A low-angle view: making sense of Cook Inlet's complex rock platform and reef habitats

Lower Cook Inlet Rocky Habitat Field Assessment

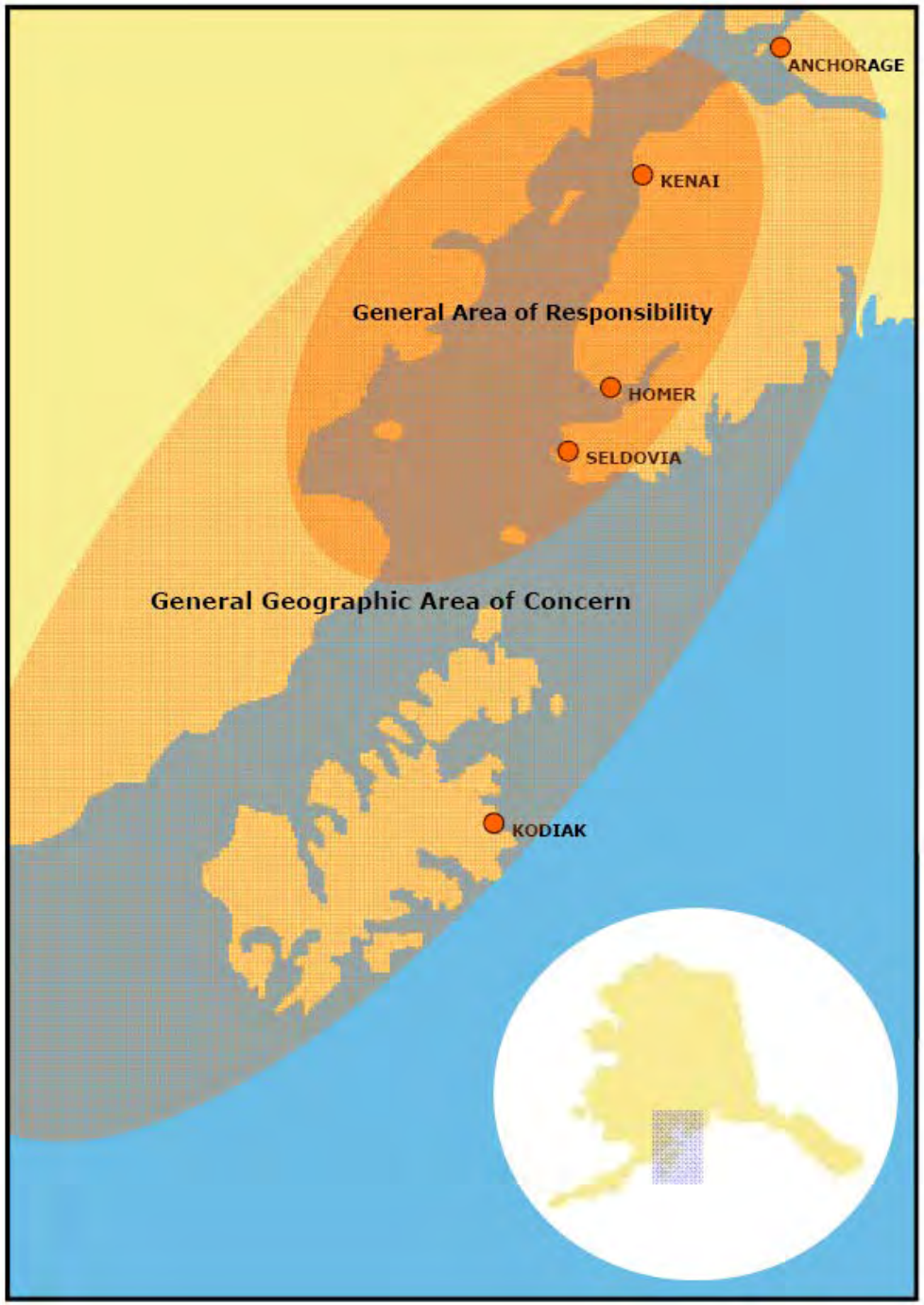
BOEM Bureau of Ocean Energy Management

National Park Service

UAF University of Alaska Fairbanks

NOAA National Oceanic and Atmospheric Administration U.S. Department of Commerce

25 Years in the Inlet Cook Inlet RCAC



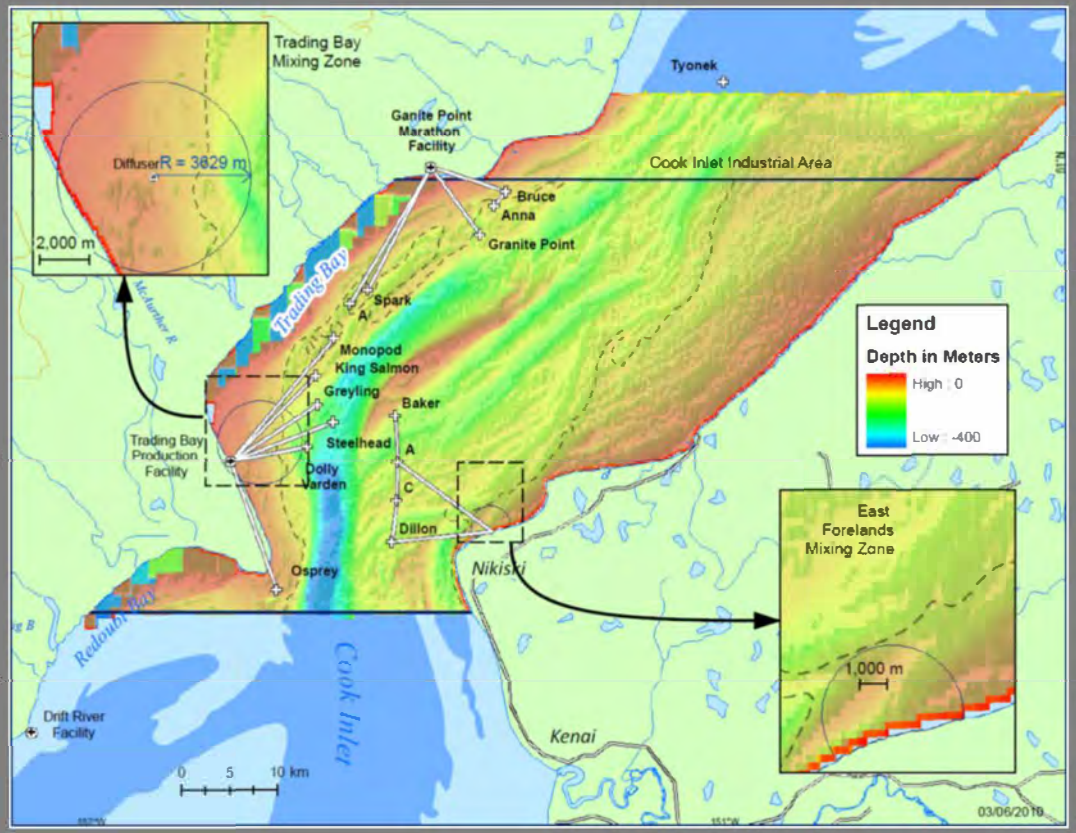
- **Geographic**

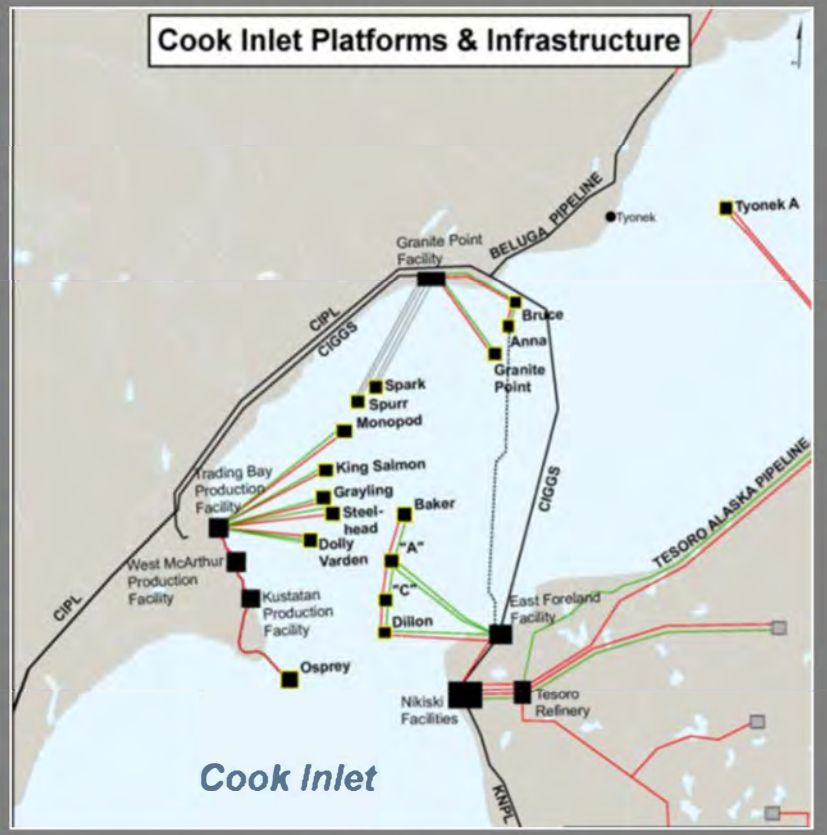
OPA 90 defined areas of responsibility

- **Programmatic**

Areas that are potentially impacted by the activities in our area of responsibility

Our mission is to represent the citizens of Cook Inlet in promoting environmentally safe marine transportation and oil facility operations.


Trading Bay
Mixing Zone
Diffuser
R = 3829 m
2,000 m
Tyonek
Ganite Point
Marathon
Facility
Cook Inlet Industrial Area
Bruce
Anna
Granite Point
Spark
A
Trading Bay
Monopod
King Salmon
Greyling
Baker
Steelhead
A
Trading Bay
Production
Facility
Dolly
Varden
C
Dillon
Osprey
Nikiski
East
Forelands
Mixing Zone
1,000 m
Legend
Depth in Meters
High : 0
Low : -400
Redoubt Bay
Cook Inlet
Drift River
Facility
0 5 10 km
Kenai
03/06/2019


Cook Inlet Platforms & Infrastructure
Granite Point
Facility
BELUGA PIPELINE
Tyonek
Tyonek A
CIPL
CIGGS
Bruce
Anna
Granite
Point
Spark
Spurr
Monopod
King Salmon
Grayling
Steel-
head
Dolly
Varden
Baker
"A"
"C"
Dillon
Trading Bay
Production
Facility
West McArthur
Production
Facility
Kustatan
Production
Facility
Osprey
East Foreland
Facility
TESORO ALASKA PIPELINE
Nikiski
Facilities
Tesoro
Refinery
KNPL
Cook Inlet

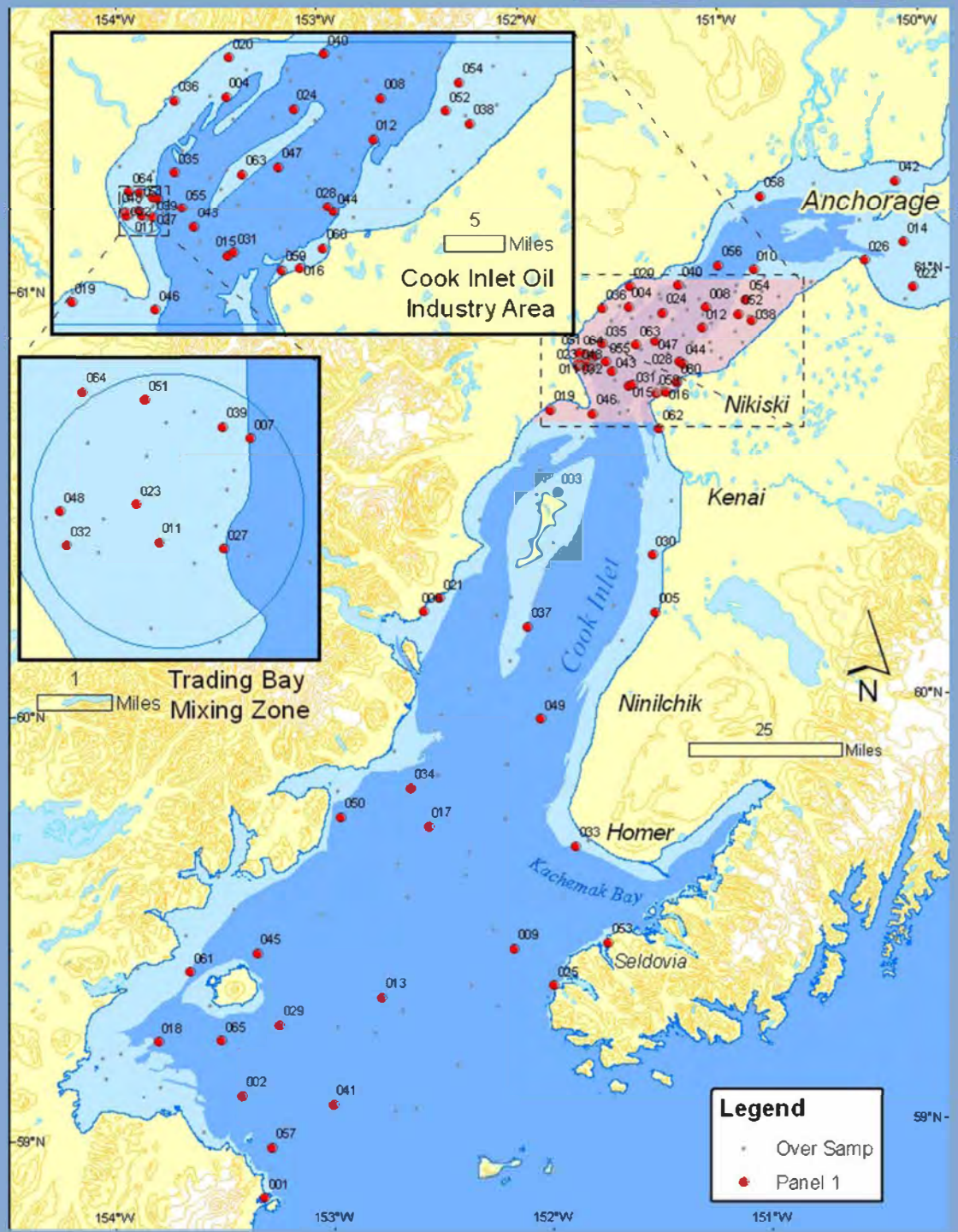
Selected RCAC Mandates from OPA 90

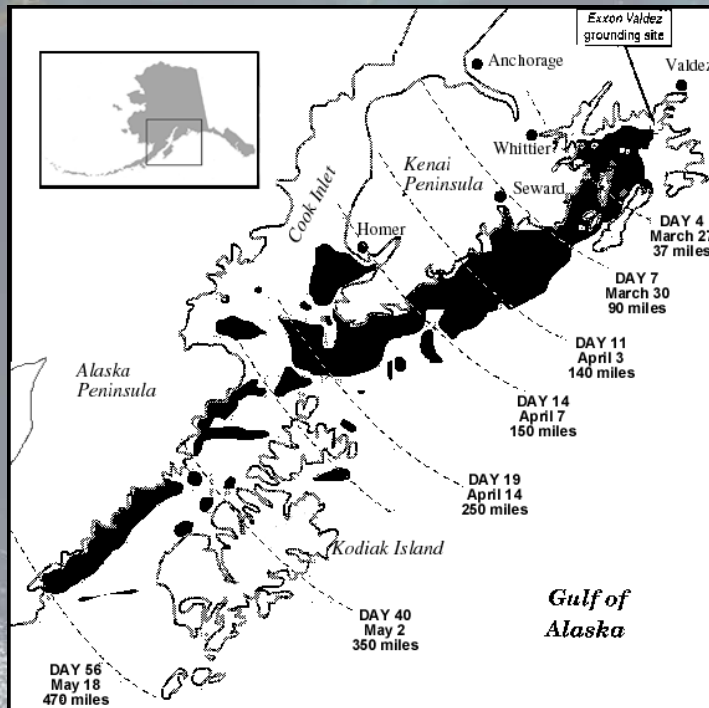
"...devise and manage a comprehensive program of monitoring the environmental impacts of the operations …"

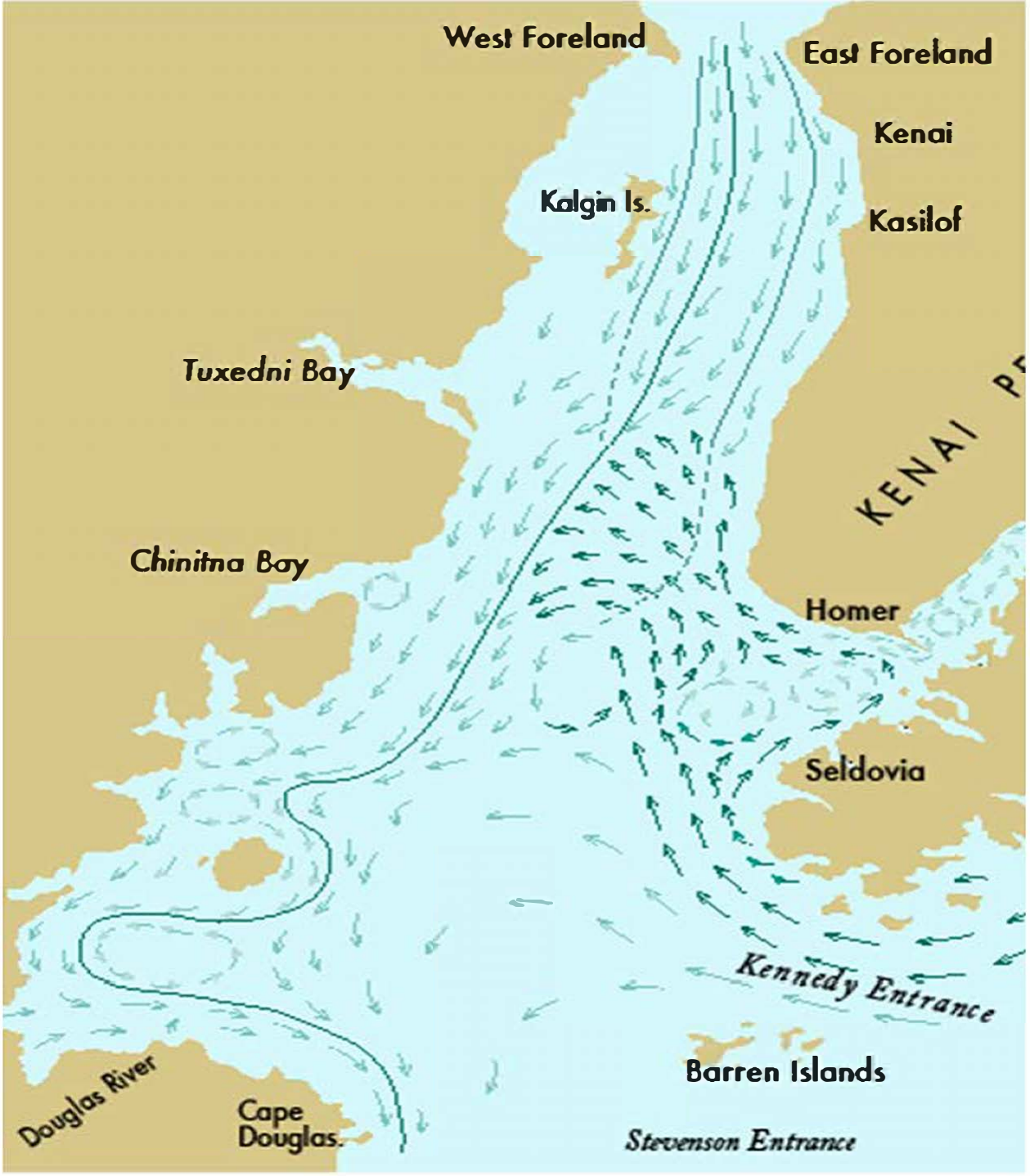
"Study wind and water currents and other environmental factors in the vicinity of terminal facilities which may affect ability to prevent, respond to, contain, and clean up an oilspill."

