

**Field report from *NOAA R/V Tatoosh*
side scan sonar mapping, HMPR-120-2006-02:
Habitat classification of side scan sonar imagery**

Report Contact

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INTRODUCTION

Two regions of the seafloor within the Olympic Coast National Marine Sanctuary (OCNMS) were surveyed using side scan sonar and the imagery was mosaicked at 1-meter pixel resolution. Sedimentary samples, video data, and the side scan sonar imagery were integrated to describe geological aspects of habitat. With a hierarchical deep-water marine benthic classification scheme (Greene et al. 1999), attributed polygon features were created for use in a geographical information system (GIS). This report provides a description of the mapping and groundtruthing effort as well as results of the image classification procedure for the two areas surveyed.

SURVEY AREA

In 2006, approximately 24 km² of side scan sonar based seafloor mapping was conducted offshore of the Bodeliteh Islands (Figure 1). Survey records were obtained from August 28 – August 31. Water depths ranged between 35 and 90 meters throughout the survey area.

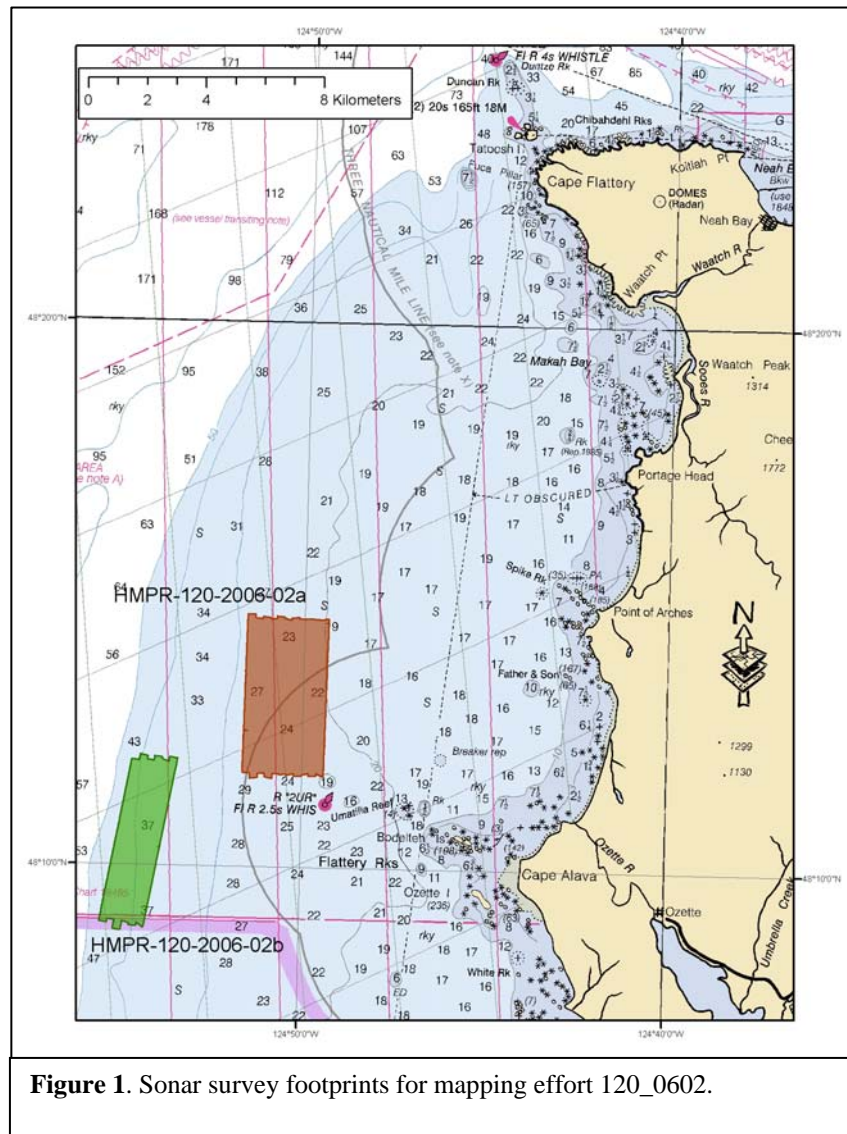


Figure 1. Sonar survey footprints for mapping effort 120_0602.

