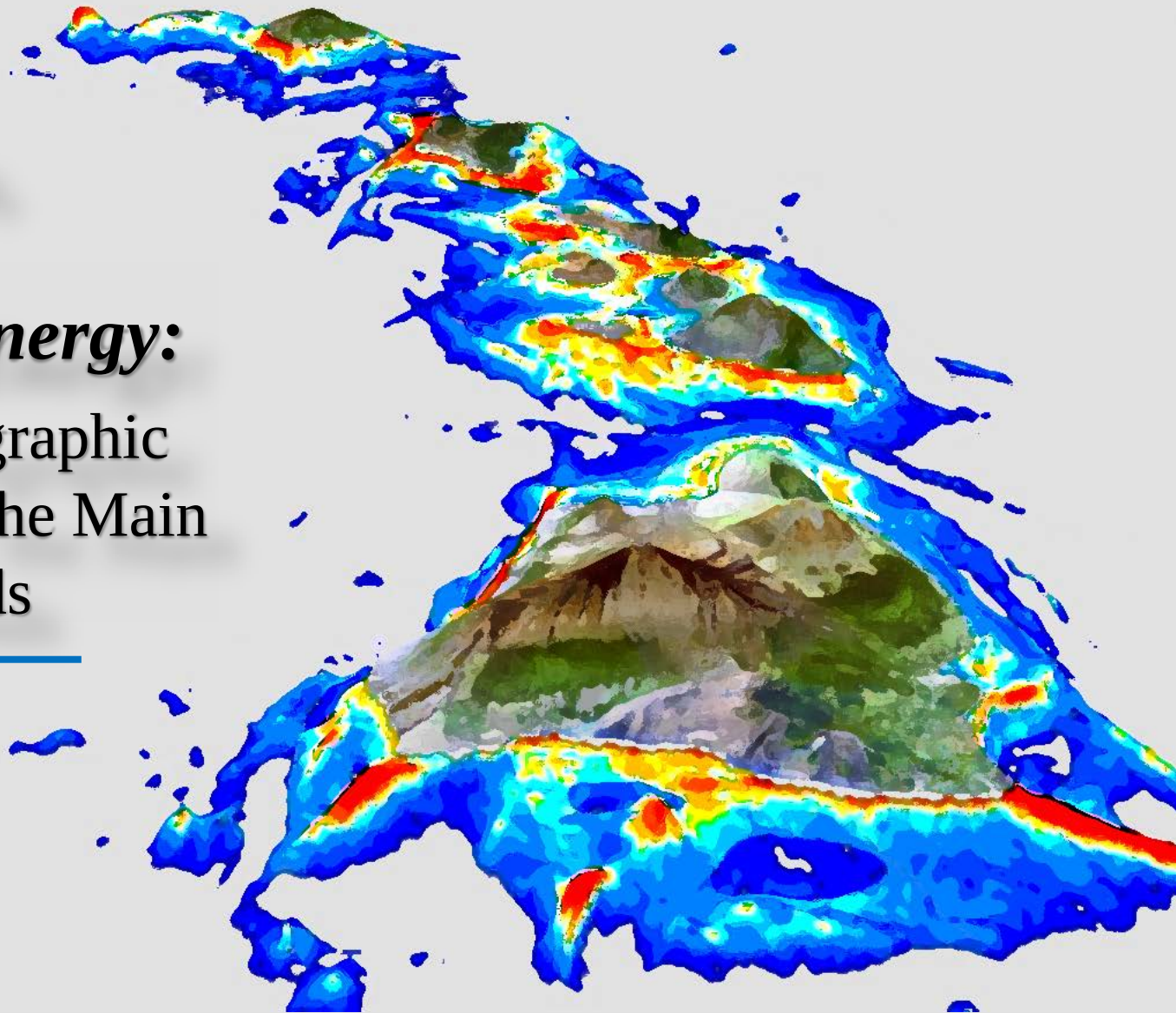

Partnerships, Patterns & Renewable Energy:

Marine Biogeographic Assessment of the Main Hawaiian Islands



Bryan Costa¹, Matt Kendall¹, Arliss Winship¹, Matt Poti¹, Laurie Bauer¹, Simon Pittman¹, Laughlin Siceloff¹, Kimberly Roberson¹, Brian Kinlan¹, Greg Sanders²

AGENDA

1. Background

2. Partnerships

3. Patterns & Products

- Environmental
- Benthics
- Fishes
- Sea Turtles
- Mammals
- Seabirds

4. Informing Decisions



Background

- Renewable Energy in the MHI
- Why Offshore?
- BOEM's Role
- Why Biogeographic Assessment?
- Why work with NCCOS?



BOEM



Biogeographic Assessment Process

Step 1
Planning

Step 2
Partnerships

Step 3
Patterns & Products

Step 4
Informing Decisions

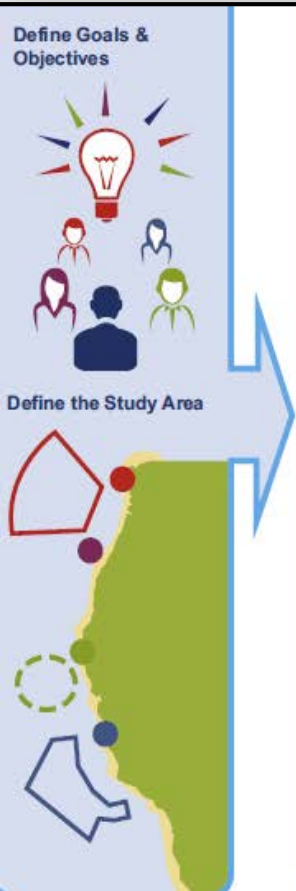


Figure. Steps in Biogeographic Assessment Process. Figure credit: Caldow et al., 2015



1. Planning (Project Scope)

1. How are select marine species or taxonomic groups distributed spatially & temporally around the MHI?
2. What environmental conditions potentially influence these distributions?
3. What significant gaps exist in our knowledge about the marine biogeography of the MHI?



1. Planning (Project Scope)

- Focus on federal waters (3-200 nm) around MHI, included data in state waters where possible

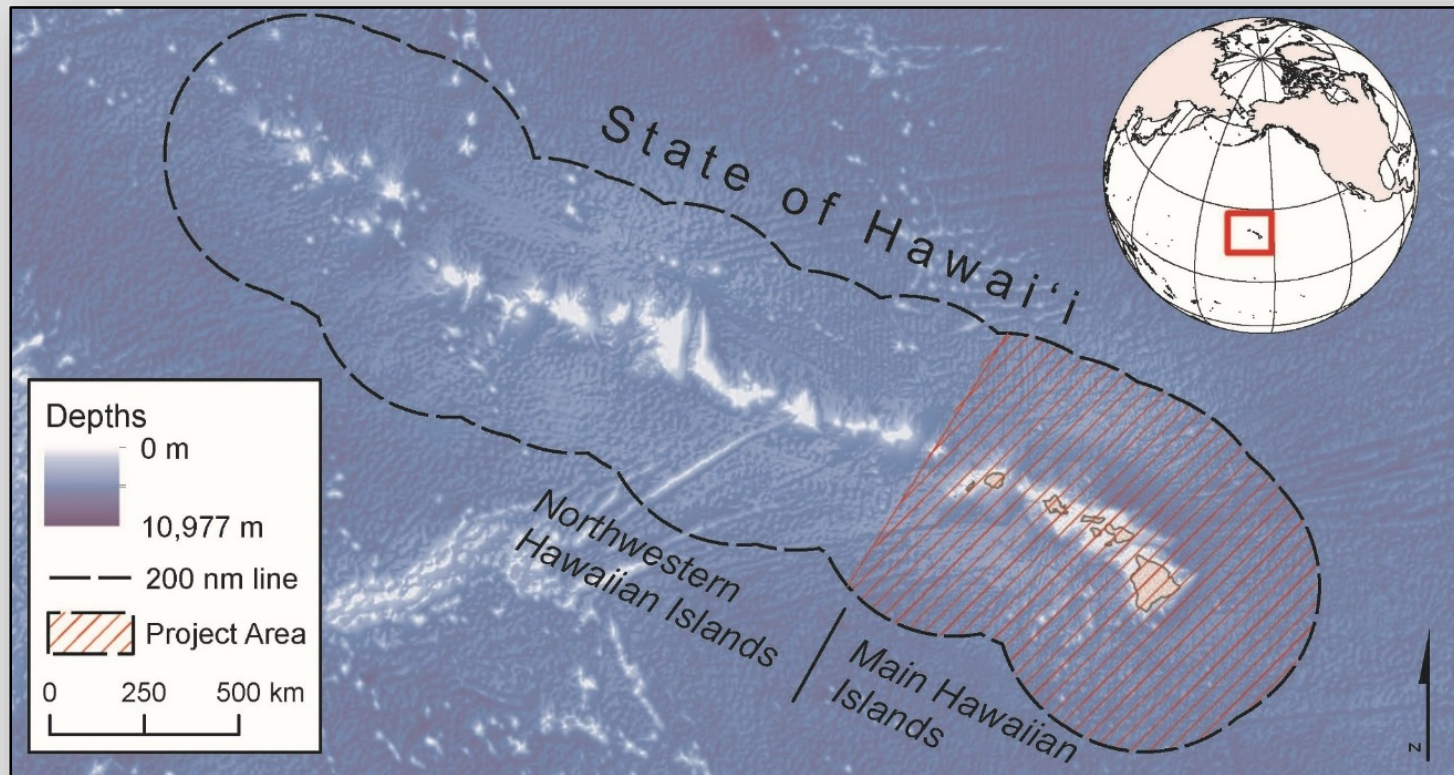


Figure. Map of study area.