"Identify highly sensitive areas which may require specific protection measures in the event of a spill…"

Review and/or monitor contingency plans, oil spills and drills, regulations, new technology; make recommendations and provide advice


Cook Inlet Oil Industry Area
5 Miles
Trading Bay Mixing Zone
1 Miles
Anchorage
Nikiski
Kenai
Cook Inlet
Ninilchik
Homer
Kachemak Bay
Seldovia
25 Miles
N
Legend
Over Samp
Panel 1
154°W
153°W
152°W
151°W
150°W
61°N
60°N
59°N


Exxon Valdez
grounding site
Anchorage
Valdez
Whittier
Kenai
Peninsula
Seward
Cook Inlet
Homer
DAY 4
March 2
37 miles
DAY 7
March 30
90 miles
DAY 11
April 3
140 miles
Alaska
Peninsula
DAY 14
April 7
150 miles
DAY 19
April 14
250 miles
Kodiak Island
Gulf of
Alaska
DAY 40
May 2
350 miles
DAY 56
May 18
470 miles


West Foreland
East Foreland
Kenai
Kalgin Is.
Kasilof
Tuxedni Bay
KENAI P
Chinitna Bay
Homer
Seldovia
Kennedy Entrance
Barren Islands
Douglas River
Cape Douglas
Stevenson Entrance

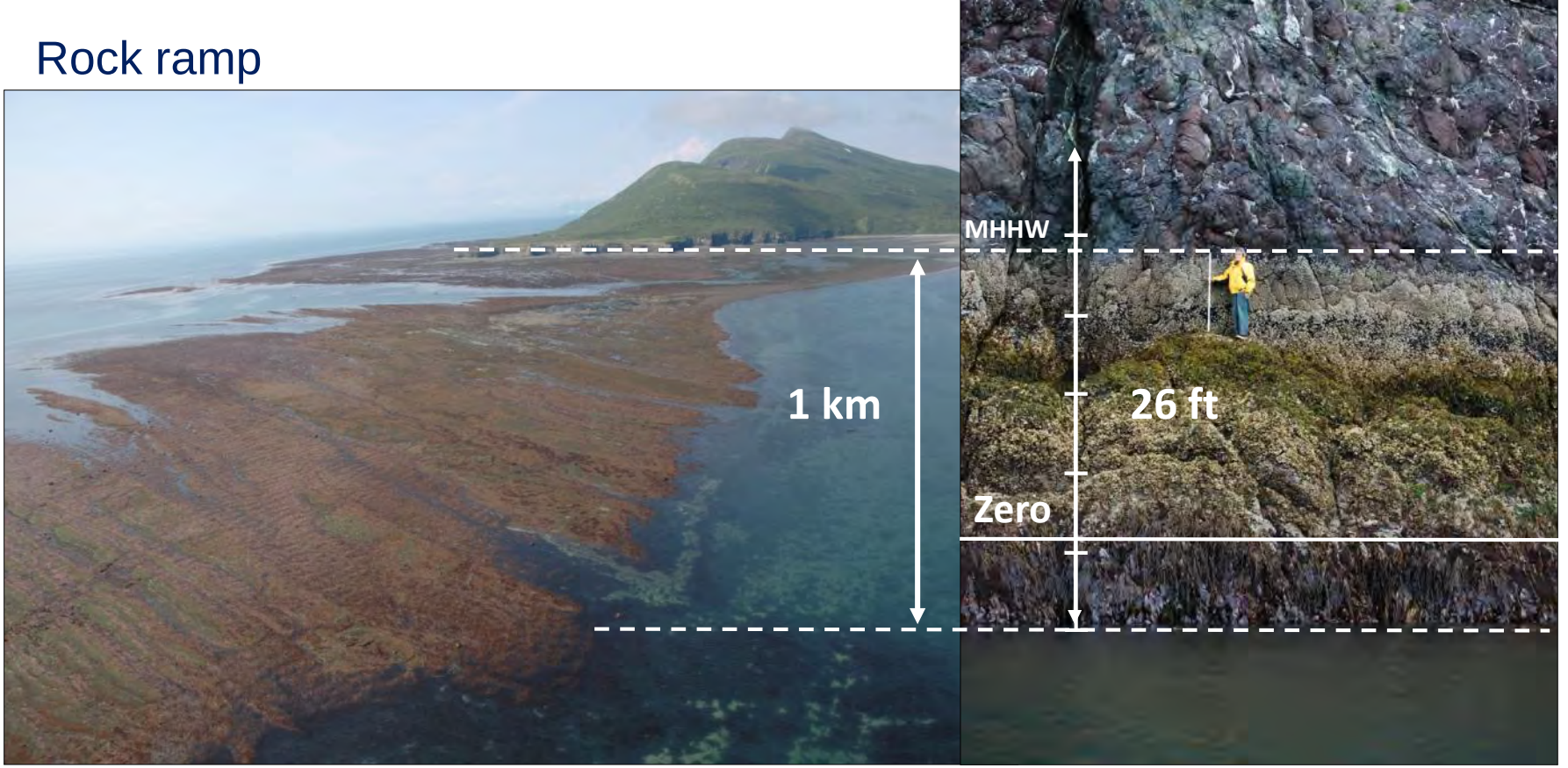
Exposed Rock Platforms – less susceptible to oil damage

Salt marsh– most likely to be damaged by oiling

Examples of Cook Inlet Tidal Range

Rock wall

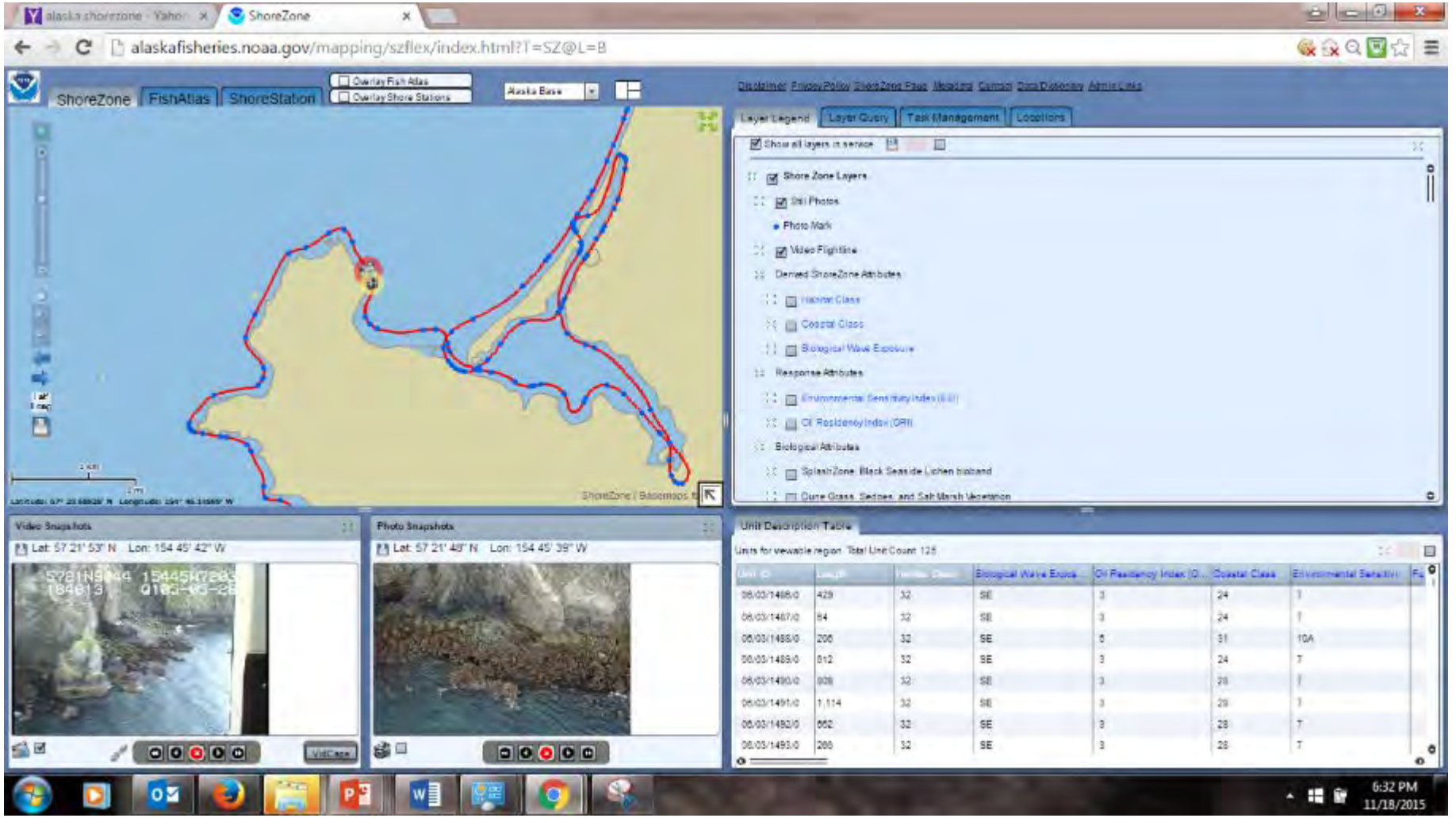
Rock ramp



Kamishak Bay

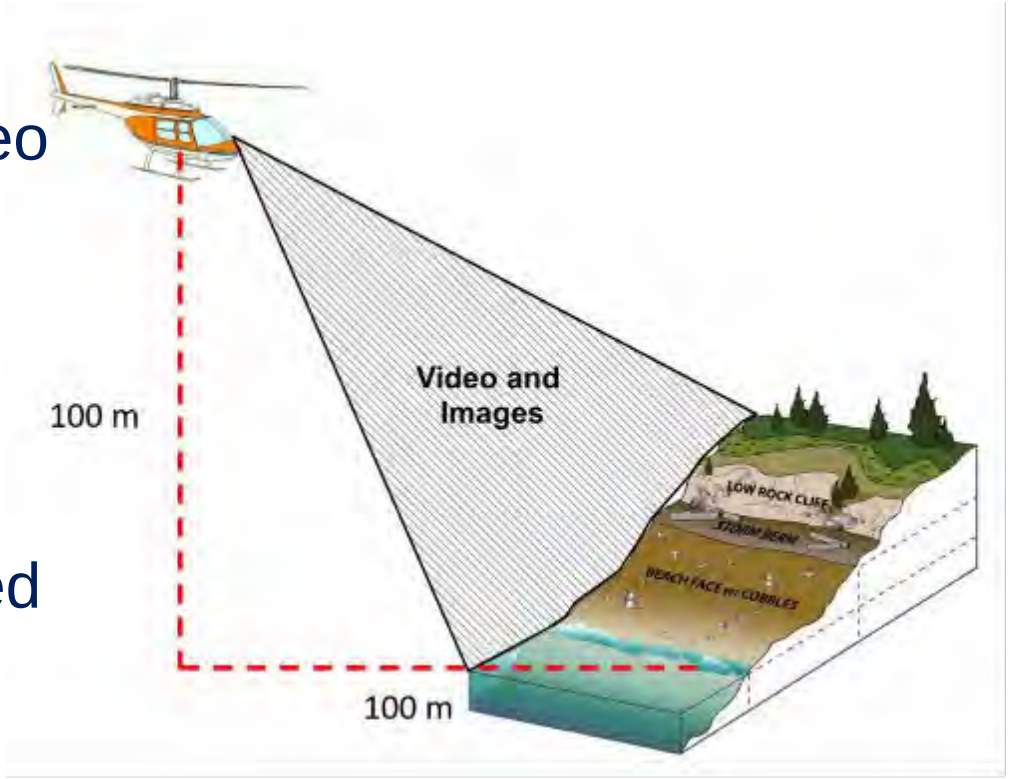
Kachemak Bay

ShoreZone: web-accessible coastal imagery and habitat information



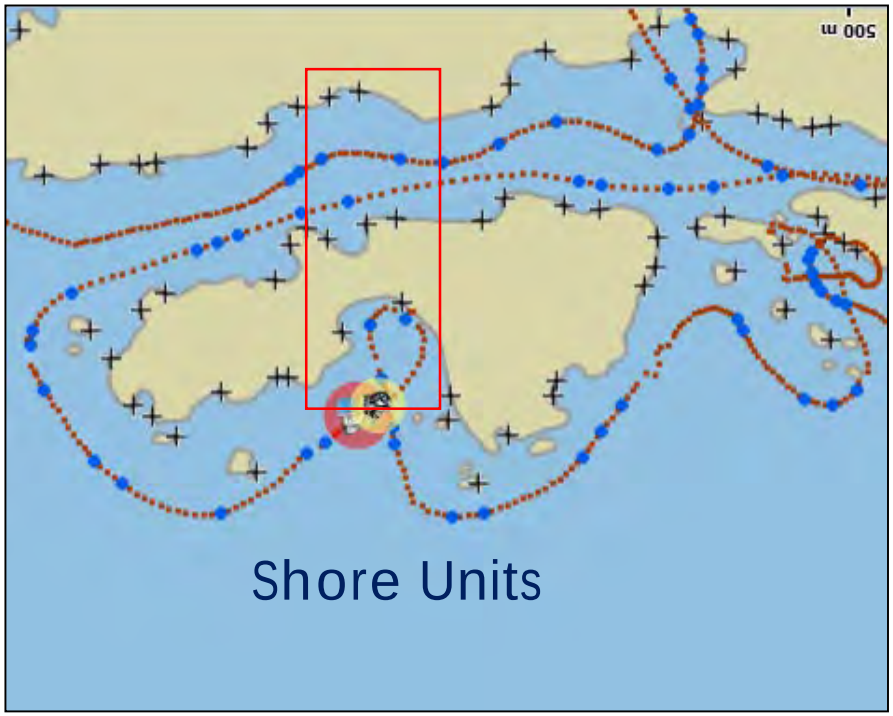
ShoreZone Aerial Surveys: Acquiring high resolution coastal imagery

- Digital, high resolution video and still imagery
- *Low-tide*, low altitude, oblique angle, spatially-referenced
- Products are georeferenced imagery and data



Habitat Mapping: From Imagery to Mapped Biophysical Habitat Data

GPS flight trackline recorded at
1-second intervals:



Segment digital shoreline into relatively homogenous along-shore units

Need Good Digital Shoreline !!

wave exposure

geomorphology

sediment texture

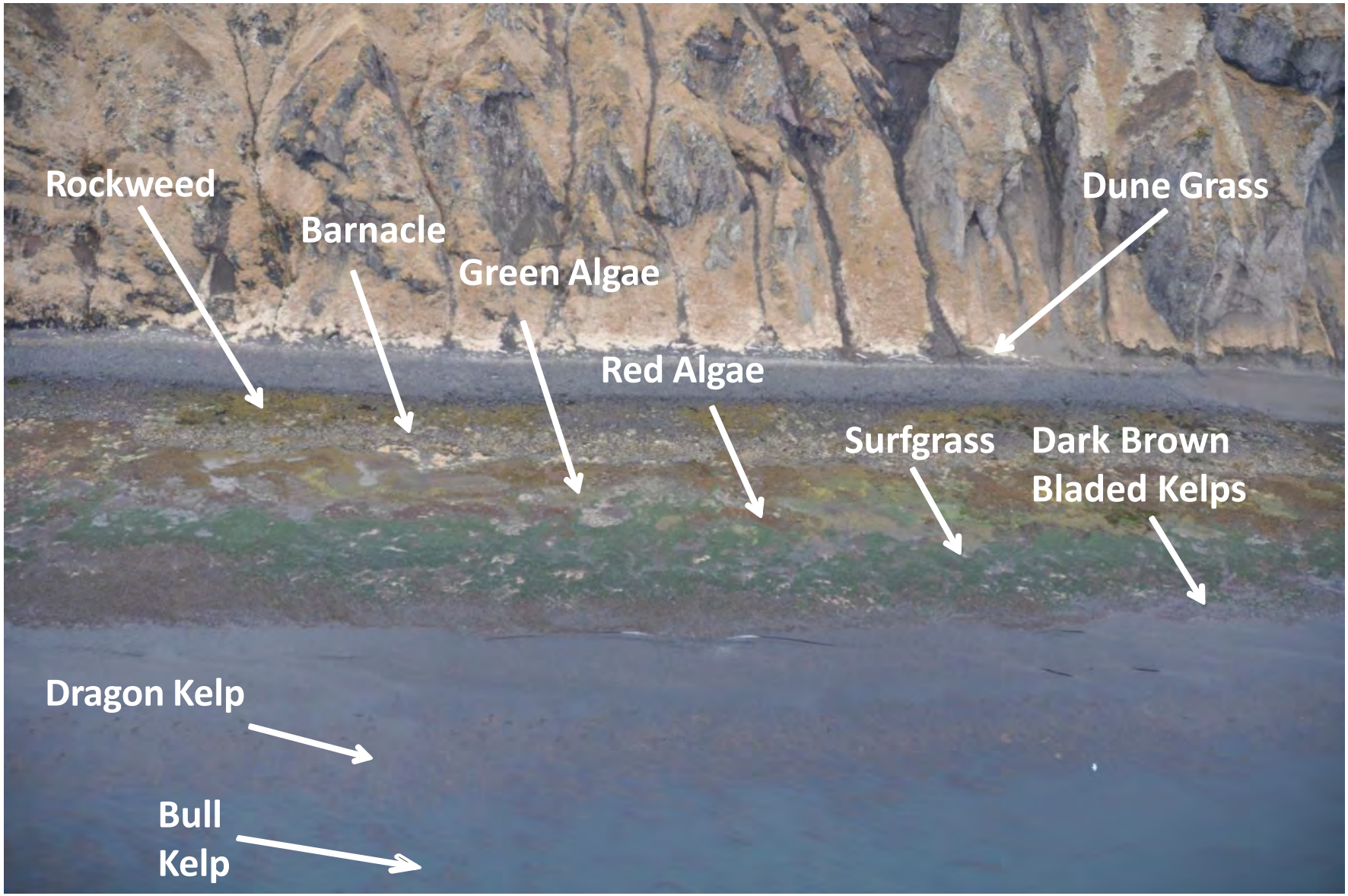
Biota (as biobands)

