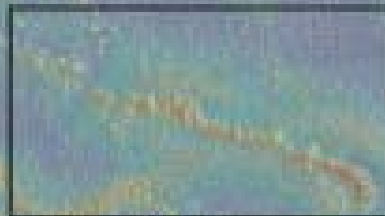


So Much Ocean, So Little Time: Optical Validation of Essential Fish Habitat in the Pacific Islands Region



**Northern
Mariana
Islands**



**Hawaiian
Archipelago**

Johnston Atoll

Kingman Reef

Palmyra Atoll

Jarvis Island

Howland Island

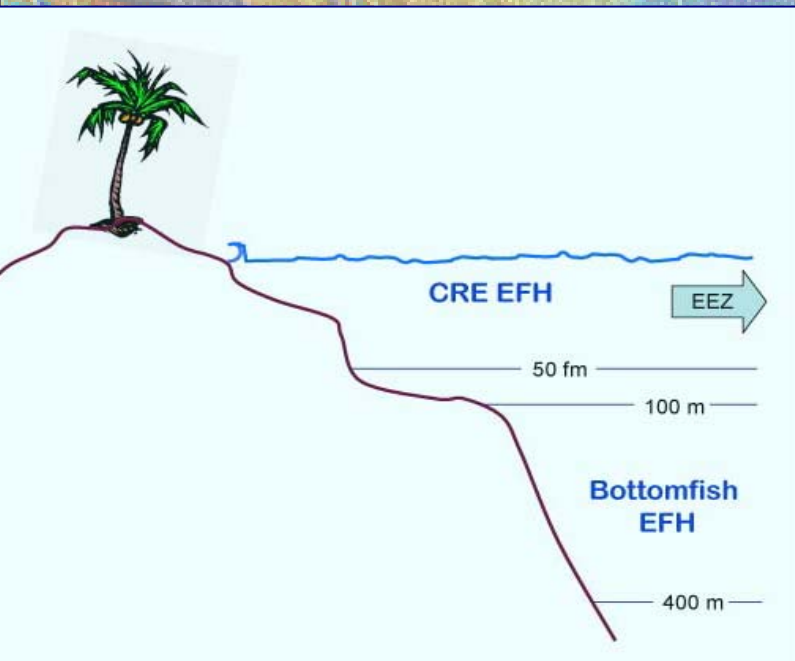
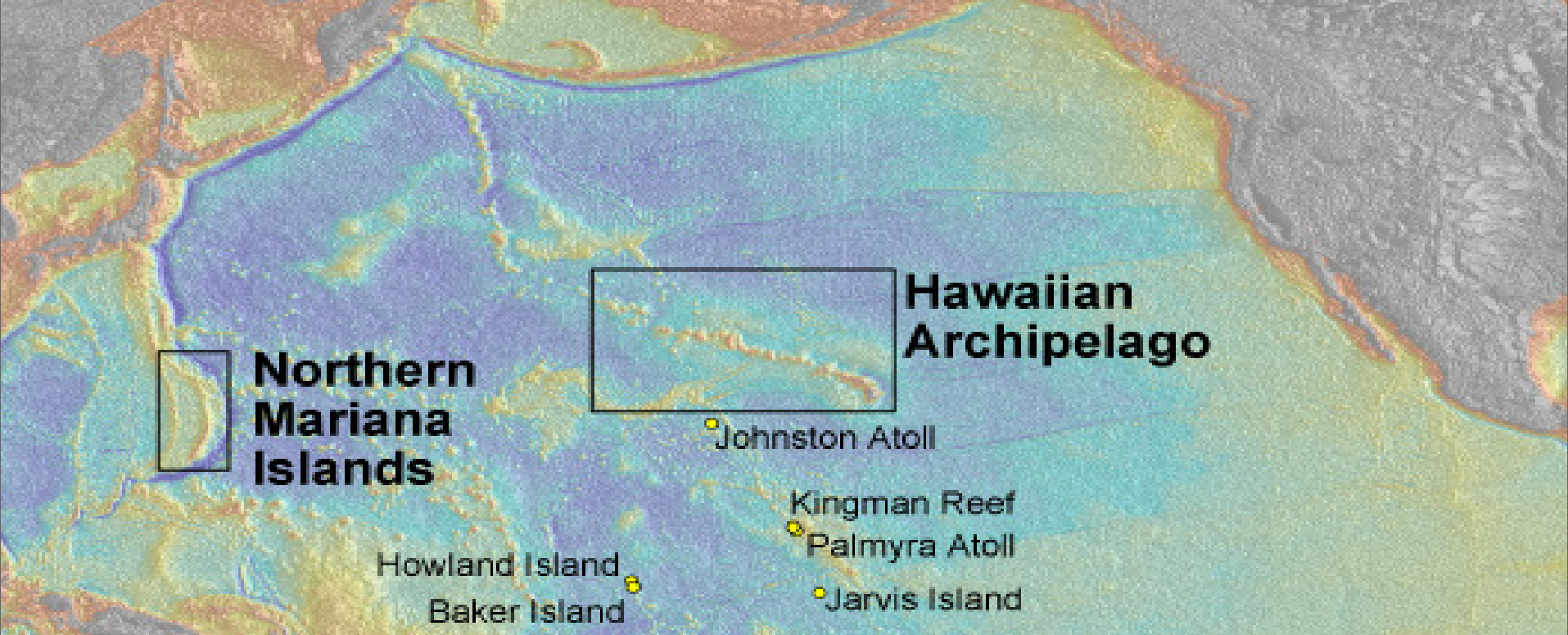
Baker Island



