Monitoring of Seafood Processing Waste Disposal in Alaska, United States

Bridgette A. Lohrman
Ecologist
United States Environmental Protection Agency

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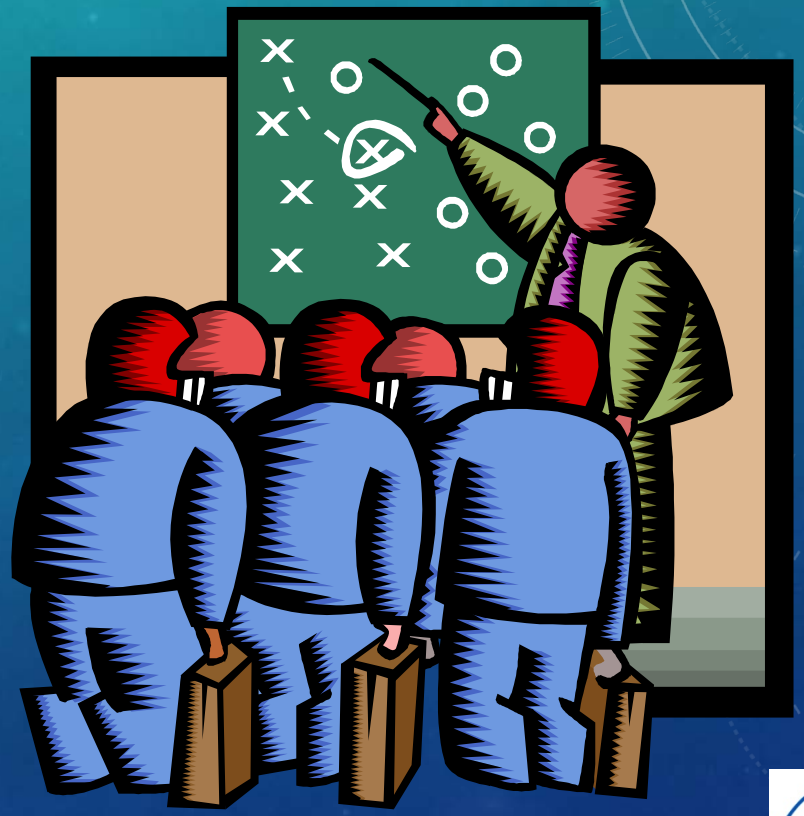
TODAY'S TALK

- Why did we monitor?
- Where did we monitor?
- How did we monitor?
- What did we find?
- Which methodology worked best?

