

Annex IV Environmental Research Webinar Series

Artificial Reefs and Benthic Changes in Relation to MRE



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Presenters

▶ Sharon Hendrix Kramer

- Marine Biologist/Fish Ecologist, H. T. Harvey & Associates

▶ Olivia Langhamer

- Research Fellow, Department of Energy and Environment, Chalmers University of Technology



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Sharon Hendrix Kramer

Evaluating the Potential for Marine and Hydrokinetic Devices to Act as Artificial Reefs or Fish Aggregating Devices



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Evaluating the Potential for Marine and Hydrokinetic Devices to Act as Artificial Reefs or Fish Aggregating Devices



Photo by D. Itano

Presented by Sharon Hendrix Kramer,
Marine Biologist/Fish Ecologist

OES Annex IV Webinar

April 25, 2017



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Introduction



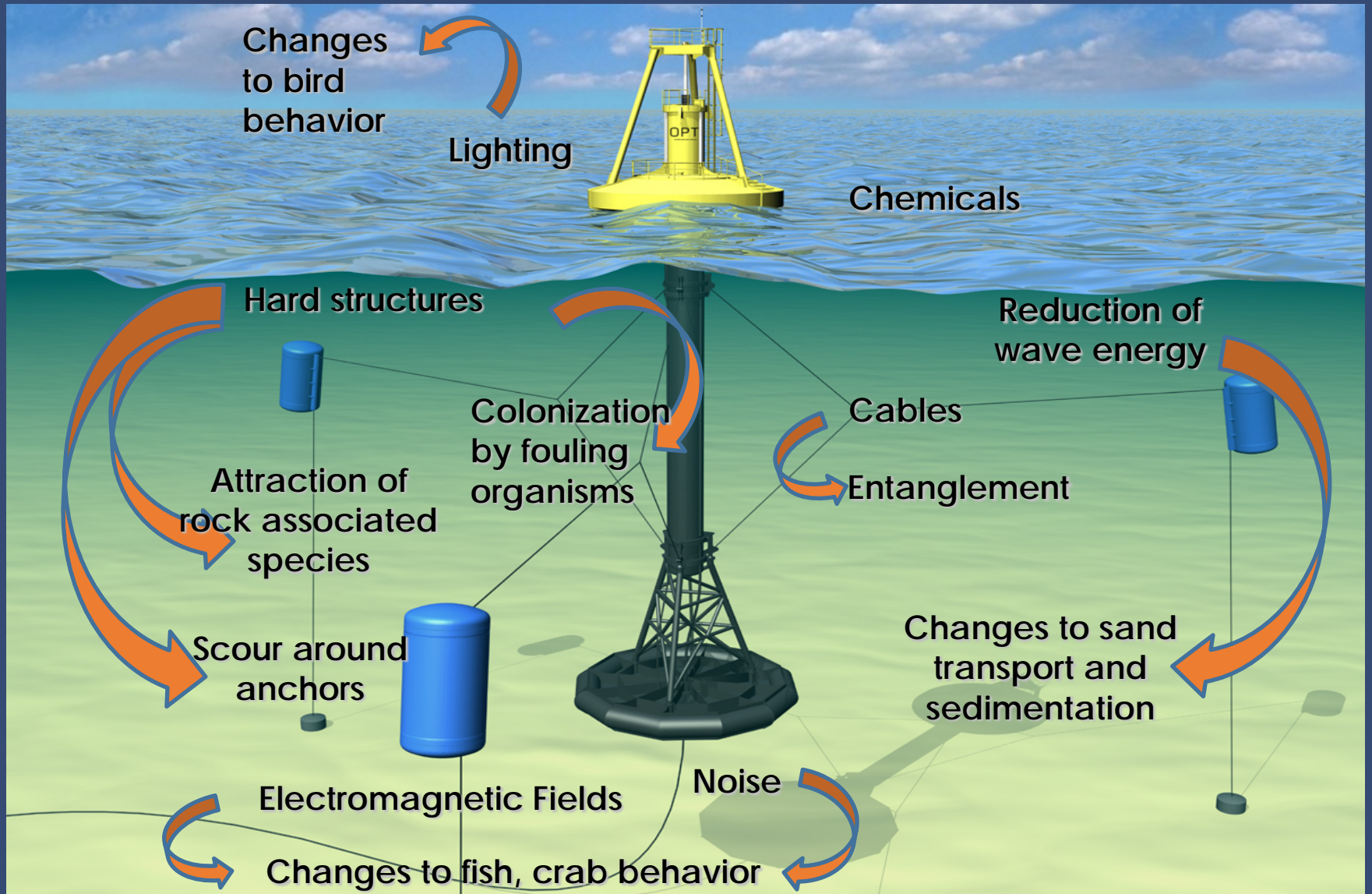
- Information gaps identified through project permitting
- Surrogates help to understand effects



