

History and Background of Deep-Sea Coral Research & Technology Program (DSCRTP)

- Mission
- Implementation
- Objectives
- Project Selection Criteria
- Sample 3-year Science Plan



NOAA
FISHERIES

NOAA's Deep-Sea Coral (and Sponge) Research and Technology Program

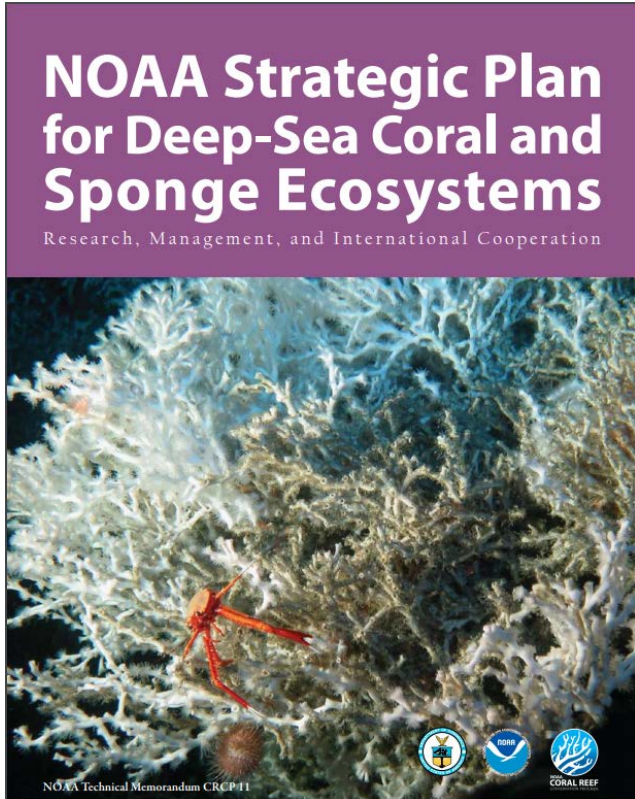
Mission: provide scientific information needed to conserve and manage deep-sea coral and sponge ecosystems

- Magnuson-Stevens Fisheries Conservation and Management Act 2007 (sec 408 and 303.b.2)
- Involvement from NOS, NMFS, OAR, & NESDIS
- Part of NOAA Coral Reef Conservation Program



**NOAA
FISHERIES**

Research and Management



NOAA's Deep-Sea Coral Research and Management Activities

Deep Sea Coral
Research and
Technology
Program
Fieldwork

- EFH and HAPC
- Precious coral FMP
- Bycatch reduction
- Deep-sea coral protection zones
- National Ocean Policy
- National Marine Sanctuaries
- Monuments
- More...



**NOAA
FISHERIES**

Congressionally Mandated Program

MSA SEC. 408(a)

1. Identify **existing research and known locations** of DSCs
2. **Locate and map** DSCs
3. **Monitor activity** where DSC are known or likely to occur
4. **Conduct research**, including cooperative research, **on DSC and related species**, and on survey methods
5. Develop technologies or **methods to reduce interactions** between fishing gear and deep-sea corals
6. Prioritize areas where DSCs occur, and where **modeling** or other methods predict presence

Submit information to the appropriate Councils



**NOAA
FISHERIES**

National DSCRTP Implementation

- Rotating funds through regions
 - SE Region (2009-2011)
 - West Coast (2010-2012) & (2018-2021)
 - Alaska (2012-2014) & (2020-2023)
 - NE Region (2013-2015)
 - US Pacific Islands (2015-2017)
 - Caribbean and Gulf of Mexico (2016-2019)
- Dedicated funding for Alaska DSCS research:
 - ~\$200k for 2020
 - ~\$1M per year for 2021-2022
 - ~\$100k for 2023



NOAA
FISHERIES

Background on Deep-Sea Coral and Sponge Research in Alaska

- Corals in Alaska
- Alaska Coral and Sponge Initiative



NOAA
FISHERIES

Alaska 2012 Research Decision Matrix

		NPFMC research priorities	EFH research priorities FMP's	EFH Implementation plan (HEPR)	State of Deep Coral Ecosystems (2005)	EFH-EIS research priorities (2010)	DSCSE's research priorities workshop (2010)	Individual species stock assessments
Coral and sponge distribution								
*	1	What is the distribution of DSCSE's in GOA, AI, EBS?	X	X	X		X	RF
	2	How does this distribution overlap with fishing activities?	X					
*	3	Regional habitat and substrate maps for Alaska	X	X	X	X	X	RF
	4	Can fishing industry knowledge be used to describe distribution of DSCSE's?					X	
*	5	Reconnaissance studies to find "hotspots" or sites of regional importance for DSCSE's	X		X			
Coral and sponge biology and interactions								
*	6	What are the associations of DSCSE's with FMP species (especially juveniles)?	X	X	X		X	RF, Atka, Sablefish
*	7	Are there linkages between production of FMP species and DSCSE's?		X		X	X	
*	8	Improvement of recovery rate estimates for damage (how fast do they grow/reproduce, how much time needed)		X	X	X	X	
	9	What are appropriate measures of condition of DSCSE's and what is condition of DSCSE's in Alaska?					X	
Coral and Sponge diversity								
*	10	What is the species diversity in closed versus open areas?				X		
*	11	What is the species composition of corals and sponges in DSCSE's?					X	
*	12	What is the connectivity among populations (i.e. genetic linkages)?					X	
*	13	Studies improving taxonomic resolution of species and providing taxonomic guides					X	
Effects of climate change								
	14	What will be the effect of ocean acidification on coral ecosystems			X		X	
	15	Where should we establish long term study sites?					X	
	16	Paleoclimatological analyses					X	
Effects of human activity								
	17	Where has historical fishing effort occurred?	X					
*	18	What are impacts of fishing gear by gear type?	X		X	X	X	
	19	What modifications to existing gear can be made to limit damage?	X		X			
	20	Have fishing closures resulted in recovery of DSCSE's?	X	X		X	X	
	21	Validation of sensitivity of DSCSE's to fishing impacts (how much damage, how many survive per pass of gear)		X	X	X		X
*	22	Is bycatch information useful in managing DSCSE's?					X	