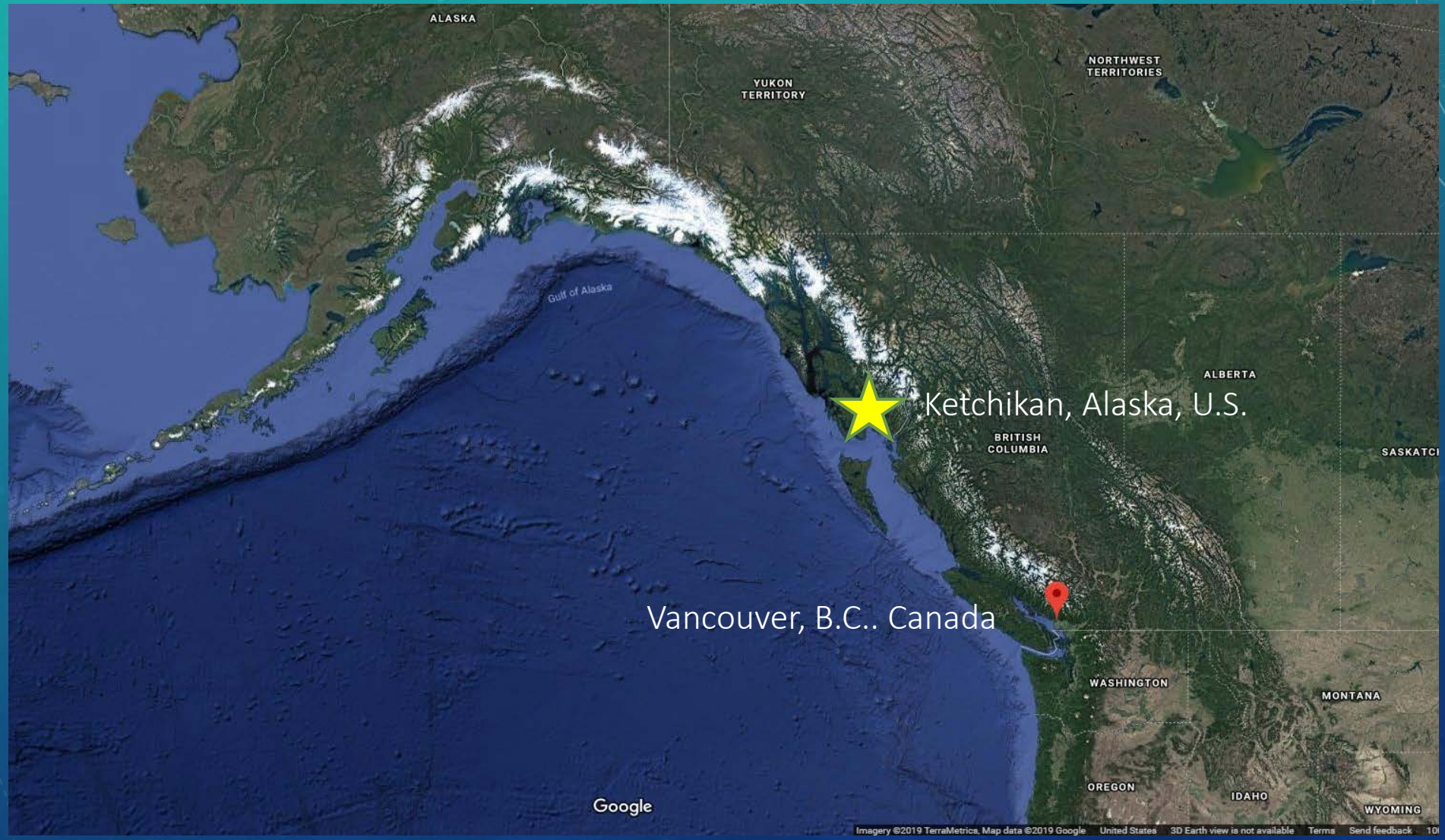


WHY DID WE MONITOR?