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Potential Environmental Effects



Artificial Reef/Fish Aggregating Device



D. Itano

Mooring lines, buoys, devices
Fish aggregating device?

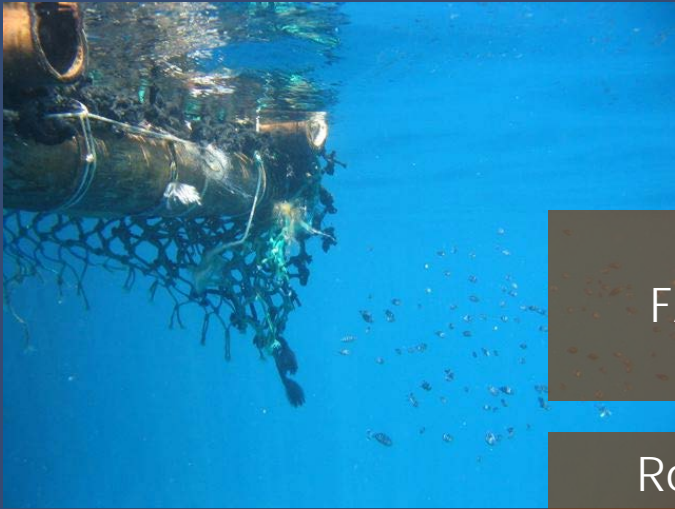


D. Schroeder, BOEM

Anchors, foundations
Artificial reef?



