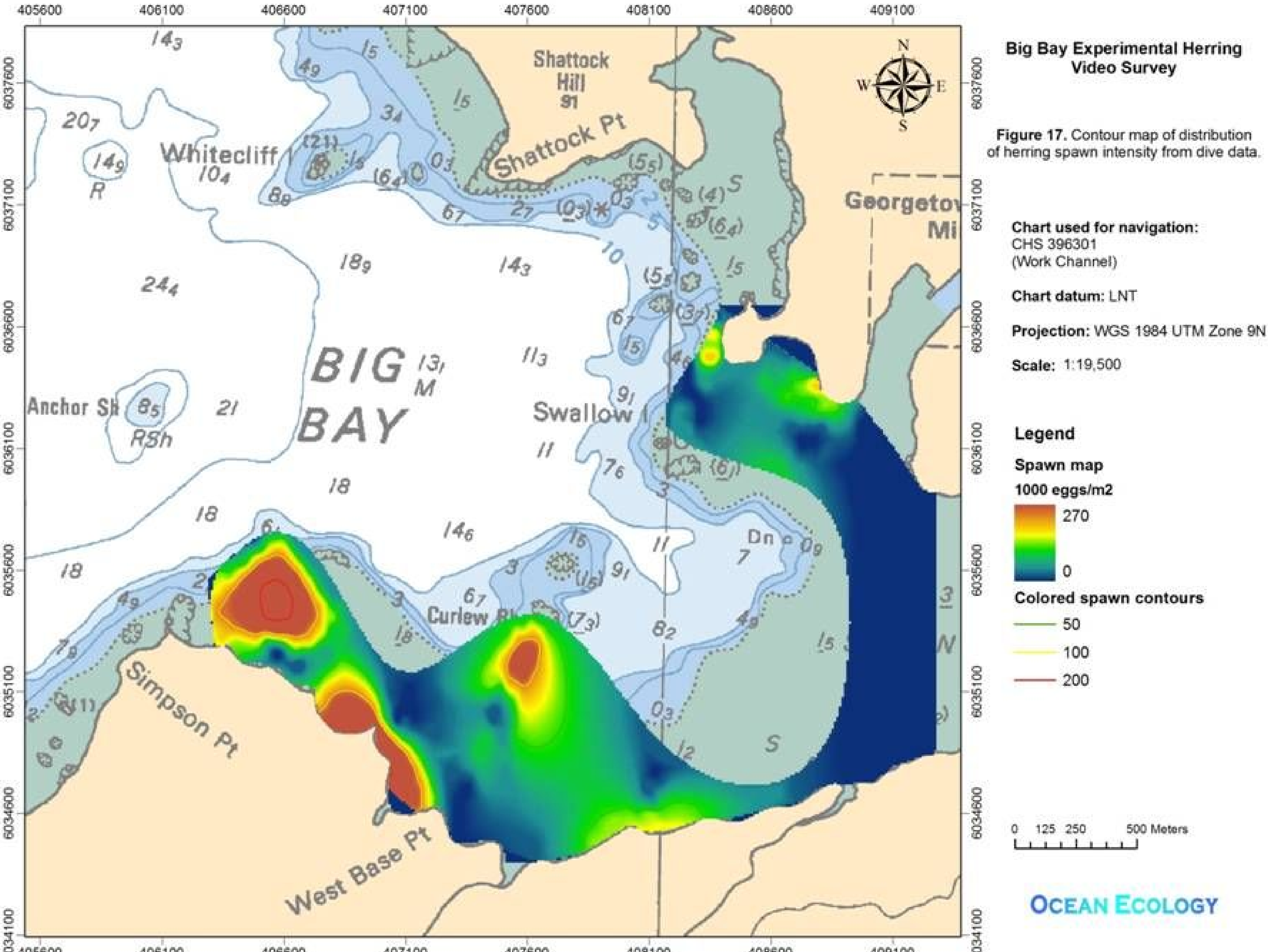
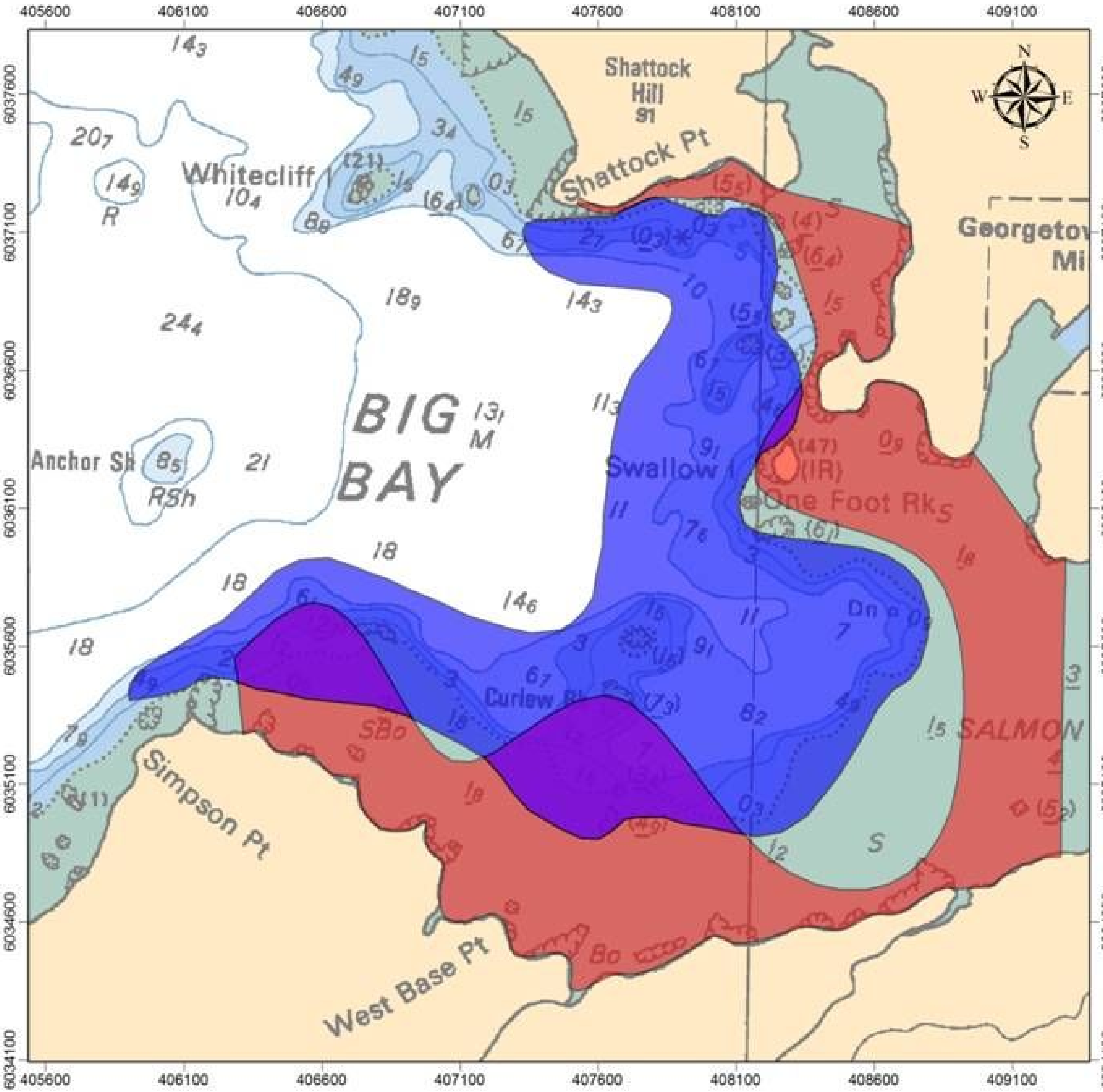