NOAA
FISHERIES

DSCS AK 2012 Objectives

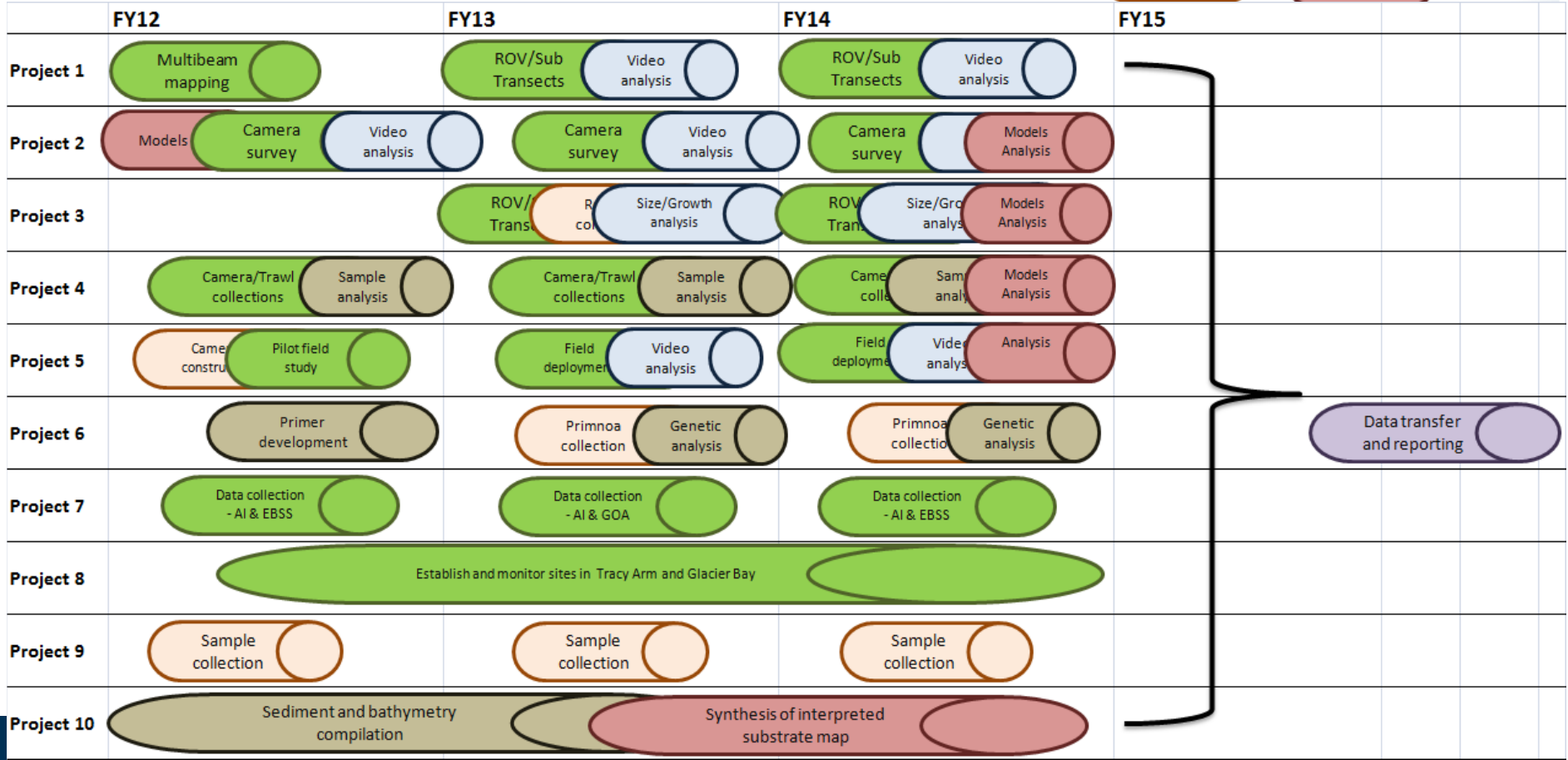
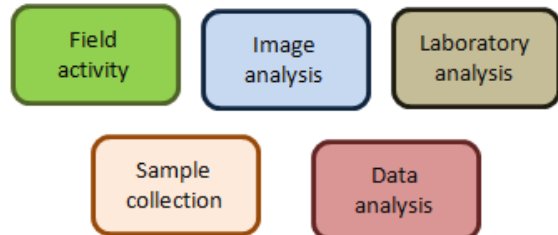
- Maps of distribution, abundance and diversity of sponge and coral
- Habitat and substrate maps
- Associations with FMP species and contribution to fisheries production
- Impacts by gear type and modifications to reduce impacts
- Recovery and recruitment rates
- Long-term monitoring program for climate change & ocean acidification



