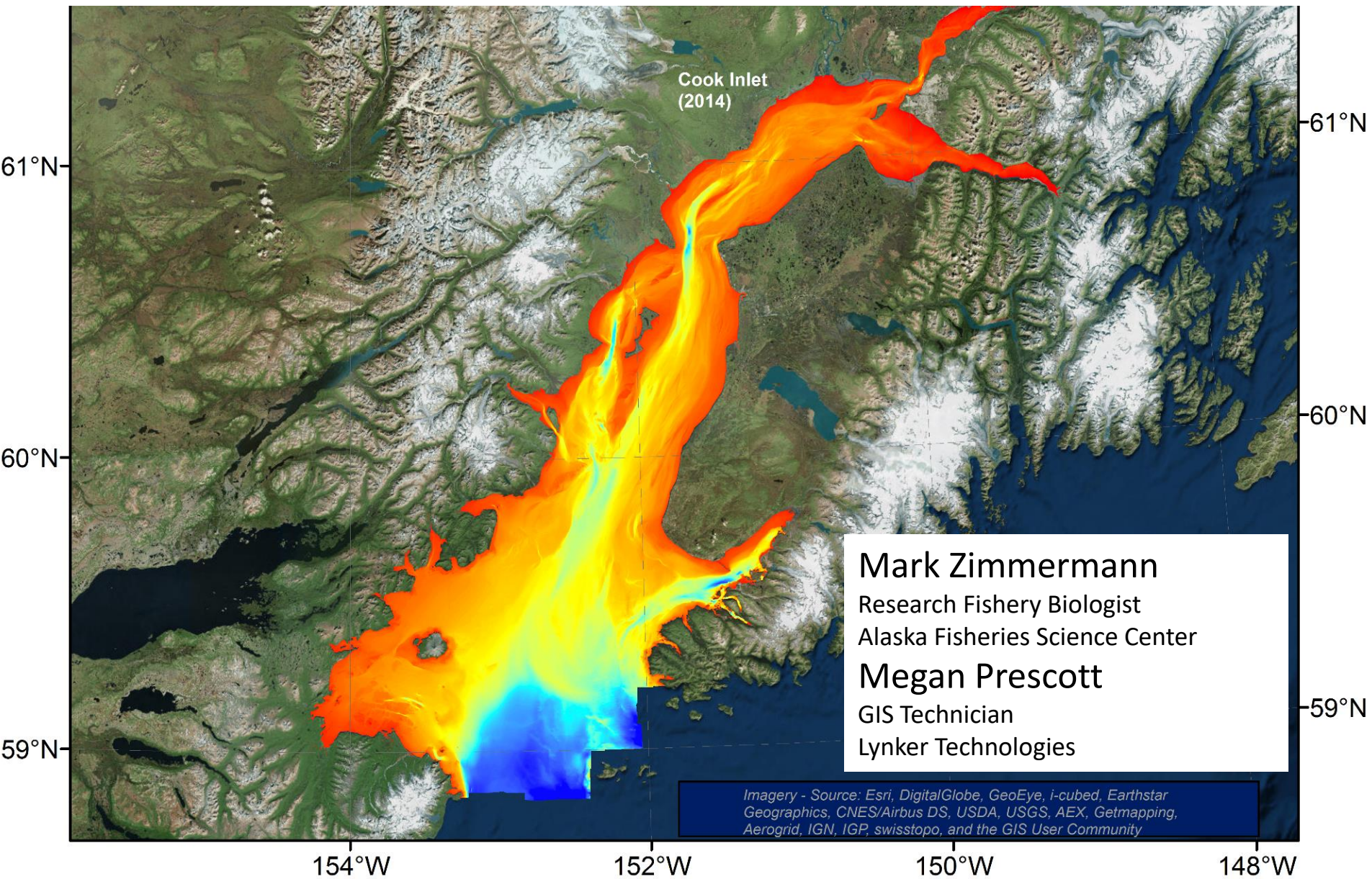
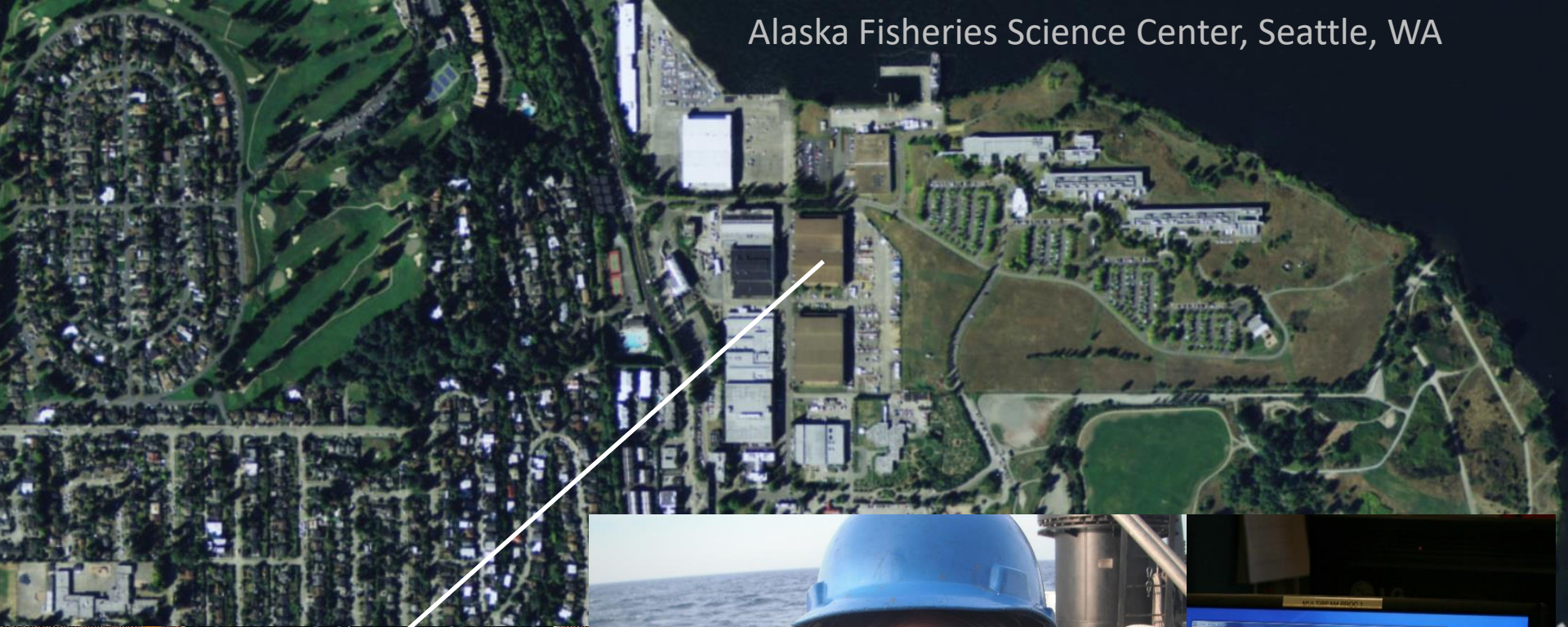


Mapping the gaps in Alaska's seafloor: Procedures, products, and prospects for completion

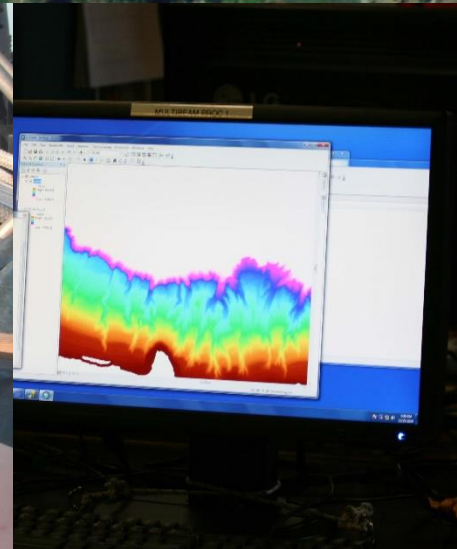


Alaska Fisheries Science Center, Seattle, WA



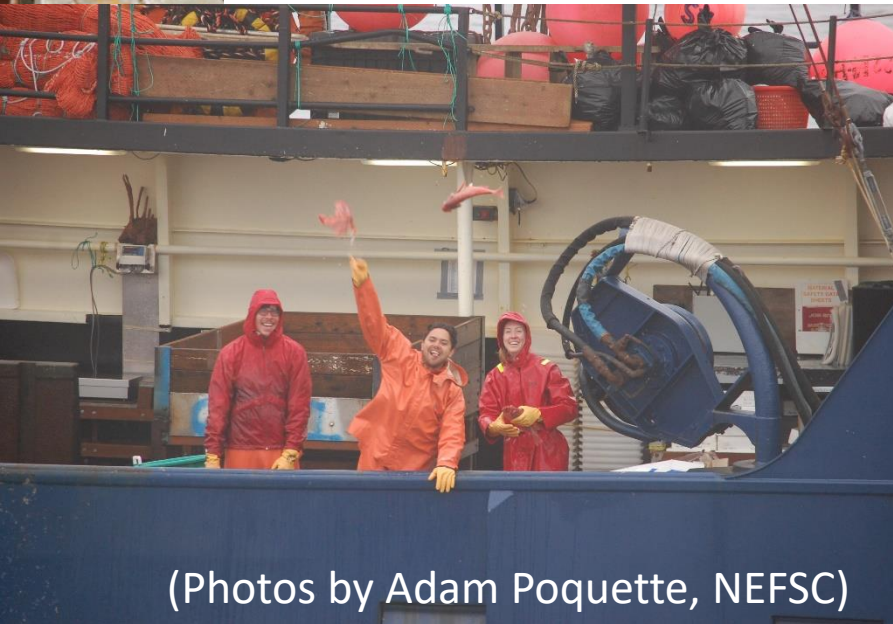
Net shed

(Photo courtesy Bob Lauth)



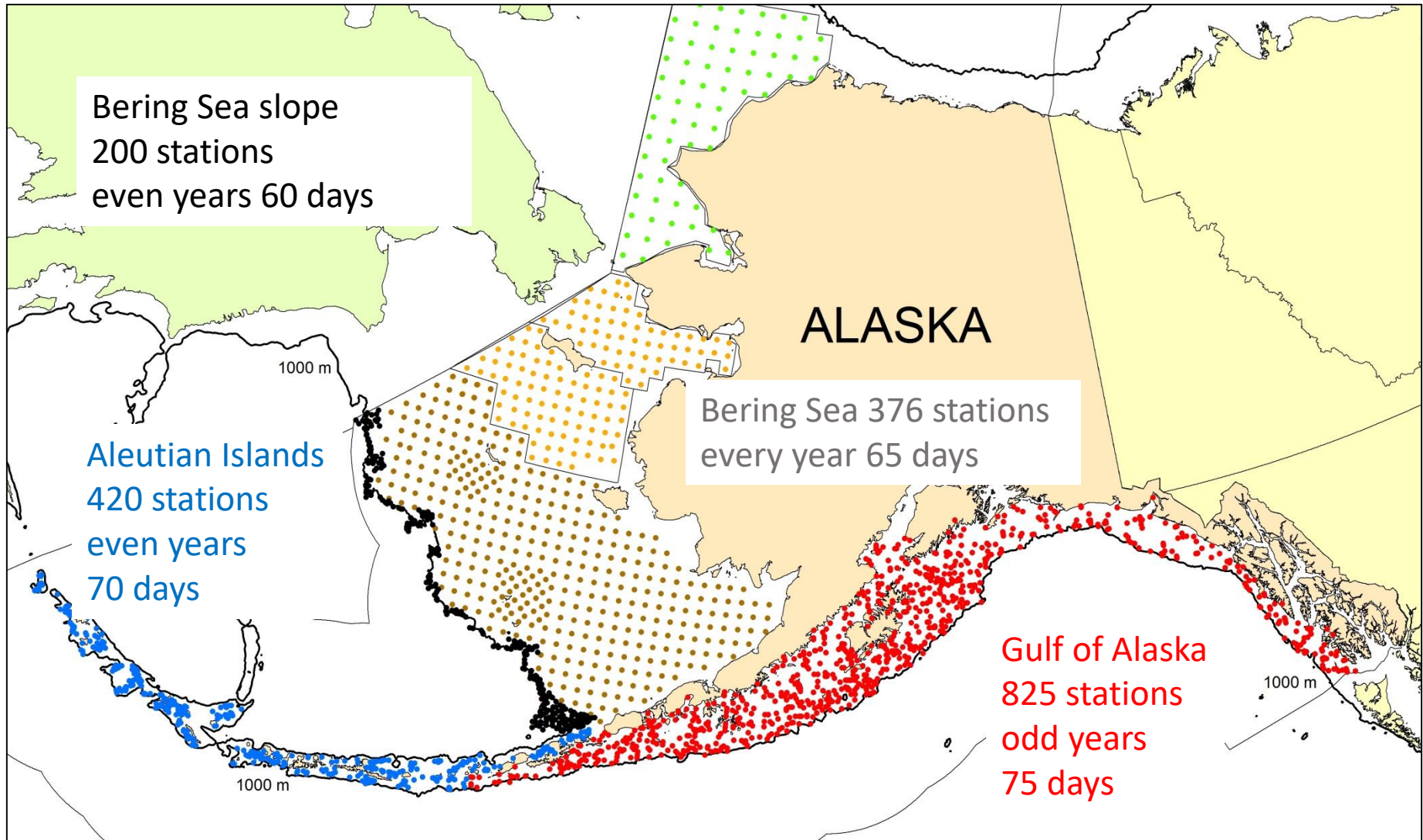


Chartered bottom trawling fishing vessels



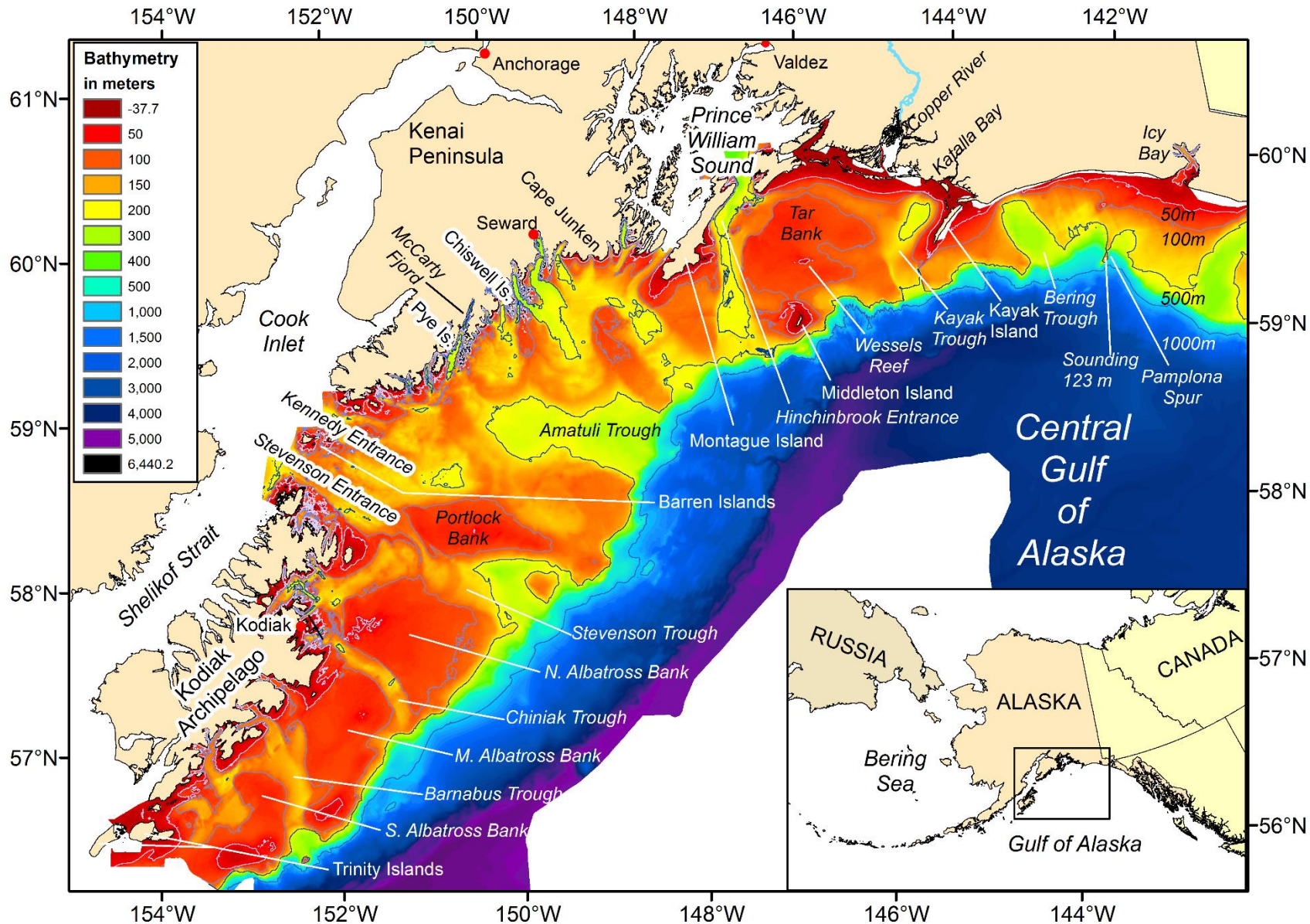
(Photos by Adam Poquette, NEFSC)

Alaska Fisheries Science Center Trawl surveys of fish populations



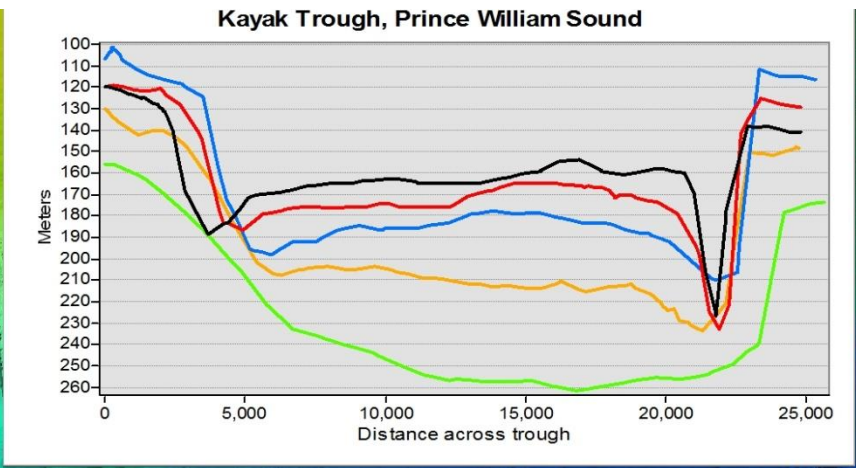
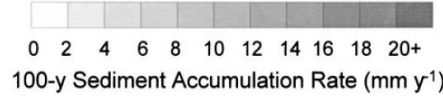
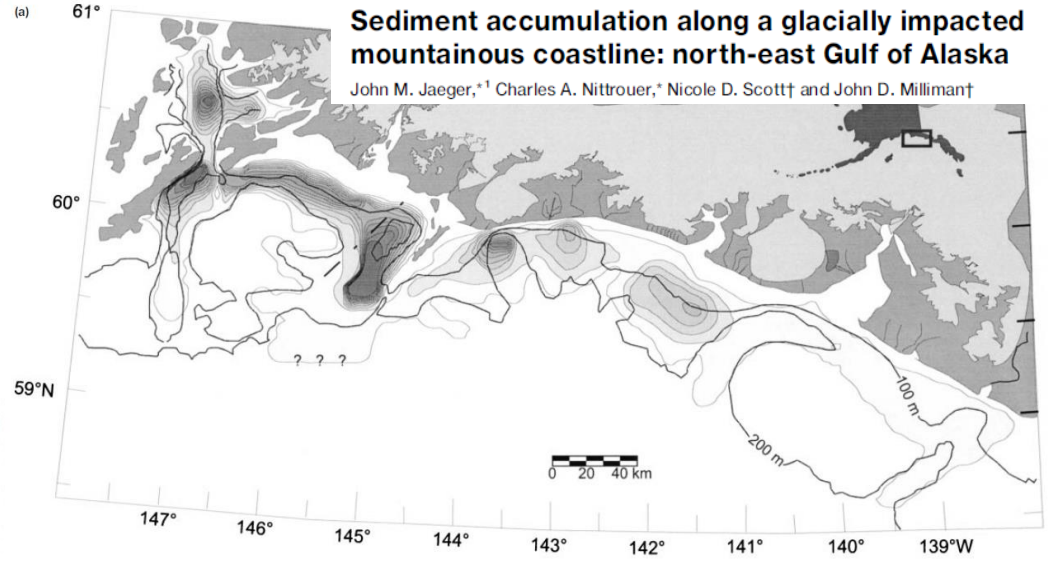
Importance of bathymetry

- Predictor of fish abundance & distribution
- Trawl survey stations & strata
- Trawl survey biomass estimates
- ***NEW Modeling approach for population estimates NEW***
- But our bathymetry maps are terrible!