1. Planning (Project Design)

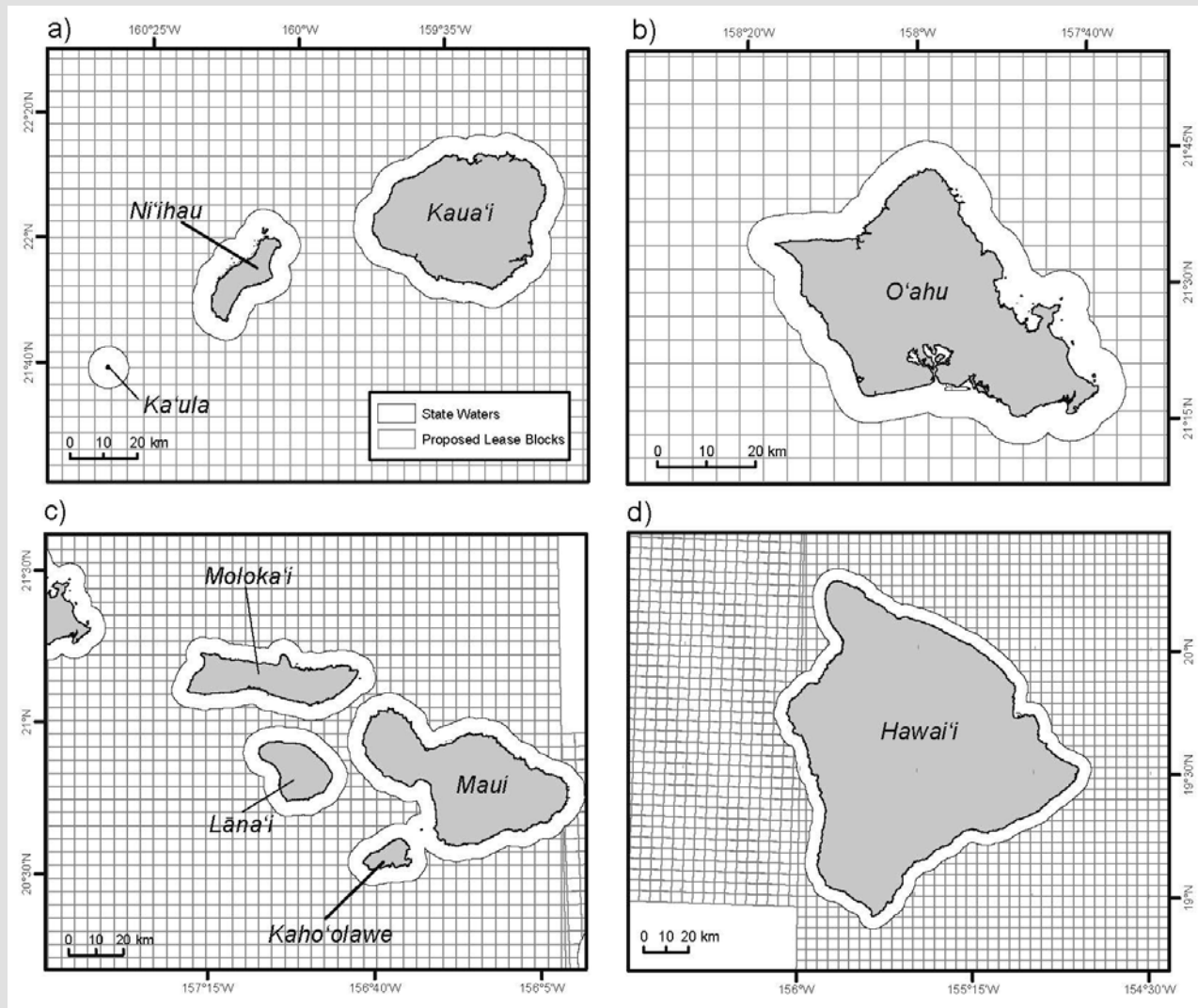
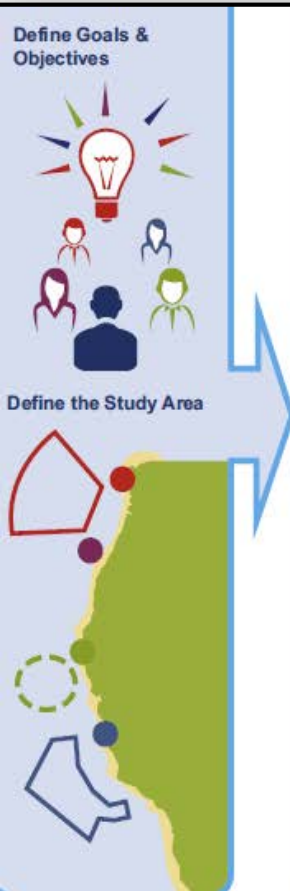


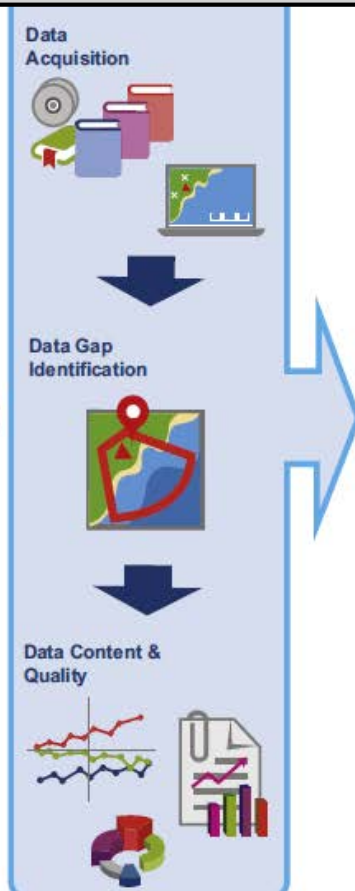
Figure. Map of BOEM's proposed lease blocks (4.8 km x 4.8 km) in federal waters around MHI.

Biogeographic Assessment Process

Step 1 *Planning*



Step 2 *Partnerships*



Step 3 *Patterns & Products*

Step 4 *Informing Decisions*

Figure. Steps in Biogeographic Assessment Process. Figure credit: Caldow et al., 2015

2. Partnerships

- Reached out to ~200 people across ~50 organizations

Key Partners & Data Providers:

- *NOAA PIFSC Protected Species Division* ([Frank Parrish](#), [Erin Oleson](#), [Charles Littnan](#), [Denise Parker](#), [Shawn Murakawa](#), [George Balazs](#), [Marie Hill](#))
- *NOAA SWFSC Marine Mammal and Turtle Division* ([Lisa Ballance](#), [Elizabeth Becker](#), [Karin Forney](#), [Trevor Joyce](#), [Jay Barlow](#))
- *NOAA PIFSC CREP* ([John Rooney](#))
- *NOAA PIFSC EOD* ([Jamie Gove](#), [Evan Howell](#))
- *NOAA ONMS* ([Daniel Wagner](#)) & *NOAA AFSC* ([Kenady Wilson](#))
- *State of Hawai'i, OP & DLNR* ([Leo Ascunion](#), [Reg Kokobun](#), [Elia Herman](#))
- *University of Hawai'i* ([Chris Kelley](#), [Kosta Stamoulis](#), [Jeff Drazen](#), [Joe Mobley](#), [Alan Friedlander](#), [Mary Donovan](#), [Jade Delevaux](#), [Virginia Moriwake](#))
- *Cascadia Research Collective* ([Robin Baird](#))
- *Plymouth Marine Laboratory* ([Peter Miller](#), [Kylie Scales](#))



2. Partnerships (Coauthors)

- 36 authors on report from ~20 federal, state & academic groups
- Many experts also recognized in acknowledgements

² BOEM Pacific Outer Continental Shelf Region, Camarillo, CA, U.S.A.

³ CSS-Dynamac, Fairfax, VA, U.S.A.

⁴ Plymouth Marine Laboratory, Remote Sensing Group, Plymouth, United Kingdom

⁵ NOAA Pacific Islands Fisheries Science Center, Ecosystem Sciences Division, Honolulu, HI, U.S.A.

⁶ NOAA Office of National Marine Sanctuaries, Pahānaumokuākea Marine National Monument, Honolulu, HI, U.S.A.

⁷ NOAA Pacific Islands Fisheries Science Center, Protected Species Division, Honolulu, HI, U.S.A.

⁸ University of Hawai'i at Mānoa, Fisheries Ecology Research Lab, Hawai'i, U.S.A.

⁹ State of Hawai'i, Department of Land and Natural Resources, Division of Aquatic Resources, Hawai'i, U.S.A.

¹⁰ University of Hawai'i at Mānoa, Deep-Sea Fish Ecology Lab, Hawai'i, U.S.A.

¹¹ University of Hawai'i at Mānoa, Department of Natural Resources and Environmental Management, Hawai'i,

¹² NOAA Pacific Islands Fisheries Science Center, Protected Species Division, Marine Turtle Biology and Assessment Program, Honolulu, HI, U.S.A.

¹³ Plymouth University, Centre for Marine and Coastal Policy Research, United Kingdom

¹⁴ Cascadia Research Collective, WA, U.S.A.

¹⁵ NOAA Southwest Fisheries Science Center, Marine Mammal and Turtle Division, CA, U.S.A.

¹⁶ University of Hawai'i at Mānoa, Joint Institute for Marine and Atmospheric Research, HI, U.S.A.

¹⁷ University of Hawai'i at Mānoa, HI, U.S.A.

¹⁸ NOAA Pacific Islands Fisheries Science Center, Protected Species Division, Cetacean Research Program, Honolulu, HI, U.S.A.

¹⁹ Nicholas School of the Environment, Duke University, NC, U.S.A.

²⁰ NOAA Alaskan Fisheries Science Center, National Marine Mammal Laboratory, WA, U.S.A.

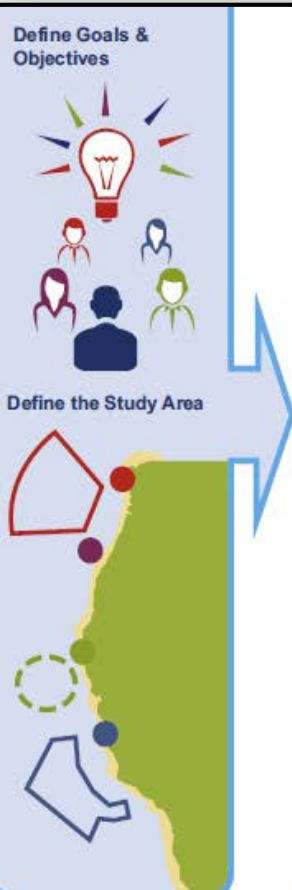
²¹ NOAA Pacific Islands Fisheries Science Center, Protected Species Division, Hawaiian Monk Seal Research Program, Honolulu, HI, U.S.A.

²² Scripps Institution of Oceanography, U.C. San Diego, CA, U.S.A.