American Samoa

John Rooney


**Pacific Islands Fisheries Science Center &
Pacific Islands Benthic Habitat Mapping Center**



American Samoa

- CRE & Bottomfish FMPs
- large areas with very wide geographic distribution
- EFH definitions deliberately broad ⇒ inadequate protection





hab·i·tat *n.* The area or environment where an organism or ecological community normally lives or occurs: a marine habitat.
(Dictionary.com, 2006)

Species	Habitat
<i>Etelis coruscans</i> , longtail snapper, onaga (juvenile & adult)	Rocky bottoms offshore, 150 m – 450 m, with numerous of holes, near steep ledges and pinnacles; distribution positively correlates with high water motion and prey fish <i>Symphysanodon maunaloae</i> (Westpac BF FMP, 2006)
<i>Pristipmoides filamentosus</i> , pink snapper, opakapaka (juveniles)	Expanses of uniform sediment clear of higher relief features, 60 m - 90 m, and close to focused sources of coastal drainage (Parrish et al., 1996)
Hawaiian coral reef fish assemblages	Areas of high topographic complexity, close to reef edges, with holes in the substratum (Friedlander and Parrish, 1998)
<i>Priacanthus cruentatus</i> , red bigeye, aweoweo	Reefs, bays and harbors under rocks and corals (daylight); offshore high in the water column (night time) (Uchida and Uchiyama, 1986)
<i>Parupeneus multifaciatus</i> , banded goatfish, moano	Reef and sand pockets, 1 m – 77 m (Uchida and Uchiyama, 1986)
<i>Monachus schauinslandi</i> , Hawaiian monk seal	Transition regions between areas of consolidated reef and sand substrates, characterized by low relief and the presence of rubble (Parrish et al., 2000)
<i>Panulirus marginatus</i> , spiny lobster, ula	Intermediate (5 cm – 30 cm) relief substrates, 1 m – 30 m, with holes where they take shelter during daylight hours (Hobson and Chave, 1990; Parrish and Polovina, 1994)

1. Spatial management of LMRs requires at least this much level of detail.
2. Ecosystem management requires more data than can be shown on a traditional map.

R/V AHI



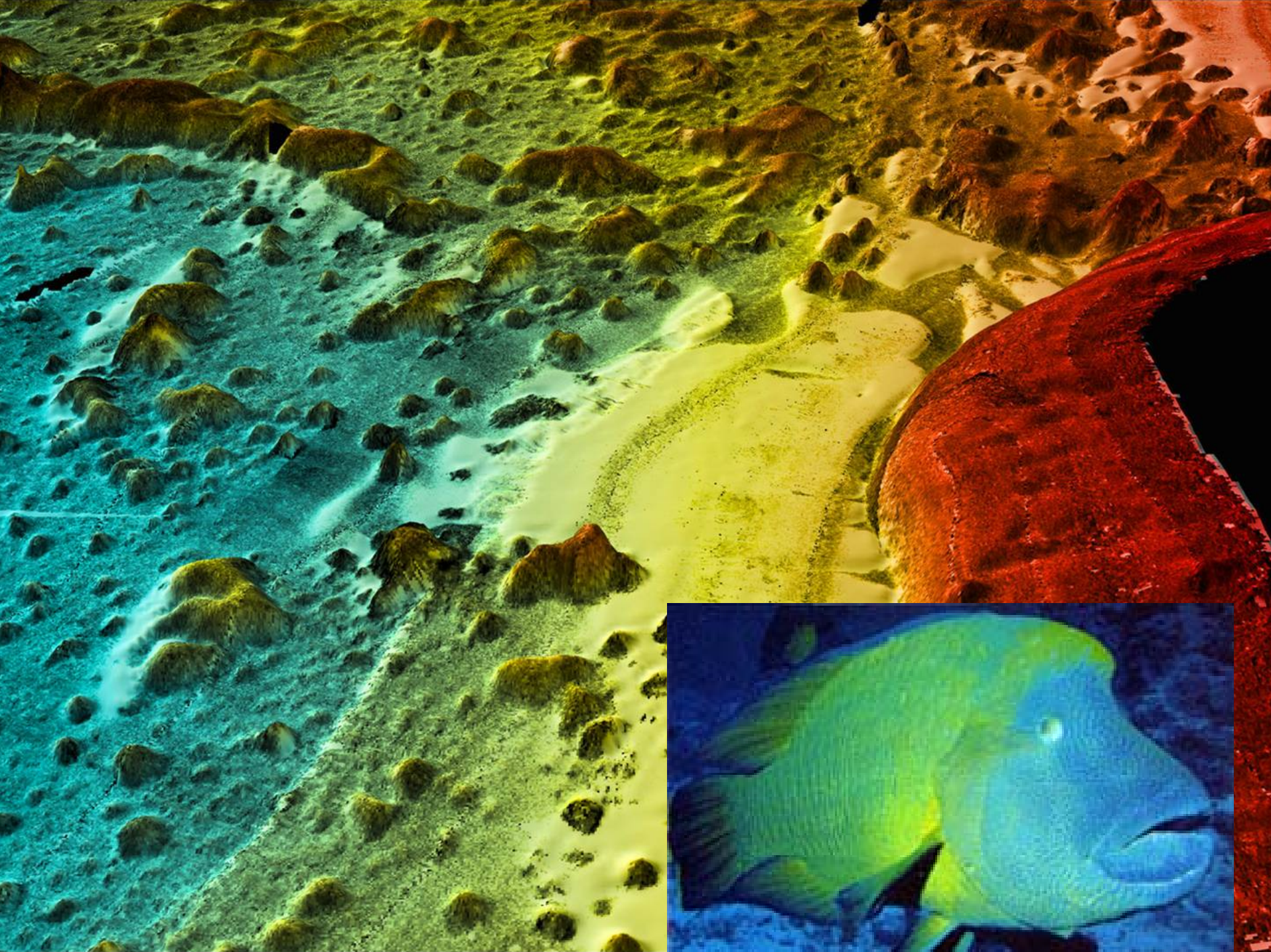
240 kHz
Reson 8101ER
250 m range
101 beams