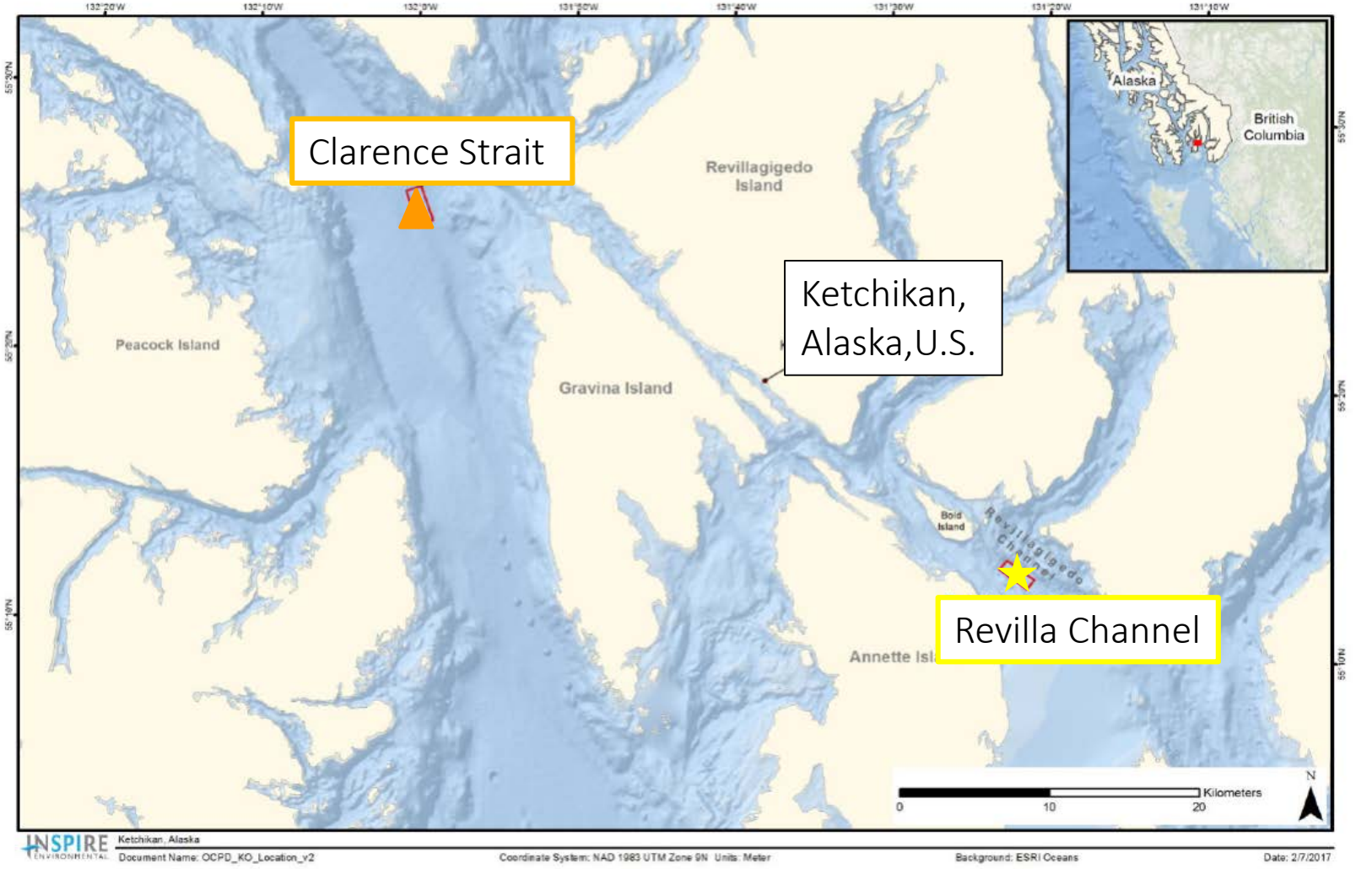
Assess potential effects on benthic environments from the disposal of organic and inorganic seafood waste.

- Characterize the physical, chemical, and biological characteristics of the seafloor;
- Identify and describe the type, composition, and quantity of seafood waste found on the seafloor.

WHERE DID WE MONITOR?



WHERE DID WE MONITOR?