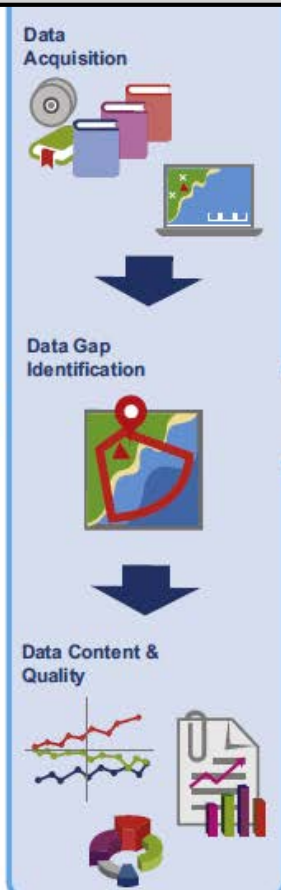


Biogeographic Assessment Process

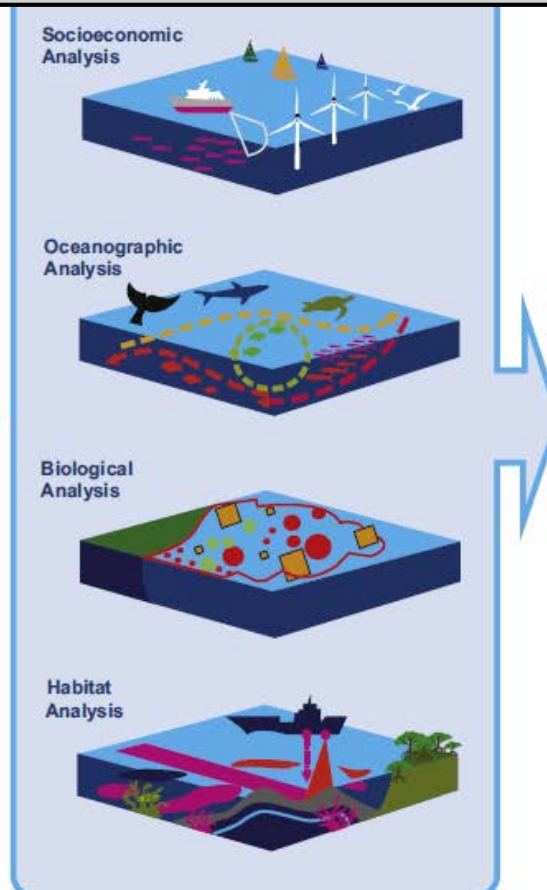
Step 1 Planning



Step 2 Partnerships



Step 3 Patterns & Products



Step 4 Informing Decisions

Figure. Steps in Biogeographic Assessment Process. Figure credit: Caldow et al., 2015

3. Patterns & Products

Front Material Executive Summary

Chapter 1 – Introduction

Chapter 2 – Environ. Setting

Chapter 3 – Benthics

Chapter 4 – Fishes

Chapter 5 – Sea Turtles

Chapter 6 – Marine Mammals

Chapter 7 – Seabirds

Appendix A – Ch. 2 Maps

Appendix B – Ch. 6, 7 Methods

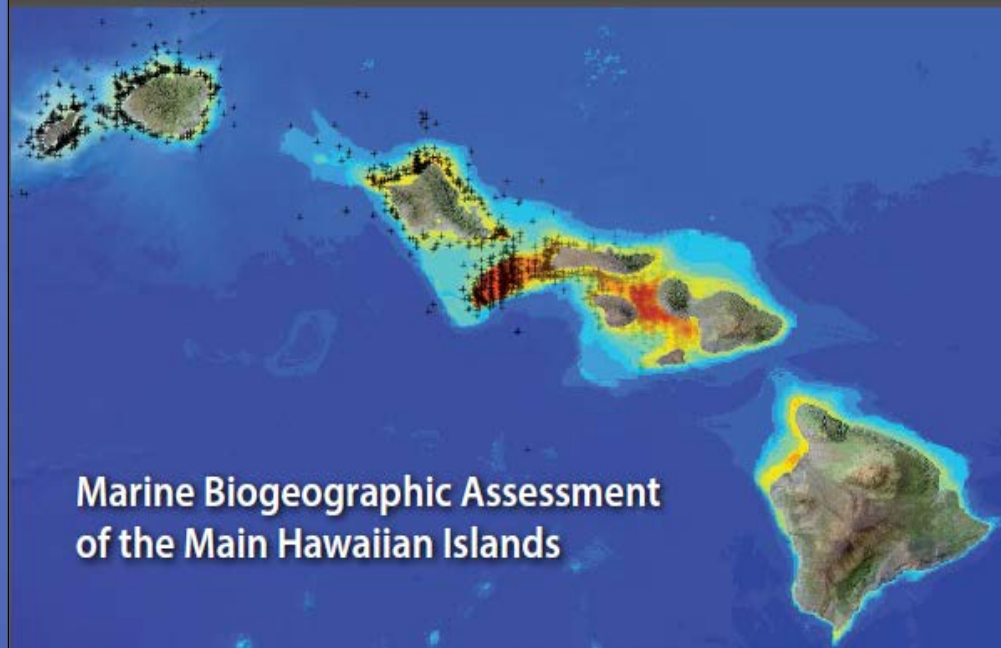
Glossary

Total = 359 pages



Marine Biogeographic Assessment of the Main Hawaiian Islands

OCS Study BOEM XXXX-XX
and
NOAA Technical Memorandum
NOS NCCOS XXX



Marine Biogeographic Assessment of the Main Hawaiian Islands



NOAA National Centers for Coastal Ocean Science
Center for Coastal Monitoring and Assessment

Editors
Bryan Costa
Matthew Kendall

July 2016

OCS Study BOEM XXXX-XX
NOAA Technical Memorandum NOS NCCOS XXX



NOAA National Centers for Coastal Ocean Science





Chapter 2 Environmental Setting

Bryan Costa, Matthew Poti, Arliss J. Winship,
Peter I. Miller, Jamison Gove



Makulua Islands, O'ahu. Photo credit: Bryan M. Costa (NOAA NOS/NCCOS)

GIS Data: (111 Spatial Layers)

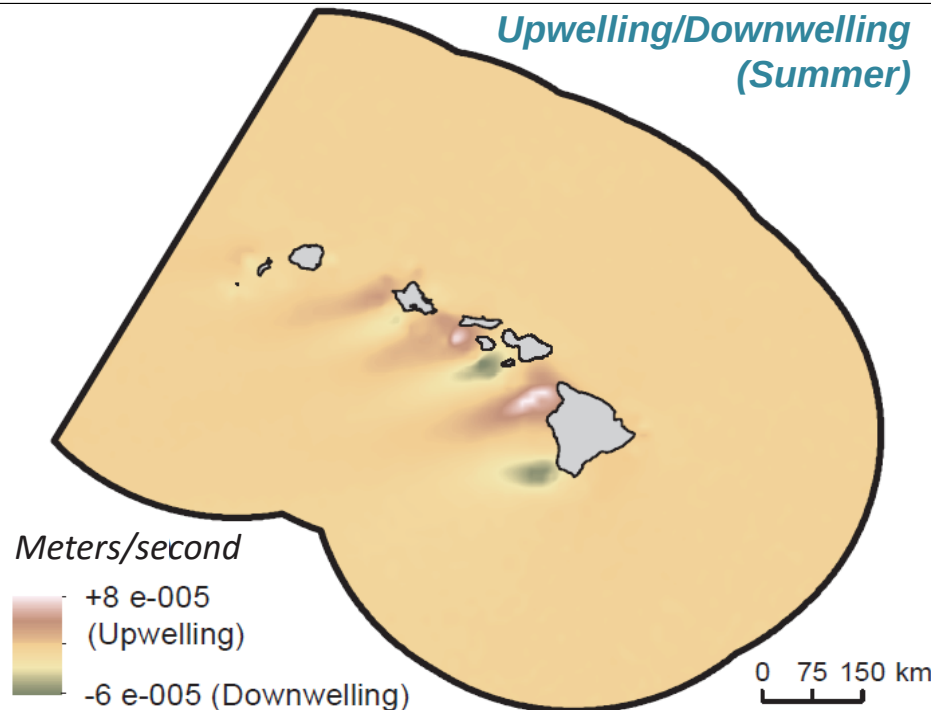
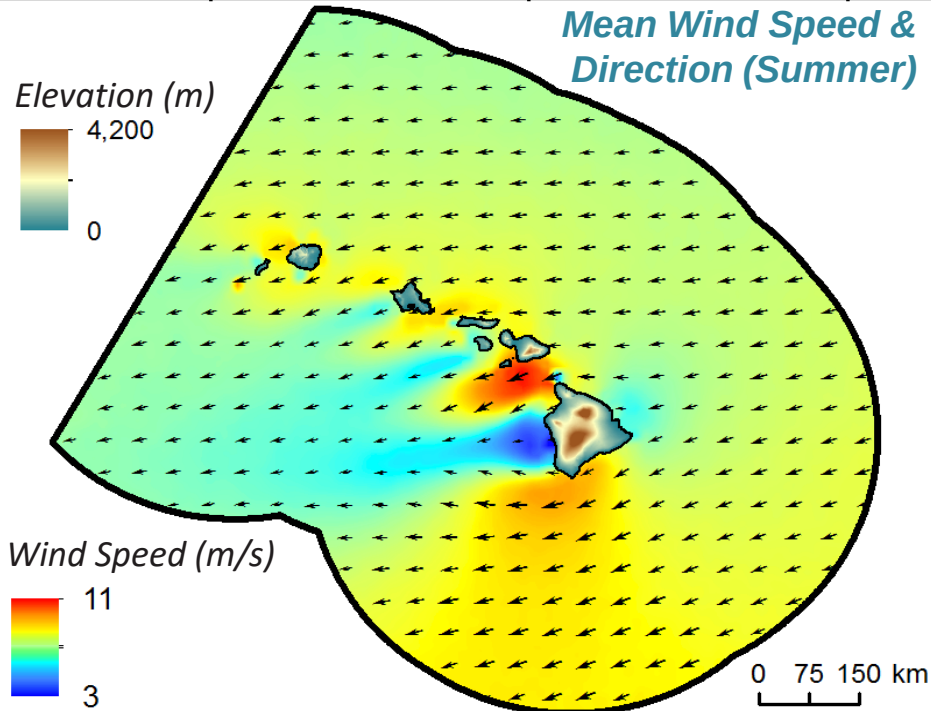
Topographic & Geographic

- Seafloor depth & complexity (17)
- Distance to ... (8)

Atmospheric & Oceanographic

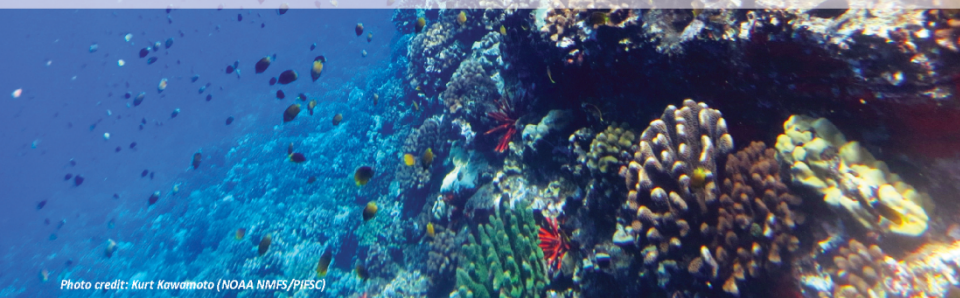
- | | |
|----------------------|-----------------------|
| ▪ Wind (12) | ▪ Water movement (29) |
| ▪ Chlorophyll-a (12) | ▪ Water temp. (15) |
| ▪ Water clarity (6) | ▪ Waves (8) |
| ▪ Water height (4) | |

