

Monitoring of Seafood Processing Waste Disposal in Alaska, United States

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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?



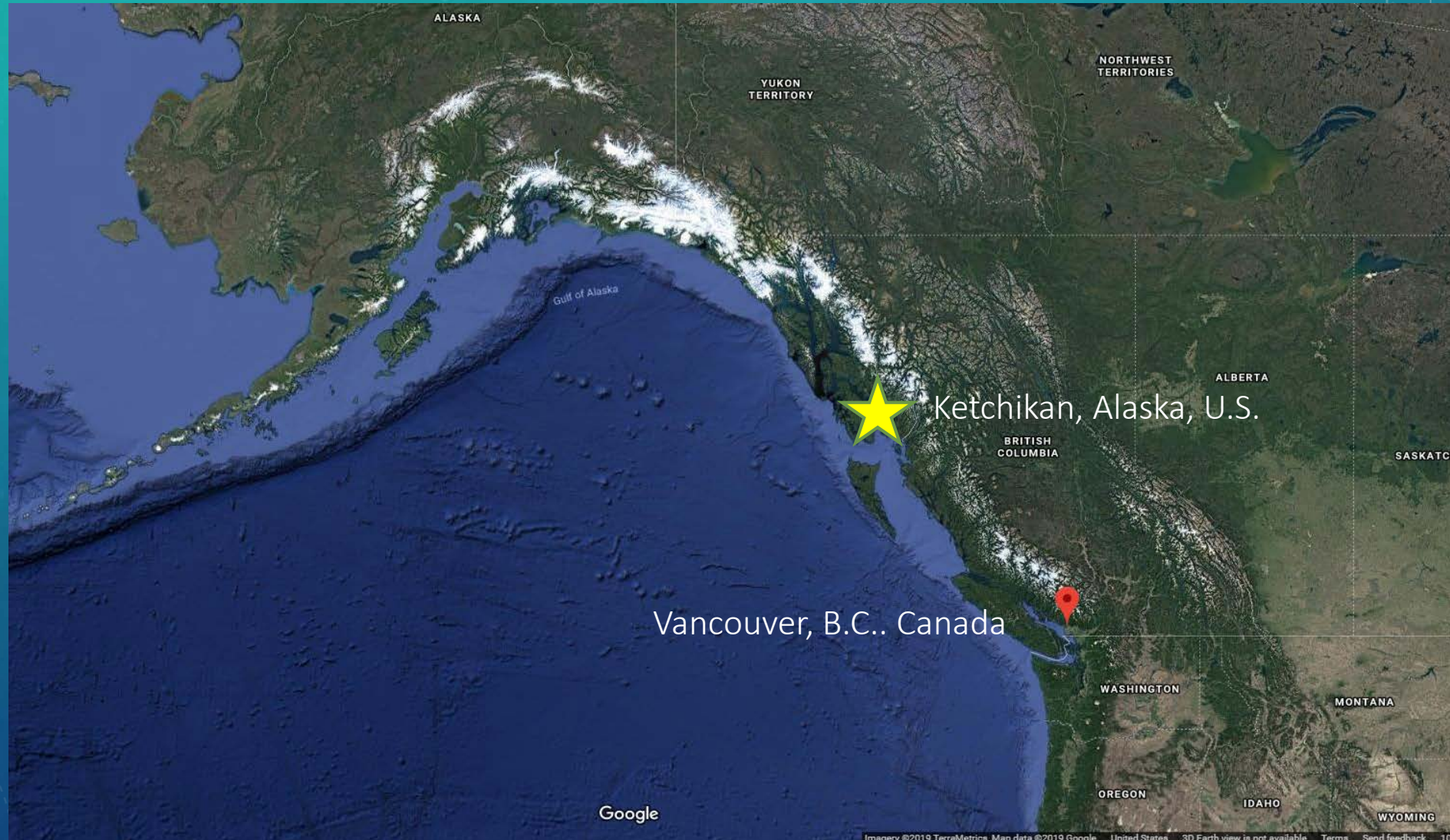
WHY DID WE MONITOR?