Surrogate Structures



FADs



Mariculture net-pens

Rocky reefs/kelp beds

Artificial reefs



Piers and docks

Oil platforms



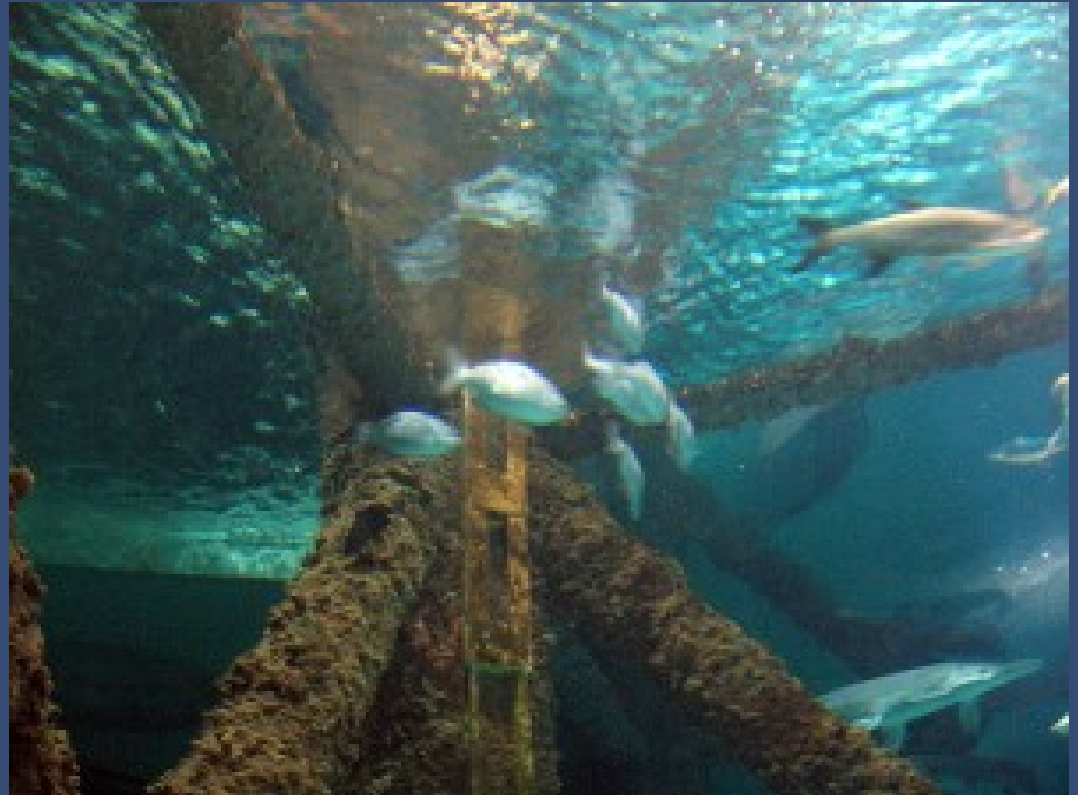
Marine debris

D. Schroeder, BOEM

BOEM

Surrogate Studies Elucidate.....

- Fish assemblages
- Special-status fish interactions
- Ecological interactions
- Interactions/ocean processes
- Seasonality



Approach

1. Analyzed literature on surrogate structures in 4 regions: 3 off West Coast and 1 in Hawai'i.
2. Held guided discussions with subject matter experts.
3. Accounted for physical, bio, and structural variables.
4. Asked:
 - Do surrogate structures attract fish?
 - Which species? What about special-status species?
 - If attraction occurs, are there negative effects?
 - What variables are important in predicting effects?