Data Sources: 12+ organizations



Chapter 3 Benthic Habitats and Corals

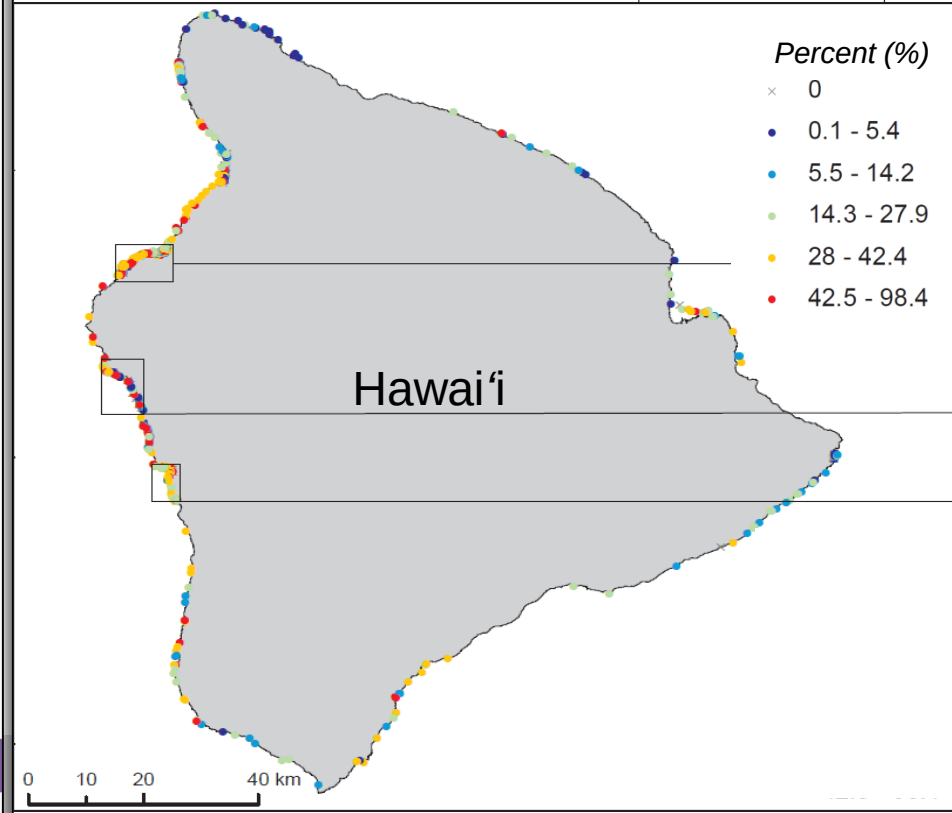
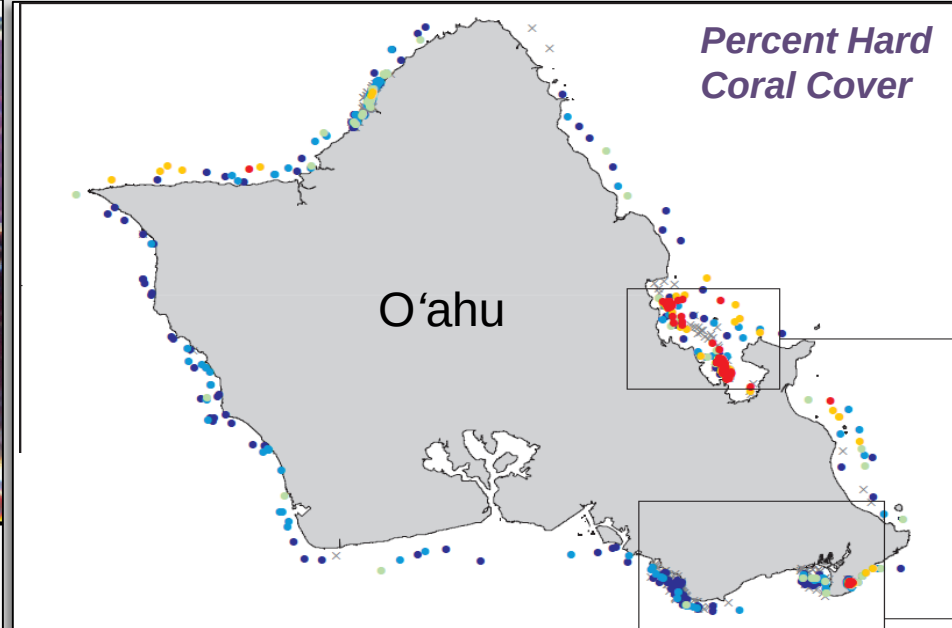
Laurie Bauer, Matthew Poti, Bryan Costa, Daniel Wagner, Frank Parrish, Mary Donovan, Brian Kinlan



1. Shallow (≤ 30 m)

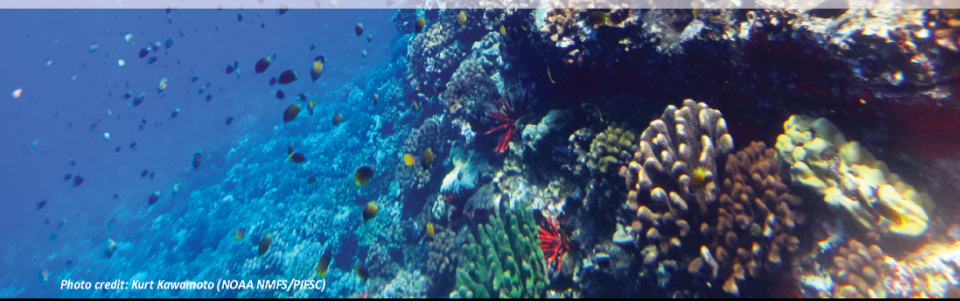
2. Mesophotic ($30 \leq 150$ m)

3. Deep (>150 m)



Chapter 3 Benthic Habitats and Corals

Laurie Bauer, Matthew Poti, Bryan Costa, Daniel Wagner, Frank Parrish, Mary Donovan, Brian Kinlan

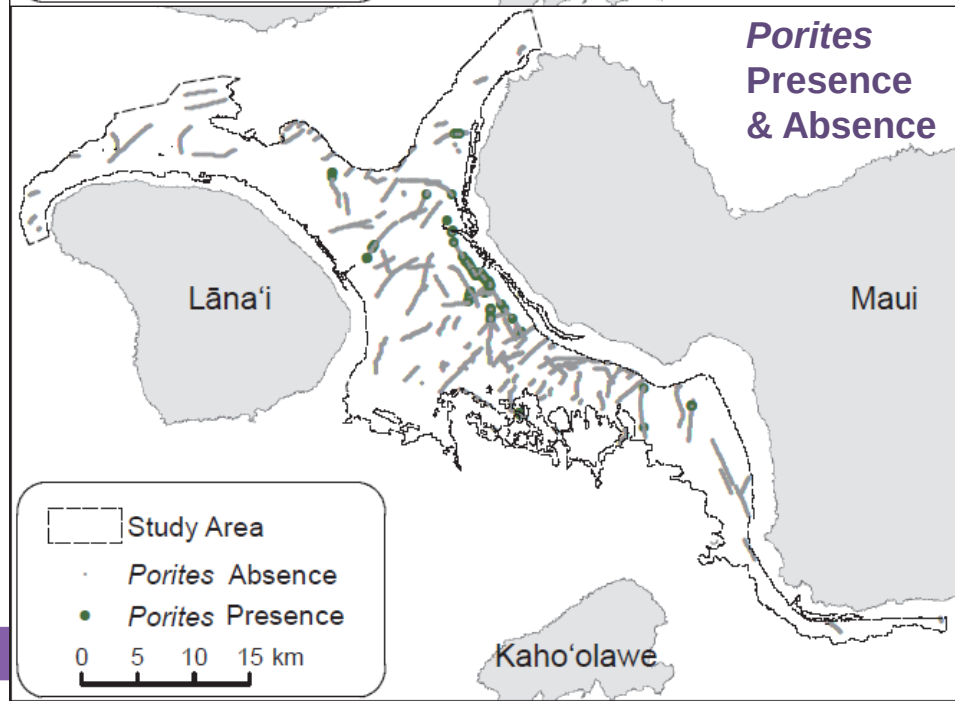
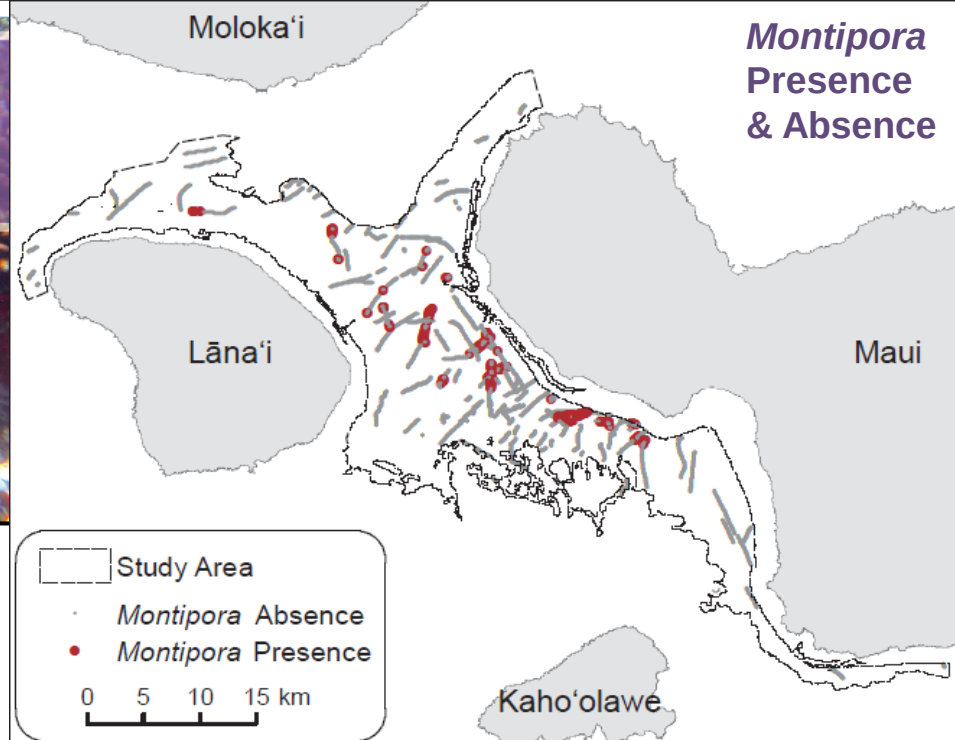


Mesophotic ($30 \leq 150$ m)

(45 Spatial Layers)