NOAA
FISHERIES

AK Initiative Timeline

3 – Year Science Plan (Nov 2011)



Summary of Accomplishments and Challenges from Previous Round of Funding (2012-2014)

- Large and Small Projects Completed
- Sampling and Fieldwork
- Data Output and Some Results
- Publications
- Past Challenges and Future Opportunities



NOAA
FISHERIES

Large Projects Completed From Last Initiative 2012-2014

- Model Validation of Coral and Sponge Habitat in the Bering Sea Canyons and Aleutian Islands
- Essential Fish Habitat in the Gulf of Alaska and Aleutian Islands
- Coral and Sponge Sample Collections for Morphological and Genetic Identification Databases
- Untrawlable Habitat Image Annotation Project



NOAA
FISHERIES

Small Projects from FY2010-2017

Basis for regional fieldwork

- FY09 - A Field Guide to the Deepwater Sponges of the Aleutian Islands Archipelago
- FY11 07 - Data Mining to Support Deep-Sea Coral and Sponge Research in Alaska
- FY12 03 - Predicting Tidal Currents for the Aleutian Islands and Gulf of Alaska
- FY12 02 – Support for Predictive Habitat Modeling for Alaska’s Deep-Sea Coral and Sponge Resources

Seeded by regional fieldwork

- FY16-07 Analyses to assess habitat associations for rockfish and coral, summarize new research on Bowers Bank and Ridge and create a story map for the eastern Bering Sea Canyons

Stand-alone

- FY11 02 - Assessing the Effectiveness of the Aleutian Islands Habitat Conservation Area in Protecting Deep-Sea Coral and Sponge Habitat
- FY12 01 - Assessment of Coral Bycatch from the Alaska Groundfish Trawl Fleet in Collaboration with the North Pacific Fisheries Observer Program
- FY14 01 - Exploring off-bottom trawling and other approaches to avoid interactions with structure-forming invertebrates during Pacific Ocean perch fishing on the Bering Sea slope
- FY15 01 - Summit on role of deep-sea corals and sponges as habitat on West Coast and in Alaska
- FY16-06 - Coral and Sponge Diversity in the eastern Bering Sea of Alaska
- FY16-08 - Extended analyses of deep-sea corals and sponges from past AFSC surveys
- Genetics of Deep-Sea Corals - Taxonomic and Genetic Identification of Fisheries Bycatch of Deep-Sea Corals



NOAA
FISHERIES

2014 Fieldwork



Stereo drop camera

15 minute tows

- 300 Randomly selected stations
- more effort in areas of higher probability (realized $n = 250$)
- ~225,000 paired seafloor images