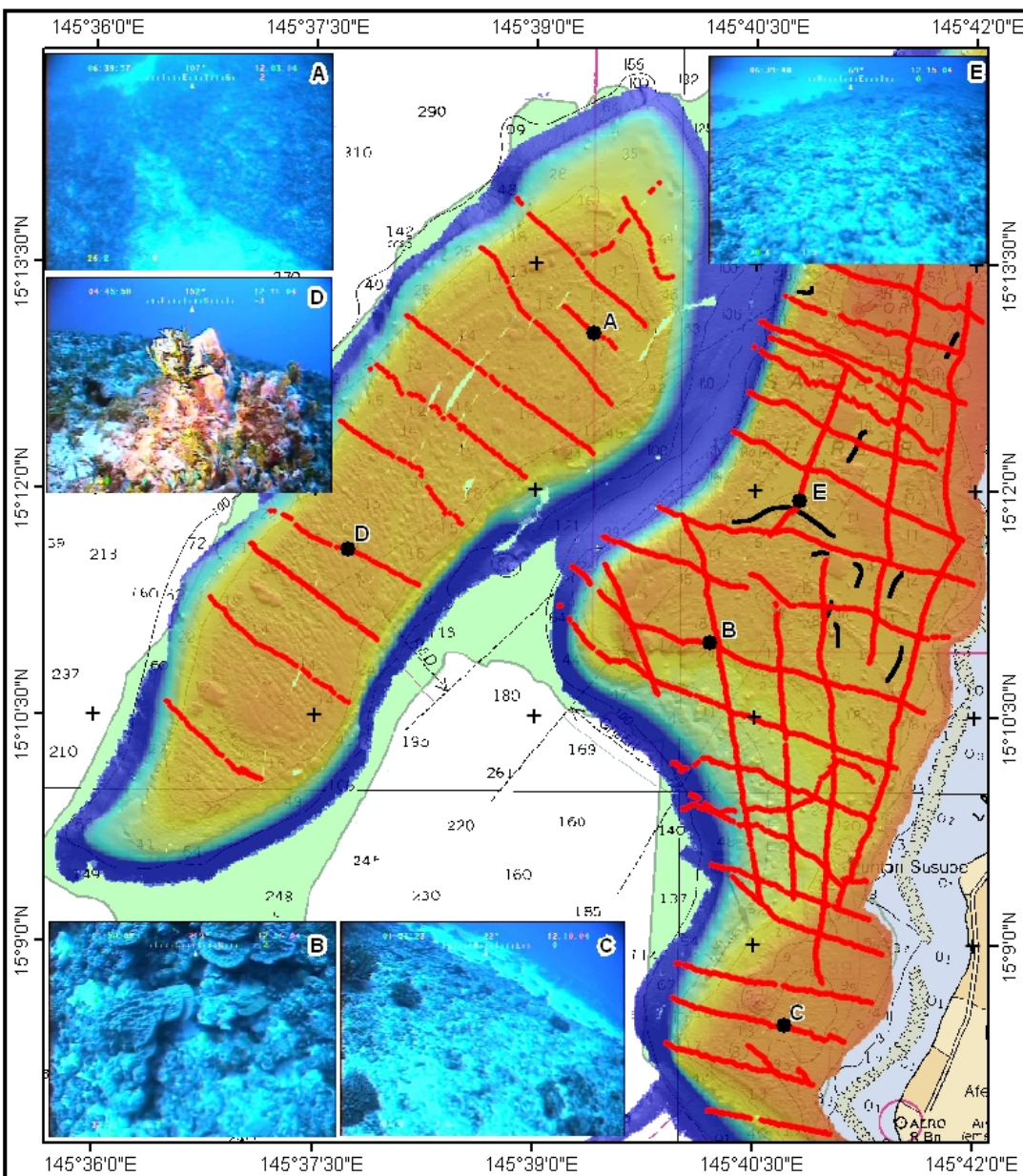
NOAA Ship Hī'ialakai






300 kHz
EM3002D
150 m range
"soundings"