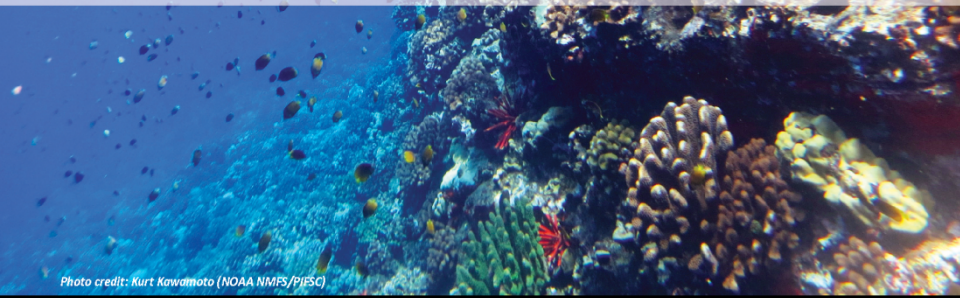
- *In-situ* benthic surveys (1)
- Spatial predictions & uncertainty for 3 coral genera (7)
- Model inputs (37)

Data Sources: HURL, NOAA PIFSC, HI DAR, Bishop Museum



Chapter 3 Benthic Habitats and Corals

Laurie Bauer, Matthew Poti, Bryan Costa, Daniel Wagner, Frank Parrish, Mary Donovan, Brian Kinlan

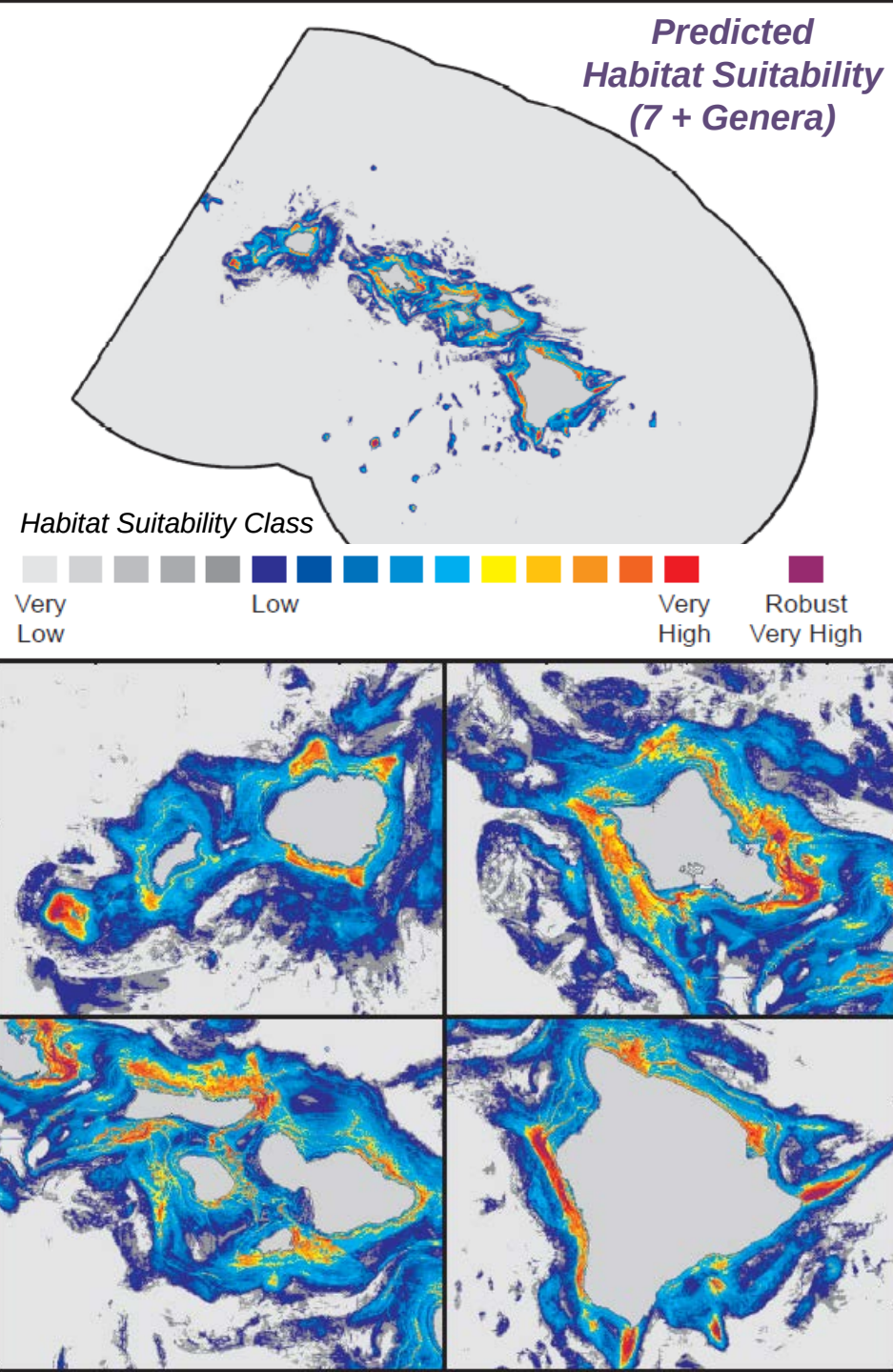


Deep (>150 m):

(118 Spatial Layers)

- Locations of *in-situ* surveys (1)
- Spatial predictions & uncertainty for 18 taxonomic groups (52)
- Model inputs (65)

Data Sources: NOAA DSCRTP, HURL



Chapter 4: Reef Fishes

K.Stamoulis, M.Poti J.Delevaux, M.Donovan,
A.Friedlander, M.Kendall



Acanthurus triostegus in Hongkum Bay, Oahu. Photo credit: Lea Wedding (Stanford University)

GIS Data: (290 Spatial Layers)

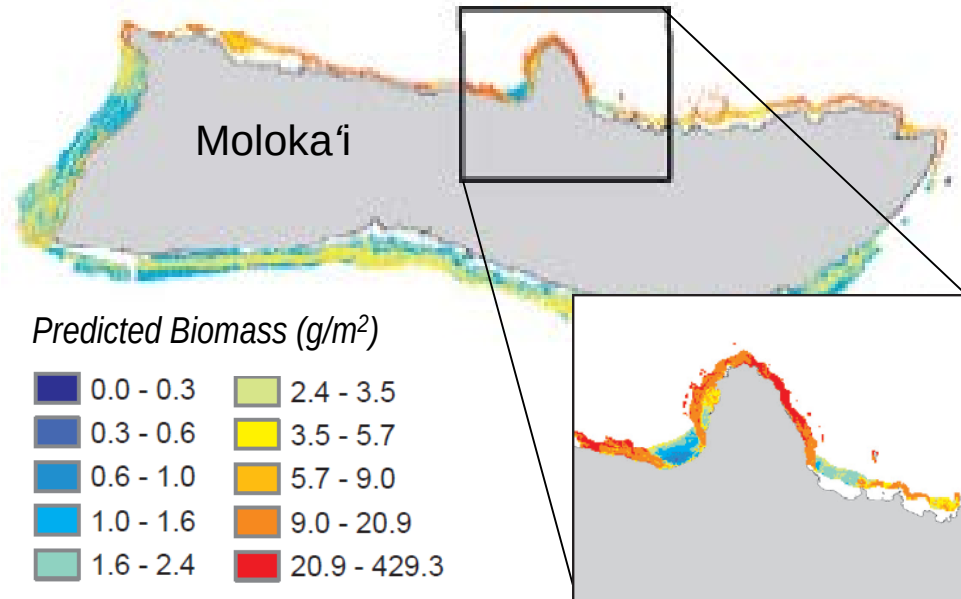
- *In situ* reef fish surveys (1)
- Spatial predictions & uncertainty for:
 - Resource biomass (8)
 - Endemic biomass & richness (16)
 - Total biomass & richness (16)
- Model inputs (249)

Data sources:

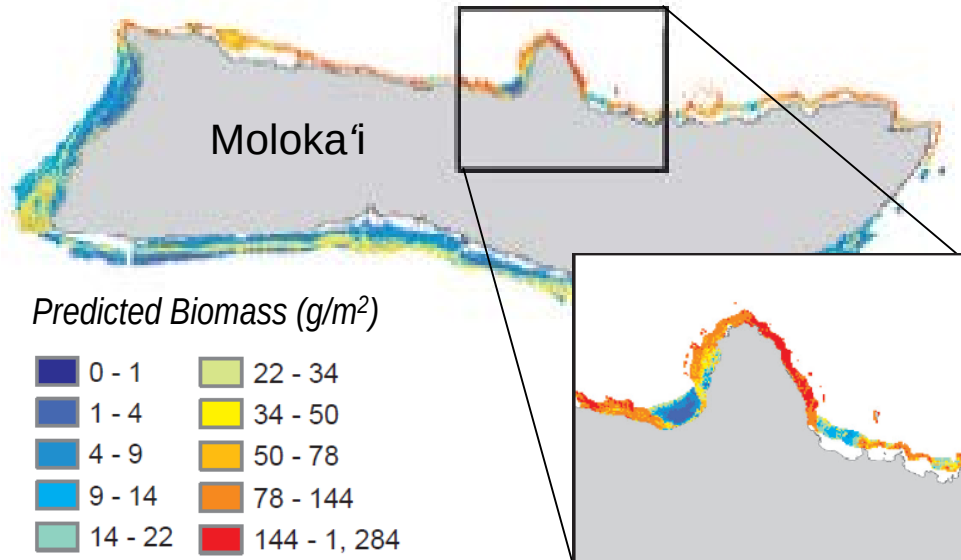
UH FERL, NOAA PIFSC CREP, HI DAR,
NPS, TNC

Endemic Reef Fish

Fishes



Resource Reef Fish



Chapter 4: Bottom Fishes

L.Siceloff, M.Kendall, R.Kokubun, J.Drazen, V.Moriwake



Acanthurus triostegus in Hanalei Bay, Oahu. Photo credit: Lea Wedding (Stanford University)

GIS Data: (7 Spatial Layers)

Fisheries Dependent:

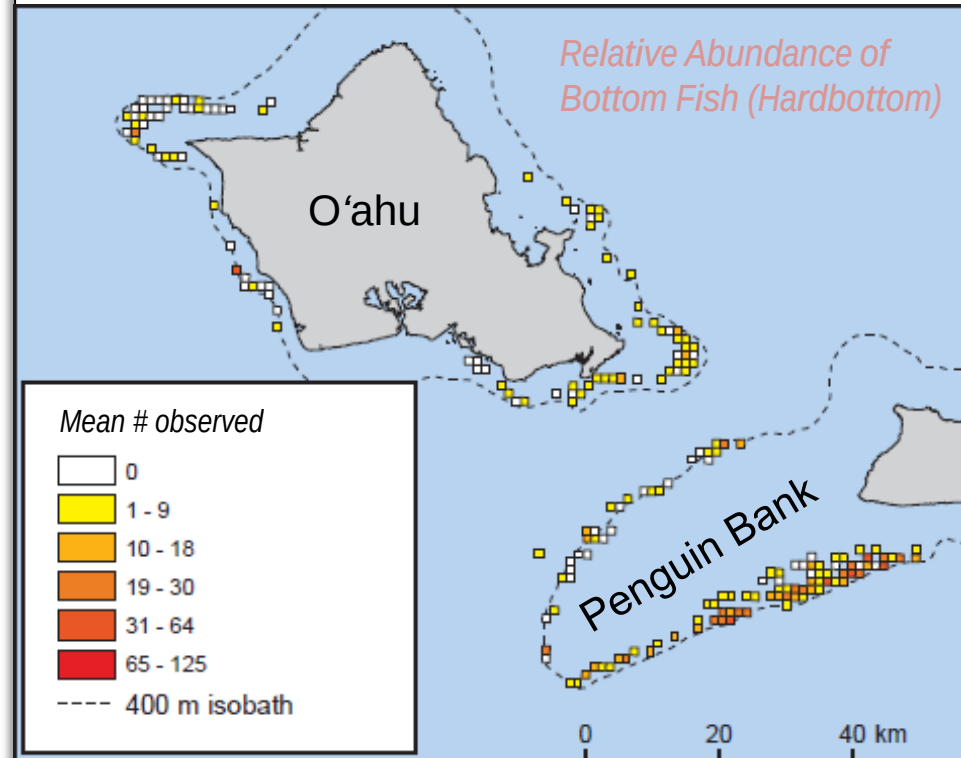
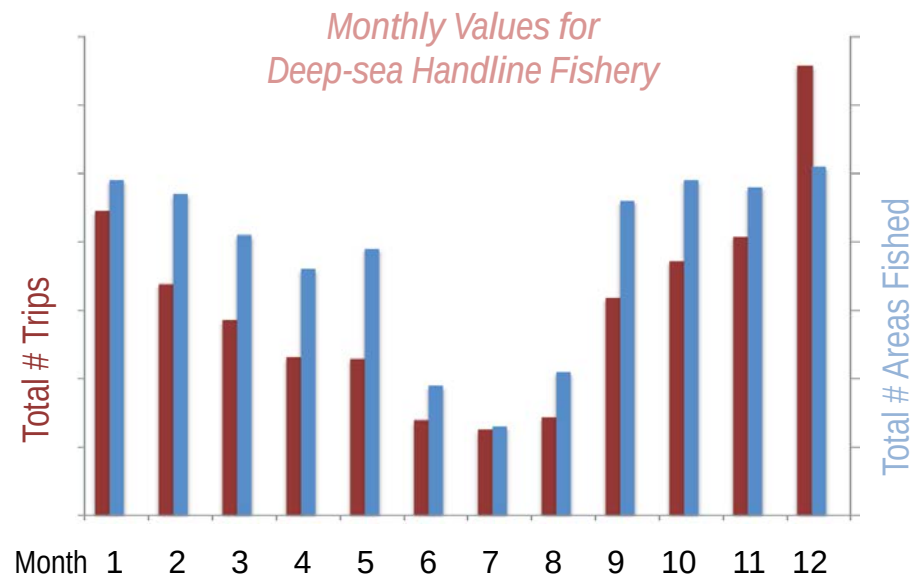
- Deep 7 species lbs. catch (1)
- Catch-per-unit-effort (1)
- # trips (1)

Data Source: HI DAR

Fisheries Independent:

- Species richness (2)
- Relative abundance (2)

Data Source: UH DSFEL



Chapter 5 Sea Turtles

K. Roberson, M. Kendall, D. Parker, S. Murakawa



GIS Data: (7 Spatial Layers)

Terrestrial turtle data:

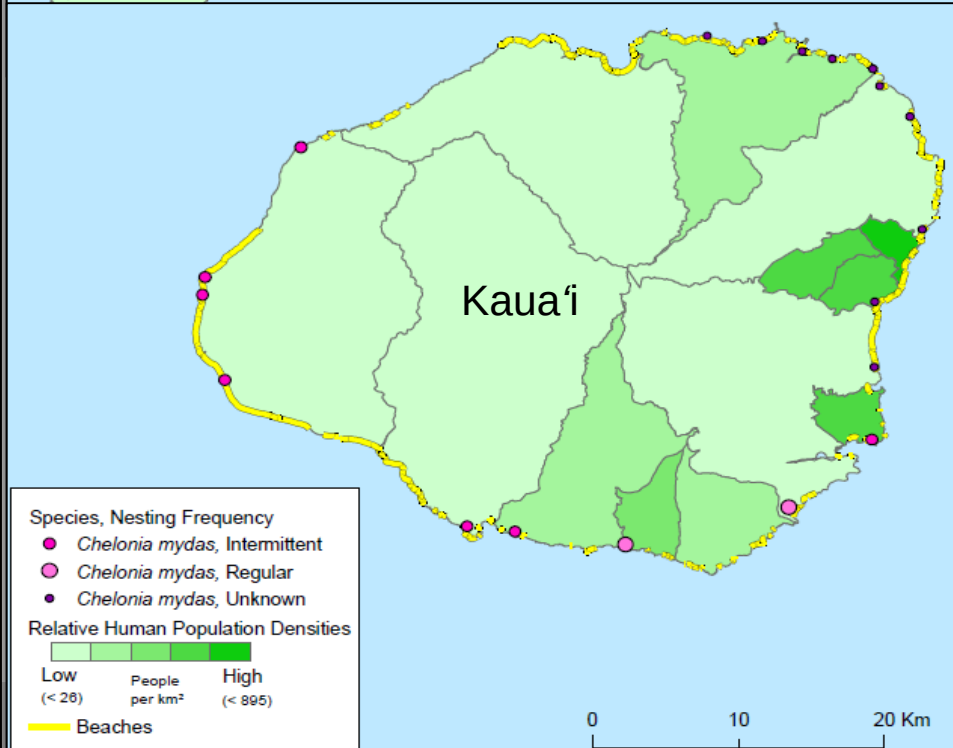
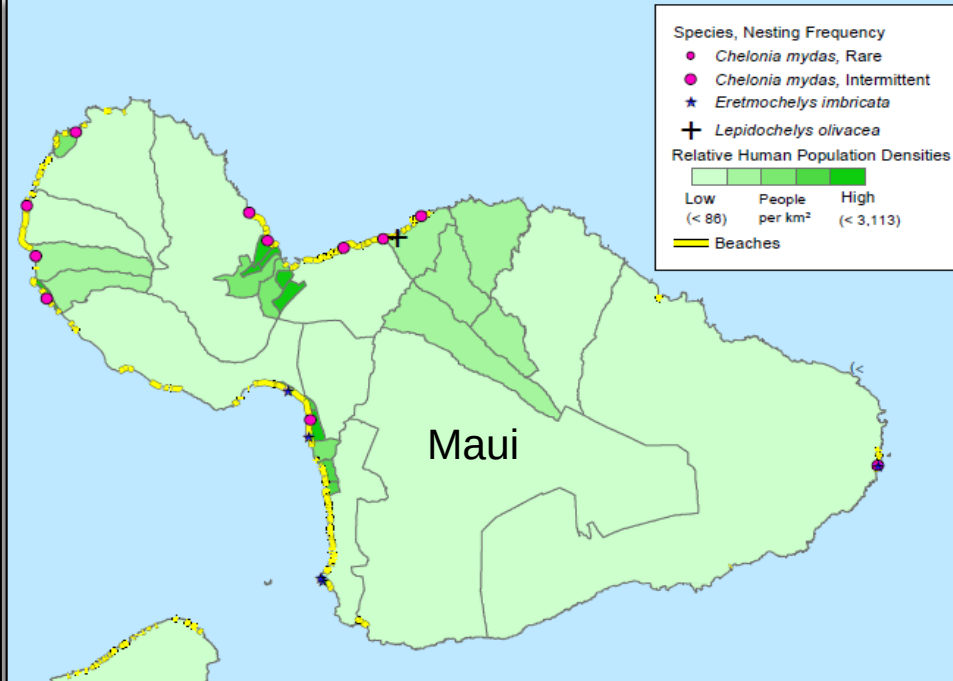
- Nesting locations 4 species (1)
- Stranding locations 4 species (1)
- Basking locations for Greens (1)

Data Source: NOAA PIFSC MTBAP

Ancillary data:

- Beaches & Cliffs (3)
- Human Population Density (1)

Data Sources: NOAA, US Census



Chapter 6:Cetaceans

S.Pittman, A. Winship, M.Poti, B.Kinlan, J. Leirness,
R.Baird, J. Barlow, E.Becker, K. Forney, M. Hill,
P.Miller, J. Mobley & E.Oleson

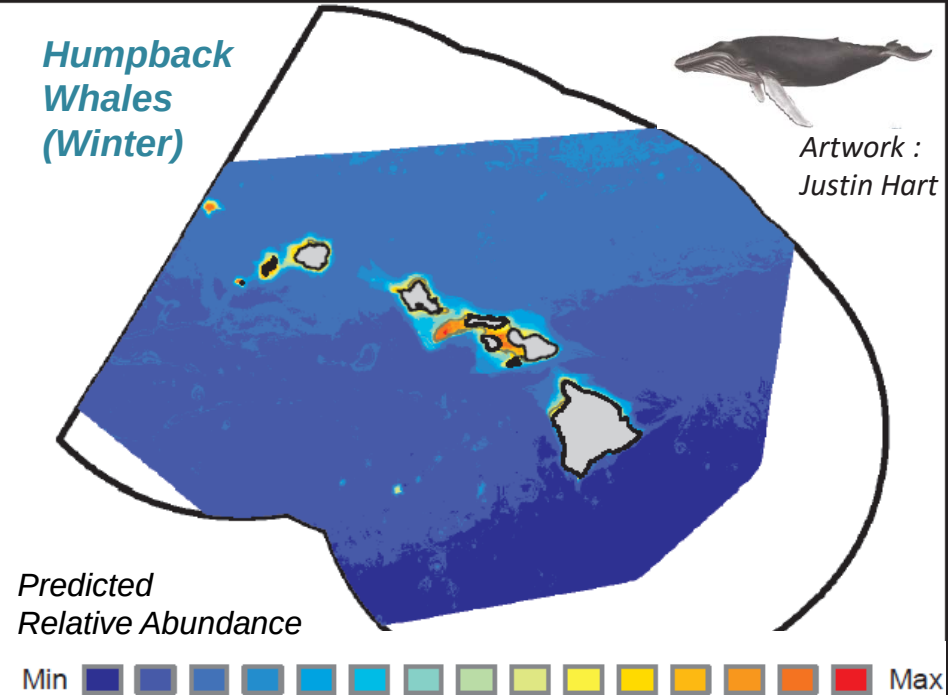


GIS Data: (66 Spatial Layers)

