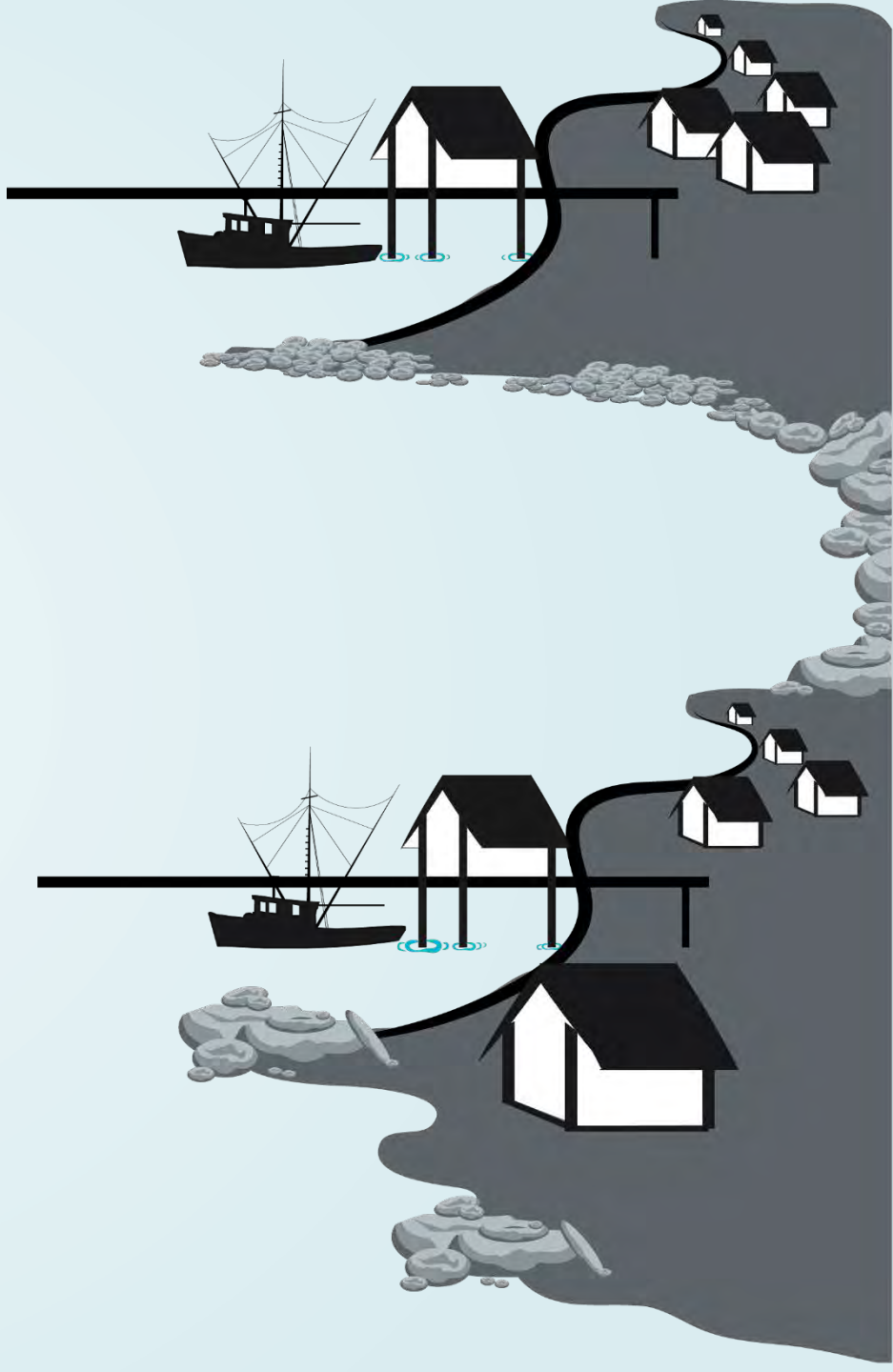
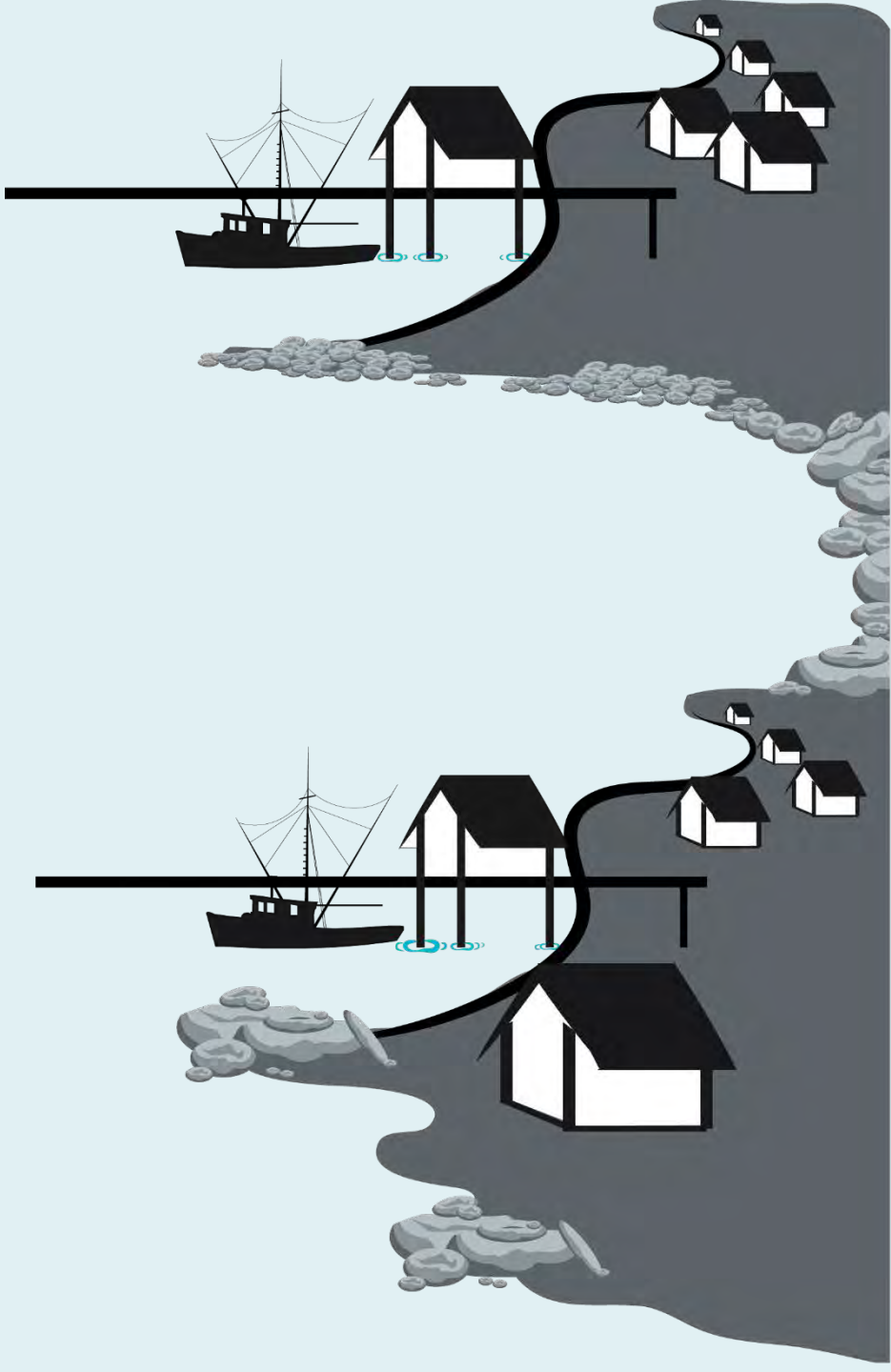
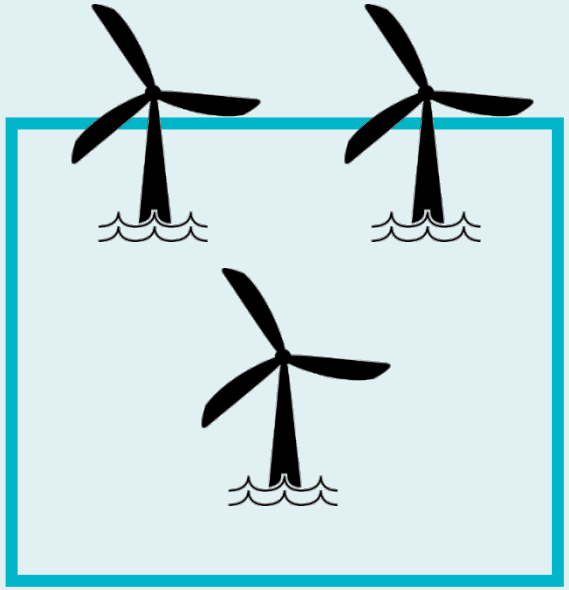
Attachment 306-17-2

Modeling Economic Impacts of Spatial Fisheries Restrictions



OREGON
MARINE RESERVES
OREGON DEPARTMENT OF FISH & WILDLIFE





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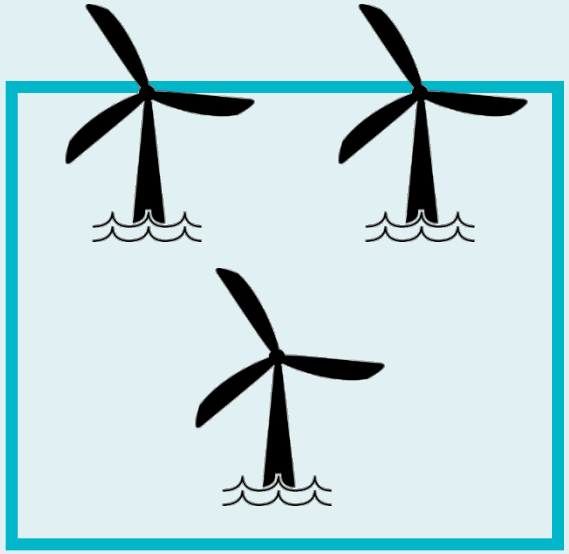
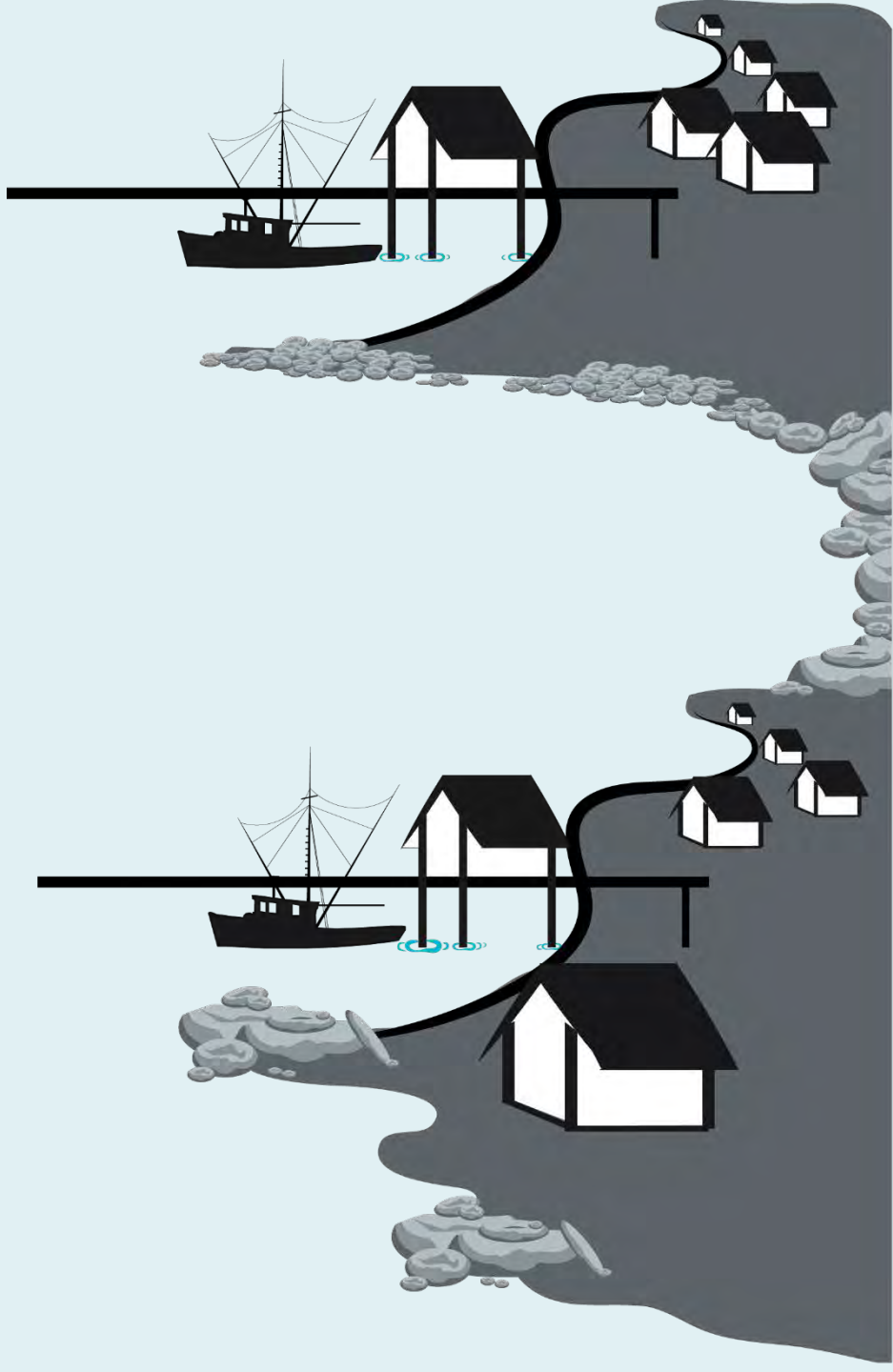
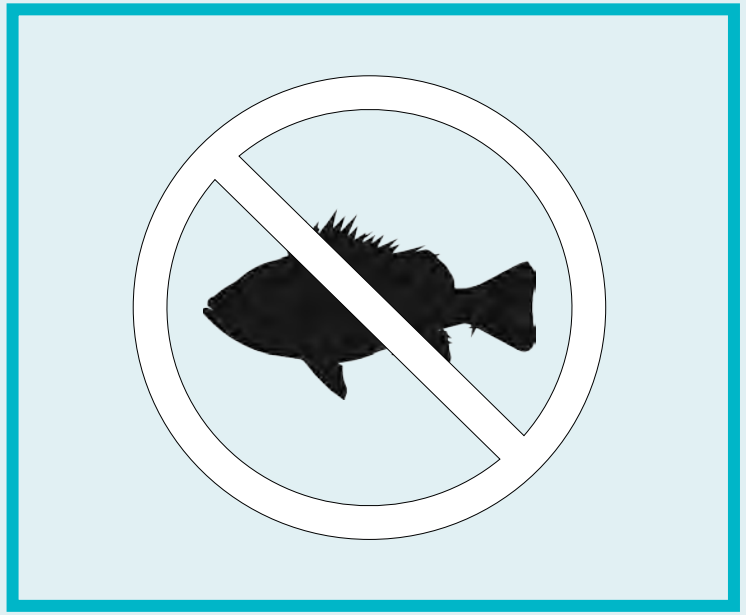
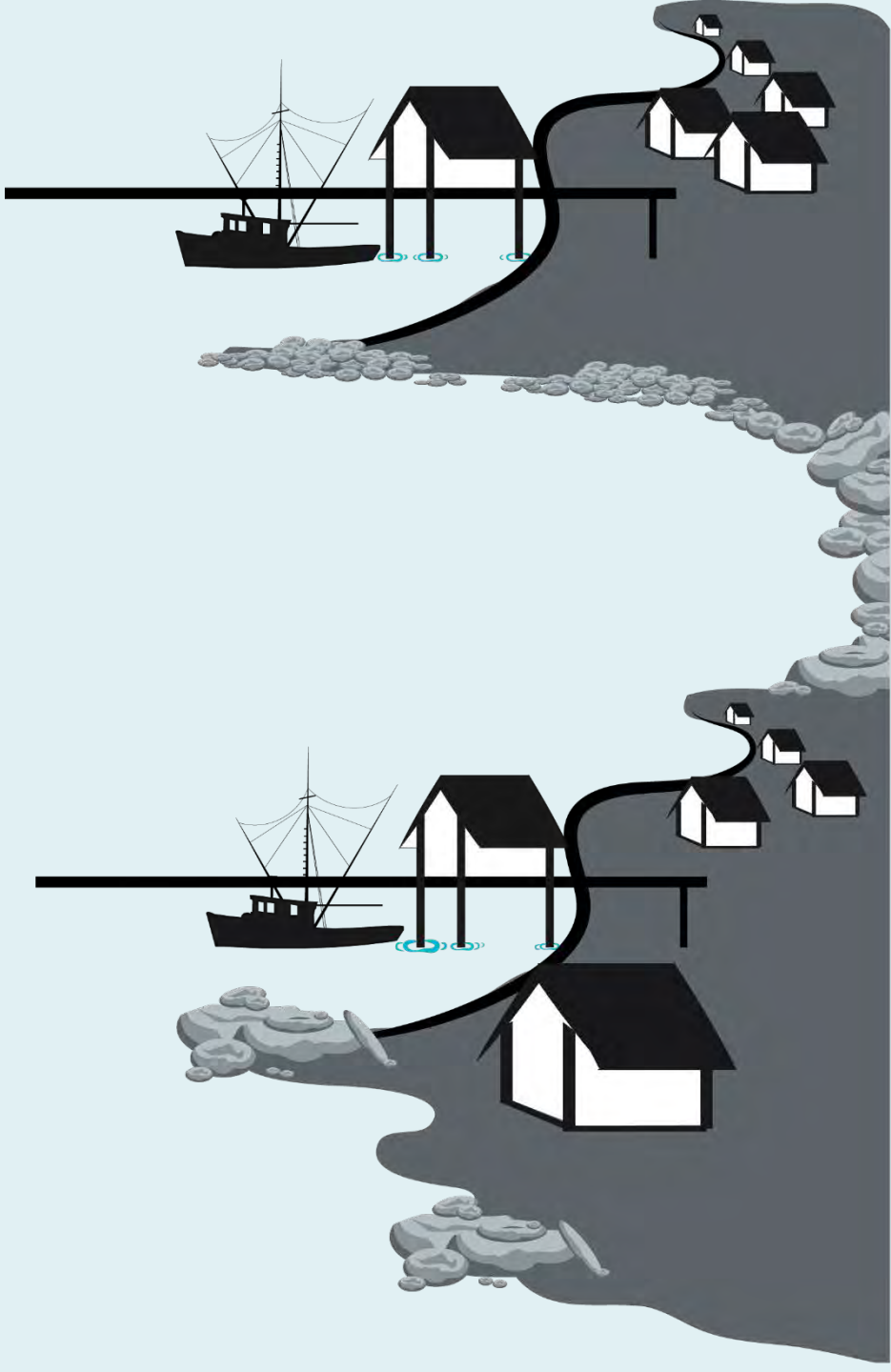
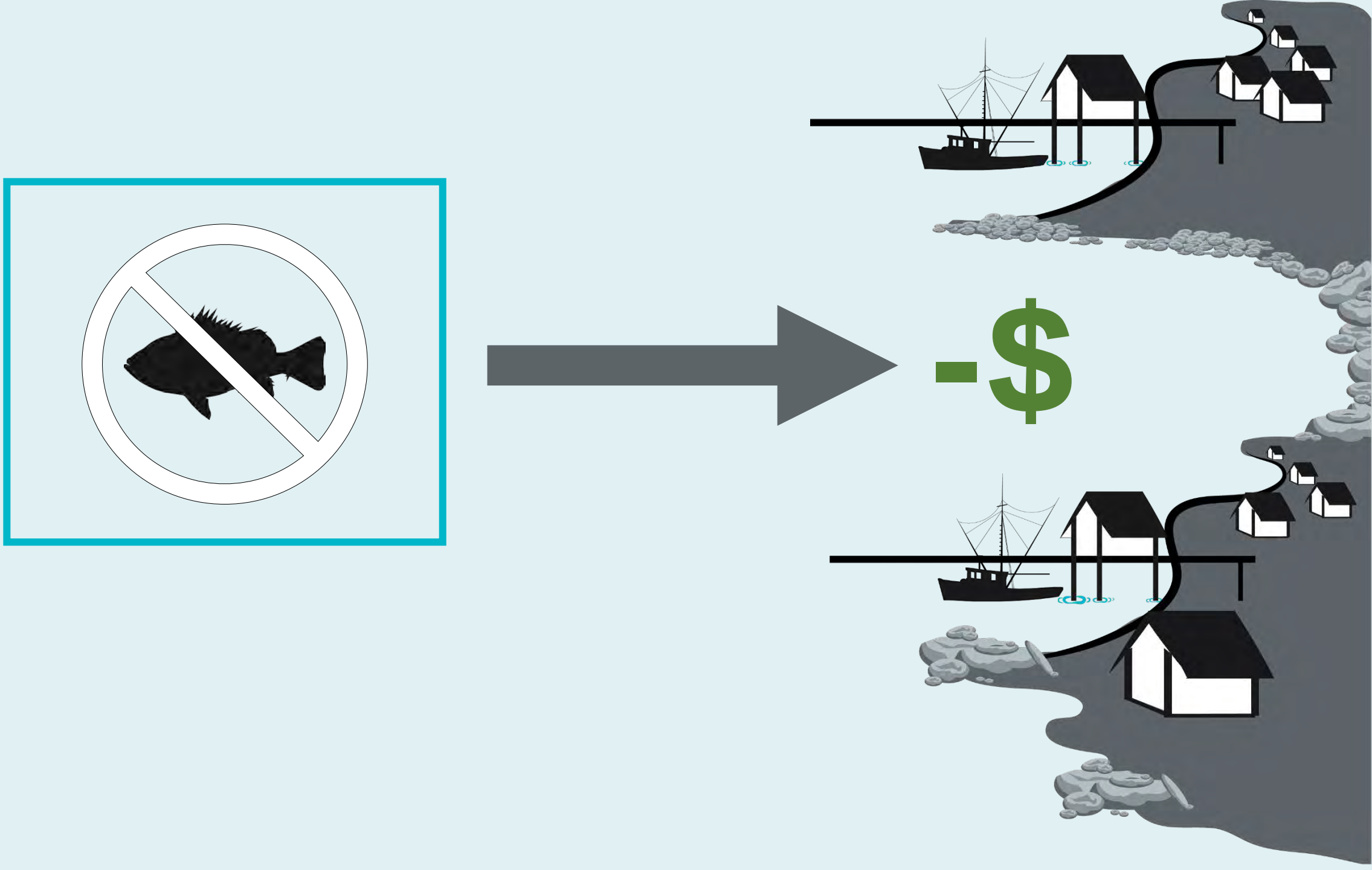


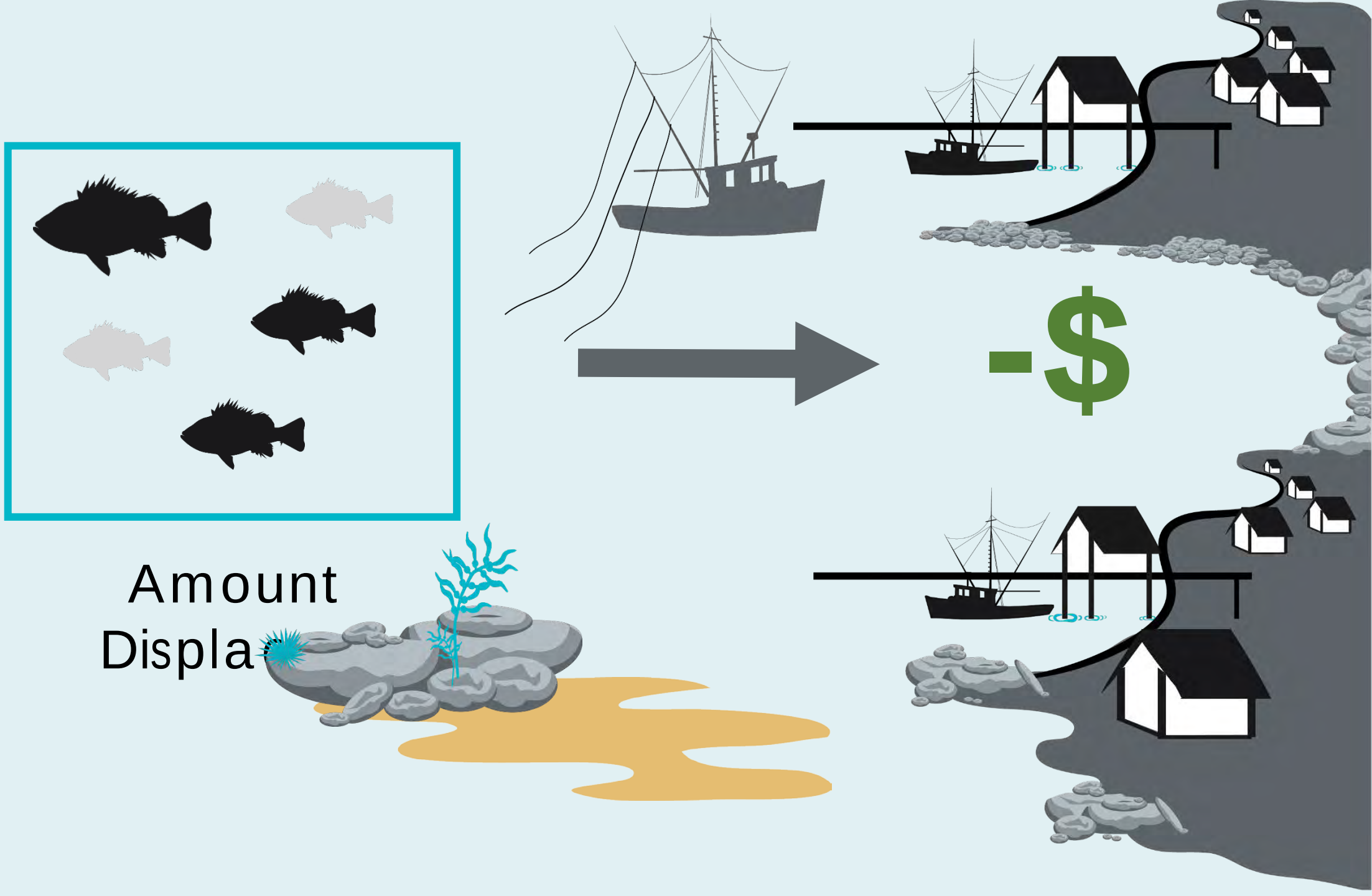








Shannon Davis
The Research Group, LCC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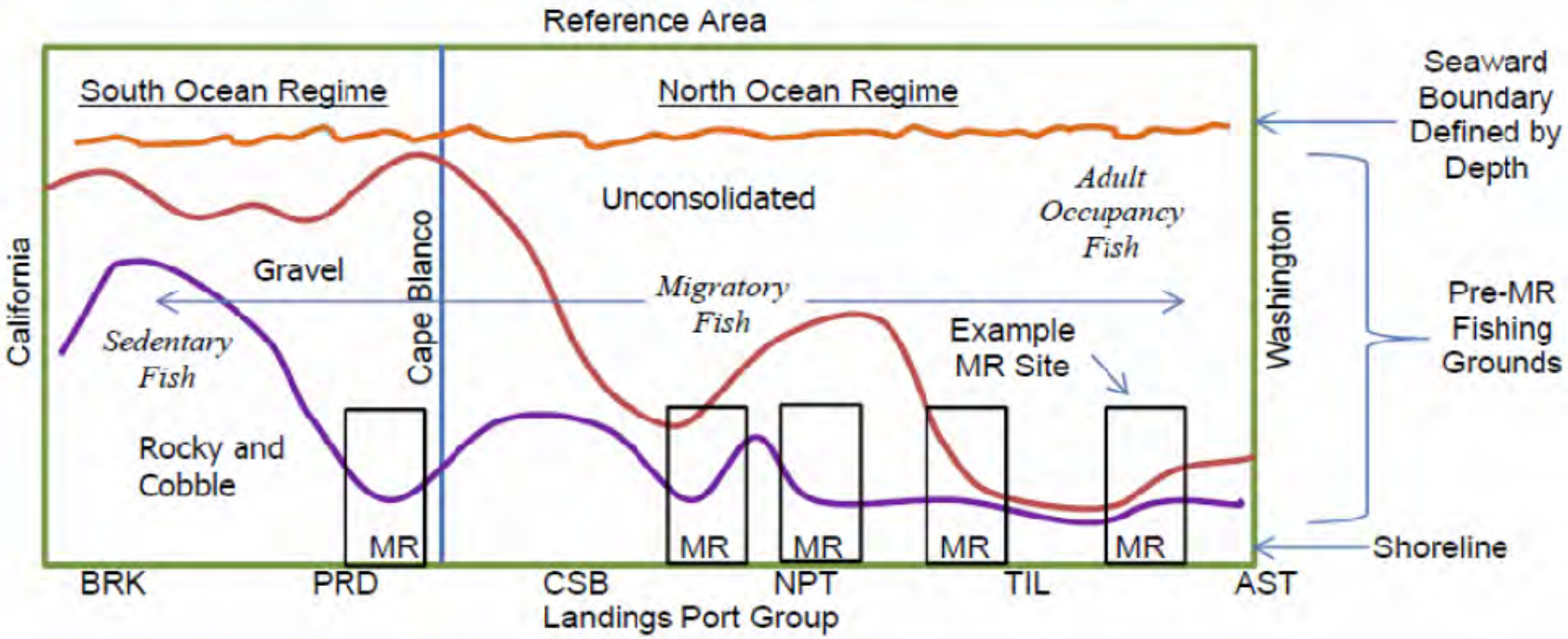
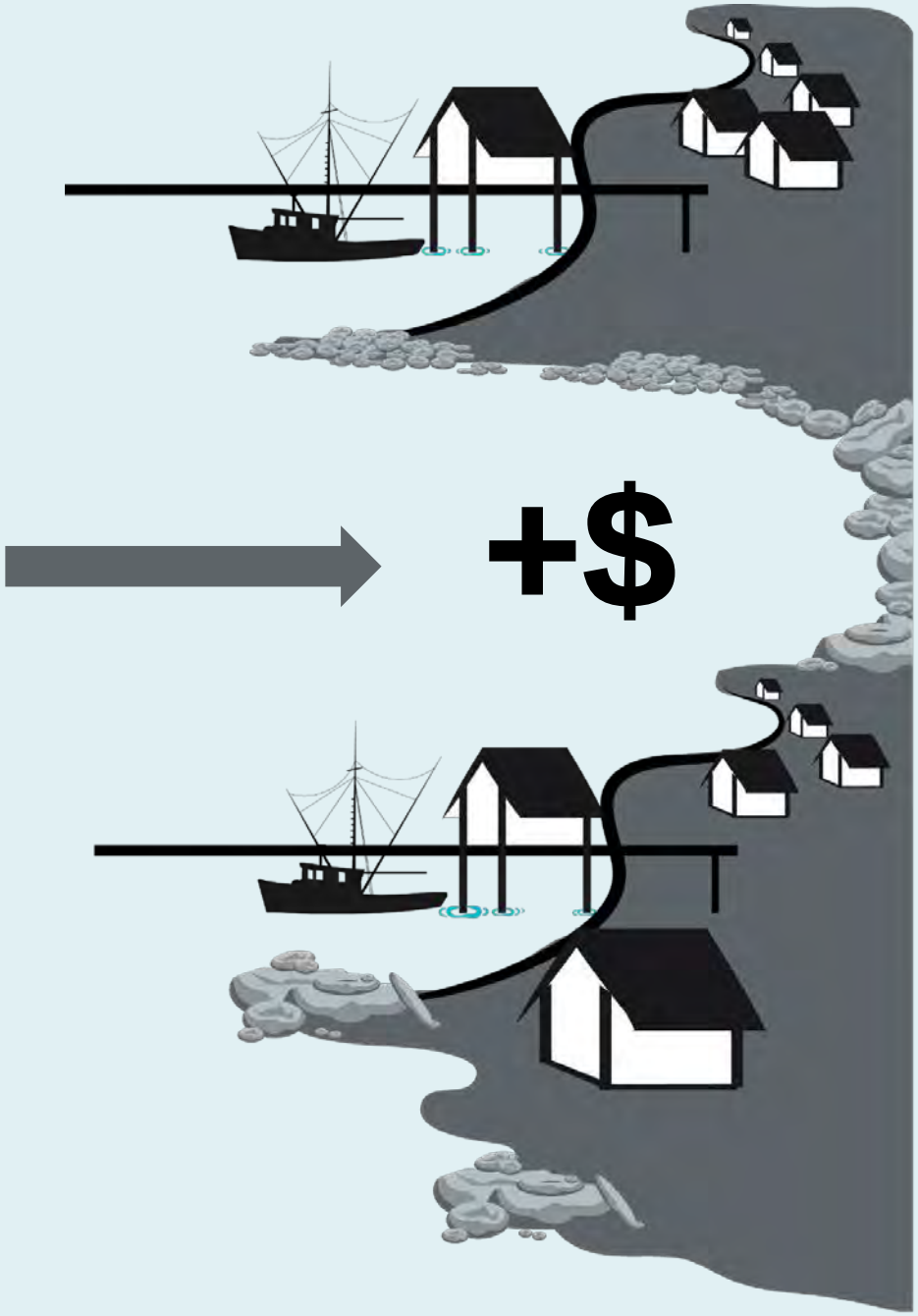
Depiction of Reference Area Used to Develop Spatial Ratio Estimator for Marine Reserve Target Fisheries