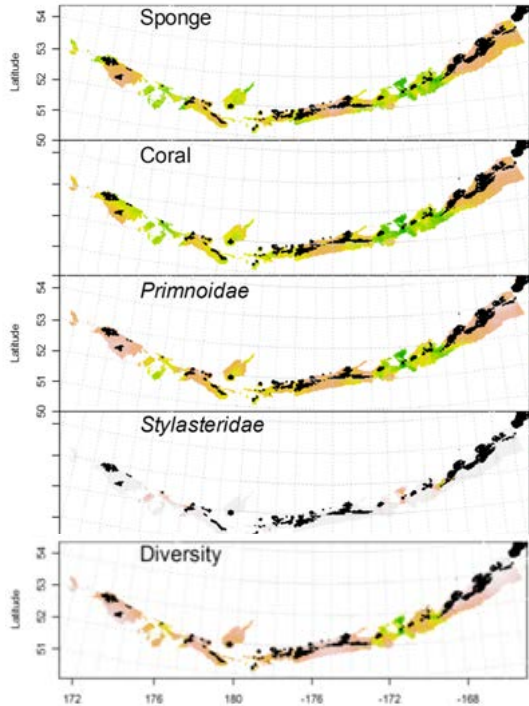


NOAA
FISHERIES

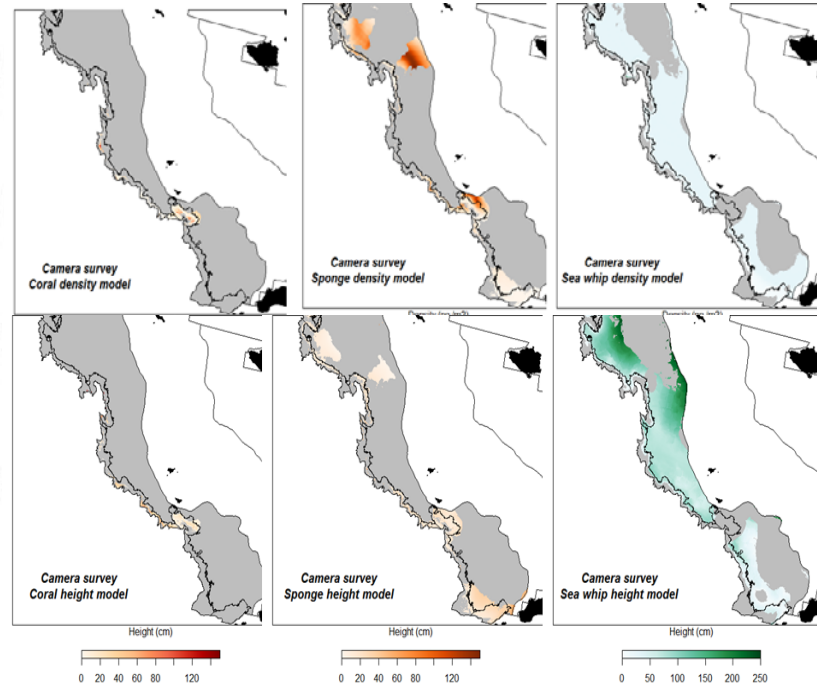
Research Output

Maps on 100 m x 100 m grid for all of Alaska showing distribution and abundance of corals