★ = Revilla Channel

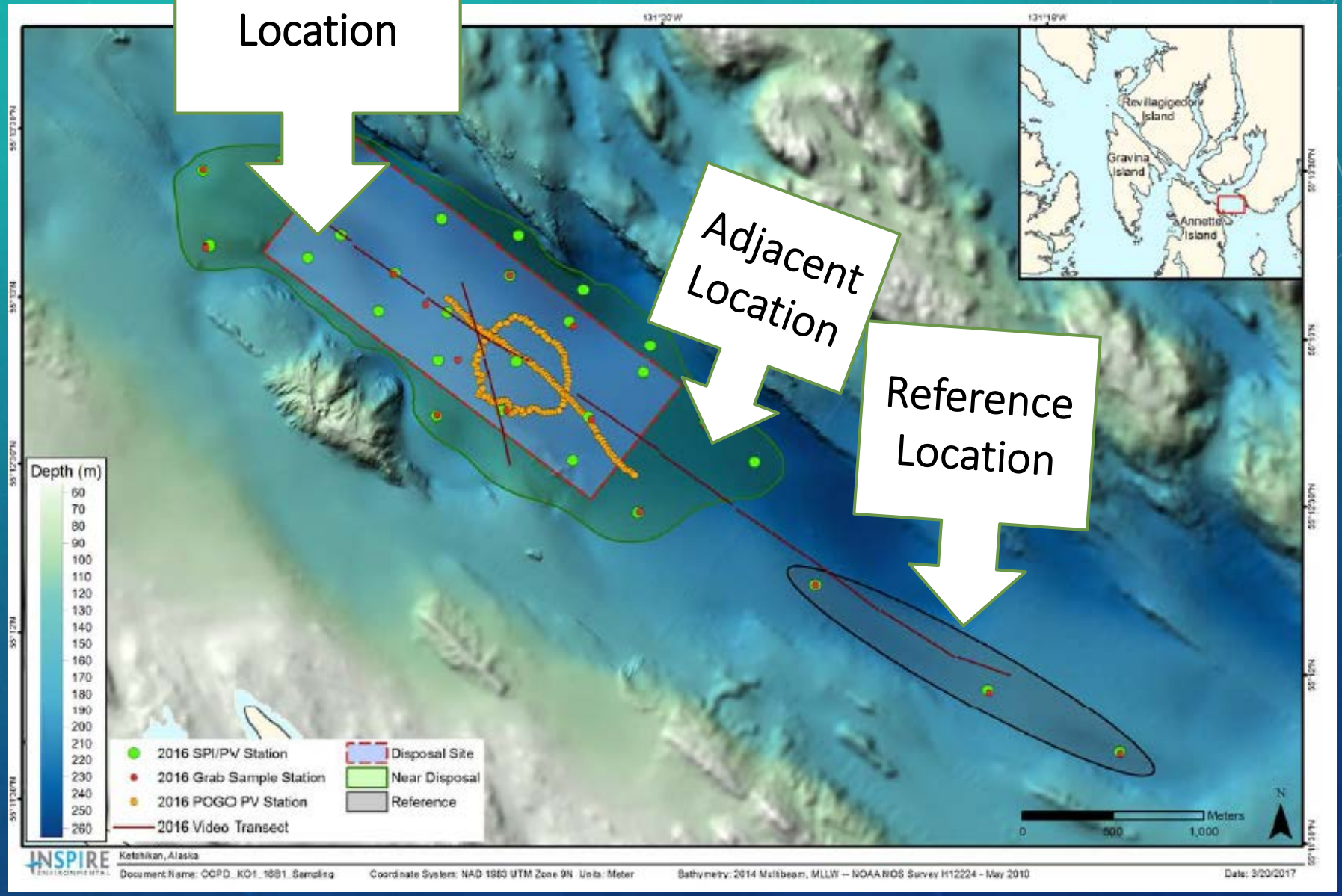
- 21 km SE of processing plant
- 220 m depth
- Used for disposal since 2003
  - 2014 – 36 trips, 14.6 million pounds (6600 tonnes)
  - 2015 – 27 trips, 4.4 million pounds (2000 tonnes)
  - 2016 - 32 trips, 8.7 million pounds (4000 tonnes)

▲ = Clarence Strait

- 24 km NE of processing plant
- 400 – 600 m depth
- Used for disposal since 2014
  - 2014 - 14 trips, 5.7 million pounds (2500 tonnes)
  - 2015 - 41 trips, 11.8 million pounds (5300 tonnes)
  - 2016 – 19 trips, 4.5 million pounds (2000 tonnes)

Seafood waste disposed June thru early October

SURVEY AREAS



METHODOLOGY

Double Van Veen Grab

- **Conventional**
  - Grain size
  - Total Organic Carbon
  - Ammonia
  - Total solids
  - Kjeldahl Nitrogen
- **Chemical**
  - Metals
  - PCBs
  - Pesticides
- **Infauna**
  - Abundance
  - Density
  - Species Richness
  - Shannon Diversity
  - Pielous' Evenness