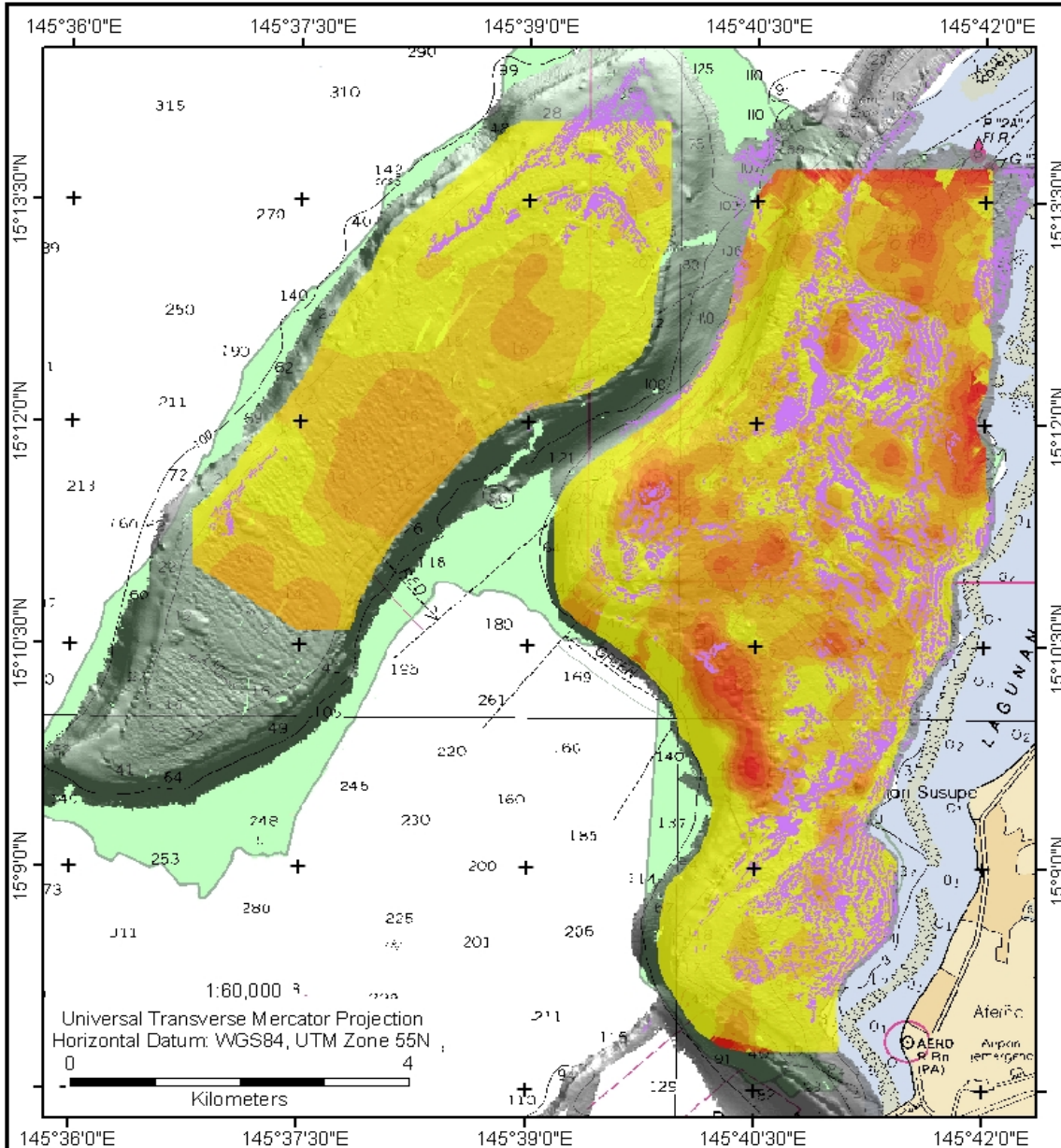
30 kHz
EM300
5000 m range
135 beams





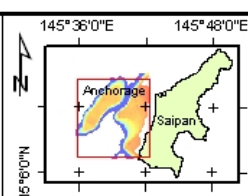
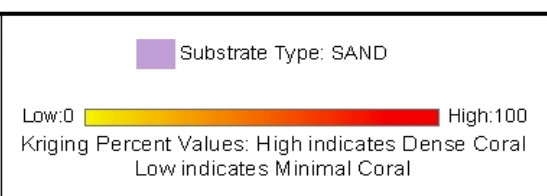
- Garapan Anchorage – expanding usage, need to avoid coral-rich areas
- 5 m bathy, camera sled tracks, framegrabs
- Contract ⇨ 2 sleds, 3 weeks fieldwork, 130 km
- optical imagery – few % of seafloor
- 100% coverage – very limited

<p>Saipan Towed Video Frame Grabs</p> <p>— 2003 Video Tracks — 2004 Video Tracks</p> <p>SURVEY DATES BATHYMETRY: 08/03 - 09/03 VIDEO: 08/03 - 09/03, 12/04</p> 	<p>Not for navigation or distribution</p> 	<p>UNIVERSAL TRANSVERSE MERCATOR PROJECTION UTM ZONE 55N, WGS84 NAUTICAL CHART SOUNDINGS IN FATHOMS 1:60,000</p> <p>0 3 Kilometers</p> <p>High: 3 Low: 300 Depth in MBSL</p>	<p>145°36'0"E 145°48'0"E</p> <p>15°9'0"N 15°13'30"N</p> <p>LOCATION MAP</p> 
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Saipan Interpolated Living Cover of Corals & Other Benthic Fauna with Sand Basins