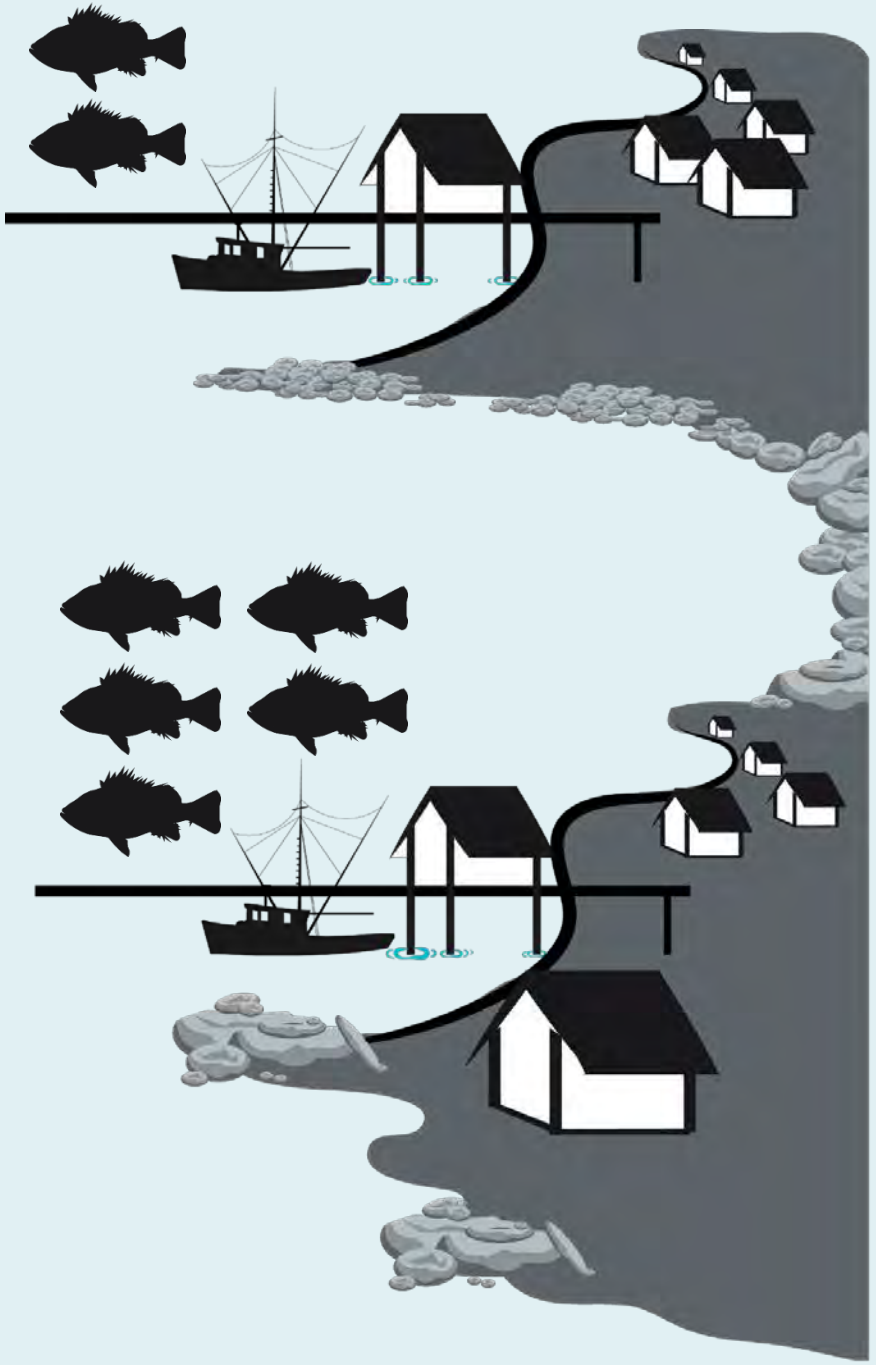


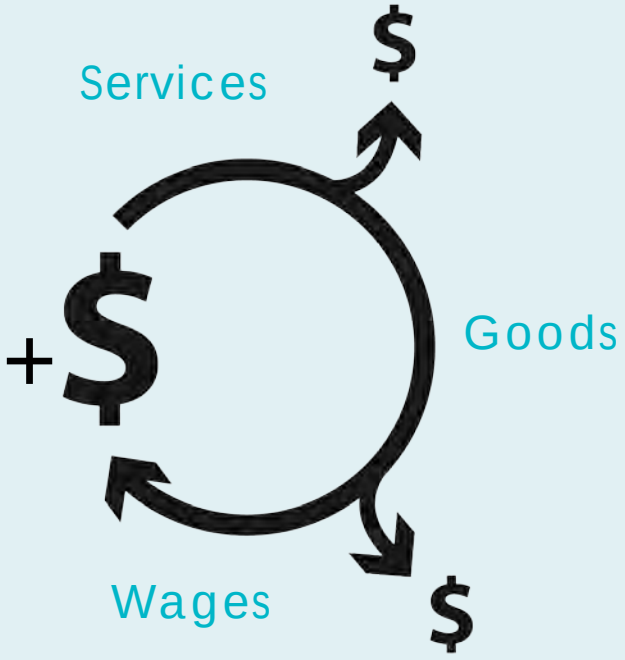
Notes: 1. Depiction does not portray actual size dimensions.
2. Seaward boundary and other area deductions different for each target fishery due to fishery management considerations, logbook program data for typical maximum depth, Essential Fish Habitat or other purpose closed fishing areas, or experiential knowledge about harvest practices.
3. Habitat area size within reference area assigned to target fisheries relied on biogeography science, and agency fishery managers and local fishing participant knowledge.

Regional Economic Impact Model



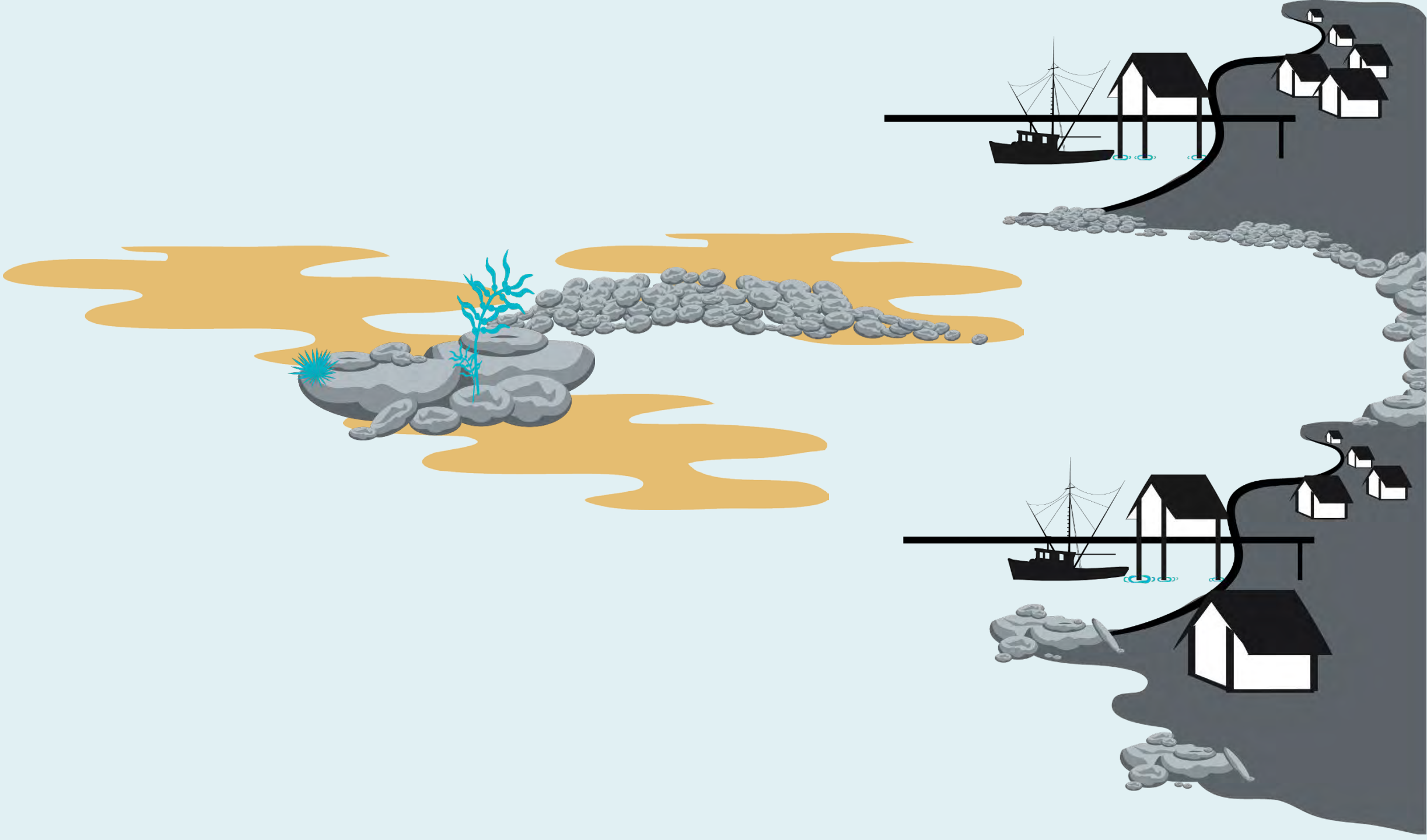
Regional Economic Impact of Fishing ($ personal income)