METHODOLOGY

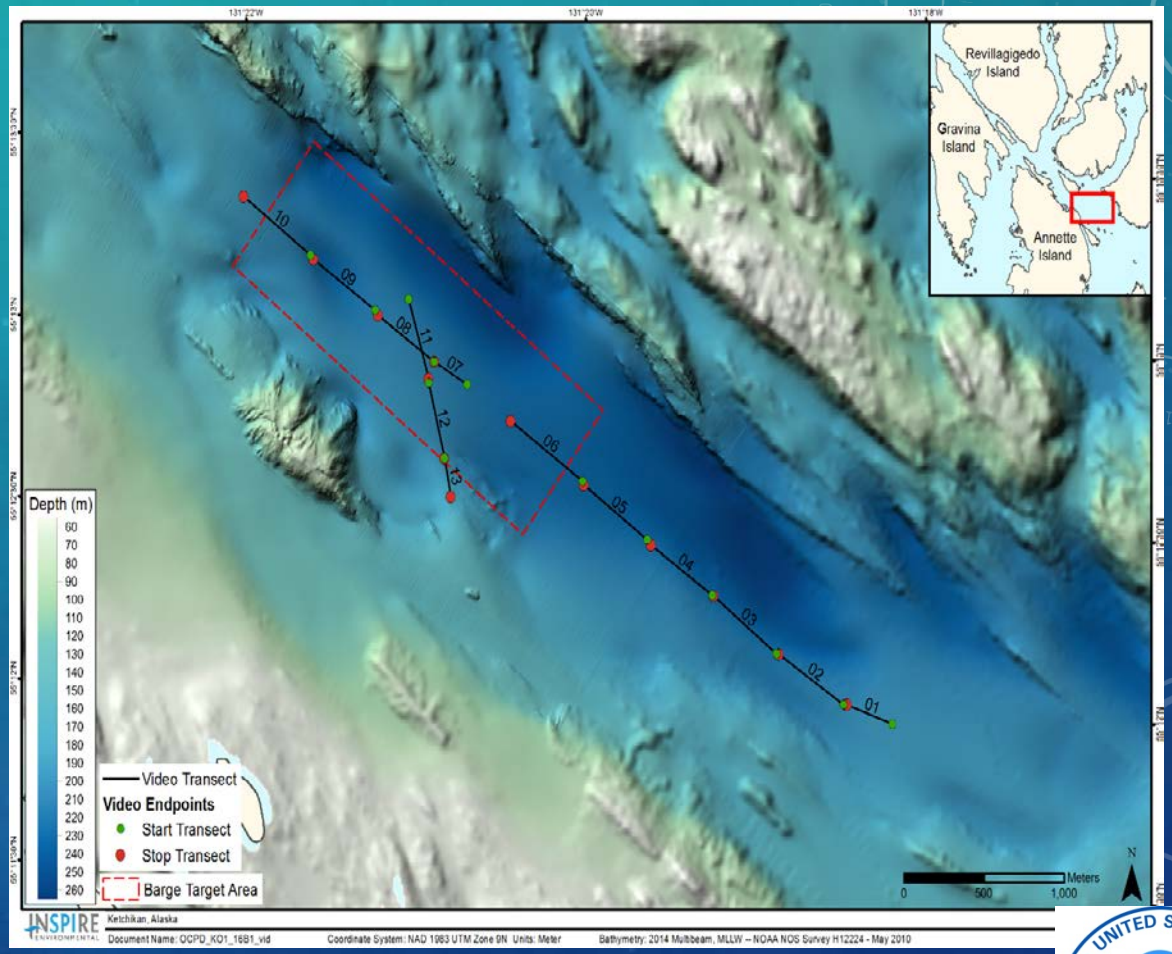
Sediment Profile (SPI) / Plan View Imagery (PVI) Camera

- Sediment type
- Prism Penetration depth
- Surface boundary roughness
- Mud clasts
- Apparent redox potential discontinuity depth
- Sediment methane
- Infaunal successional stage