SONAR ACQUISITION

The NOAA research vessel *TATOOSH*, measuring 11.5 meters in length, served as the survey platform. We acquired ship positioning with a Trimble DSM 212L differential GPS (DGPS) and controlled line planning through Hypack Max software. We estimated towfish position through use of a digital cable counter, manufactured by Hydrographic Surveys, which logged line out.



Figure 2. Survey platform *R/V TATOOSH*.

A Klein System 3000 digital side scan sonar was used for acquiring the acoustic imagery. Only the 100 kHz sonar channels were used for creating mosaics. The sonar system has a horizontal beam width of 1.0° at 100 kHz with a vertical beam width measuring 40° . A 150-meter range scale was used during survey operations. We maintained vessel speed at between 3 and 3.5 knots throughout operations. We logged sonar imagery as 16 bit data with 2,048 samples per channel using Triton Imaging, Inc. (TII) Isis Sonar and recorded as eXtended Triton Format (XTF).

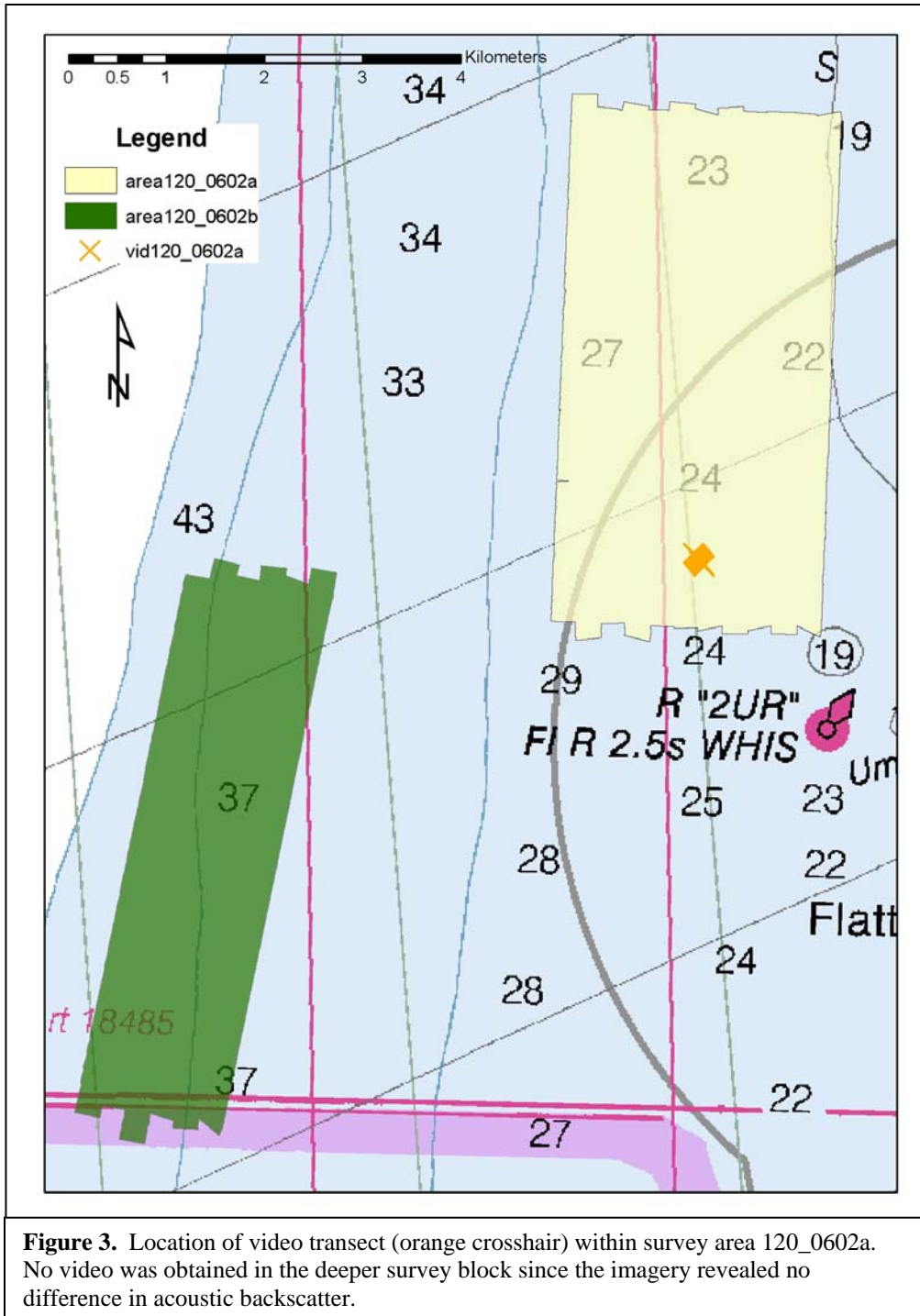
SONAR DATA PROCESSING AND IMAGE CLASSIFICATION