164
© 1998 Blackwell Science Ltd, *Basin Research*, 10, 155-173

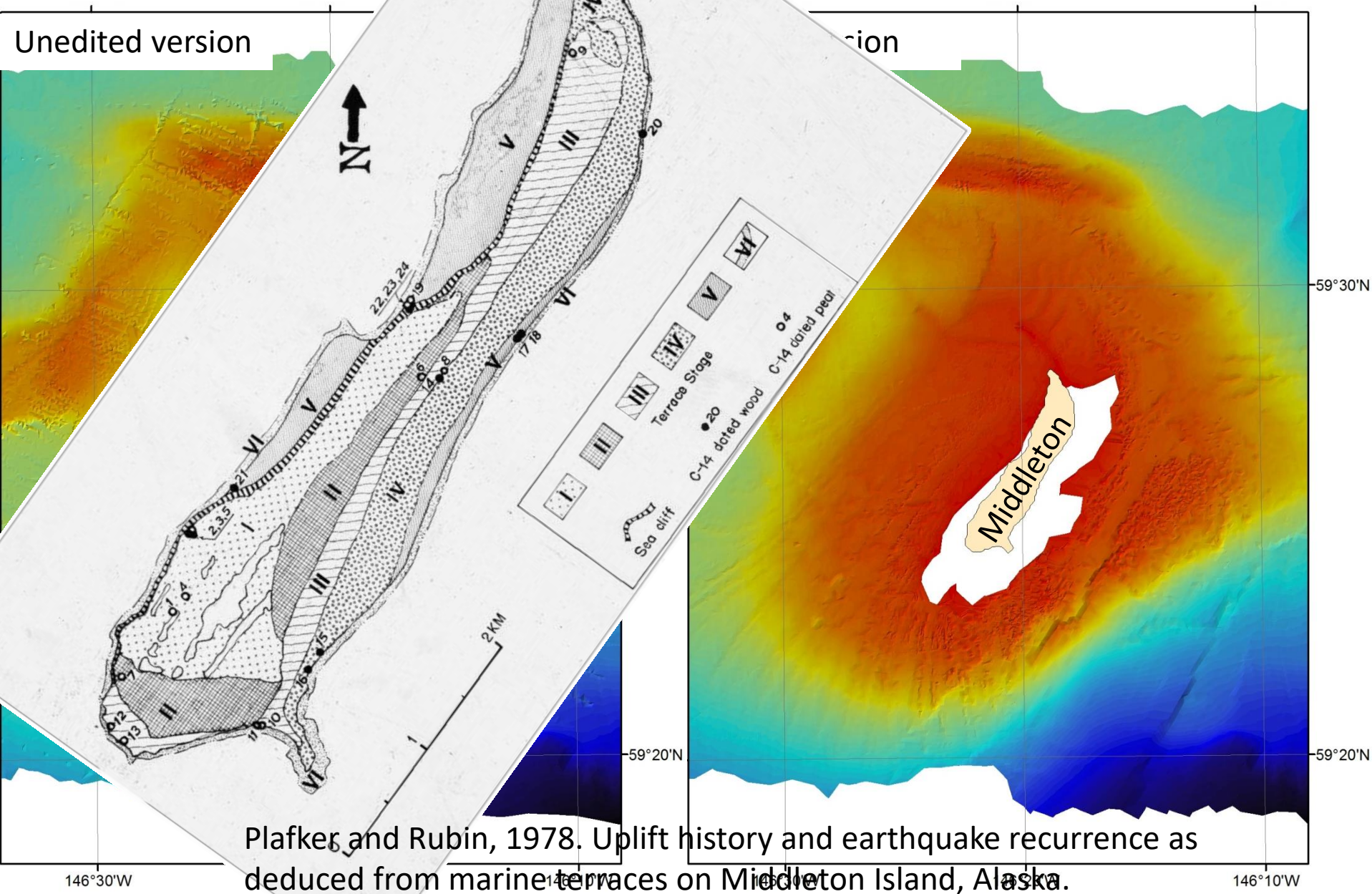
Kayak Island

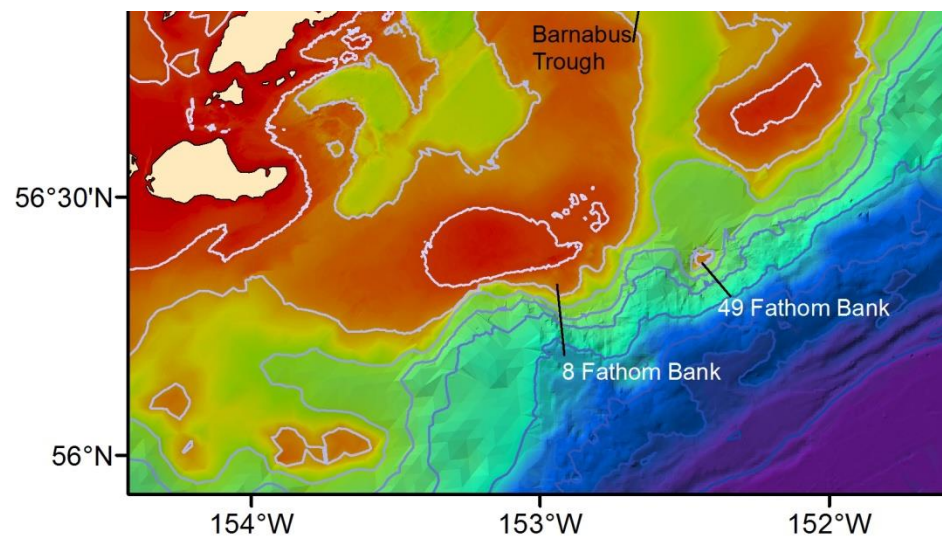
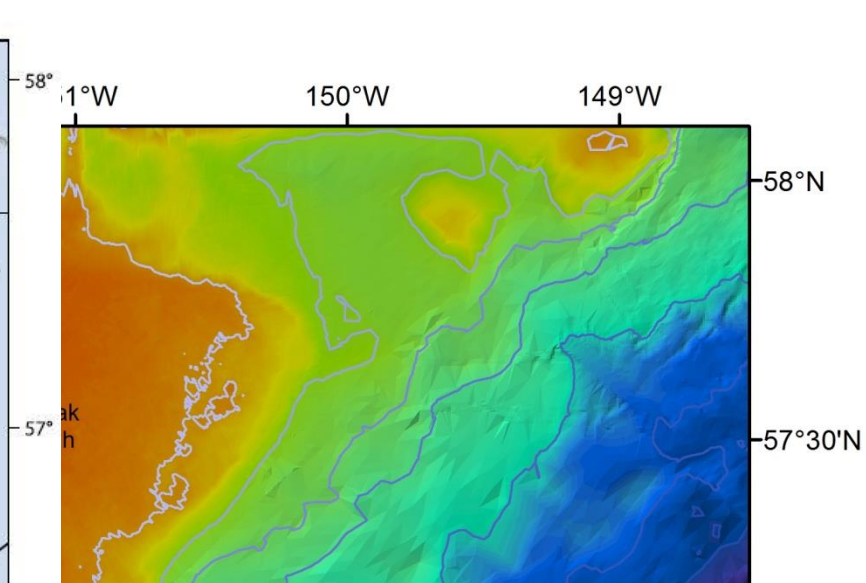
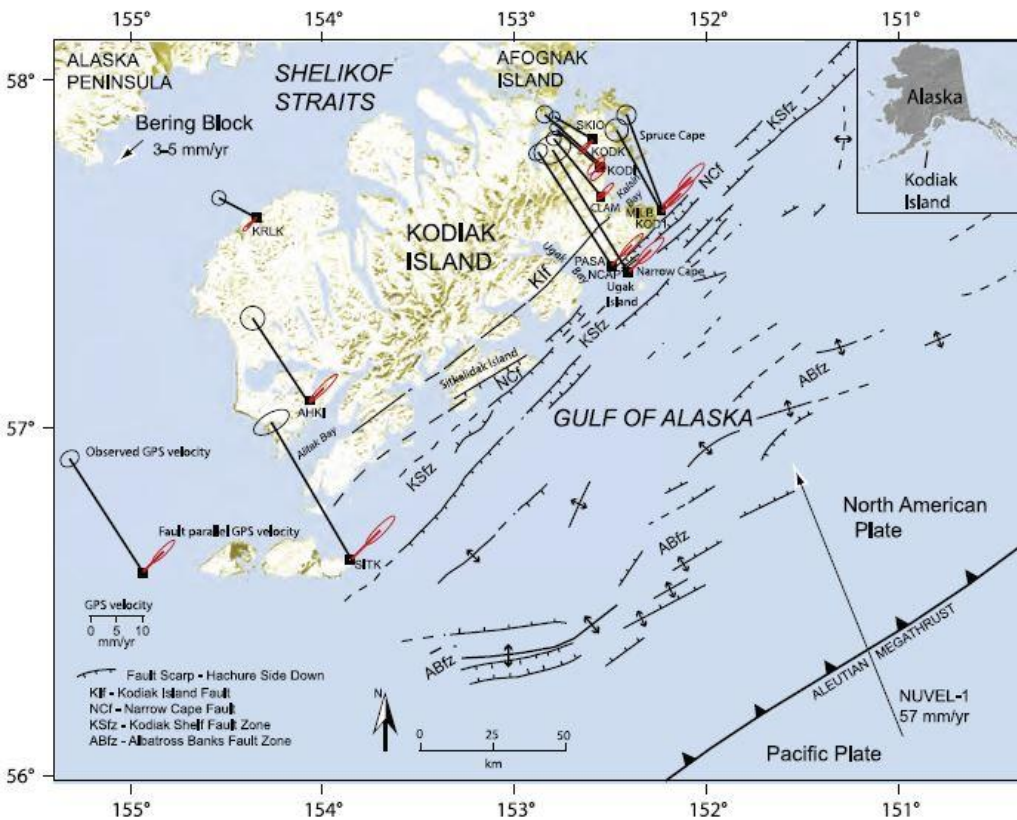


(courtesy of Sean Gulick (UT Austin) and Peter Haeussler, USGS)

Edit the bathymetry

Understand the seafloor

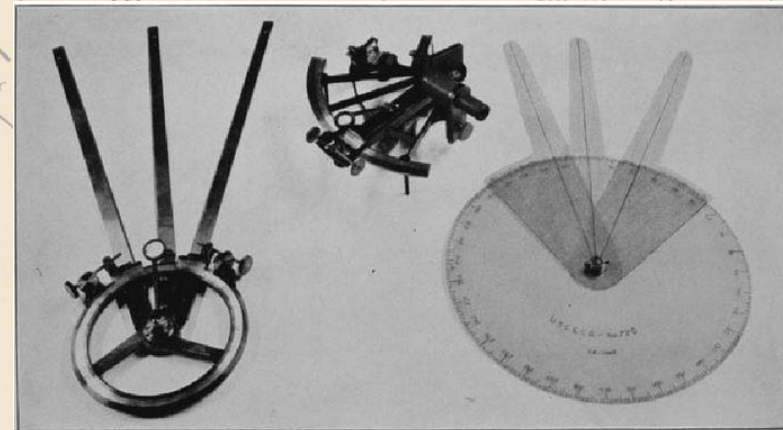
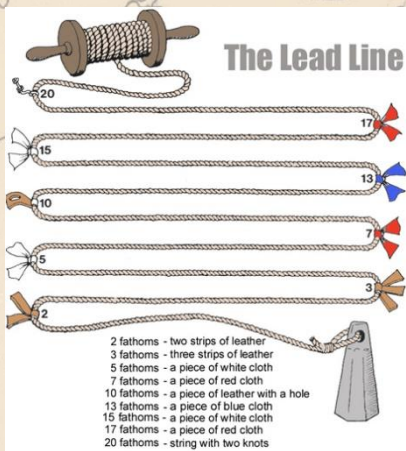




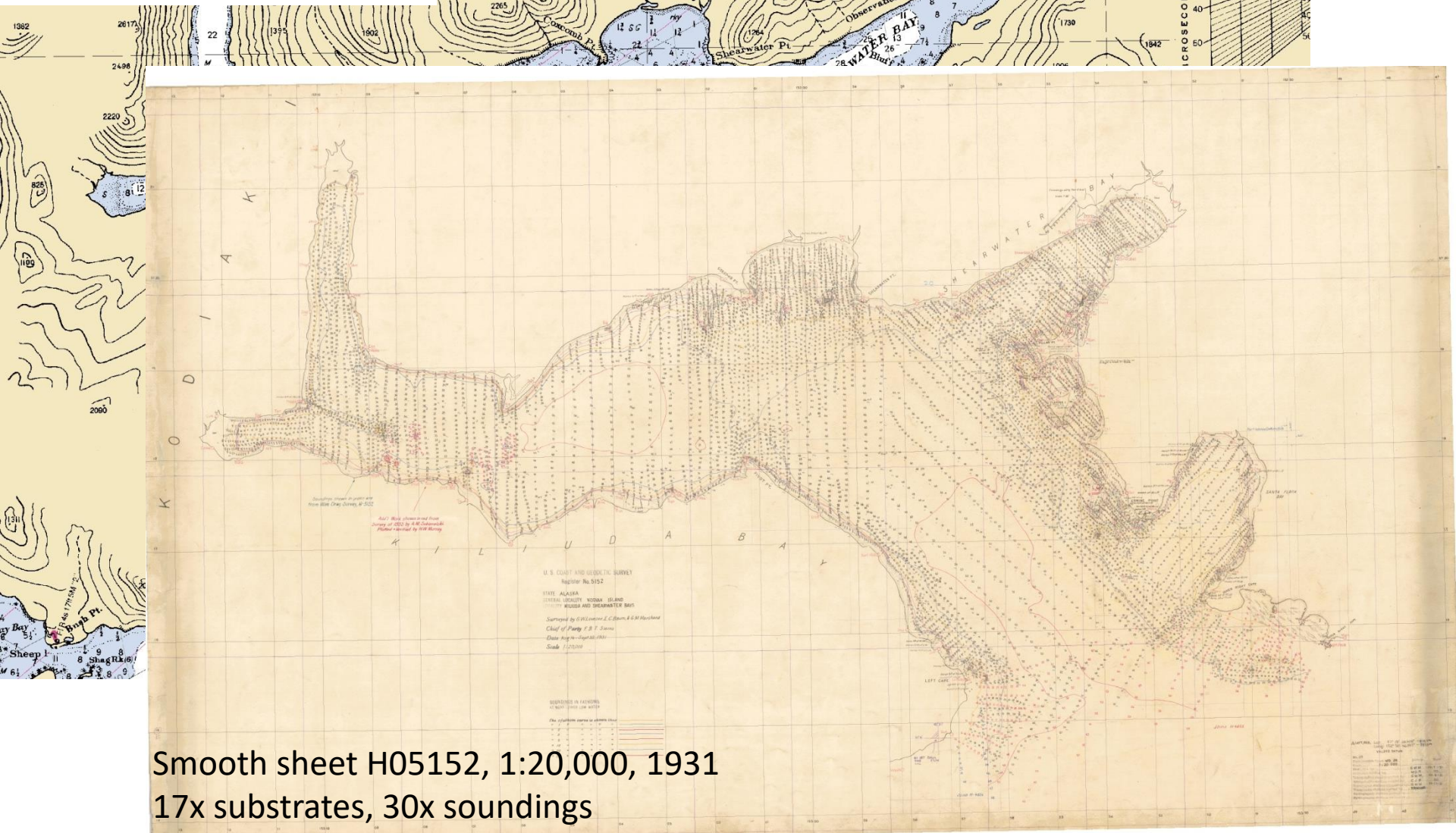
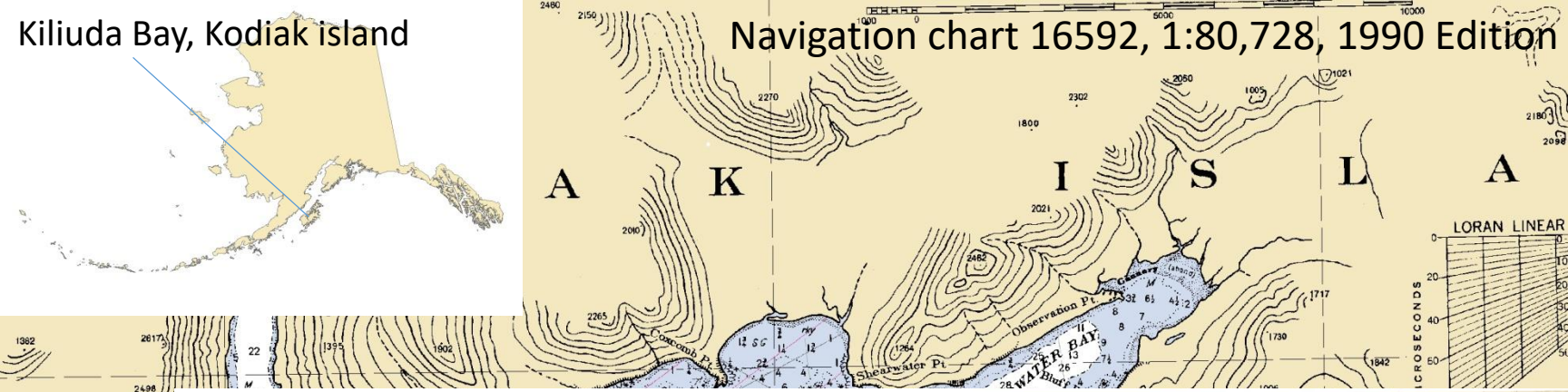
Carver et al. 2008. Active Faults on Northeastern Kodiak Island, Alaska.