Not for navigation or distribution



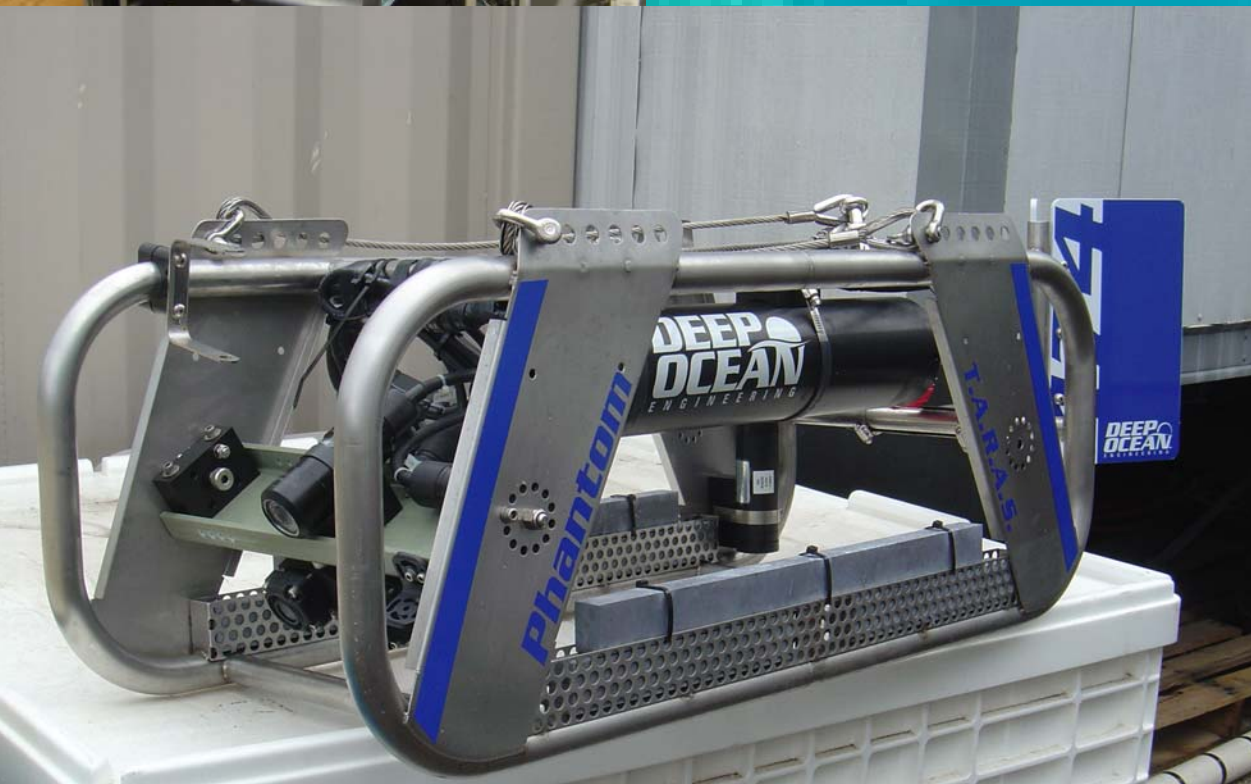
- initial assumption
- point count every 20 m, substrate type & living cover
- ↑ spatial heterogeneity; ↓ regional consistency
- interpolation techniques; ordinary kriging
- interpolation problems: E.g., data dependence, “bleeding”
- sand masking; LFH + hydrological modeling utilities



- **Minibat towed; Guildline Inc.**
- **Camera sleds – optical “workhorse”**
- **limited areal coverage**
- **optical mapping goals ⇒ technological evolution**
- **reinventing the wheel; collaboration**



- TARAS Sled system
- 220/440 VAC winch & remote control
- 2 video feeds
- HMI Gas discharge light





- 200 m, surface video feed, surface power supply, rugged

- progressive scan video camera, housing, surface feed

- digital still camera, adaptable housing (OIS DSC6000), lights

- information /collaboration?

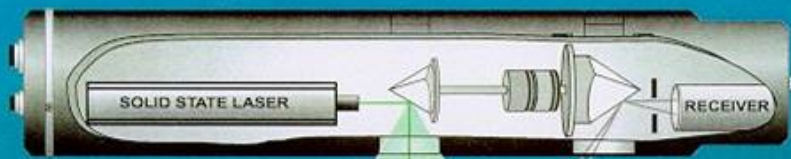
habitat utilization

- only diver-based
- behavioral modifications
- limited areal and temporal coverage
- only data available
- advice?

08-31-03

10:00:47

LASER LINE SCANNER CONCEPT



Rotating Mirror Deflects Blue-Green Laser Light Through a 70° Sector of the Object Plane