The navigation data was smoothed in Isis Sonar using a combination of a Kalman filter and a 7-point moving average filter. We accomplished slant range correction and bottom tracking in Isis Sonar, in addition to the application of time-varied gain and beam angle compensation curves.

We imported individual line mosaics into TII's DelphMap, merged them into separate mosaics for each survey block and then exported them as geotiff images. Image homogeneity and entropy were calculated for each mosaic using custom designed software (Cochrane and Lafferty 2002). Mosaics from the side scan packets, entropy and homogeneity images were all layer stacked in Erdas Imagine to create multi-spectral images. A supervised classification was performed using a maximum likelihood decision rule to produce a final classified image (Intelmann et al. 2006). Adobe Photoshop was then used to edit misclassified data such as that occurring near-nadir or in other various areas such as misclassified side lobes or shadows. Raster images were then smoothed with a low pass filter and converted to features in ArcGIS.

GROUNDTRUTHING

Minimal video groundtruthing was obtained in area120_0602a on 9 September 2006, and no grab samples were available from the usSeabed project (Reid et al. 2006) to assist with sonar interpretation (Figure 3).



SURVEY RESULTS AND INTERPRETATION

Over 153 linear km of survey lines were acquired aboard the NOAA *R/V Tatoosh* in 2006 (Table 1), with nearly 16 hours of actual logged sonar records being obtained.

Table 1. Survey effort statistics for HMPR-120-2006-02. Data acquired using a Klein 3000 side scan sonar aboard the NOAA *R/V Tatoosh*. Area is presented in square kilometers, length of linear track lines in kilometers, and hours of actual logged sonar packets in hours, minutes, and seconds.

Year	Survey Date	Area (km²)	Tracks (km)	Hours (h:m:s)
2006	Aug. 28-Aug. 31	23.54	153.21	15:47:11

Both survey blocks 120_0602a and 120_0602b were located entirely on the flat shelf offshore of the Umatilla Reef and were characterized entirely as soft, silty substrate (Table 2; Figure 4). Video data acquired in area 120_0602a further confirmed the substrate as silt.

Table 2. Distribution of sediment class from survey HMPR-120-2006-02. See Figure 1 for area locations. Area is presented in square meters along with percentage of mapped area.

Survey Area	Sediment Code	Count	Area (m)	Percent Area
120_0602a	Ss(m)_u*(m) :Shelf, unconsolidated soft silty sediment, video confirmed	1	14,758,539.9	100.000
120_0602b	Ss(m)_u : Shelf, unconsolidated soft silty sediment	1	8,739,442.0	100.000