man-made features

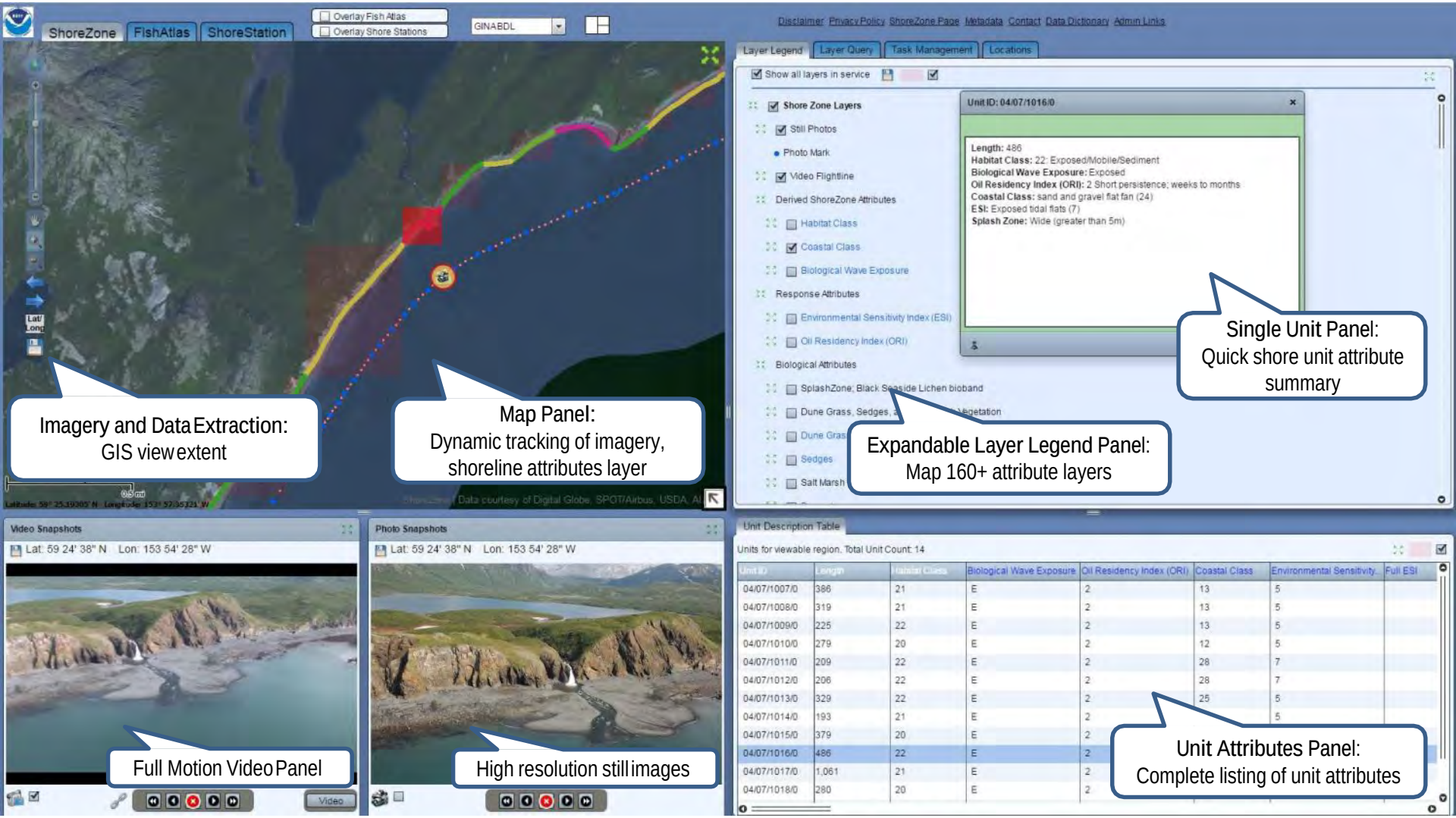
features

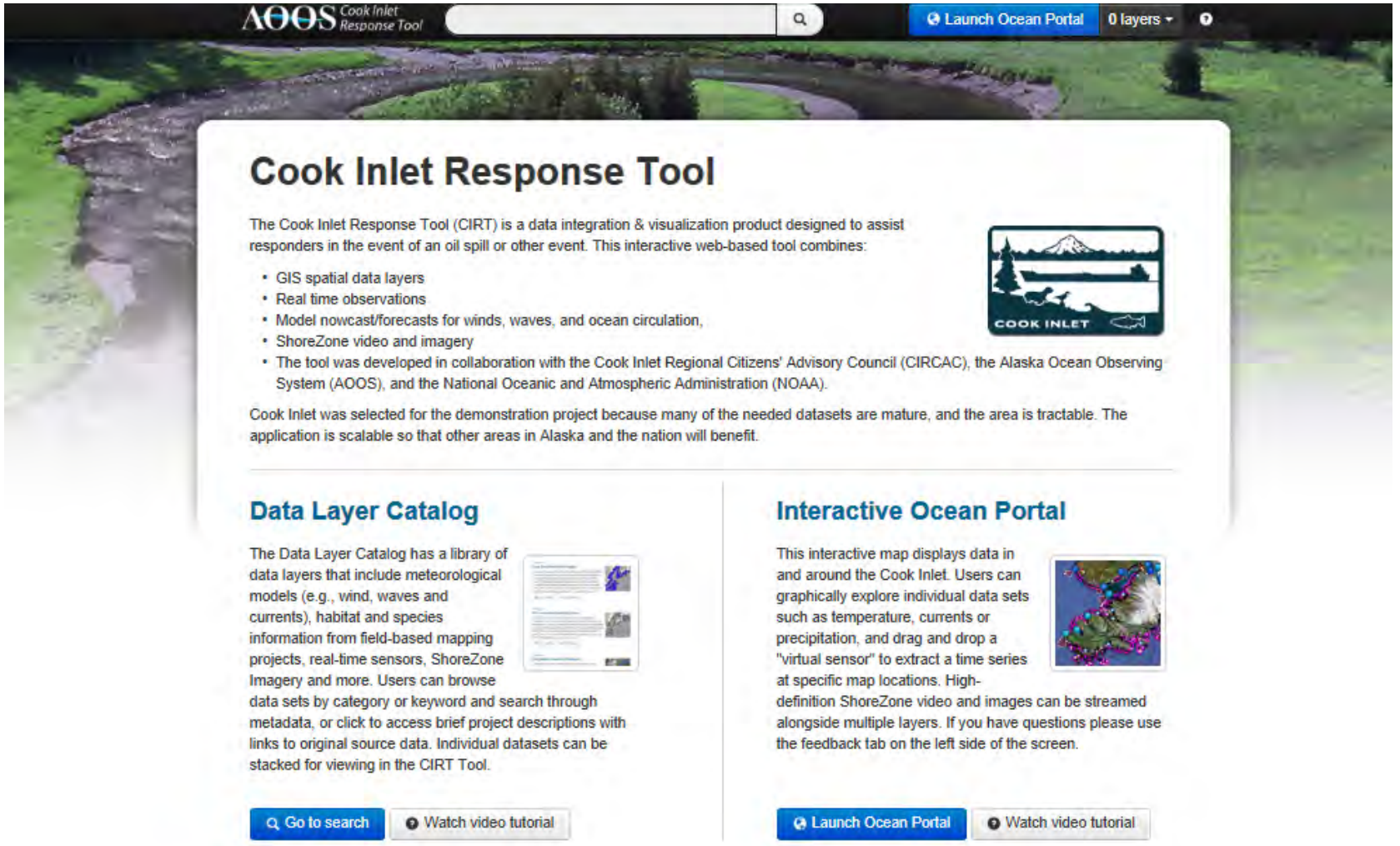
- Aspect, Slope
- Fetch, Wave energy
- Width, Length, Area
- Anthropogenic modifications
- Cultural features
- Geomorphology
- Biobands
- Dominant process
- Coastal vulnerability
- Environmental sensitivity
- Oil Residence
- Erosion and Depositional Models
- Debris Accumulation Models
- Invasive Species Habitat Models

Biobands

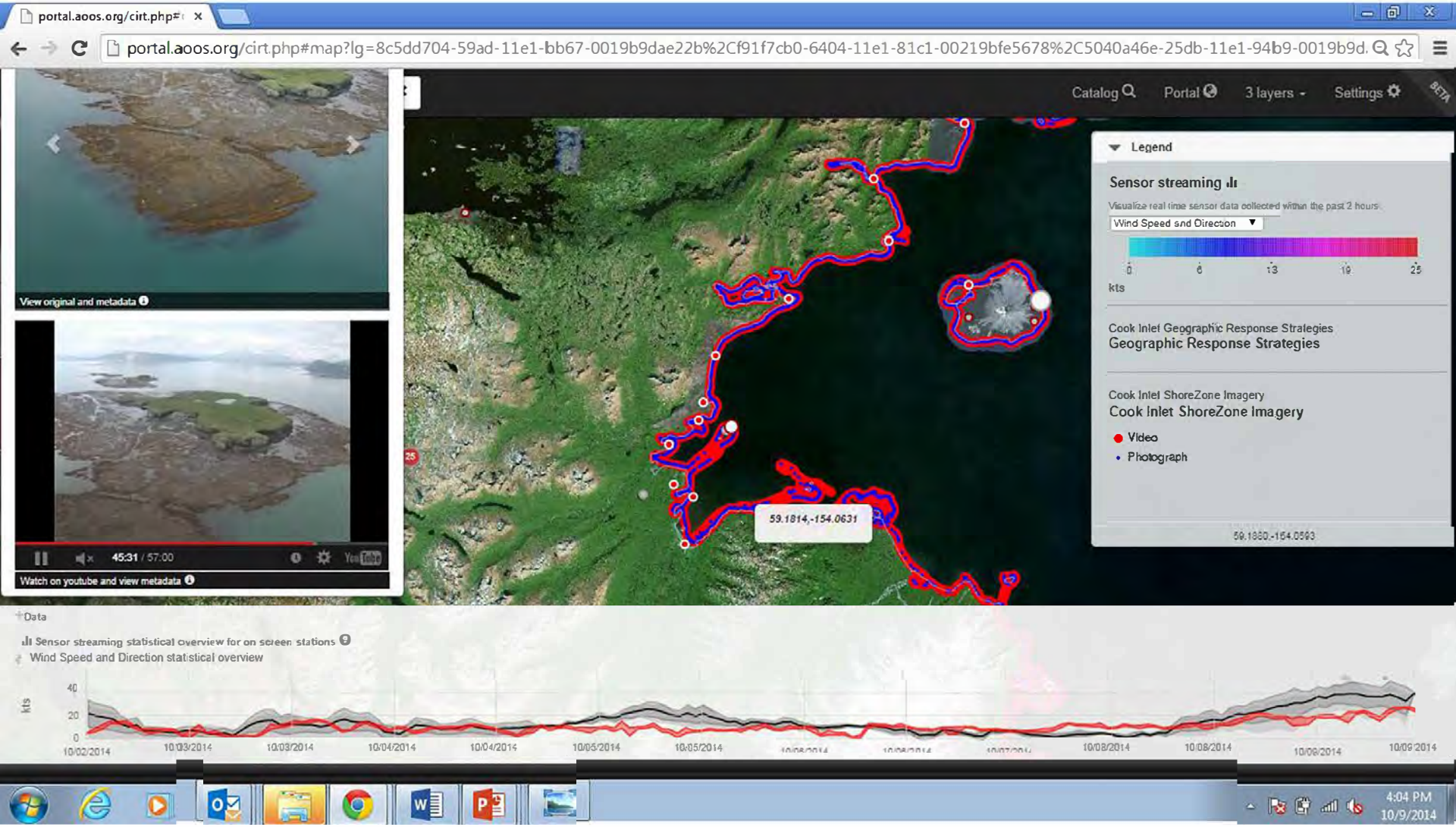

Rockweed
Barnacle
Green Algae
Red Algae
Surfgrass
Dark Brown Bladed Kelps
Dune Grass
Dragon Kelp
Bull Kelp

ShoreZone NOAA Online

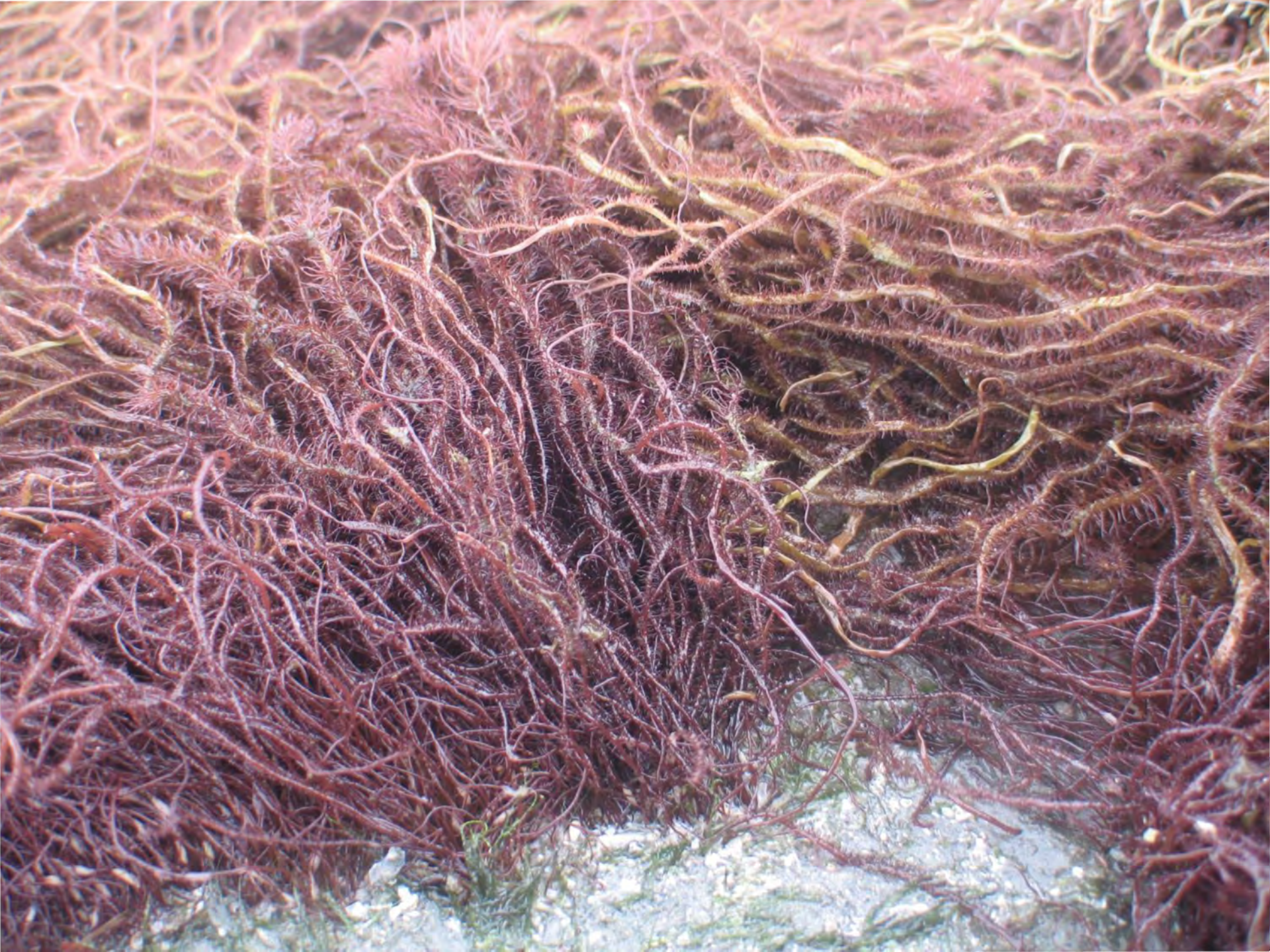



AOOS Cook Inlet Response Tool
Launch Ocean Portal
0 layers
Cook Inlet Response Tool
The Cook Inlet Response Tool (CIRT) is a data integration & visualization product designed to assist responders in the event of an oil spill or other event. This interactive web-based tool combines:
GIS spatial data layers
Real time observations
Model nowcast/forecasts for winds, waves, and ocean circulation,
ShoreZone video and imagery
The tool was developed in collaboration with the Cook Inlet Regional Citizens' Advisory Council (CIRCAC), the Alaska Ocean Observing System (AOOS), and the National Oceanic and Atmospheric Administration (NOAA).
COOK INLET
Cook Inlet was selected for the demonstration project because many of the needed datasets are mature, and the area is tractable. The application is scalable so that other areas in Alaska and the nation will benefit.
Data Layer Catalog
The Data Layer Catalog has a library of data layers that include meteorological models (e.g., wind, waves and currents), habitat and species information from field-based mapping projects, real-time sensors, ShoreZone Imagery and more. Users can browse data sets by category or keyword and search through metadata, or click to access brief project descriptions with links to original source data. Individual datasets can be stacked for viewing in the CIRT Tool.
Go to search
Watch video tutorial
Interactive Ocean Portal
This interactive map displays data in and around the Cook Inlet. Users can graphically explore individual data sets such as temperature, currents or precipitation, and drag and drop a "virtual sensor" to extract a time series at specific map locations. High-definition ShoreZone video and images can be streamed alongside multiple layers. If you have questions please use the feedback tab on the left side of the screen.
Launch Ocean Portal
Watch video tutorial

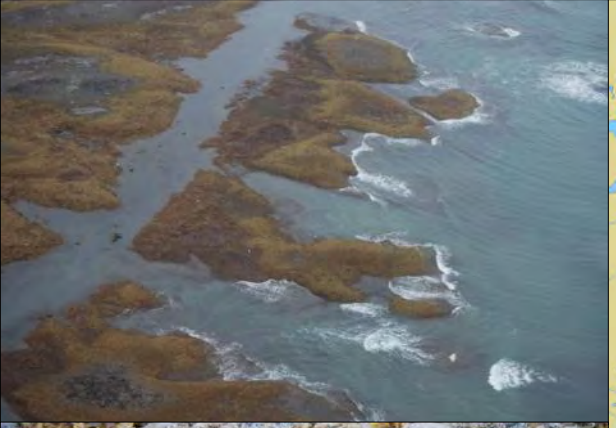
www.aoos.org

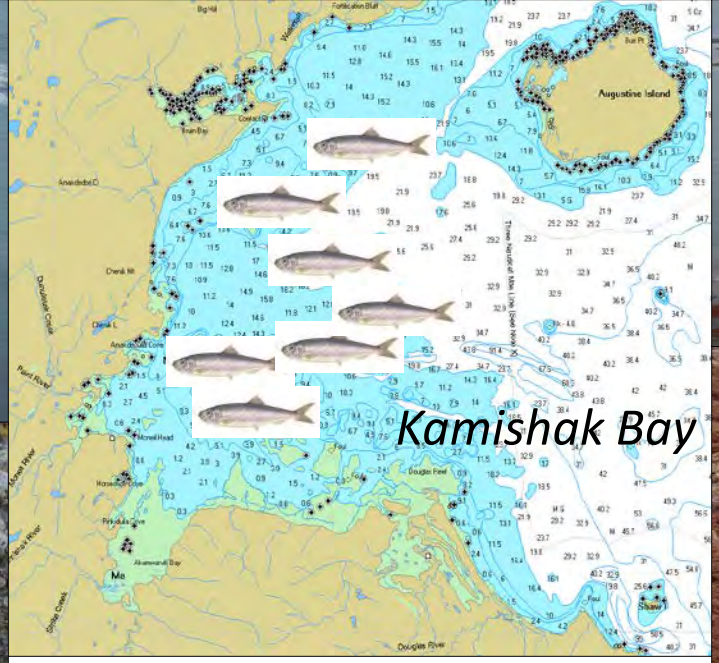

portal.aoos.org/cirt.php#
portal.aoos.org/cirt.php#map?lg=8c5dd704-59ad-11e1-bb67-0019b9dae22b%2Cf91f7cb0-6404-11e1-81c1-00219bfe5678%2C5040a46e-25db-11e1-94b9-0019b9d
Catalog
Portal
3 layers
Settings
BETA
View original and metadata
45:31 / 57:00
Watch on youtube and view metadata
Legend
Sensor streaming
Visualize real time sensor data collected within the past 2 hours
Wind Speed and Direction
0
6
13
19
25
kts
Cook Inlet Geographic Response Strategies
Geographic Response Strategies
Cook Inlet ShoreZone Imagery
Cook Inlet ShoreZone Imagery
Video
Photograph
59.1814,-154.0631
Data
Sensor streaming statistical overview for on screen stations
Wind Speed and Direction statistical overview
kts
40
20
0
10/02/2014
10/03/2014
10/03/2014
10/04/2014
10/04/2014
10/05/2014
10/05/2014
10/08/2014
10/08/2014
10/09/2014
10/09/2014
4:04 PM
10/9/2014