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

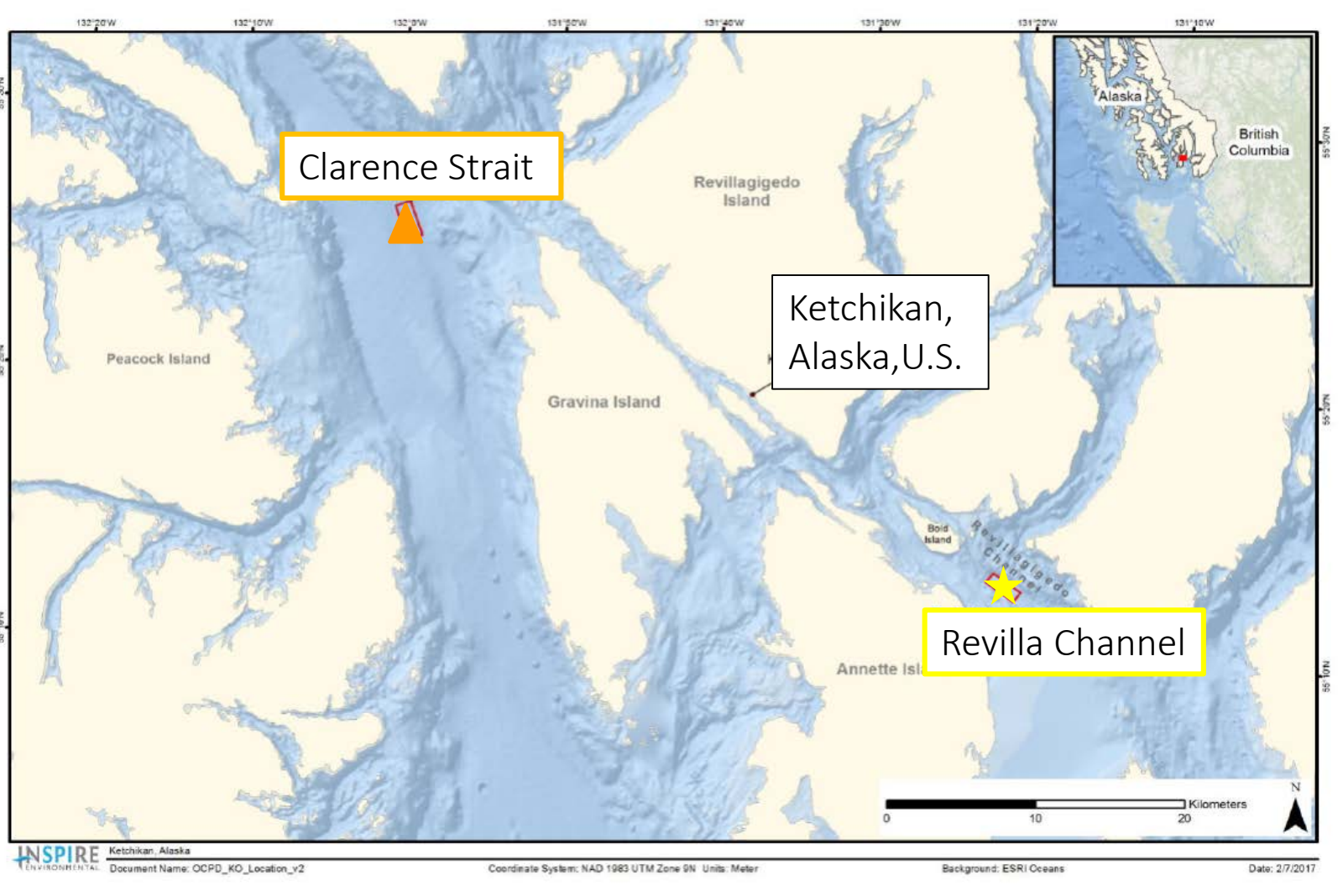
- Characterize the physical, chemical, and biological characteristics of the seafloor;
- Identify and describe the type, composition, and quantity of seafood waste found on the seafloor.



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)