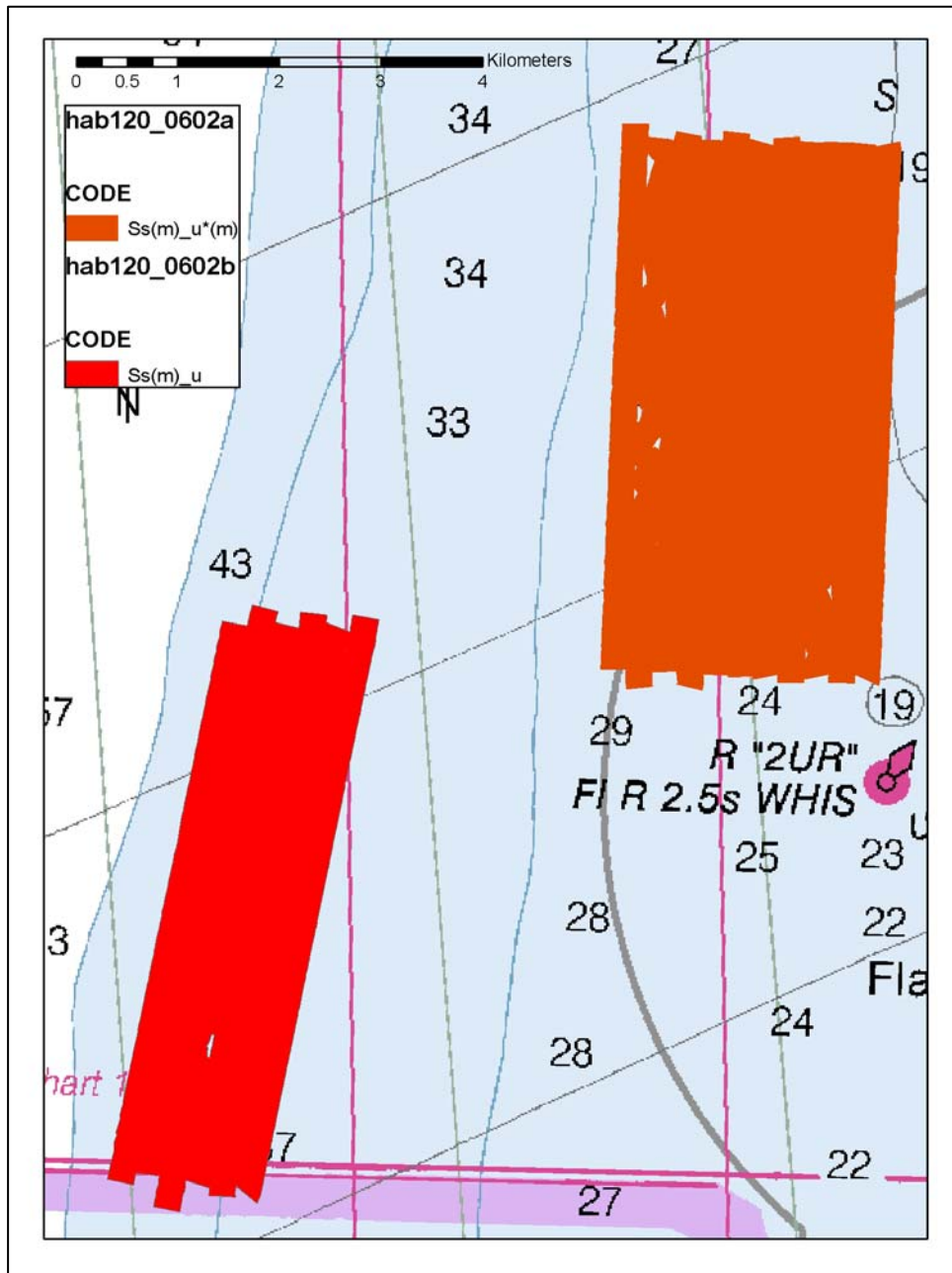


Figure 4. Attributed habitat classification polygons for survey 120_0602a and 120_0602b. Polygon codes are taken from Greene et al (1999); where S=continental shelf megahabitat, s(m)=soft silt, and u=unconsolidated sediment modifier. Letter following asterisk in 120_0602a code indicates video confirmation.

ACKNOWLEDGMENTS

The author would like to thank David Kirner and Andy Palmer for skippering the *RV Tatoosh* and for assistance with deployment and retrieval of the video sled and towfish during operations.