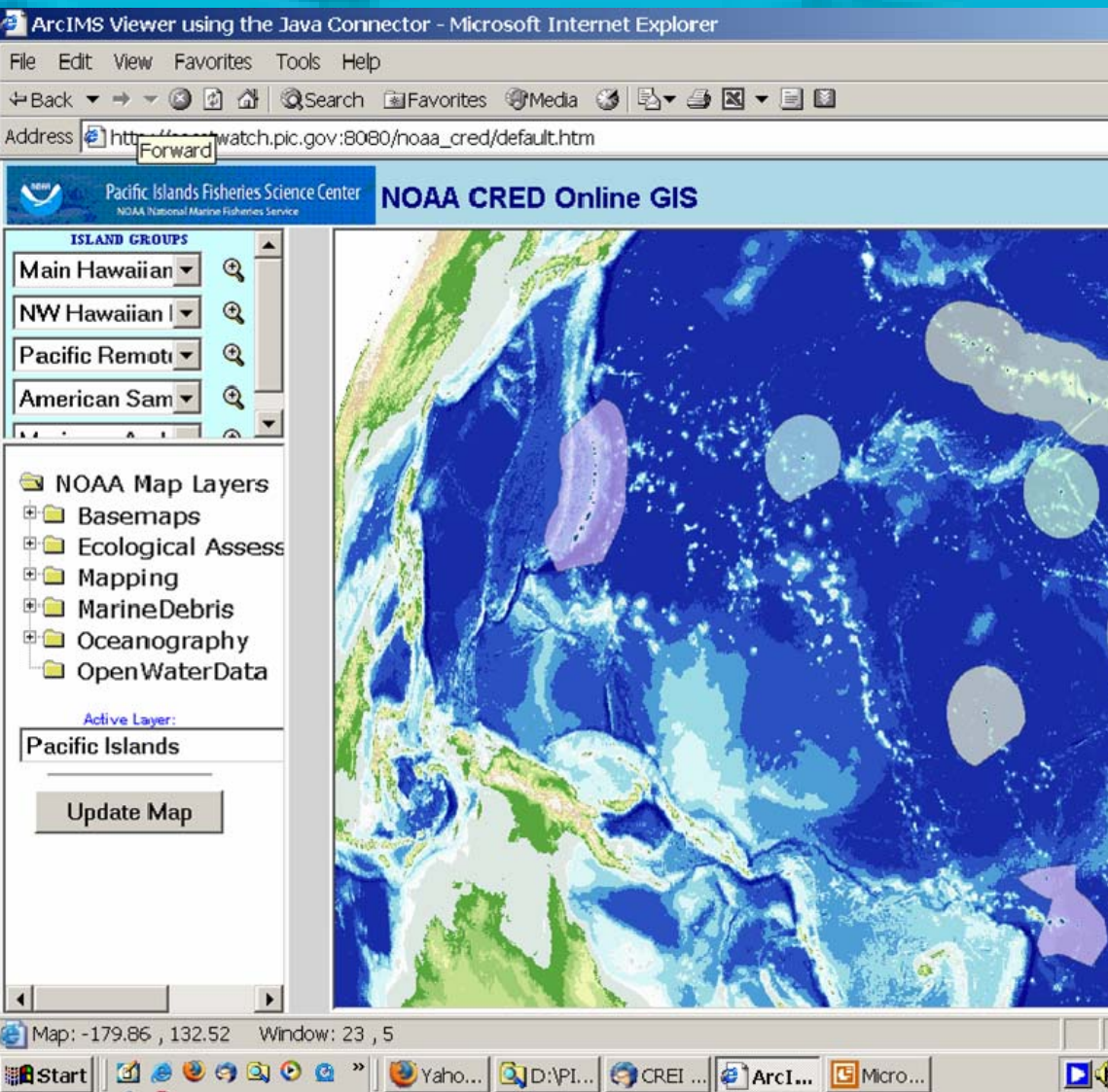
Synchronized Detector Optics Track a Single Point of Illumination, Minimizing the Effect of Backscatter in the Water Column.

70°

- rotating blue-green laser “scans” a narrow swath of seafloor
- wide swath width, high resolution, high altitude
- images demersal populations, apparently without affecting behavior
- still only able to image a small percentage of seafloor

Altitude (m)	Swath Width (m)	Pixel Size (cm)
30	43	4.2
15	22	2.1
5	7	0.7





Data Presentation & Analysis

- BH data required to support effective spatial management >> data that can be displayed in any single map
- printed map products limited ability, expensive, hard to update & distribute
- GIS-type layered map product
- technologically-challenged users
- Oracle database – ArcIMS map server

Workshop Goals:

- **Specific information on :**
 - a. still and video camera systems \Rightarrow improve optical image quality
 - b. streamline data collection \Rightarrow presentation pipeline
 - c. Classification of benthic habitat using multiple data sets
 - d. analysis and display of habitat utilization information, especially the temporal component
- **Initiate collaborations:**
 - a. any of the above
 - b. use of AUVs for benthic habitat mapping