2. Procedures

- Old hydrographic surveys (NOS)
- “Smooth sheets” & unproofed data available online
- GIS proofing and editing
 - Latitude/Longitude positioning
 - Tide information
 - Depth errors



Kiliuda Bay, Kodiak island



Smooth sheet H05152, 1:20,000, 1931
17x substrates, 30x soundings

Layers

Bathymetric Surveys

- Multibeam Bathymetric Surveys
- Multibeam Bathymetry Mosaic (Shaded Relief Imagery)
- Single-Beam (Trackline) Bathymetric Surveys
- Trackline Bathymetry Density
- NOS Hydrographic Surveys:
 - All Surveys with Digital Data
 - Surveys with Bathymetric Attributed Grids (BAGs)
 - Surveys without Digital Data
- BAG Footprints
- BAG Color Shaded Relief Imagery

Search Surveys Reset

Digital Elevation Models (DEMs)

- DEM Footprints
- DEM Color Shaded Relief Imagery

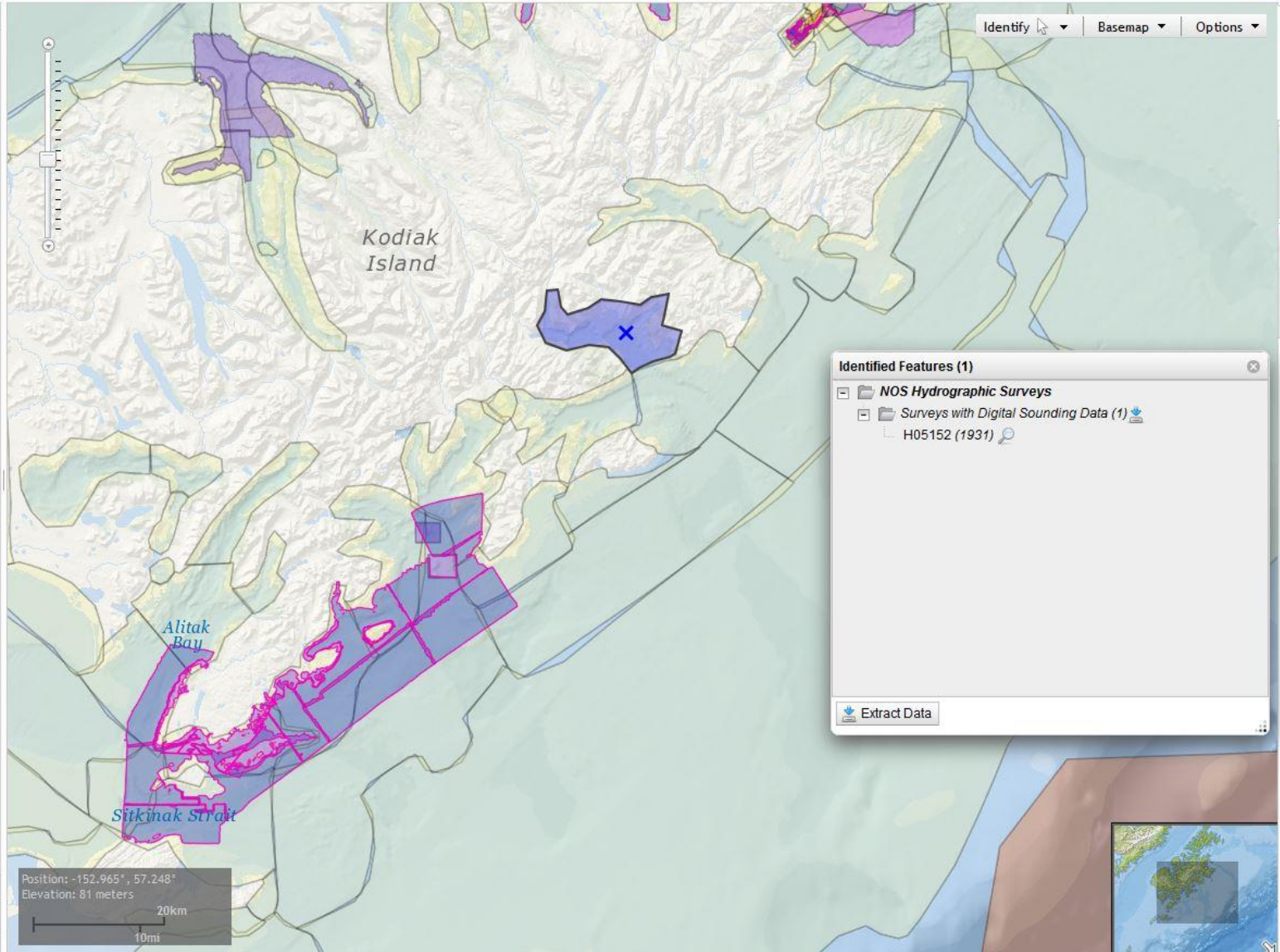
Bathymetric Lidar

- Coastal Lidar Datasets available from [NOAA's Office for Coastal Management](#)

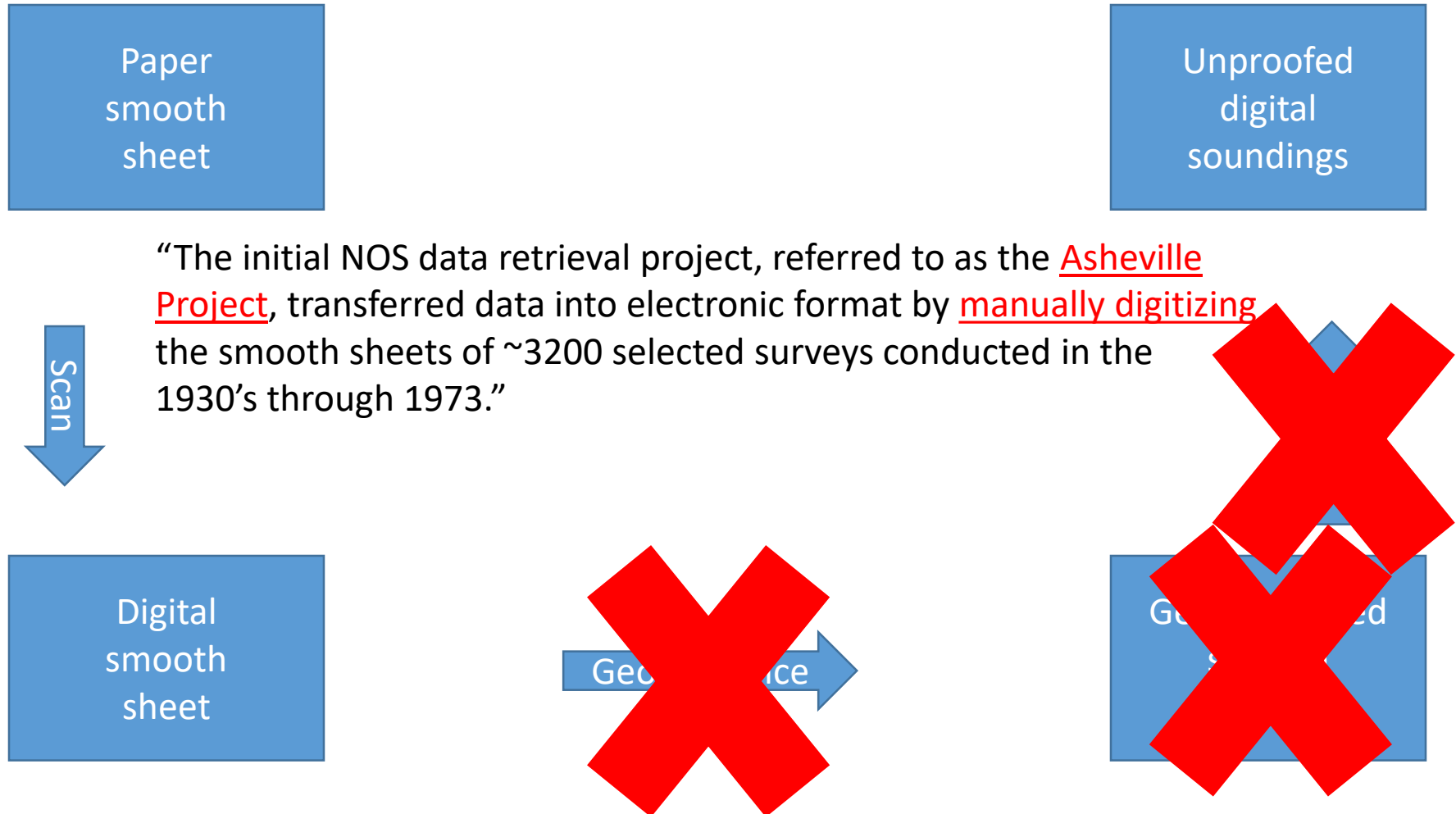
Legend

[More Information](#)

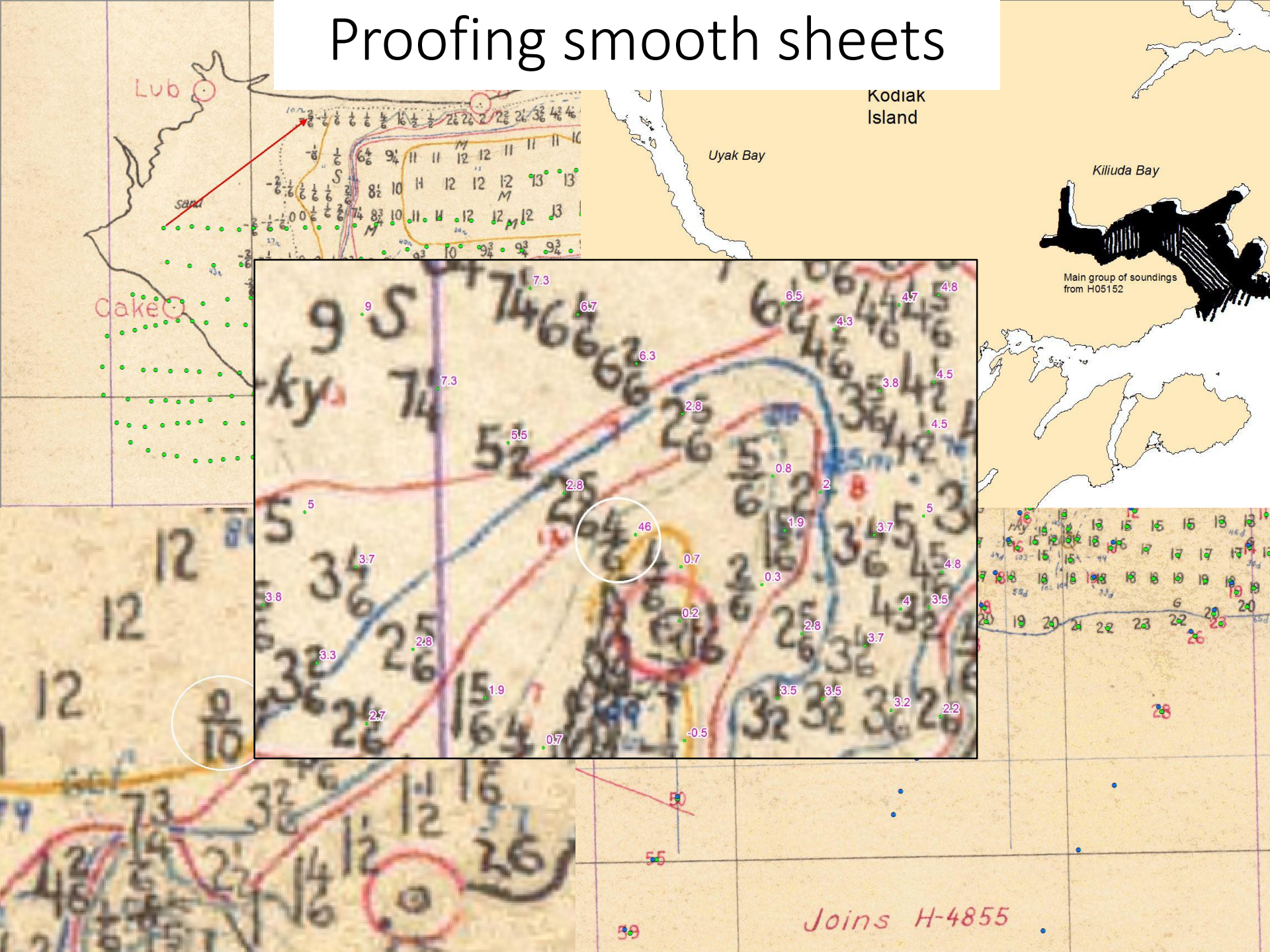
[Help](#)



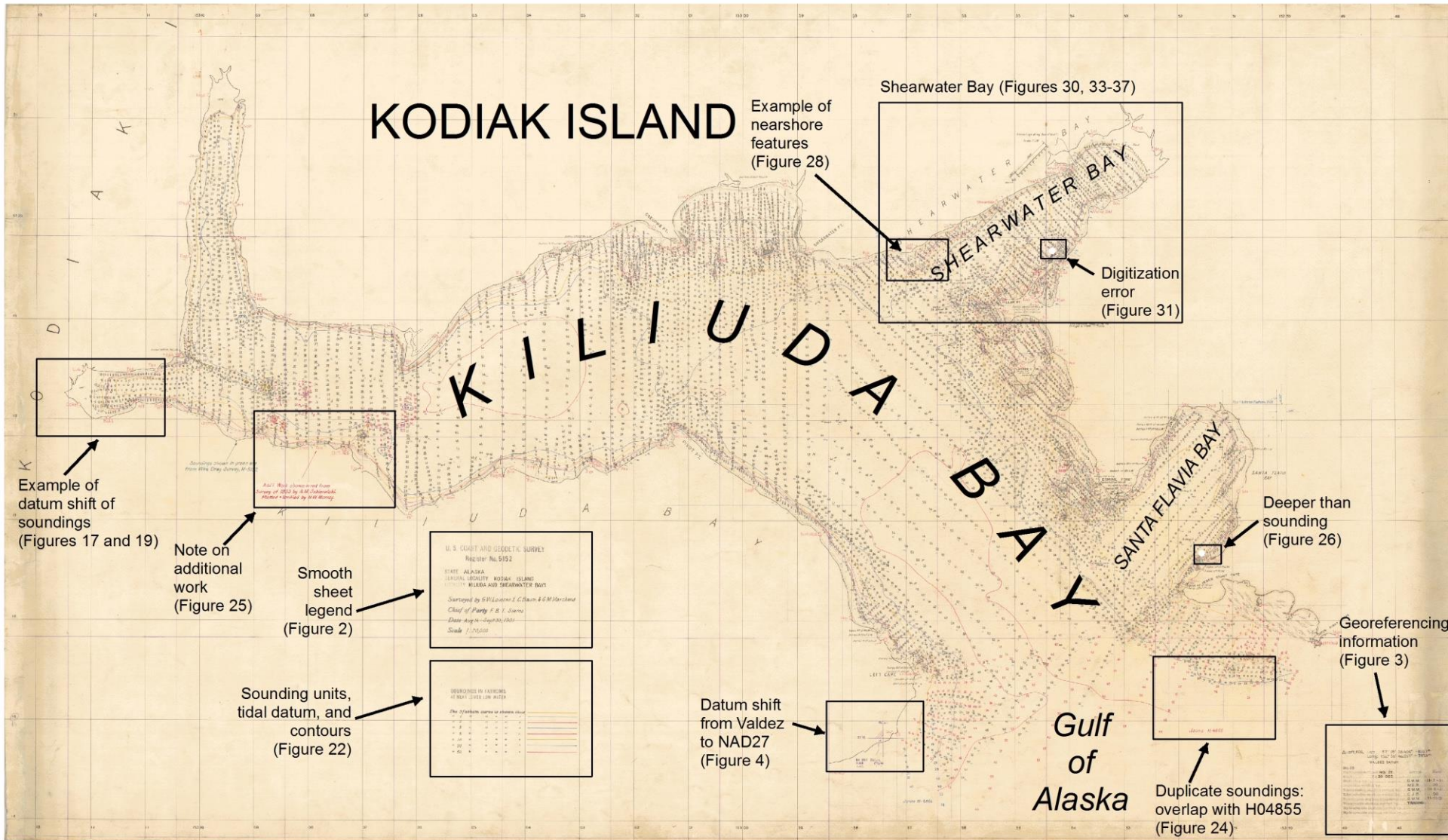
Digitizing smooth sheets: Asheville Project



Proofing smooth sheets



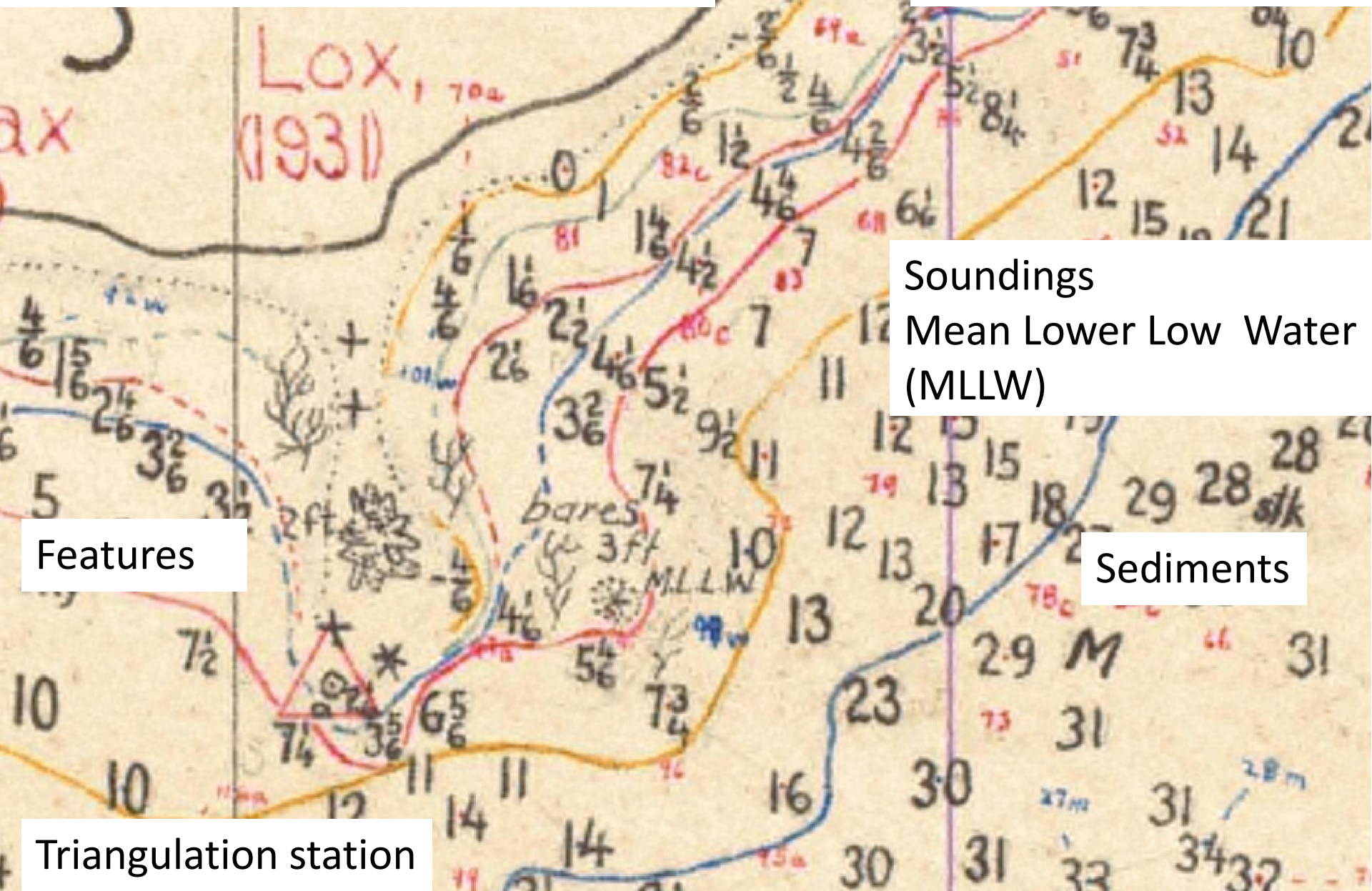
Reading the smooth sheet



lots of critical information especially lat./long. and tides

Shoreline – Mean High Water (MHW)

Smooth sheet details



Soundings
Mean Lower Low Water (MLLW)