2009 Kamisha Bay
Rocky Platforms and Reefs




N73AJ

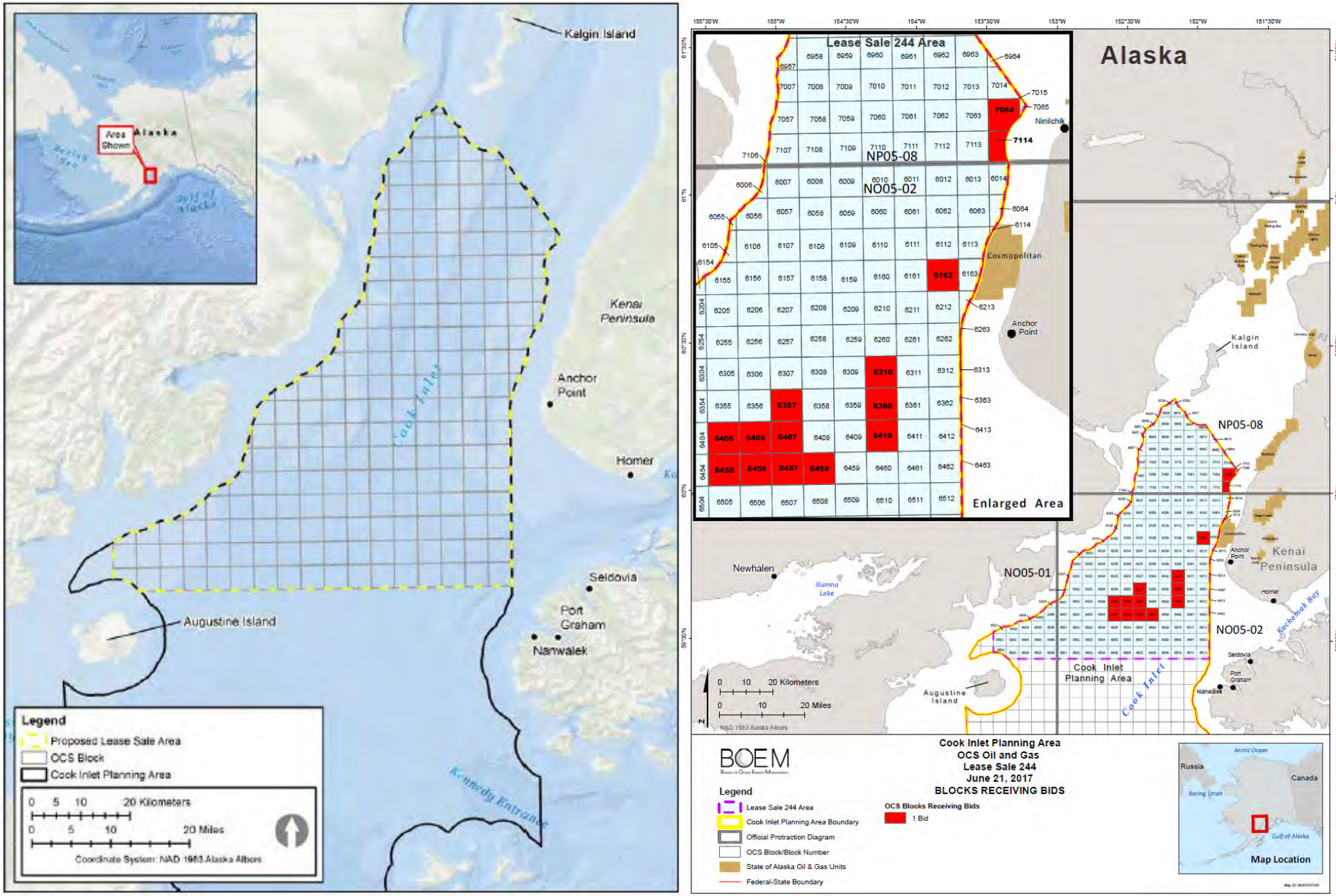




“Rocky” Habitat
Kamishak Bay Reefs

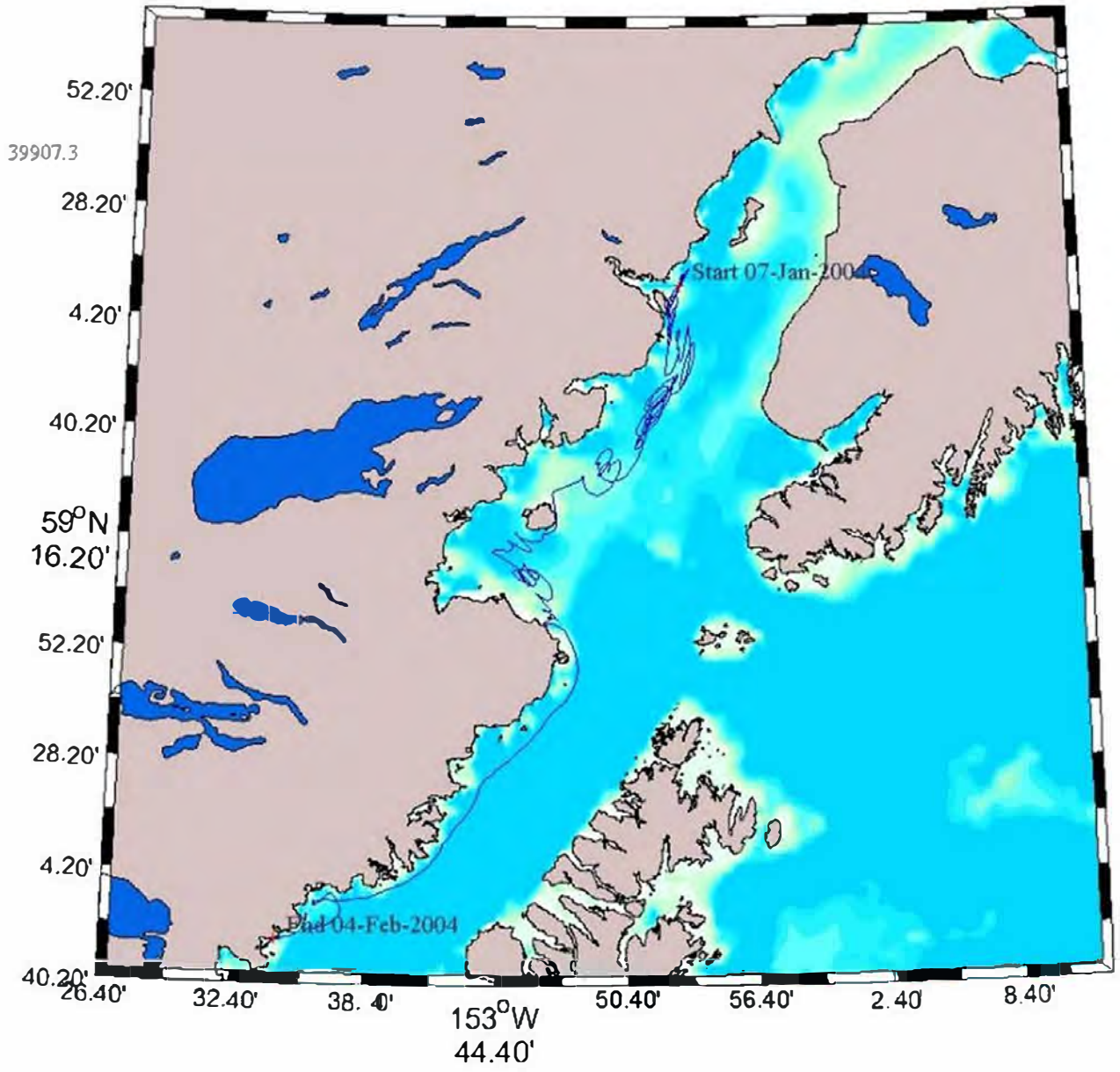
Can be important nearshore herring spawn habitat

Essential fish habitat

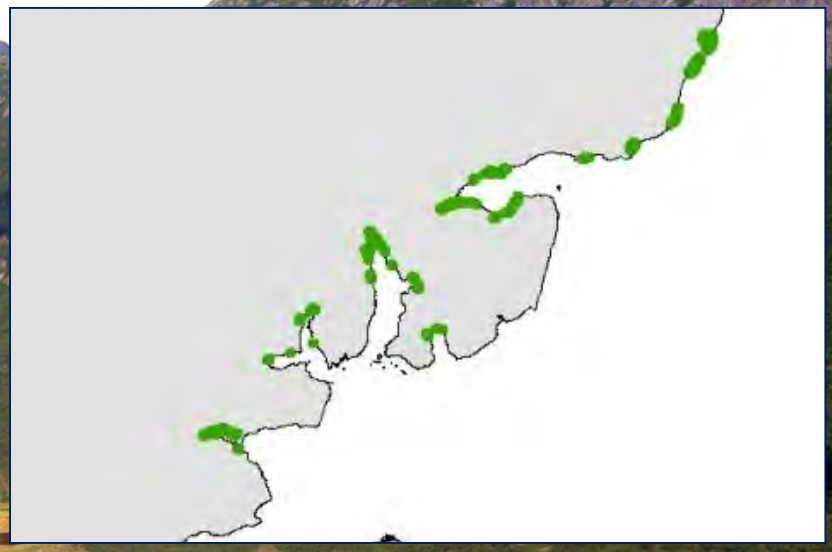


20 June 2017

Bidding closes for Cook Inlet OCS Oil and Gas Lease Sale 244


39907.3
52.20'
28.20'
4.20'
40.20'
59°N
16.20'
52.20'
28.20'
4.20'
40.20'
26.40'
32.40'
38.40'
153°W
44.40'
50.40'
56.40'
2.40'
8.40'
Start 07-Jan-2004
End 04-Feb-2004
0
10
20
30
40
50
60
70
80
90

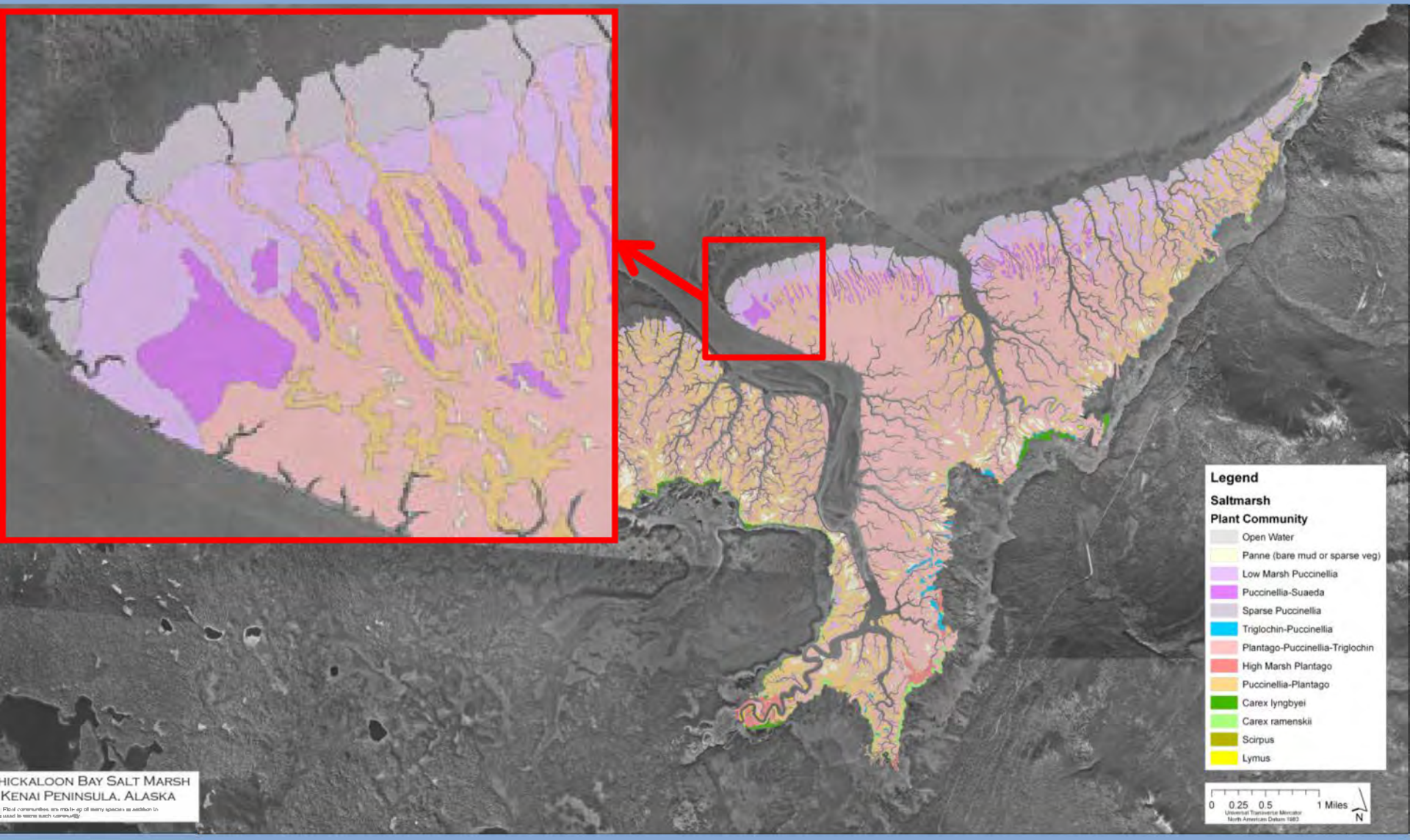
ShoreZone Biobands are species assemblages



Salt marsh habitats are particularly sensitive to oil and can retain oil for many years

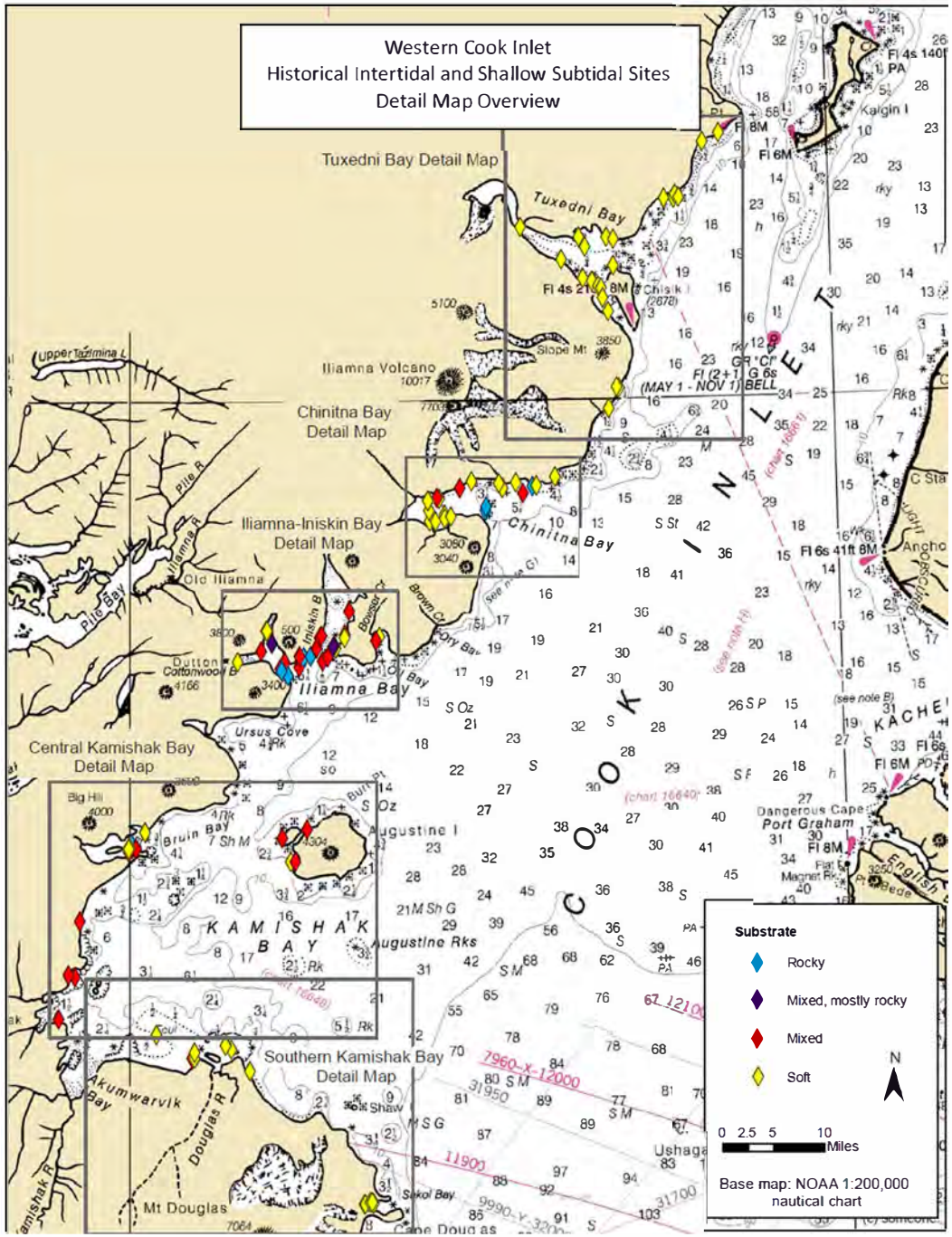
Salt marshes important feeding areas for migrating birds

Salt marsh habitats will likely be impacted by inundation of saltwater with sea level rise


Legend
Saltmarsh
Plant Community
Open Water
Panne (bare mud or sparse veg)
Low Marsh Puccinellia
Puccinellia-Suaeda
Sparse Puccinellia
Triglochin-Puccinellia
Plantago-Puccinellia-Triglochin
High Marsh Plantago
Puccinellia-Plantago
Carex lyngbyei
Carex ramenskii
Scirpus
Lymus
0 0.25 0.5 1 Miles
Universal Transverse Mercator
North American Datum 1983
N
HICKALOON BAY SALT MARSH
KENAI PENINSULA, ALASKA

Assess rocky habitats in lower Cook Inlet that are at risk to activities associated with potential federal Cook Inlet lease sales.