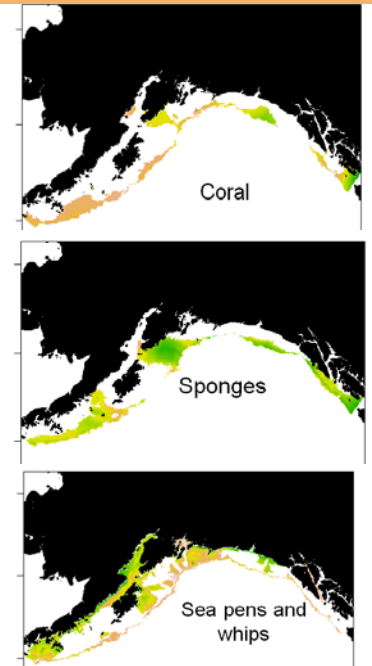
Aleutian Islands

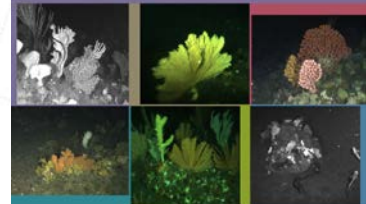


Eastern Bering Sea



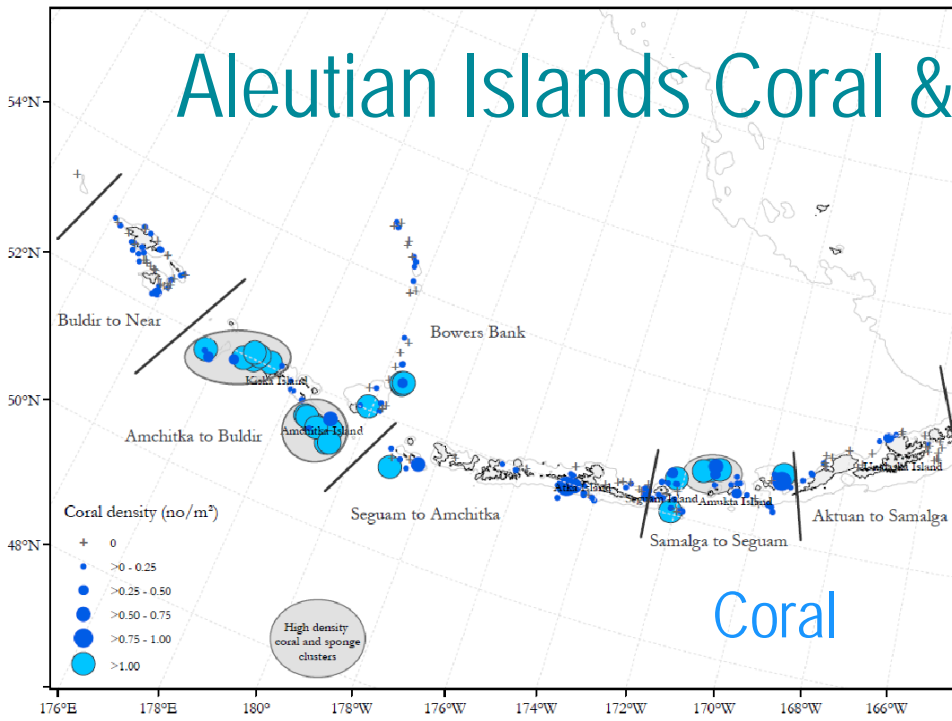
Gulf of Alaska



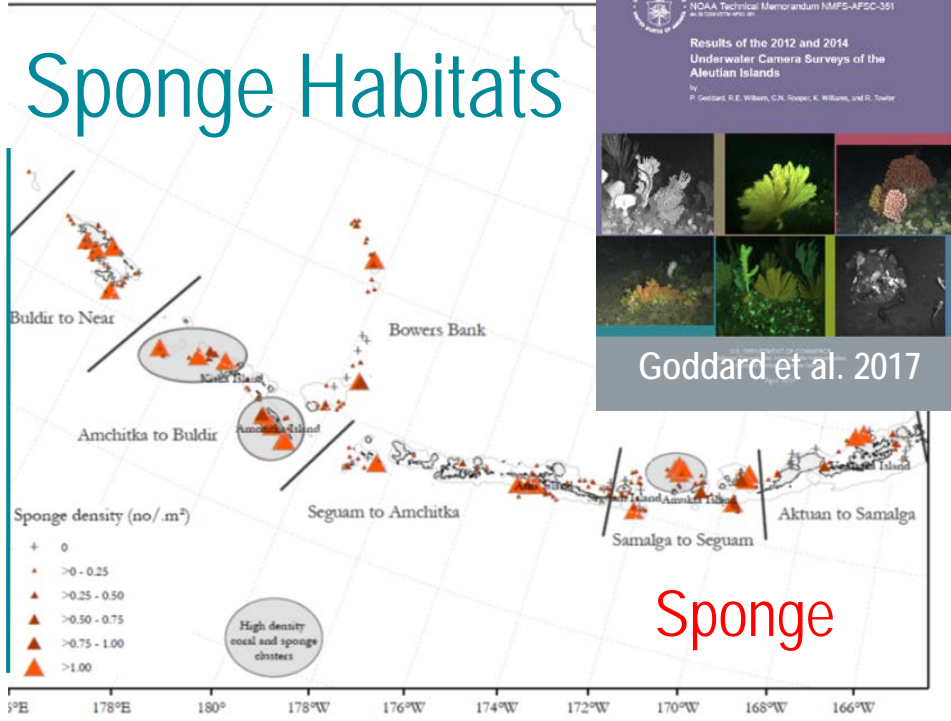


Goddard et al. 2017

Aleutian Islands Coral & Sponge Habitats



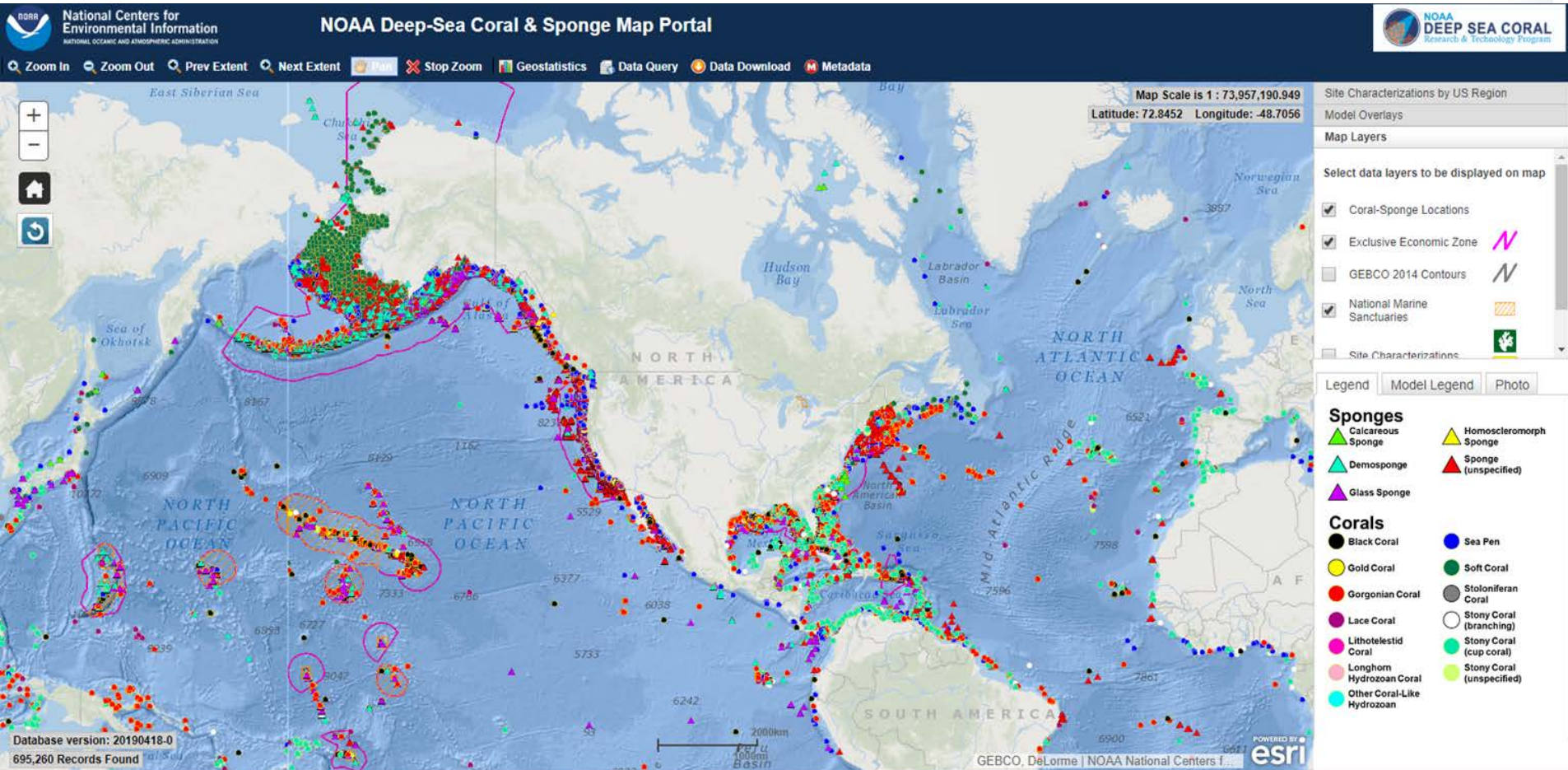
Coral



Sponge



Centralized Data Management & Dissemination



What is Known About Coral in Alaska?