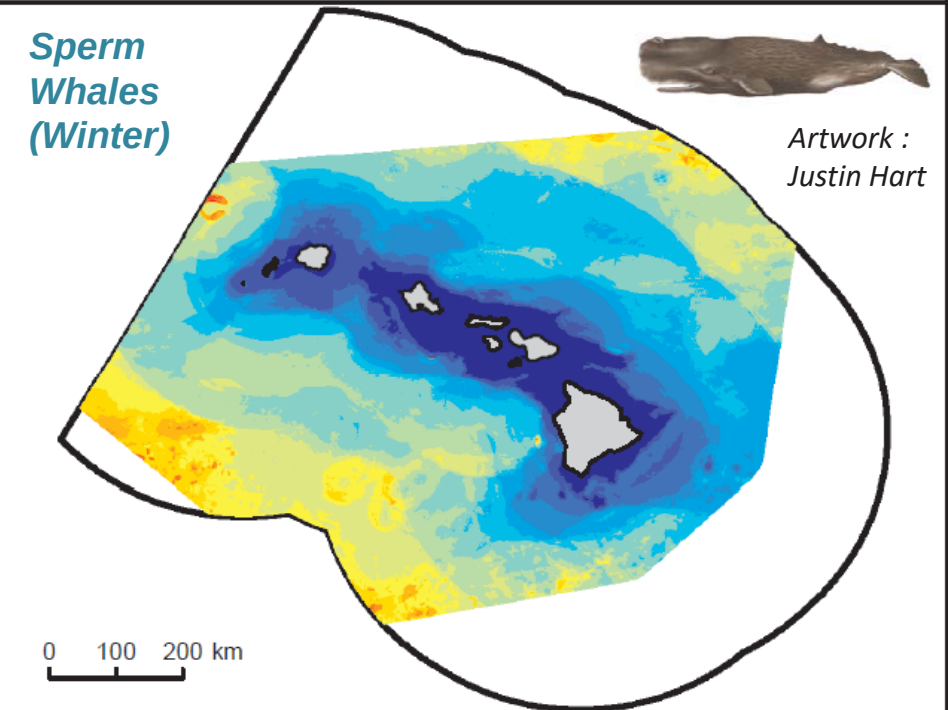
- Summer/winter presences for 22 species (42)
- Summer/winter spatial predictions & uncertainty for 7 species (24)
- Model inputs (listed in Chapter 2)

Data Sources: NOAA SWFSC
MMTD, NOAA PIFSC PSD,
Cascadia Research, UH

Humpback Whales (Winter)



Sperm Whales (Winter)



Chapter 6: Monk Seals

S.Pittman, A. Winship, K. Wilson, C. Littnan



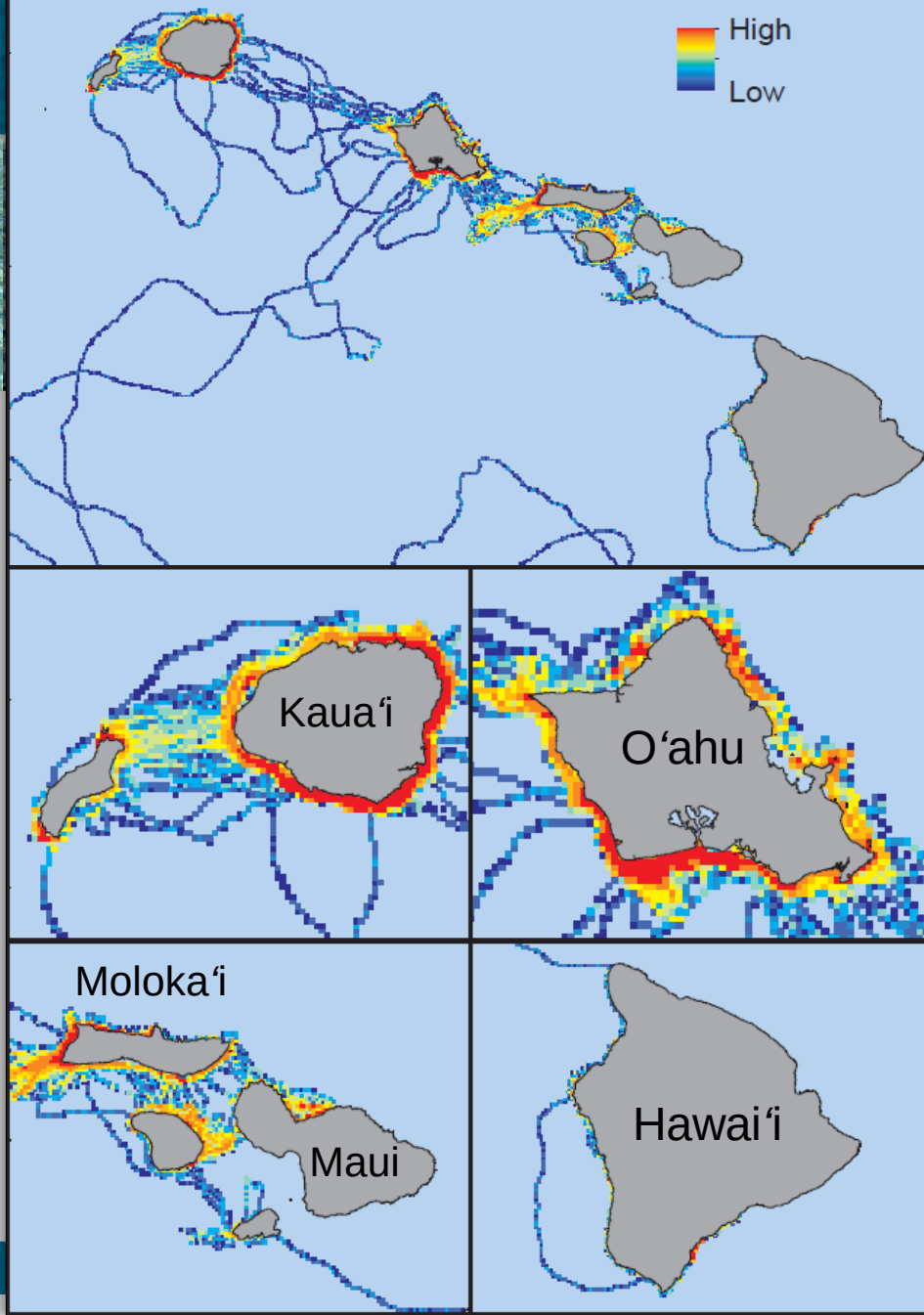
GIS Data: (4 Spatial Layers)

- Terrestrial presences (1)
- Critical marine habitats (1)
- Critical terrestrial habitats (1)
- Telemetry tracks for 16 individuals (1)

Data Sources:

NOAA PIFSC PSD HMSRP

Density of telemetry points



Chapter 7 Seabirds

A. Winship, B. Kinlan, L. Ballance, T. Joyce,
J. Leirness, B. Costa, M. Poti, P. Miller



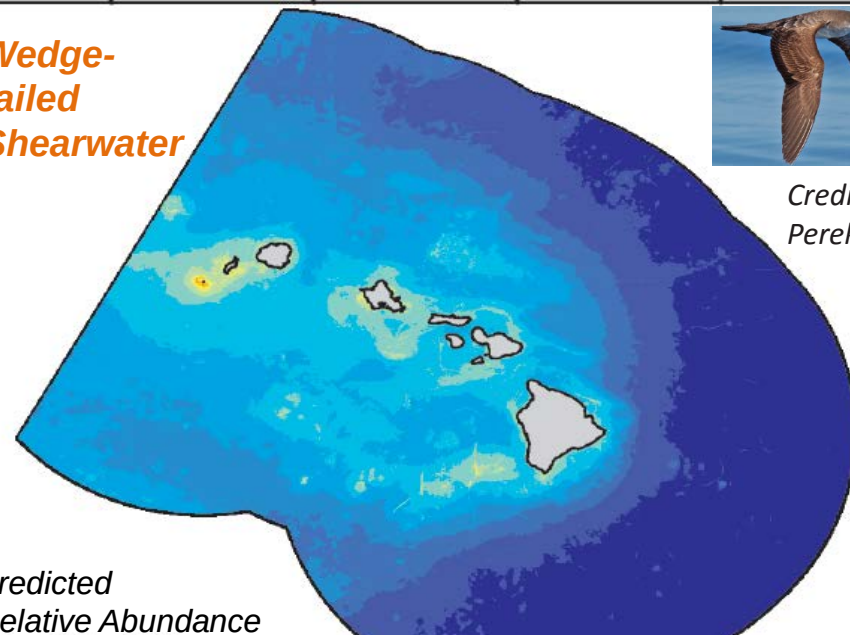
Laysan Albatross at Kaena Point, O'ahu. Photo credit: Arliss Winship (NOAA/NOS/NCCOS)

GIS Data: (78 Spatial Layers)

- At-sea presences 24 spp (42)
- Foraging ranges for 8 spp (8)
- Spatial predictions & uncertainty for 14 species (28)
- Model inputs (listed in Chapter 2)