- Compile historical reports/data
- Nearshore habitat assessments
- Recommendations for potential future longer-term monitoring program


Western Cook Inlet
Historical Intertidal and Shallow Subtidal Sites
Detail Map Overview
Tuxedni Bay Detail Map
Chinitna Bay Detail Map
Iliamna-Iniskin Bay Detail Map
Central Kamishak Bay Detail Map
Southern Kamishak Bay Detail Map
Tuxedni Bay
Iliamna Volcano
Chinitna Bay
Iliamna Bay
Ursus Cove
Augustine I
Augustine Rks
Port Graham
Dangerous Cape
Mt Douglas
Substrate
Rocky
Mixed, mostly rocky
Mixed
Soft
N
0 2.5 5 10
Miles
Base map: NOAA 1:200,000
nautical chart

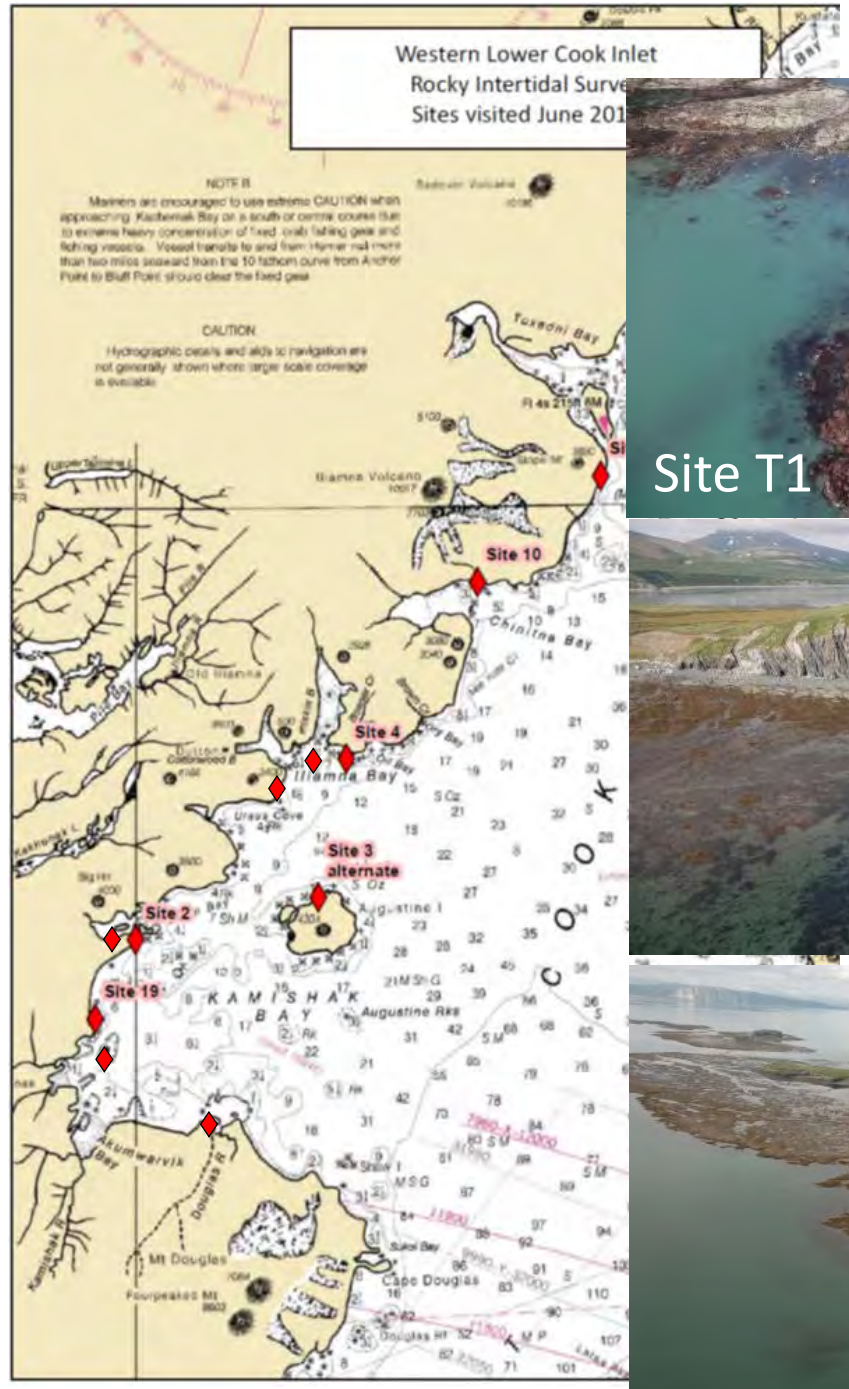
Sites were selected based on two primary considerations:

- Sites representative of a range of rocky habitats
- Sites give most complete geographic coverage of western lower Cook Inlet within the constraints of the project

  - Vessel- and helicopter based surveys
  - Minus-tide windows
  - Constrained between Tuxedni Bay and Chenik Head

ShoreZone coastal class data used to select rocky or mixed rock and gravel shorelines (Classes 1-10).

A geoprocessing tool was applied to generate spatially balanced random points within the shoreline segments.


Western Lower Cook Inlet
Rocky Intertidal Surve
Sites visited June 201
Site 10
Site 4
Site 3
alternate
Site 2
Site 19
Iliamna Bay
Chinitna Bay
KAMISHAK
BAY
Augustine Rks
Mt Douglas
Cape Douglas


Site T1

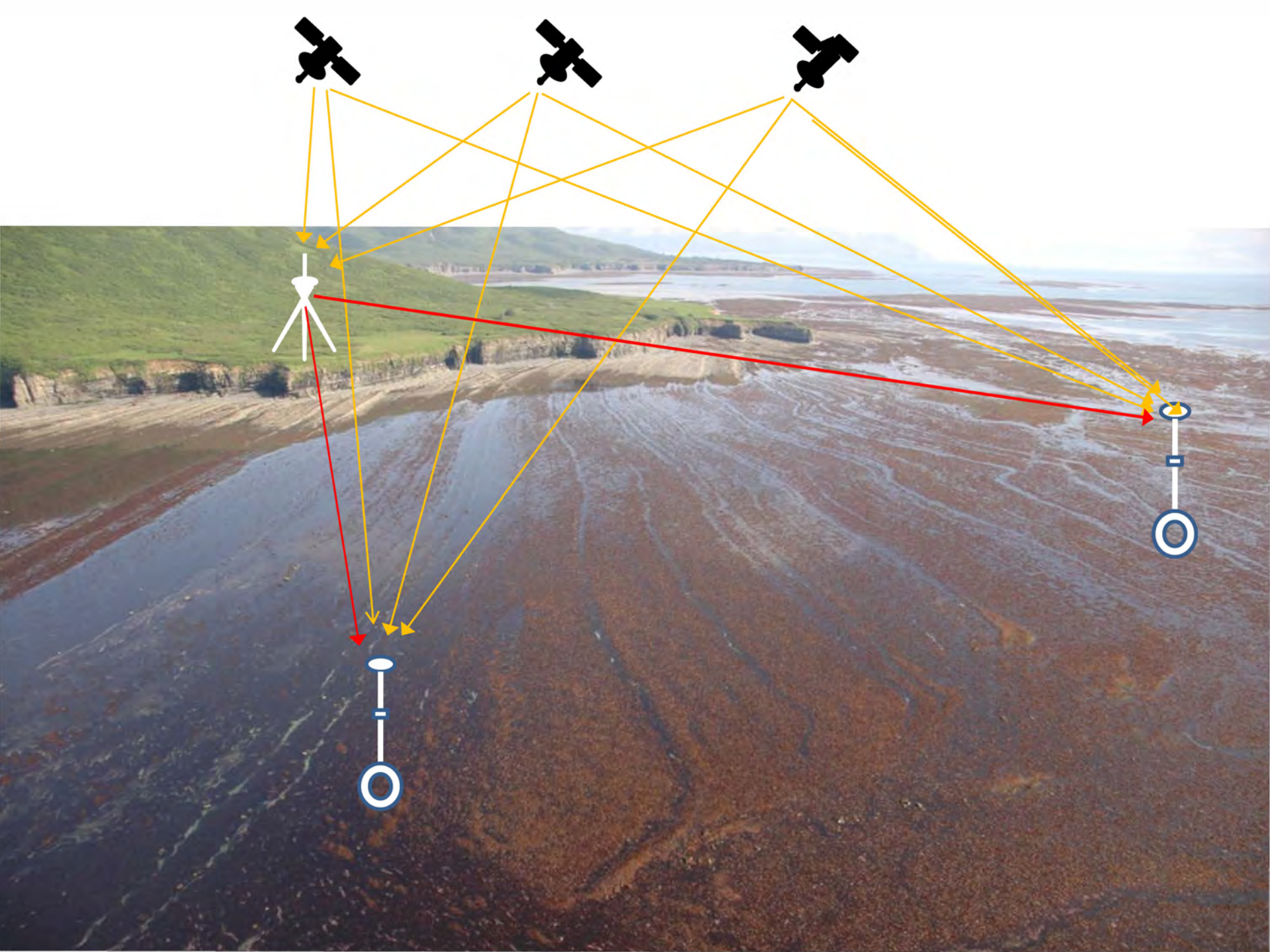

Site S1


Site B1

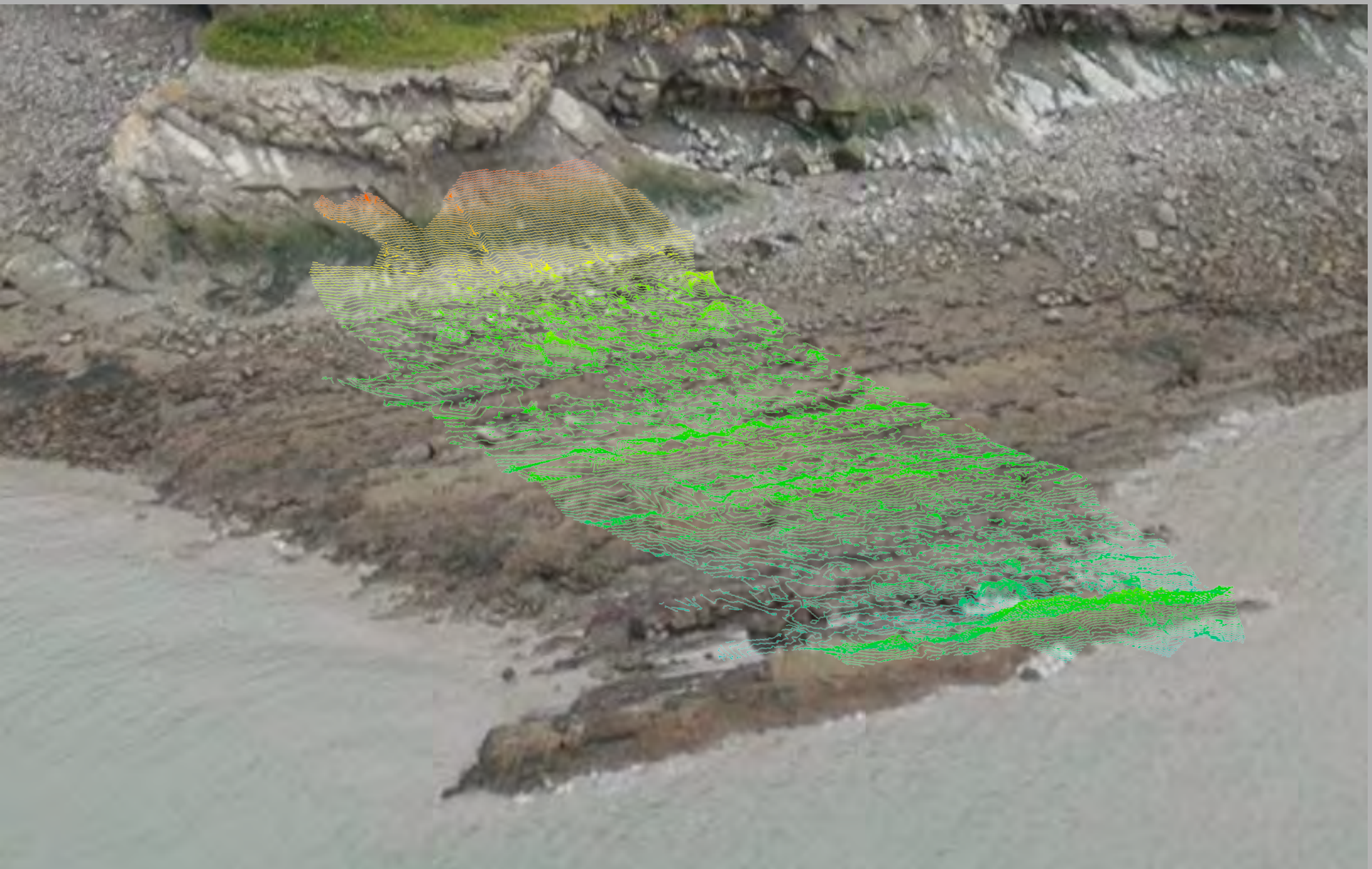

Site 2


Site N1

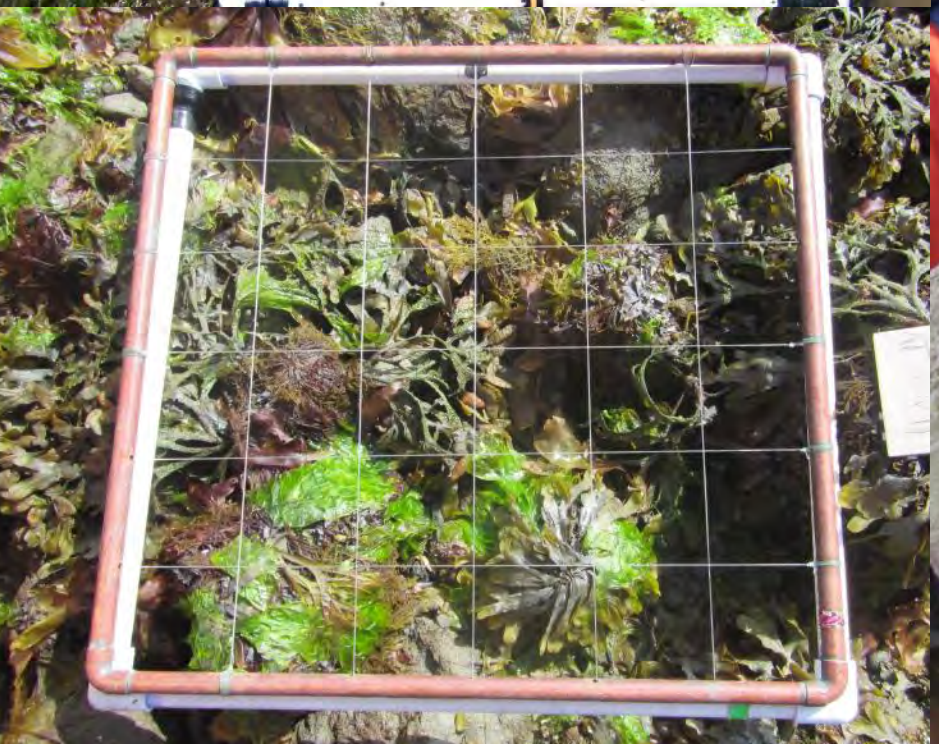

Site 19

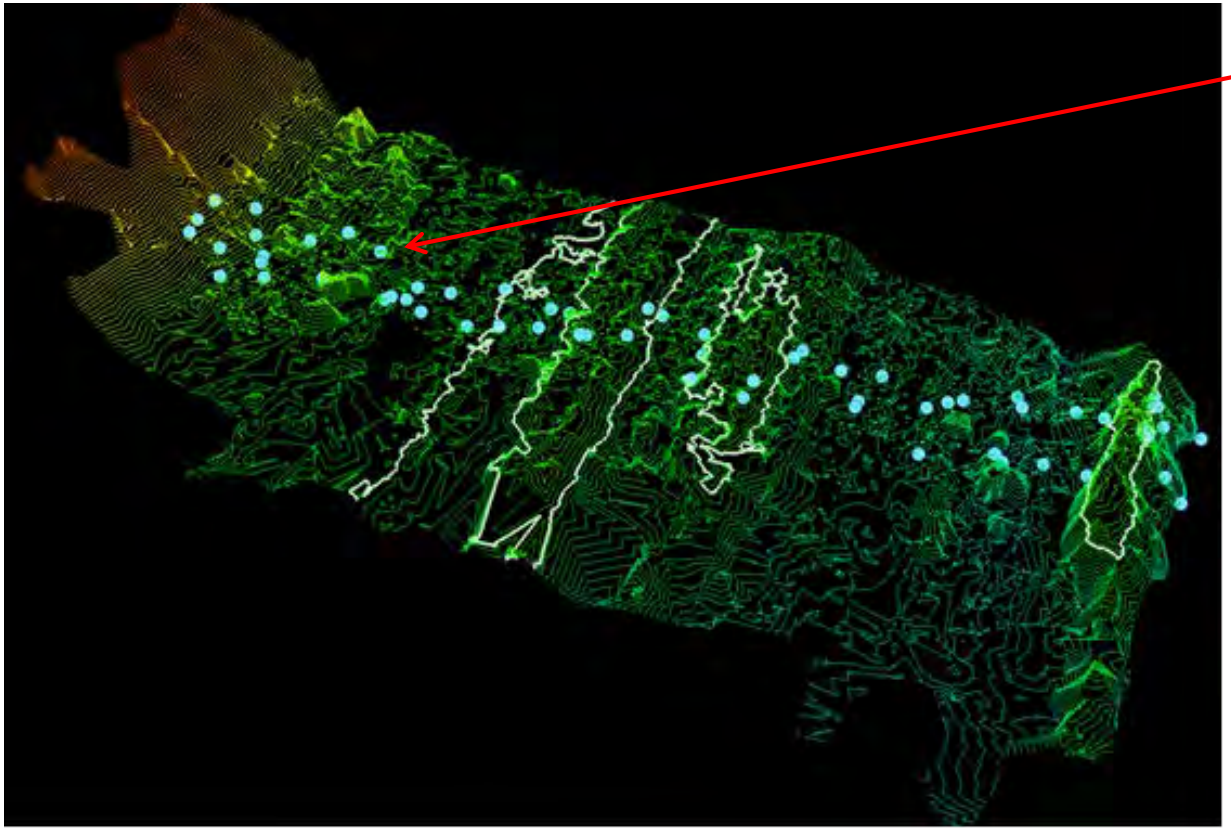


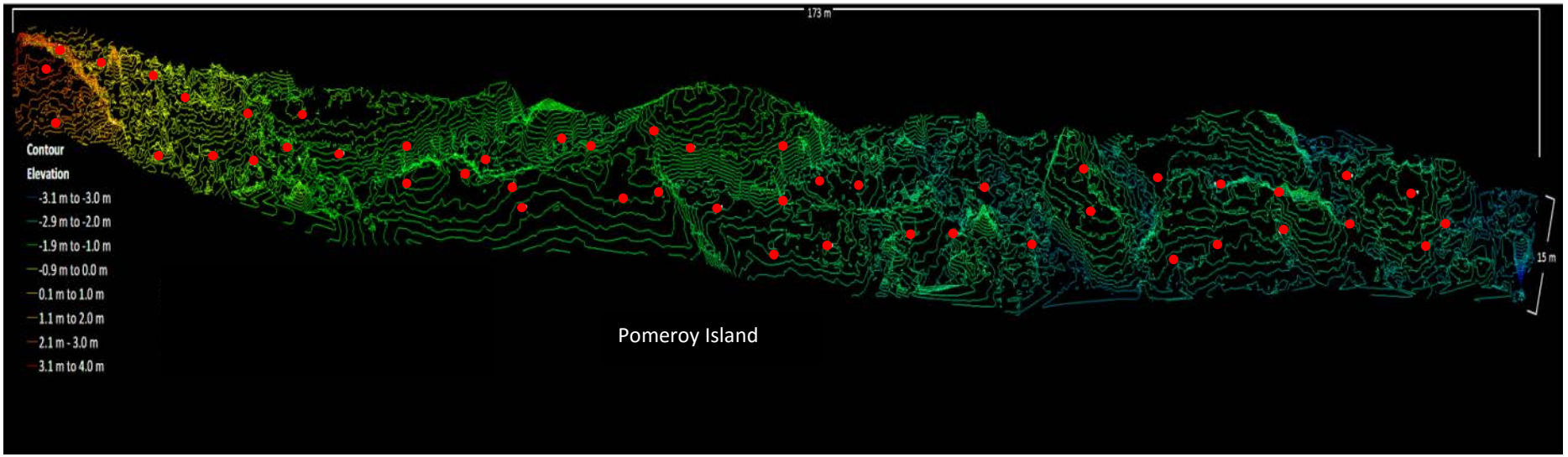
SHOREZONE IMAGE OVERLAID WITH RTK TOPOGRAPHY