Knowns-

- Alaska is one of the most diverse areas in world for deep-sea coral (Aleutians particularly)
- Commercially important species have strong associations with coral (juvenile POP)
- Studies were mostly conducted on small “postage stamps” and indicated coral importance, diversity and vulnerability (SE Alaska *Primnoa* thickets)
- Where postage stamps indicated high abundance, closures were applied (HAPC closures in the Aleutians)

Known unknowns-

- Alaska-wide distribution of corals
- Where spatial management would be most effective
- How much coral should we be protecting to maintain fisheries production
- How much coral is currently protected



Publications from Last DSCRTP Initiative

- 1) Conrath, CL, CN Rooper, RE Wilborn, BA Knoth, DT Jones. 2019. Seasonal habitat use and community structure of rockfishes in the Gulf of Alaska. *Fisheries Research*. <https://doi.org/10.1016/j.fishres.2019.105331>
- 2) Rooper, CN, P Goddard, R Wilborn. 2019. Are fish associations with corals and sponges more than an affinity to structure: Evidence across two widely divergent ecosystems? *Canadian Journal of Fisheries and Aquatic Sciences*, doi.org/10.1139/cjfas-2018-0264
- 3) Wilborn R, CN Rooper, P Goddard, L Li, K Williams, R Towler. 2018. The potential effects of substrate type, currents, depth and fishing pressure on distribution, abundance, diversity, and height of cold-water coral and sponge in temperate, marine waters. *Hydrobiologia*. <https://doi.org/10.1007/s10750-017-3492-9>
- 4) Rooper CN, R Wilborn, P Goddard, K Williams, R Towler, GR Hoff. 2018. Validation of deep-sea coral and sponge distribution models in the Aleutian Islands, Alaska. *ICES Journal of Marine Science*. 75(1):199-209
- 5) Wilborn R, C Conrath, B Knoth, CN Rooper. 2017. Results from the underwater camera survey of the 49 Fathom Pinnacle and Snakehead Bank sites near Kodiak Island, Alaska. U.S. AFSC Processed Rep. 2017-06, 75p
- 6) Goddard P, CN Rooper, R Wilborn, K Williams, R Towler. 2017. Results of the 2012-2014 underwater camera survey of the Aleutian Islands. U.S. Dep. Commer., NOAA Tech. Memo. NMFS-AFSC-351, 505p
- 7) Goddard P, R Wilborn, CN Rooper, K Williams, R Towler, M Sigler, P Malecha. 2016. Results of the 2014 underwater camera survey of the eastern Bering Slope and Outer Shelf. U.S. Dep. Commer., NOAA Tech. Memo. NMFS-AFSC-313, 304p
- 8) Rooper CN, M Sigler, P Goddard, P Malecha, R Towler, K Williams, R Wilborn, M Zimmerman. 2016. Validation and improvement of distribution models for structure-forming invertebrates in the eastern Bering Sea with an independent survey. *Marine Ecology Progress Series*. 551:117-130
- 9) Waller RG, Stone RP, Rice LN, et al. Phenotypic plasticity or a reproductive dead end? *primnoa pacifica* (cnidaria: Alcyonacea) in the southeastern alaska region. *Frontiers in Marine Science*. 2019. <https://search.proquest.com/docview/2316158304?accountid=28257>. doi: <http://dx.doi.org/10.3389/fmars.2019.00709>.
- 10) Stone RP, Lehnert H, Hoff GR. 2019. Inventory of the eastern Bering Sea sponge fauna, geographic range extensions and description of *Antho ridgwayi* sp. nov. *Zootaxa*. 4567(2): 236-250. <http://dx.doi.org/10.11646/zootaxa.4567.2.2>
- 11) Chu JWF, Nephin J, Georgian S, Knudby A, Rooper CN, Knudby A, Gale KSP. 2019. Modeling the environmental niche space and distributions of cold-water corals and sponges in the Canadian northeast Pacific Ocean. *Deep Sea Res I*
- 12) Rooper, C.N., M. Zimmermann, M. Prescott. 2017. Comparisons of methods for modeling coral and sponge distribution in the Gulf of Alaska. *Deep Sea Research II* 126:148-161.
- 13) MacLean SA, Rooper CN, Sigler MS. 2017. Corals, Canyons, and Conservation: Science based fisheries management decisions in the eastern Bering Sea. *Frontiers Marine Science* 4: 1-5
- 14) Sigler, M.S., Rooper, C.N., Hoff, G.R, Stone, R.P., McConnaughey, R.A. and T. K. Wilderbeur. 2015. Faunal features of submarine canyons on the eastern Bering Sea slope. *Mar. Ecol. Prog. Ser.* 526:21-40
- 15) Laman, N., S. Kotwicki & C.N. Rooper. 2015. Sponge and coral morphology influences the distribution of Pacific ocean perch life stages. *Fish Bull.* 113:270-289.
- 16) Rooper, C.N., M. Zimmermann, M. Prescott, A. Hermann. 2014. Predictive models of coral and sponge distribution, abundance and diversity in bottom trawl surveys of the Aleutian Islands, Alaska. *Mar. Ecol. Prog. Ser.* 503:157-176