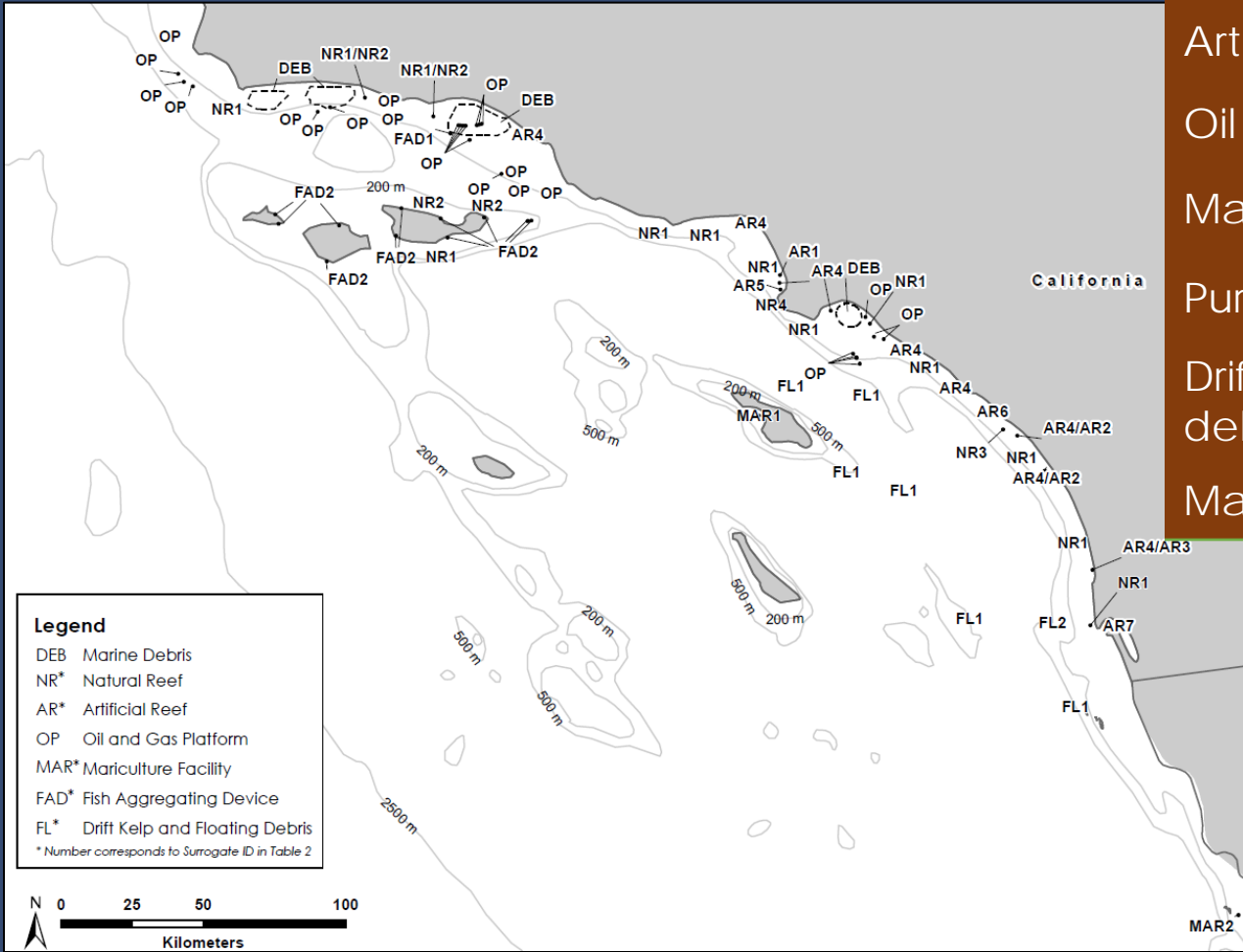


Photo Credit: Dave Itano



Surrogate Structures: Southern California Bight

| Surrogate | # Sites |
|-----------------------------|---------|
| Natural reefs | 80+ |
| Artificial reefs | 21 |
| Oil platforms | 27 |
| Mariculture net-pens | 2 |
| Purpose-built FAD | 10 |
| Drift kelp, floating debris | 50+ |
| Marine debris | 100+ |



Fish Association: Southern California Bight

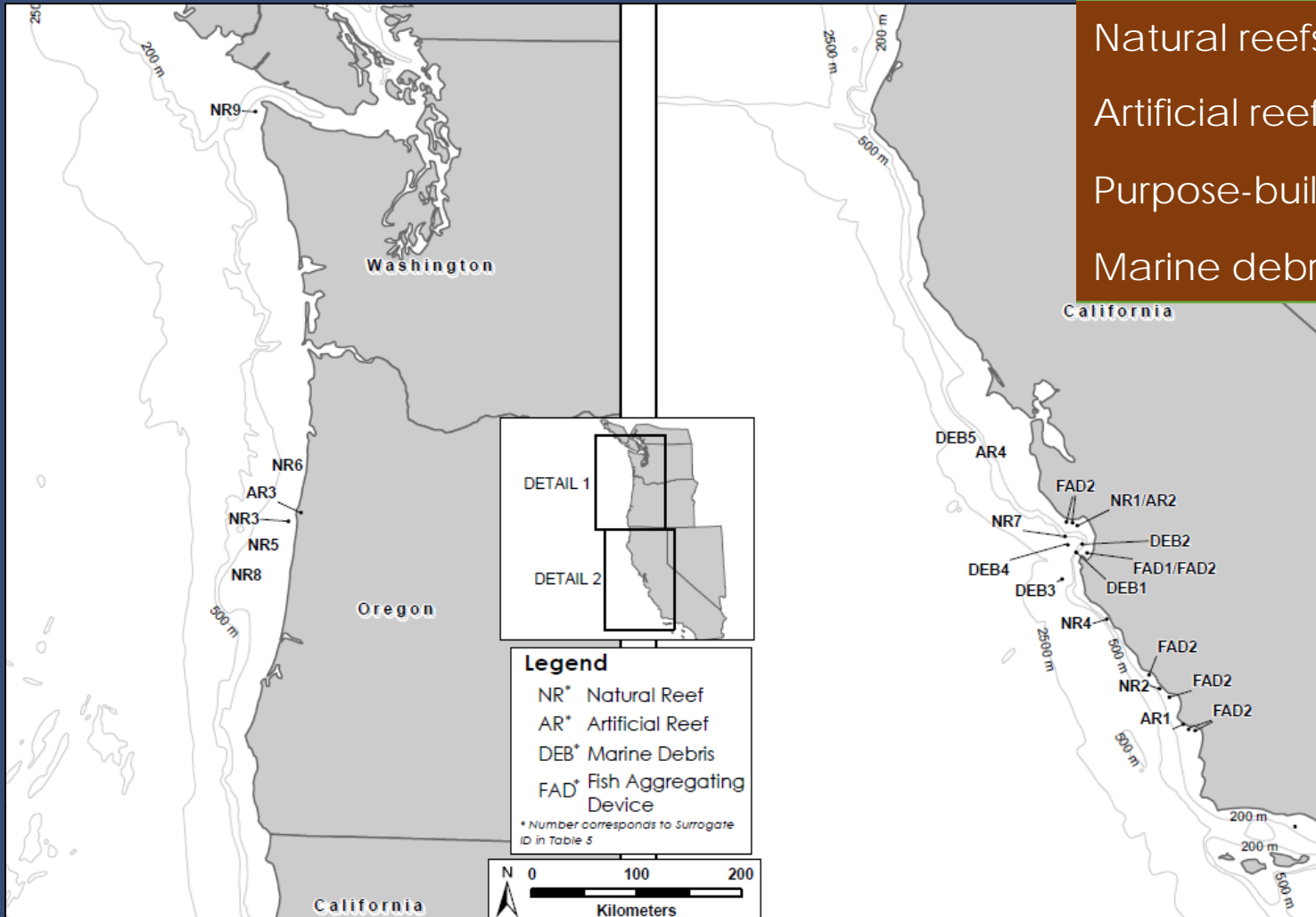
| Common Name | Position in Water Column | | Affected by Depth of Bottom Structure? (Y/N) | Associated with Midwater/ Surface Structure? (Y/N) |
|----------------------|--------------------------|-------|--|--|
| | Juvenile | Adult | | |
| Bocaccio | WC | B | N | Y |
| Canary rockfish | WC | B | Y | N |
| Cowcod | B | B | Y | N |
| Yelloweye rockfish | B | B | Y | Maybe |
| Pacific Ocean perch | B | B | N | N |
| Steelhead | WC | WC | N | N |
| Pacific bluefin tuna | WC | WC | N | N |