Figure 17. Contour map of distribution of herring spawn intensity from dive data.

Qualitative comparison:

- Both surveys found high levels of spawn at Simpson Point, Curlew Rock, and Swallow Island.
- The video survey reported significant amounts of spawn in slightly deeper water areas and in the region around Shattock Point.



Big Bay Experimental Herring Video Survey

Figure 18. Comparison of video and dive survey boundaries.

Chart used for navigation: CHS 396301 (Work Channel)

Chart datum: LNT

Projection: WGS 1984 UTM Zone 9N

Scale: 1:19,500

Legend

- Video survey boundary
- Dive survey boundary
- Overlap regions between surveys

0 125 250 500 Meters

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Quantitative comparison:

- From the video survey, the total estimated tonnes of spawning fish at the survey site were 2533, whereas from the dive survey, the total estimated tonnes of spawning fish at the survey site were 736.

- Except for three relatively small areas, the dive survey was carried out almost entirely inshore of the video survey. In the area of overlap between the two surveys, the estimated tonnes of spawning fish at the survey site from the video survey were 338, whereas the estimated tonnes of spawning fish at the survey site from the dive survey were 291. These values are surprisingly similar!

Conclusions and Recommendations

Herring Spawn Percent Cover

- **Conclusion**: the towed video system is very good at assessing the percent cover of vegetation with herring spawn when there is less than 100% cover. However, as the total percent cover exceeds 100%, the video camera system becomes less accurate.

- **Recommendation**: that the "Herring spawn percent cover" categories be modified for the towed video survey to reflect the decreased accuracy of the system at higher percent cover levels.