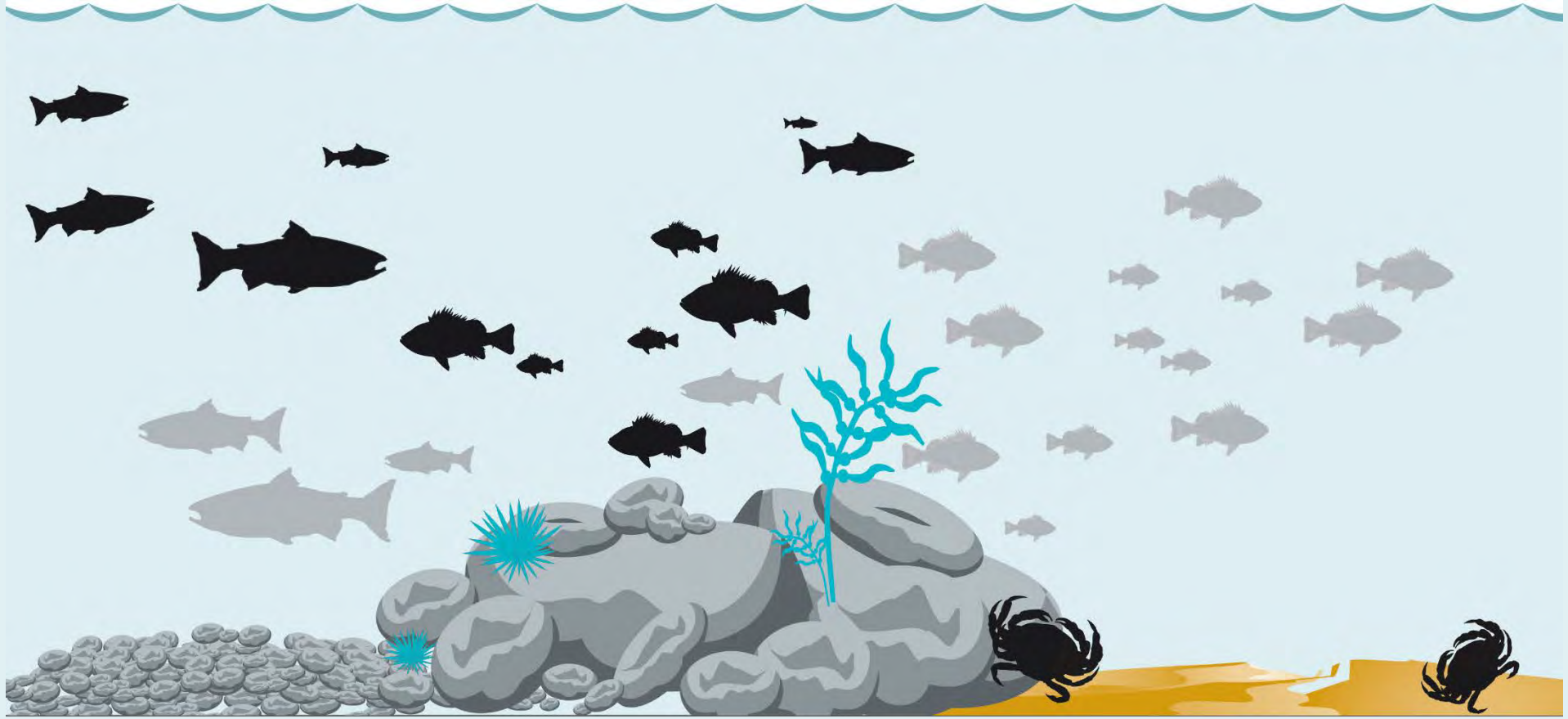


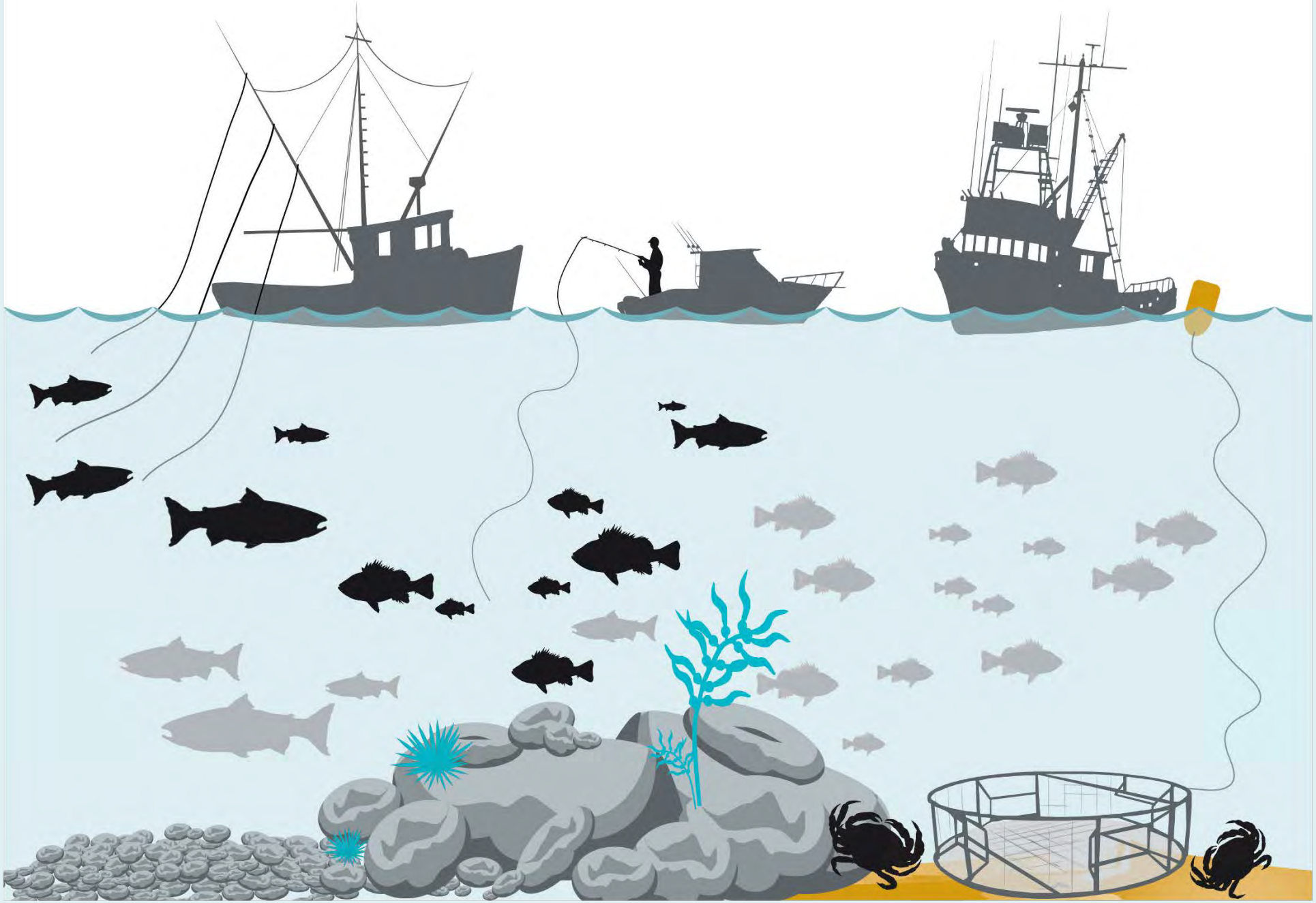


Multiplier Effect

Port Group

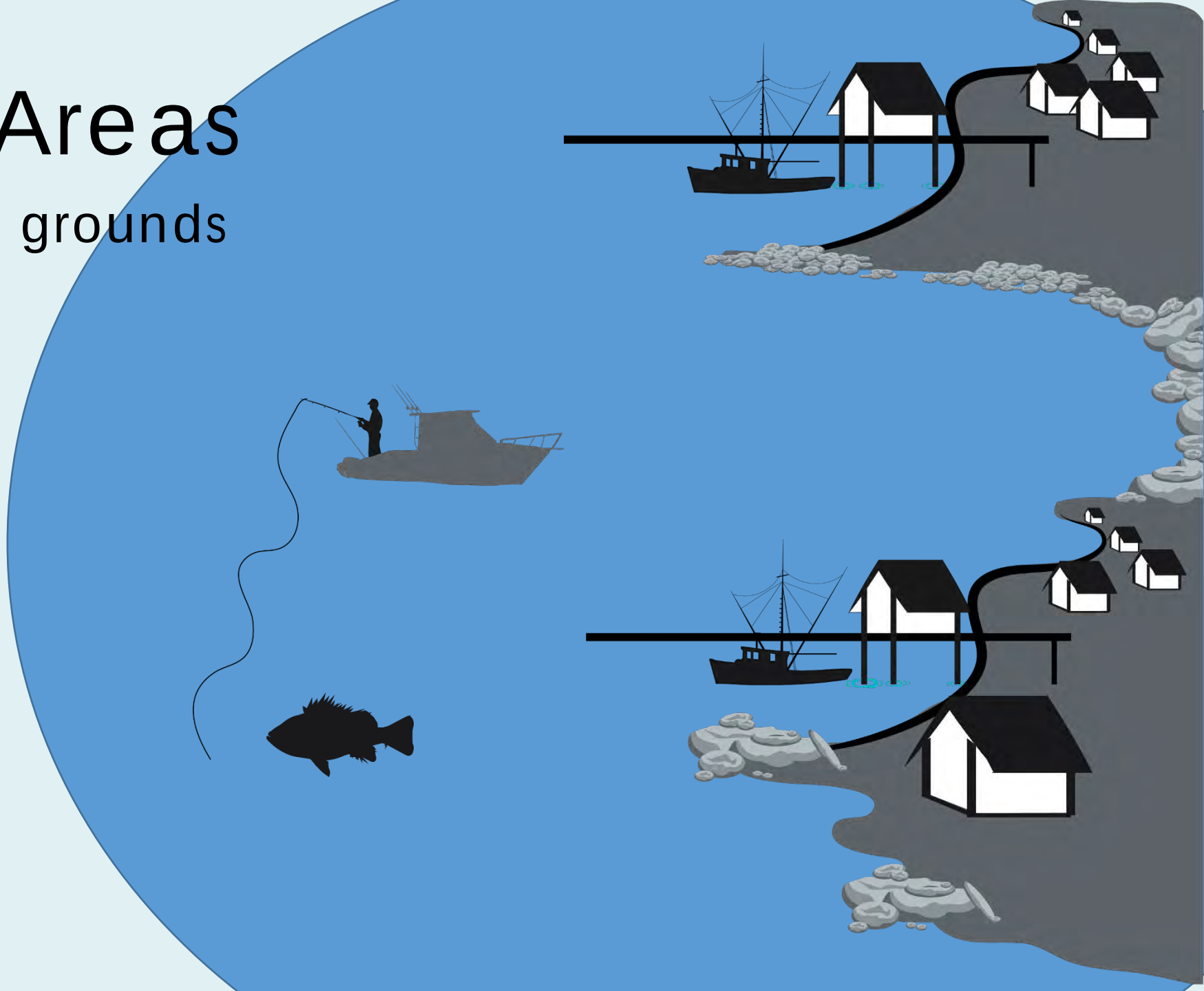






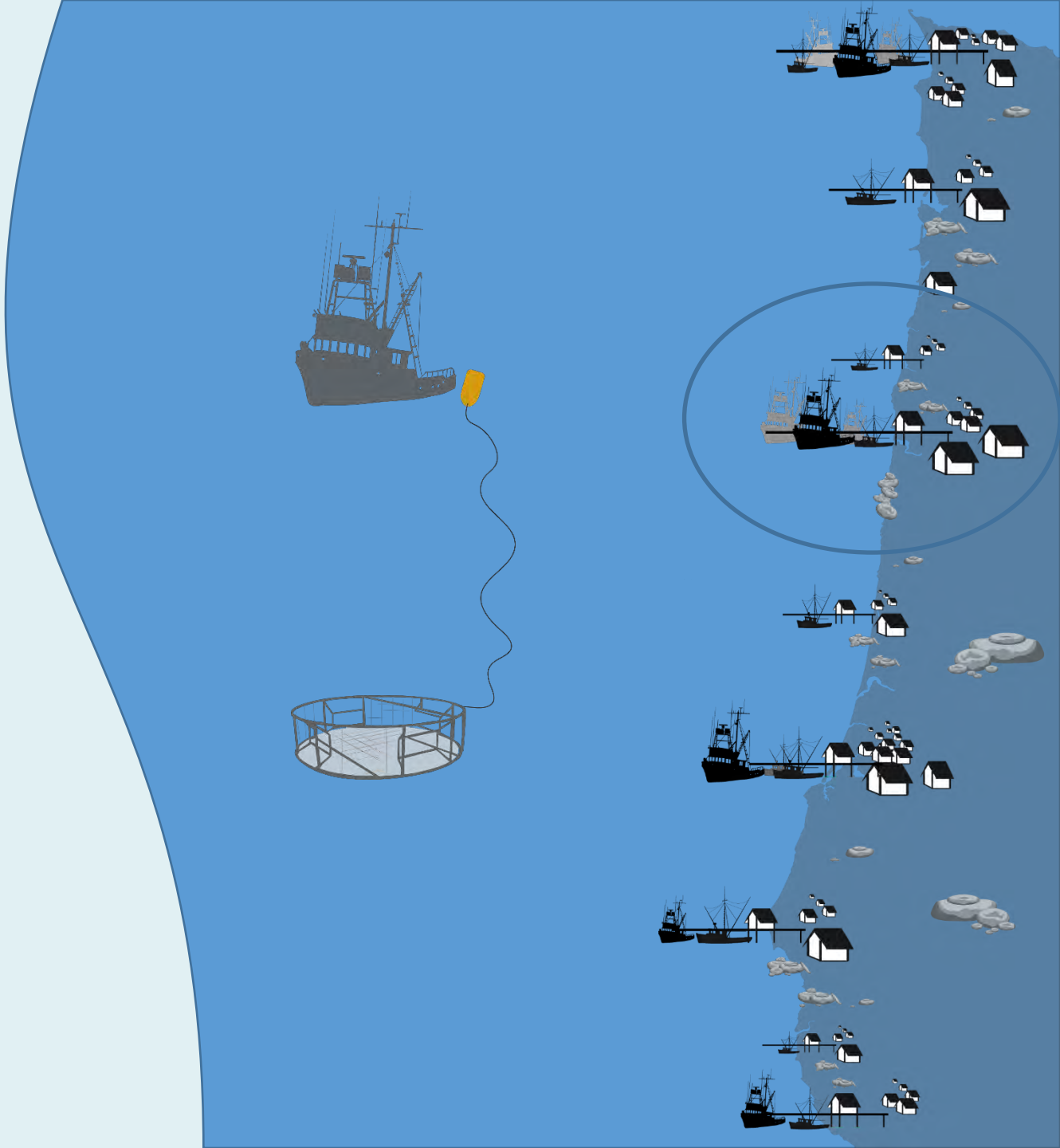
Reference Areas

Port Group's fishing grounds



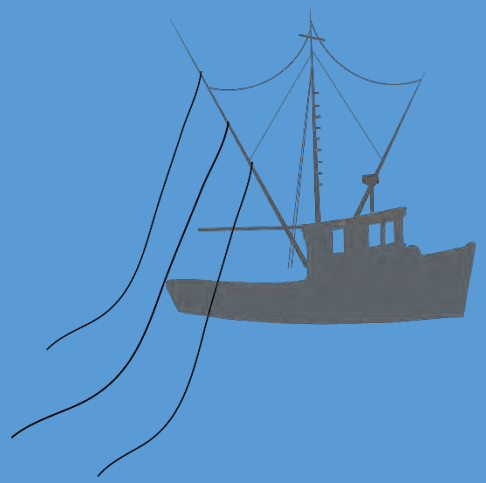
Reference Areas

Port Group’s fishing grounds

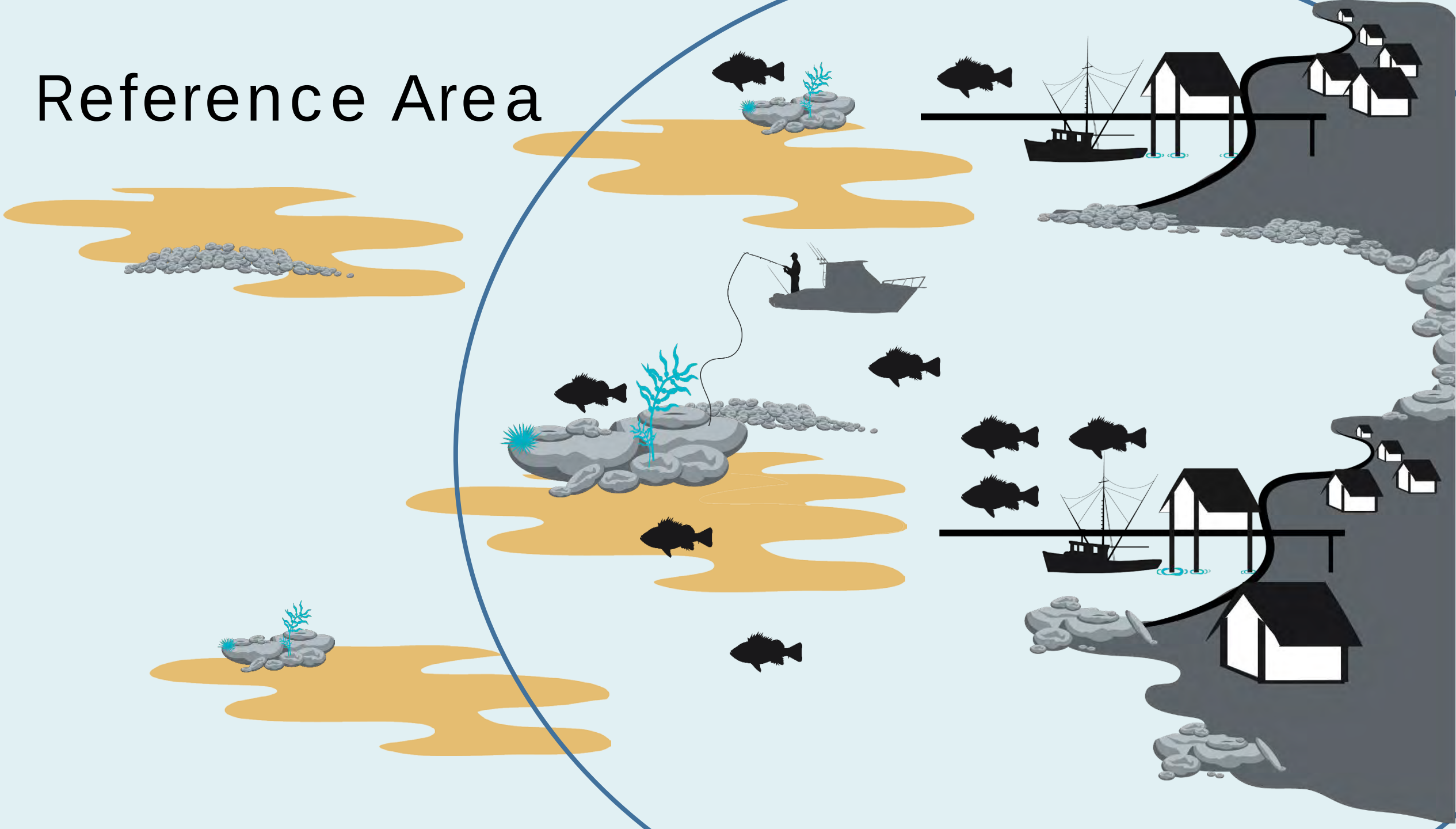


Reference Areas

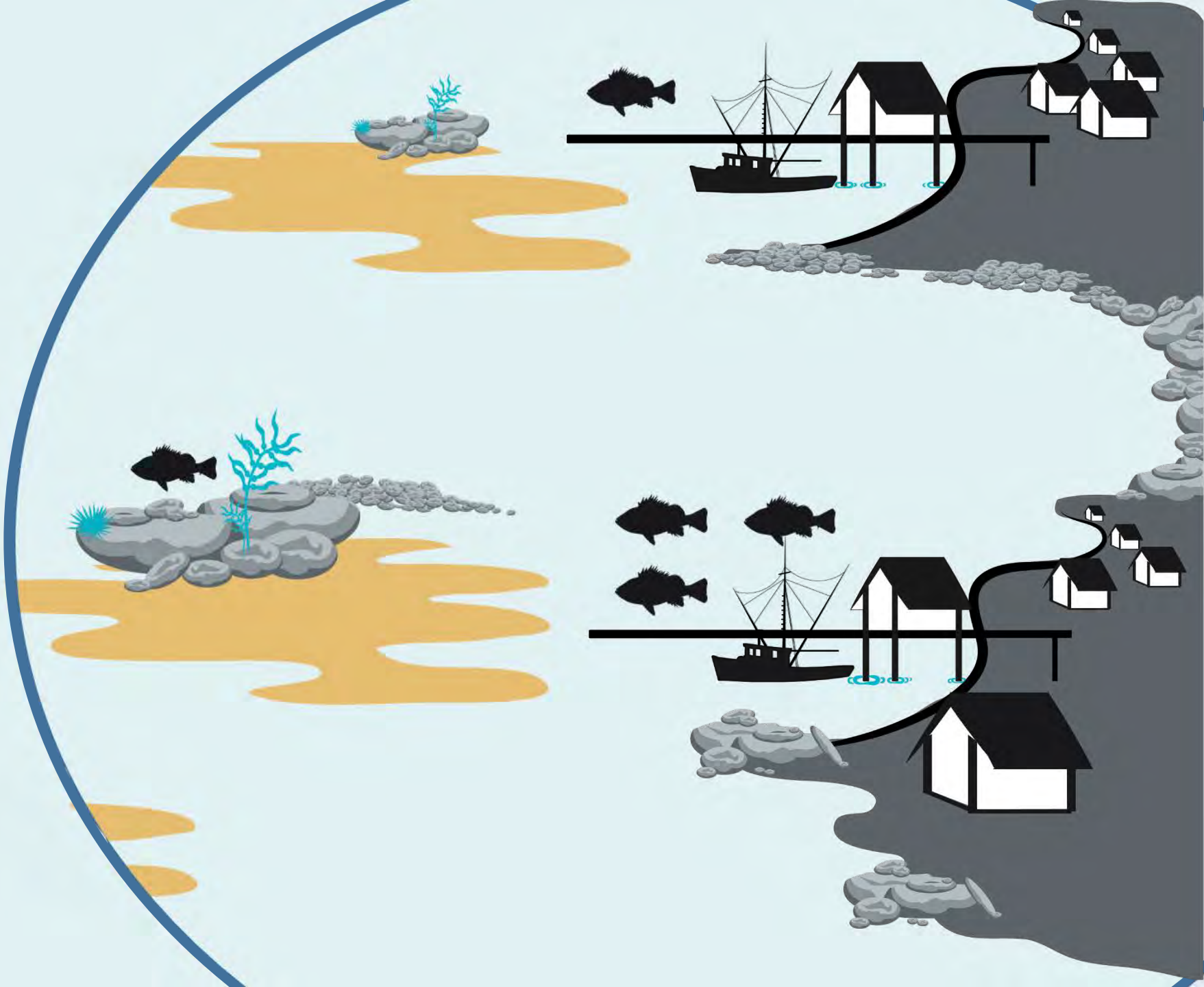
Port Group’s fishing grounds



Reference Area



$$\frac{\text{Amount}}{\text{Amount}}$$



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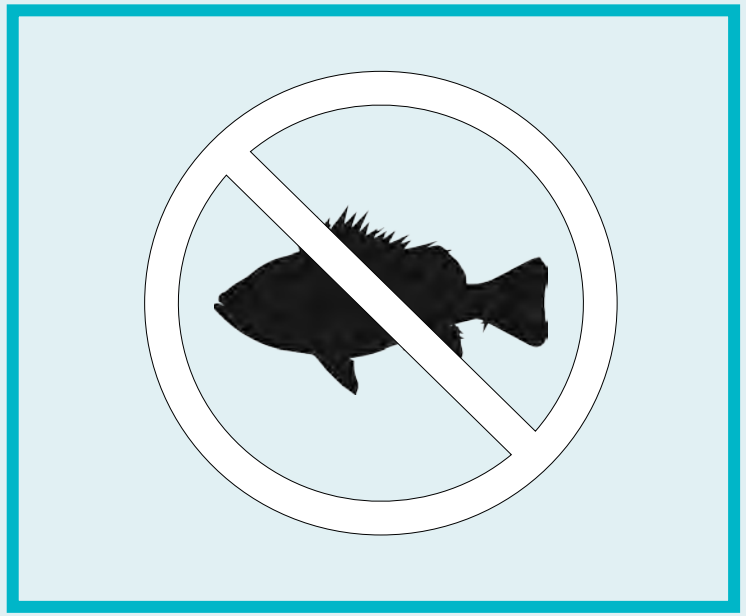
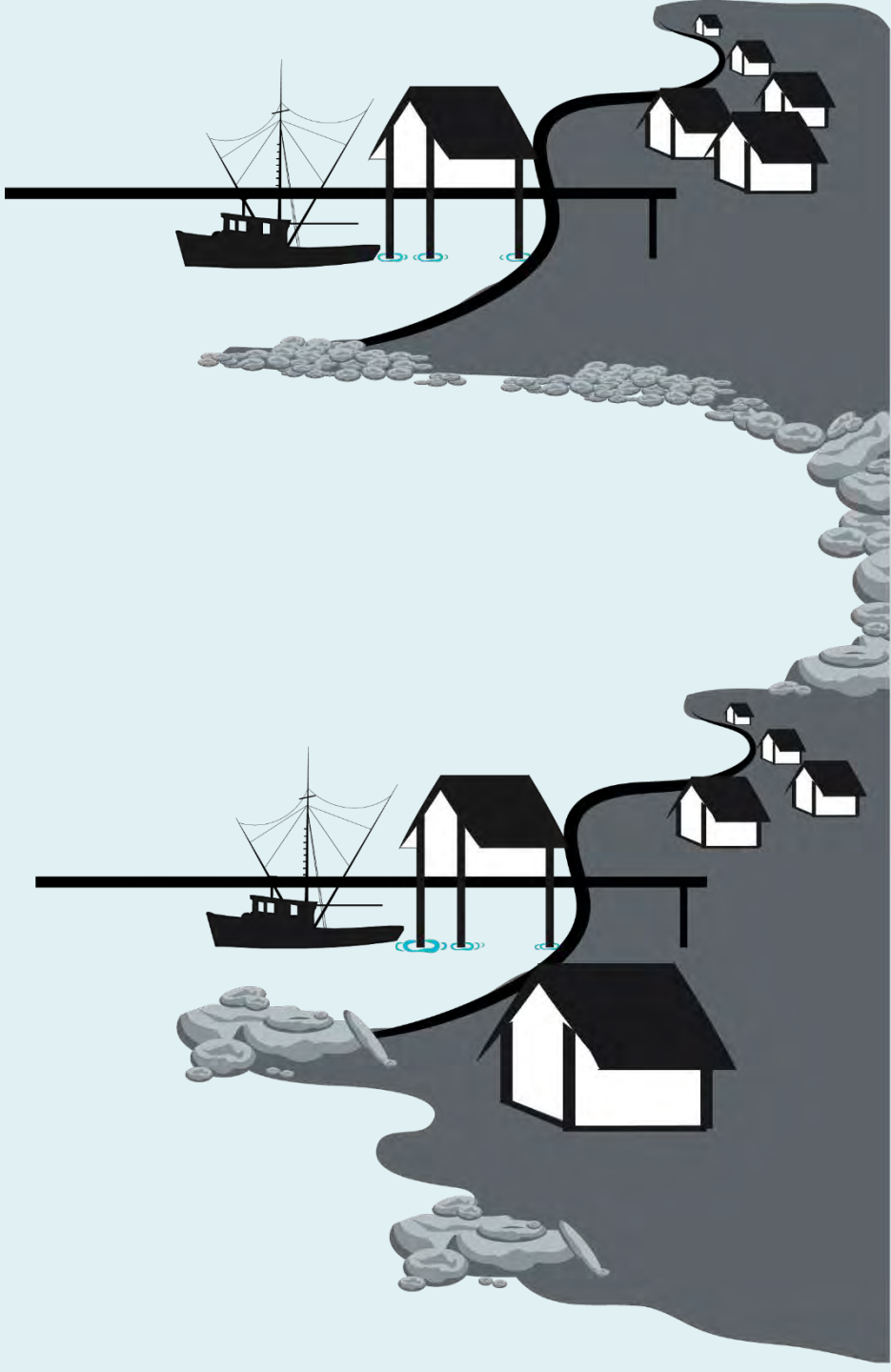
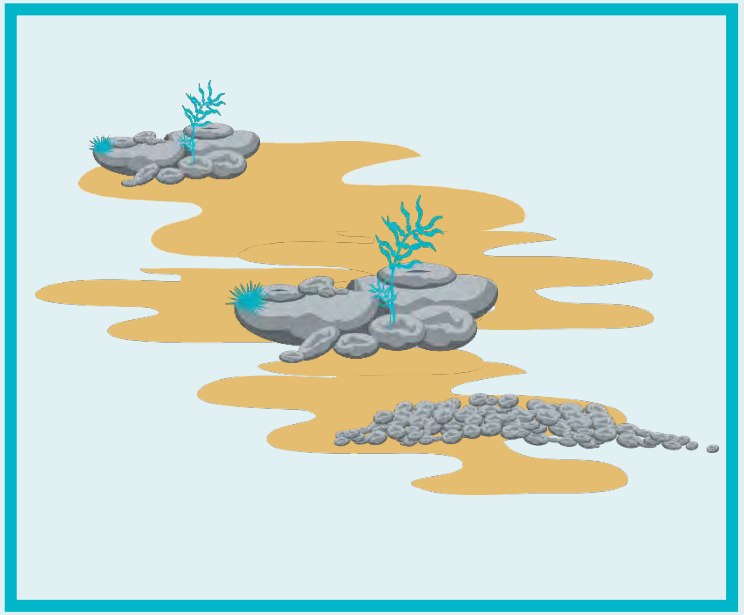
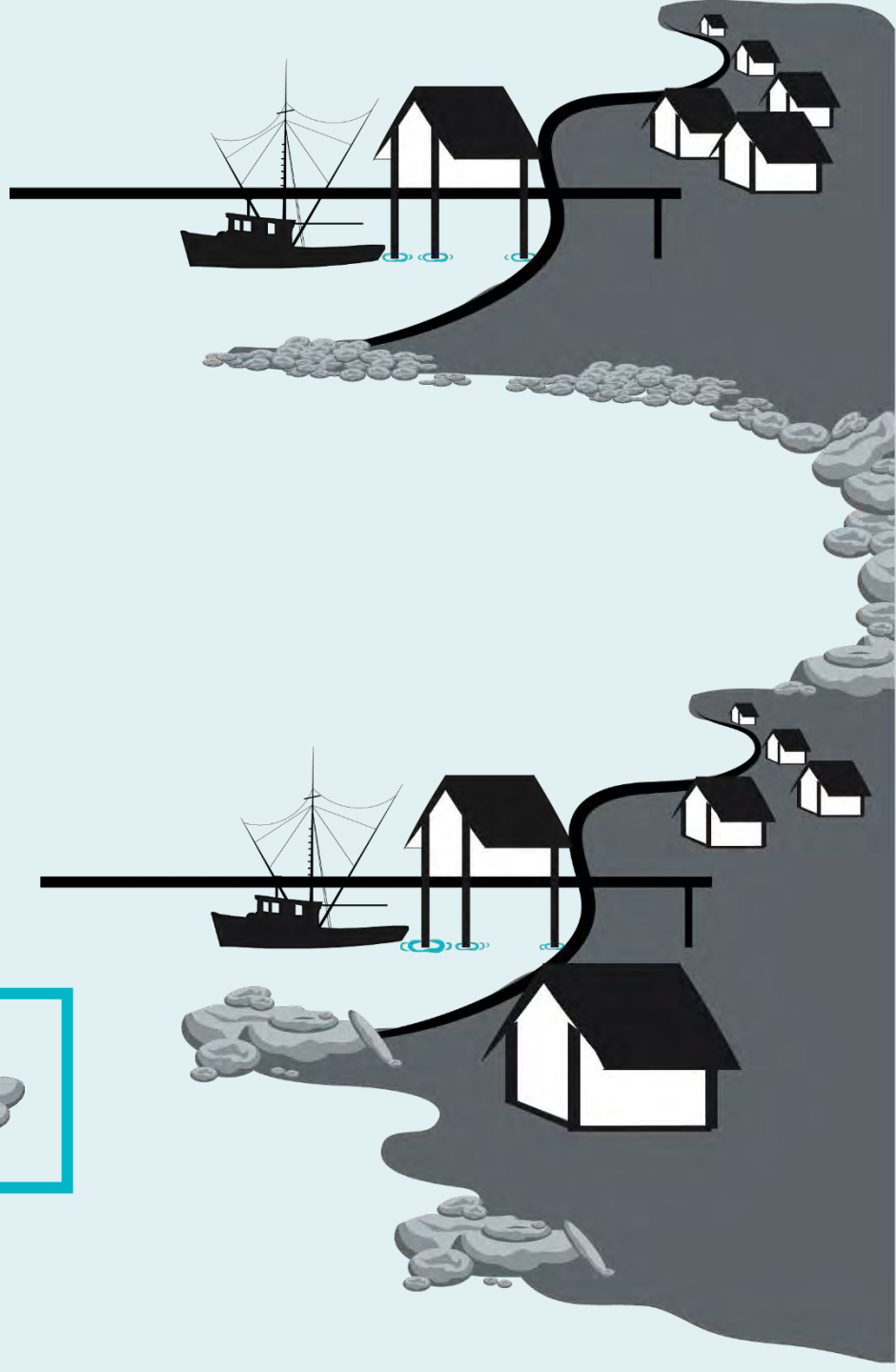


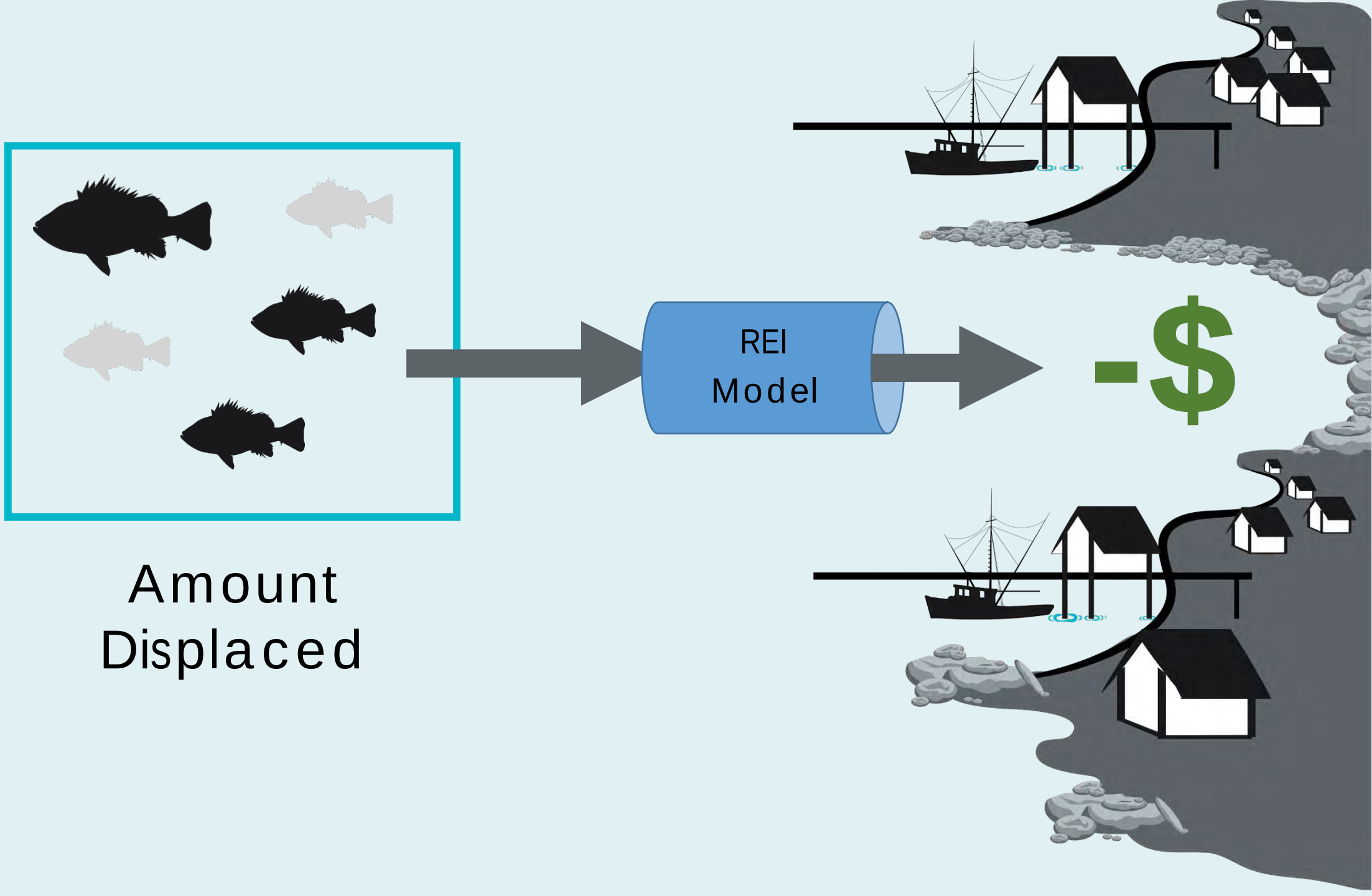






$$\frac{\text{Amount}}{\text{Amount}} \times \boxed{\text{Amount}}$$

$$\frac{\text{Amount}}{\text{Amount}} \times \boxed{\text{Amount}} = \text{Amount Displaced}$$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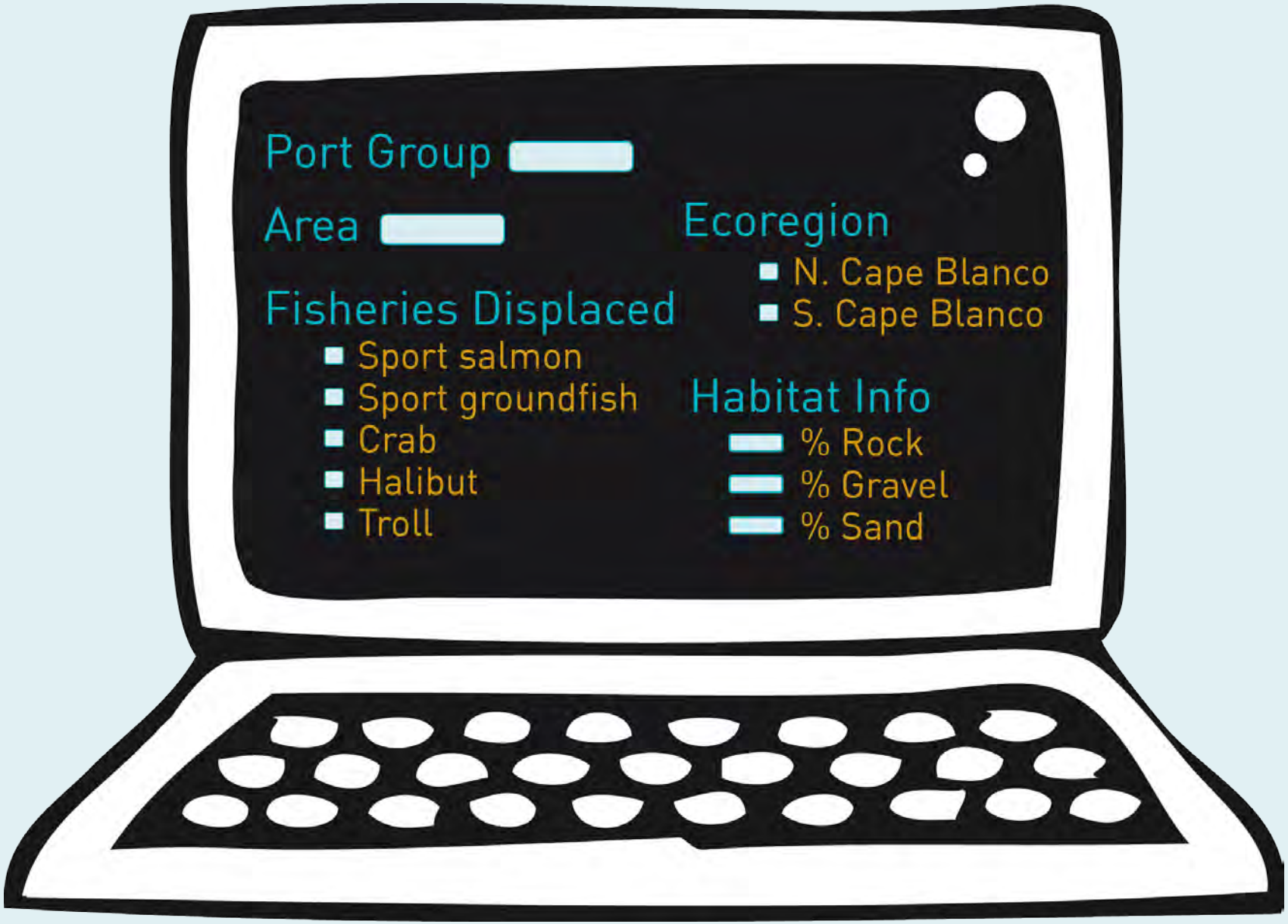

Port Group
Area
Ecoregion
N. Cape Blanco
S. Cape Blanco
Fisheries Displaced
Sport salmon
Sport groundfish
Crab
Halibut
Troll
Habitat Info
% Rock
% Gravel
% Sand

COMMUNICATIONS

OREGON DOESN'T STOP AT
THE BEACH

THERE'S MORE BENEATH
THE SURFACE

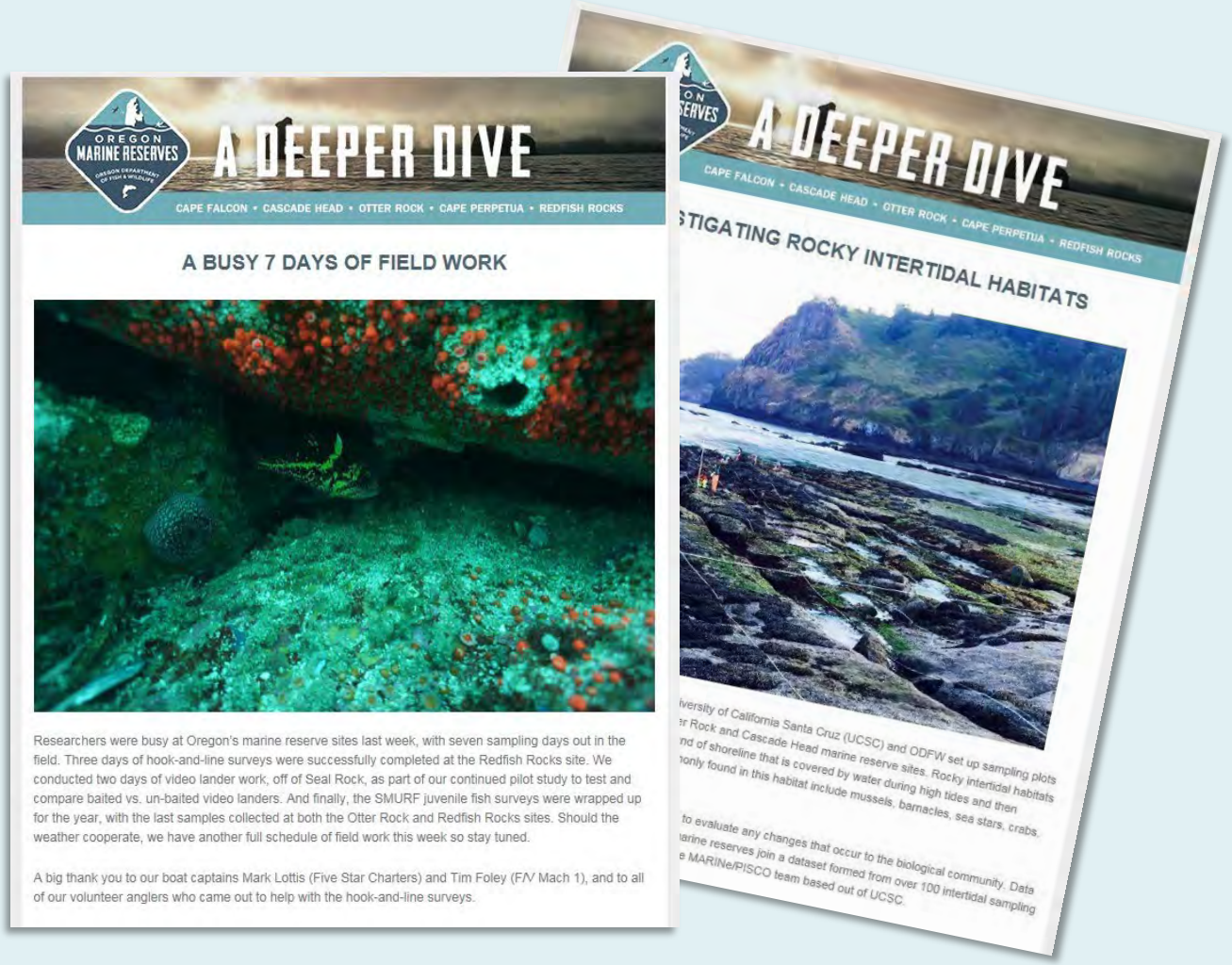
OREGON
MARINE RESERVES
OREGON DEPARTMENT OF FISH & WILDLIFE

HOW TO BRING

DEEPER UNDERSTANDING

TO THE SURFACE

TAKE A DEEPER DIVE



OREGON MARINE RESERVES

A DEEPER DIVE

CAPE FALCON • CASCADE HEAD • OTTER ROCK • CAPE PERPETUA • REDFISH ROCKS

A BUSY 7 DAYS OF FIELD WORK

Researchers were busy at Oregon's marine reserve sites last week, with seven sampling days out in the field. Three days of hook-and-line surveys were successfully completed at the Redfish Rocks site. We conducted two days of video lander work, off of Seal Rock, as part of our continued pilot study to test and compare baited vs. un-baited video landers. And finally, the SMURF juvenile fish surveys were wrapped up for the year, with the last samples collected at both the Otter Rock and Redfish Rocks sites. Should the weather cooperate, we have another full schedule of field work this week so stay tuned.

A big thank you to our boat captains Mark Lottis (Five Star Charters) and Tim Foley (F/V Mach 1), and to all of our volunteer anglers who came out to help with the hook-and-line surveys.

A DEEPER DIVE

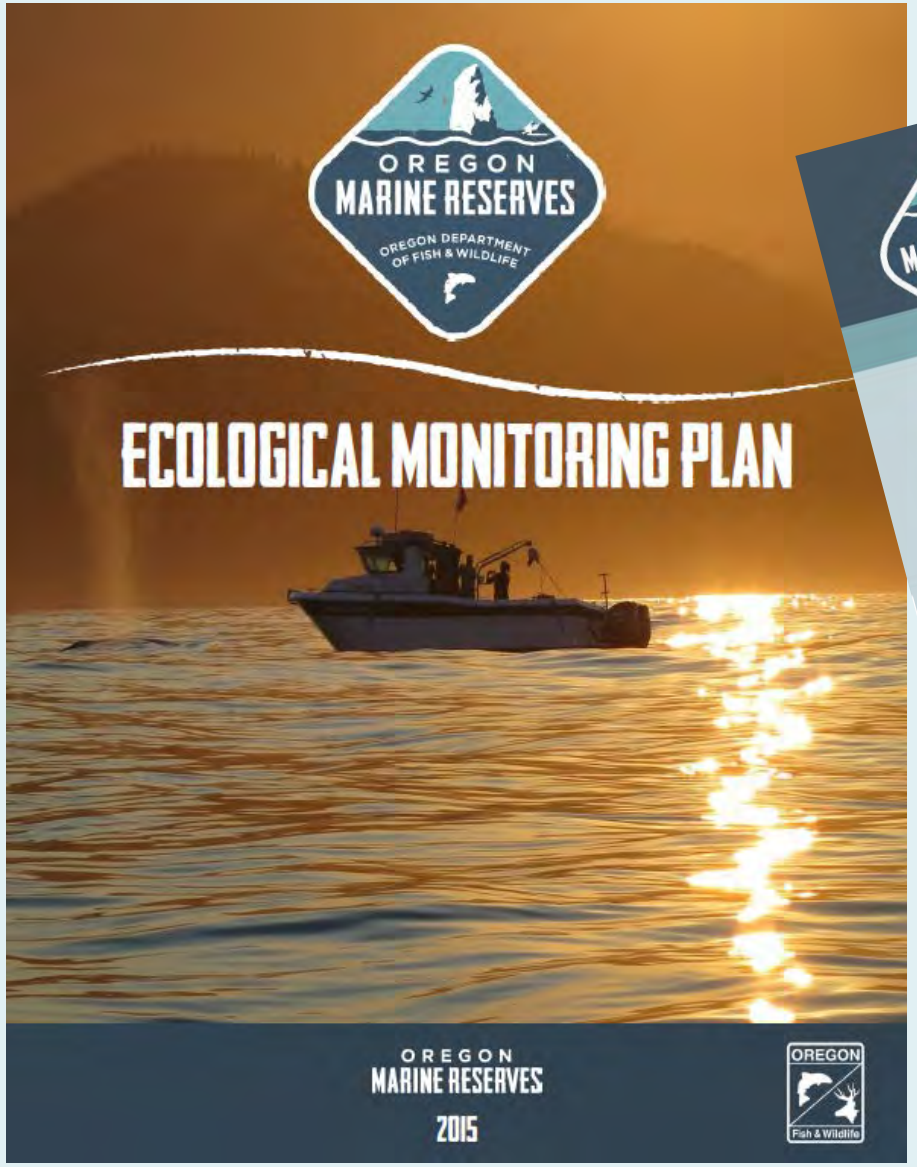
CAPE FALCON • CASCADE HEAD • OTTER ROCK • CAPE PERPETUA • REDFISH ROCKS

STIGATING ROCKY INTERTIDAL HABITATS

iversity of California Santa Cruz (UCSC) and ODFW set up sampling plots
er Rock and Cascade Head marine reserve sites. Rocky intertidal habitats
nd of shoreline that is covered by water during high tides and then
nonly found in this habitat include mussels, barnacles, sea stars, crabs.

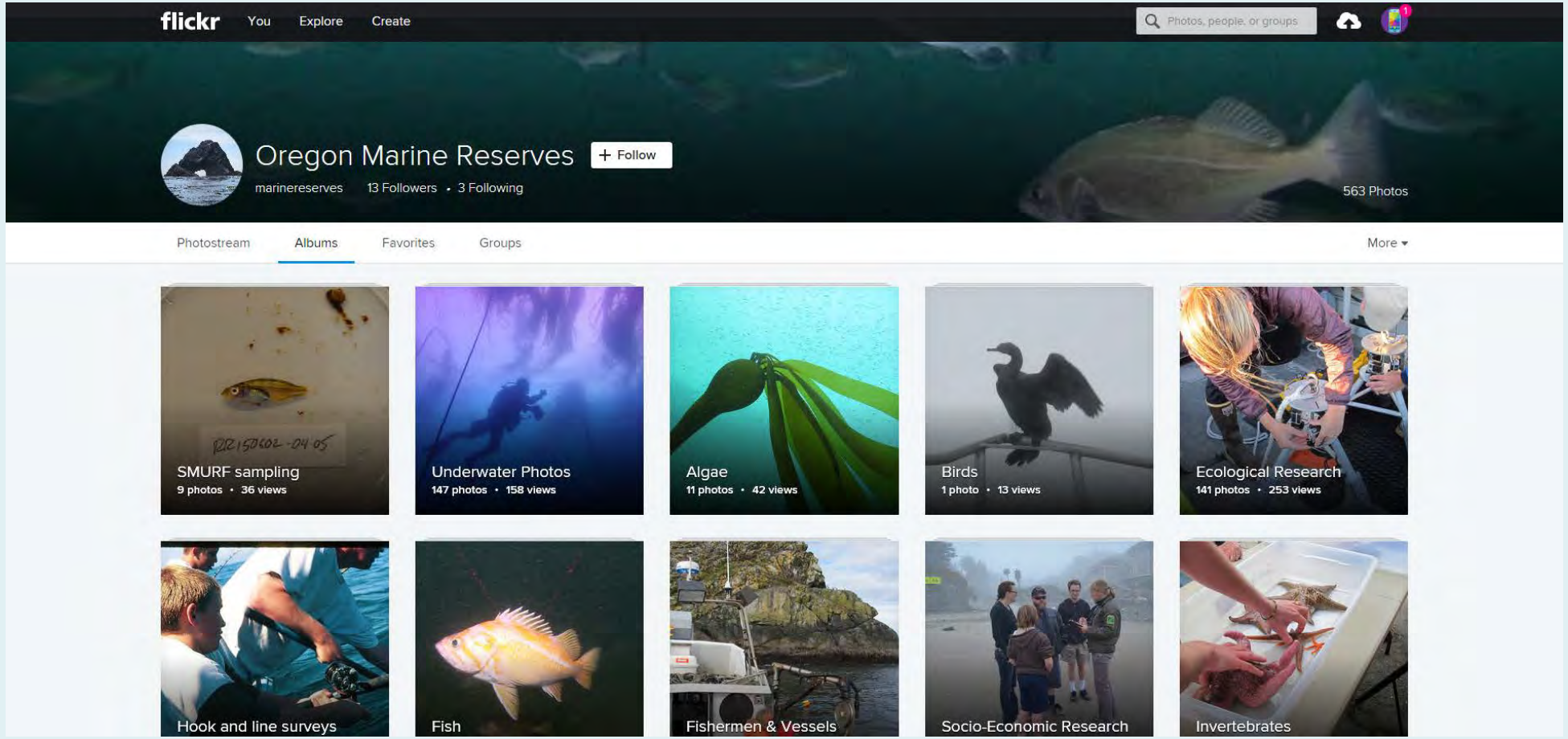
to evaluate any changes that occur to the biological community. Data
arine reserves join a dataset formed from over 100 intertidal sampling
e MARINe/PISCO team based out of UCSC.

Sign up for our weekly e-Newsletter



Periodic publications

EXPLORE PHOTOS



Outreach & Communications

OREGON Fish & Wildlife

Oregon Marine Reserves Partnership

OREGON STATE PARKS

OREGON
MARINE RESERVES

Thank You

Cristen Don
cristen.n.don@state.or.us

Website
OregonOcean.Info/MarineReserves

flickr YouTube OREGON Fish & Wildlife

OREGON MARINE RESERVES

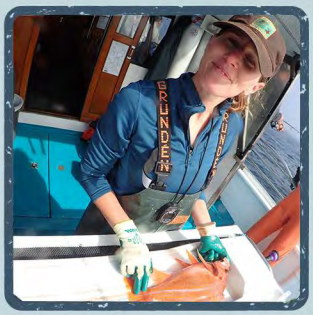
Attachment 306-17-4

OREGON MARINE RESERVES
OREGON DEPARTMENT OF FISH & WILDLIFE

FISH ON!

HOOK-AND-LINE SURVEY VOLUNTEER NEWSLETTER

SPRING & FALL 2015



Greetings Volunteers!

This year's hook-and-line surveys were a great success! We want to thank all of the volunteer anglers - travelling from as far as Vancouver, Washington to help in this year's surveys. Also, many thanks to scientific assitants Zoey, Josh, Annalee, Wes, and Janet for helping collect data. To charter captains and crews: Lars and Shad on the Samson, Lance and Mitch on the Norwester, and Mark of the Rogue Star - we appriciate your help and collaboration! We completed the fifth year of surveys in Redfish Rocks, the third year in Cascade Head, and the second year in Cape Falcon (which will be closed to fishing on January 1, 2016). Please enjoy this brief summary of the data YOU ALL helped to collect this year.

Thank you all and we hope to see you again next year for surveys in Cape Perpetua and Cascade Head!