Features

Sediments

Triangulation station

Geographic reference system

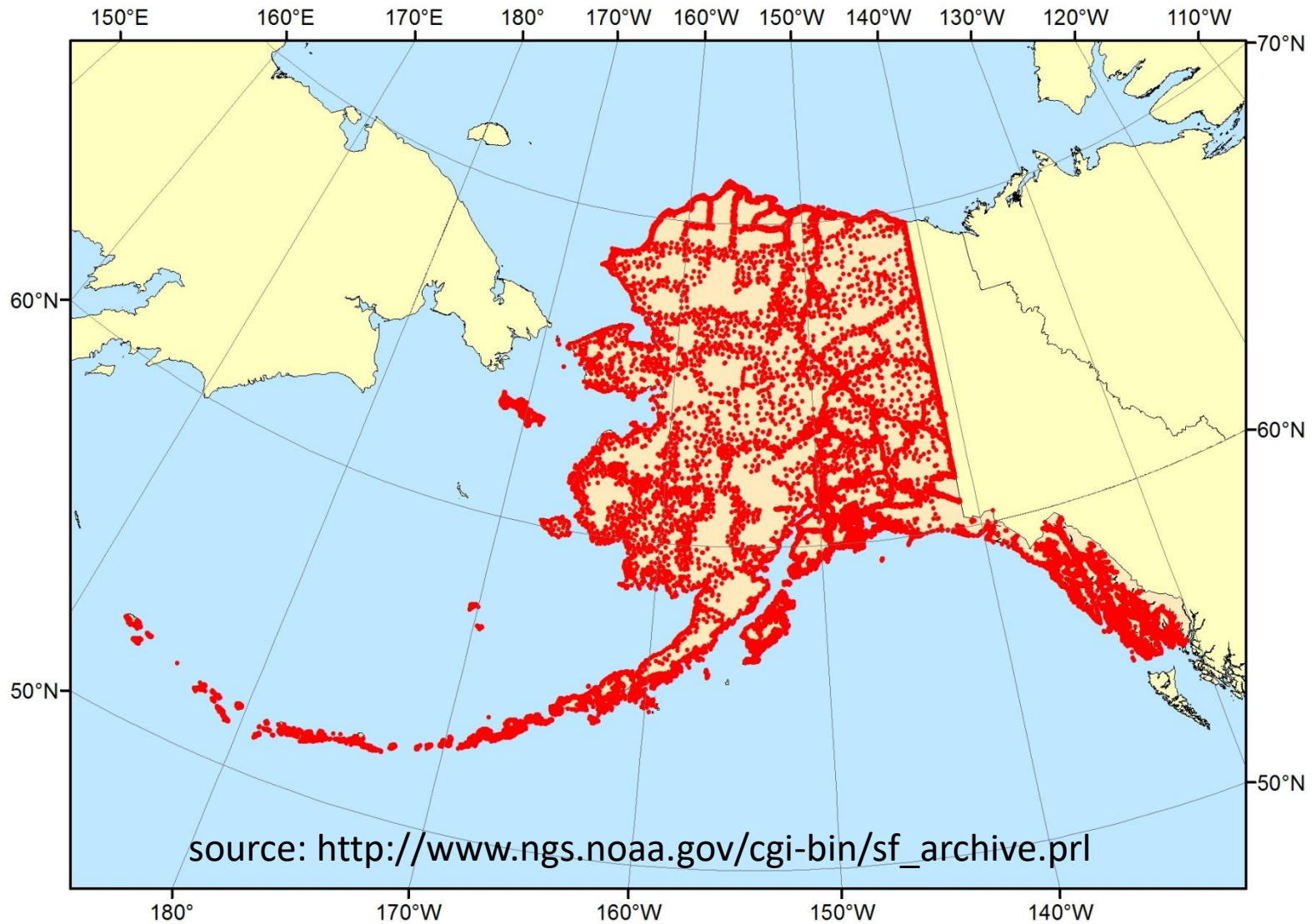
- Horizontal Datums

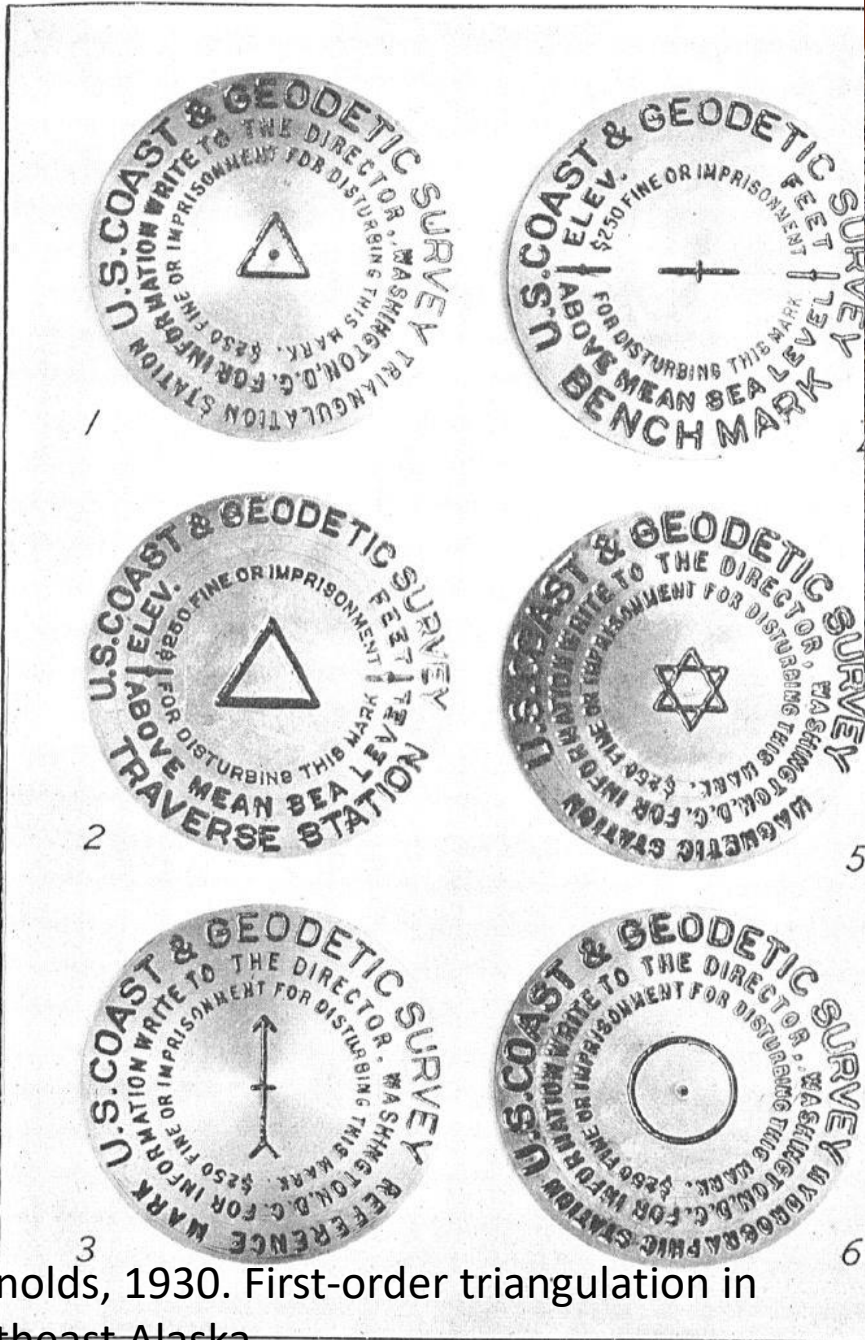
- WGS84 – GPS units
- NAD83- modern charts
- Historical smooth sheets: Valdez, Port Hobron, Unalaska,

- Triangulation stations  shape file.

http://www.ngs.noaa.gov/cgi-bin/sf_archive.prl

Alaska Triangulation Stations





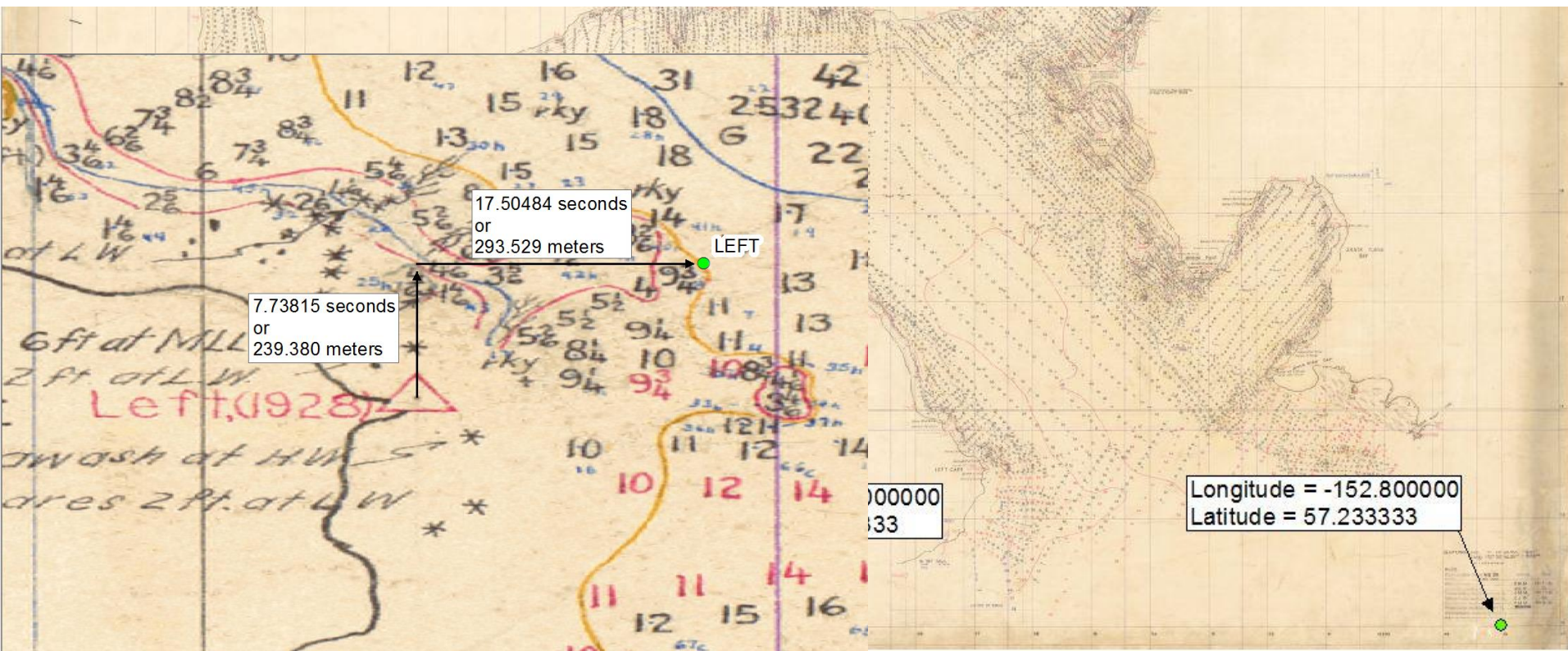
Reynolds, 1930. First-order triangulation in southeast Alaska.

FIGURE 2.—STANDARD MARKS OF THE U. S. COAST AND GEODETIC SURVEY

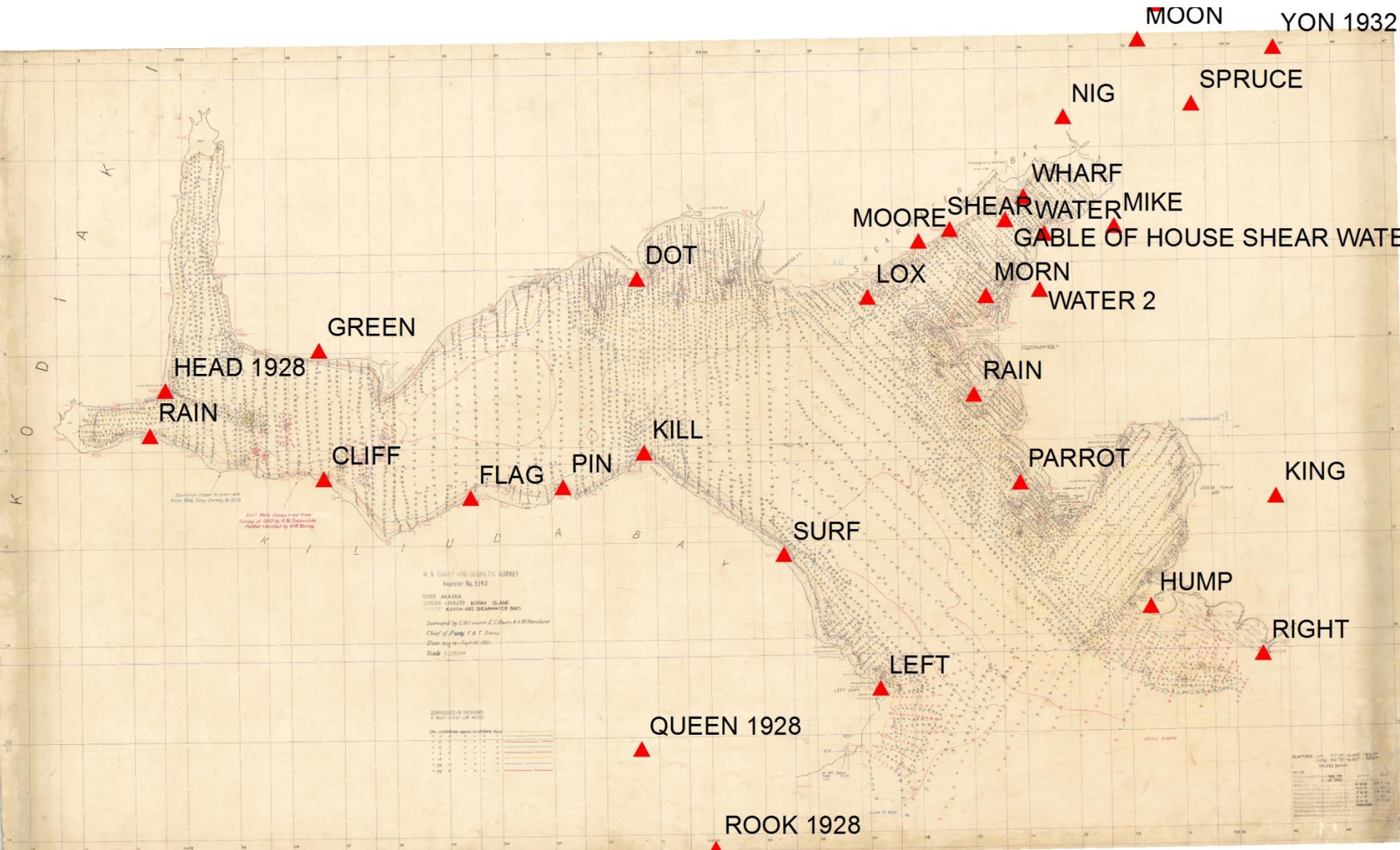
Horizontal Control:

△ Left, 1928, Lat: 57° 15' 28.406" - 878.7 m.
Long: 152° 56' 46.997" - 787.9 m.
VALDEZ DATUM

DESIGNATION – LEFT 57 15 36.14415(N)
152 56 29.49216(W)
NAD83



Alignment with triangulation stations



SOUNDINGS IN FATHOMS
AT MEAN LOWER LOW WATER

Tidal reference:
High and low tides



KODIAK ISLAND, AK StationId: 9457292

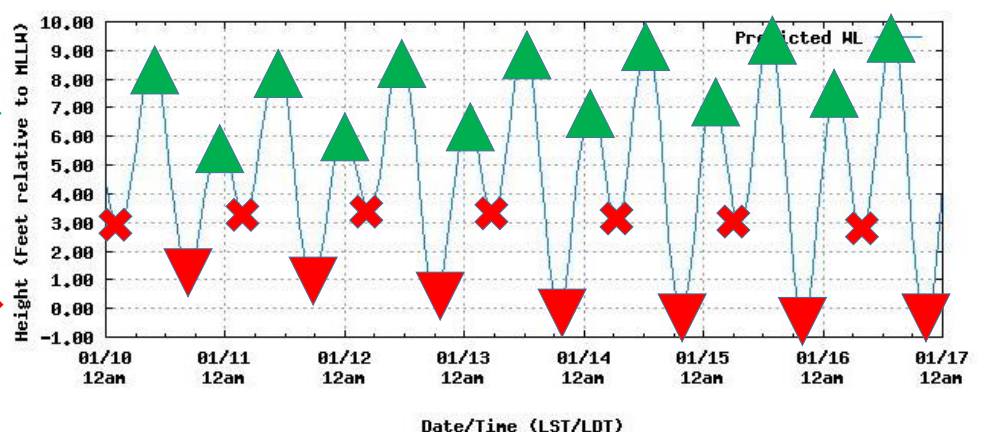
Weekly Tide Prediction in Feet
Time Zone: LST/LDT
Datum: MLLW