Herring Spawn Egg Layers

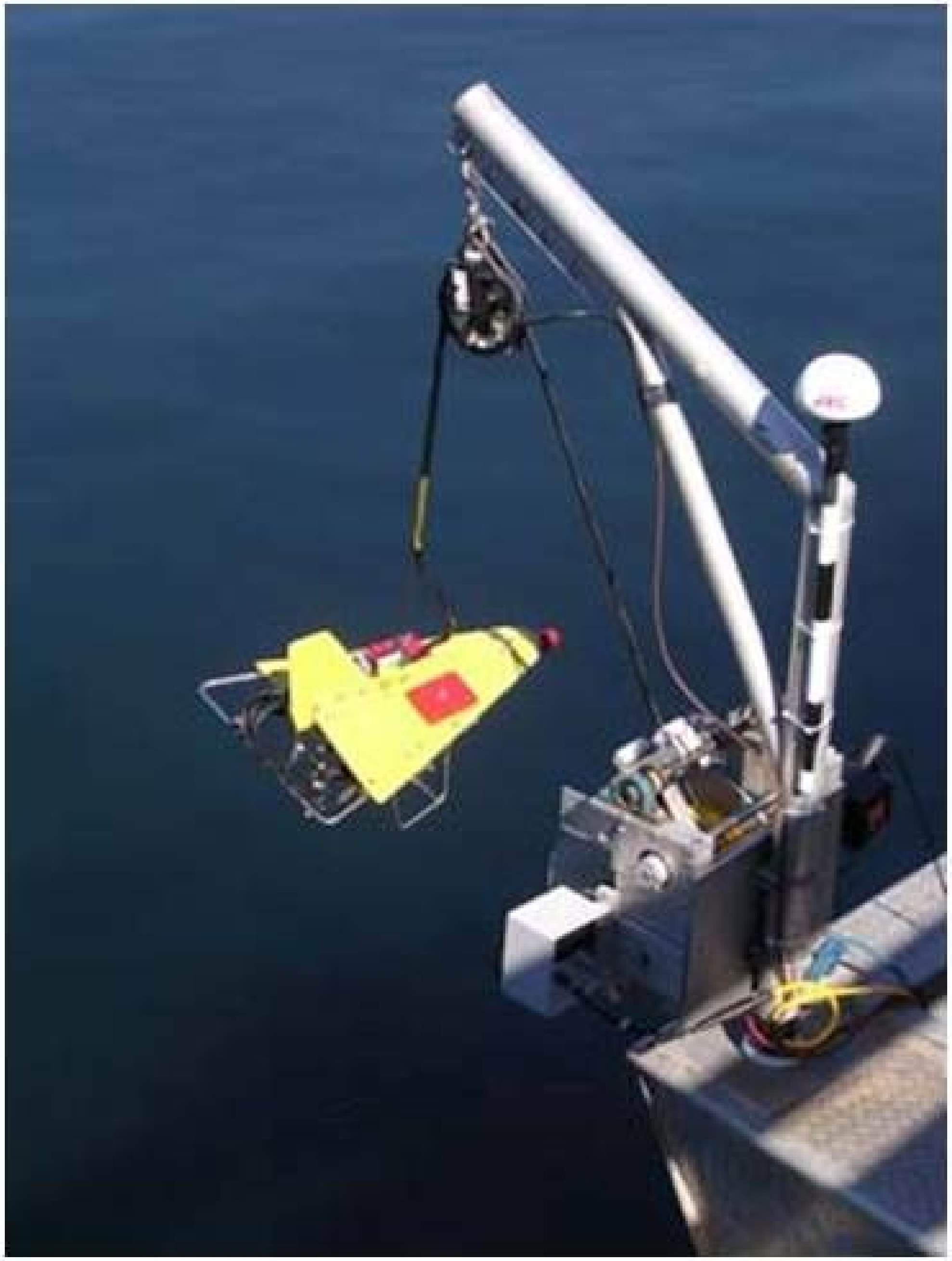
- **Conclusion**: a reasonable estimate of egg layers is possible using the egg distribution patterns and egg layer colorations (e.g., translucent white through to pale yellow). The accuracy of the video camera system decreases when the spawn exceeds more than 2 layers.

- **Recommendation**: that the "Herring spawn egg layers" categories be modified for the towed video survey to reflect the decreased accuracy of the system as spawn layers increase.