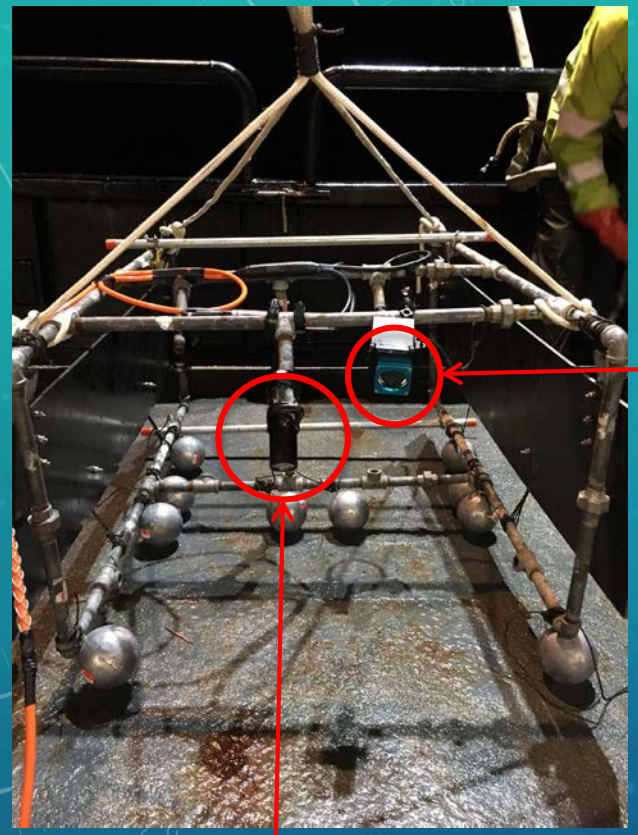
METHODOLOGY

Towed video sled

- Outland Camera
- GoPro HD camera

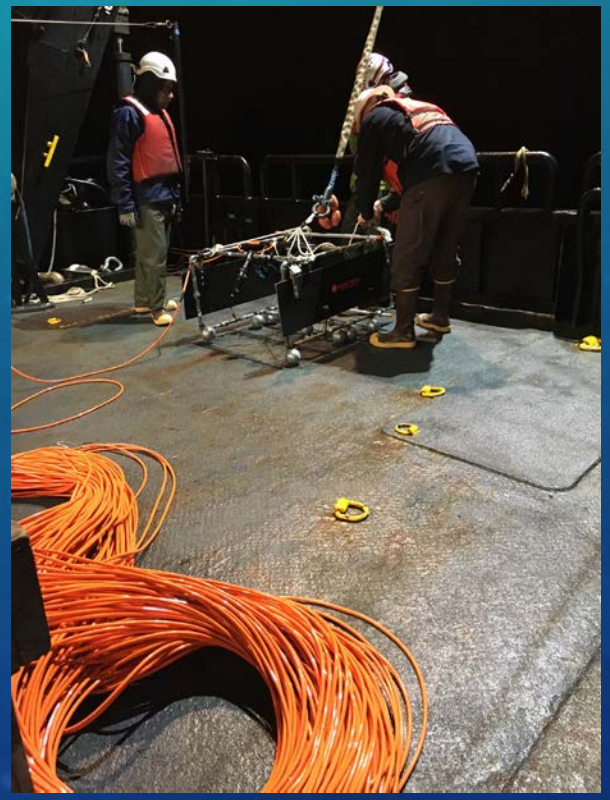


Video Camera Sled



GoPro Camera

Lower Resolution Camera
(w/ GPS, time stamp, depth)



SAMPLING DESIGN

	Revilla Channel				Clarence Strait		
	Disposal	Adjacent	Reference		Disposal	Adjacent	Reference
Sediment Grabs – Physical Analysis	8	6	3		11	6	5
Sediment Grabs -Chemical analysis	8	6	3		11	6	5
Sediment Grabs -Infaunal Analysis	8	6	3		11	6	5
Sediment Profile Imagery	15	10	3		16	31	7
Plan View Imagery	15	10	3		16	31	7
Plan View Imagery (Opportunistic))	163	0	0		0	0	0
GoPro Still Images	2,000 (150 images analyzed)				750 (150 images analyzed)		
Towed benthic video sled (Outland and GoPro Technology)	13				10		0

SELECTED RESULTS - SUBSTRATE

Sediment Profile Image

- Both Revilla and Clarence similar in grain size
- Disposal and Reference similar

- Fine silt and clay (91% - Revilla; 100% Clarence)
- Total Organic Carbon (4.3% Revilla; 2.7% Clarence)
  - sediment grabs
  - sediment profile imagery
  - plan view imagery
  - towed video
  - GoPro HD still images

Revilla – GoPro Still Image

SELECTED RESULTS - CHEMISTRY

- Sediment grabs

- All PCB analytes, all pesticides except 4,4'-DDE non-detected.