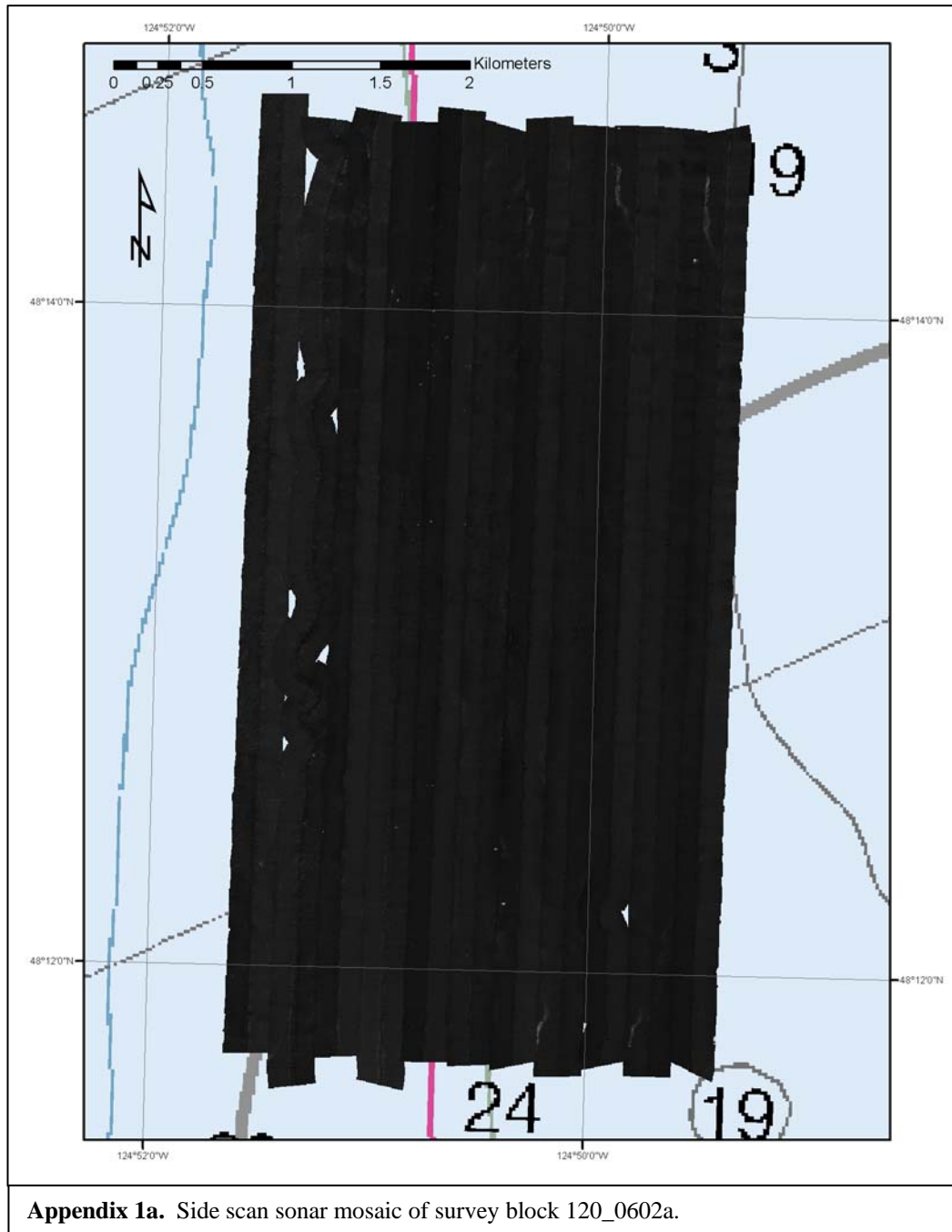
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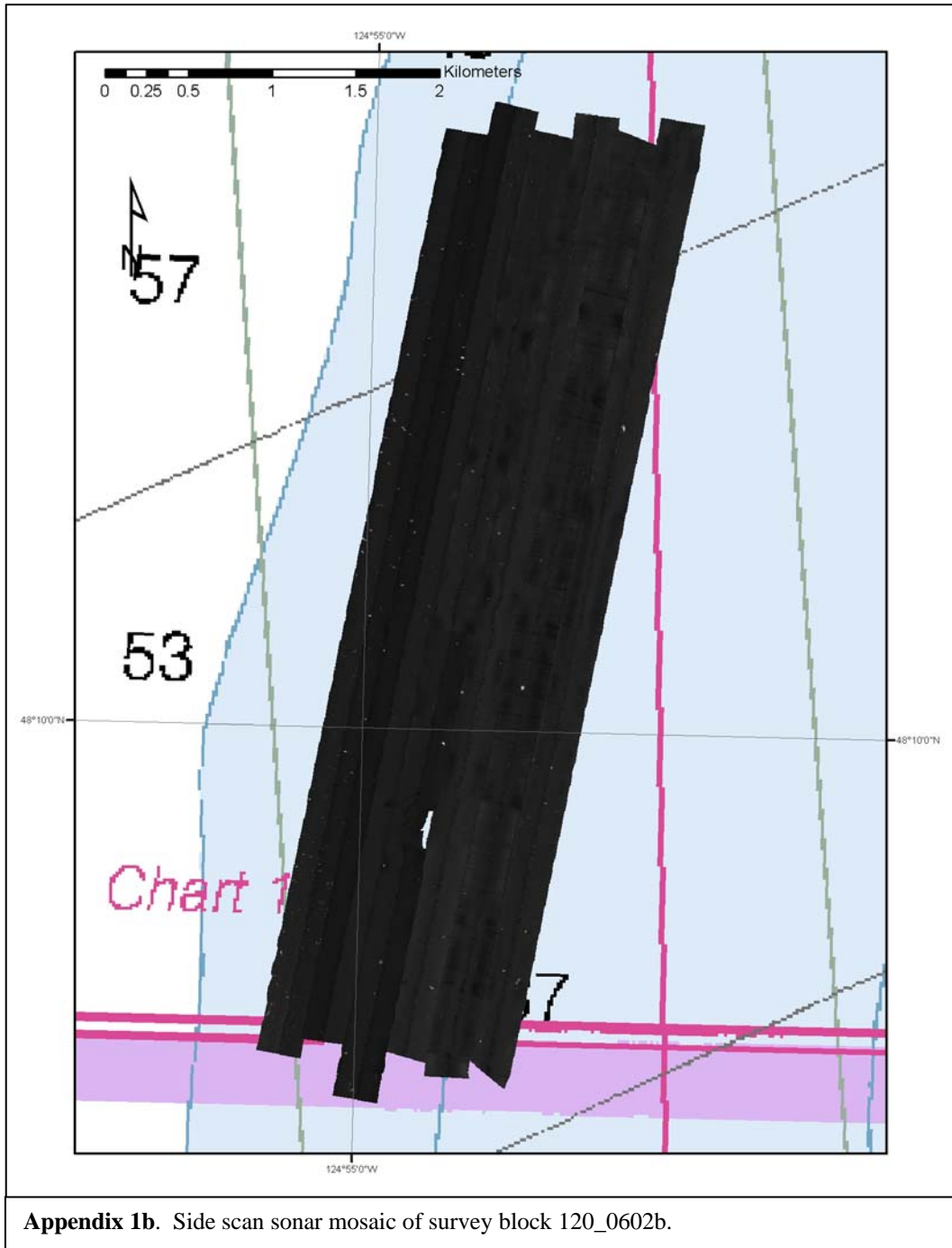
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APPENDIX

Appendix 1. Side Scan Sonar Imagery

See Figure 1 for perspective of survey location in relation to shoreline.





Appendix 2. Isis Processing Parameters

HMPR-120-2006-02

Lateral Offset: 0.0m

Layback Offset: 6.7m

Heading= use CMG

Mosaic resolution: 1m

Duration: 135m

Threshold: 4

Apply BAC

TVG: start at first return

Curve = -2 +0.09 + 1