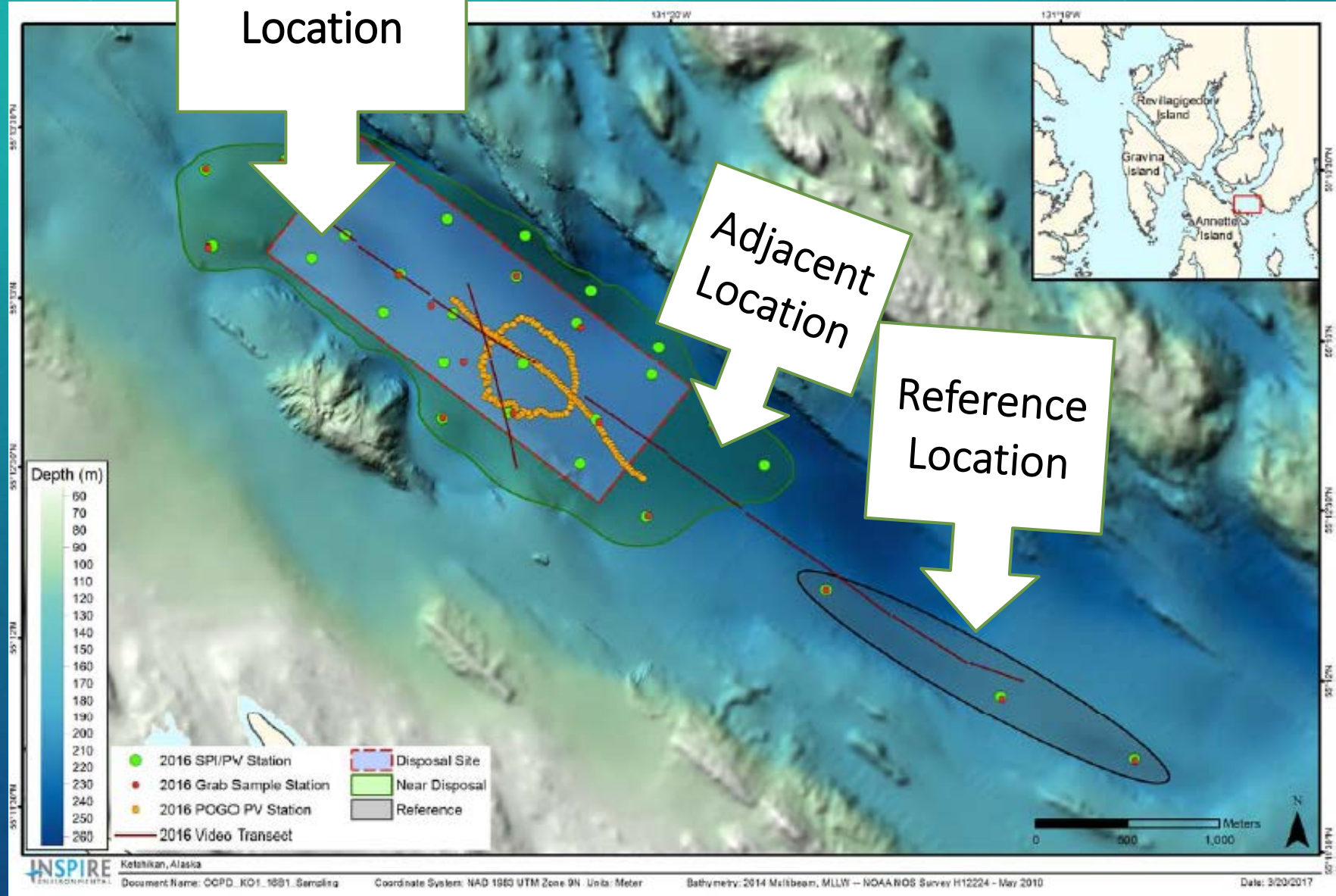
Seafood waste disposed June thru early October