- technological... progress? WOG, TOAD, Ghetto Frog

03:34:38

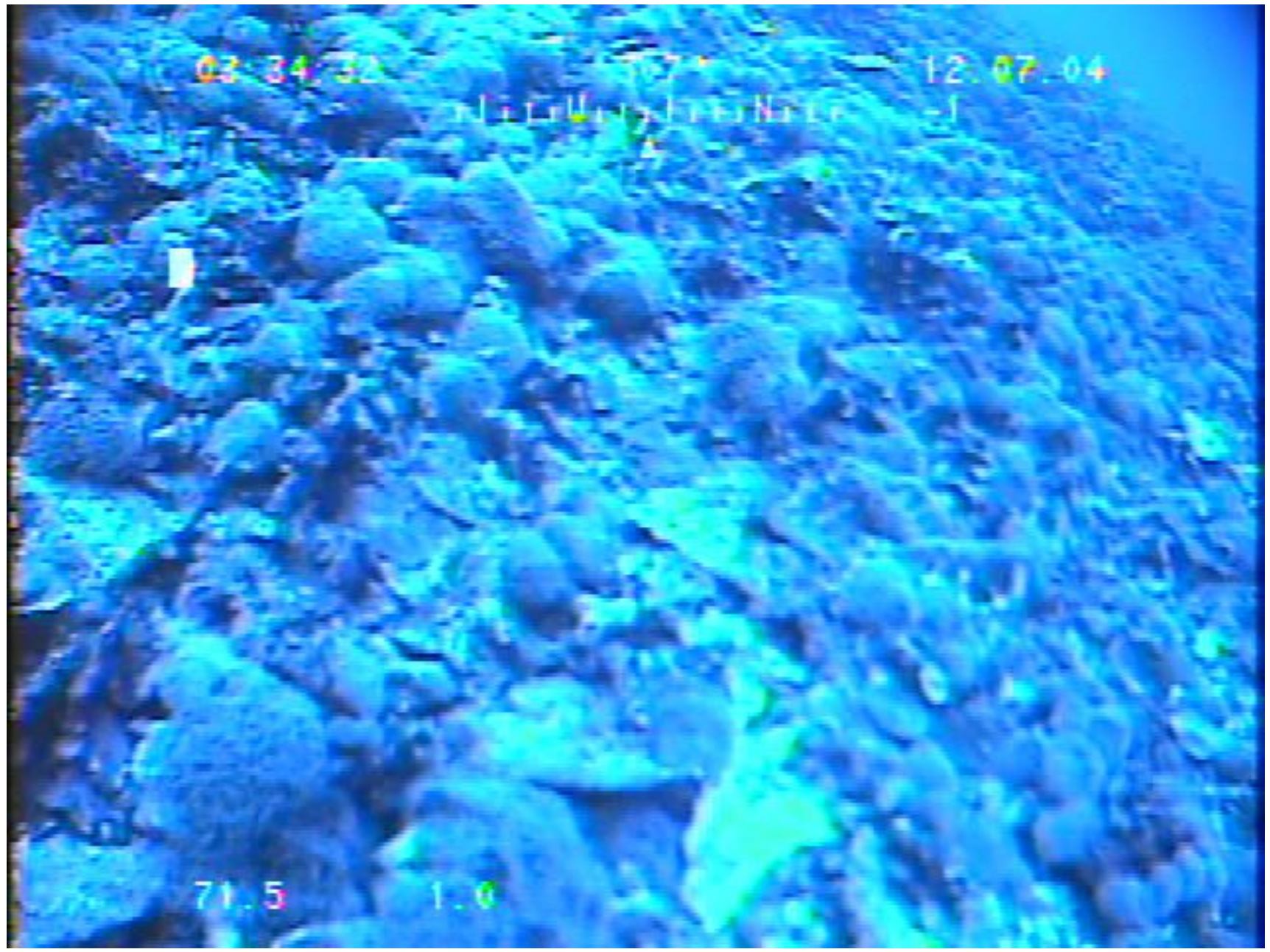
30.7°

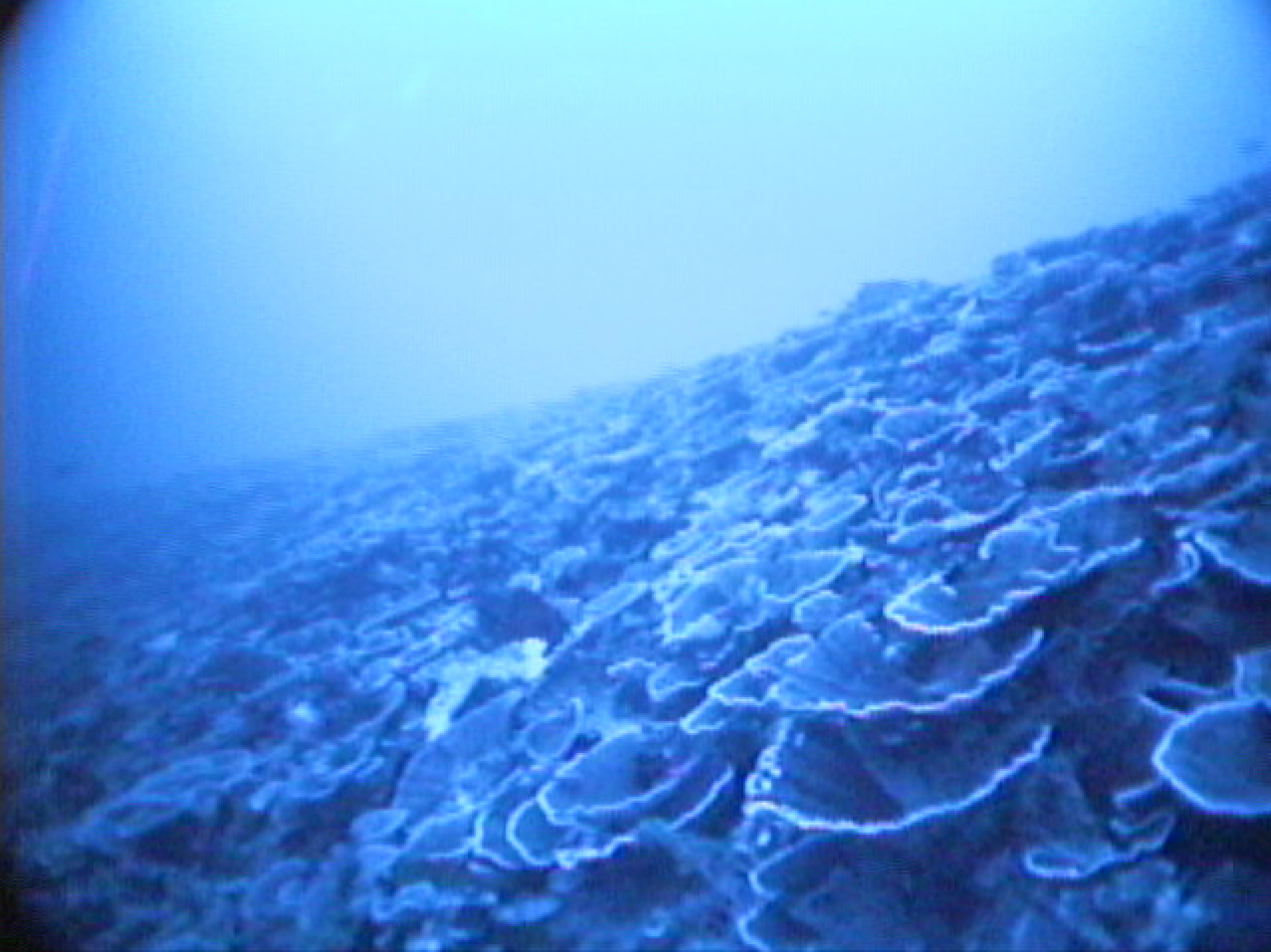
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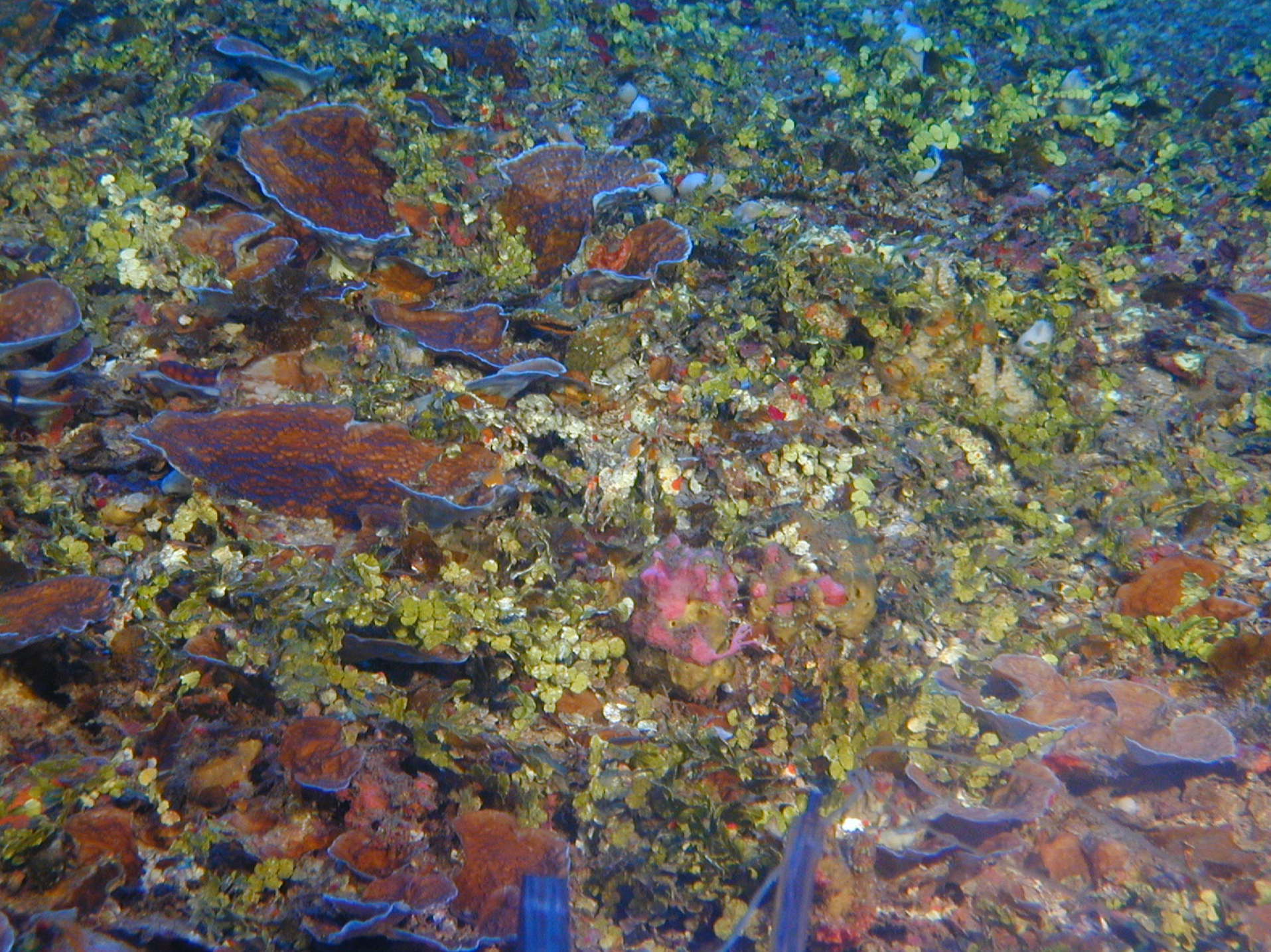
WILHELMSTRASSE 1

71.5

1.0









So Much Ocean, So Little Time...

- Pacific Island fisheries supported by optical validation of EFH
- Characteristics of EFH
- Acoustic mapping capabilities & why they alone aren't sufficient
- Case Study: Garapan Anchorage Area, Saipan, CNMI
- Camera sleds: where we have been, & hope to go
- New data acquisition & presentation efforts
- Requests for information & collaboration