- Low levels of 4,4,' DDE and metals were found.
  - Revilla – Disposal Location higher in cadmium and zinc than Adjacent or Reference locations.
    - Cadmium (0.47, 0.38 mg/kg)
    - Zinc (88, 86, 85 mg/kg)
  - Clarence – Disposal Location higher in cadmium than Adjacent or Reference locations.
    - Cadmium (0.28, 0.26 mg/kg)

Revilla had higher levels than Clarence of: Cadmium, zinc, arsenic, copper, mercury, silver, ammonia, Total Kjedhal Nitrogen, Total Organic Carbon, Phosphorus.

SELECTED RESULTS – INFAUNA

Sediment Profile Imagery

- Infaunal successional stage = mature.
  - Stage 3 taxa at every station.
  - Large-bodied infauna, deep subsurface burrows, and/or deep feeding voids.
  - Stage 1 observed on top of Stage 3.
  - Stage 1 indicated by presence of very small tubes at the sediment/water interface; respond to perturbations rapidly.

- Oxygenated depth in sediment ranged from 2.1 cm at Disposal to 3.0 cm at Reference (Catastrophic stress = <1cm)

Sediment grabs

- Taxonomic identification to species
- Statistical comparison of community dynamics between 3 areas
- No significant differences found.

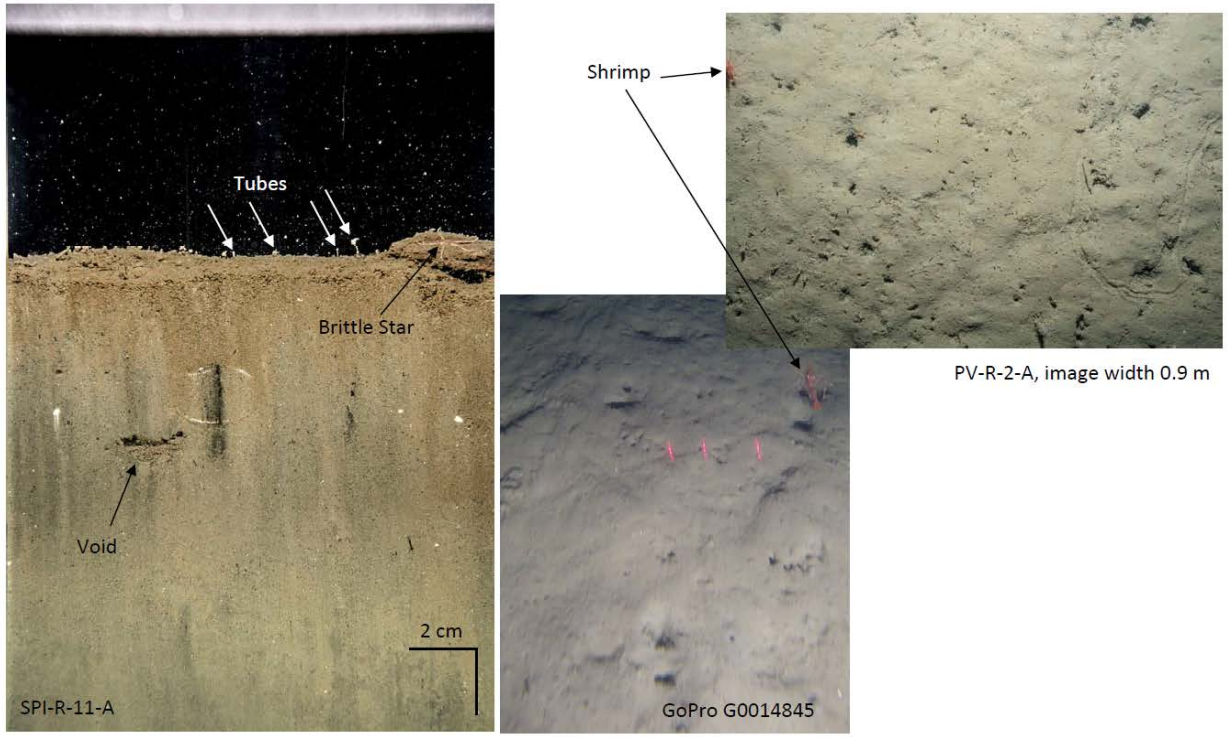


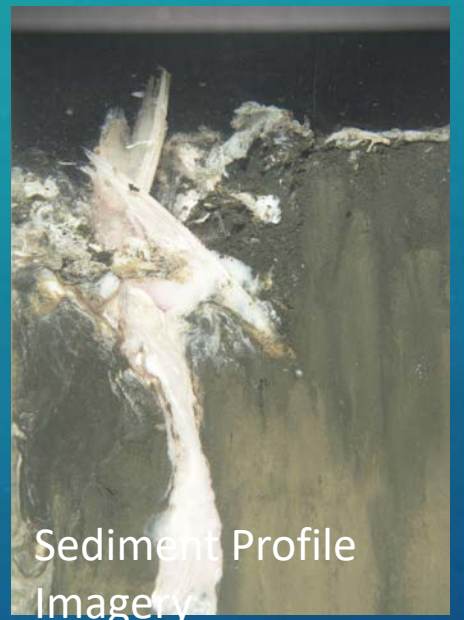
Figure 3-3. Representative SPI, PV and GoPro images showing typical soft sediment community at Revilla Channel. Evidence of burrowing fauna is apparent as burrow openings in PV and GoPro and as a sub-surface void in the profile image. Shrimp and brittle stars were commonly observed epifauna.

SELECTED RESULTS – SEAFOOD WASTE

- Only at Revilla Disposal Location.
- Observed through Sediment Profile Imagery, Plan View Imagery, towed video, still images, sediment grab
- Flesh, fish heads, bones, thiophilic bacterial mats.


Plan View Imagery R-10

Revilla –towed video still image


Sediment Profile Imagery

Sediment Grabs


Revilla – GoPro video still image

SELECTED RESULTS – EPIBENTHIC MACROFAUNA

- Video and Still images
- Family-type categories of organisms – benthic fish, pelagic fish, crabs, shrimp. Species identified when possible.
  - Spot prawns, flatfish, spiny dogfish shark, hermit crabs, tanner crab, spotted ratfish, anemone, squid