◀ 2014/01/10 - 2014/01/16 ▶

http://tidesandcurrents.noaa.gov/tide_predictions.shtml

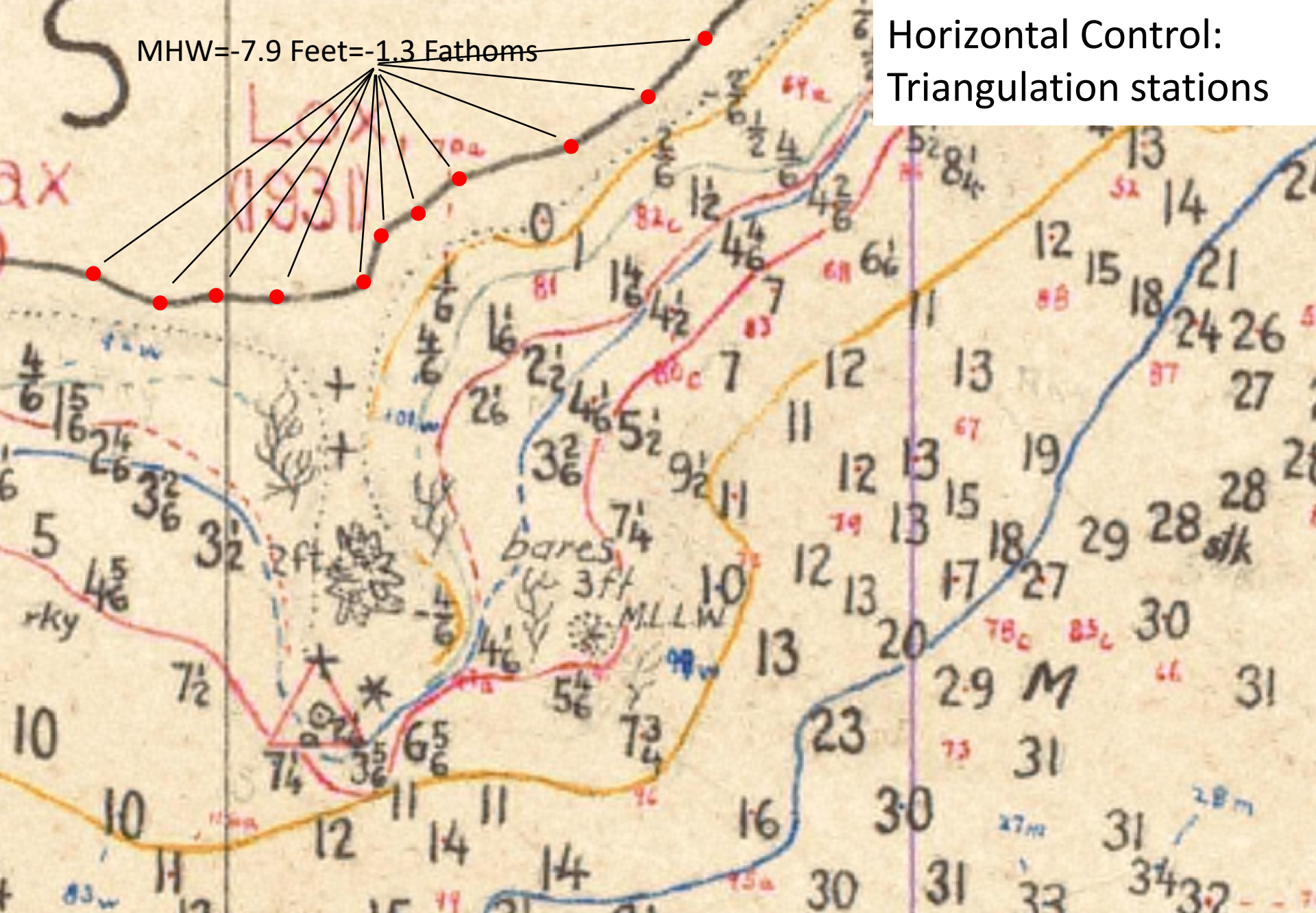
MHW= →

MLLW= →

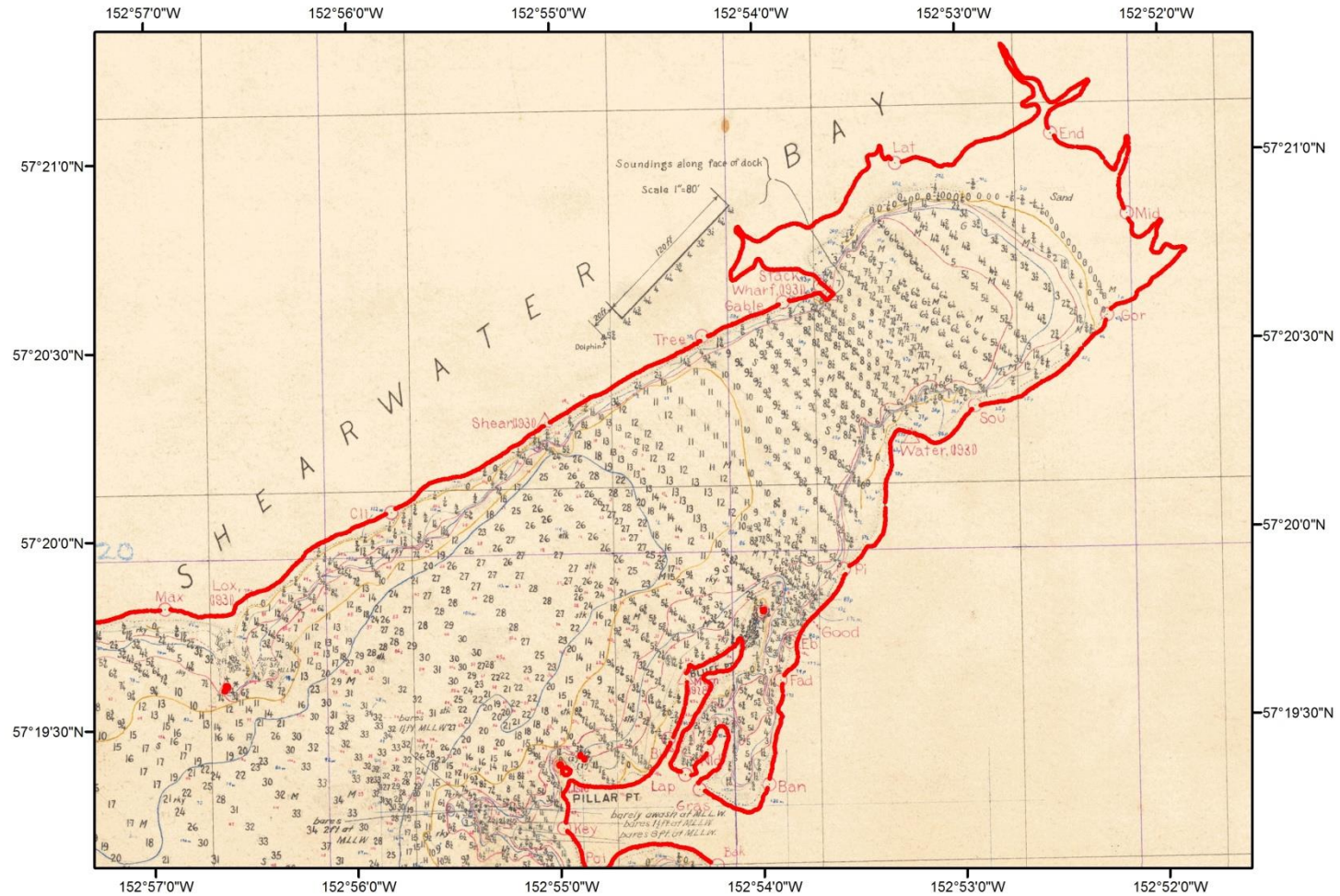


MHW=-7.9 Feet=-1.3 Fathoms

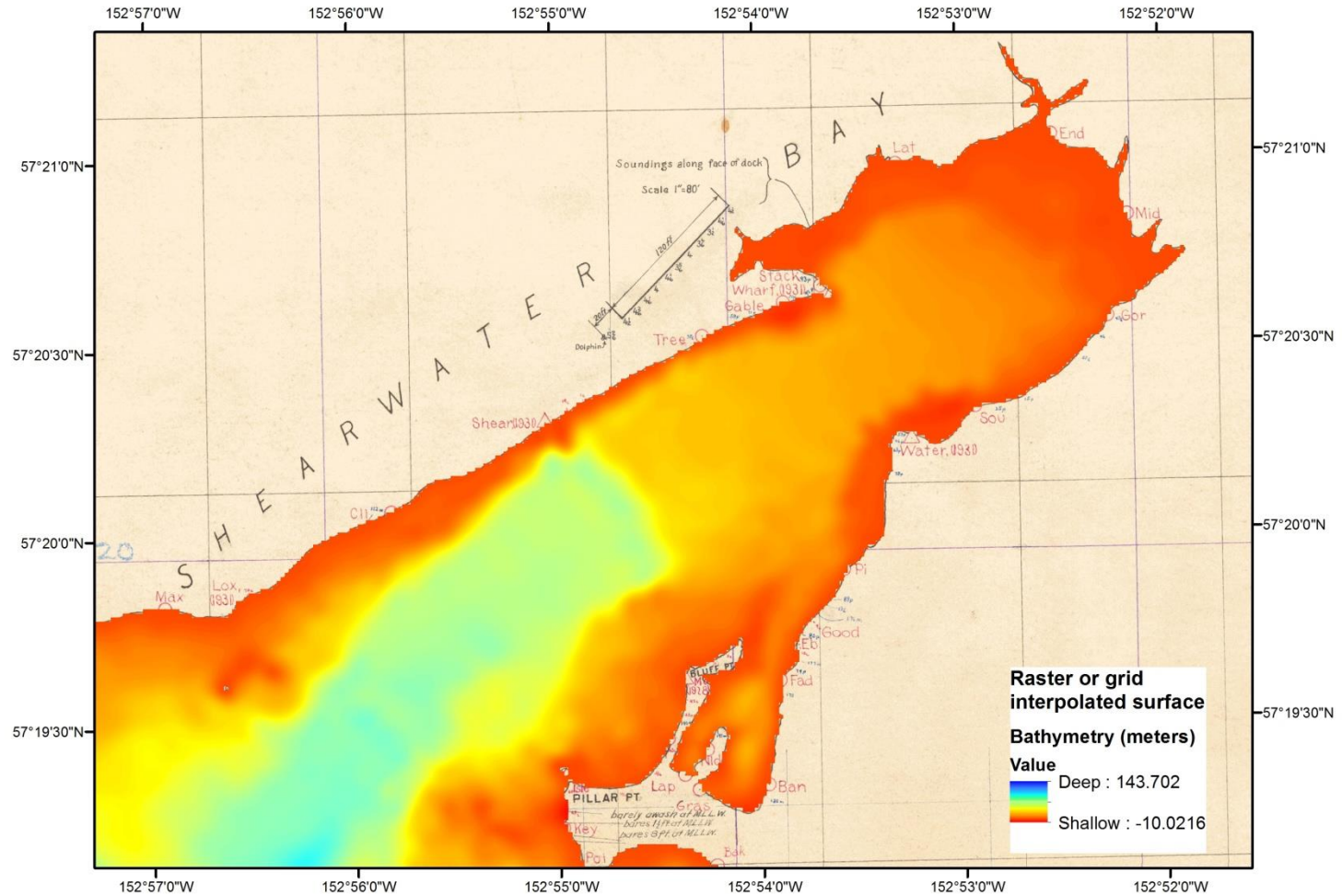
Horizontal Control:
Triangulation stations



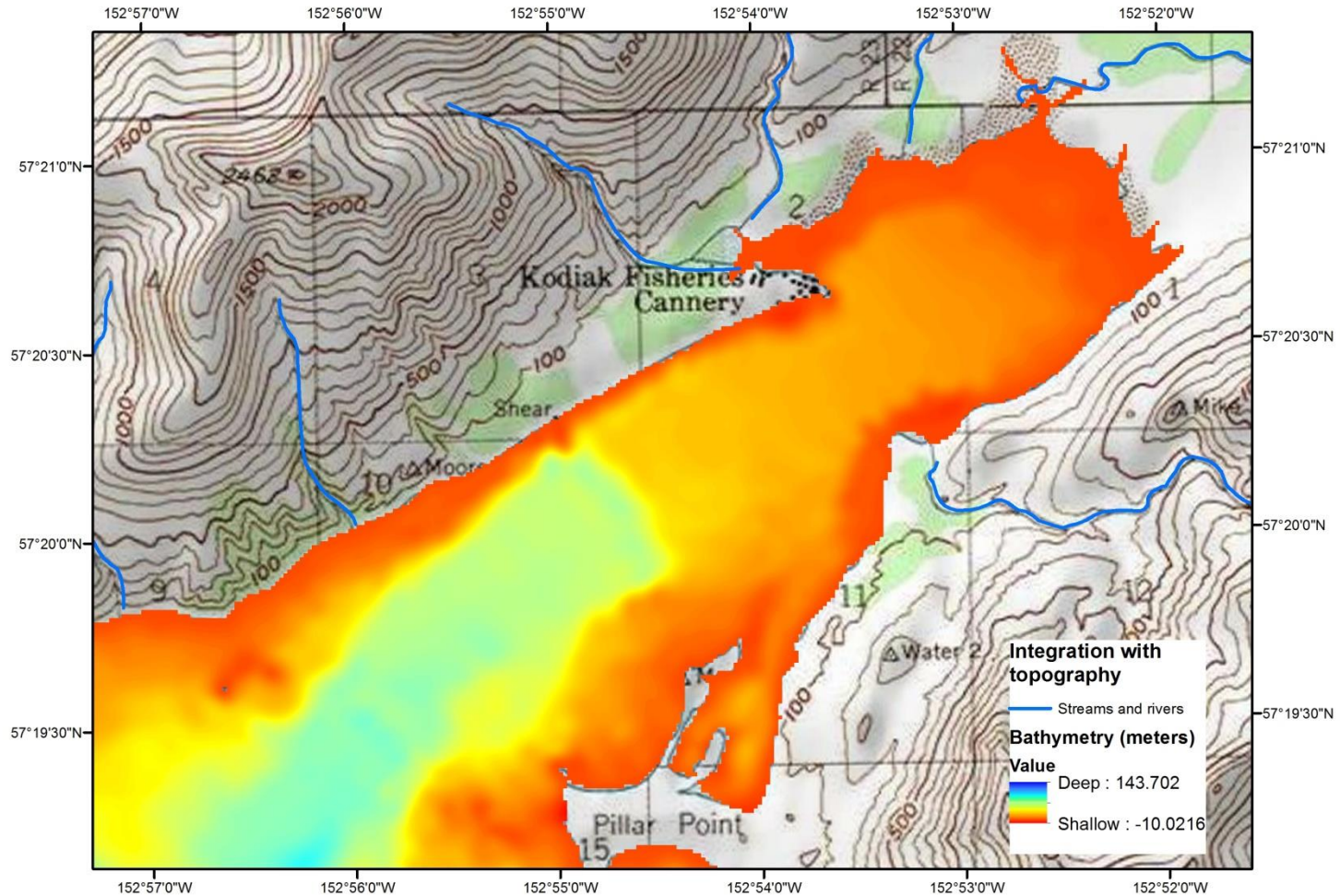
Digitize the shoreline (MHW)



Create a complete bathymetry surface

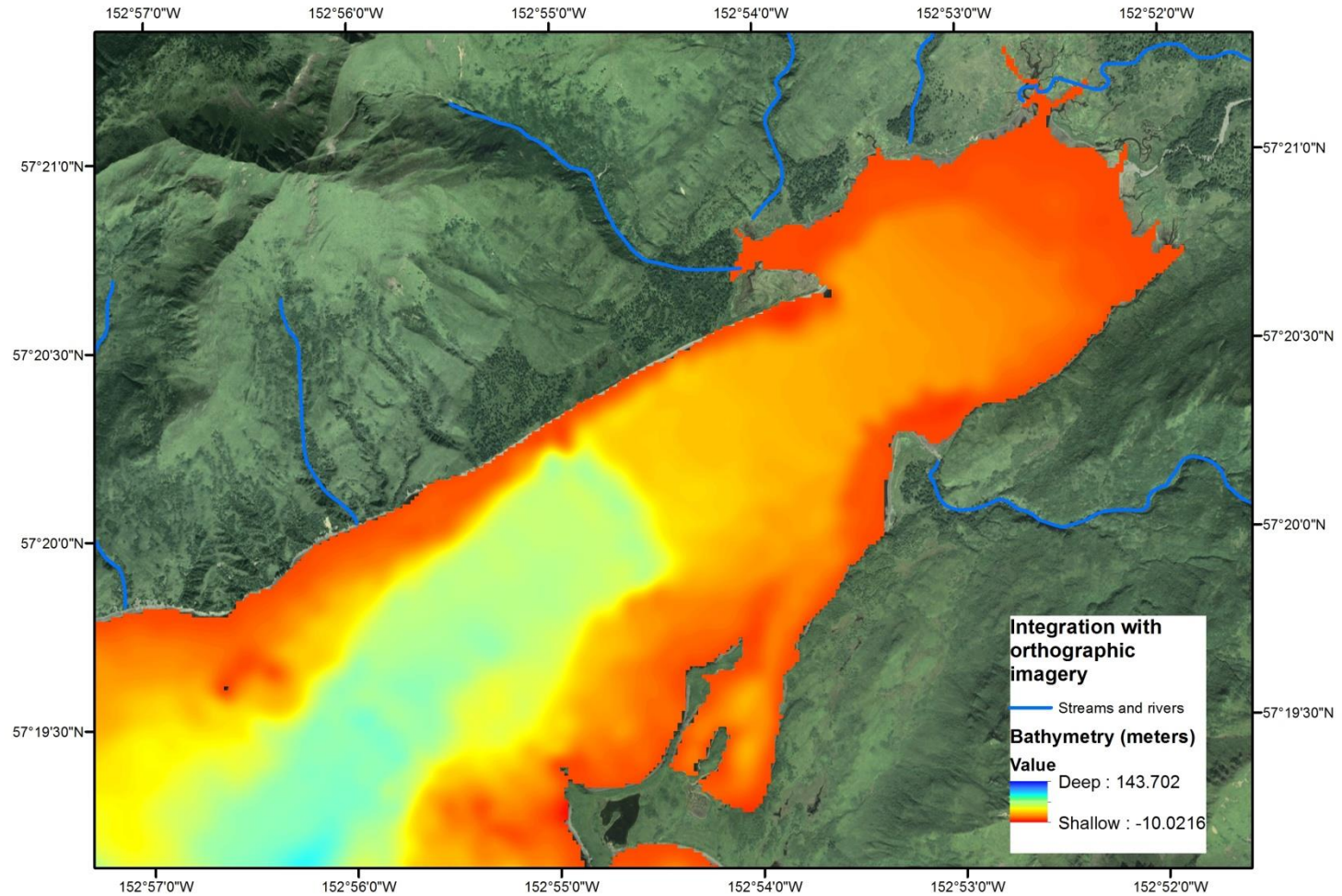


Connect to land, river, and watersheds



Streams and rivers: ftp://ftp.dnr.state.ak.us/asgdc/adnr/hydro_63360.zip

Align with orthographic photos



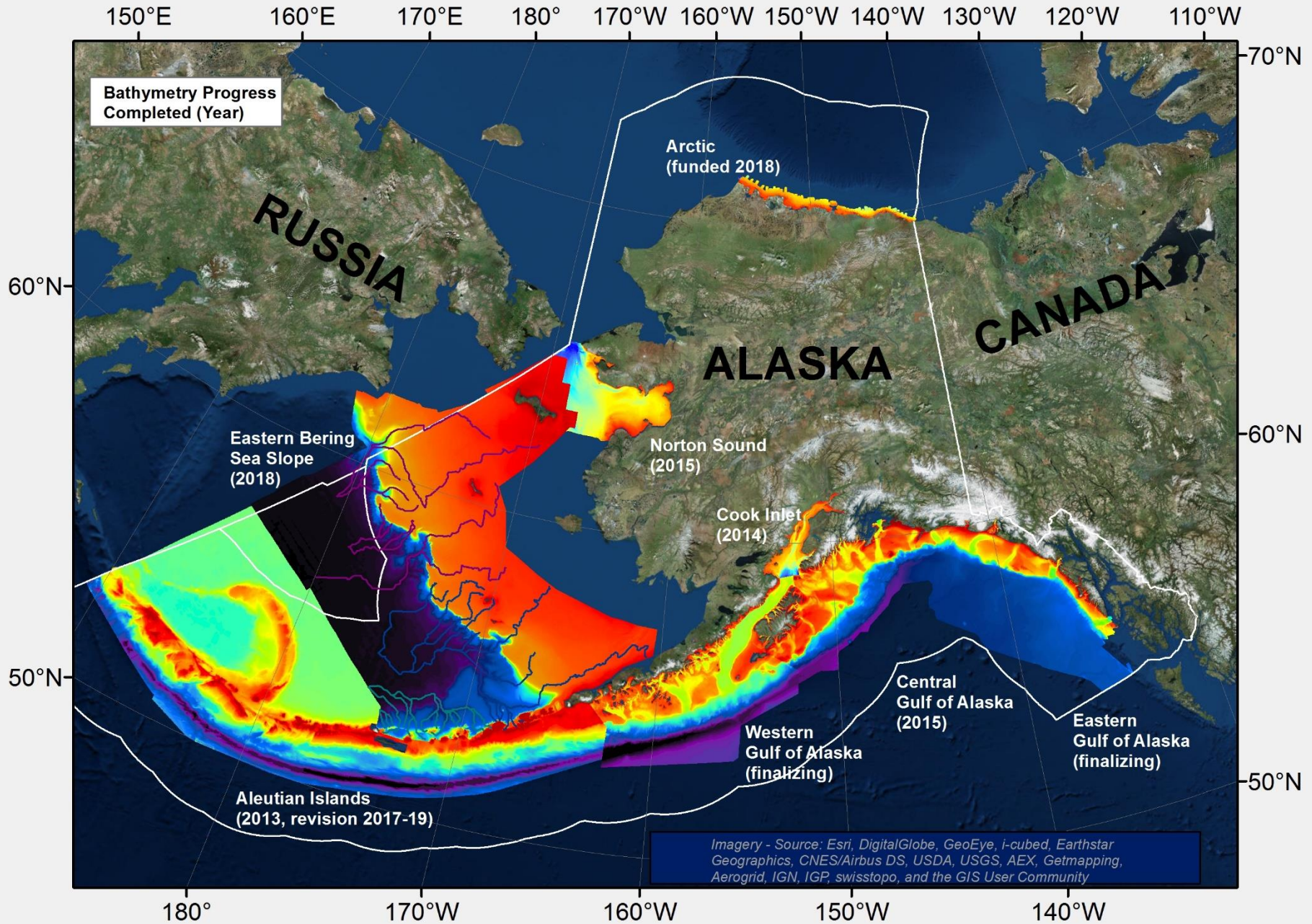
3. Products

- Regional bathymetry compilations
- NOAA Tech. memos
- Web page
- NOAA priorities
 - Essential Fish Habitat (EFH)
 - NOAA's Deep Sea Coral Research and Technology Program (DSCRTP)
 - NPRB's Gulf of Alaska - Integrated Ecosystem Research Program (GOA-IERP)
- GEBCO priorities

Progress - tabular

Area	Bathymetry	Shoreline	Features	Sediments
Aleutians	Yes/In progress	In progress	In progress	Yes
Cook Inlet	Yes	Yes	Yes	Yes
Norton Sound	Yes	Yes	Yes	Yes
cGOA	Yes	No	Yes	No
EBS Slope	Yes	Yes	Yes	No
wGOA	Yes	No	Yes	No
eGOA	Yes	Yes	Yes	No
Arctic	In progress	No	In progress	No
Chukchi				
Kotzebue Sd.				
Bristol Bay				
PWS				
Inside waters				