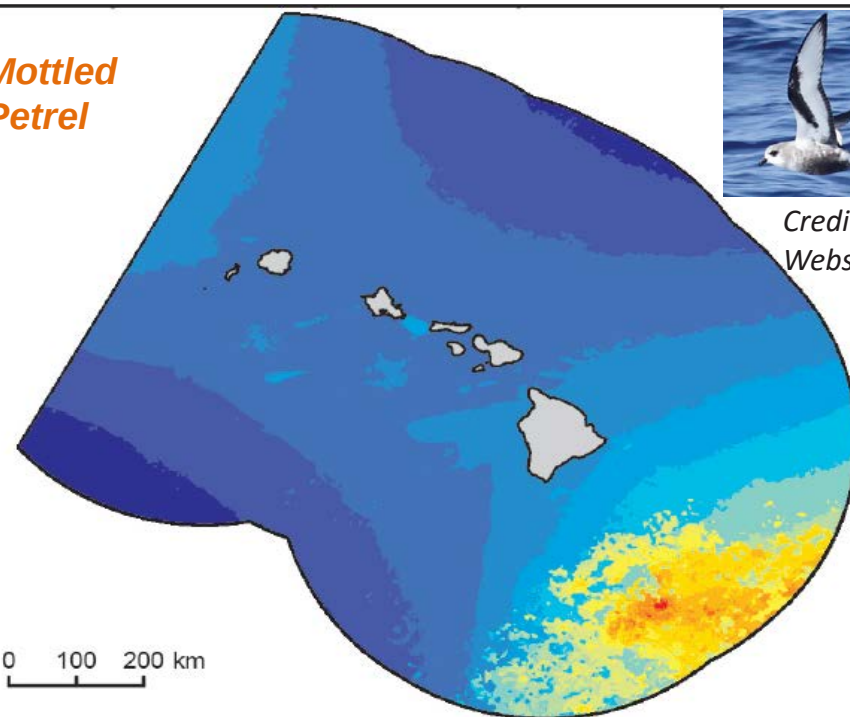
Data Sources: NOAA SWFSC MMTD

Wedge-tailed Shearwater



Credit: D. Pereksta

Mottled Petrel



Credit: D. Webster

U.S. Department of Commerce

Penny Pritzker, Secretary of Commerce

National Oceanic and Atmospheric Administration

Kathryn Sullivan, Acting Under Secretary for Oceans and Atmosphere

National Ocean Service

Holly Bamford, Assistant Administrator for National Ocean Service

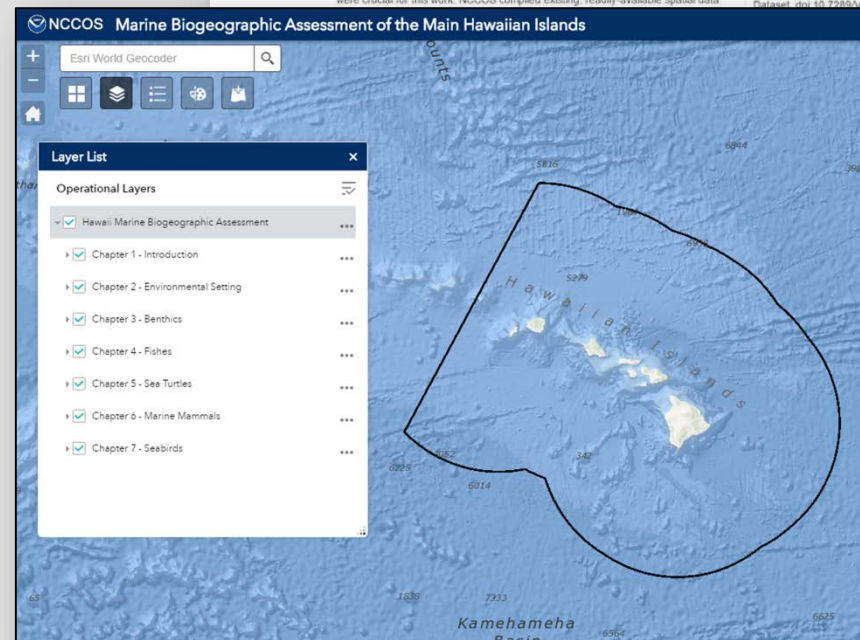
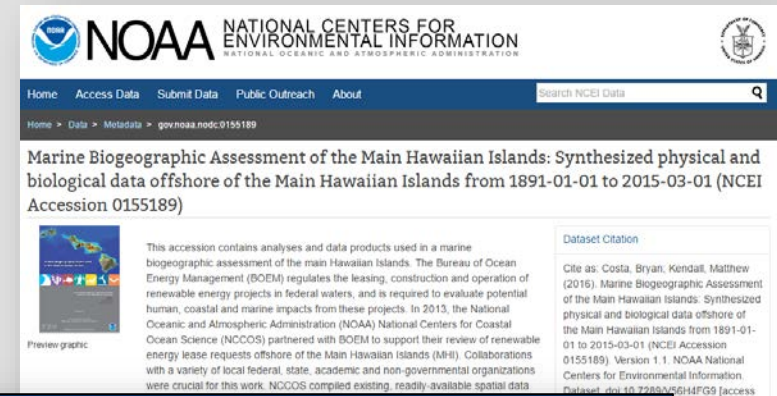
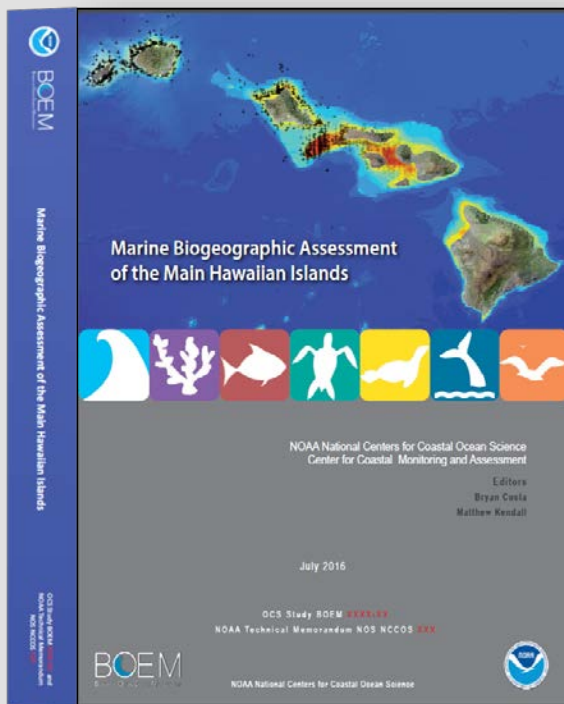
The mission of the National Centers for Coastal Ocean Science is to provide managers with scientific information and tools needed to balance society's environmental, social and economic goals. For more information, visit: <http://www.coastalscience.noaa.gov/>.



3. Products (Publicly Available)

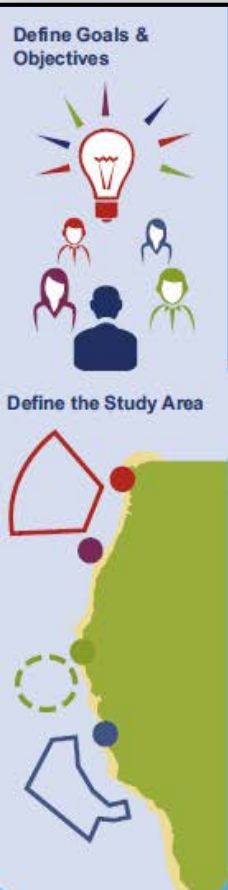
1. Technical Report (1)
2. Online Map with key GIS layers (1)
3. Web Mapping Services (~70)
4. Compiled GIS layers (~730)

Website: coastalscience.noaa.gov

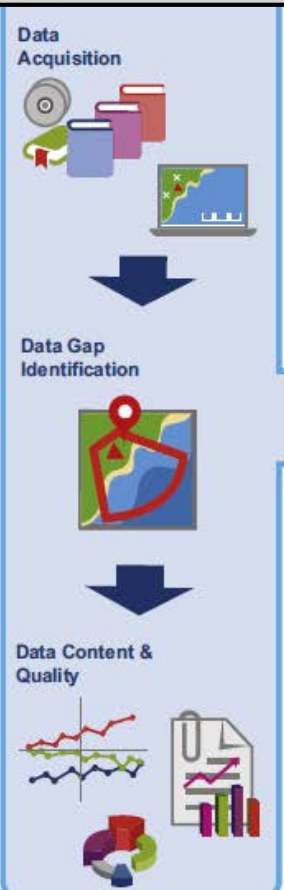


Biogeographic Assessment Process

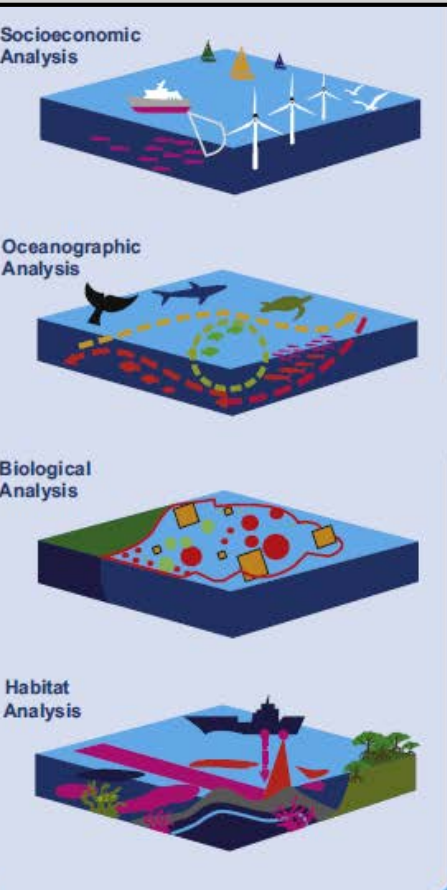
Step 1 Planning



Step 2 Partnerships



Step 3 Patterns & Products



Step 4 Informing Decisions

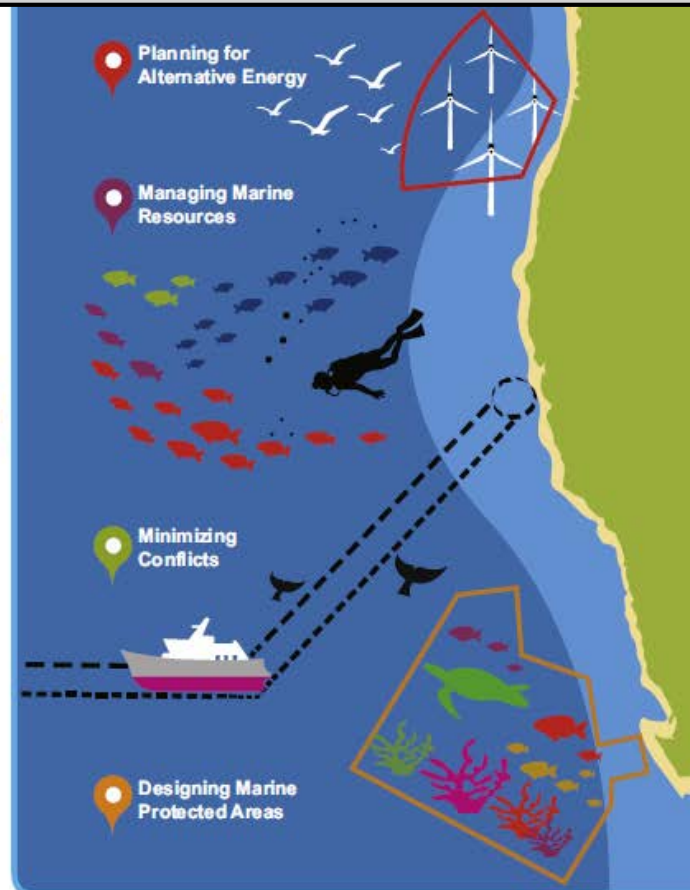
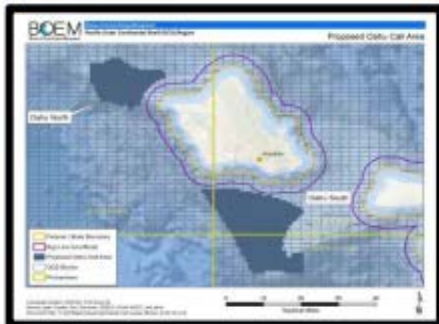


Figure. Steps in Biogeographic Assessment Process. Figure credit: Caldow et al., 2015

4. Informing Decisions

Planning and Analysis



Leasing



Site Assessment



Construction and Operations



Burning Questions?



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