Sincerely,
Brittany, Jessica, Wolfe, and Ashley
ODFW Marine Reserves Ecological Monitoring Team

OREGON Fish & Wildlife

3 Sites Surveyed

- Cape Falcon -- 8 days
- Cascade Head -- 12 days
- Redfish Rocks -- 16 days

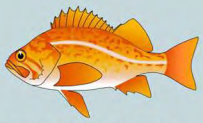
36 Trips

93 Volunteer Anglers

4,325 Fish Caught: 22 Species from 7 Families

RECORD LARGEST and smallest catches from 2015

BLACK ROCKFISH
minimum: 14 cm (5.5 in)
maximum: 56 cm (22 in)



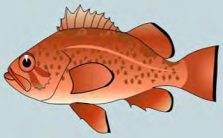
CANARY ROCKFISH
minimum: 14 cm (5.5 in)
maximum: 52 cm (20.5 in)

CHINA ROCKFISH
minimum: 23 cm (9 in)
maximum: 46 cm (18 in)

COPPER ROCKFISH
minimum: 39 cm (15 in)
maximum: 51 cm (20 in)

DEACON & BLUE ROCKFISH
minimum: 16 cm (6 in)
maximum: 50 cm (20 in)

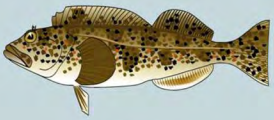
QUILLBACK ROCKFISH
minimum: 17 cm (7 in)
maximum: 47 cm (18.5 in)



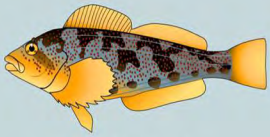
VERMILION ROCKFISH
minimum: 40 cm (16 in)
maximum: 57 cm (22.5 in)

YELLOWEYE ROCKFISH
minimum: 25 cm (10 in)
maximum: 64 cm (25 in)

YELLOWTAIL ROCKFISH
minimum: 13 cm (5 in)
maximum: 50 cm (20 in)



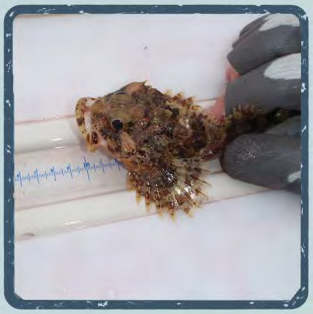
LINGCOD
minimum: 27 cm (10.5 in)
maximum: 100 cm (39 in)



KELP GREENLING
minimum: 24 cm (9.5 in)
maximum: 48 cm (19 in)

CABEZON
minimum: 31 cm (12 in)
maximum: 72 cm (28 in)

WOLF EEL
150 cm (59 in)



Fish icons courtesy of Dr. Larry Allen of CSUN

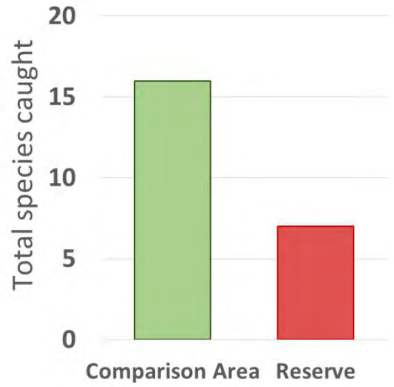
The graphs below show the total species richness and the catch composition for the reserve and comparison areas surveyed in 2015. Although Black Rockfish dominate overall, the differing compositions among the reserves underscores that each reserve is unique.

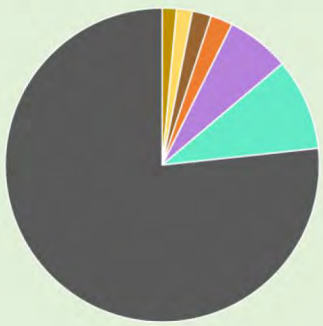
Species Richness

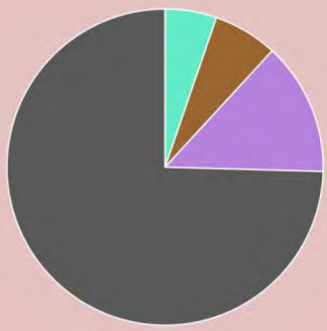
Species Composition

Comparison Areas | Reserve

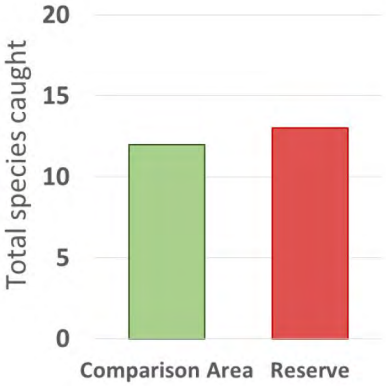
CAPE FALCON MARINE RESERVE *

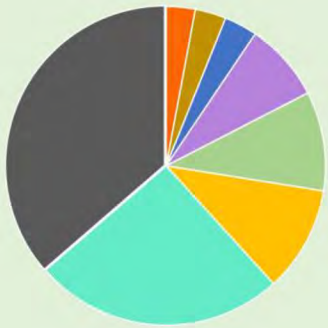


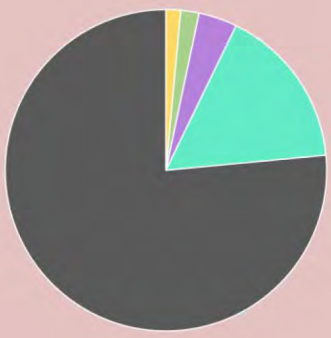




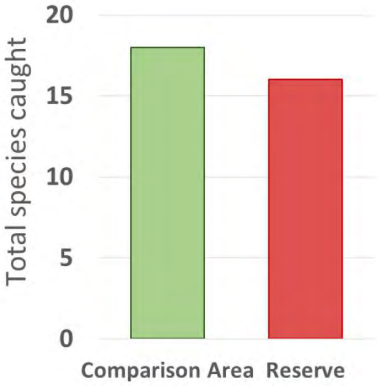
CASCADE HEAD MARINE RESERVE

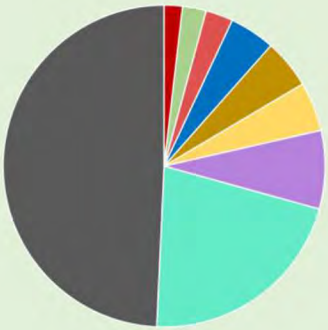


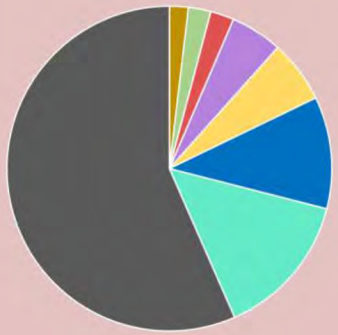




REDFISH ROCKS MARINE RESERVE







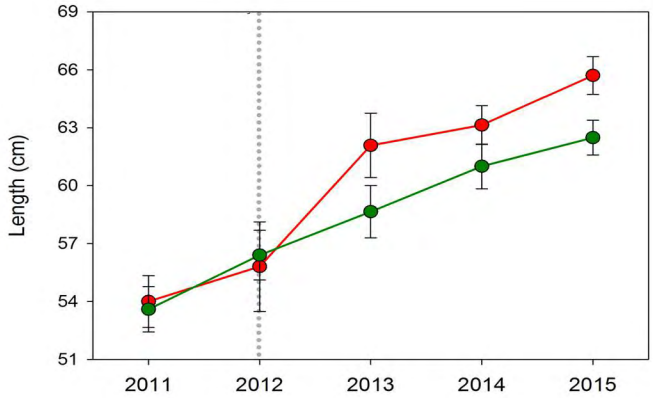
Black Rockfish | Canary Rockfish | China Rockfish | Deacon Rockfish
Quillback Rockfish | Yelloweye Rockfish | Yellowtail Rockfish | Cabezon
Buffalo Sculpin | Kelp Greenling | Lingcod

*Reserve harvest restrictions not in effect until 1/1/2016

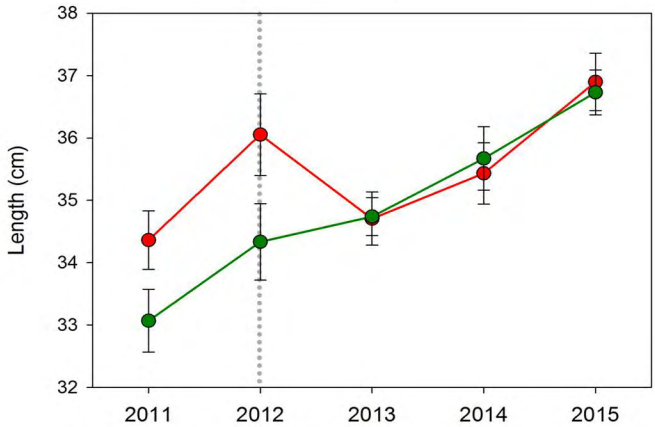
Graphs show species comprising 95% of the total catch for each area

Changes in average length over time in Redfish Rocks

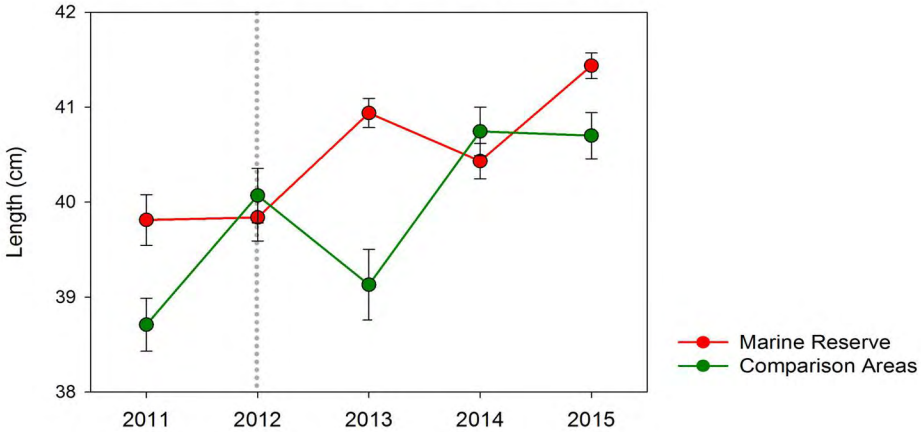
LINGCOD



KELP GREENLING



BLACK ROCKFISH



As we have now five years of monitoring data from Redfish Rocks Marine Reserve and Comparison Areas, we are conducting our first comprehensive analysis of baseline conditions within this site. These simple graphs demonstrate how we will use our fish size and catch data to understand the natural variation at Redfish Rocks over a long-term period. Summaries, like those above, track the magnitude of change that occurs over time in the areas open to fishing (green) compared to the Redfish Rocks Marine Reserve (red). The dashed line indicates the year the reserve was closed to fishing. When comparing the trends among these 3 species both in the Reserve and outside, there is a lot of variation (up and down) from year to year. Not all species will show the same patterns during this 5-year baseline period, which is why we conduct our analyses at the species level. To tease out the natural variation from an actual reserve effect, we will continue long term monitoring. In the meantime, our team will be working hard on these analyses over the coming months. Look for our data discoveries in early 2016!

REDFISH ROCKS MARINE RESERVE
OREGON DEPARTMENT OF FISH & WILDLIFE

Attachment 306-17-5

MARINE RESERVES UPDATES

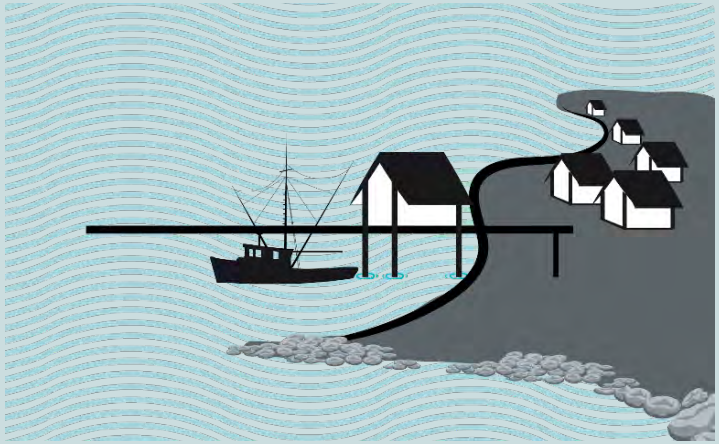
OREGON MARINE RESERVES

OREGON DEPARTMENT OF FISH & WILDLIFE

OREGON Fish & Wildlife

CASCADE HEAD
MARINE RESERVE
OREGON DEPARTMENT OF FISH & WILDLIFE

(20 minutes)



(20 minutes)

(5 minutes)

?s

(15 minutes)

OREGON'S GOALS

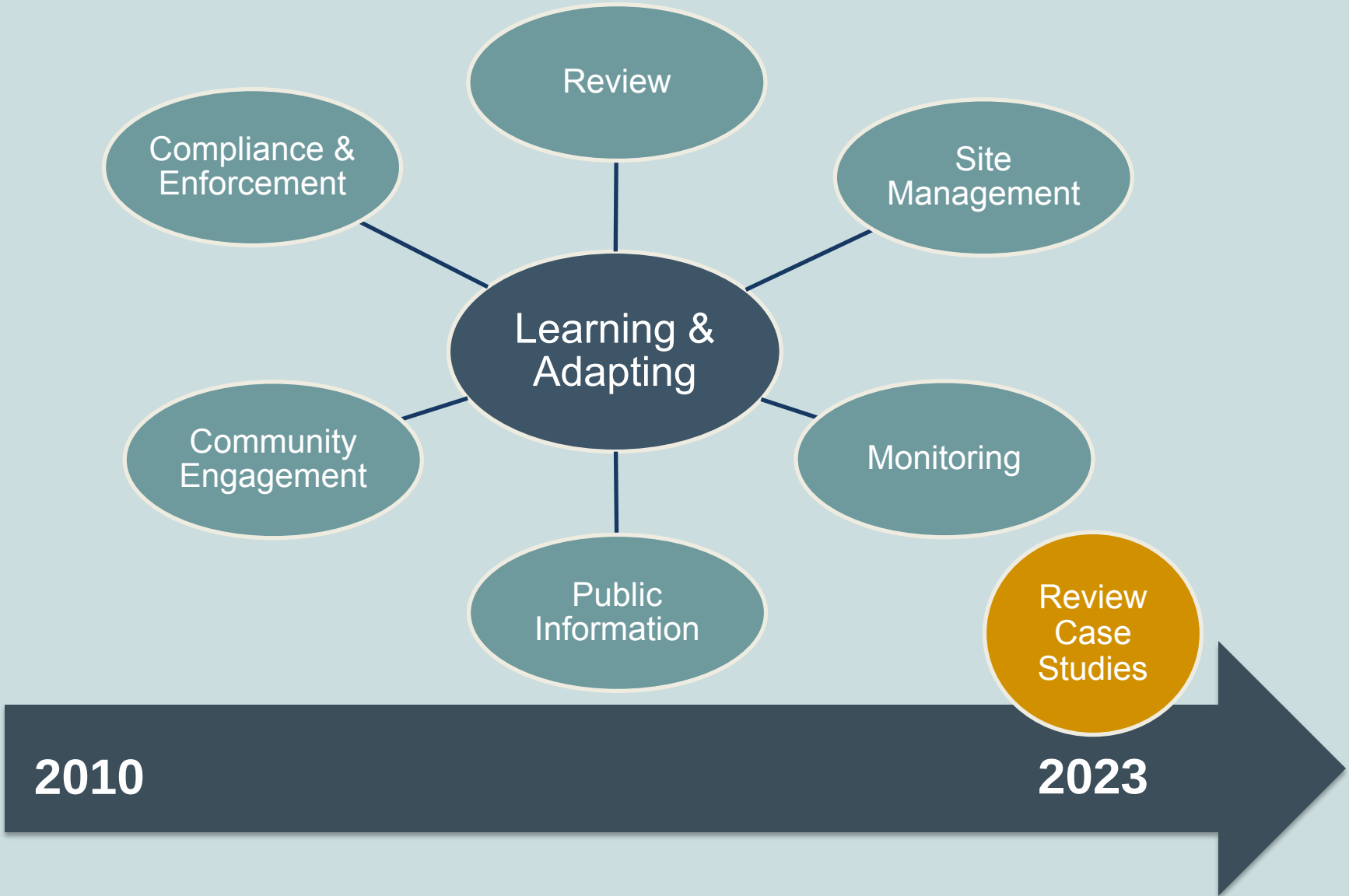
- **Conservation**
  Conserve habitats and biodiversity
- **Research**
  Serve as scientific reference sites to inform management
- **Communities**
  Avoid significant adverse impacts to ocean users and coastal communities

(OPAC 2008)

FIVE CASE STUDIES

OREGON
MARINE RESERVES

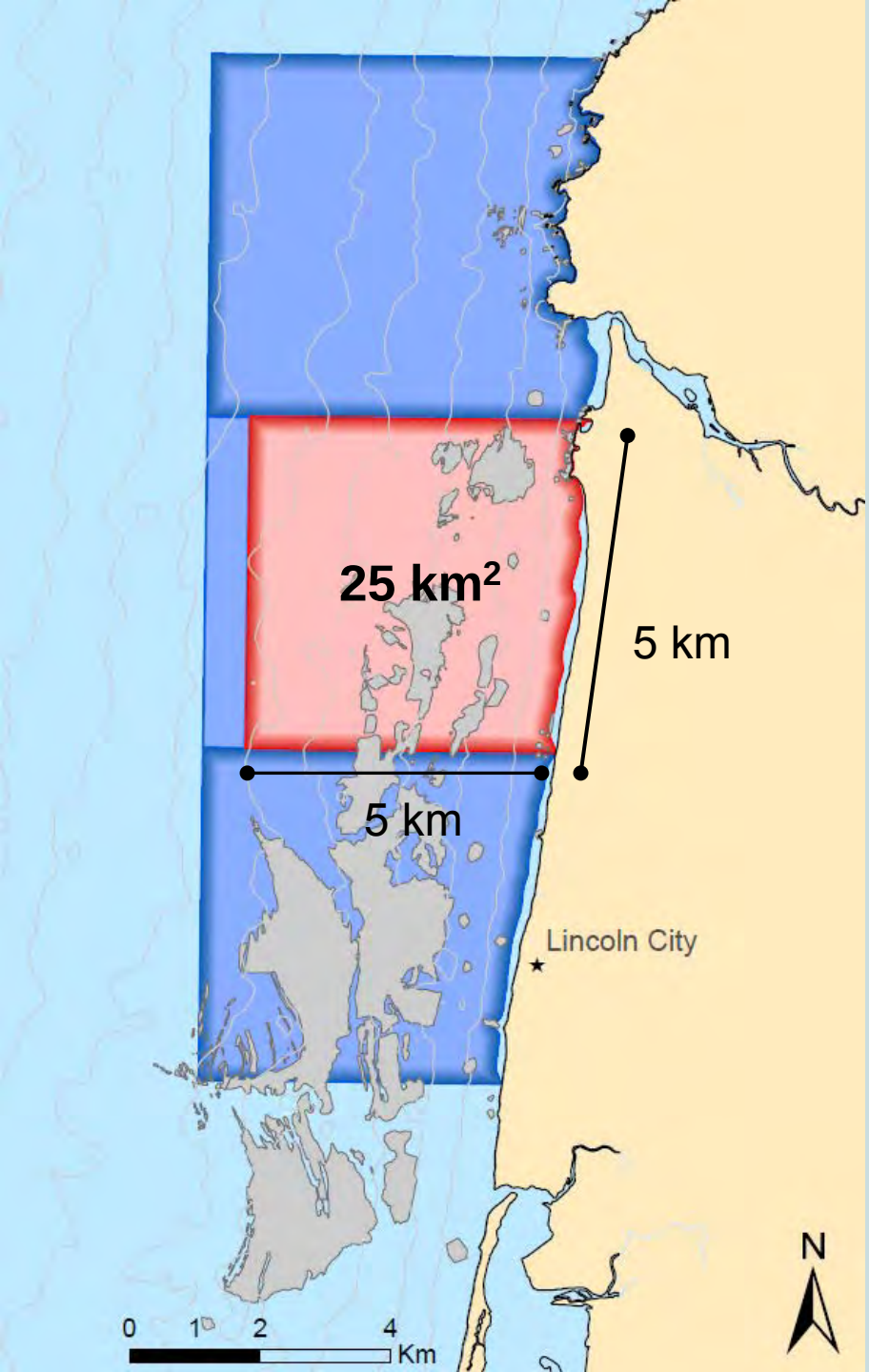
PROGRAM EVALUATION



CASCADE HEAD
MARINE RESERVE

OREGON DEPARTMENT OF FISH & WILDLIFE

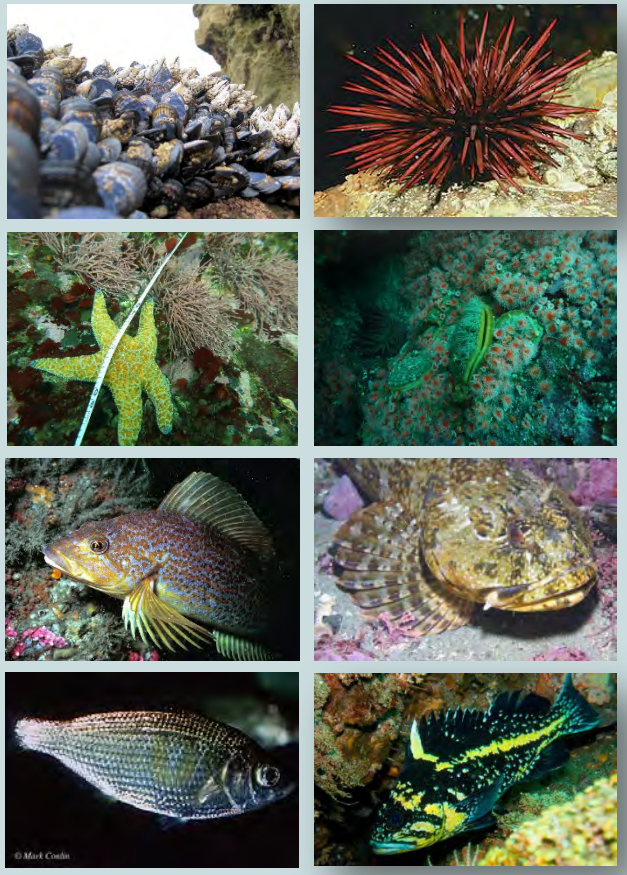
OREGON
MARINE RESERVES



DESIGN AND PLACEMENT MATTERS

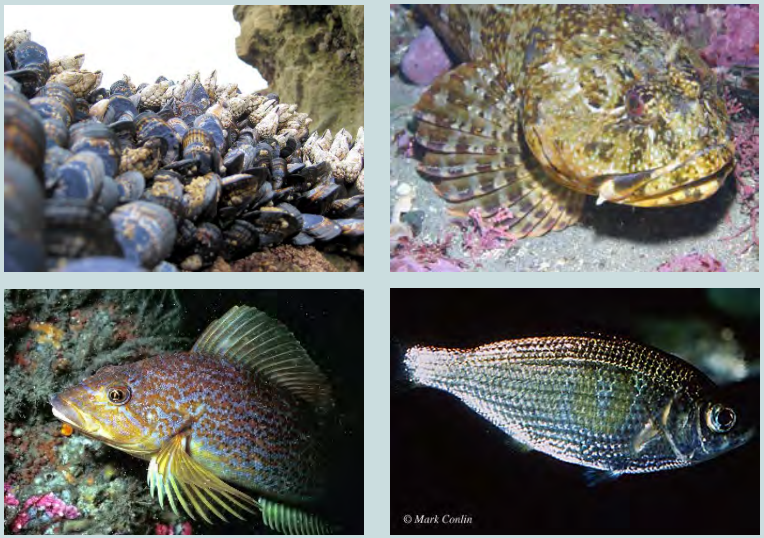
- Size and depth
- Habitats
- Adult home ranges
- Ocean uses
- Fishing pressure
- Demographics

WHAT'S PROTECTED

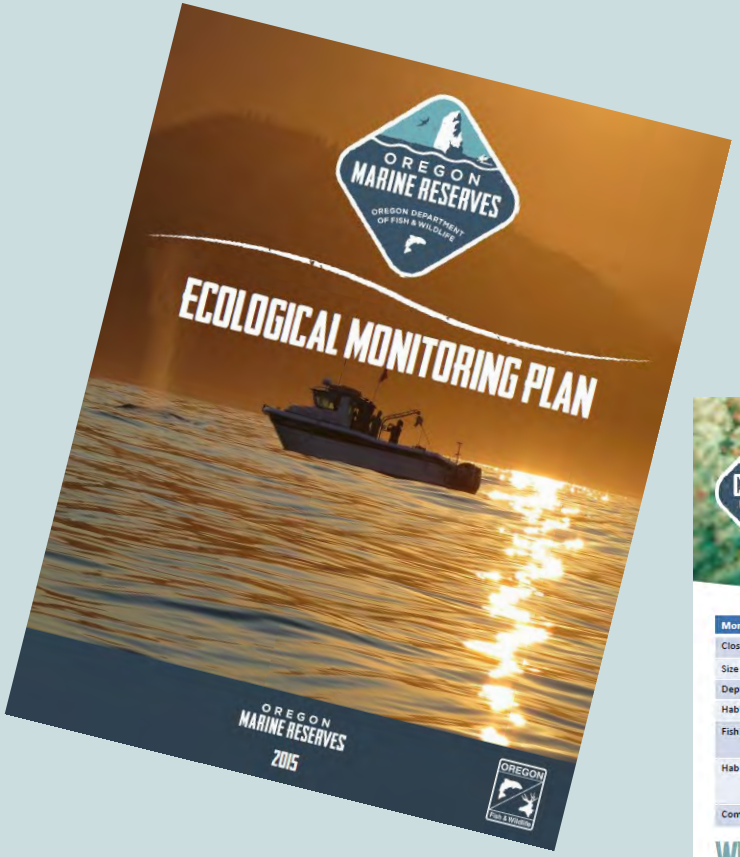


VS.

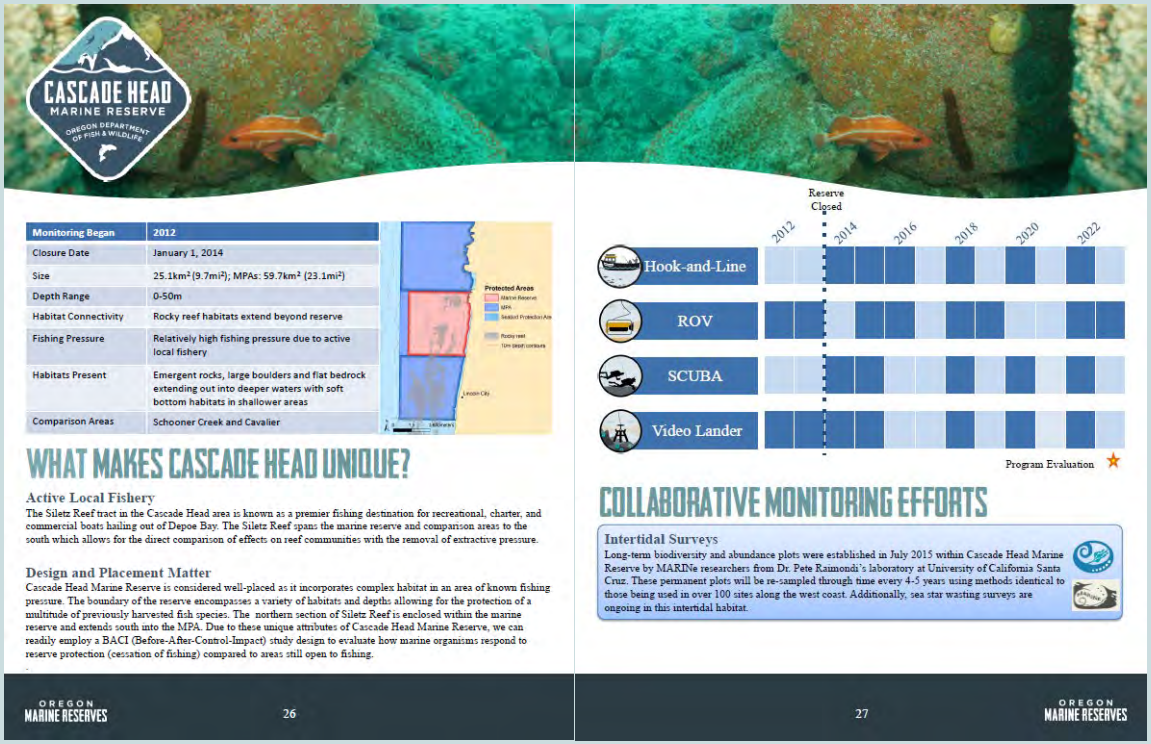
SCIENTIFICALLY DETECT CHANGE



Biggest factor is fishing pressure!



Understanding changes over time



CASCADE HEAD MARINE RESERVE

OREGON DEPARTMENT OF FISH & WILDLIFE

Monitoring Began	2012
Closure Date	January 1, 2014
Size	25.1km² (9.7mi²); MPAs: 59.7km² (23.1mi²)
Depth Range	0-50m
Habitat Connectivity	Rocky reef habitats extend beyond reserve
Fishing Pressure	Relatively high fishing pressure due to active local fishery
Habitats Present	Emergent rocks, large boulders and flat bedrock extending out into deeper waters with soft bottom habitats in shallower areas
Comparison Areas	Schooner Creek and Cavalier

Protected Areas

WHAT MAKES CASCADE HEAD UNIQUE?

Active Local Fishery

The Siletz Reef tract in the Cascade Head area is known as a premier fishing destination for recreational, charter, and commercial boats hailing out of Depoe Bay. The Siletz Reef spans the marine reserve and comparison areas to the south which allows for the direct comparison of effects on reef communities with the removal of extractive pressure.

Design and Placement Matter

Cascade Head Marine Reserve is considered well-placed as it incorporates complex habitat in an area of known fishing pressure. The boundary of the reserve encompasses a variety of habitats and depths allowing for the protection of a multitude of previously harvested fish species. The northern section of Siletz Reef is enclosed within the marine reserve and extends south into the MPA. Due to these unique attributes of Cascade Head Marine Reserve, we can readily employ a BACI (Before-After-Control-Impact) study design to evaluate how marine organisms respond to reserve protection (cessation of fishing) compared to areas still open to fishing.