Challenges and Future Opportunities

- Obtaining ship time was challenging
 - possibility for the Okeanos Explorer to be in AK waters 20-23
- Alaska has short weather window
- Contracting and administrative support
 - hired 2 part-time project coordinators
- At AFSC no robust habitat infrastructure or program, and primary focus is on stock assessment
- Integrating into existing programs and getting personnel time



NOAA
FISHERIES

Alaska Deep-Sea Coral and Sponge Initiative 2020-2023

- Next Steps
- Planning
- Workshop



NOAA
FISHERIES

DSCS AK 2020-2023 -Moving Forward

- **Research Planning Workshop**
ADFG, AFSC, Native Corporation, BOEM, DFO-Canada, Freezer Longline Coalition, NCCOS, DSCRTP, IPHC, Oceana, Greenpeace, OER, PMEL, NPRB, UAF, UOM, APU, NPFMC, USGS, At Sea Processors Association, NWFSC, Ocean Exploration Trust, U.S. Seafoods, Groundfish Forum, & others
- **Alaska Research Priorities**
- **Review Pre-2020 research activities**
Data accumulation and mining
Field research planning and implementation
- **FY2021-FY2022 Fieldwork and Analyses**
- **FY2023 Completion and Reporting**



NOAA
FISHERIES

DSCS AK 2020-2023 Planning

- **Research Priorities For Discussion**
 - Distribution of coral and sponge in GOA/AI
 - Coral and sponge distribution in trawlable vs untrawlable habitats
 - Fish/Invertebrate Deep-Sea Coral and Sponge associations
 - Connectivity between populations
 - Impact of climate change
 - Mapping
 - Biodiversity