Towed Video Systems

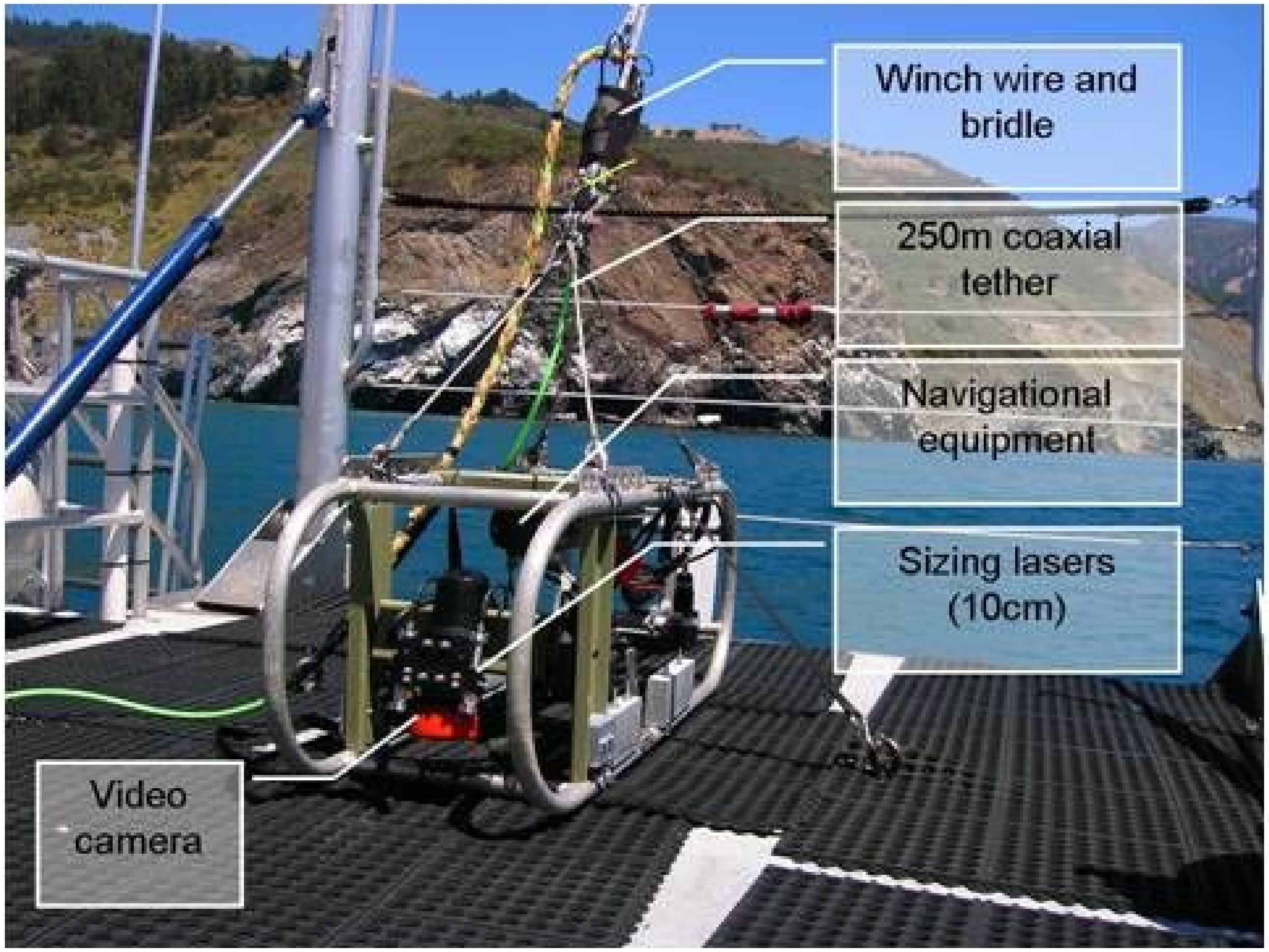
- **Conclusion**: towed video systems have three main body designs: depressor wing, sled-style, and custom. Each design has different pros and cons which ultimately determine where and how they can be deployed.

- **Recommendation**: that HCRS determine the types of environments (e.g., deep or shallow water, etc.) in which towed video surveys will be most useful, and use this information to assist in decision making regarding the type of towed unit which should be used.



Depressor wing towed video system

Sled-style towed video system



Camera Systems

- **Conclusion**: while digital video cameras produce very high resolution images, they are generally bulky in size and require large amounts of storage for data. Analog video cameras produce lower resolution images, but are much smaller, cheaper, and have models designed for operation in very low light conditions.

- **Recommendation**: that analog cameras remain the best choice for underwater towed video systems until further improvements in technology create cheaper, smaller, more robust digital cameras with better video compression.