OREGON MARINE RESERVES 26

Reserve Closed

2012 2014 2016 2018 2020 2022

Hook-and-Line

ROV

SCUBA

Video Lander

Program Evaluation

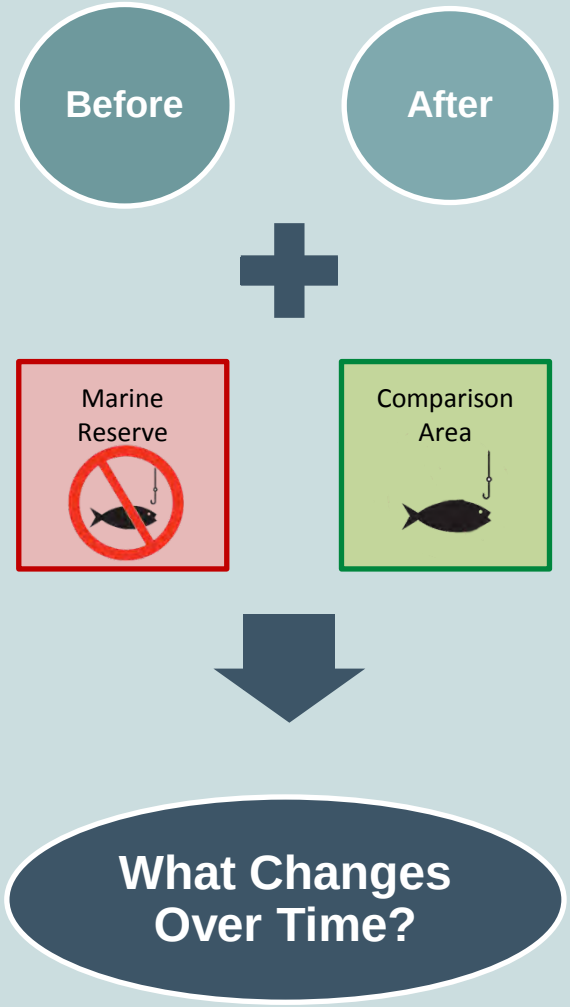
COLLABORATIVE MONITORING EFFORTS

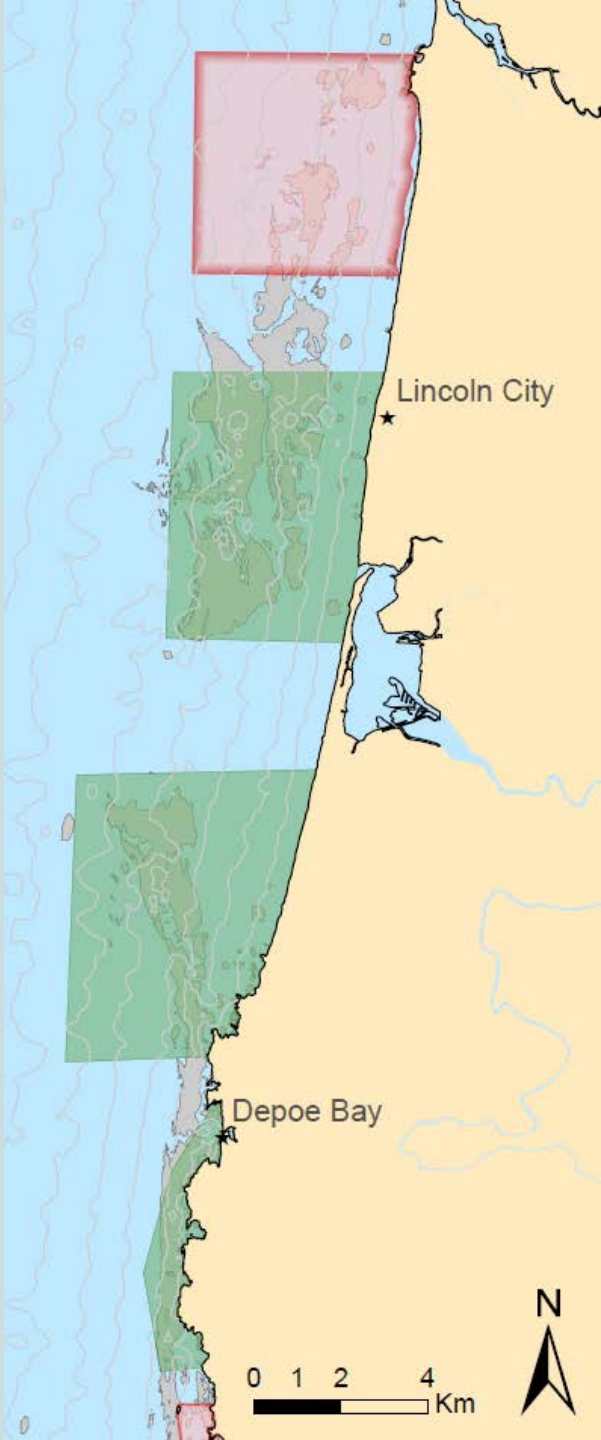
Intertidal Surveys

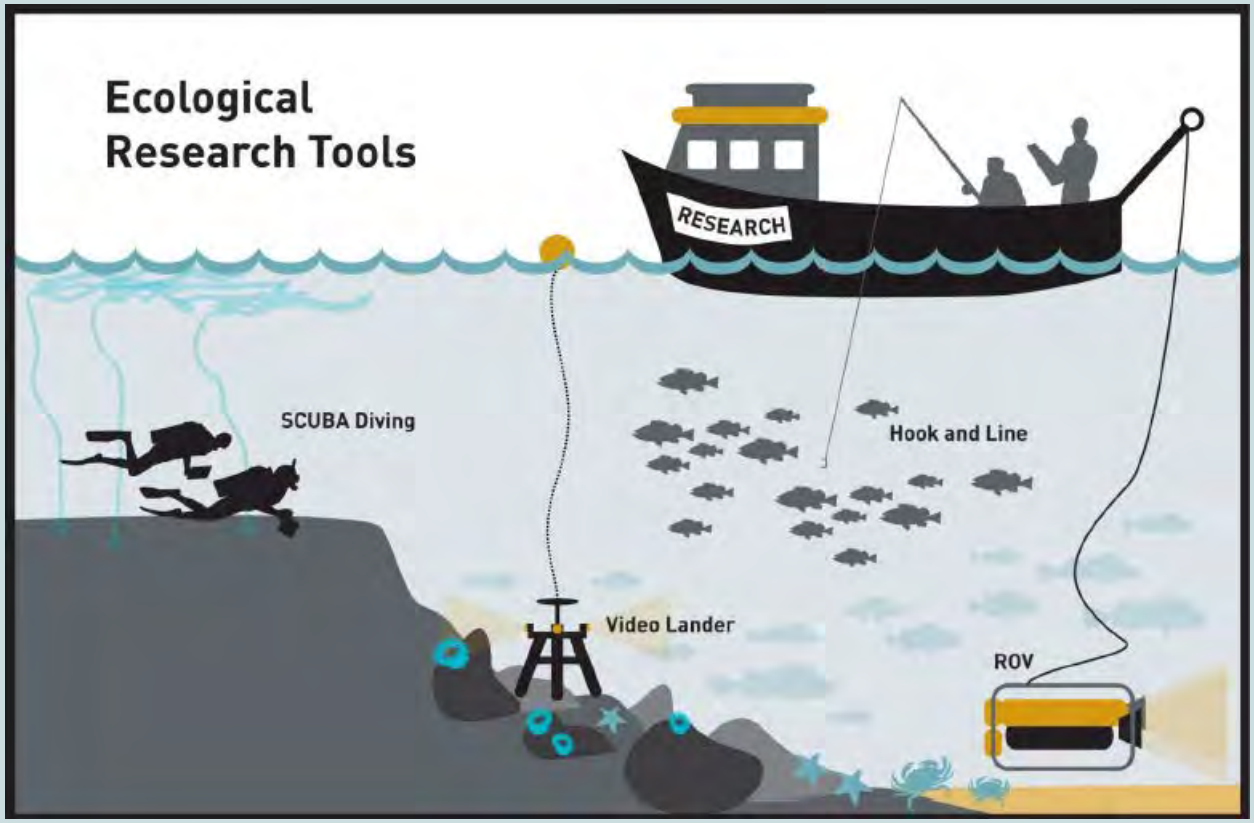
Long-term biodiversity and abundance plots were established in July 2015 within Cascade Head Marine Reserve by MARINe researchers from Dr. Pete Raimondi's laboratory at University of California Santa Cruz. These permanent plots will be re-sampled through time every 4-5 years using methods identical to those being used in over 100 sites along the west coast. Additionally, sea star wasting surveys are ongoing in this intertidal habitat.

27 OREGON MARINE RESERVES

We Sample


Before
After
Marine Reserve
Comparison Area
What Changes Over Time?


Lincoln City
Depoe Bay
0 1 2 4
Km
N



Monitoring Ecosystems

Ecological Monitoring

OREGON Fish & Wildlife

OSU Oregon State UNIVERSITY

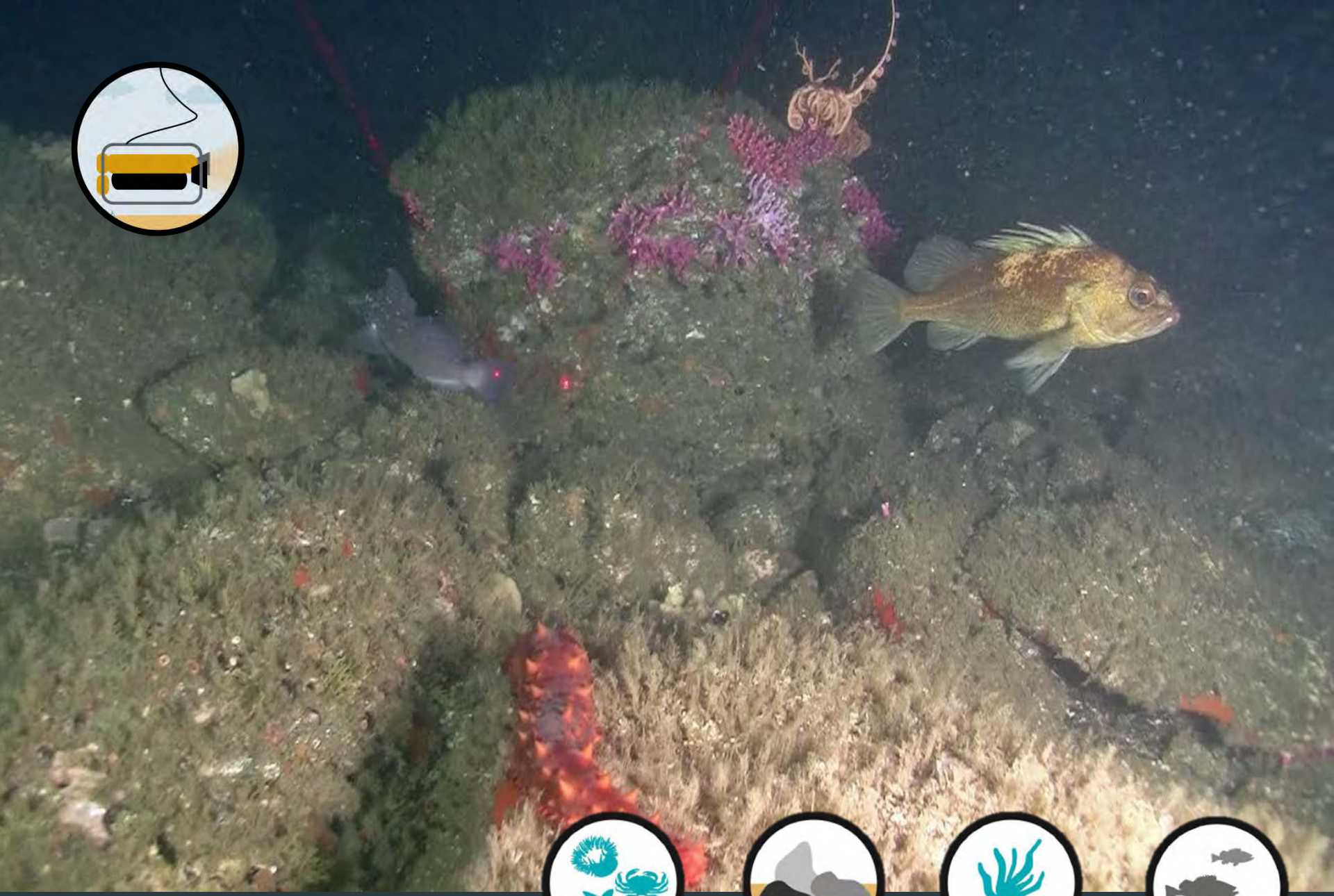
UC SANTA CRUZ

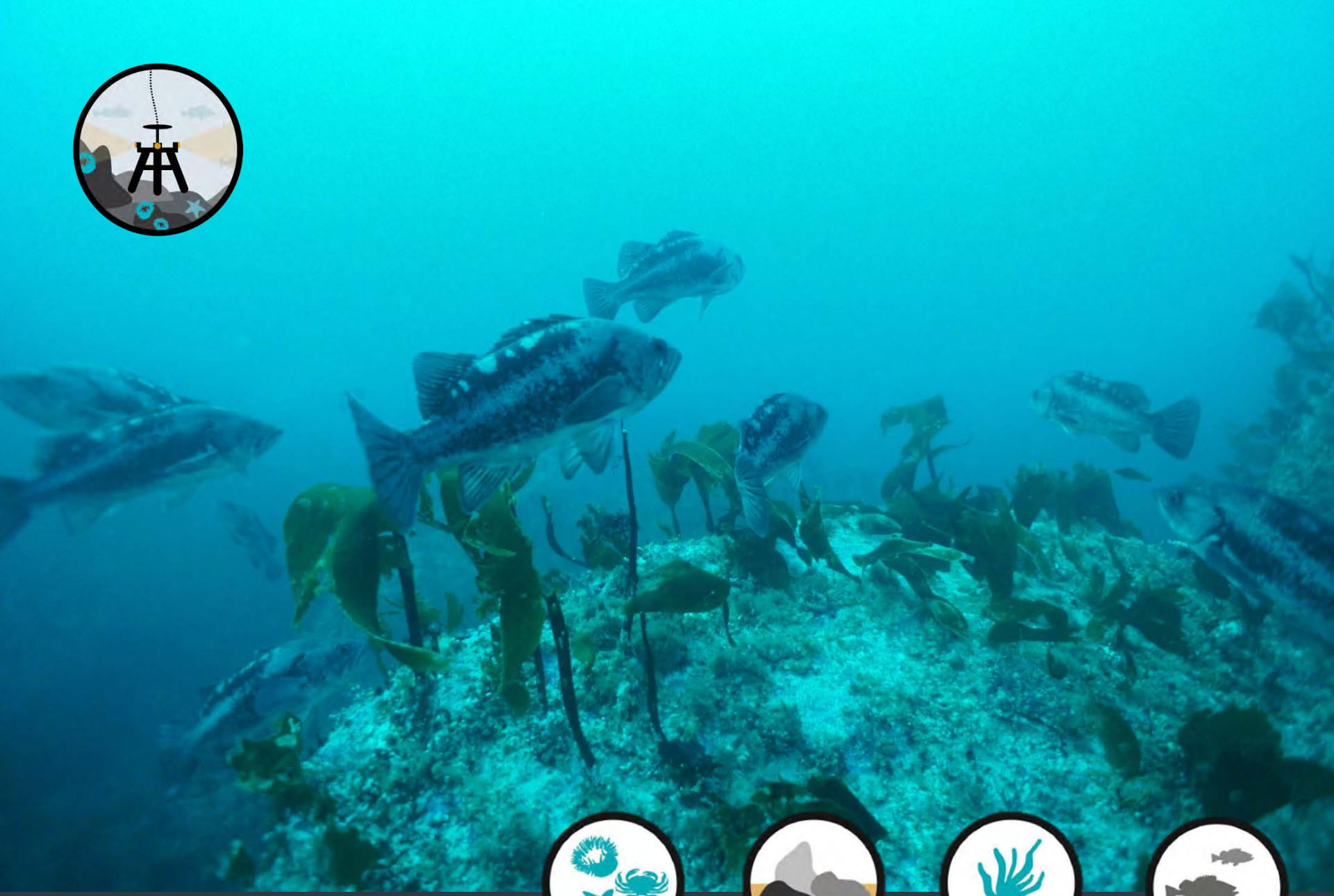
OREGON COAST AQUARIUM NEWPORT

PISCO

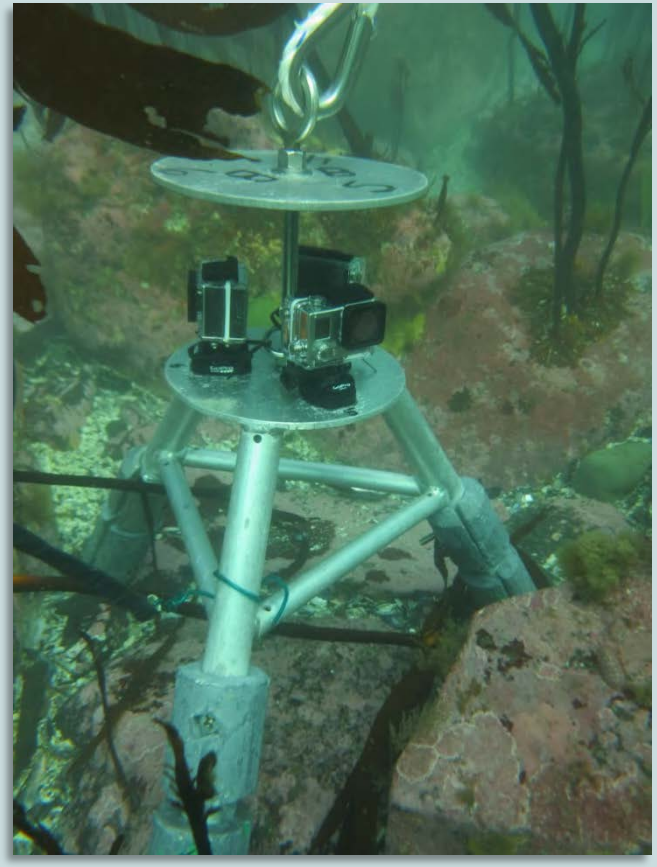
OSU Oregon State University

OREGON COAST AQUARIUM NEWPORT



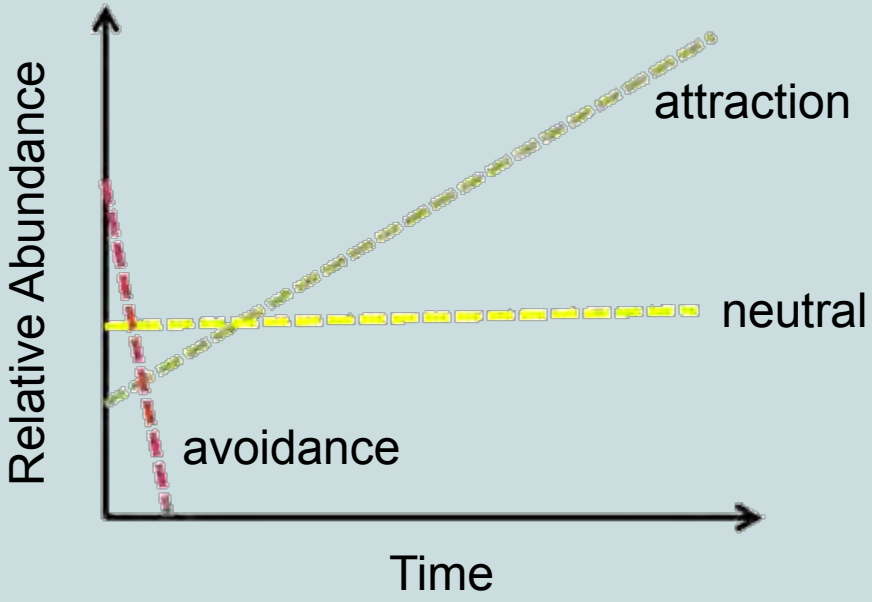


LEARNING & ADAPTING

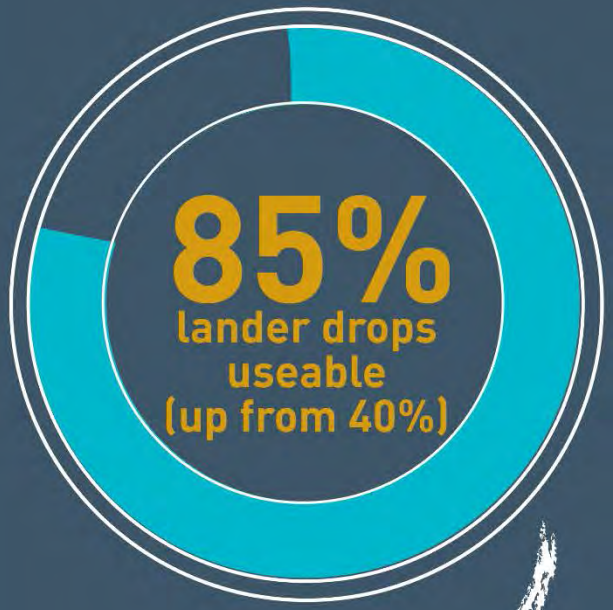


Mini-lander pilot study

1. Diversity and frequency of fish observations
2. Optimal drop duration
3. Behavioral response
4. Bait or no bait

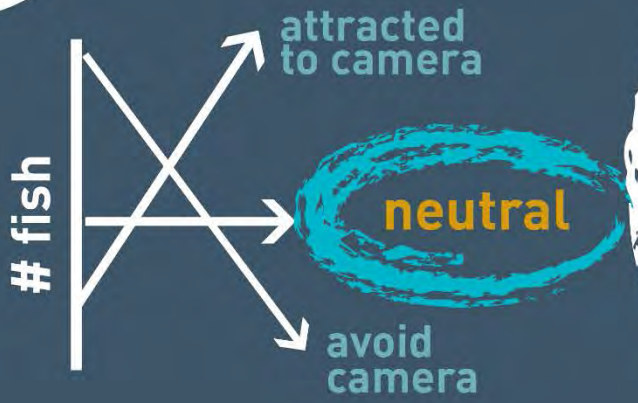


Conclusions from pilot study

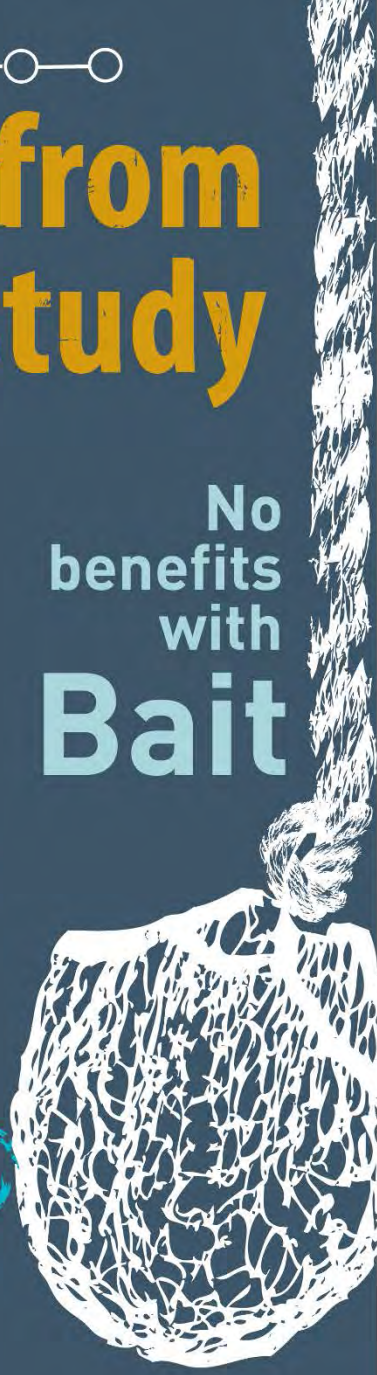


8 minutes
optimal drop time
(previously 4 minutes)

Are fish camera shy?



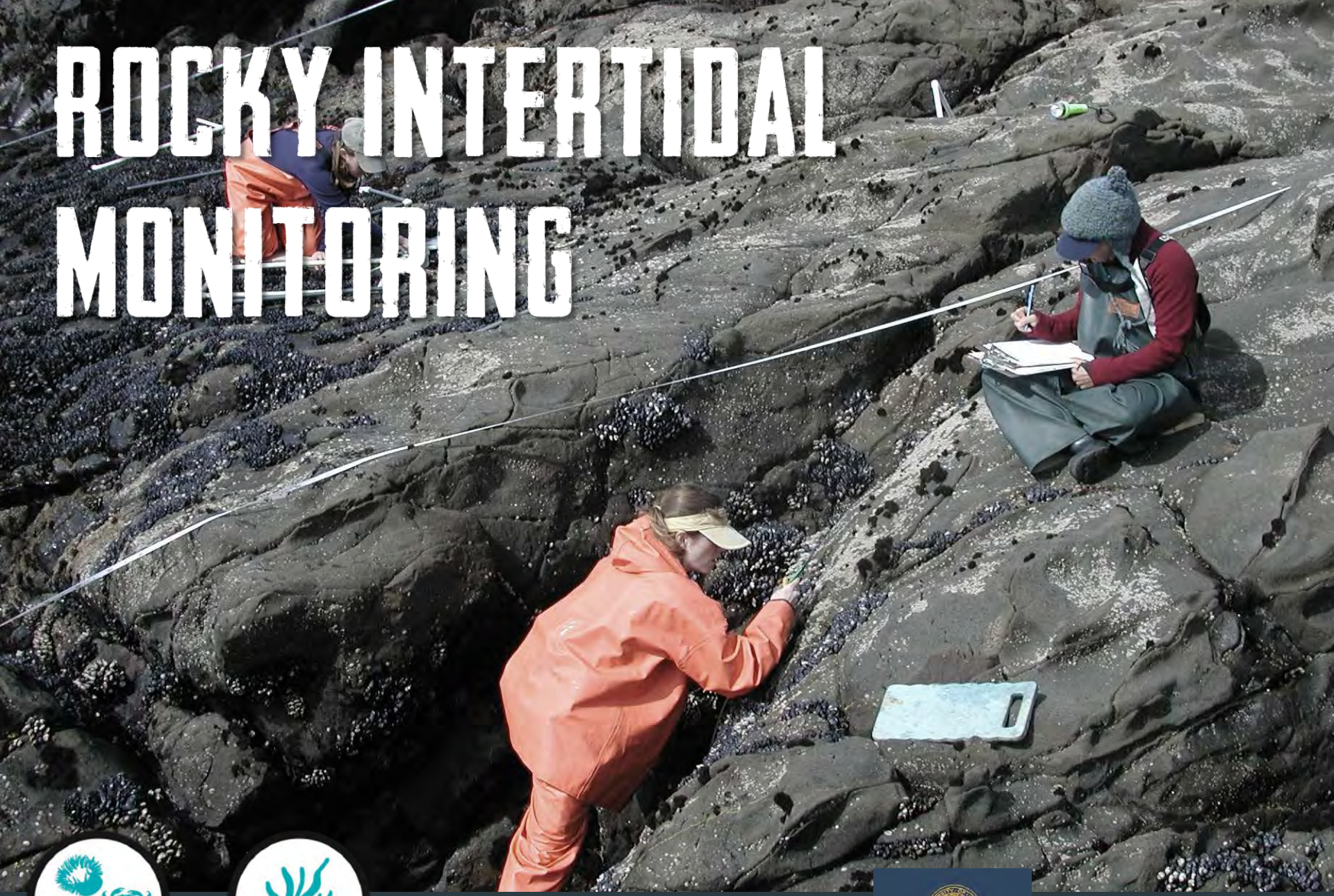
No benefits with Bait



RESEARCH

INFORMING MANAGEMENT

ROCKY INTERTIDAL MONITORING



UC SANTA CRUZ

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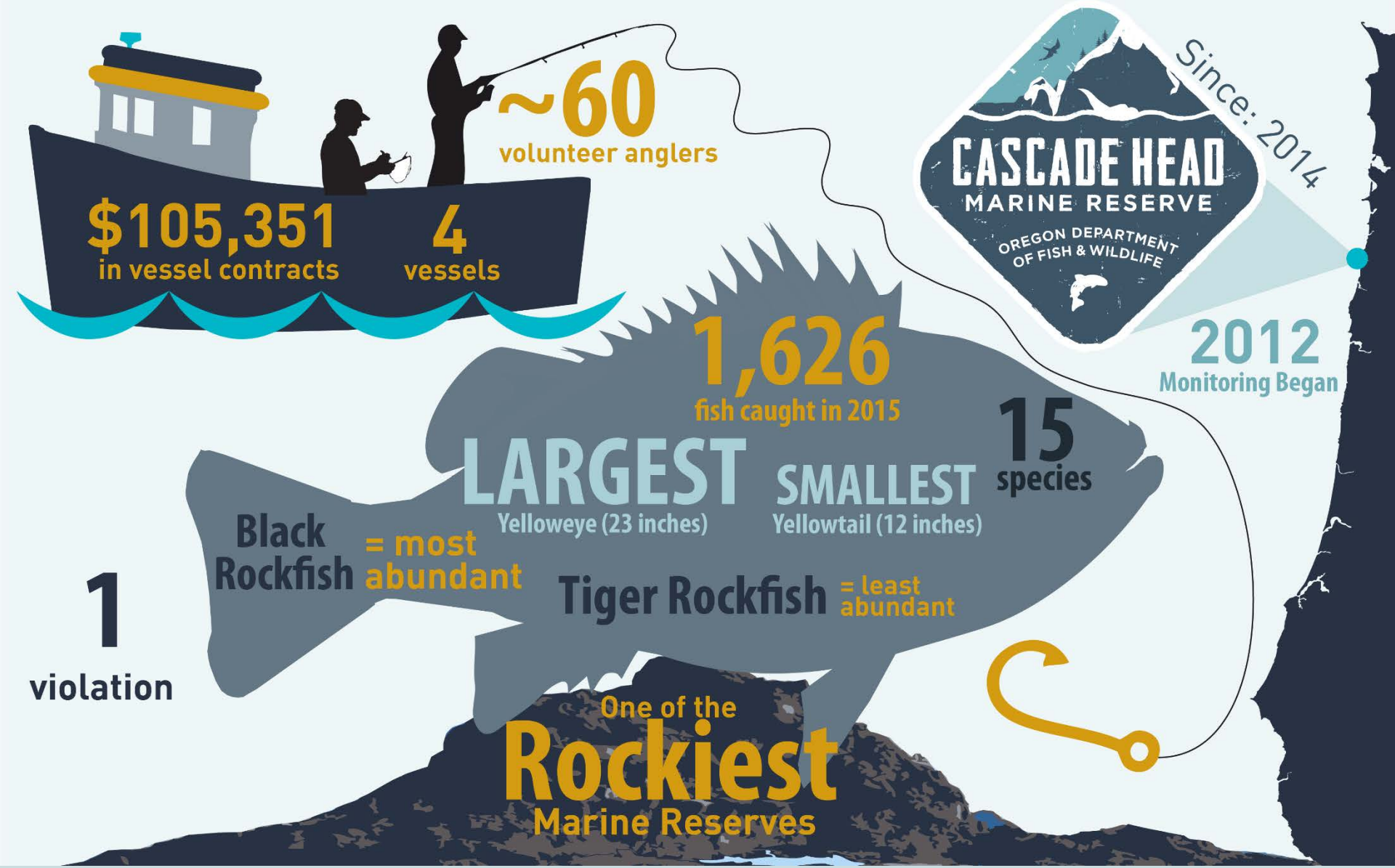
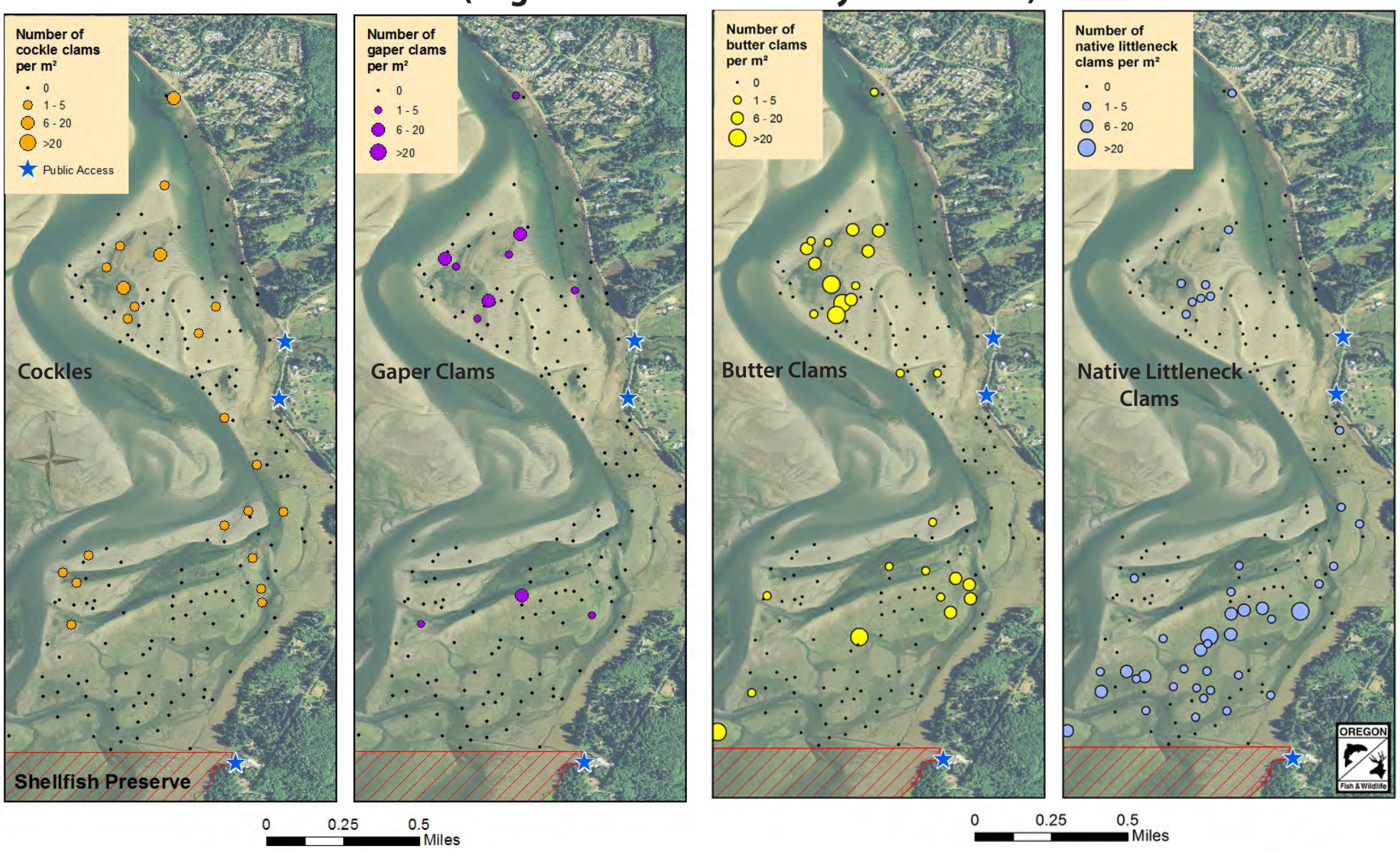

~60
volunteer anglers
$105,351
in vessel contracts
4
vessels
CASCADE HEAD
MARINE RESERVE
OREGON DEPARTMENT OF FISH & WILDLIFE
Since: 2014
2012
Monitoring Began
1,626
fish caught in 2015
LARGEST
Yelloweye (23 inches)
SMALLEST
Yellowtail (12 inches)
15
species
Black Rockfish
= most abundant
Tiger Rockfish
= least abundant
1
violation
One of the
Rockiest
Marine Reserves

Bay Clam Densities in Netarts Bay, 2013-2014

Eastside (Yager Creek and Whiskey Creek Flats)



The blue stars indicate easy walk-on access points.