SURVEY AREAS

Disposal
Location

Adjacent
Location

Reference
Location



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



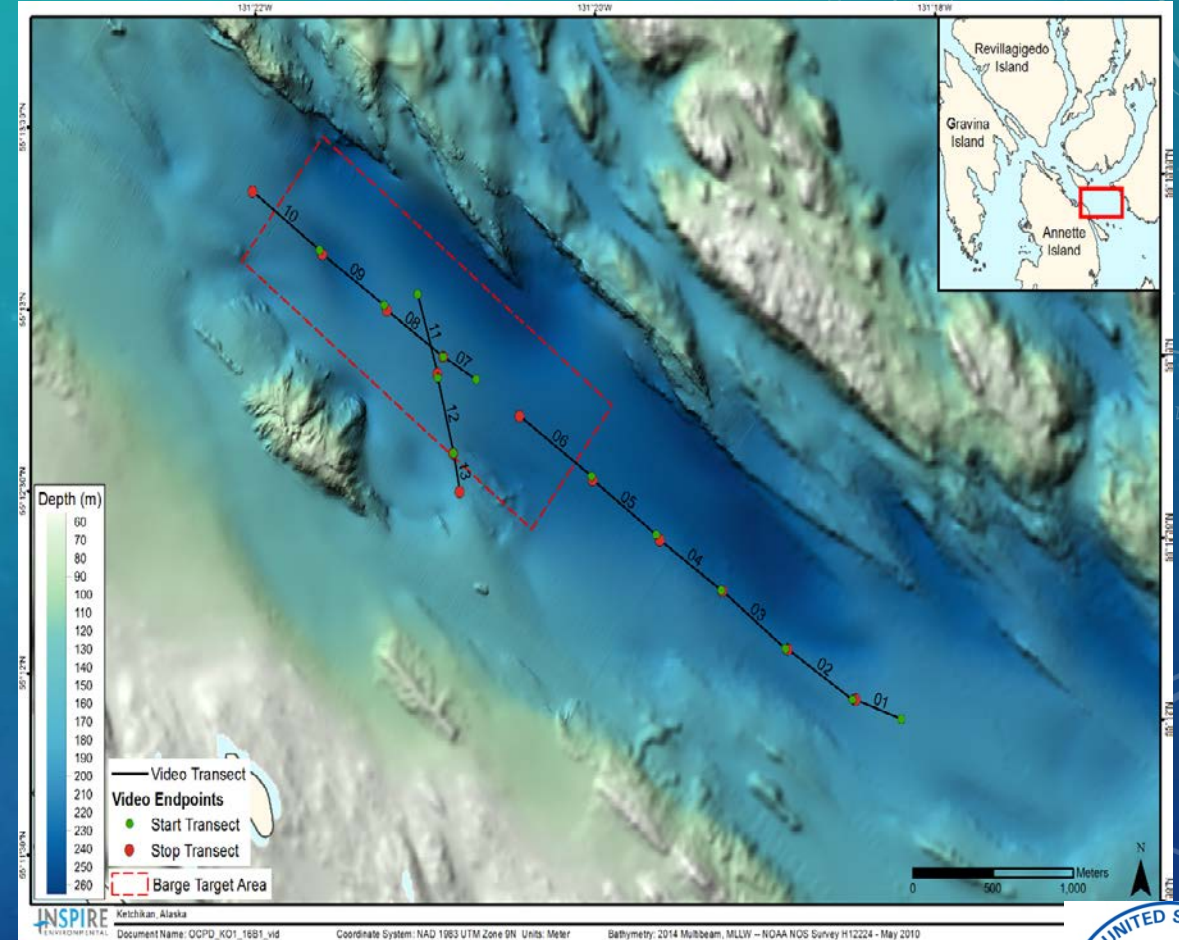
METHODOLOGY



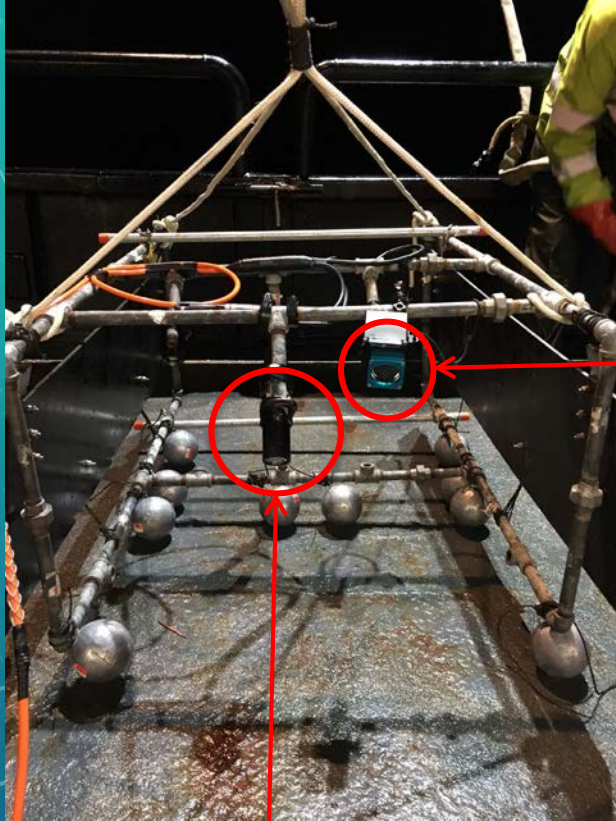
Outland
Camera

Towed video
sled

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		

SELECTED RESULTS - SUBSTRATE

- 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



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 Kjeldhal Nitrogen, Total Organic Carbon, Phosphorus.