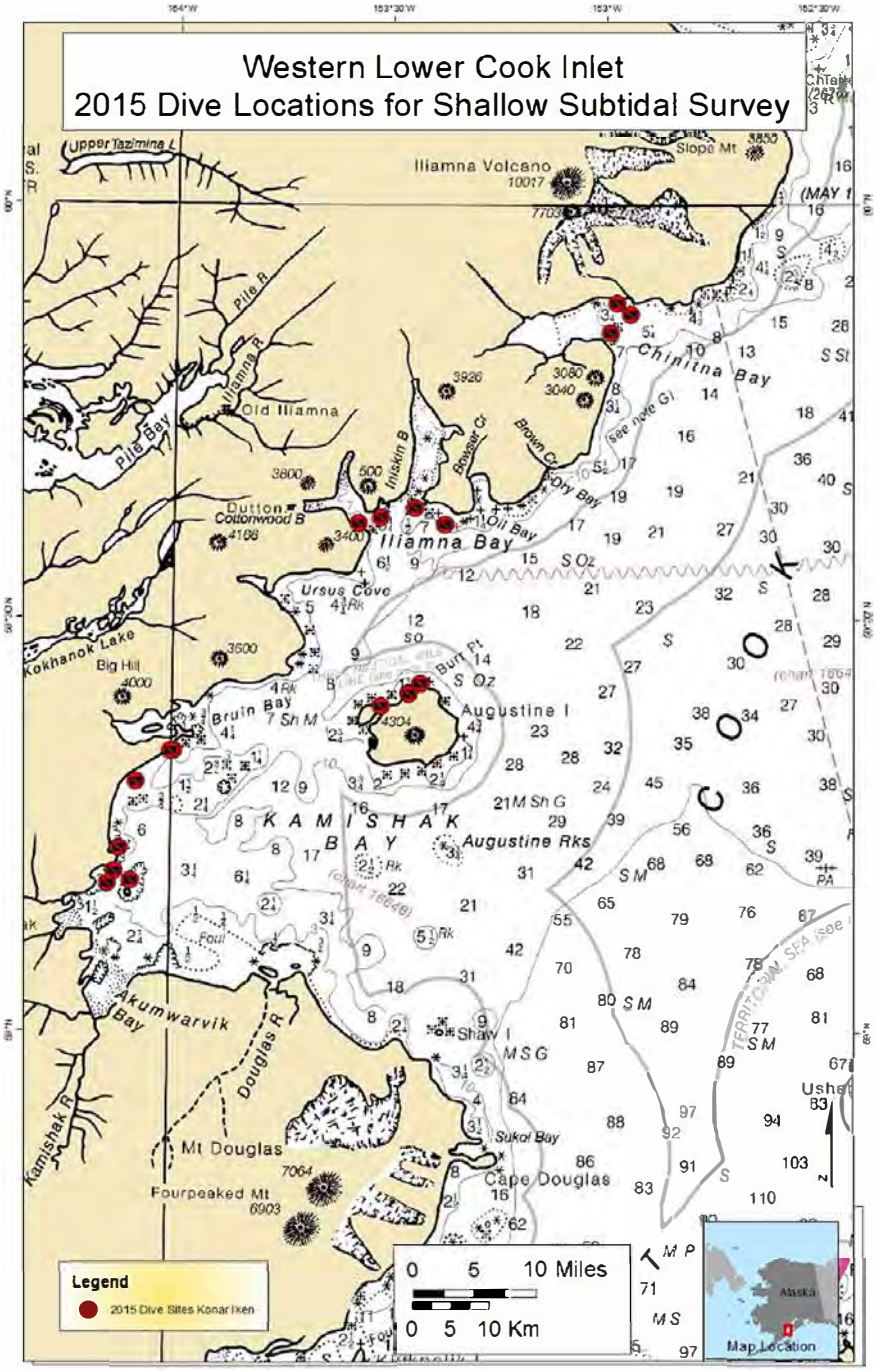
Point-count and photo quadrats

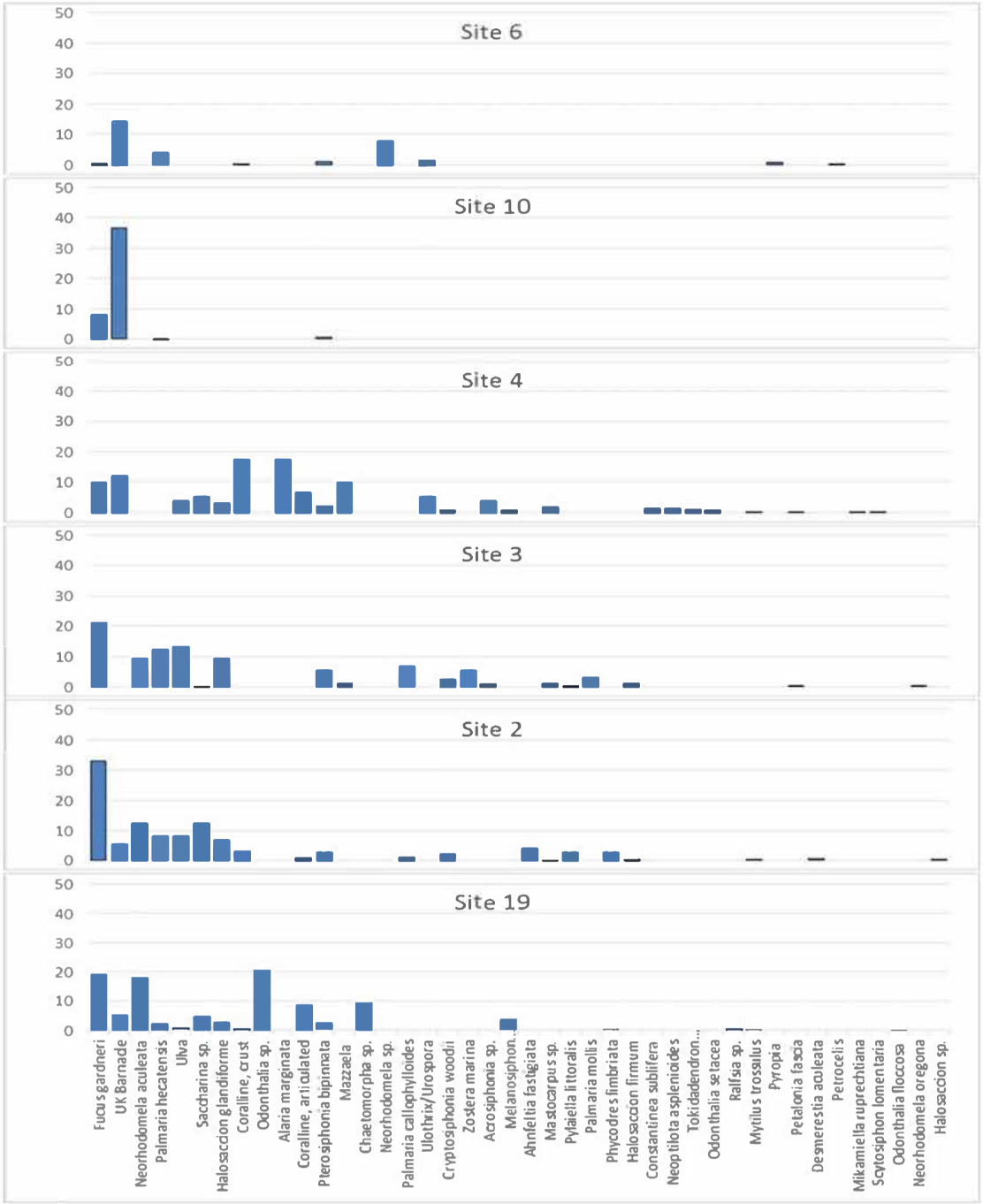


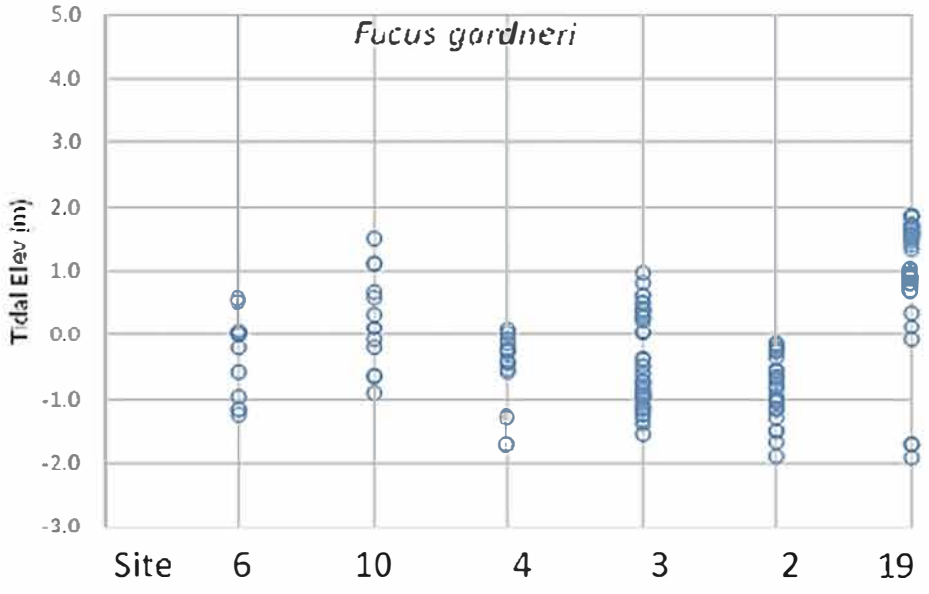


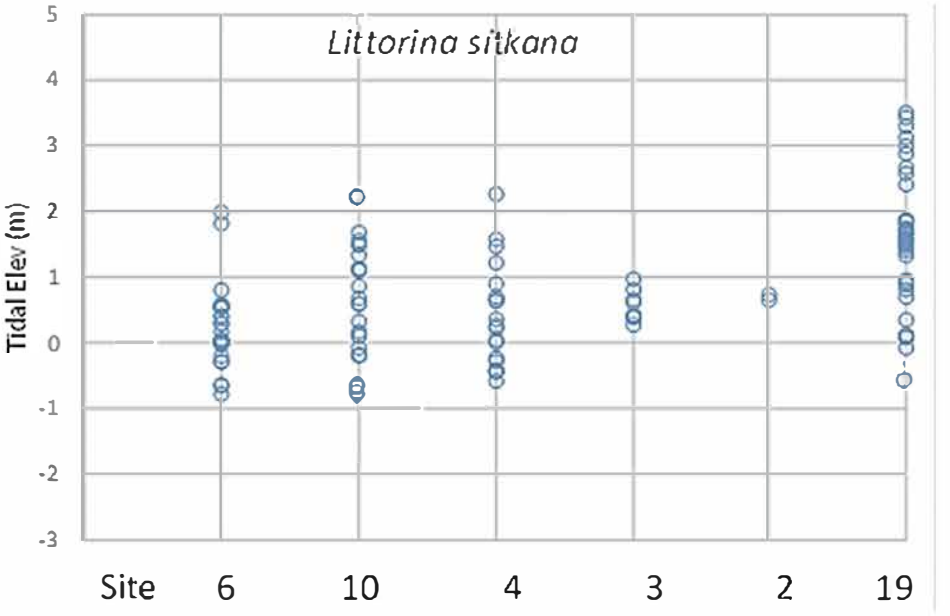


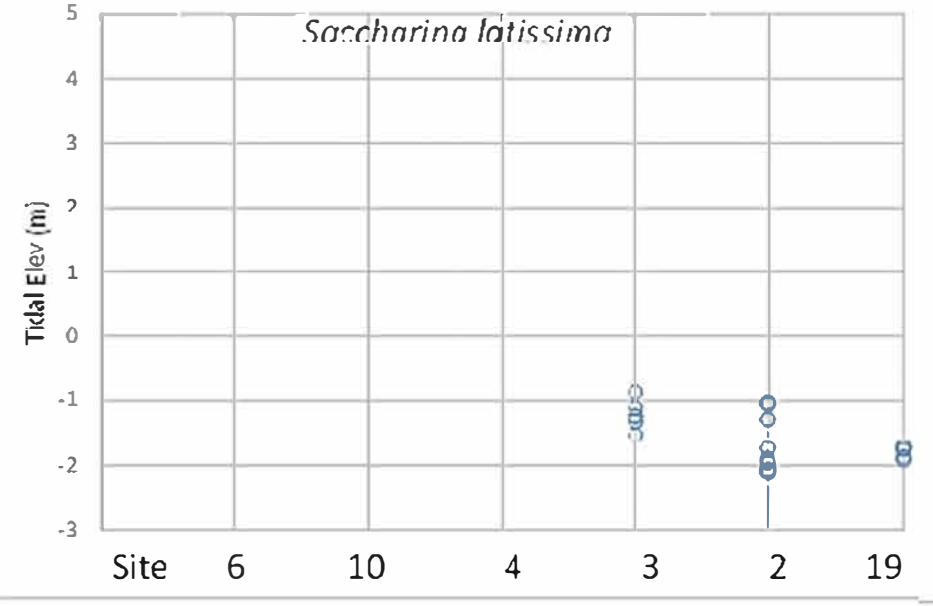
Pomeroy Island

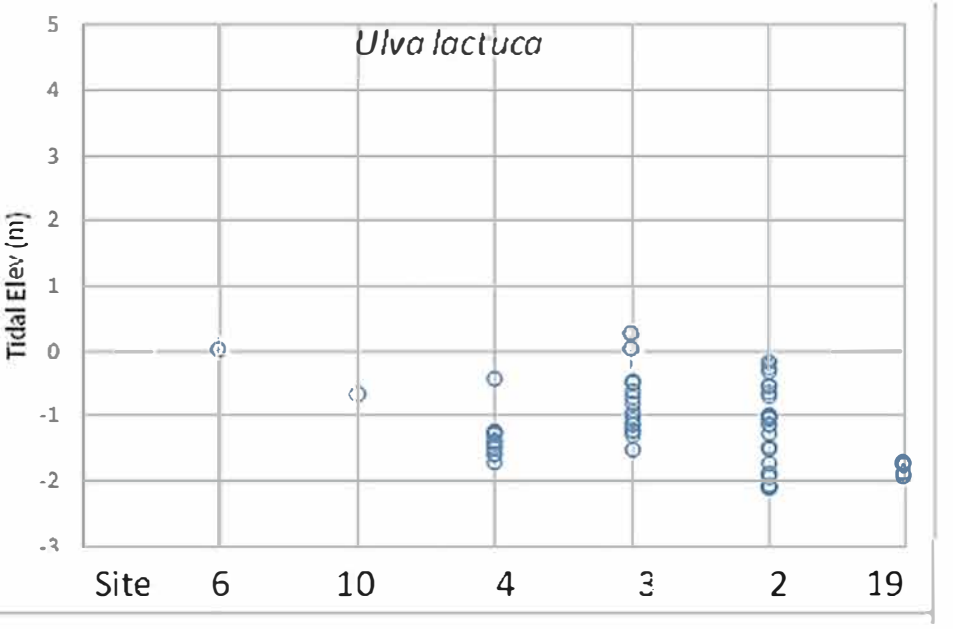

Western Lower Cook Inlet
2015 Dive Locations for Shallow Subtidal Survey
Iliamna Volcano
10017
Slope Mt
Chinitna Bay
Iliamna Bay
Old Iliamna
Pile Bay
Pile R
Iliamna R
Iniskin B
Dutton
Cottonwood B
Ursus Cove
Kokhanok Lake
Big Hill
Bruin Bay
Augustine I
Augustine Rks
K A M I S H A K
B A Y
Akumwarvik
Bay
Douglas R
Kamishak R
Mt Douglas
Fourpeaked Mt
6903
Cape Douglas
Sukoi Bay
Shaw I
Legend
2015 Dive Sites Konar Iken
0 5 10 Miles
0 5 10 Km
Alaska
Map Location

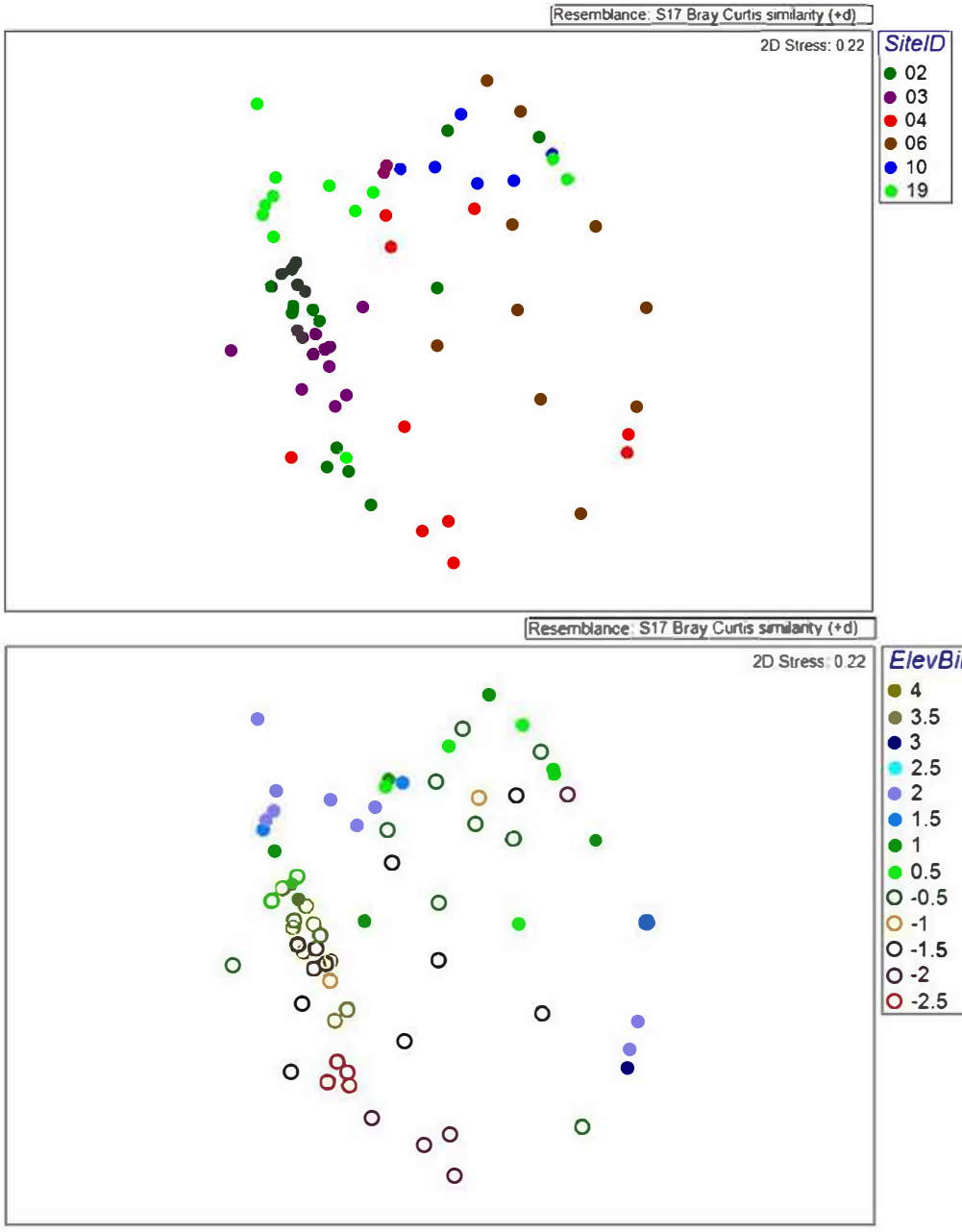

Site 6
Site 10
Site 4
Site 3
Site 2
Site 19
0
10
20
30
40
50
Fucus gardneri
UK Barnacle
Neorhodomela aculeata
Palmaria hecatensis
Ulva
Saccharina sp.
Halosaccion glandiforme
Coralline, crust
Odonthalia sp.
Alaria marginata
Coralline, articulated
Pterosiphonia bipinnata
Mazzaela
Chaetomorpha sp.
Neorhodomela sp.
Palmaria callophylloides
Ulothrix/Urospora
Cryptosiphonia woodii
Zostera marina
Acrosiphonia sp.
Melanosiphon...
Ahnfeltia fastigiata
Mastocarpus sp.
Pylaiella littoralis
Palmaria mollis
Phycodres fimbriata
Halosaccion firmum
Constantinea subilifera
Neoptilota asplenioides
Tokidadendron...
Odonthalia setacea
Ralfsia sp.
Mytilus trossulus
Pyropia
Petalonia fascia
Desmerestia aculeata
Petroceiis
Mikamiella ruprechtiana
Scytosiphon lomentaria
Odonthalia floccosa
Neorhodomela oregona
Halosaccion sp.