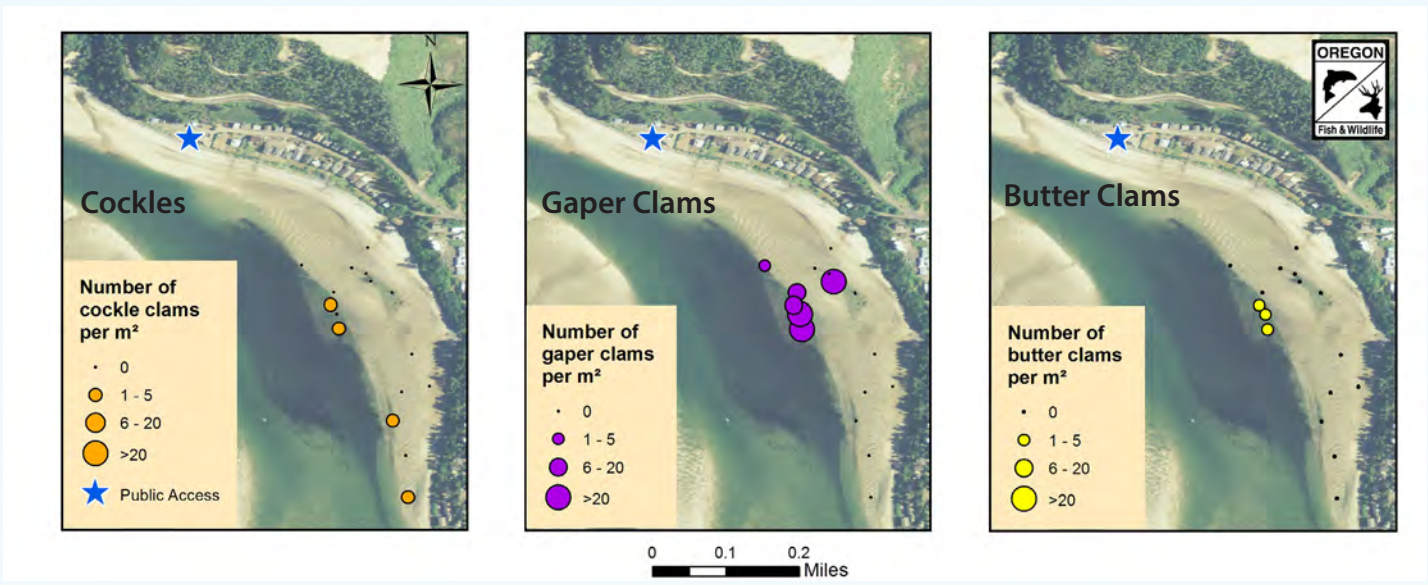
Shellfish Preserves are areas closed to clam harvest.

Additional clamming maps and directions to access points can be found at:

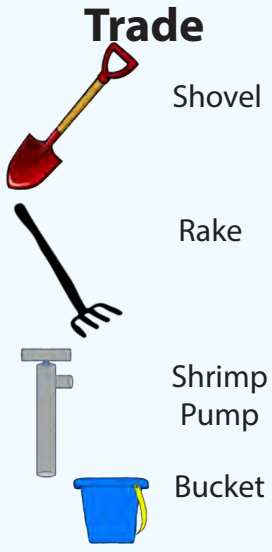
www.dfw.state.or.us/MRP/shellfish/SEACOR

Happy Camp

Additional access point just south of map near the boat ramp.



Tools of the Trade



Bay Clams

Cockle "show"

Cockles
(*Clinocardium nuttallii*)

- Found in sand or sandy mud sediments
- Located near the surface
- Live throughout the intertidal
- Size 1.5 - 3 inches
- Harvest with a rake; avoid eelgrass beds
- Tip: often found laying on the surface

Gaper "show"

Gaper Clams
(*Tresus capax*)

- Found in sandy sediments
- Located 1 to 3.3 feet deep
- Live in low intertidal
- Size 3-6 inches
- Harvest with a shovel or shrimp pump; avoid eelgrass beds
- Tip: gaper shows can look like burrowing shrimp holes. Stick your finger in the hole and if you feel the neck retract, you have found a gaper. Dig beside the show to avoid damaging the clam.

Butter Clams
(*Saxidomus gigantea*)

- Found in sandy mud sediments
- Located 0.5 to 1.2 feet deep
- Live in the high intertidal
- Size 2 - 4 inches
- Harvest with a shovel or rake
- Tip: dig carefully; the clam might not be directly below show

Butter "show"

Native Littleneck Clams
(*Leukoma staminea*)

- Found in sandy mud sediments
- Located surface to 0.8 feet deep
- Live in the high intertidal
- Size 1.5 - 2.5 inches
- Harvest with a rake; avoid eelgrass beds
- Tip: most common and readily accessible by foot on the flat near the Whiskey Creek Fish Hatchery

Where to Harvest Bay Clams

OREGON Fish & Wildlife

What is SEACOR?

The Shellfish and Estuarine Habitat Assessment of Coastal Oregon (SEACOR) is part of ODFW's Shellfish program. SEACOR staff conduct counts of bay clams in Oregon estuaries. The primary goals include:

Document where recreationally important bay clams are found

Count the abundance and biomass of each species

Describe the type of habitats where each species is found

This research targets recreationally harvested bay clams: cockles, butters, gapers, and native littlenecks.

Information obtained by SEACOR informs resource managers and provides a baseline for monitoring future changes in Oregon estuaries.

A SEACOR biologist sorting and identifying clams on Netarts Bay

*Front cover photo- Netarts Bay, ShoreZone Imaging Project, Oregon, 2011

A SEACOR biologist recording habitat data in Netarts Bay

For More Information

Website
www.dfw.state.or.us/MRP/shellfish/SEACOR

Email
ODFW.SEACOR@state.or.us

Shellfish Regulations
www.dfw.state.or.us/MRP/shellfish/regulations

Shellfish Harvest Hotline
1-800-448-2474

Recreational shellfish license fees provided funding for this study. Clam diggers and crabbers contribute directly to research on resources they use.

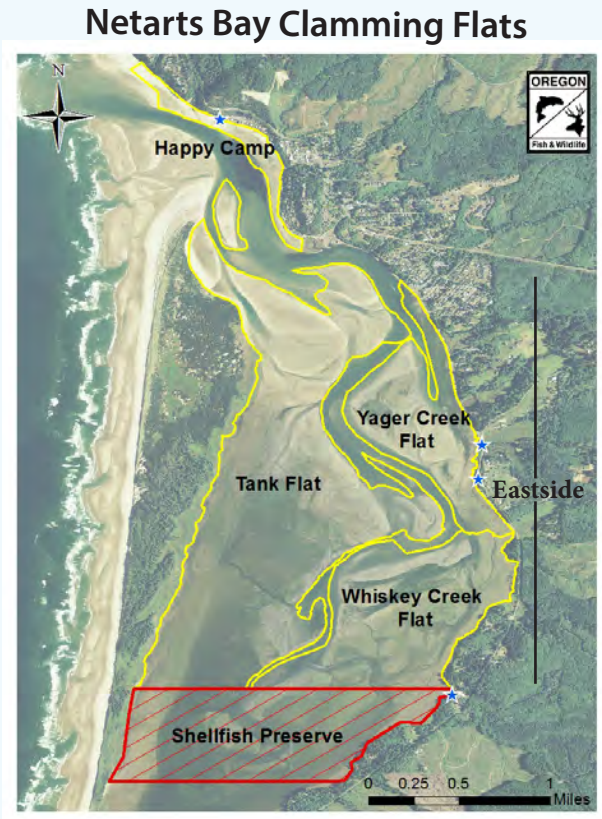
OREGON Fish & Wildlife
Oregon Dept. of Fish and Wildlife
Marine Resources Program
2040 SE Marine Science Dr.
Newport, OR 97365
541-867-4741

Netarts Bay

Netarts Bay provides excellent habitat for many shellfish species and is a popular location for recreational clamming and crabbing. Commercial harvest of cockles and oyster farming also occur within the bay. These various uses make it important for ODFW to map and quantify estuarine habitat and resources.

Unlike most of Oregon's estuaries, Netarts Bay is not fed by a major river. Instead, a number of small streams flow into it from the surrounding watershed. This results in relatively high salinity in the bay, enhancing shellfish habitat quality.

Netarts Bay Clamming Flats



How Many Clams Can I Harvest?

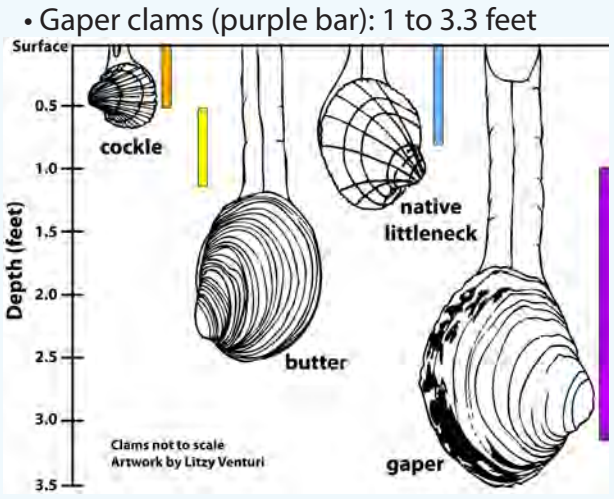
The daily catch limit is 20 bay clams (cockle, butter, native littleneck and gaper clams) per person, of which only 12 may be gaper clams.

For more on shellfish regulations visit:
www.dfw.state.or.us/MRP/shellfish/regulations

How Deep Should I Dig?

Different bay clam species live at different depths in the sediment.

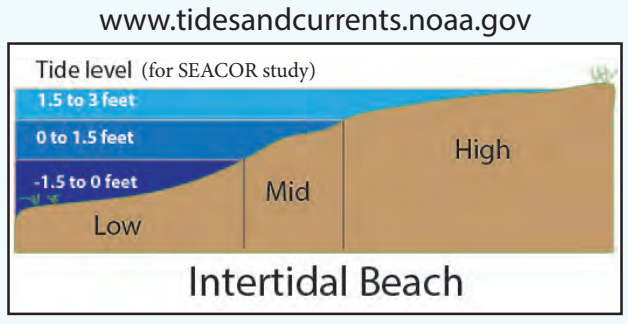
- Cockles (orange bar): surface to 0.5 feet
- Butter clams(yellow bar): 0.5 to 1.2 feet
- Native littleneck clams (blue bar): surface to 0.8 feet
- Gaper clams (purple bar): 1 to 3.3 feet



When Should I Dig?

Bay clams are often harvested in the intertidal- the part of the beach between high tide and low tide. Many clams live in the low intertidal, only accessible during a minus tide.

Find tide tables at:
www.tidesandcurrents.noaa.gov



What is Good Clamming Etiquette?

1. **Refill your holes:** a pile of sand can harm clams you may want to dig another day.
2. **Avoid digging in the eelgrass:** eelgrass is an essential home for many animals living in the estuary. Once eelgrass is dug up, it no longer provides that necessary shelter. Dig in gaps between eelgrass patches.

Clammers on Yager Creek Flat

TART 11x17 folldown trifold brochure_LazerQuick.indd 2 10/21/2014 4:10:44 PM

Attachment 309-1-1

Oregon Territorial Sea Plan: Resource Inventory and Effects Evaluation

Project Title: Measuring changes in ambient noise levels from the installation and operation of a surge wave energy converter in the coastal ocean

Prepared for:
U.S. Army Corps of Engineers
Oregon Department of State Lands
Joint Permit Application

Prepared by:
Joseph Haxel Assistant Professor, Cooperative Institute for Marine Resources Studies, Oregon State University;

RESOURCE INVENTORY

1 Description of proposed action

(1a) Location

The proposed action would be performed just outside the surf zone, offshore of the Slusher Lake area of the Oregon Military Department Camp Rilea facility designated for a shallow water surgeWEC device demonstration (Figure 1).

Seafloor lander frames, with no surface expression will be deployed along a cross-shore line at 10 m and 15 m depth extending from the proposed surgeWEC installation in 7 m water depth at 46.111°N / -123.961°W. The ADUH drifting buoy deployments will also be carried out in this area offshore of the surf zone.

The project site lies entirely within Oregon's Territorial Sea (< 3 nm) and ranges in depth from 0 to 15 meters with a gently sloping soft, sandy bottom.

Figure 1. *Maps showing the locations of the hydrophone lander deployment positions with respect to the surgeWEC device. Inset map shows the location of Camp Rilea, Oregon.*

(1b & 1c) Bottom-mounted hydrophone lander frames

Two, passive acoustic seafloor hydrophone mooring platforms will be deployed at the project site in 10 m and 15 m water depths separated by a cross-shore distance of roughly 500 m. Each hydrophone lander frame will be outfitted with 2 identical hydrophone instrument systems

enabling coherence measurements to identify periods of data contamination from wave and current induced flow noise. The lander frame consists of hollow aluminum tubing weighted with lead ballast and an estimated circular seafloor footprint of roughly 30 square feet ($r \approx 3$ ft., Figure 2). The vertical extent of each frame reaches 6 feet and using a cylindrical volume estimate ($V = \pi r^2 h$), a total displacement volume is calculated at ~ 170 cubic feet for each lander frame (or ~6 cubic yards). In addition, an acoustic release recovery system will allow the entire instrument package and frame to remain fully submerged with no surface expression during the deployment period. At the end of a deployment period, an acoustic command will initiate the release of a messenger float to the surface, enabling the lander frame and all components to be lifted and recovered from the seafloor. The 10 m depth contour is chosen as a shoreward deployment limit to reduce potential damage from breaking wave action and to avoid data contamination and burial rates encountered inside of the estimated sediment transport closure depth of 10-12 m found along the Pacific Northwest coast.

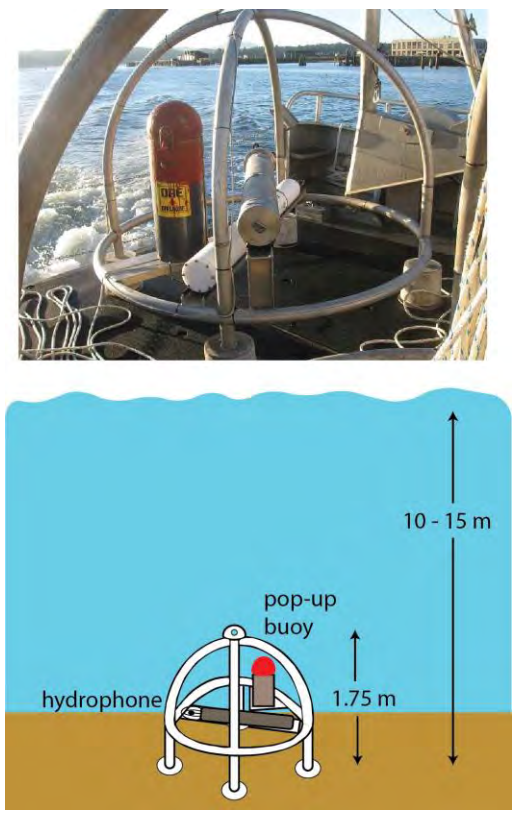


Figure 2. *An example of the bottom mounted hydrophone lander frames to be deployed at 10 m and 15 m water depths at the project site.*

(1d) Transportation

A single vessel will be used for each deployment and recovery operation with up to 10 deployment/recovery operations over the 2 year project duration. Anticipated deployment duration is 4 to 8 weeks depending on recovery vessel availability and weather conditions. The

proposed action will incorporate best practices for vessel operations and limit vessel interactions for the protection of marine mammals and sea turtles.

All deployment dates are approximate and subject to change based on weather and ocean conditions and other logistical factors. In addition, durations and/or frequencies may be modified slightly per coordination with and input from agencies and stakeholders.

(1e) Materials disposal

No material removal will occur.

(1f) Hazardous materials used or produced

No hazardous materials will be used or produced in this project.

(1g) Navigation aids

No navigation aids will be used. The seafloor lander frames will remain completely submerged with no surface expression, therefore not affecting vessel navigation or transit.

(1h) Proposed time schedule

The seafloor lander frames are scheduled for deployment August 3, 2015 weather conditions permitting. The instrument frames will be recovered and redeployed at a roughly 4-8 week intervals over the 2 year project period ending May 31, 2017.

2 Description of all affected areas (onshore support facilities)

The seafloor lander frames will be staged and prepared for deployments at the U.S. Army Camp Rilea facility.

3 Description of physical conditions

(3a) Water depth

Seafloor lander frames will be deployed in 10 m and 15 m water depths.

(3b) Wave regime

Incident wave energy at Camp Rilea is highly variable, ranging from significant wave heights on the order of 1 m during summer conditions up to 10 m and above during winter storms. Because of shallow sloping bathymetry, the project area is considered a highly dissipative region with a broad breaking surf zone extending far offshore during peak wave conditions.

(3c) Current velocities

Mean near bottom current velocities around 30 cm/s (Kaminsky et al., 2010) have been observed near the shallow waters of the project area influenced by wave driven circulation.

(3d) Dispersal, horizontal transport, and vertical mixing

The major oceanographic influences for the marine environmental setting in the project area are the California Current Large Marine Ecosystem (LME) alongshore, and the physical, chemical and biological functions of the Columbia River mouth to the immediate north.

The larger marine environmental setting for the study area is the northern end of the California Current LME. The upwelling and biological productivity of the California Current are strongly seasonal. During spring and summer -the prevailing northerly winds cause surface water to flow offshore, resulting in the upwelling of cold, nutrient-rich water near shore. During fall and winter a northerly countercurrent, the Davidson, flows inshore of the California Current, and is strengthened during winter by southerly storm winds. These strong southerly winds also tend to drive surface water onshore, causing downwelling. The annual cycle described above is overprinted by episodic events at longer time scales, like the El Niño-Southern Oscillation (ENSO). Strong episodic events can lead to major disturbances, for example, the extensive beach erosion which occurred along the Pacific coast during the 1997 El Niño.

The Columbia River is the largest source of freshwater outflow into the Pacific Ocean from North America. The Camp Rilea project nearshore area is within the Columbia River Littoral Cell (CRLC), which extends from Tillamook Head, Oregon, north to Point Grenville, Washington; a total distance of roughly 100 nautical miles (185 km). The CRLC is comprised of four sub-cells, of which the Clatsop Plains sub-cell is the southernmost and extends northwards from Tillamook Head to the Mouth of the Columbia River. In practical terms, this means that most of the sediment movement in the region of study area takes place between Tillamook Head and the Columbia River estuary.

(3e) Meteorological conditions

Periodically strong southerly winds (20-30 kts) are typical during winter months associated with incoming storms off the Pacific Ocean. High pressure dominates the summer pattern with a daily rise in northerly wind velocities accompanying the inland temperature increase. Annual rainfall amounts also exhibit a seasonal pattern with average annual rainfall estimates near 70 inches.

(3f) Water quality

Water quality is typical of Oregon's well mixed nearshore surf zone with no known nearby influence from municipal or industrial outfalls.

4 Description of bathymetry

Seaward of the shoreline, the surf zone is comprised of a series of highly dynamic, parallel nearshore sand bars. Continuing offshore beyond the breaking surf zone, the continental shelf seaward of Camp Rilea is flat and shallow sloping ($\beta = 0.01$), with a water depth of only about 10-12 m at one nautical mile offshore.

5 Description of geologic structures and hazards

The project area is located approximately 10 nautical miles (18 km) south of the mouth of the Columbia River, offshore of the coastal land region known as the Clatsop Plains. The shoreline at Camp Rilea is characterized by a broad gently sloping beach, backed by dunes with vegetation. The Cascadia Subduction Zone represents the major geologic hazard for the area associated with intense ground motion and tsunami inundation during a seismic event.

6 Description of biological features

(6a) Designated critical marine habitats

Critical habitat has been designated for some species in or near the project area. Vertebrate species listed under the ESA may include intraspecific taxa described as Distinct Population Segments (DPS), some of which have been described by the National Marine Fisheries Service (NMFS) as Evolutionarily Significant Units (ESU). Designated Critical Habitat (DCH) for the following species occurs in or near the Camp Rilea project area:

- ***Coho salmon*** (Oncorhynchus kisutch) **-** NMFS listed the Oregon coast coho salmon ESU as threatened and DCH. Critical habitat for Oregon coast coho salmon includes riverine and estuarine areas within 80 occupied watersheds in 13 associated sub-basins. Critical habitat for coho salmon includes the waters of the Columbia River, but does not extend out to the offshore waters of the Camp Rilea project area.
- ***Green sturgeon*** (Acipenser medirostris) **-** NMFS designated all nearshore waters to a depth of 60 fathoms (360 feet or 110 meters) offshore Oregon as critical habitat for the southern DPS of the green sturgeon. As such, the green sturgeon DCH includes the Camp Rilea project area.
- ***Leatherback sea turtle*** (Dermochelys coriacea) **-** Critical habitat for the leatherback sea turtle was designated in the Pacific Ocean off areas of Washington, Oregon, and California. The area designated includes the offshore waters between Cape Flattery, Washington, and Cape Blanco, Oregon, out to the 2,000-meter depth contour and an similar area offshore California. As such, the leatherback sea turtle DCH occurs within the Camp Rilea project area.
- **Eulachon** (Thaleichthys pacificus) - NMFS designated the lower Columbia River as critical habitat for eulachon.
- **Western Snowy Plover** (Charadrius alexandrinus nivosus) - Areas of beach habitat at the Columbia River Mouth, on the spit inshore of the South Jetty, and on the Necanicum River spit, have been proposed as critical habitat for western snowy plover. Thus far the most northerly Critical Habitat designated is Bay Ocean Spit at Tillamook Bay to the south.

(6b) Other habitats

There are no plant species, either algae or vascular, known to be listed in the region at this time. Bull kelp (Nereocystis luetkeana) is listed as a strategy species in the Oregon Nearshore Strategy (ODFW 2006), but is not expected to occur in the soft bottom substrates offshore of the Camp Rilea project area. The south Columbia River jetty to the north provides some rocky habitat for shallow water fish (e.g. rockfish, lingcod, perch, etc.) as well as a variety of shallow benthic species (e.g. crabs, echinoderms, shellfish).

(6c) Fish, shellfish and marine mammals

The nearshore and offshore regions off Camp Rilea encompass mostly soft bottom sub-tidal habitats, the rocky structure provided by the Columbia River Jetties and the open water pelagic environment. This area, therefore, supports a variety of fish species that typically inhabit all three

habitats with frequent movement of fish between them. Typical fish species that inhabit these areas are discussed below. Although very little hard bottom substrate is known to be present in the project areas, the rocky jetty structure may support pelagic and benthic fish communities that associate with rocky, rather than soft, substrate. Fish species commonly observed in sandy bottom areas offshore include English sole (*Parophrys vetulus*), butter sole (*Isopsetta isolepis*), Pacific sanddab (*Citharichthys sordidus*), speckled sanddab (*Citharichthys stigmaeus*), and starry flounder (U.S. Army Corps of Engineers and U.S. Environmental Protection Agency 2011; Henkel 2011).

Rocky sub-tidal, or jetty habitats typically experience a wide variety of wave and current regimes, substrate, depths, and food sources, producing diverse biological communities. The rocky jetty structures found at the mouth of the Columbia River provide important habitat for fish species that include sculpins (*Cottidae*), surf perch (*Embiotocidae*), and rocky reef fishes. Shallow water species are likely to dominate the assemblages including black rockfish (*Sebastes melanops*), while deeper water species like lingcod (*Ophiodon elongates*) are also likely to be found in significant numbers (U.S. Army Corps of Engineers and U.S. Environmental Protection Agency 2001). Although these areas of rocky sub-tidal habitat are located outside the Camp Rilea project area, juvenile lingcod and rockfish would likely use pelagic and soft bottom habitats, and older mature fish typically associated with rocky sub-tidal habitats could be found swimming in the deeper soft bottom regions.

A number of environmental factors affect the fish species present in the pelagic zone, including light penetration, water temperature, proximity to river plumes, and underwater currents. Pelagic species commonly found in the area include Pacific herring (*Clupea pallasi*), northern anchovy, and Pacific Ocean perch (*Sebastes alutus).* The area is also utilized by salmon, steelhead, and shad that migrate alongshore. Threatened and endangered fish species that are likely to occur offshore of Camp Rilea and could be affected by the project include Chinook salmon, coho salmon, green sturgeon, and eulachon. In addition, critical habitat for the southern DPS of green sturgeon includes the project area. Pacific salmon are highly motile and patchy in distribution (NMFS 2012). Eulachon movements in coastal waters are poorly known, though there is no evidence that they use specific marine areas for migration (NMFS 2012). Tagged green sturgeon spend longer durations in highly complex seafloor habitats (e.g., boulders; Huff et al. 2012); the Project area, in contrast, is sand. So, while all are expected to occur in the project area, their exposure to the project, given the expanse of open ocean surrounding the project, is expected to be small.

Marine mammal species potentially present in the Camp Rilea project area include cetaceans (whales, dolphins, and porpoises) and pinnipeds (seals and sea lions). The most common year-round inhabitants are the pinnipeds: Pacific harbor seal (*Phoca vitulina*), and Steller sea lion (*Eumetopias jubatus*).

Cetaceans potentially present in the project areas include transient killer whales (*Orcinus orca*), which appear along the Oregon coast in April, in conjunction with the California gray whales' northward migration. Killer whales of the southern resident group occasionally pass by during migrations from their principal range in Washington and British Columbia, en route to foraging grounds off central California, where they seasonally feed on migrating Chinook salmon (Northwest Fisheries Science Center 2007). Other whales observed offshore of the Oregon coast include blue whale (*Balaenoptera musculus*), finback whale (*Balaenoptera physatus*), sei whale (*Balaenoptera*

borealis), Pacific right whale (*Balaena glacialis japonica*), humpback whale (*Megaptera novaeangliae*), and sperm whale (*Physeter catodon*).

California gray whales (*Eschrichtius robustus*) occur along the Oregon coast throughout the year with a small population of resident whales present between May and October. Migrating gray whales occur between March and June on their northward migration, and between December and March on their southward migration.

(6d) Recreationally or commercially important finfish or shellfish

Dungeness crab represent the most important recreational and commercial benthic species in the Camp Rilea project area. Additionally, razor clam harvest along the Clatsop Spit beaches is also an important sport and recreational fishing activity. Other finfish species common to the project area and important for commercial and sport harvest have been discussed in the section above.

(6e & 6f) Primary productivity, planktonic and benthic flora and fauna

The upwelling and biological productivity of the California Current that dominates the region are strongly seasonal. As discussed in section 3d, during spring and summer -the prevailing northerly winds cause surface water to flow offshore, resulting in the upwelling of cold, nutrient-rich water near shore. This supply of nutrient-rich water and the seasonally higher level of seasonal incident solar energy (insolation) provide the basis for primary production by photosynthesis that ultimately supports the Northern California Current's biological productivity. During fall and winter a northerly countercurrent, the Davidson, flows inshore of the California Current, and is strengthened during winter by southerly storm winds. These strong southerly winds also tend to drive surface water onshore, causing downwelling. The annual cycle described above is overprinted by episodic events at longer time scales, like the El Niño-Southern Oscillation (ENSO) and the Pacific Decadal Oscillation (PDO). Strong episodic events can lead to major disturbances, for example, the extensive beach erosion and northward range extension of warm water species, which occurred along the Pacific coast during the 1997 El Niño.

The benthic infauna is of particular interest, as the landers will be deployed on soft, sandy seafloor habitat and non-motile organisms may be temporarily affected. Richardson et al. (1977) and Braun 2005 show benthic invertebrates near the mouth of the Columbia River are composed of five groupings, influenced primarily by sediment deposition. Braun 2005 goes on to show "seasonal variations of benthic community structure and species composition are considerable, especially at inshore locations exposed to sediment movement due to winter storms and at locations affected by sedimentation from the river." The seasonal variability in benthic communities is probably related to yearly fluctuations in the intensity of winter storms and in the output of water from the Columbia River.

7 Description of mineral deposits

The Clatsop Spit region was formed by westward shoreline progradation from the formation of a series of parallel sand dune ridges after construction of the Columbia River jetties. There are no known mineral deposits outside of typical beach sands in the Camp Rilea vicinity.

8 Description of cultural economic and social uses

(8a) Commercial and sport fishing

Astoria is one of the top ten U.S. ports in the poundage of commercial landings. The most important commercial 2010 fisheries in Astoria in terms of weight were (in decreasing order): Pacific sardines, Pacific whiting (hake), pink shrimp, Dover sole, arrowtooth flounder, albacore tuna, Dungeness crab and sablefish (black cod). Reported 2010 economic values show that the most important fisheries in Astoria were (in decreasing order): Dungeness crab, albacore tuna, sablefish (black cod), pink shrimp, Chinook salmon, Pacific sardines and Dover sole (fishery statistics are developed annually by NOAA Fisheries).Recreational fishing landings follow a profile different from that of commercial landings. The most commonly targeted fish in the ocean recreational fisheries include Pacific salmon, groundfish (including lingcod), flatfish, albacore tuna and sturgeon.

(8b) Aquaculture

N/A

(8c) Scientific research

N/A

(8d) Ports, harbors and navigation

Nearby ports inside of the Columbia River entrance include Hammond, Warrenton and Astoria on the Oregon side of the river. The Columbia River bar entrance has a number of buoys and lighted structures for aids to navigation associated with the jetties.

(8e) Recreation

Popular shore-based recreational activities in and around the Camp Rilea project area include beach-walking, bird watching, photography, camping, beach combing and fishing. Popular offshore activities include recreational fishing, crabbing, kayaking, surfing, and wind and kite surfing.

(8f) Tourism

Tourists visiting the Clatsop Spit vicinity are drawn from within and without the state of Oregon. Popular destinations include Fort Stevens State Park, the Lewis and Clark National Historical Park, Camp Rilea itself, and other attractions in nearby cities and (e.g. Seaside, Astoria).

(8g) Mineral extraction

N/A

(8h) Waste discharge

N/A – no offshore outfall discharge facilities

9 Description of significant historical or archeological sites

The most notable significant nearby historical area is Fort Stevens State Park to the north of the study area containing a number of significant battlement structures and facilities within the inland dune areas of the park.

EFFECTS EVALUATION

(a)(i) Biological and ecological effects

The area of the proposed action is subject to high energy environmental conditions including large breaking waves, currents and therefore significant sediment transport. The regularity (4-8 weeks) with which the lander frames will be deployed and removed will reduce burial or scouring associated with the structures. Additionally, the small footprint (~ 30 sq. feet) of the lander frames is considered negligible in comparison to the surrounding expanse of similar sandy bottom type, suggesting the action will have no effect on long term displacement of benthic species.

Vessels used as part of the proposed action would cause short term increases in marine traffic in the vicinity of the project area. Most of the sound pressure produced by the propulsion system of vessels would dissipate to ambient levels a short distance from the vessel. Vessels would be slow moving or idle in the action area during hydrophone lander and buoy deployments causing little disturbance above ambient levels common to the area.

The lander frames will have no direct surface expression (surface buoys), therefore making entanglement of marine mammals or fish within the frames highly unlikely.

(a)(ii) Conformity with existing uses

The area of the proposed action is subject to extensive commercial crabbing during the season. Precaution will be used for siting the instrument frames with dialogue from local crabbing and fishing community members. The completely subsurface nature of the frames eliminates other conflicts with recreational and commercial users of the area.

(a)(iii) Local and regional economies

Funds to support project logistics including vessel transportation from the harbor to the project site as well as hotel and per diem usages during multi-day project activities will be spent in local communities.

(a)(iv) Archeological and historical resources

N/A.

(a)(v) Transportation safety, accidents

The proposed action will also incorporate best management practices for vessel operations and limit vessel interactions for the protection of marine mammals and sea turtles.

(a)(vi) Geologic hazards

N/A.

(a)(vii) Cumulative effects of project in conjunction with past, present, future projects

Due to the limited temporal nature, small spatial footprint and vast expanse of similar area immediately adjacent to the project area, the proposed action is likely to have no cumulative effect from the present project or future projects in the area.

(b) Evaluation of the financial and technical capability of the applicant to perform

This is a 2 year U.S. Department of Energy supported project awarded to the applicant based on his experience in the field of underwater acoustics.

(c) Evaluation of the applicant's and agencies' ability to monitor performance

U.S. Department of Energy quarterly reporting requirements enable regularly scheduled evaluation of progress and project performance by the applicant.

(d) Evaluation of the feasible alternatives to achieve the purpose or objective of the proposed action

The proposed project is closely linked with an industry partner who is working exclusively with Camp Rilea personnel. This wave energy converter monitoring project is the only "live" testing operation in Oregon at this time.

(e) Evaluations for development for nonrenewable resources

N/A – this is not part of a separate permit application by the wave energy device developer and pertains only to the proposed action of baseline and project "noise" measurement

Input questions: 404/401 Pre-Application Meeting

RESOLUTE MARINE ENERGY DEMONSTRATION PROJECT

Note: This document contains preliminary project information to inform the pre-application meeting with federal and state agencies for Resolute Marine Energy's wave energy demonstration project offshore Camp Rilea, OR. The information provided here addresses the Pre-Application Meeting Input Questions, as well as questions posed by resource agencies during informal pre-consultation and coordination. As noted in the Pre-Application Information Packet, this information is intended to provide an overview of the conceptual plans, while maintaining the flexibility to change plans based on agency feedback and project-specific technical analyses. Accordingly, this information is subject to change during the final project design process.

1 What is the project purpose and need?

Since 2007, Resolute Marine Energy has been developing a wave energy converter technology "SurgeWEC™" with unique features that make it particularly well-suited for electricity and fresh water production in remote, off-grid, areas. The Oregon Military Department (OMD) is investigating the use of various renewable energy technologies to help it meet at least two objectives: 1) compliance with a Department of Defense mandate to derive 25% of its energy requirements from renewable energy resources by 2025; and 2) preparation of Camp Rilea as an emergency recovery site and relief staging area in anticipation of a catastrophic natural event such as an earthquake or tsunami. The purposes of this demonstration project are to 1) evaluate the performance of the SurgeWEC™ in producing electricity to power a reverse osmosis plant and 2) assess the technology's ability to help meet OMD's renewable energy and emergency recovery objectives.