B = bottom; WC = water column



Surrogate Structures: Central California, Washington

| Surrogate | # Sites |
|-------------------|---------|
| Natural reefs | 20+ |
| Artificial reefs | 4 |
| Purpose-built FAD | 8 |
| Marine debris | 100+ |



Fish Association: Central California, Washington

| Common Name | Position in Water Column | | Affected by Depth of Bottom Structure? (Y/N) | Associated with Midwater/Surface Structure? (Y/N) |
|----------------|--------------------------|-------|--|---|
| | Juvenile | Adult | | |
| Green sturgeon | - | B | Y | N |
| Eulachon | WC | WC | N | N |
| Bocaccio | WC | B | N | Y |
| Chinook salmon | WC | WC | N | N |
| (Etc.) | | | | |

B = bottom; WC = water column

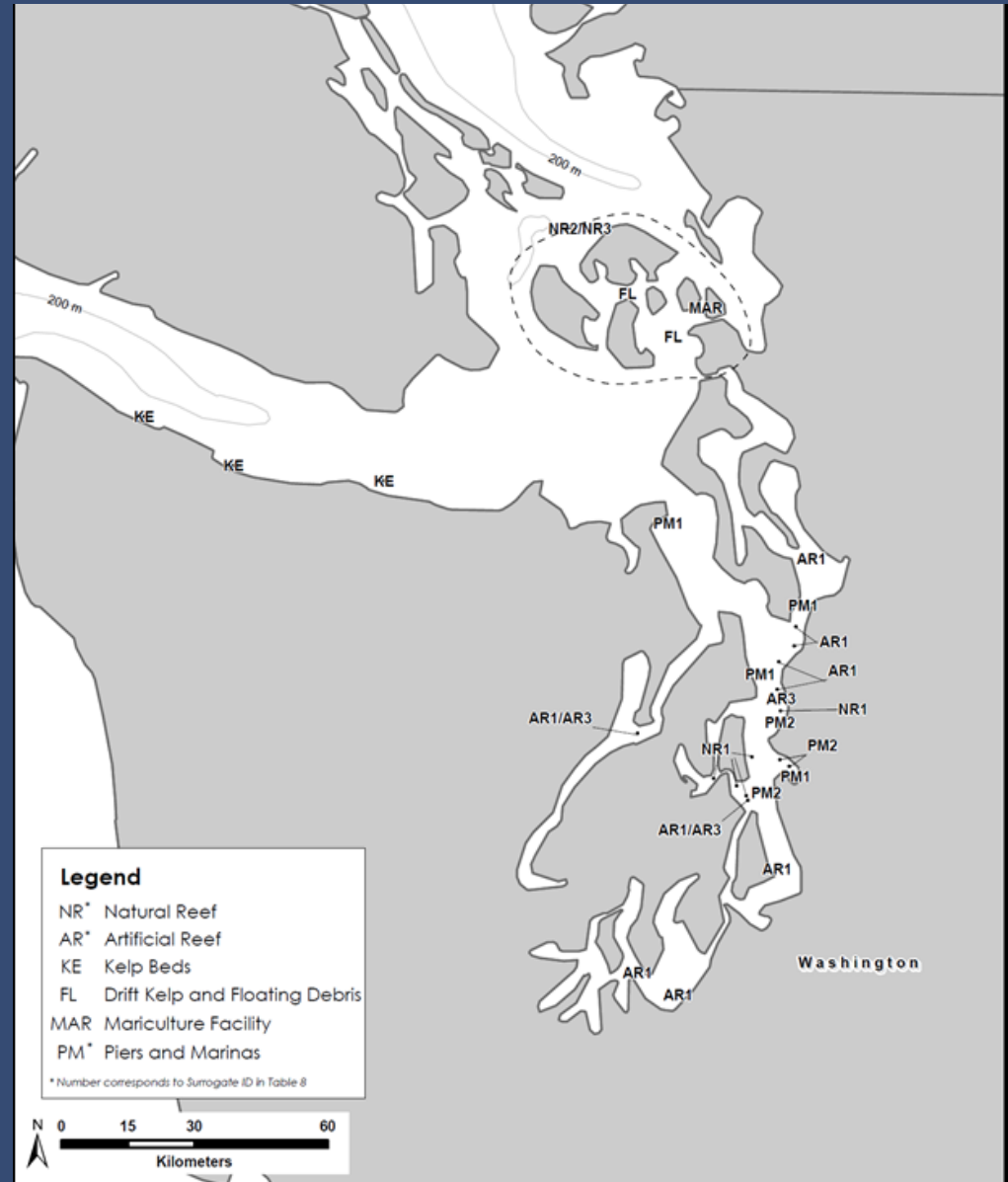


Surrogate Structures: Puget Sound

Surrogate

Sites

| | |
|-----------------------------|-----|
| Natural reefs | 20+ |
| Artificial reefs | 23 |
| Piers and docks | 10+ |
| Mariculture net-pens | 1 |
| Drift kelp, floating debris | 2 |
| Kelp beds | 4 |