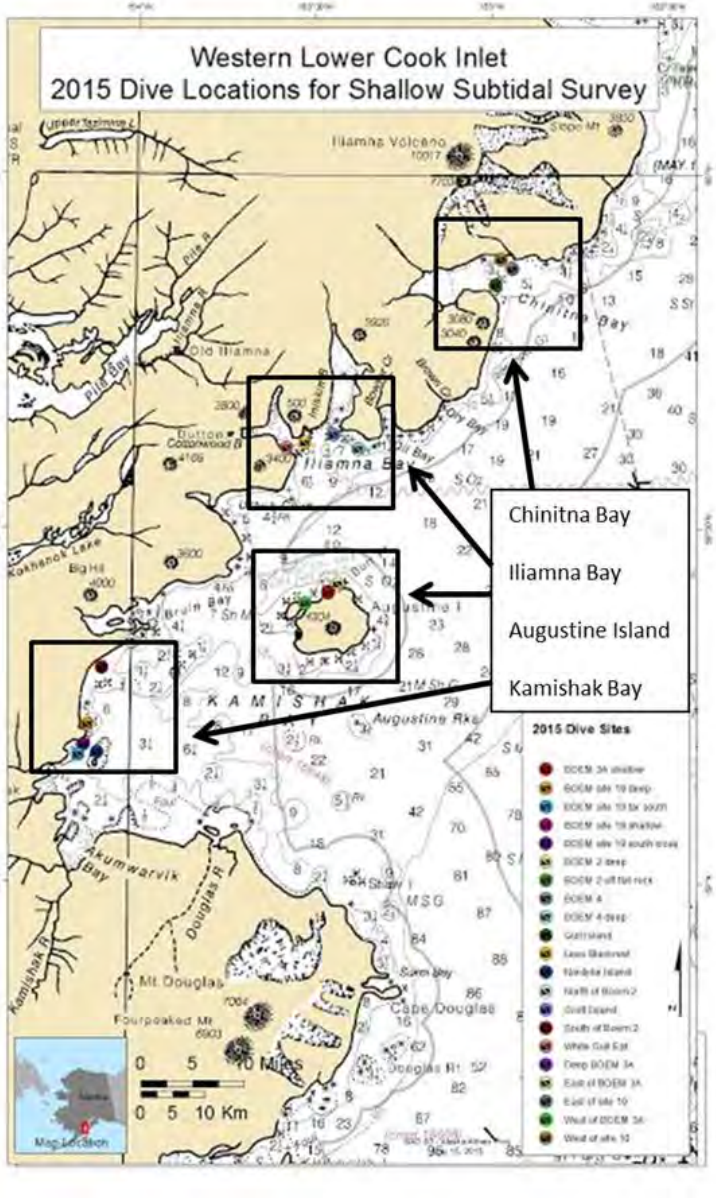

Fucus gardneri
Tidal Elev (m)
5.0
4.0
3.0
2.0
1.0
0.0
-1.0
-2.0
-3.0
Site
6
10
4
3
2
19


Littorina sitkana
Tidal Elev (m)
5
4
3
2
1
0
-1
-2
-3
Site
6
10
4
3
2
19


Saccharina latissima
Tidal Elev (m)
5
4
3
2
1
0
-1
-2
-3
Site
6
10
4
3
2
19

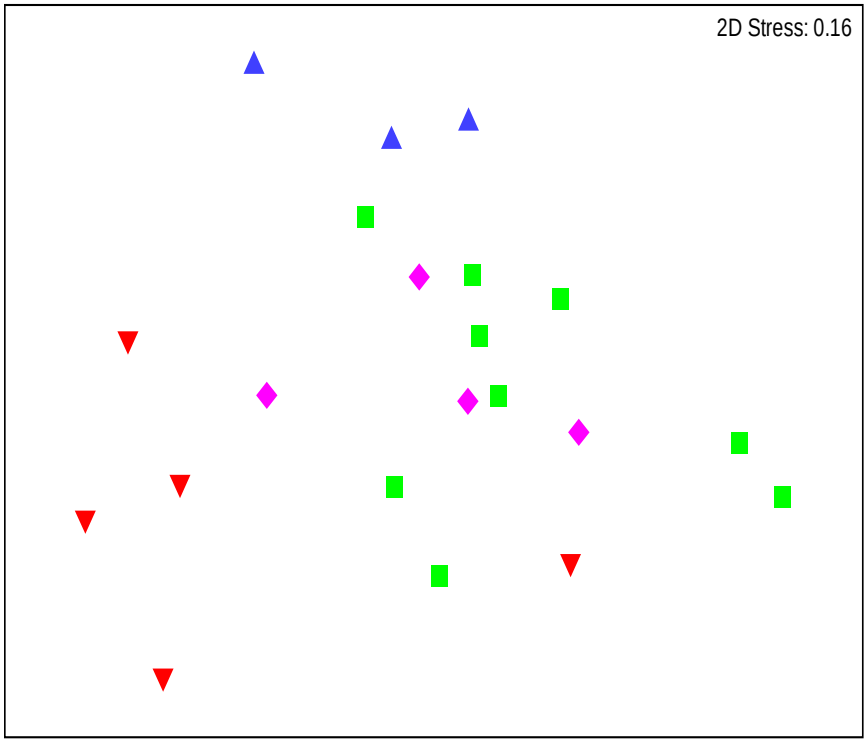

Ulva lactuca
Tidal Elev (m)
5
4
3
2
1
0
-1
-2
-3
Site
6
10
4
3
2
19


Resemblance: S17 Bray Curtis similarity (+d)
2D Stress: 0.22
SiteID
02
03
04
06
10
19
Resemblance: S17 Bray Curtis similarity (+d)
2D Stress: 0.22
ElevBin0.5m
4
3.5
3
2.5
2
1.5
1
0.5
-0.5
-1
-1.5
-2
-2.5



Non-metric MDS

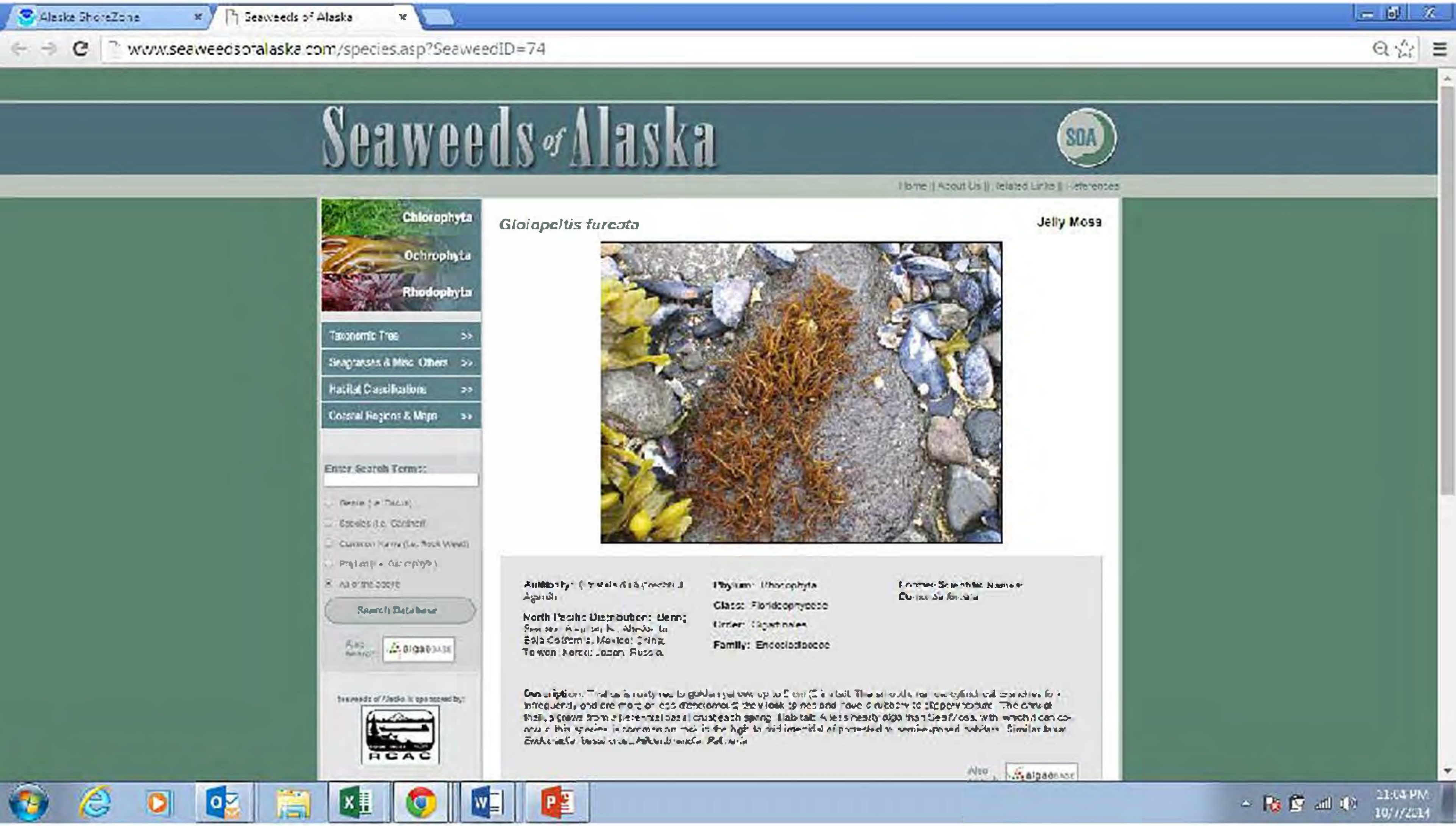
Transform: Square root
Resemblance: S17 Bray-Curtis similarity



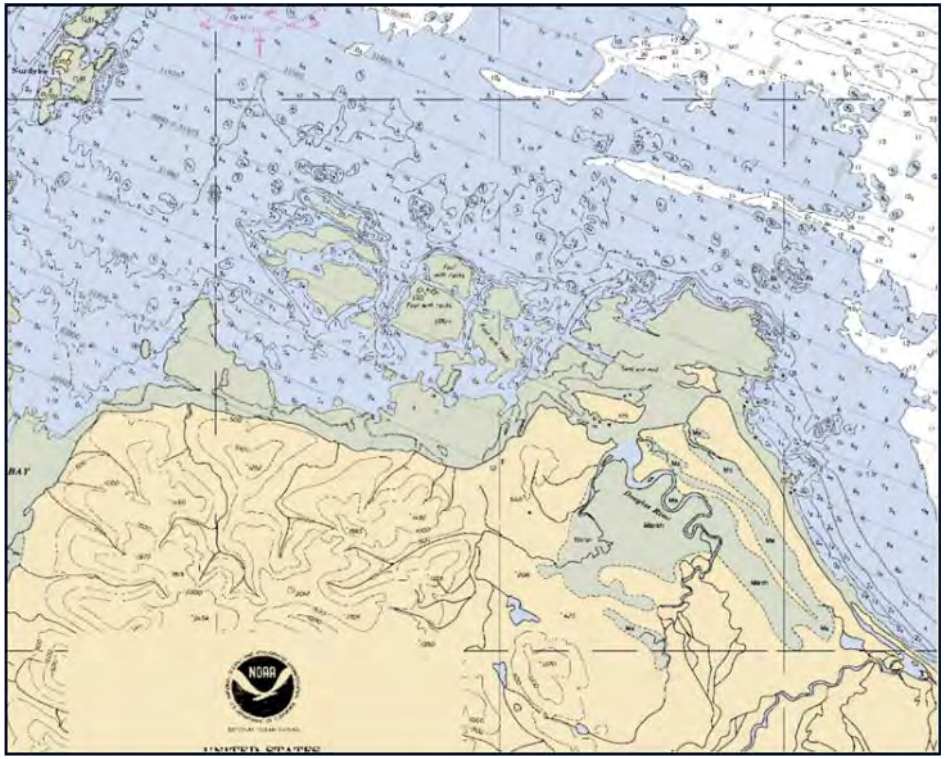
Agarum_turneri_2_2015.jpg
intertidal, rock ramp ; Lower Cook Inlet, Contact Pt., site 2

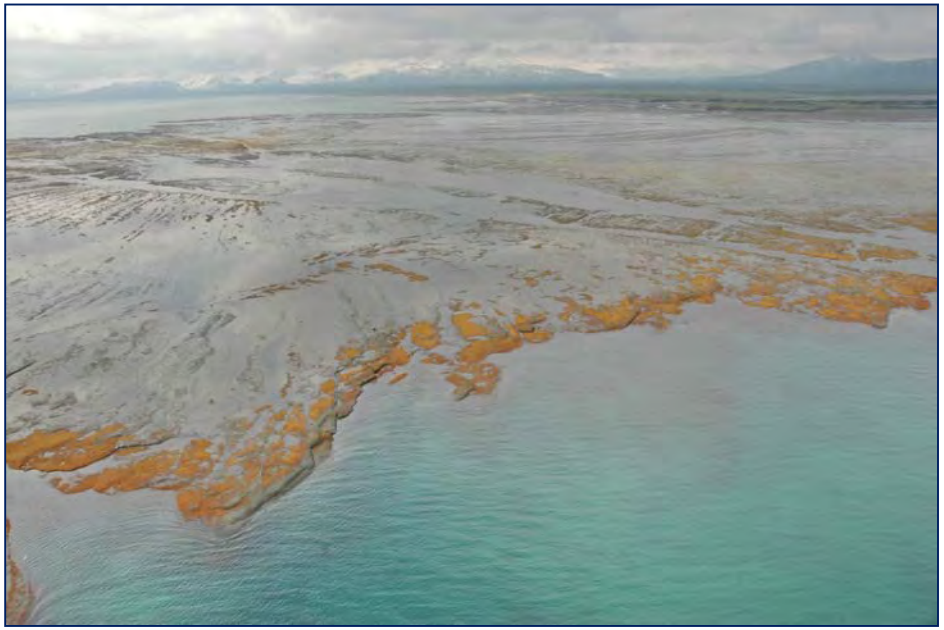
BOEM LCI 2015

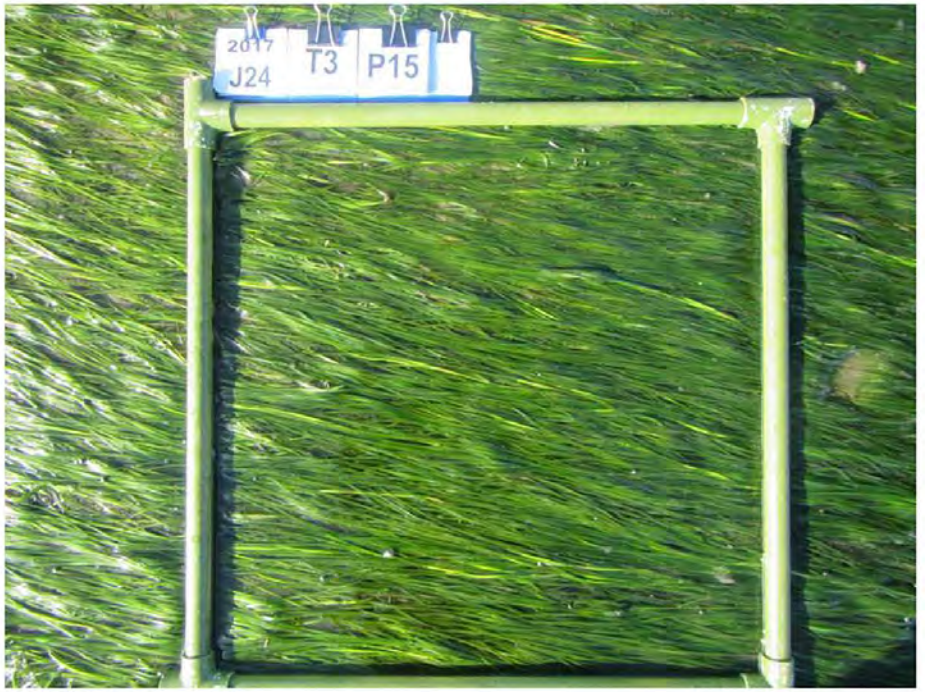
Palmaria_callophylloides_5_2015.jpg
depth 15-18' ; BOEM subtidal #? Scott Is.

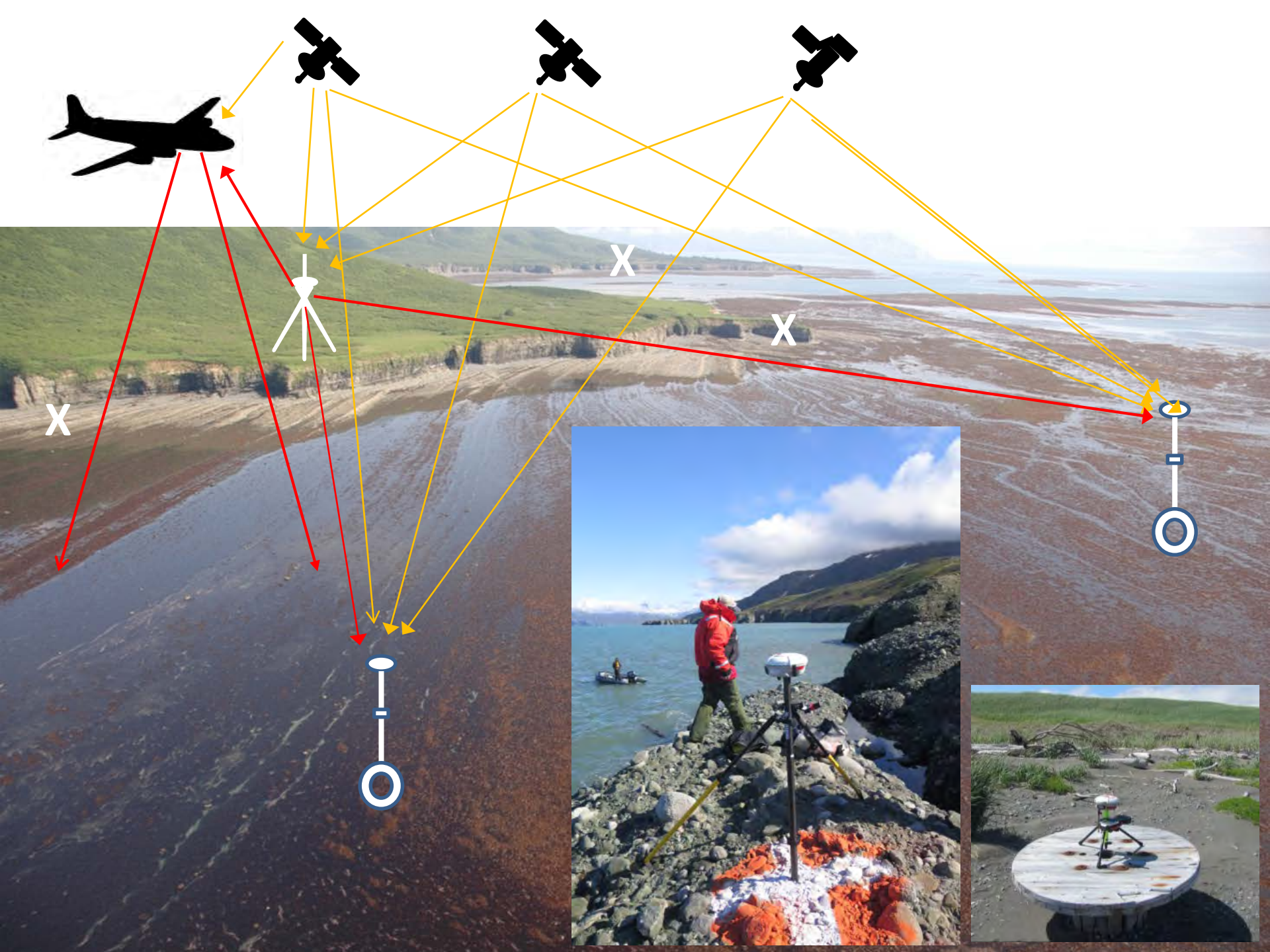

Alaska ShoreZone
Seaweeds of Alaska
www.seaweedsofalaska.com/species.asp?SeaweedID=74
Seaweeds of Alaska
SOA
Home || About Us || Related Links || References
Chlorophyta
Ochrophyta
Rhodophyta
Taxonomic Tree
Habitat Classifications
Coastal Regions & Maps
Enter Search Terms:
Search Database
Gloiopeltis furcata
Jelly Moss
Phylum: Rhodophyta
Class: Florideophyceae
Family: Endocladiaceae
RCAC