- Revilla – relationship with fish waste and organism abundance. Highest abundance at medium levels of fish waste.
- Clarence – No discernable relationship between thiophilic bacterial mats and epifaunal abundance. Potentially because very little fish waste on seafloor.
- Visibility – at times problematic from sled creating plume of silt/clay when hitting seabed.
- Quality – Outlander versus GoPro HD, speed of vessel, equipment malfunction (GoPro battery-life, camera sideways).

Revilla- Outlander Video Still Image

SELECTED RESULTS – SEAFOOD WASTE REVILLA CHANNEL DISPOSAL LOCATION VIDEO

WHICH METHODOLOGY TO USE?

THE ANSWER DEPENDS ON YOUR QUESTION

	Metrics Measured	Implementability	Cost	Precision	Organism Behavior	Clarity	Scale	Post-processing Time
Sediment grabs	Physical, chemical, infauna, seafood waste (4)	Equipment relatively easy to operate from various platforms. Difference sizes allow for handling flexibility.			No		Narrow	Low
Sediment Profile Imagery	Sediment type, prism penetration depth, surface boundary roughness, mud clasts, aRPD depth, sediment methane, infaunal successional stage, seafood waste (8)	Need trained technical crew members for deployment. Equipment is large in size. Special handling required.			No		Narrow	Medium
Plan View Imagery	Sediment type, sediment texture, thiophilic bacteria, anoxic sediments, seafood waste, epifauna (6)	Need trained technical crew members for deployment. Equipment is large in size. Special handling required.			No		Narrow	Medium
Video Imagery (Towed sled)	Substrate, epifauna, habitat, seafood waste, behavior (5)	Experience and familiarity with equipment needed. Range in size and type of equipment depending on needs.			Yes	Depends on quality of recording device.	Broad	High
Still images	Substrate, epifauna, habitat, seafood waste, bacterial mats (5)	Range in size and type of equipment depending on needs.			No	Depends on quality of recording device.	Broad	Medium

THANK YOU FOR LISTENING

AND

THANK YOU TO :
U.S. EPA STAFF AND INTERNS
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BRIDGETTE LOHRMAN

ECOLOGIST, OCEAN DUMPING COORDINATOR

OREGON, WASHINGTON, ALASKA – UNITED STATES

LOHRMAN.BRIDGETTE@EPA.GOV