Fish Association: Puget Sound

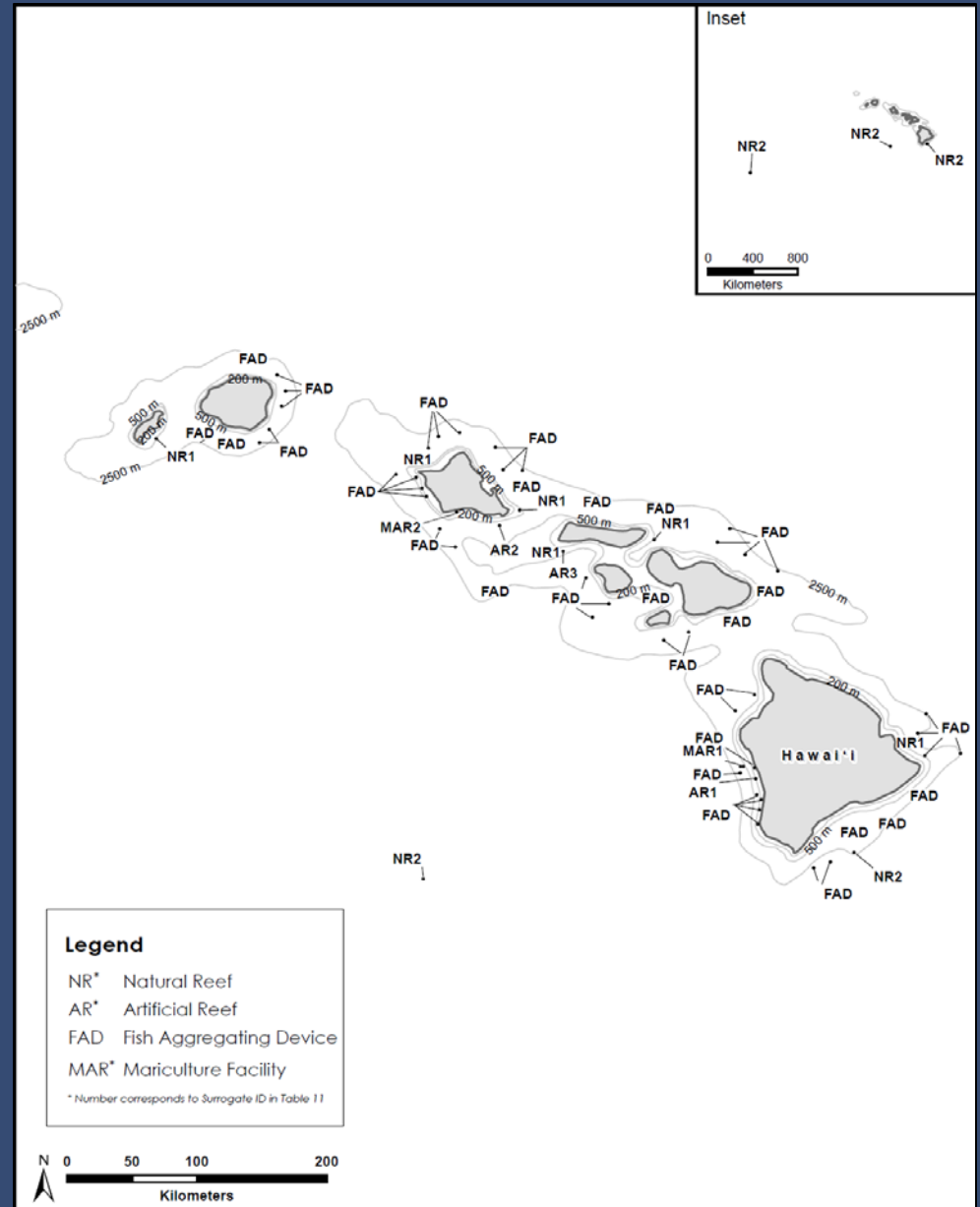
| Common Name | Position in Water Column | | Affected by Depth of Bottom Structure? (Y/N) | Associated with Midwater/Surface Structure? (Y/N) |
|----------------|--------------------------|-------|--|---|
| | Juvenile | Adult | | |
| Green sturgeon | – | B | N | N |
| Eulachon | WC | WC | N | Maybe |
| Bocaccio | WC | B | Y | N |
| Chinook salmon | WC | WC | N | N |
| (Etc.) | | | | |

B = bottom; WC = water column



Surrogate Structures: Hawai'i

| Surrogate | # Sites |
|----------------------|---------|
| Natural reefs | 9 |
| Artificial reefs | 3 |
| Mariculture net-pens | 4 |
| FADs | 60+ |



Fish Association: Hawai'i

| Common Name | Position in Water Column (Juv. and Adult) | Affected by Depth of Bottom Structure? (Y/N) | Affected by Midwater/Surface Structure? (Y/N) |
|-----------------------|---|--|---|
| Silverjaw snapper | B | Y | N |
| Squirrelfish snapper | B | Y | N |
| Longtail snapper | B | Y | N |
| Pink snapper | B | Y | N |
| Von Siebold's snapper | B | Y | N |
| Brigham's snapper | B | Y | N |
| Hawaiian sea bass | B | Y | N |