Survey Design

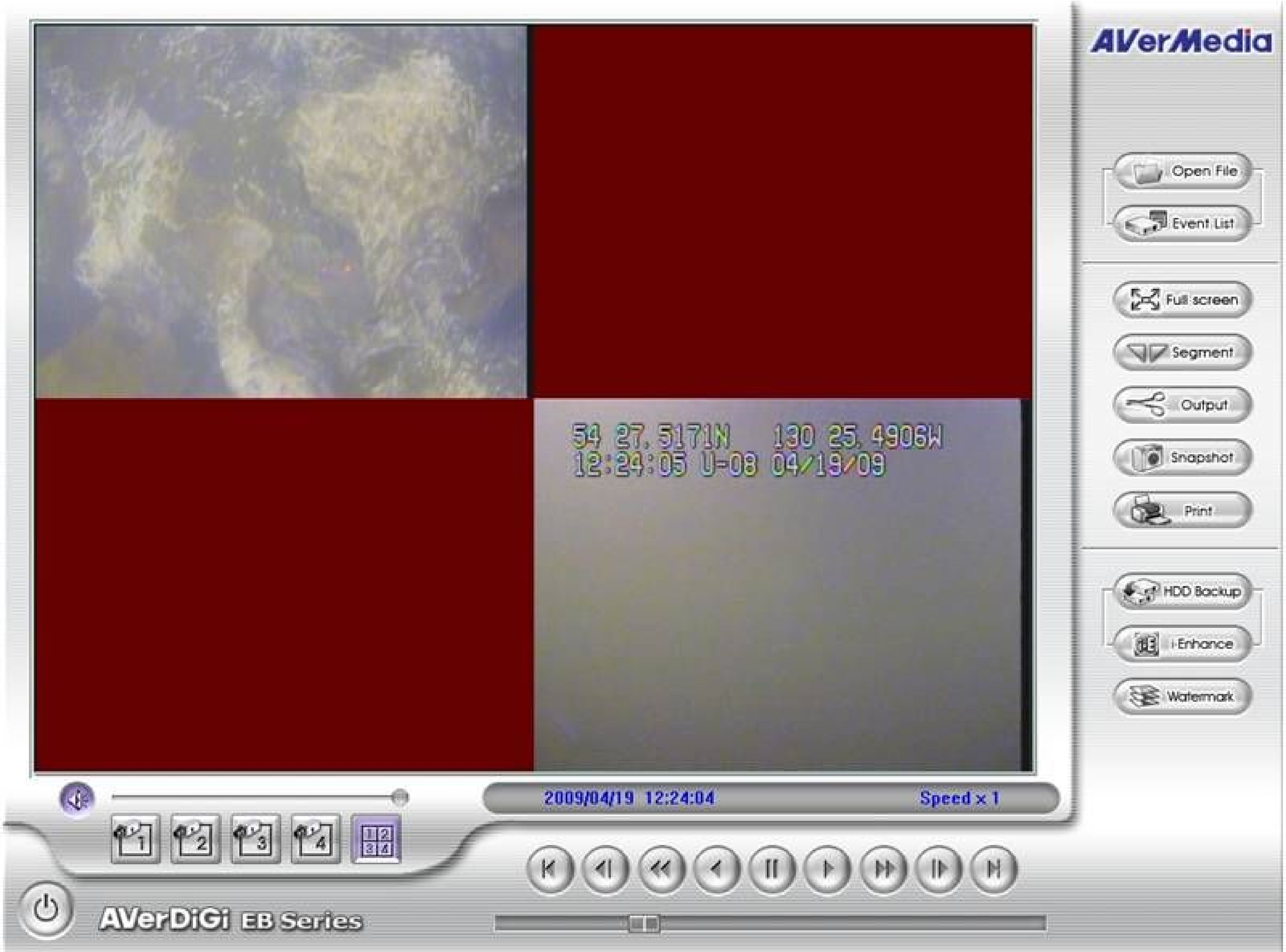
- **Conclusion**: the Big Bay video survey consisted of 18 video transects, providing a total coverage distance of 14.6 km. The survey took three days to complete. The total cost of the survey was $9,504.35. This survey provided a large amount of good quality scientific data; however, it may not be necessary to carry out such extensive surveys for the purpose of stock assessment.

- **Recommendation**: that full scale towed benthic video analysis be used only for scientific herring research. A modified, down-scaled survey is recommended for stock assessments. Rather than recording video for the entire length of a transect, it is suggested that short video segments, or even drop videos, be taken at intervals along a transect. This design would be more comparable to the herring dive survey, and would be faster and cheaper to perform.

Video Processing

- **Conclusion**: video processing can be a long and tedious process. Well designed surveys can reduce the amount of video footage collected in the field while still retaining the necessary level of data collection for statistical analyses. Expertise with various software programs and data management can further ease the load.

- **Recommendation**: that HCRS fully investigate the different products (e.g., databases, maps, etc.) that can be generated from the processing of video data, and determine which products best fit their needs. This will be important both in dealing with contractors who may be performing video analysis for HCRS, or in deciding to develop an in-house system for HCRS.