Progress - geographical



NOAA Tech. memos



NOAA Technical Memorandum NMFS-AFSC-249

**Smooth Sheets:
How to Work with Them in a GIS
to Derive Bathymetry, Features
and Substrates**



NOAA Technical Memorandum NMFS-AFSC-250

**Smooth Sheet Bathymetry
of the Aleutian Islands**



NOAA Technical Memorandum NMFS-AFSC-275

**Smooth Sheet Bathymetry
of Cook Inlet, Alaska**



NOAA Technical Memorandum NMFS-AFSC-287

**Smooth Sheet Bathymetry
of the Central Gulf of Alaska**

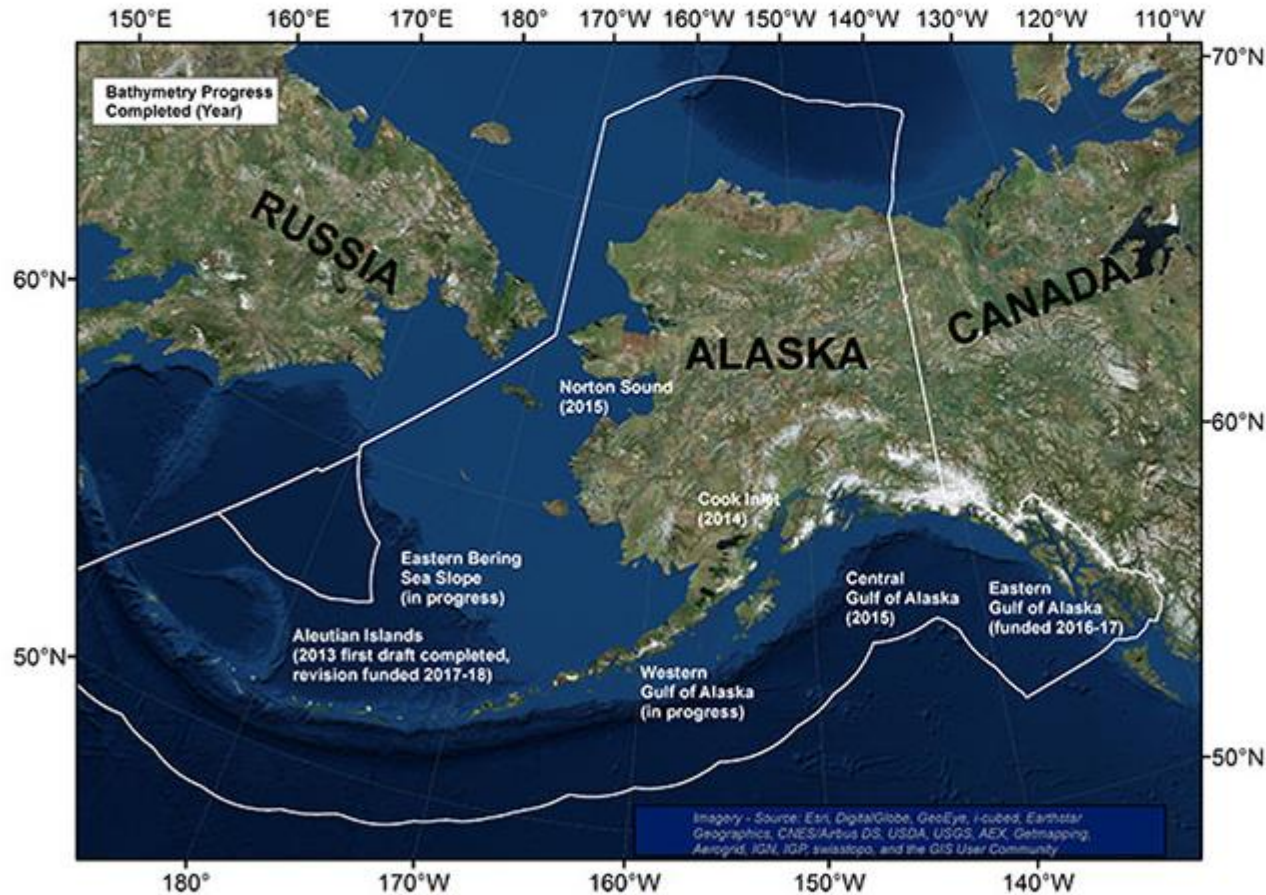


NOAA Technical Memorandum NMFS-AFSC-298
doi:10.7289/V5V69GJ9

**Smooth Sheet Bathymetry
of Norton Sound**



Alaska Bathymetry, Sediments, and Smooth Sheets



- [RACE Home](#)
- [Groundfish Assessment Program](#)
- [Bathymetry Data](#)
 - [Smooth Sheets](#)
 - [Aleutian Islands](#)
 - [Cook Inlet](#)
 - [Central Gulf of Alaska](#)
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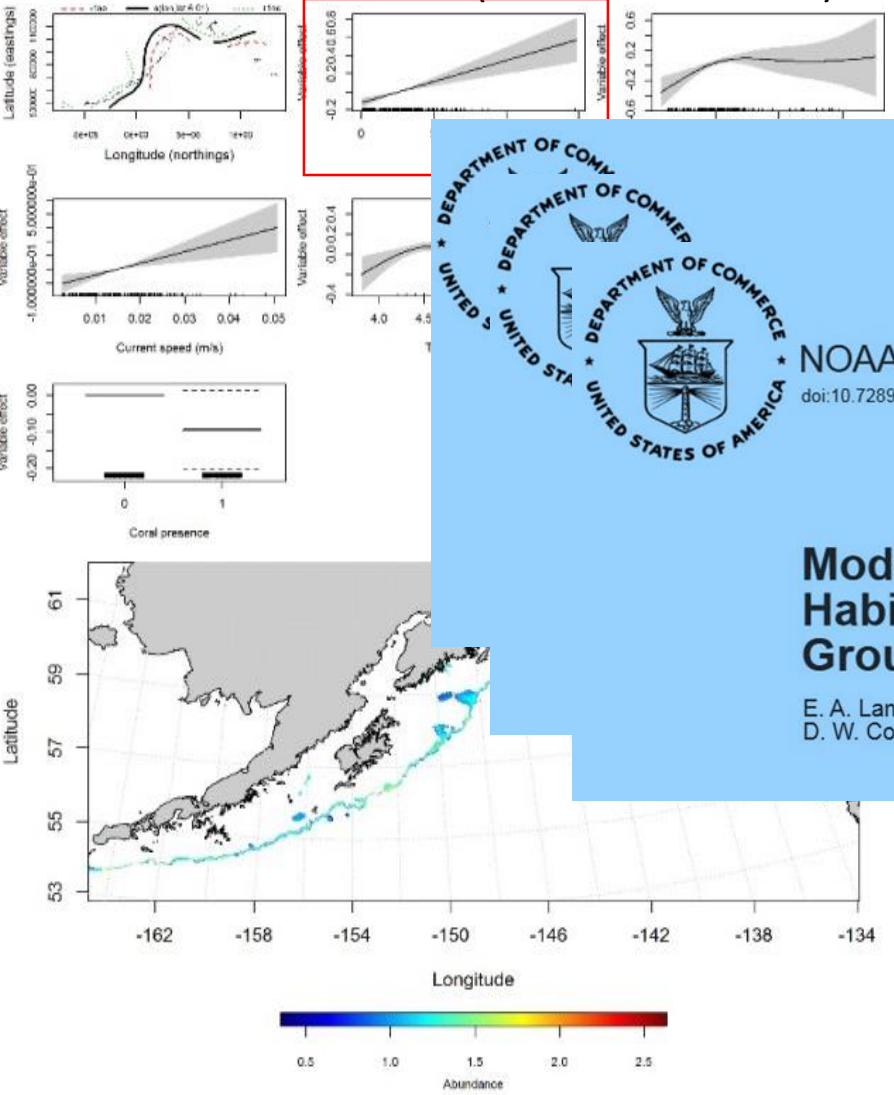
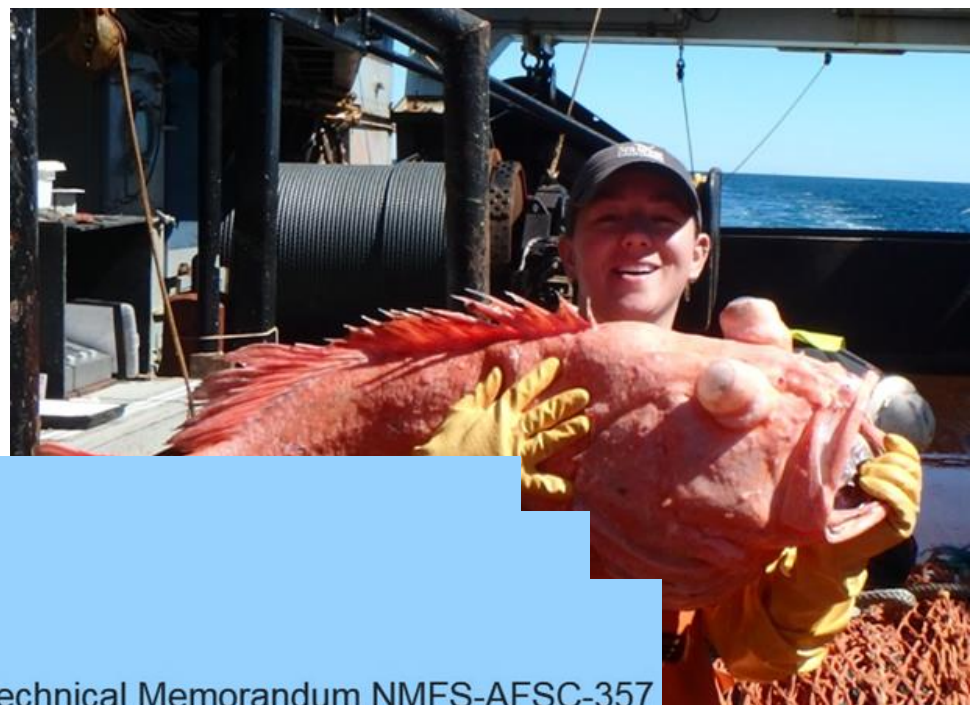
Click map project area for more information



Habitat Protection
Reaches Milestone

ESSENTIAL FISH HABITAT

Shorttraker rockfish (*Sebastes borealis*)



NOAA Technical Memorandum NMFS-AFSC-357
doi:10.7289/V5/TM-AFSC-357

Model-based Essential Fish Habitat Definitions for Bering Sea Groundfish Species

E. A. Laman, C. N. Rooper, S. C. Rooney, K. A. Turner,
D. W. Cooper, and M. Zimmermann



Diel vertical migration of adult Pacific cod *Gadus macrocephalus* in Alaska

D. G. NICHOL*, S. KOTWICKI AND M. ZIMMERMANN

Alaska Fisheries Science Center, National Marine Fisheries Service, National Oceanic and Atmospheric Administration, 7600 Sand Point Way NE, Seattle, WA 98115, U.S.A.



ELSEVIER

Deep Sea Research Part II: Topical Studies in Oceanography

Available online 11 December 2017

In Press, Corrected Proof

Habitat suitability models for groundfish in the Gulf of Alaska

Jodi L. Pirtle ^{a,1}, S. Kalei Shotwell ^b, Mark Zimmermann ^c, Jane A. Reid ^d, Nadine Golden ^d

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<https://doi.org/10.1016/j.dsr2.2017.12.005>

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ELSEVIER

Deep Sea Research Part I: Oceanographic Research Papers

Volume 126, August 2017, Pages 148–161

Comparison of modeling methods to predict the spatial distribution of deep-sea coral and sponge in the Gulf of Alaska

Christopher N. Rooper ^a, Mark Zimmermann ^a, Megan M. Prescott ^b

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<https://doi.org/10.1016/j.dsr.2017.07.002>

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Predictive models of coral and sponge distribution, abundance and diversity in bottom trawl surveys of the Aleutian Islands, Alaska

Christopher N. Rooper^{1,*}, Mark Zimmermann¹, Megan M. Prescott², Albert J. Hermann³¹Alaska Fisheries Science Center, RACE Division, 7600 Sand Point Way NE, Bldg. 4, Seattle, Washington 98115, USA²Ocean Associates Inc., 4007 N. Abington St., Arlington, Virginia 22207, USA³Pacific Marine Environmental Laboratory, 7600 Sand Point Way NE, Bldg. 3, Seattle, Washington 98115, USA

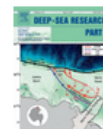
Validation and improvement of species distribution models for structure- forming invertebrates in the eastern Bering Sea with an independent survey

Christopher N. Rooper^{1,*}, Michael F. Sigler², Pam Goddard¹, Pat Malecha³, Rick Towler¹, Kresimir Williams¹, Rachel Wilborn¹, Mark Zimmermann¹assessment and Conservation Engineering Division, Alaska Fisheries Science Center, Seattle, Washington 98115, USA
ological Processes Research Program, and ³Auke Bay Laboratories, Alaska Fisheries Science Center, Juneau, Alaska 99801, USA

ARTICLE

Using species distribution models to describe essential fish habitat in Alaska

Edward A. Laman, Christopher N. Rooper, Kali Turner, Sean Rooney, Dan W. Cooper, and Mark Zimmermann



Deep Sea Research Part II: Topical Studies in Oceanography

Available online 31 January 2018

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Influence of environmental factors on capelin distributions in the Gulf of Alaska

David W. McGowan ^a, John K. Horne ^a, James T. Thorson ^b, Mark Zimmermann ^c

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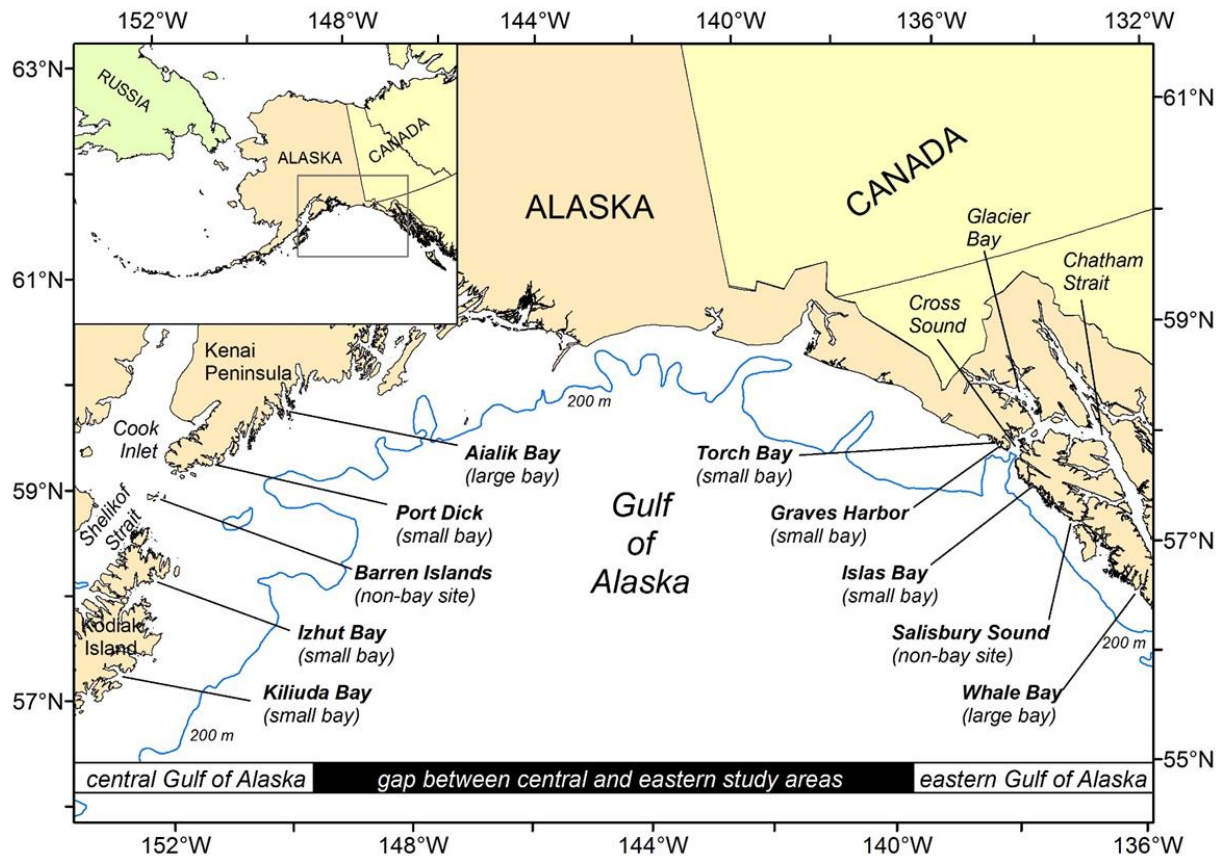
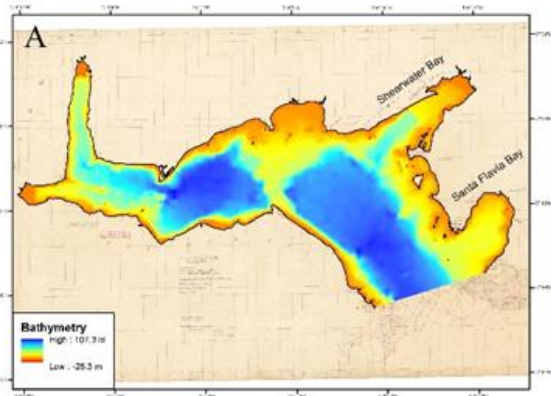
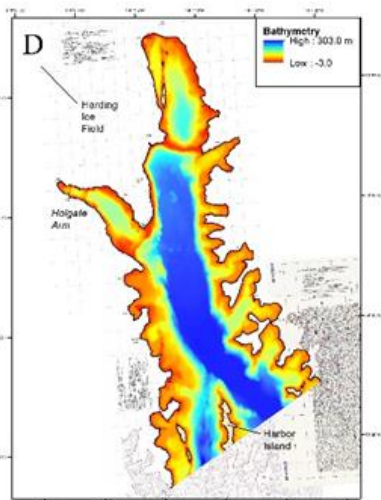
Using smooth sheets to describe groundfish habitat in Alaskan waters, with specific application to two flatfishes



Mark Zimmermann ^{a,*}, Jane A. Reid ^b, Nadine Golden ^b

^a National Marine Fisheries Service, NOAA, Alaska Fisheries Science Center, 7600 Sand Point Way NE, Bldg. 4, Seattle, WA 98115-6349, USA

^b U.S. Geological Survey, Pacific Coastal and Marine Science Center, 400 Natural Bridges Drive, Santa Cruz, CA 95060, USA





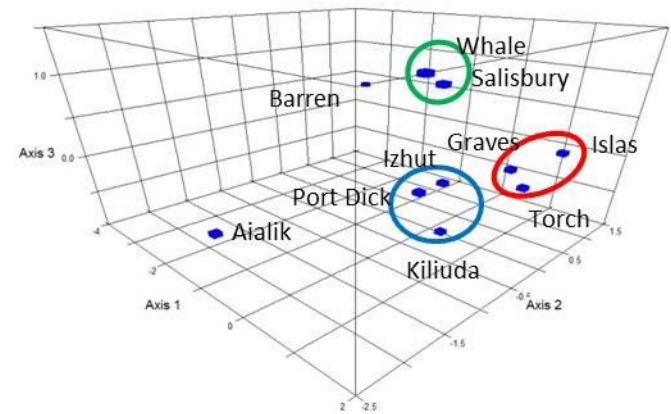
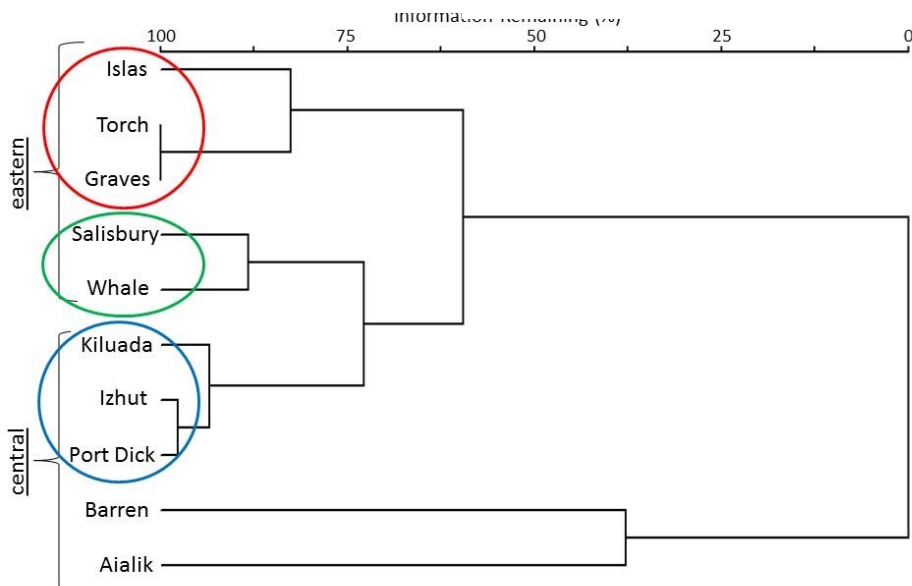
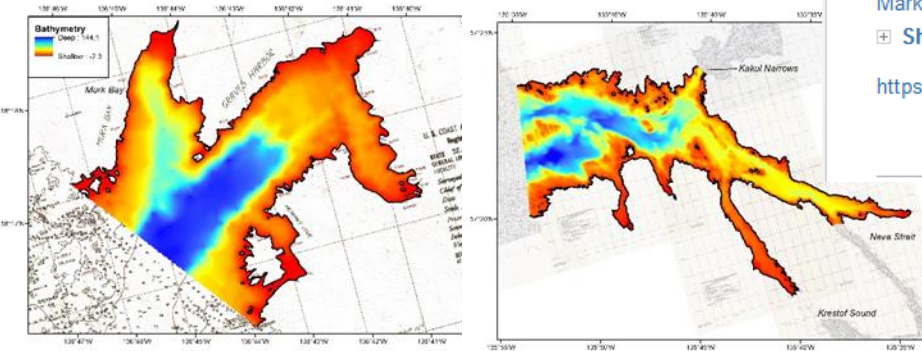
Comparison of the physical attributes of the central and eastern Gulf of Alaska Integrated Ecosystem Research Program inshore study sites