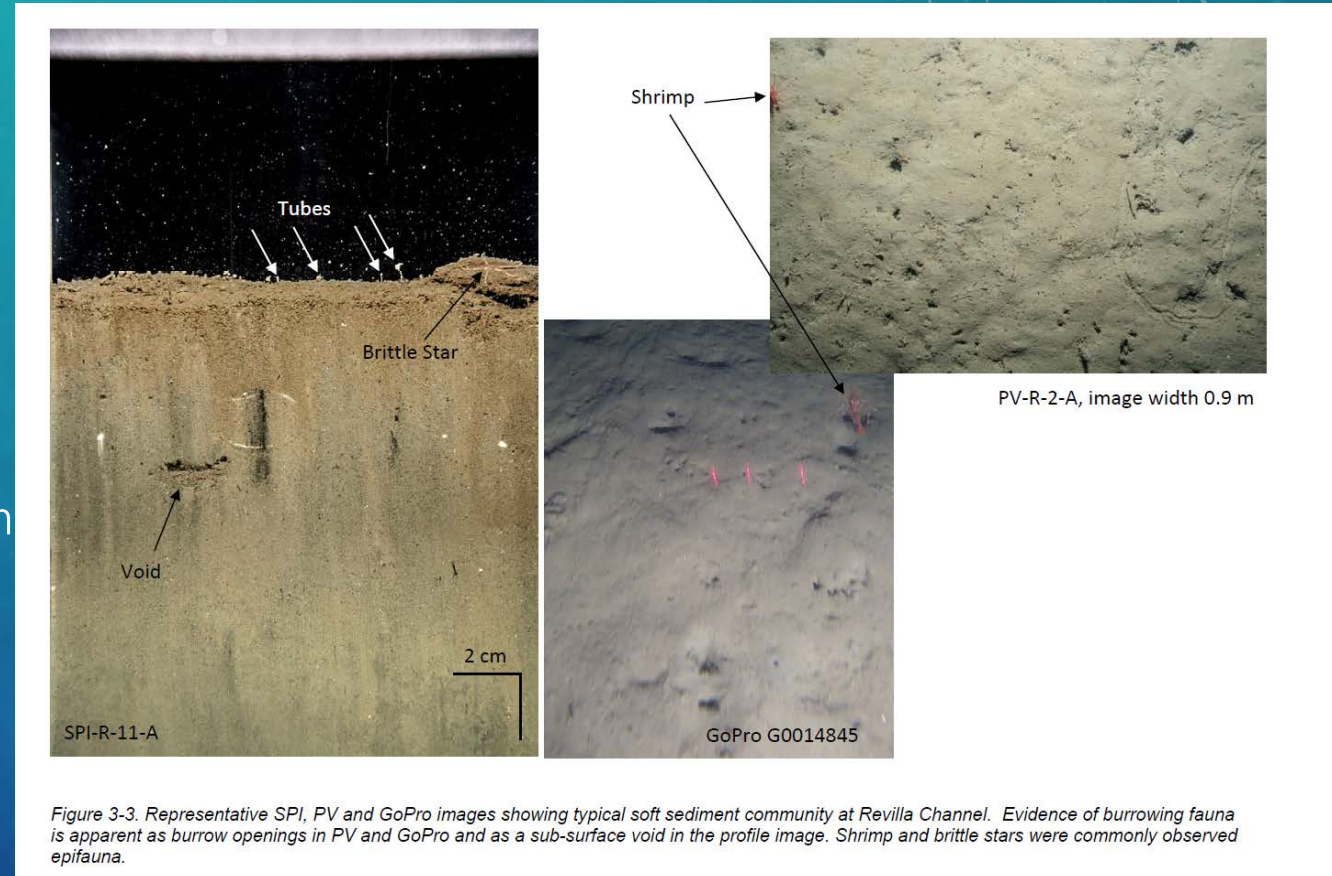
SELECTED RESULTS — INFAUNA

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)

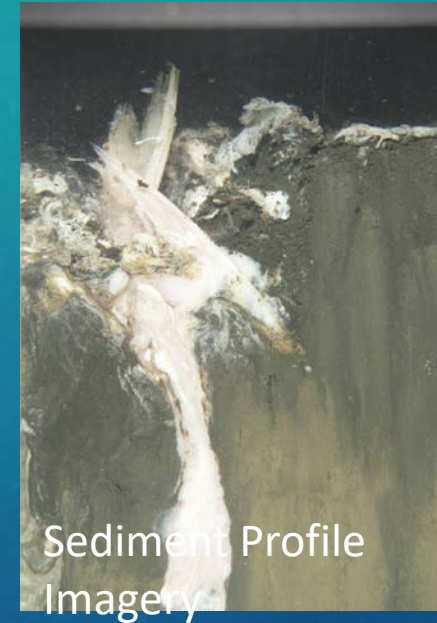
Sediment grabs

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



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.



Sediment Grabs



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

U.S. EPA CONTRACTORS:

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