Product – raw video data

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April 2009

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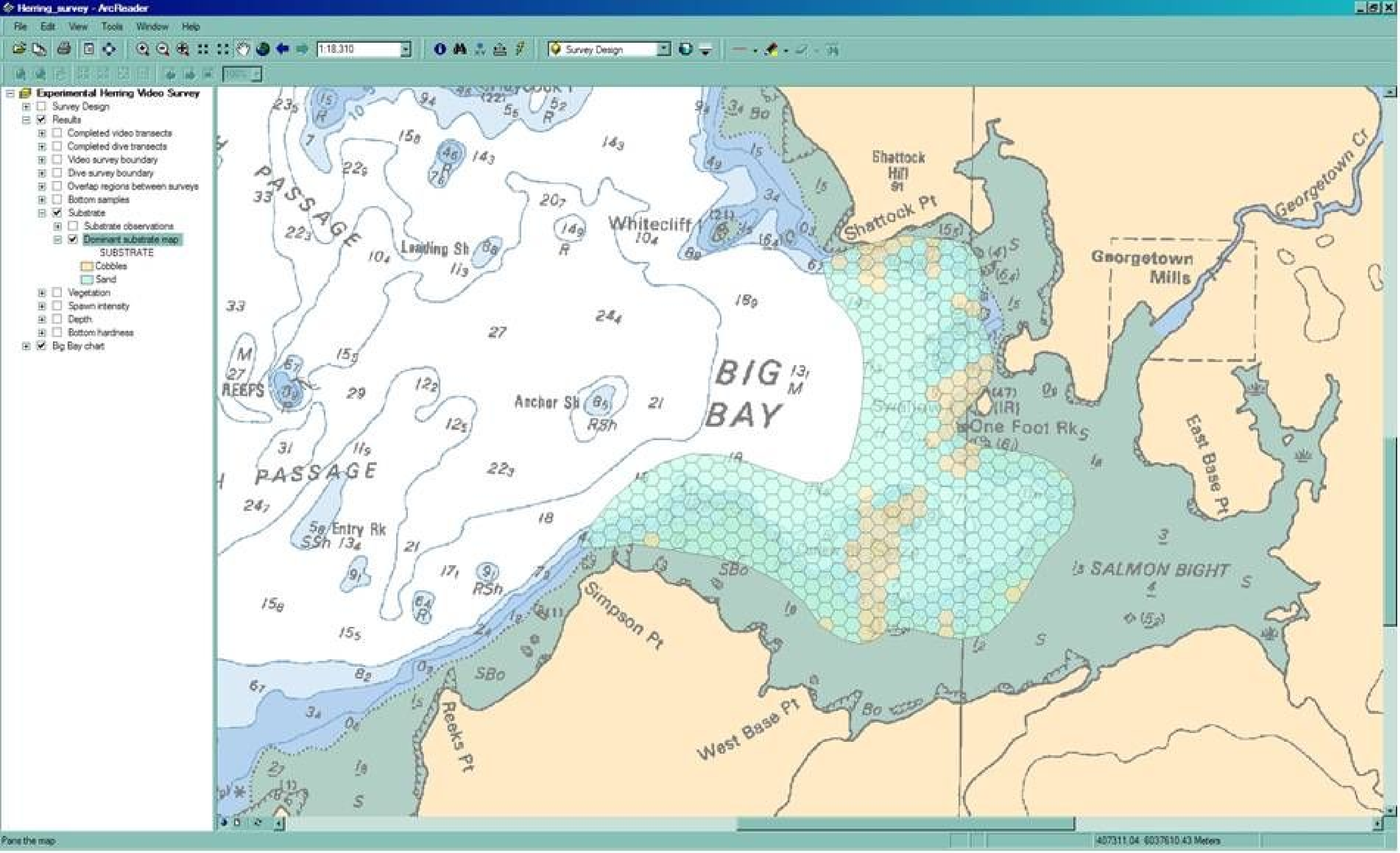
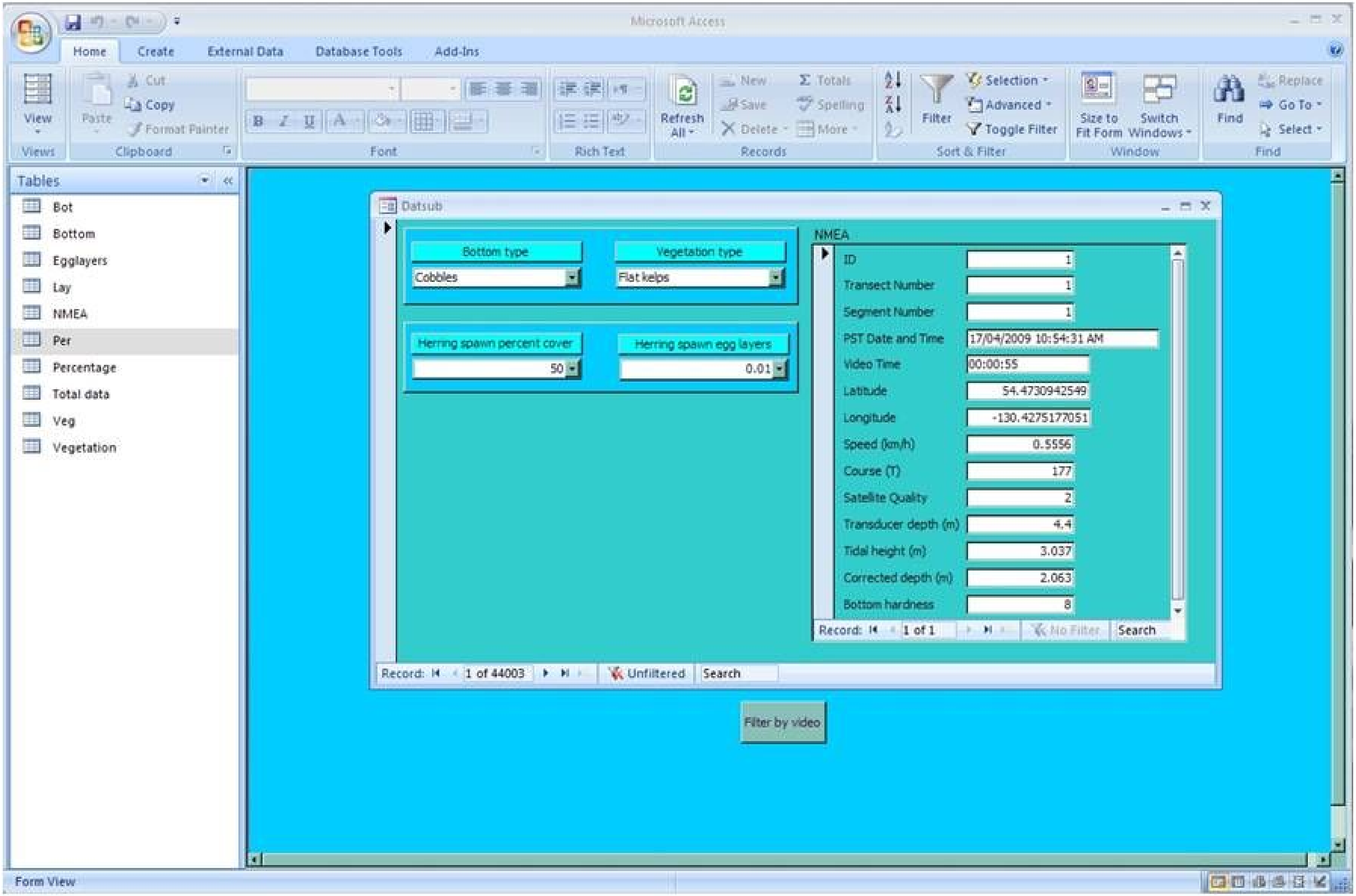
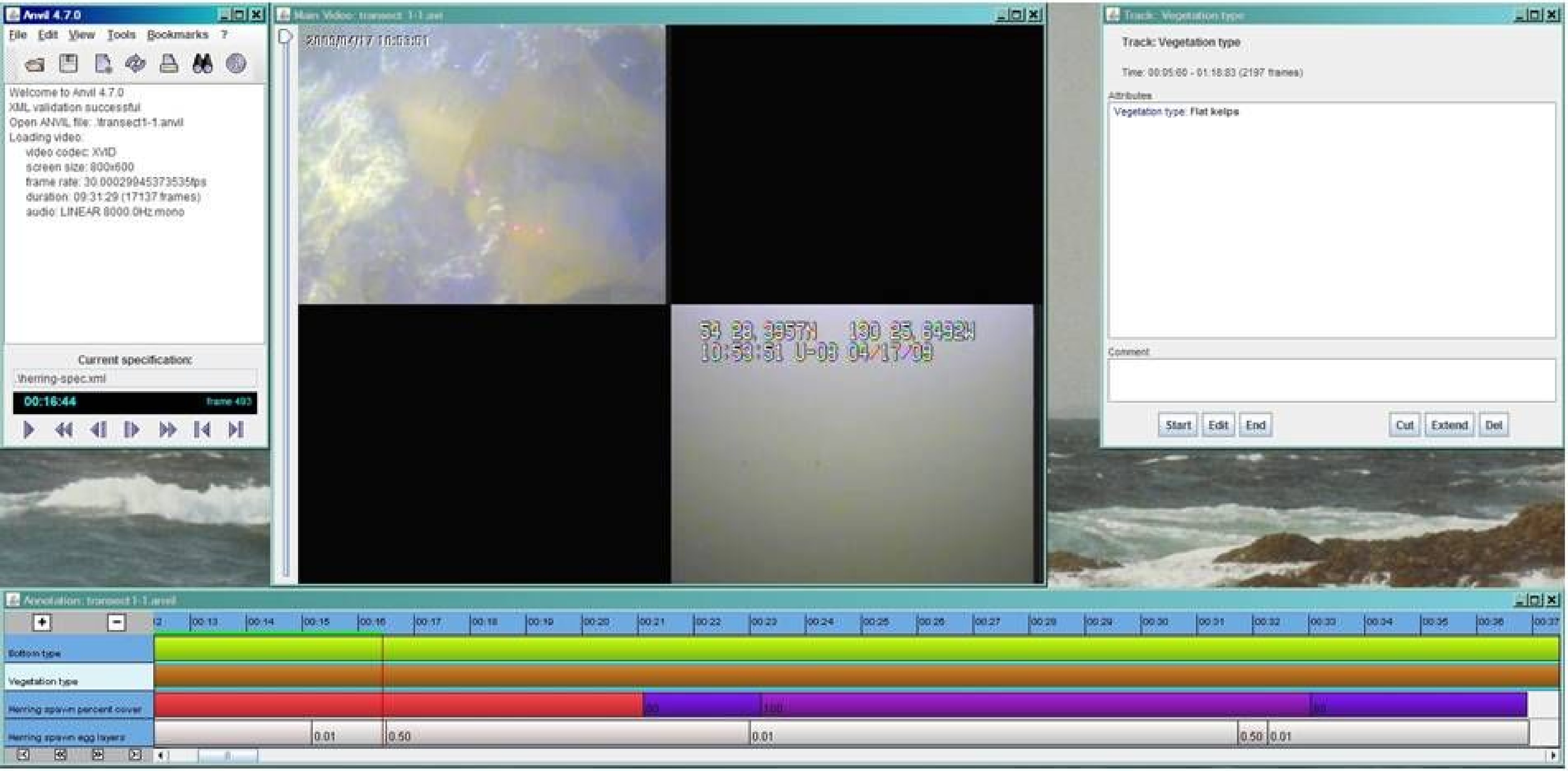
Product – written report