Mark Zimmermann

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<https://doi.org/10.1016/j.dsr2.2018.05.011>

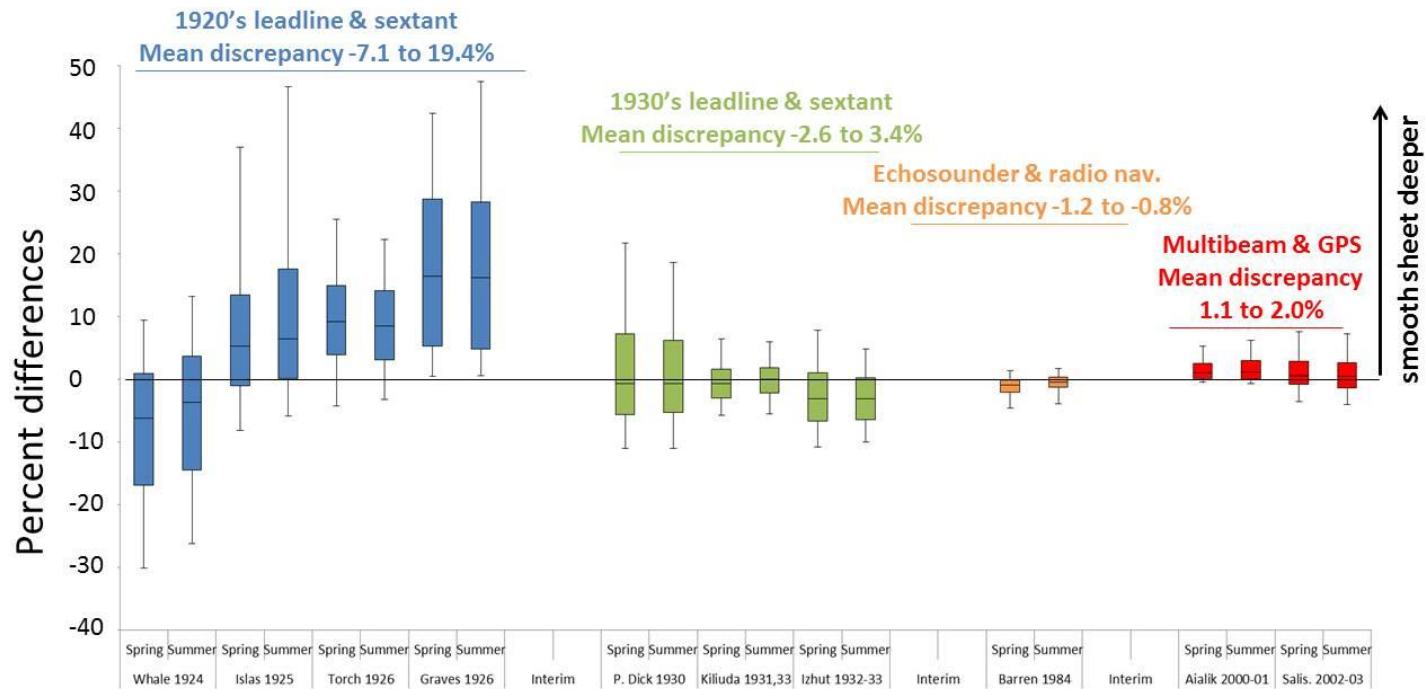
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Verification of historical smooth sheet bathymetry for the Gulf of Alaska - Integrated Ecosystem Research Program (in review)

Mark Zimmermann, Alex De Robertis, and Olav Ormseth



Box plot shows 10%, 25%, Median, 75%, and 90%.
((Smooth sheet – Echosounder)/Echosounder)*100



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Estuarine, Coastal and Shelf Science

journal homepage: www.elsevier.com/locate/ecss



Volcanic ash deposition, eelgrass beds, and inshore habitat loss from the 1920s to the 1990s at Chignik, Alaska



Mark Zimmermann^{a,*}, Gregory T. Ruggerson^b, Jeffrey T. Freymueller^c, Nicole Kinsman^d, David H. Ward^e, Kyle R. Hogrefe^e



LEADERSHIP MESSAGE

U.S. Seafood Can Help Solve One of the World's Greatest...

National



FEATURE STORY

Fighting for Coral: Force Blue Coral Response Highlights...

Southeast

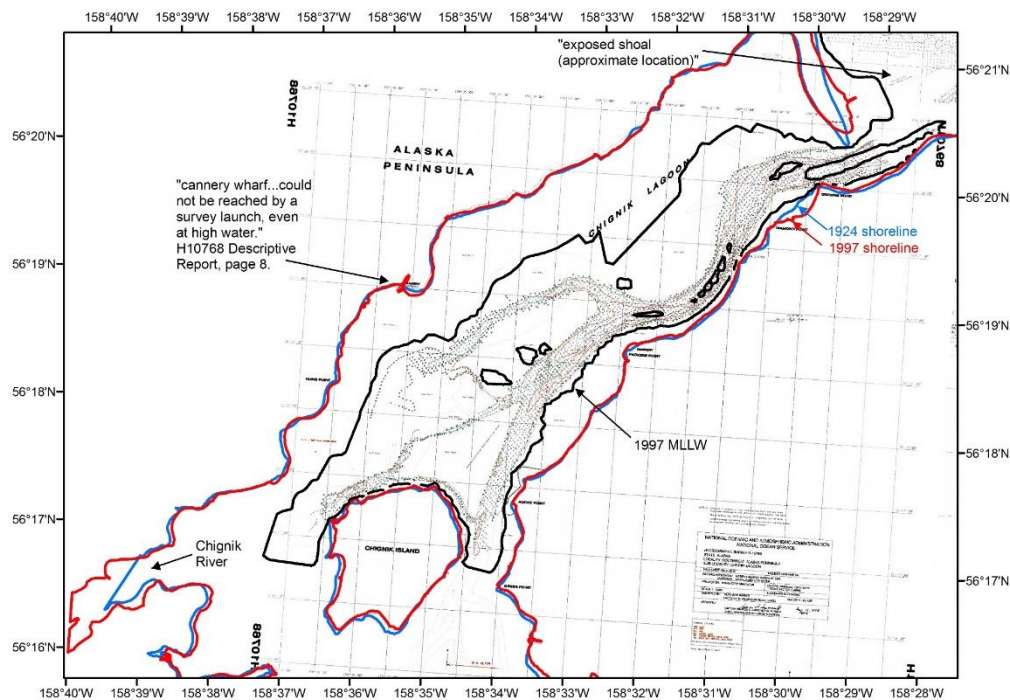
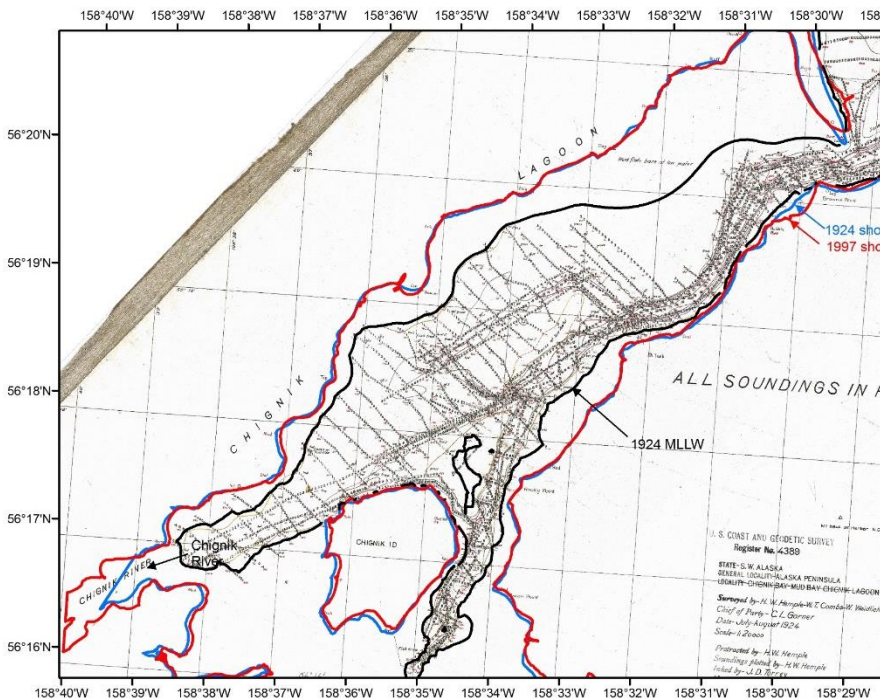
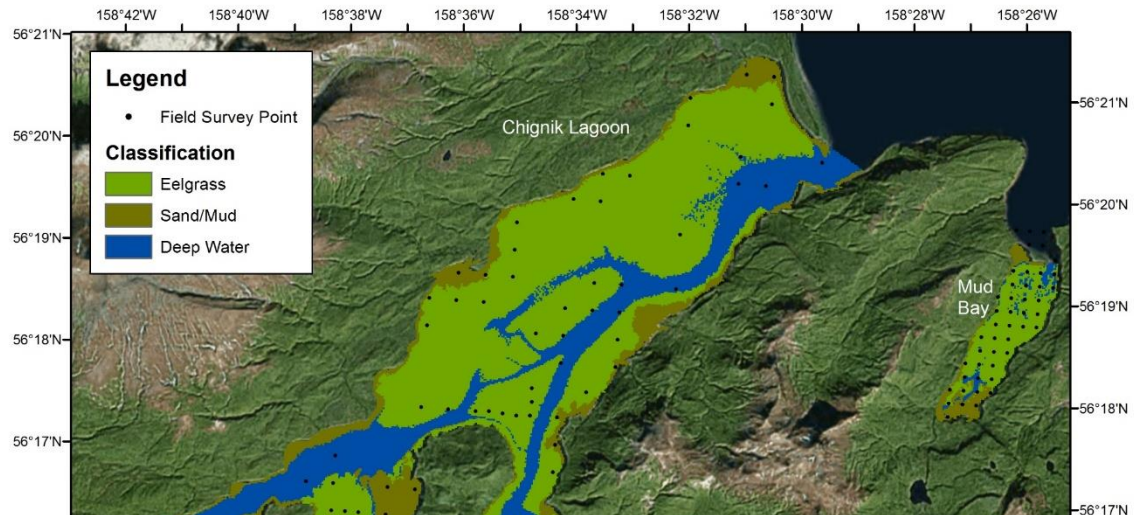
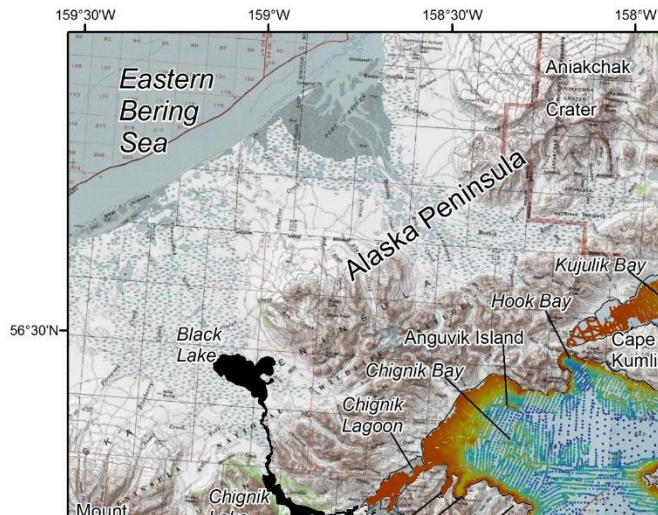


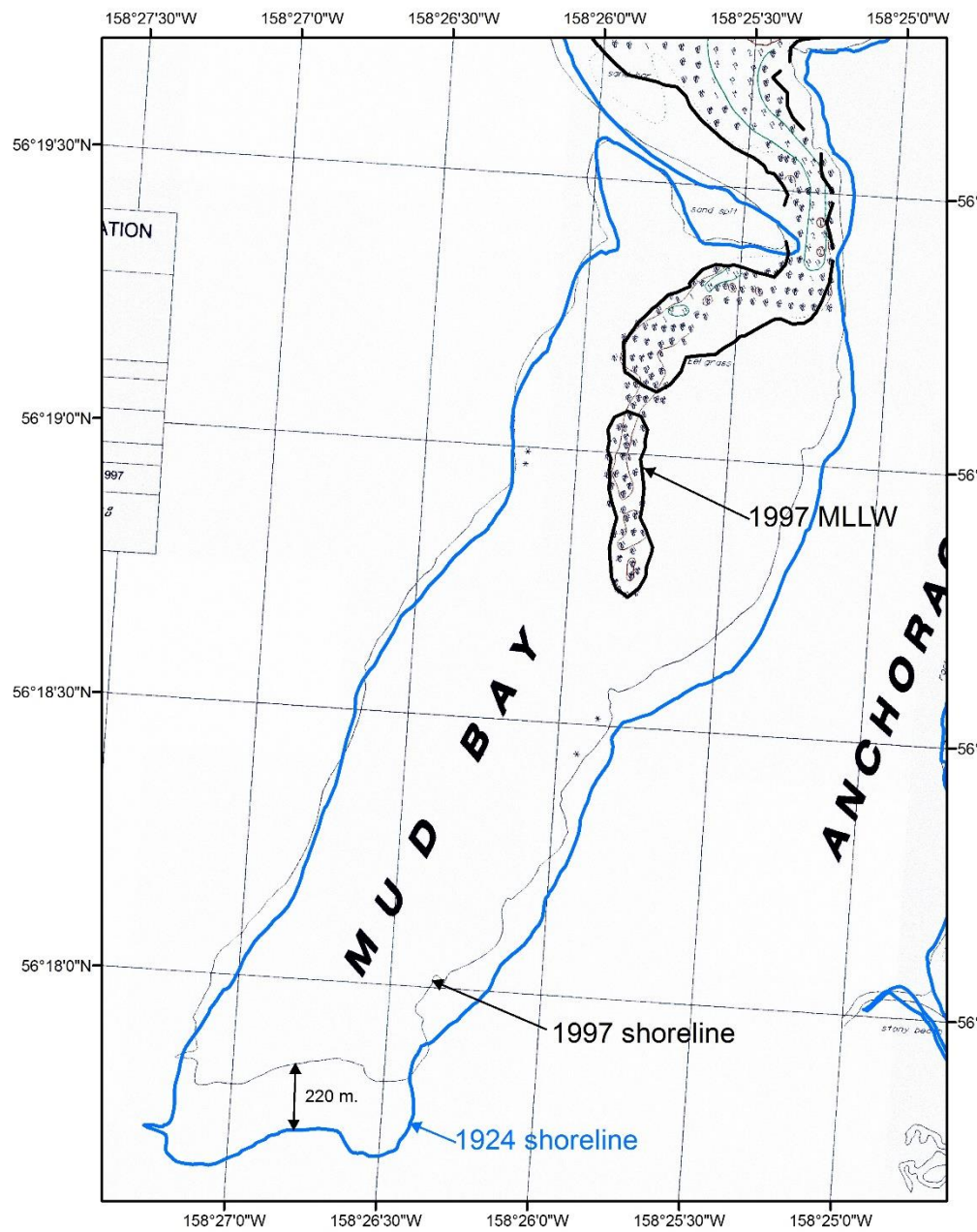
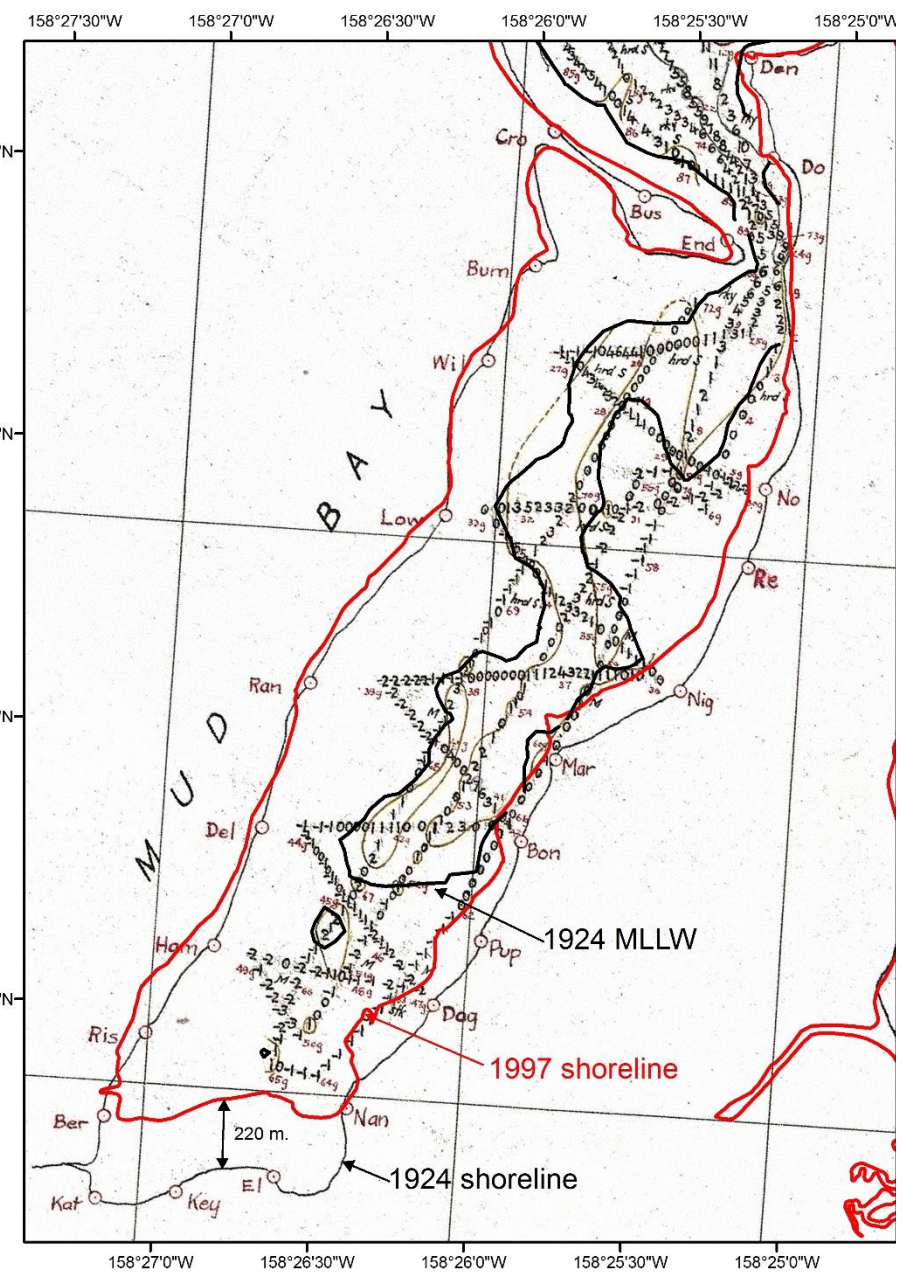
FEATURE STORY