NOAA
FISHERIES

Questions

PI Contacts

Jerry Hoff: jerry.hoff@noaa.gov

Pat Malecha: pat.malecha@noaa.gov



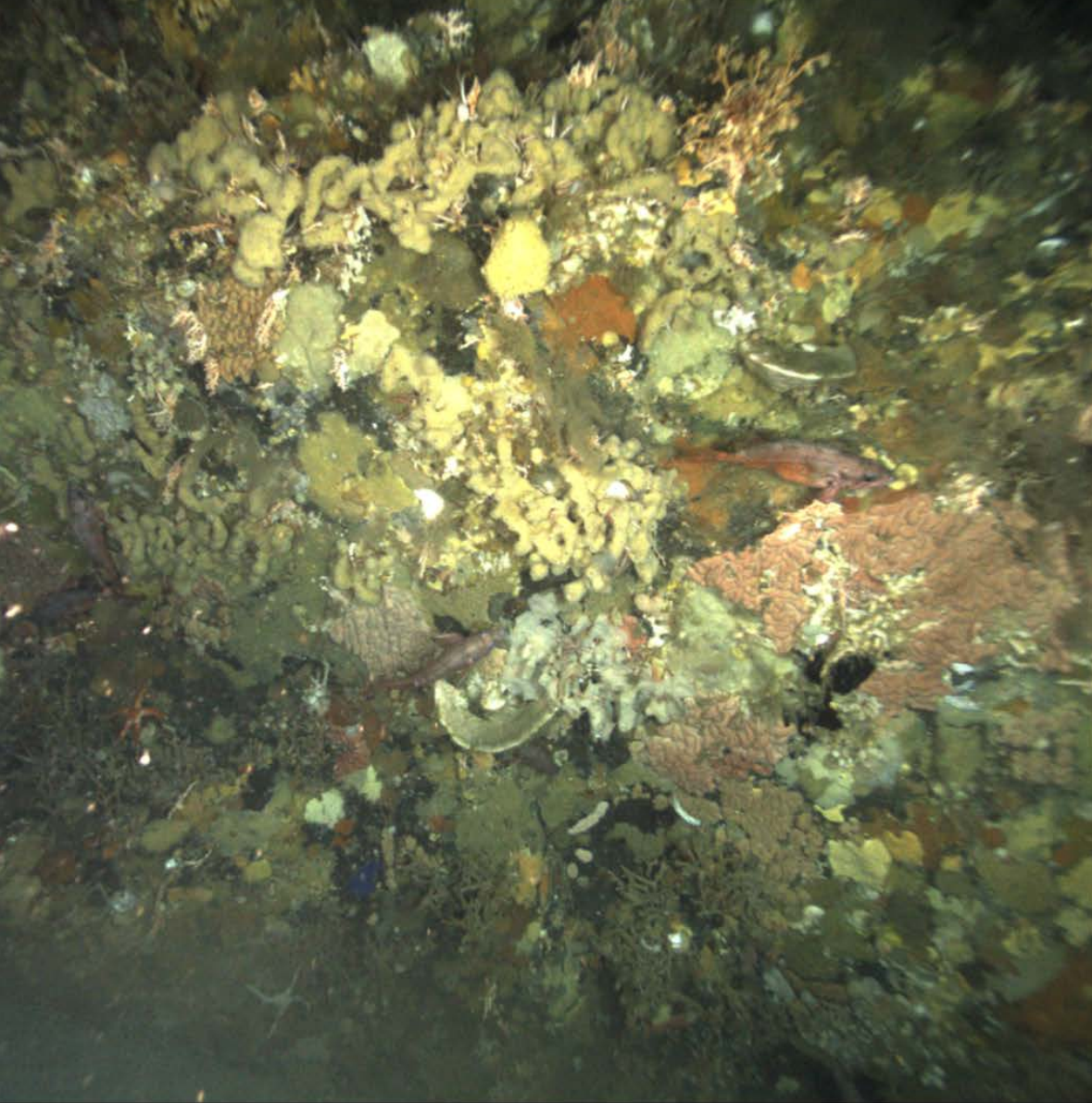
NOAA
FISHERIES

Images from Aleutian Islands and Gulf of Alaska



NOAA
FISHERIES



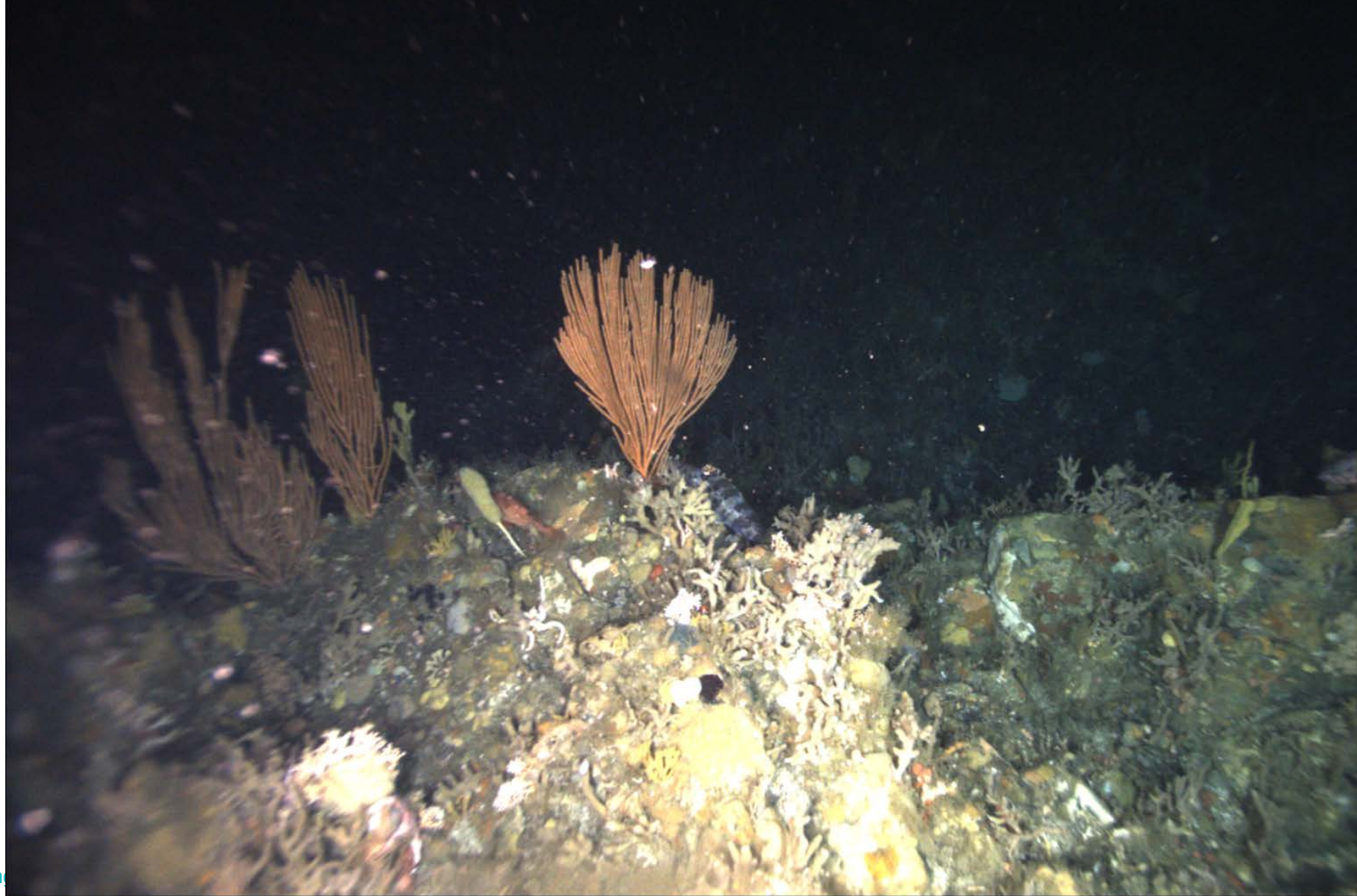












Images from eastern Bering Sea Slope



NOAA
FISHERIES