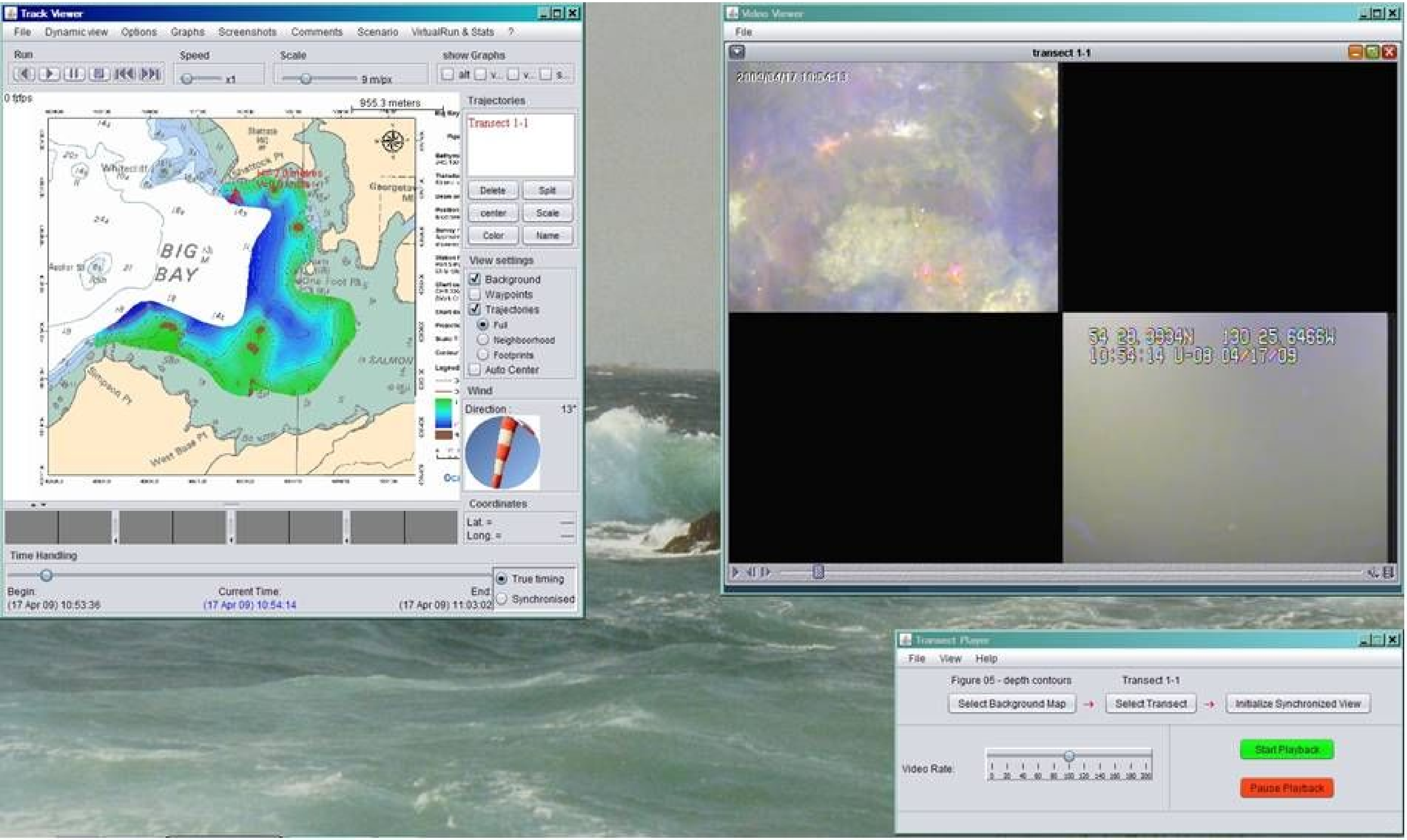
Product – ArcGIS maps



Product – Access database



Product – library of video annotations



Product – video mapping

Towed Video System Calibration

- **Conclusion**: the equations used to calculate spawning intensity were empirically derived from dive data. These equations were not calibrated for the towed video system, as the amount of work required for calibration was outside the scope of this project.

- **Recommendation**: that HCRS look at the possibility of doing further calibration studies with towed video systems should it be decided that such systems will be of value to HCRS in evaluation of herring spawn.

Questions for thought:

- What role, if any, will towed video camera technology play in the management of the herring fishery (e.g., deep water surveys, scientific studies, etc)?
- Is the amount of herring spawn being assessed accurately (e.g., spatial distribution)?
- Are changes in predation on egg biomass being accounted for (e.g., increases in seal populations, bird predation on spawn in the intertidal regions)?
- Are changes in open ocean survival being accounted for (e.g., hake and mackerel predation/competition, global climate change)?
- Do we need to change the current model?