2 What is the proposed location?

The proposed project site is located within the *Camp Rilea Renewable Energy Facility Suitability Study Area* (REFFSA) established by the Oregon Land Conservation and Development Commission. Coordinates for the Camp Rilea REFFSA are: MinX= -124.031416; MinY= 46.090391; MaxX= -123.938429; MaxY= 46.13915. Coordinates for the project site will be provided in the permit applications. A map of the Project Area is provided in Figure 1, and Figure 2 shows the approximate location of the proposed project.

The offshore portion of the proposed project is located approximately 1,000 meters offshore in 7m (23ft) of mean water, and it comprises of an area of approximately 200 square meters (1/8 nm^2). Pending the results of a pre-installation seabed survey, the SurgeWECs will be positioned due west of the Slusher Lake Road turn-around. The onshore portion of the proposed project is located approximately 300 m from shore, at the Slusher Lake Rd. turnaround area. The onshore site is located behind the fore dune so it is protected, while minimizing the distance to the SurgeWECs.

According to FEMA's National Flood Hazard Layer, the proposed site for shoreside infrastructure does not lie within a 100 year floodplain. The area is categorized as Minimal Flood Hazard Risk, zone X (panel number 41007C0352E, effective 9/17/2010). Data from the General Bathymetric Chart of the Oceans (GEBCO) show that bathymetry within the proposed site is not complex – mostly sand. Shoreline topography in the area of interest is relatively flat and presents no major obstacles to SurgeWEC deployment and retrieval or to the placement of the two onshore containers.

The nearest Public Beach Access point is Sunset Beach State Park, which is located about a mile south of the proposed project site.

3 Please provide a general project description.

The proposed project involves deploying two SurgeWEC devices to demonstrate the Wave2E™ (electricity producing) and the Wave2O™ (fresh water producing) technologies at Camp Rilea. Wave energy captured by the Wave2E™ SurgeWEC will power the flow of working fluid through hydraulic lines connected to the onshore Wave2E™ unit, where the pressurized working fluid will drive a generator to produce electricity. The electricity will be used to power the reverse osmosis (RO) system in the onshore Wave2O™unit. Wave energy captured by the Wave2O™ SurgeWEC will power the flow of seawater into and out of the RO system in the onshore Wave2O™unit. Both onshore units will be housed in a standard 30 ft. shipping container. **No electricity will be generated at or transmitted by the SurgeWEC devices or any other in-water project structures.** Figure 3 shows a high level schematic of the overall system.

3.1 Wave2E™ System

The Wave2E™ consists of a SurgeWEC connected to two hydraulic lines running to a containerized onshore electric unit. It is a closed-loop system in which wave energy captured by the SurgeWEC is used to pressurize working fluid through a (high-pressure) hydraulic line to the onshore unit. At the onshore unit, the pressurized working fluid is used to drive a variable displacement motor (VDM) connected directly to a synchronous generator. From the onshore unit, the working fluid flows back to the SurgeWEC through a low-pressure hydraulic line, and the process is repeated.

The Wave2E™ will utilize about 2700 gallons of working fluid. The working fluid is a 70% Propylene Glycol (PG) in water solution that is water soluble (does not form a slick and disperses quickly), nontoxic to humans and aquatic life (often used as a food additive and for aircraft de-icing), and completely biodegrades in air, water, and soil aerobically and anaerobically with half-lives reported on the order of a few days or less. The MSDS for PG is provided in Appendix A. **No other working fluids or lubricants will be used in either SurgeWEC.** A high level schematic of the Wave2E™ system is shown in Figure 4.

3.2 Wave2O™ System

The Wave2O™ consists of a SurgeWEC, a seawater intake port, and a seawater discharge port, and four hydraulic lines connecting to the onshore RO unit. It is an open-loop system in which wave energy captured by the SurgeWEC is used to move seawater through a hydraulic line (high-pressure) to the

onshore unit. Energy from the pressurized seawater is used to pull seawater into the intake port and through the intake hydraulic line (atmos pressure) to the onshore unit. At the onshore unit, the seawater will pass through an RO system to create freshwater. Brine rejected from the RO membranes will be mixed with permeate, resulting in discharge water which is the same salinity and not more than 2°C warmer than the input water. The discharge water will be filtered to 5µm (the required filtration level for the system) and exit the onshore unit through the discharge hydraulic line (atmos pressure) to the discharge port in the ocean. The flow rate of the discharged seawater is equivalent to the flow through the RO system, which has a maximum flow rate of 185gpm; average flow rate is approximately 60% of this value. This means that, using the average flow rate value, the system will pick up and discharge approximately 160,000 gallons of seawater/day. A high level schematic of the RO plant is shown in Figure 5.

The onshore unit will consist of a Parker Sea Recovery Atlantic Sea 500 m^3/day RO system, with small modifications to suit the project-specific needs. The RO unit will not use or discharge any additives in normal use or during regular maintenance. The membranes will be back-flushed with fresh water as part of a regular maintenance routine to reduce the effects of scaling and fouling and lengthen the useful life of the membranes.

3.3 SurgeWECs

The two SurgeWEC devices will be deployed about 1000m offshore, in approximately 7 m (23ft) of water. Each SurgeWEC will be 8m (26ft) wide and cover up to 99% of the vertical water column under most conditions and may pierce the surface during certain low tides. The SurgeWECs will be constructed of welded steel plate, a large diameter welded steel tube, and a 1m diameter steel ballast cylinder will be placed concentric with the hinge axis, which will be filled with high-density concrete to counter the buoyant force from the large buoyancy chamber and reduce foundation and bearing loads. Cathodic protection will be used to prevent significant corrosion, guided by DNV-RP-B401 and a fatigue analysis will be completed following DNV-RP-C203. Two rotary pumps comprise the power take-off (PTO) system. The SurgeWEC design is shown in Figures 6 and 7.

3.4 Anchors

The proposed anchoring system consists of an embedded suction caisson, which is a cylindrical structure made steel and protected from corrosion with a cathodic protection system. It is open at the base and closed at the top; once installed, it is flush with the seafloor. The SurgeWEC foundation will be attached to the suction caisson, so no mooring lines are needed. A suction caisson is easy to install and remove, so it is well-suited to this temporary demonstration project. Results of a geotechnical survey will be used to confirm that the sea floor substrate is suitable for this anchoring system.

3.5 Hydraulic Lines & Strainer Assembly

A total of six hydraulic lines will run between the SurgeWECs and the shore-based containers (two for the Wave2E™ and four for the Wave2O™). All the hydraulic lines will be 3” Fiberspar LinePipe HDPE

pipe, which is commonly used - over 50 million feet has been installed since 1999. Key advantages include rapid and low-cost installation, improved corrosion resistance, long lengths without joints or connections (up to 27,000 ft, 8 km), improved flow characteristics, tolerance to impact damage, and light weight for improved safety during installation.

The Fiberspar lines will be bundled together for the majority of the run from the offshore site to the onshore units, a distance of approximately 300 m. Once they reach the beach transition zone, the subsea lines will be buried to such a depth as not to impact normal use of the beach. The lines will exit behind the dunes at the onshore containers.

The seawater intake line will include a strainer assembly comprised of a number of plastic strainers attached to a common pipe to prevent large objects and marine life from entering the line. The strainer assembly will also reduce flow velocity through the strainers to a level that is not harmful to marine organisms. The strainer assembly will be constructed of PVC and attached to the seabed on a small temporary weighted foundation near the SurgeWECs. The seawater discharge unit will only require a small strainer since seawater exit velocity is not an environmental concern given the flow direction.

3.6 Navigational Aids

Day and night visible aids to navigation in the form of moored lighted buoys will be employed to ensure the project doesn't present a hazard to vessels in the area. Four lighted navigational buoys will be used to mark off an area of 1/8 mile x 1/8 mile around the pair of SurgeWECs, along with a night visible beacon on each SurgeWEC. Additionally, the top portion of the devices will be painted yellow to aid in daytime visibility. These markers will be designed in accordance with and approved by the Thirteenth Coast Guard District.

3.7 Installation

The first step in the installation procedure is installation of the caisson anchors. After an initial penetration into the seabed caused by self-weight, suction (relative to seabed water pressure) is applied within the caisson, which forces the remainder of the caisson to embed itself, leaving the top f ush with the seabed. The SurgeWEC foundations are then placed onto the caisson anchors. The entire assembly is weighted to overcome the buoyancy of the SurgeWEC, resulting in a net downward force on the foundation. After the foundations are installed and inspected, the Fiberspar hydraulic lines to shore will be installed. The Fiberspar lines are flexible HDPE and may be installed directly from a spool by an amphibious craft. The offshore portions of the hydraulic lines will be sunken with weighted collars and buried from the beach transition zone to the onshore containers. Site-specific analysis will be conducted to determine the optimal method for burying the hydraulic lines under the beach and fore dune transition zone.

The SurgeWEC will be assembled on shore in the staging area. Any assembly of the SurgeWEC will be completed on shore, and a test fit of all components will be performed at this time. The SurgeWEC will then be rolled out from the staging area to the beach and pulled into the water with a deployment

vessel. Float bags will be attached to the SurgeWEC as necessary to adjust its buoyant properties and ensure efficient towing to the foundation site. Once the SurgeWEC has been positioned over the foundation, it will be lowered and attached to the foundation. A diver will inspect and assist with the deployment operation. Once the installation process is completed, the commissioning process will include flushing and pressure testing the hydraulic lines to ensure their integrity before being filled with working fluid, at which point the SurgeWEC will be deemed safe to begin operating.

3.8 Operations

The SurgeWECs will require periodic scheduled maintenance and monitoring. Inspection and maintenance windows will be scheduled in advance; however, in the interest of safety, operations will be dependent on sea conditions. Routine maintenance may involve a diver to inspect pump seals, hydraulic connections, corrosion, and local sediment transport around the devices. It is not anticipated that the SurgeWEC would need to be removed to perform routine maintenance, so no large vessels will be required. The SurgeWECs and hydraulic lines will incorporate sensors and communication equipment to measure and report system performance in real time, including detecting leaks and anticipating equipment failures. A failure mode effects analysis will be conducted and documented prior to project installation.

3.9 Removal/Decommissioning

The SurgeWECs and Fiberspar hydraulic lines will be removed following the reverse procedure of the installation. Once the SurgeWECs have been removed, the suction caissons will be removed by creating a positive pressure within the caisson. All equipment will be removed from the site at the end of the proposed one-year test period.

3.10 Emergency Response/Recovery

In any emergency situation, the appropriate federal, state and local authorities would be contacted before response operations are implemented to assess and minimize potential environmental impacts.

SurgeWEC Dislodged

In the case that there is a failure of the foundation or SurgeWEC attachment to the foundation, the device could become partially or fully dislodged from the foundation. In this case the SurgeWEC would most likely float upright and the attached lighted beacons would be visible to warn boaters of the hazard. The USCG and local authorities would be contacted immediately to assist in locating and recovering the device. Once the device has been located, it would be secured with a temporary anchor and marked until it can be safely floated to shore for recovery at the Camp Rilea staging area. Subcontractors would be employed as necessary to help with the operation.

Working Fluid Leak

If the SurgeWEC is dislodged the hydraulic lines to shore may be ruptured. Also, if a line connector, valve or other component fails, a leak could occur, which has the potential to release Propylene Glycol

(PG) into the environment. Leaks will be detected by measuring and comparing the average flow of working fluid to and from the SurgeWEC. If a difference is detected between the outgoing and return flow, a leak warning will be issued, which will include information about the severity of the leak. A small leak may be addressed by depressurizing the line and repairing the leak in place. In the case of a large leak or line rupture, the charge pump would immediately suck all fluids back into a storage tank (with a volume at least equal to the volume of the working fluid), significantly minimizing the amount of fluid that could enter the environment.

Loss of Buoyancy

If the SurgeWEC buoyancy chamber is ruptured, a loss of positive buoyancy could occur if the chamber fills with water. However, this is not likely to be a catastrophic event. The SurgeWEC may perform sub-optimally, or in a worst case, lay flat while still being attached to the foundation. In this case, a patch would be welded over the rupture by a diver and the flap would be restored to vertical by purging the trapped water with compressed air using sealable ports on the top and bottom of the buoyancy tube.

Navigation Light Failure

Aids to navigation will be regularly checked for proper operation and repaired or replaced immediately if a failure occurs. Since all aids to navigation will be redundant, there would not be a significant impact to visibility unless multiple aids to navigation fail simultaneously. The SurgeWEC itself is visible above the water surface in both daylight and nighttime conditions.

4 Please provide a general project footprint (narrative or map).

The offshore portion of the proposed project site comprises an area of approximately 200 square meters (1/8 nm^2). Two caisson anchors, two SurgeWECs, an intake port, a discharge port, and six hydraulic lines will be placed in the offshore site. The hydraulic lines will be buried and transit approximately 300m under the beach to two onshore containers located at the Slusher Lake Rd. turnaround area. The 30 ft. containers will be placed on temporary foundations (likely a gravel bed).

5 Please attach any conceptual drawings, maps or other supporting documents you have.

- Figure 1: Project Area (Camp Rilea REFFSA boundaries in blue; OMD facility boundaries in red).
- Figure 2: Approximate Location of Project
- Figure 3: Overall System
- Figure 4: High Level Schematic of the Wave2E™ System
- Figure 5: High Level Schematic of the Wave2O™ System
- Figure 6: SurgeWEC Concept Sketch
- Figure 7: SurgeWEC Geometry
- Figure 8: Wetlands in Project Area
- Table 1: Eco-toxicity for Propylene Glycol
- Appendix A: Propylene Glycol MSDS

6 Please describe the general idea or scope of potential impact.

Since the proposed project is small scale and temporary, it is anticipated that any potential effects would be minimal. The two hydraulic lines used in the Wave2E™ system will contain Propylene Glycol (PG) as a working fluid. PG has very low toxicity for humans and aquatic life. It is water soluble and disperses quickly without forming a slick. Additionally, it is 100% biodegradable in air, water, and soil. Table 1 shows the ecotoxicity of PG for a selection of aquatic life. No other working fluids or lubricants will be used in either SurgeWEC. The other four hydraulic lines will use seawater as a working fluid. The seawater intake line will include a strainer assembly comprised of a number of plastic strainers attached to a common pipe to prevent marine life from entering and reduce flow velocity through to an acceptable level that is not harmful to marine life.

The only project lighting is navigational; given the small spatial scale of the project, the navigational lighting is not expected to affect seabirds or other marine life. No electric power is produced or transmitted by/through the in-water project structures, so the project will not emit electromagnetic fields in the marine environment.

Sediment may accumulate around the anchors; however, it is not likely to occur on a significant level given the small spatial and temporal scale of the project. Analysis of local sediment transport patterns will be conducted to determine if appropriate protection methods against scouring or excess accumulation are needed.

Acoustic studies undertaken during ocean trials in North Carolina revealed a SurgeWEC™ sound signature that could not be detected over the sound generated by nearby breaking waves. Pre- and post-deployment acoustic surveys will be performed to determine potential effects on sound-sensitive species like marine mammals. It is anticipated that ambient acoustic levels at the project site are relatively high since it's located in the surf zone.

7 Please provide a proposed schedule or timing of proposed work.

The proposed project duration is one year, beginning in Q2 2015 and ending in Q2 2016.

8 Are there any Endangered Species Act-subject species present? If so, which ones?

Yes. Special status species *potentially* in the project area are listed below. We are coordinating with resource agencies to identify the particular protected species which occur in the project area.

Plants

- ≠ There are no plant species, either algae or vascular, known to be listed in the region at this time. Bull kelp (*Nereocystisluetkeana*) is listed as a strategy species in the Oregon Nearshore Strategy (ODFW 2006), but is not expected to occur in the soft bottom substrates offshore of Camp Rilea.

Animals

<u>Invertebrates</u>

- ≠ **Oregon silverspot butterfly**(*Speyeriazerenehippolyta*) is listed as threatened.
- ≠ All **krill** (euphausiid) harvest on the West Coast has been banned by the Pacific Fisheries Management Council (PMFC).

Fish

- ≠ **Green sturgeon** (*Acipensermedirostris*) is threatened.
- ≠ **Sockeye salmon** (*Oncorhynchusnerka*) Columbia River runs threatened or endangered.
- ≠ **Chinook salmon** (*Oncorhynchustshawytscha*) multiple Columbia River runs are threatened or endangered.
- ≠ **Coho salmon** (*Oncorhynchuskisutch*) lower Columbia run is threatened.
- ≠ **Chum salmon** (*Oncorhynchusketa*) Columbia River run is threatened.
- ≠ **Steelhead trout** (*Oncorhynchusmykiss*) some Columbia River runs are threatened.
- ≠ ***Eulachon*** *(Thaleichthyspacificus) southern DPS* is *threatened.*

Turtles

- ≠ **Leatherback turtle** (*Dermochelyscoriacea)* is *endangered.*

Avians (seabirds or shorebirds)

- ≠ **Short-tailed albatross** (*Phoebastriaalbatrus*) is endangered.
- ≠ **Marbled murrelet** (*Brachyramphusmarmoratus*) is threatened.
- ≠ **Western snowy plover** (*Charadriusalexandrinusnivosus*) is threatened.
- ≠ **California least tern** (*Sterna antillarumbrowni*) is endangered (Oregon listing).
- ≠ **Brown pelican** (*Pelecanusoccidentalis*) isendangered (Oregon listing).

Marine Mammals (note: marine mammals may additionally be declared "depleted" under the MMPA)

- ≠ **Northern sea otter** (*Enhydralutriskenyoni*) is threatened (incidental sightings in Oregon are rare).
- ≠ **Blue Whale** (*Balaenopteramusculus*) is endangered.
- ≠ **Fin Whale** (*Balaenopteraphysalus*) is endangered.
- ≠ **Humpback Whale** (*Megapteranovaeangliae*) is endangered.
- ≠ **Killer Whale** (*Orcinus orca*) southern resident population (SRKW) is endangered.
- ≠ **North Pacific Right Whale** (*Eubalaena japonica*) is endangered.
- ≠ **Sei Whale** (*Balaenoptera borealis*) is endangered.
- ≠ **Sperm Whale** (*Physetermacrocephalus*) is endangered.
- ≠ **Gray Whale** (*Eschrichtiusrobustus*) is depleted (under MMPA).

9 Are there any known tribal government resource concerns or issues?

No.

10 Are there any known cultural or historical resource concerns or issues?

No.

11 Have you done a wetland delineation determination? If so, what were the results?

No. Wetlands and water bodies in the area are shown in Figure 8.

12 Will more than 5000 cubic yards of material be removed from the site?

No material will be removed from the project site. The project involves temporary placement of less than 500 cubic yards of fill material. All fill material will be removed from the site upon project completion. (For the purposes of removal/fill authorization from the Corps, all structures placed within the water column and on the seabed and the beach are considered "fill" material; for the purposes of removal/fill authorization from DSL, all structures placed on the seabed and the beach are considered "fill" material.)

13 Are there issues or provisions related to water rights or use at your proposed location?

The proposed project is small scale and temporary, and the production of energy is a by-product of the testing process and is not transmitted for beneficial use off-site. Accordingly, we do not anticipate that the project is required to obtain a water right.

14 Are there fish passage barriers or changes to current passage expected?

No.

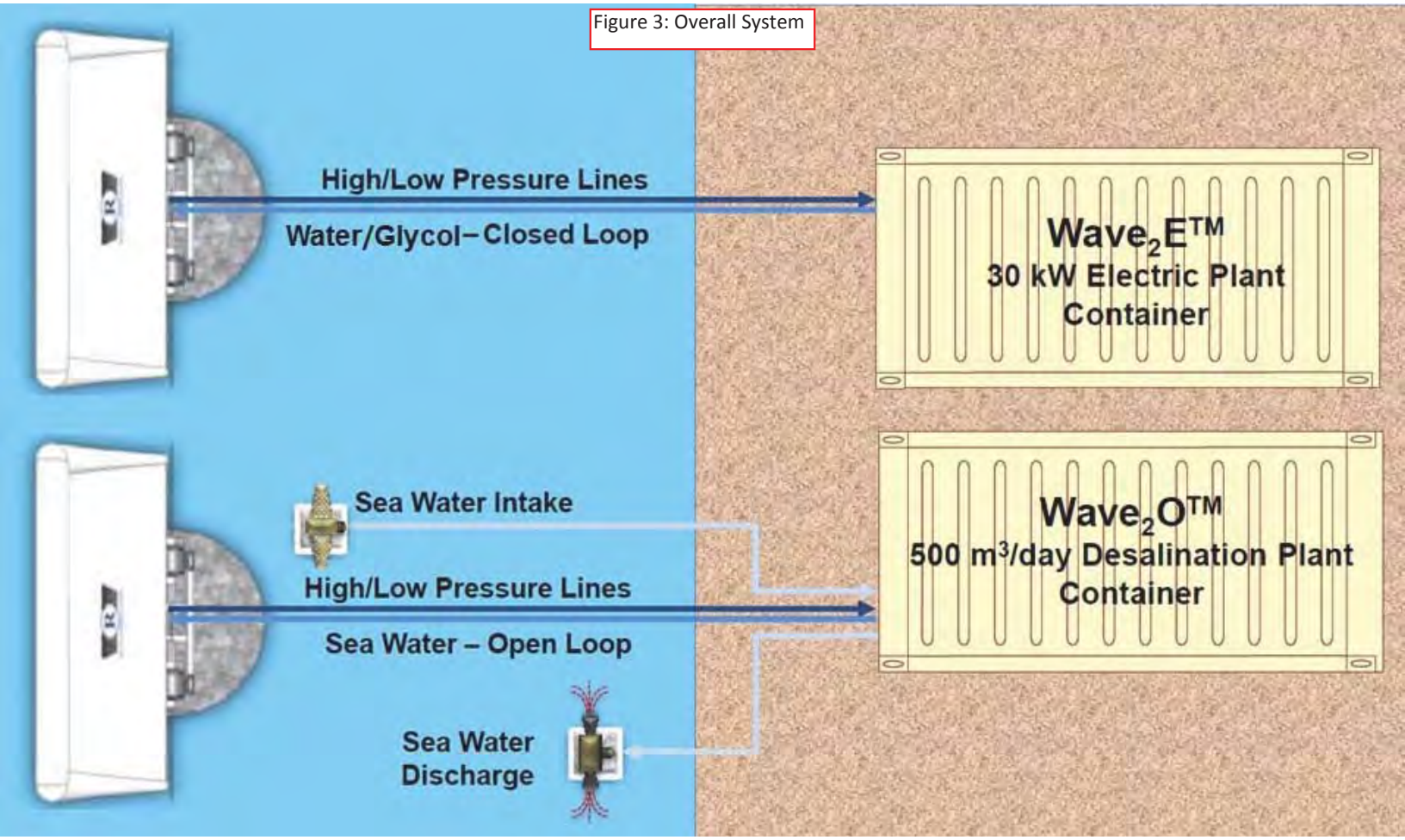
15 Do you have preliminary mitigation plans? If so, please provide the draft plans.

No. All equipment and foundations will be removed from the site upon project completion. We do not anticipate mitigation will be necessary, as project is temporary and will not result in the permanent loss of any lands or waters of the U.S. or the State of Oregon.

Figure 1: Project Area (Camp Rilea REFFSA boundaries in blue; OMD facility boundaries in red).

Figure 2: Approximate Project Location

Figure 3: Overall System



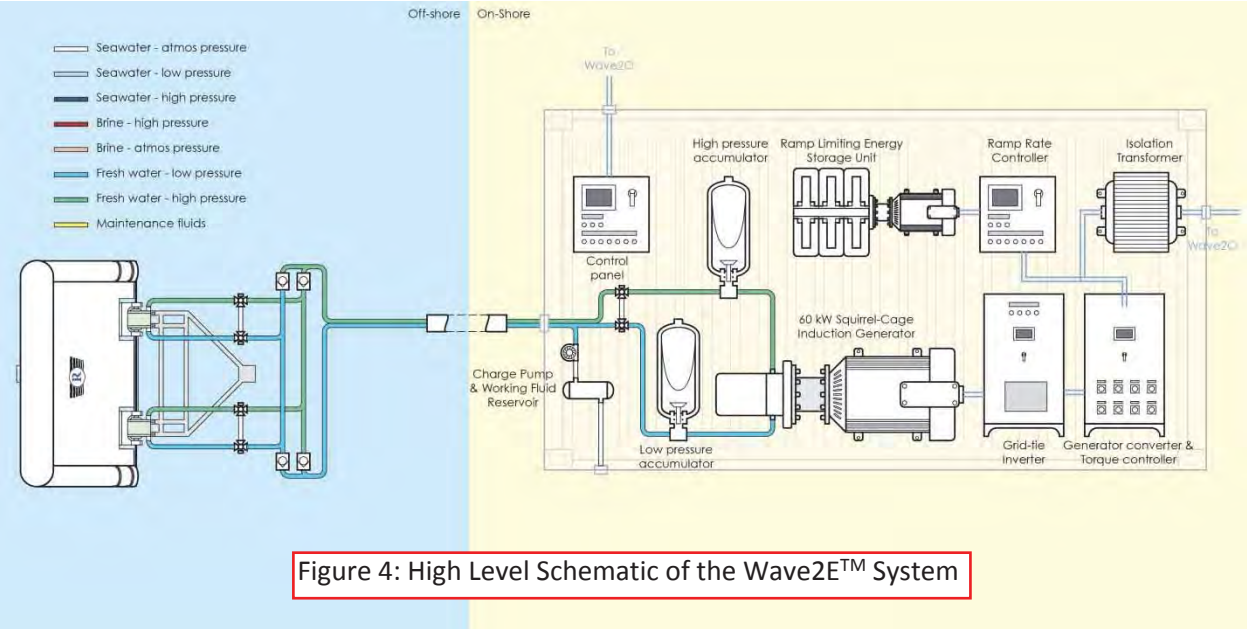


Figure 4: High Level Schematic of the Wave2E™ System

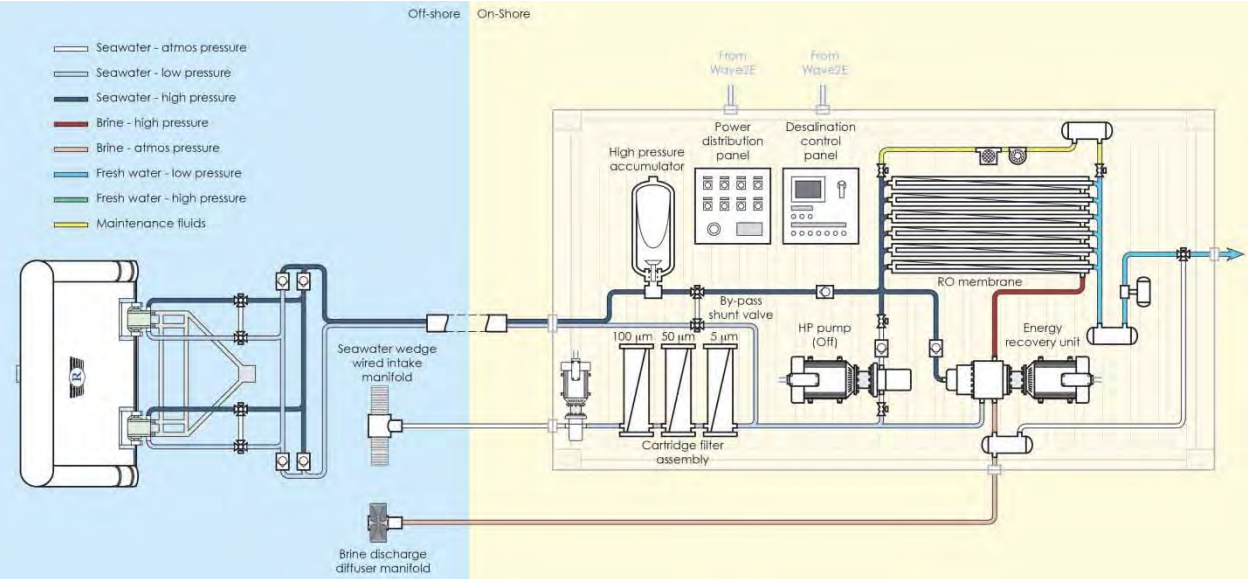
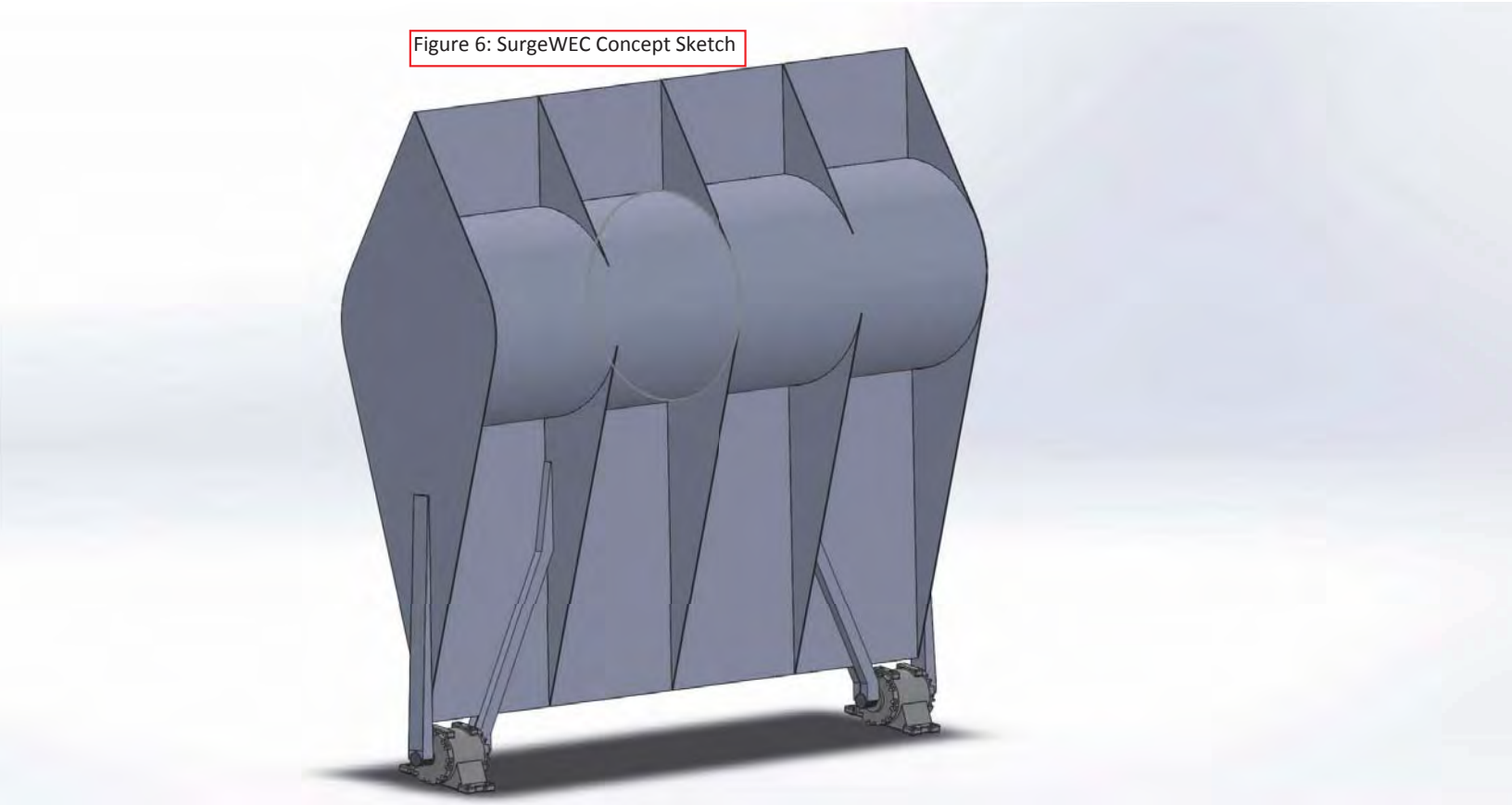


Figure 5: High Level Schematic of the Wave2O™ System

Figure 6: SurgeWEC Concept Sketch



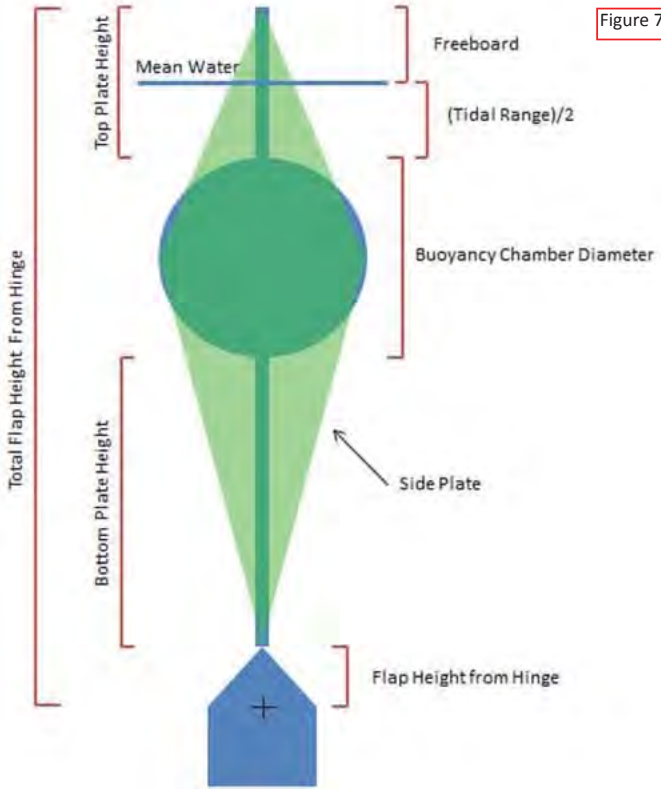


Figure 7: SurgeWEC Geometry

Parameter	Value	Unit
Freeboard	0.75	m
Average Tidal Range	1	m
Flap Height from Hinge	0.2	m
Total Flap Height from Hinge	6.95	m
Top Plate Height	1.25	m
Bottom Plate Height	3.1	m
Buoyancy Chamber Diameter	2.4	m
Flap Width	8	m

Figure 8: Wetlands in Project Area

Species	Percent Active Ingredient	Test Type	Toxicity	Reference
Mysid (*Mysidopsis bahia)*	99.9	96-hour static acute	LC50 = 11,000 ppm	MRID #40228401 (Mayer, 1986)
Sheepshead minnow (*Cyprinodon variegatus*)	99.9	96-hour static acute	LC50 = 48,000 ppm	MRID #40228401 (Mayer, 1986)
Bluegill sunfish (*Lepomis macrochirus*)	unknown	96 hour static acute	LC50 > 10,000 ppm	Verschuren, 1983
Menidia beryllina	unknown	96 hour static	LC50 > 10,000 ppm	Verschuren, 1983
Fathead minnow (*Pimephales promelas*)	unknown	96 hour flow-through	LC 50 59,900 - 77,400 ppm	Geiger et al., 1988

Material Safety Data Sheet
The Dow Chemical Company

Product Name: Propylene Glycol Industrial Grade

Issue Date: 08/01/2012
Print Date: 02 Aug 2012

The Dow Chemical Company encourages and expects you to read and understand the entire (M)SDS, as there is important information throughout the document. We expect you to follow the precautions identified in this document unless your use conditions would necessitate other appropriate methods or actions.