B = bottom; WC = water column

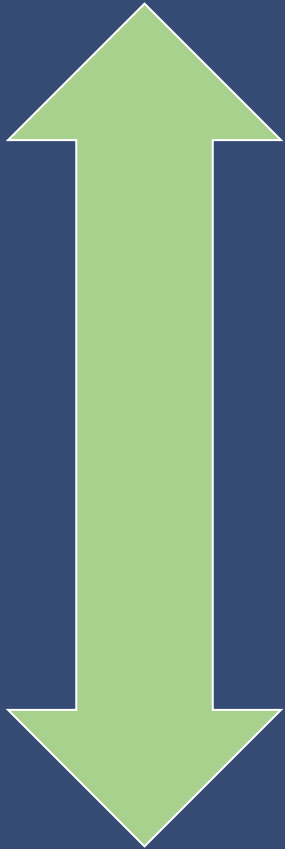


Resemblance of Surrogates to WECs/TECs by Subregion

| Surrogate Structure | Resemblance of Surrogate Structure to WECs/TECs | | Distribution and Quantity of Surrogate Structures | | | |
|-----------------------------|---|--------------------------------|---|-----------|----------------|---------|
| | Bottom Structure | Midwater/ Surface Structure | SCB | CA- WA | Puget Sound | Hawai'i |
| Natural reef | Low | n/a | High | High | High | High |
| Natural reef/kelp bed | Low | Low | High | High | High | None |
| Artificial reef | Low | n/a | High | Low | High | High |
| Artificial reef/kelp bed | Low | Low | High | Low | High | None |
| Oil and gas platform | High | Low | High | None | None | None |
| Marine debris | Low | n/a | Low | Low | None | None |
| Mariculture net-cage | High | High | Low | None | Low | Low |
| Purpose-built FAD | High | High | Low | Low | None | High |
| Drift kelp, floating debris | n/a | Low | Low | None | Low | None |
| Piers and docks | High | Low | None | Low | High | None |

Findings

High Certainty



FAD Effect

Artificial Reef

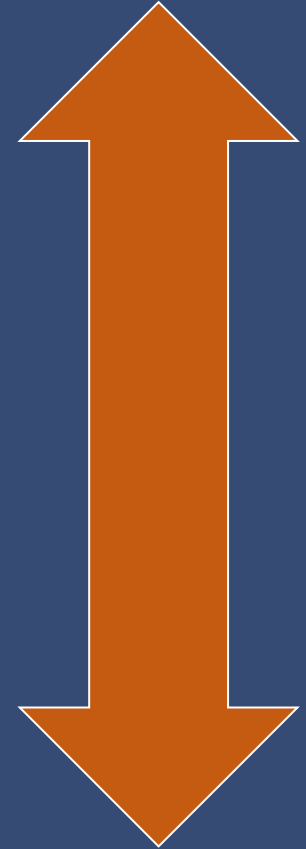
Hawai'i

All regions

Southern California
Bight

Central California-
Washington
Puget Sound

High Attraction



Less Certainty

Less Attraction



Findings

- **Uncertainties:**
 - FAD effect in temperate waters?
 - Effects of installation scale?
- **Adverse effects on special-status fish unlikely.**



Kelp bass, *Paralabrax clathratus*, Platform Gina, © James Forte



Inform Permitting

- Provide supporting information to:
 - address uncertainties that can hold up permitting
 - support analysis of effects for NEPA and ESA documents
- Focus monitoring to address anticipated effects:
 - build on understanding as projects are built
 - minimize need for extensive monitoring at every project



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Link to report:

<http://tethys.pnnl.gov/publications/evaluating-potential-marine-and-hydrokinetic-devices-act-artificial-reefs-or-fads>

or

<http://www.boem.gov/2015-021/>



Olivia Langhamer

Reef effects of offshore wind and wave power parks - Swedish case studies



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Questions & Answers



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- ▶ Watch for announcements on *Tethys* and your email for the next Annex IV webinar
- ▶ For those of you who are not on the webinar mailing list, visit
<https://tethys.pnnl.gov/tethys-blasts/join>

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