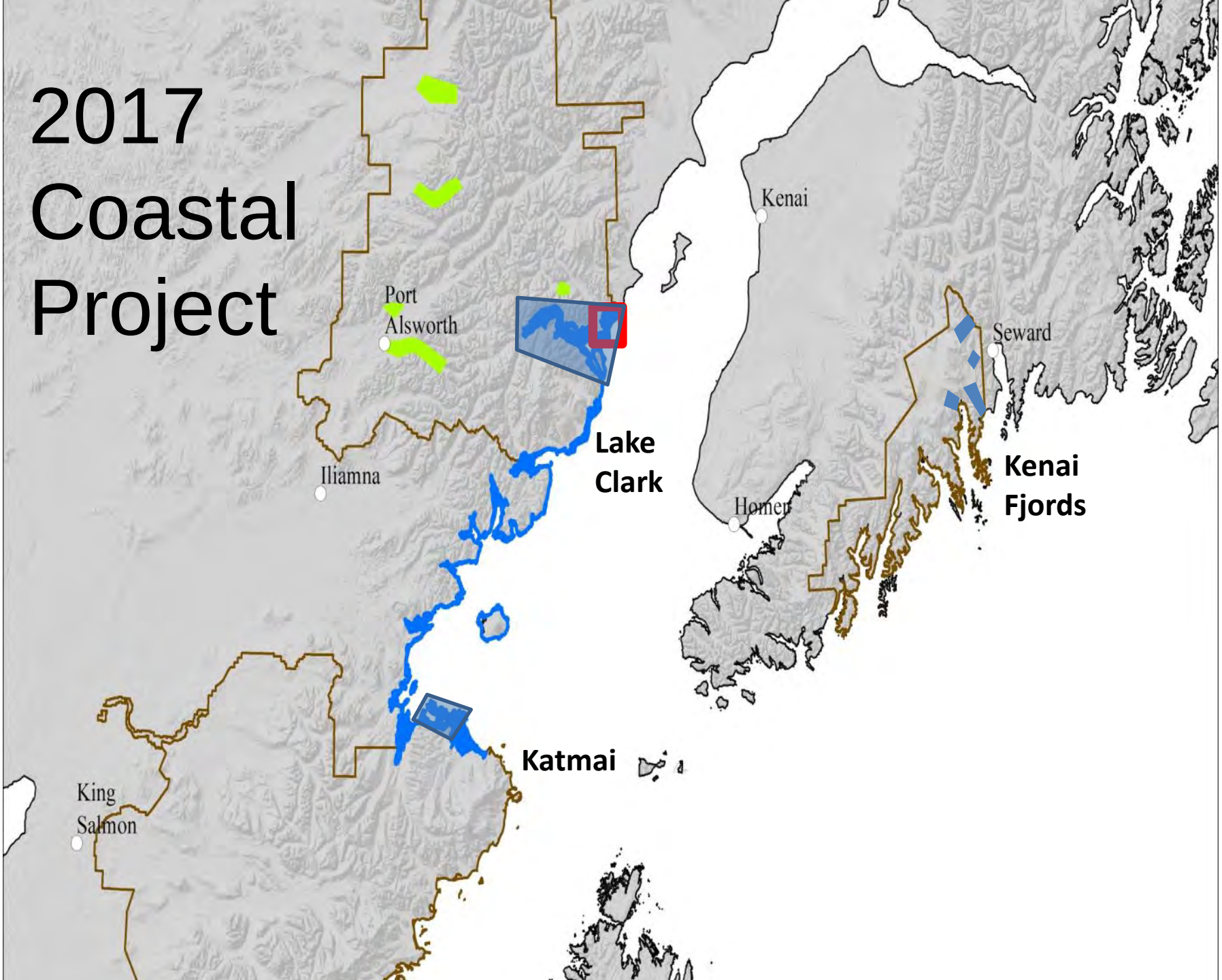
Kamishak Bay Rocky Reefs



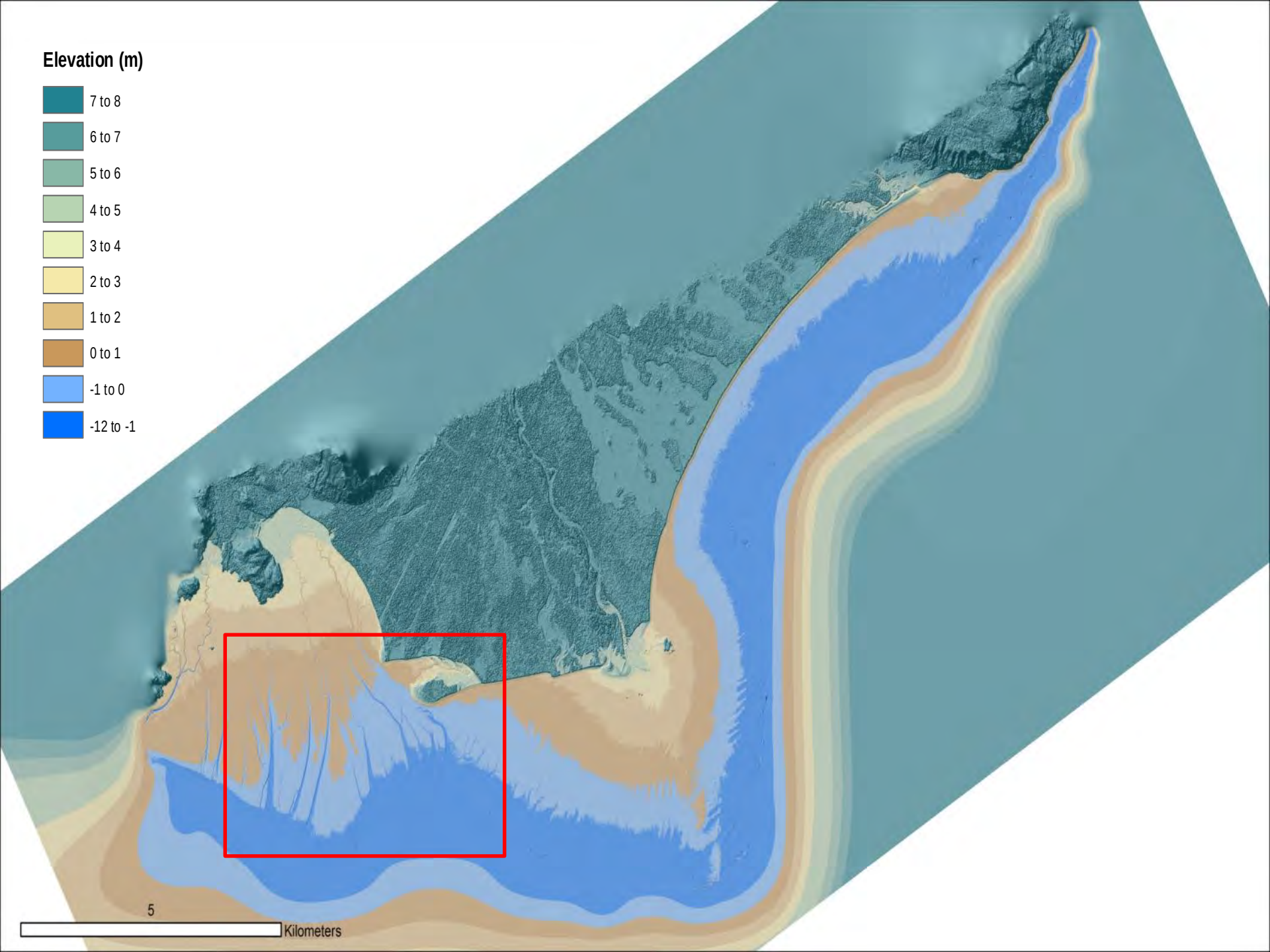


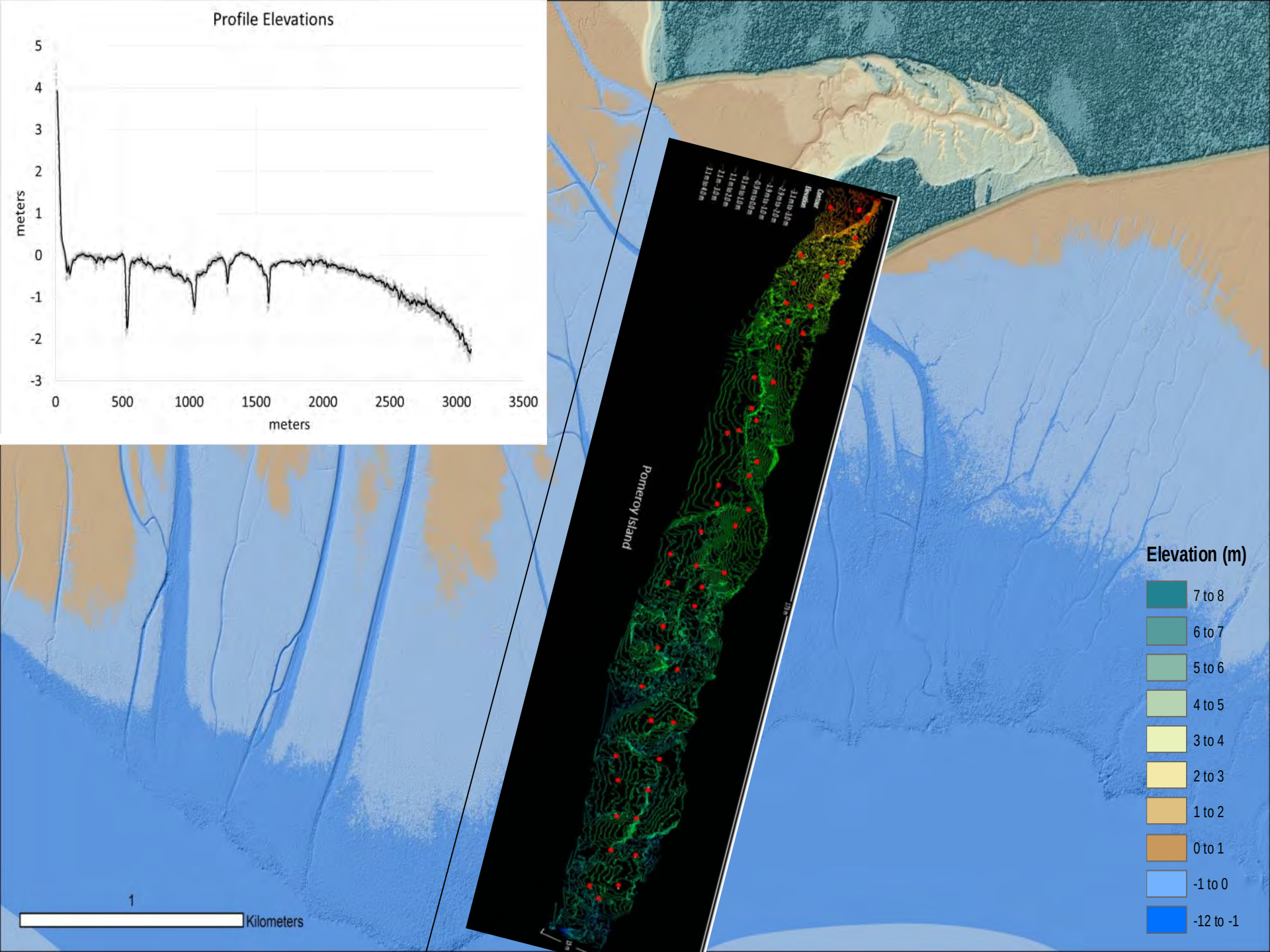

2017
J24
T3
P15

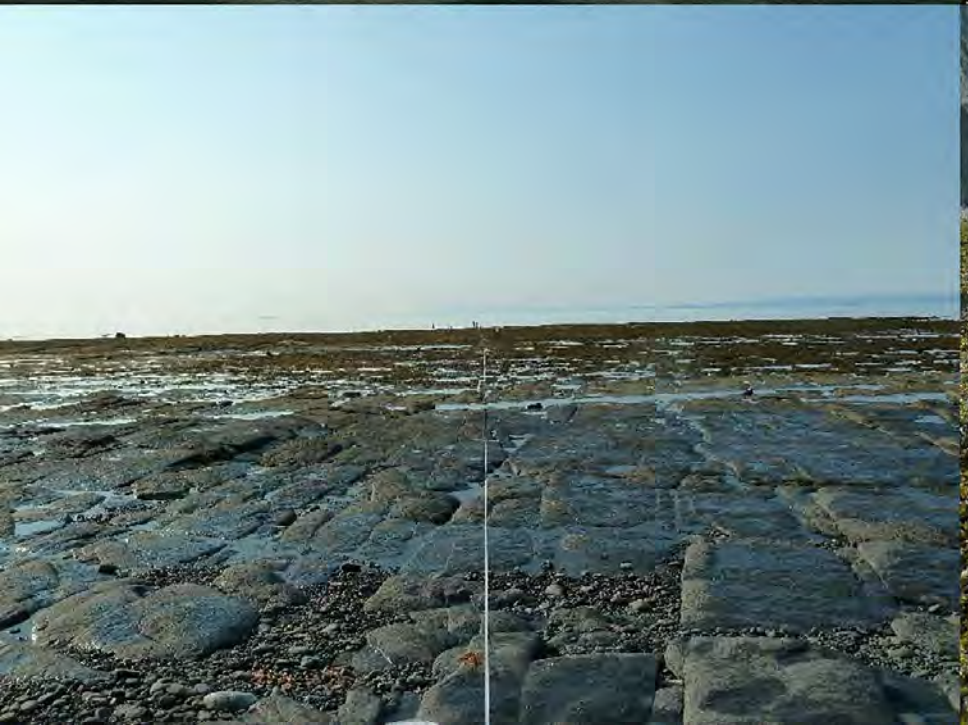

X
X
X

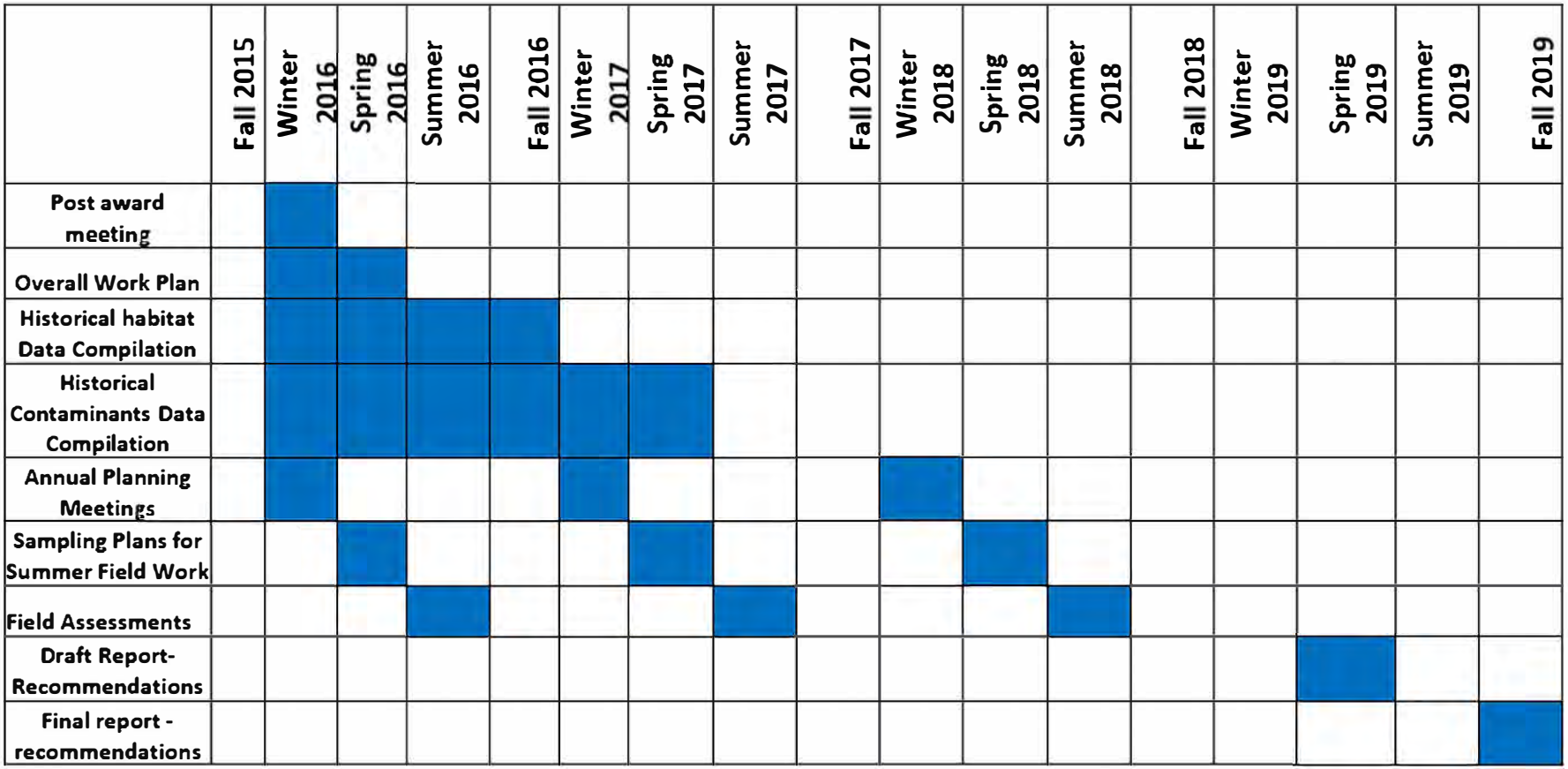

2017
Coastal
Project
Kenai
Port
Alsworth
Seward
Lake
Clark
Kenai
Fjords
Iliamna
Homer
Katmai
King
Salmon


5
Kilometers


Elevation (m)
7 to 8
6 to 7
5 to 6
4 to 5
3 to 4
2 to 3
1 to 2
0 to 1
-1 to 0
-12 to -1
5
Kilometers


Profile Elevations
meters
5
4
3
2
1
0
-1
-2
-3
0
500
1000
1500
2000
2500
3000
3500
meters
Pomeroy Island
Elevation (m)
7 to 8
6 to 7
5 to 6
4 to 5
3 to 4
2 to 3
1 to 2
0 to 1
-1 to 0
-12 to -1
1
Kilometers




Fall 2015
Winter 2016
Spring 2016
Summer 2016
Fall 2016
Winter 2017
Spring 2017
Summer 2017
Fall 2017
Winter 2018
Spring 2018
Summer 2018
Fall 2018
Winter 2019
Spring 2019
Summer 2019
Fall 2019
Post award meeting
Overall Work Plan
Historical habitat Data Compilation
Historical Contaminants Data Compilation
Annual Planning Meetings
Sampling Plans for Summer Field Work
Field Assessments
Draft Report- Recommendations
Final report - recommendations

saupe@circac.org