Volcanoes and Eelgrass Transform Salmon Habitat

Alaska Fisheries Science Center

<https://www.fisheries.noaa.gov/feature-story/volcanoes-and-eelgrass-transform-salmon-habitat>





Article

Bathymetry and Canyons of the Eastern Bering Sea Slope

Mark Zimmermann ^{1,*}  and Megan M. Prescott ² 

¹ National Marine Fisheries Service, NOAA, Alaska Fisheries Science Center, 7600 Sand Point Way NE, Bldg. 4, Seattle, WA 98115-6349, USA

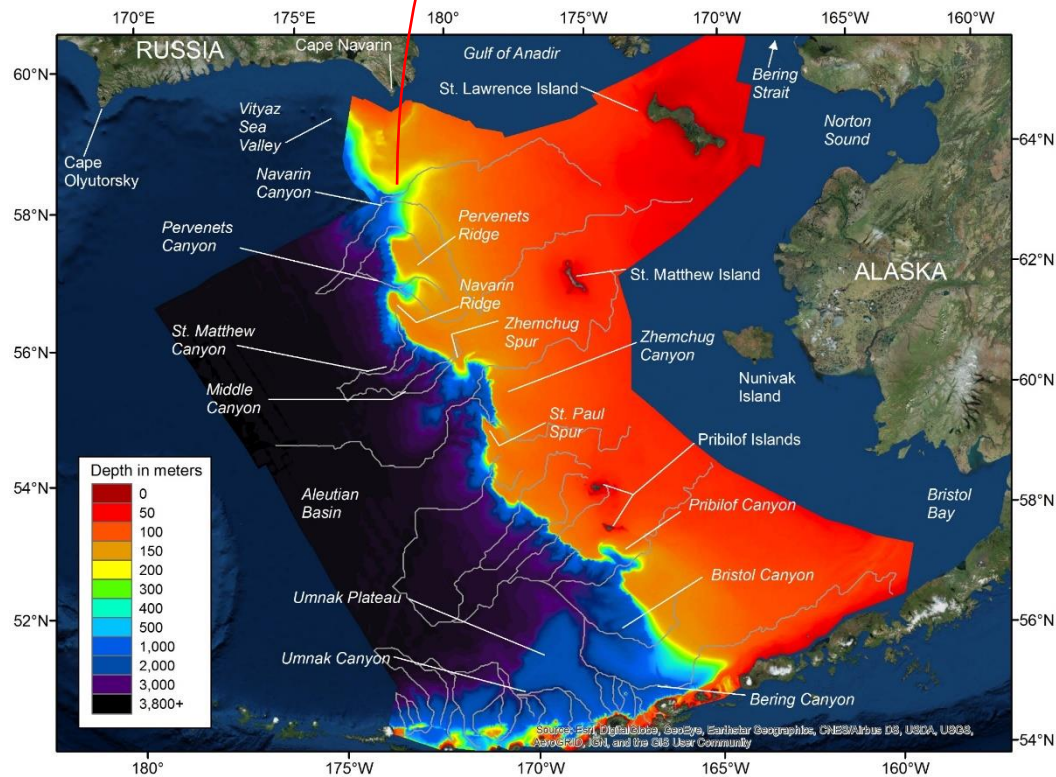
² Lynker Technologies, Under contract to Alaska Fisheries Science Center, 7600 Sand Point Way NE, Bldg. 4, Seattle, WA 98115-6349, USA; megan.prescott@noaa.gov

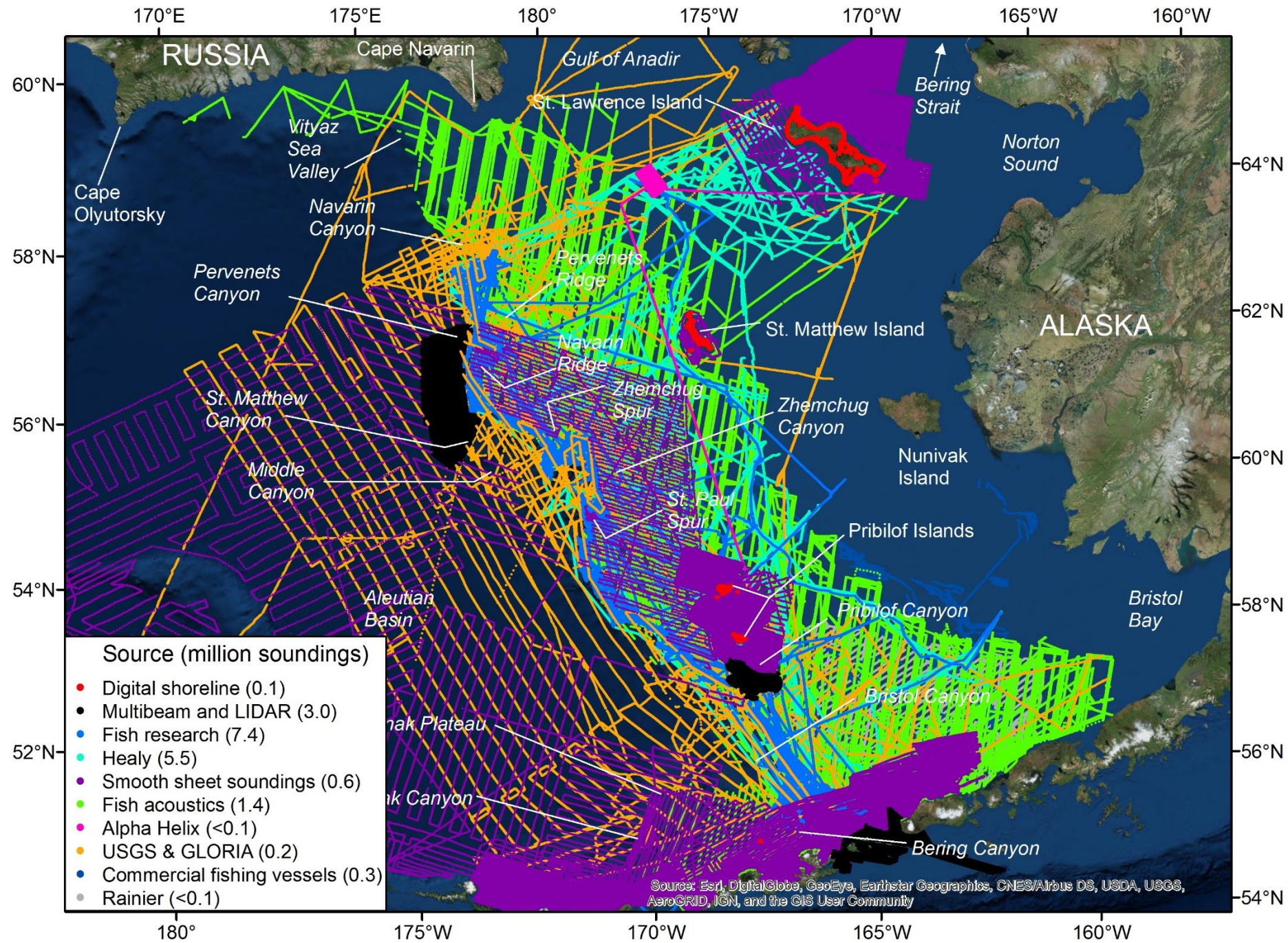
* Correspondence: mark.zimmermann@noaa.gov; Tel.: +1-206-526-4119

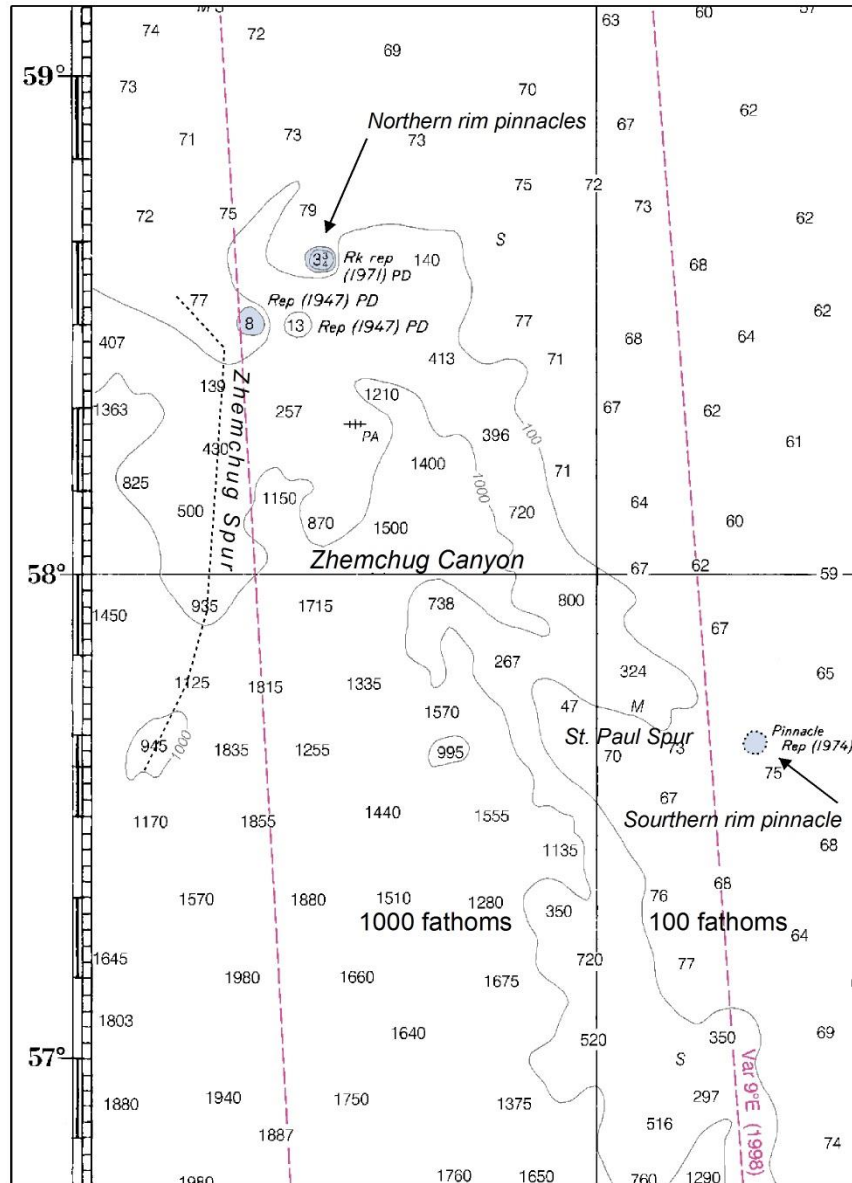
Received: 28 February 2018; Accepted: 15 May 2018; Published: 21 May 2018



thalweg [tahl-veg]
or canyon centerline
or line of lowest elevations

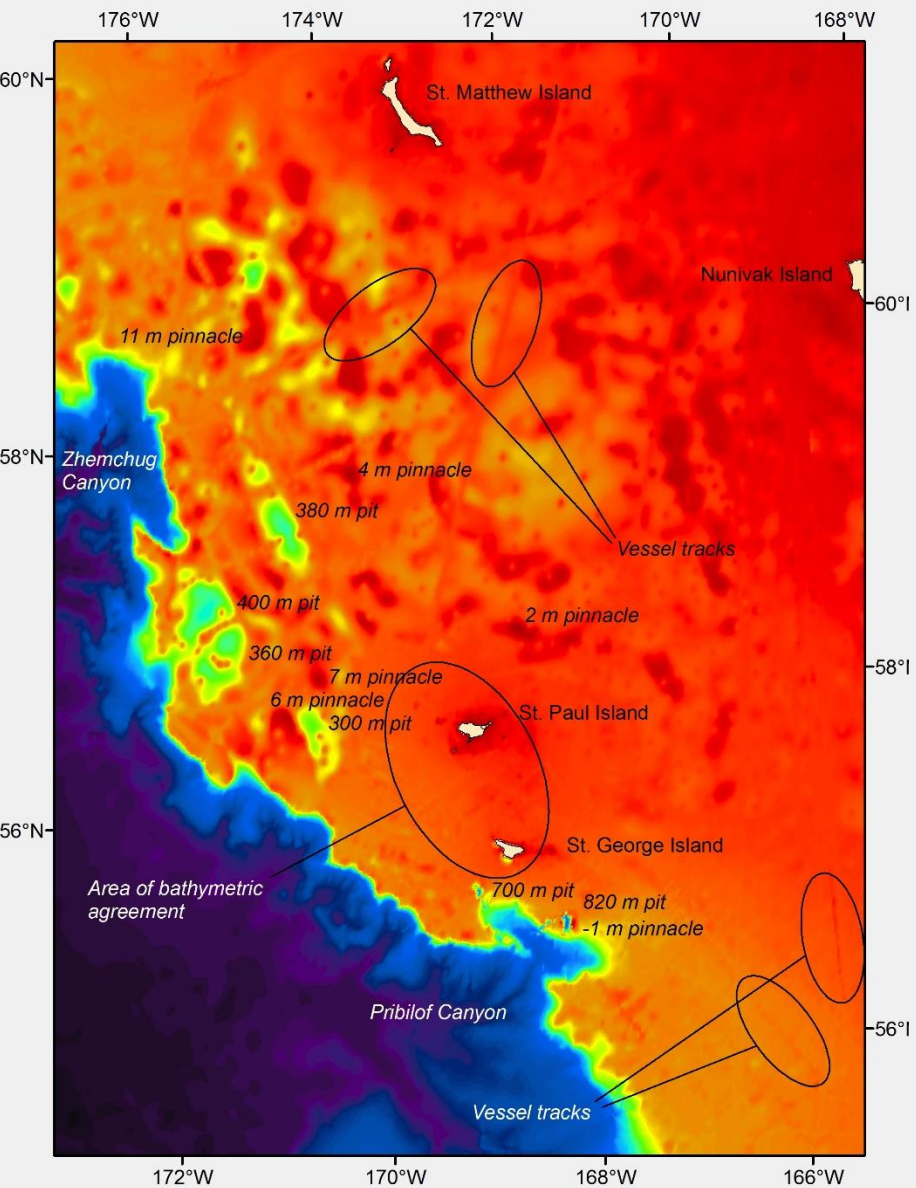




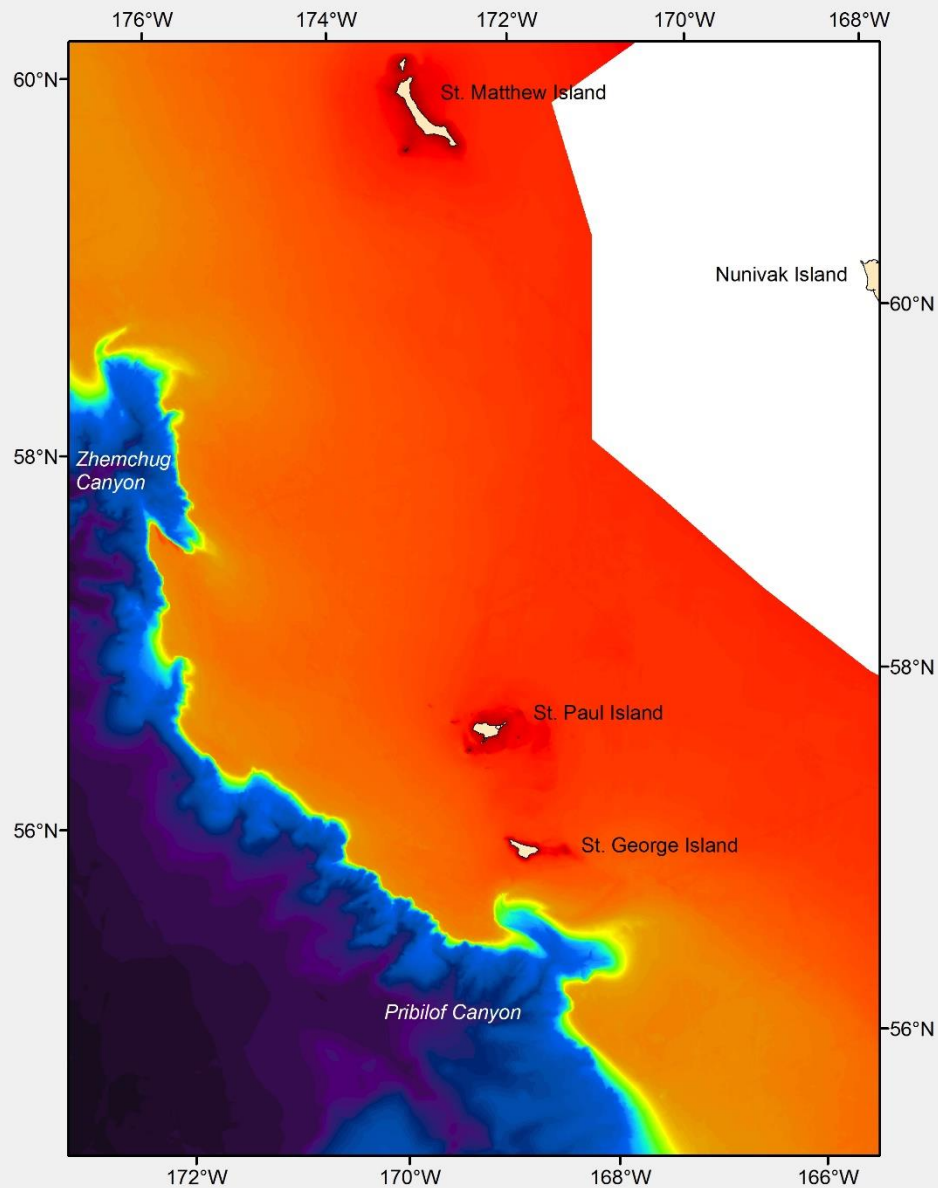


Detail of NOS navigational chart 16006 (Edition 37, 2015, Scale 1:1,534,076), showing reported pinnacles in the Zhemchug Canyon area.

GEBCO bathymetry




Our bathymetry



A topographic map of a region in Alaska, likely the Wrangell Mountains, showing contour lines, lakes, and various place names. Handwritten annotations in black ink are scattered across the map, including numbers and letters such as 'rky', 'Sh.rky', 'Aug', 'Wet', 'Ley', 'Bok', 'Rye', 'Rap', 'Srk', 'bkS rky', 'OPIO', and 'Neat lin'. Two specific numbers, '8' and '10', are circled in yellow. The map also features a grid of latitude and longitude lines.

4. Prospects for funding

- Complete all Alaska regions?
- Create and maintain bathymetry database?
- Research grant history
- Salary grant history



Research grants

- PI - International Science Fellowship 2017 (FY18), NMFS S&T (Arctic).
- Co-PI for HAIP funds for 2013-2014, predicting trawlability.
- Collaborator for GOA-IERP (2010-2015) part of founding team in 2009.
- Co-PI for NPRB, 2008-2011, Gulf of Alaska trawlability work.
- Co-PI for Rockfish Working Group, 2007-2008, archived echosounder analysis.
- PI for NPRB, 2004-2006, Aleutian Islands trawlability work.



Salary grants

- Lead PI for NPRB funds for 2017-2019 for Aleutians bathymetry revision.
- Lead PI for AKR EFH funds for 2016-2017 for SE AK bathymetry compilation
- Lead PI for AKR EFH funds for 2015-2016 for EBS Slope bathymetry compilation.
- Lead PI for National EFH funds for 2014-2015 for Norton Sound, GOA mb.
- Lead PI for AKR EFH funds for 2013-2014 for Cook Inlet bathymetry compilation.
- Co-PI for Alaska Deep Sea Coral Initiative (FY 2012-2014) (Aleutians) (PI Chris Rooper).

5. Future directions

- Regions to map?
 - Prince William Sound? Kotzebue Sound? Chukchi?
- Tailor products for what uses?
 - Resolutions? Vertical datums (MLLW vs. MSL)?
 - Shift toward derived products – thalwegs, bay metrics, pass cross-sections
- Permanent funding source
 - Need plan to finish Alaska, create database
- GEBCO collaboration
 - seafloor feature naming
 - global bathymetry compilation