1. Product and Company Identification

Product Name
Propylene Glycol Industrial Grade

COMPANY IDENTIFICATION
The Dow Chemical Company
2030 Willard H. Dow Center
Midland, MI 48674
United States

Customer Information Number: 800-258-2436
SDSQuestion@dow.com

EMERGENCY TELEPHONE NUMBER

24-Hour Emergency Contact: 989-636-4400
Local Emergency Contact: 989-636-4400

2. Hazards Identification

Emergency Overview
Color: Colorless
Physical State: Liquid.
Odor: Odorless
Hazards of product:

Stay out of low areas.

OSHA Hazard Communication Standard
This product is not a "Hazardous Chemical" as defined by the OSHA Hazard Communication Standard, 29 CFR 1910.1200.

Potential Health Effects
Eye Contact: May cause slight temporary eye irritation. Corneal injury is unlikely. Mist may cause eye irritation.
Skin Contact: Prolonged contact is essentially nonirritating to skin. Repeated contact may cause flaking and softening of skin.
Skin Absorption: Prolonged skin contact is unlikely to result in absorption of harmful amounts.

®(TM)*Trademark

Inhalation: At room temperature, exposure to vapor is minimal due to low volatility. Mist may cause irritation of upper respiratory tract (nose and throat).
Ingestion: Very low toxicity if swallowed. Harmful effects not anticipated from swallowing small amounts.
Aspiration hazard: Based on physical properties, not likely to be an aspiration hazard.
Effects of Repeated Exposure: In rare cases, repeated excessive exposure to propylene glycol may cause central nervous system effects.

3. Composition Information

Component	CAS #	Amount
Propylene glycol	57-55-6	> 99.5 %

4. First-aid measures

Description of first aid measures

General advice: If potential for exposure exists refer to Section 8 for specific personal protective equipment.
Inhalation: Move person to fresh air; if effects occur, consult a physician.
Skin Contact: Wash skin with plenty of water.
Eye Contact: Flush eyes thoroughly with water for several minutes. Remove contact lenses after the initial 1-2 minutes and continue flushing for several additional minutes. If effects occur, consult a physician, preferably an ophthalmologist.
Ingestion: No emergency medical treatment necessary.

Most important symptoms and effects, both acute and delayed

Aside from the information found under Description of first aid measures (above) and Indication of immediate medical attention and special treatment needed (below), no additional symptoms and effects are anticipated.

Indication of immediate medical attention and special treatment needed

No specific antidote. Treatment of exposure should be directed at the control of symptoms and the clinical condition of the patient.

5. Fire Fighting Measures

Suitable extinguishing media

Water fog or fine spray. Dry chemical fire extinguishers. Carbon dioxide fire extinguishers. Foam. Alcohol resistant foams (ATC type) are preferred. General purpose synthetic foams (including AFFF) or protein foams may function, but will be less effective.
Extinguishing Media to Avoid: Do not use direct water stream. May spread fire.

Special hazards arising from the substance or mixture

Hazardous Combustion Products: During a fire, smoke may contain the original material in addition to combustion products of varying composition which may be toxic and/or irritating. Combustion products may include and are not limited to: Carbon monoxide. Carbon dioxide.
Unusual Fire and Explosion Hazards: Container may rupture from gas generation in a fire situation. Violent steam generation or eruption may occur upon application of direct water stream to hot liquids.

Advice for firefighters

Fire Fighting Procedures: Keep people away. Isolate fire and deny unnecessary entry. Use water spray to cool fire exposed containers and fire affected zone until fire is out and danger of reignition has passed. Fight fire from protected location or safe distance. Consider the use of unmanned hose holders or monitor nozzles. Immediately withdraw all personnel from the area in case of rising sound from venting safety device or discoloration of the container. Burning liquids may be extinguished by dilution with water. Do not use direct water stream. May spread fire. Move container from fire area if this is possible without hazard. Burning liquids may be moved by flushing with water to protect personnel and minimize property damage.
Special Protective Equipment for Firefighters: Wear positive-pressure self-contained breathing apparatus (SCBA) and protective fire fighting clothing (includes fire fighting helmet, coat, trousers, boots, and gloves). If protective equipment is not available or not used, fight fire from a protected location or safe distance.

6. Accidental Release Measures

Personal precautions, protective equipment and emergency procedures: Spilled material may cause a slipping hazard. Keep unnecessary and unprotected personnel from entering the area. Use appropriate safety equipment. For additional information, refer to Section 8, Exposure Controls and Personal Protection.

Environmental precautions: Prevent from entering into soil, ditches, sewers, waterways and/or groundwater. See Section 12, Ecological Information.

Methods and materials for containment and cleaning up: Contain spilled material if possible. Small spills: Any absorbent material. Collect in suitable and properly labeled open containers. Wash the spill site with large quantities of water. Large spills: Dike area to contain spill. Pump into suitable and properly labeled containers. See Section 13, Disposal Considerations, for additional information.

7. Handling and Storage

Handling
General Handling: Spills of these organic materials on hot fibrous insulations may lead to lowering of the autoignition temperatures possibly resulting in spontaneous combustion. See Section 8, EXPOSURE CONTROLS AND PERSONAL PROTECTION.
Other Precautions: Spills of these organic materials on hot fibrous insulations may lead to lowering of the autoignition temperatures possibly resulting in spontaneous combustion.

Storage
Store away from direct sunlight or ultraviolet light. Keep container tightly closed when not in use. Store in a dry place. Protect from atmospheric moisture. Store in the following material(s): Stainless steel. Aluminum. Plasite 3066 lined container. 316 stainless steel. Opaque HDPE plastic container.

Shelf life: Use within	Maximum storage temperature
12.0 Months	40 °C

8. Exposure Controls / Personal Protection

Exposure Limits

Component	List	Type	Value
Propylene glycol	WEEL	TWA Aerosol.	10 mg/m3

Personal Protection

Eye/Face Protection: Use safety glasses (with side shields). If there is a potential for exposure to particles which could cause eye discomfort, wear chemical goggles.

Skin Protection: No precautions other than clean body-covering clothing should be needed.

Hand protection: Chemical protective gloves should not be needed when handling this material. Consistent with general hygienic practice for any material, skin contact should be minimized.

Respiratory Protection: Respiratory protection should be worn when there is a potential to exceed the exposure limit requirements or guidelines. If there are no applicable exposure limit requirements or guidelines, wear respiratory protection when adverse effects, such as respiratory irritation or discomfort have been experienced, or where indicated by your risk assessment process. In misty atmospheres, use an approved particulate respirator. The following should be effective types of air-purifying respirators: Organic vapor cartridge with a particulate pre-filter.

Ingestion: Use good personal hygiene. Do not consume or store food in the work area. Wash hands before smoking or eating.

Engineering Controls

Ventilation: Use local exhaust ventilation, or other engineering controls to maintain airborne levels below exposure limit requirements or guidelines. If there are no applicable exposure limit requirements or guidelines, general ventilation should be sufficient for most operations. Local exhaust ventilation may be necessary for some operations.

9. Physical and Chemical Properties

Appearance	
Physical State	Liquid.
Color	Colorless
Odor	Odorless
Odor Threshold	No test data available
pH	Not applicable
Melting Point	< -20 °C (< -4 °F) *EU Method A.1 (Melting / Freezing Temperature)*
Freezing Point	< -20 °C (< -4 °F) *EC Method A1*
Boiling Point (760 mmHg)	184 °C (363 °F) *Literature* .
Flash Point - Closed Cup	104 °C (219 °F) *EC Method A9 (CC)* (PMCC)
Flash Point - Open Cup	No test data available
Evaporation Rate (Butyl Acetate = 1)	0.01 *Estimated.*
Flammability (solid, gas)	Not applicable to liquids
Flammable Limits In Air	**Lower**: 2.6 %(V) *Estimated.* **Upper**: 12.5 %(V) *Estimated.*
Vapor Pressure	20 Pa @ 25 °C *EC Method A4*
Vapor Density (air = 1)	2.62 *Literature*
Specific Gravity (H2O = 1)	1.03 20 °C/20 °C *EU Method A.3 (Relative Density)*
Solubility in water (by weight)	100 % @ 20 °C *EU Method A.6 (Water Solubility)*
Partition coefficient, n-octanol/water (log Pow)	-1.07 *Measured*
Autoignition Temperature	100.01 kPa > 400 °C (> 752 °F) *EC Method A15*
Decomposition Temperature	No test data available
Dynamic Viscosity	43.4 mPa.s @ 25 °C *Literature*
Kinematic Viscosity	No test data available
Explosive properties	Not explosive
Oxidizing properties	No
Liquid Density	1.03 g/cm3 @ 20 °C *Literature*
Solubility in Solvents	No test data available
Pour point	< -57 °C (< -71 °F) *Literature*
Henry's Law Constant (H)	1.2E-08 atm*m3/mole Measured

10. Stability and Reactivity

Reactivity
No dangerous reaction known under conditions of normal use.

Chemical stability
Stable under recommended storage conditions. See Storage, Section 7. Hygroscopic.

Possibility of hazardous reactions
Polymerization will not occur.

Conditions to Avoid: Exposure to elevated temperatures can cause product to decompose. Generation of gas during decomposition can cause pressure in closed systems. Avoid direct sunlight or ultraviolet sources.

Incompatible Materials: Avoid contact with: Strong acids. Strong bases. Strong oxidizers.

Hazardous decomposition products
Decomposition products depend upon temperature, air supply and the presence of other materials. Decomposition products can include and are not limited to: Aldehydes. Alcohols. Ethers. Organic acids.

11. Toxicological Information

Acute Toxicity
Ingestion
LD50, rat > 20,000 mg/kg
Dermal
LD50, rabbit > 2,000 mg/kg
Inhalation
No deaths occurred at this concentration. LC50, 2 h, Aerosol, rabbit 317.042 mg/l
Eye damage/eye irritation
May cause slight temporary eye irritation. Corneal injury is unlikely. Mist may cause eye irritation.
Skin corrosion/irritation
Prolonged contact is essentially nonirritating to skin. Repeated contact may cause flaking and softening of skin.
Sensitization
Skin
Did not cause allergic skin reactions when tested in humans.
Respiratory
No relevant data found.
Repeated Dose Toxicity
In rare cases, repeated excessive exposure to propylene glycol may cause central nervous system effects.
Chronic Toxicity and Carcinogenicity
Did not cause cancer in laboratory animals.
Developmental Toxicity
Did not cause birth defects or any other fetal effects in laboratory animals.
Reproductive Toxicity
In animal studies, did not interfere with reproduction. In animal studies, did not interfere with fertility.
Genetic Toxicology
In vitro genetic toxicity studies were negative. Animal genetic toxicity studies were negative.

12. Ecological Information

Toxicity

Material is practically non-toxic to aquatic organisms on an acute basis (LC50/EC50/EL50/LL50 >100 mg/L in the most sensitive species tested).

Fish Acute & Prolonged Toxicity
LC50, Oncorhynchus mykiss (rainbow trout), static test, 96 h: 40,613 mg/l
Aquatic Invertebrate Acute Toxicity
LC50, Ceriodaphnia Dubia (water flea), static test, 48 h: 18,340 mg/l
Aquatic Plant Toxicity
ErC50, Pseudokirchneriella subcapitata (green algae), Growth rate inhibition, 96 h: 19,000 mg/l
Toxicity to Micro-organisms
NOEC, no data available; Pseudomonas putida, 18 h: > 20,000 mg/l
Aquatic Invertebrates Chronic Toxicity Value
Ceriodaphnia Dubia (water flea), semi-static test, 7 d, number of offspring, NOEC: 13020 mg/l

Persistence and Degradability

Material is readily biodegradable. Passes OECD test(s) for ready biodegradability. Biodegradation may occur under anaerobic conditions (in the absence of oxygen).
OECD Biodegradation Tests:

Biodegradation	Exposure Time	Method	10 Day Window
81 %	28 d	OECD 301F Test	pass
96 %	64 d	OECD 306 Test	Not applicable

Indirect Photodegradation with OH Radicals

Rate Constant	Atmospheric Half-life	Method
1.28E-11 cm3/s	10 h	Estimated.

Biological oxygen demand (BOD):

BOD 5	BOD 10	BOD 20	BOD 28
69.000 %	70.000 %	86.000 %	

Chemical Oxygen Demand: 1.53 mg/mg
Theoretical Oxygen Demand: 1.68 mg/mg

Bioaccumulative potential
Bioaccumulation: Bioconcentration potential is low (BCF < 100 or Log Pow < 3).
Partition coefficient, n-octanol/water (log Pow): -1.07 Measured
Bioconcentration Factor (BCF): 0.09; Estimated.

Mobility in soil
Mobility in soil: Given its very low Henry's constant, volatilization from natural bodies of water or moist soil is not expected to be an important fate process., Potential for mobility in soil is very high (Koc between 0 and 50).
Partition coefficient, soil organic carbon/water (Koc): < 1 Estimated.
Henry's Law Constant (H): 1.2E-08 atm*m3/mole Measured

13. Disposal Considerations

DO NOT DUMP INTO ANY SEWERS, ON THE GROUND, OR INTO ANY BODY OF WATER. All disposal practices must be in compliance with all Federal, State/Provincial and local laws and regulations. Regulations may vary in different locations. Waste characterizations and compliance with applicable laws are the responsibility solely of the waste generator. AS YOUR SUPPLIER, WE HAVE NO CONTROL OVER THE MANAGEMENT PRACTICES OR MANUFACTURING PROCESSES OF PARTIES HANDLING OR USING THIS MATERIAL. THE INFORMATION PRESENTED HERE

PERTAINS ONLY TO THE PRODUCT AS SHIPPED IN ITS INTENDED CONDITION AS DESCRIBED IN MSDS SECTION: Composition Information. FOR UNUSED & UNCONTAMINATED PRODUCT, the preferred options include sending to a licensed, permitted: Recycler. Reclaimer. Incinerator or other thermal destruction device. As a service to its customers, Dow can provide names of information resources to help identify waste management companies and other facilities which recycle, reprocess or manage chemicals or plastics, and that manage used drums. Telephone Dow's Customer Information Group at 1-800-258-2436 or 1-989-832-1556 (U.S.), or 1-800-331-6451 (Canada) for further details.

14. Transport Information

DOT Non-Bulk
NOT REGULATED

DOT Bulk
NOT REGULATED

IMDG
NOT REGULATED

ICAO/IATA
NOT REGULATED

This information is not intended to convey all specific regulatory or operational requirements/information relating to this product. Additional transportation system information can be obtained through an authorized sales or customer service representative. It is the responsibility of the transporting organization to follow all applicable laws, regulations and rules relating to the transportation of the material.

15. Regulatory Information

OSHA Hazard Communication Standard
This product is not a "Hazardous Chemical" as defined by the OSHA Hazard Communication Standard, 29 CFR 1910.1200.

Superfund Amendments and Reauthorization Act of 1986 Title III (Emergency Planning and Community Right-to-Know Act of 1986) Sections 311 and 312

Immediate (Acute) Health Hazard	No
Delayed (Chronic) Health Hazard	No
Fire Hazard	No
Reactive Hazard	No
Sudden Release of Pressure Hazard	No

Superfund Amendments and Reauthorization Act of 1986 Title III (Emergency Planning and Community Right-to-Know Act of 1986) Section 313
To the best of our knowledge, this product does not contain chemicals at levels which require reporting under this statute.

Pennsylvania (Worker and Community Right-To-Know Act): Pennsylvania Hazardous Substances List and/or Pennsylvania Environmental Hazardous Substance List:
The following product components are cited in the Pennsylvania Hazardous Substance List and/or the Pennsylvania Environmental Substance List, and are present at levels which require reporting.

Component	CAS #	Amount
Propylene glycol	57-55-6	>= 99.5 %

Pennsylvania (Worker and Community Right-To-Know Act): Pennsylvania Special Hazardous Substances List:

To the best of our knowledge, this product does not contain chemicals at levels which require reporting under this statute.

Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) Section 103
To the best of our knowledge, this product does not contain chemicals at levels which require reporting under this statute.

US. EPA Emergency Planning and Community Right-To-Know Act (EPCRA) SARA Title III Section 302 Extremely Hazardous Substance (40 CFR 355, Appendix A)
To the best of our knowledge, this product does not contain chemicals at levels which require reporting under this statute.

California Proposition 65 (Safe Drinking Water and Toxic Enforcement Act of 1986)
This product contains no listed substances known to the State of California to cause cancer, birth defects or other reproductive harm, at levels which would require a warning under the statute.

US. Toxic Substances Control Act
All components of this product are on the TSCA Inventory or are exempt from TSCA Inventory requirements under 40 CFR 720.30
CEPA - Domestic Substances List (DSL)
All substances contained in this product are listed on the Canadian Domestic Substances List (DSL) or are not required to be listed.
European Inventory of Existing Commercial Chemical Substances (EINECS)
The components of this product are on the EINECS inventory or are exempt from inventory requirements.

16. Other Information

Product Literature
Additional information on this and other products may be obtained by visiting our web page.

Hazard Rating System

NFPA	Health	Fire	Reactivity
	0	1	0

Recommended Uses and Restrictions
Identified uses
Manufacture of substance, industrial. Distribution of substance, industrial. Formulation & (re)packing of substances and mixtures, industrial. Uses in Coatings, industrial. Use in Cleaning Agents, industrial. Use as binders and release agents: Industrial (SU3) Functional Fluids, industrial. Use in laboratories, industrial. Polymer production: Industrial (SU10) Rubber production and processing, industrial. Water treatment chemicals For industrial use. Mining Chemicals For industrial use. Use in laboratories, professional. Use as binders and release agents, professional. Professional use in cleaning agents. Water treatment chemicals professional use Uses in Coatings, professional. Functional Fluids, professional. De-icing and anti-icing applications, professional. Professional use in agrochemicals. Uses in Coatings, consumer. Use in Cleaning Agents, consumer. Functional Fluids, consumer. Other Consumer Uses Consumer use in agrochemicals. De-icing and anti-icing applications, consumer.

Revision
Identification Number: 40808 / 1001 / Issue Date 08/01/2012 / Version: 5.0
Most recent revision(s) are noted by the bold, double bars in left-hand margin throughout this document.

Legend

N/A	Not available
W/W	Weight/Weight
OEL	Occupational Exposure Limit
STEL	Short Term Exposure Limit
TWA	Time Weighted Average
ACGIH	American Conference of Governmental Industrial Hygienists, Inc.
DOW IHG	Dow Industrial Hygiene Guideline
WEEL	Workplace Environmental Exposure Level
HAZ_DES	Hazard Designation
Action Level	A value set by OSHA that is lower than the PEL which will trigger the need for activities such as exposure monitoring and medical surveillance if exceeded.

The Dow Chemical Company urges each customer or recipient of this (M)SDS to study it carefully and consult appropriate expertise, as necessary or appropriate, to become aware of and understand the data contained in this (M)SDS and any hazards associated with the product. The information herein is provided in good faith and believed to be accurate as of the effective date shown above. However, no warranty, express or implied, is given. Regulatory requirements are subject to change and may differ between various locations. It is the buyer's/user's responsibility to ensure that his activities comply with all federal, state, provincial or local laws. The information presented here pertains only to the product as shipped. Since conditions for use of the product are not under the control of the manufacturer, it is the buyer's/user's duty to determine the conditions necessary for the safe use of this product. Due to the proliferation of sources for information such as manufacturer-specific (M)SDSs, we are not and cannot be responsible for (M)SDSs obtained from any source other than ourselves. If you have obtained an (M)SDS from another source or if you are not sure that the (M)SDS you have is current, please contact us for the most current version.

Attachment 309-1-3

New Cross Pacific (NCP) Cable System

September 14, 2015

NCP Project Overview Presentation

DANIEL M. MARQUIS - Sr. Mgr. Permitting and Regulatory Affairs

TE connectivity

SUBCOM

Presentation Overview

- **Who is NCP?**
- **Who is TE SubCom?**
- **Subsea Fiber-Optic Telecommunications System Overview**
- **Marine Process Overview from Concept to System Operation**
  - Desktop Study (DTS)
  - Marine Route Survey
  - Cable Engineering
  - Marine Installation and Shore End Construction
    - Beach Construction Operations
    - Route Clearance (RC)
    - Pre-lay Grapnel Operations (PLGR)
    - Main Lay & Plowing Operations
    - Post Lay Inspection and Burial Operations (PLIB)
- **NCP System Overview for Oregon**
  - Marine
  - Terrestrial
- **NCP Provisional Schedule**

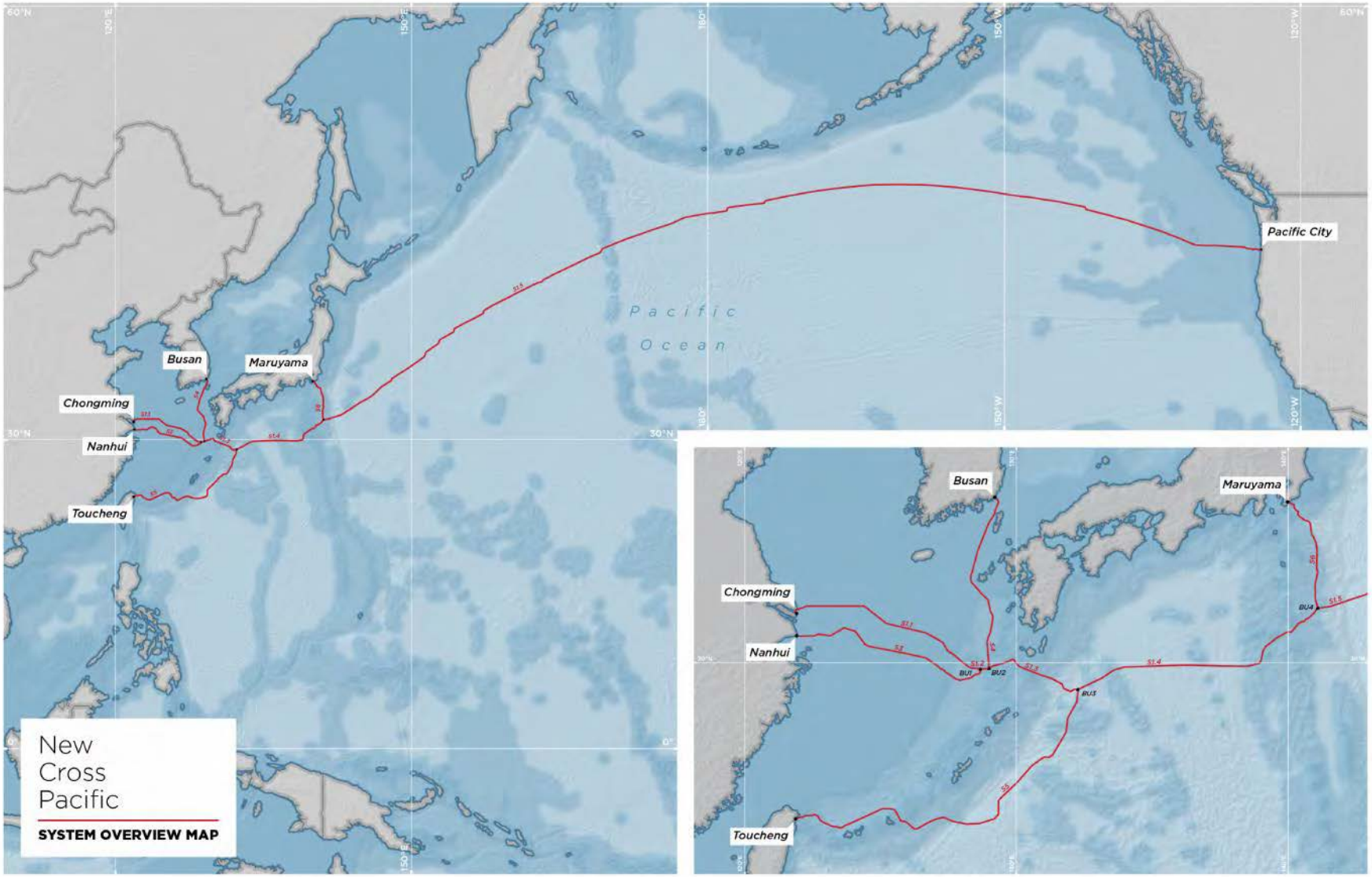
NCP System Overview

- Project **Proponent**

NCP Consortium	Cable Landing Location
o Microsoft	Pacific City, Oregon (USA)
o SoftBank Mobile Corp.	Maruyama, Japan
o China Telecom	Chongming, China
o China Unicom	Nanhui, China
o China Mobile	Lingang, China
o Chunghwa Telecom	Toucheng, Taiwan
o KT Corporation	Busan, South Korea

- **Project Purpose**
  - Trans-Pacific Undersea Fiber-Optic Network Servicing Escalating Bandwidth Demands in the Emerging Asia-Pacific Region
- **Project Design**
  - ~13,000 km (~8,100 miles) in length with up to 7 fiber-optic cable pairs.
  - 100G repeatered cable system delivering up to 80 Terabits per second (Tbps) of capacity.
    - 80 Terabits = 10 Terabytes
    - 1 Terabyte = 1,000 copies of the Encyclopedia Britannica.
    - 10 Terabytes = the printed collection of the Library of Congress.

NCP System Overview



Tyco Electronics Subsea Communications LLC (*TE SubCom*)

- Leading global supplier of undersea fiber optic telecommunication systems with greater than five decades of experience

- Fully integrated system supplier: design, engineer, manufacture, install, maintain, and upgrade undersea telecom networks

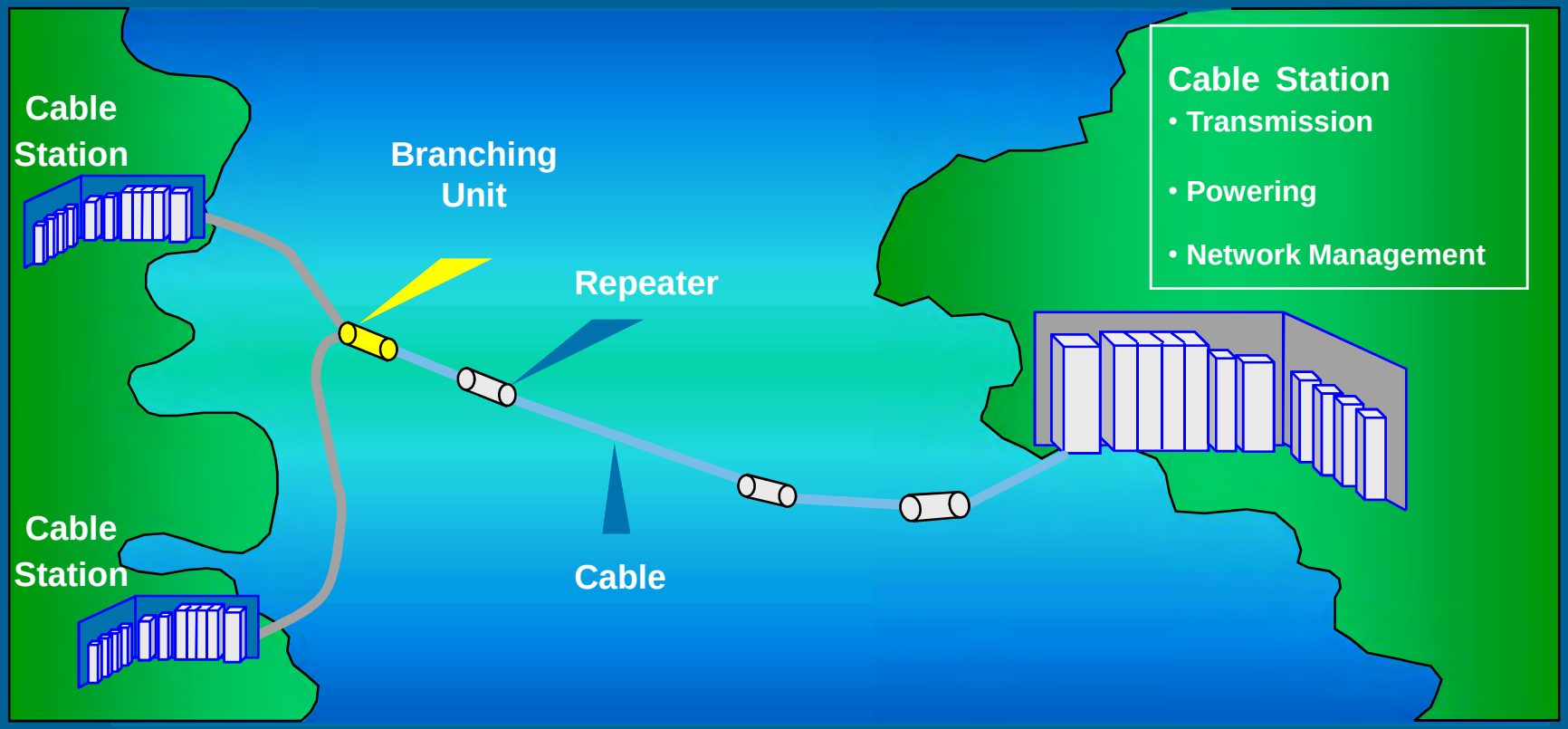
- Greater than **490,000 kilometers** of cable in 100+ undersea systems
  - >12x the earth's equatorial circumference
  - backbone of the international communications network (voice and internet)

- Parent Company **TE Connectivity Limited**
  - $12.1 billion company
  - 100,000 employees worldwide
  - designs and manufactures over 500,000 products in consumer electronics, energy and healthcare, automotive, aerospace, and communication networks
  - Business Operating Segments
    - o Transportation Solutions
    - o Communications and Industrial Solutions
    - o Network Solutions → ***TE SubCom***

- TE SubCom's NCP SubContractors
  - 48 north solutions, Inc. of Seattle, Washington (Regulatory Compliance)
  - EGS (Asia) Limited of Hong Kong (Cable Route Survey)

TE connectivity SUBCOM

Key Elements of a Subsea Fiber-Optic Telecom Network



Cable Station

- **Transmission Equipment**
  - Digitized data and voice signals are converted to coded light pulses that are then transmitted through the fiber optic cable
  - send and receive multiple high-quality, high-bandwidth signals over ultra-long distances

- **Power Feed Equipment (PFE)**
  - Powers laser pumps in undersea repeaters
  - Up to 12,500 volts at currents up to 1.6 amperes
  - A single cable station is capable of powering a trans-Pacific cable
  - Supports Electroding (toning) and other tests for cable fault localization

- **Element & Network Management System (TEMS)**
  - control panel for the cable system
  - user's main interface for all of the undersea and dry equipment

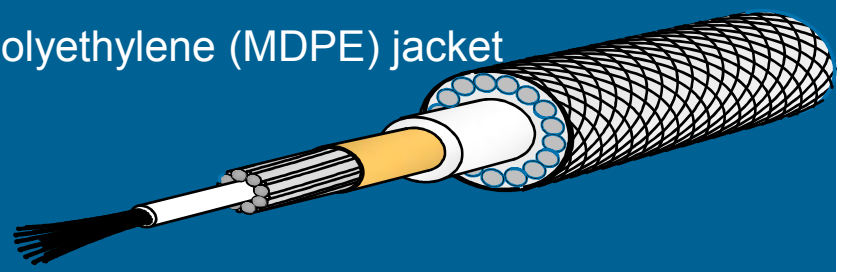
Cable

SL Lightweight (LW) Cable...

Serves as the core for all other (armored) cables types

Key Components

1. Hair-like glass optical-fibers
2. Ultra-high strength steel wires
3. Copper power conductor
4. Protective medium-density polyethylene (MDPE) jacket

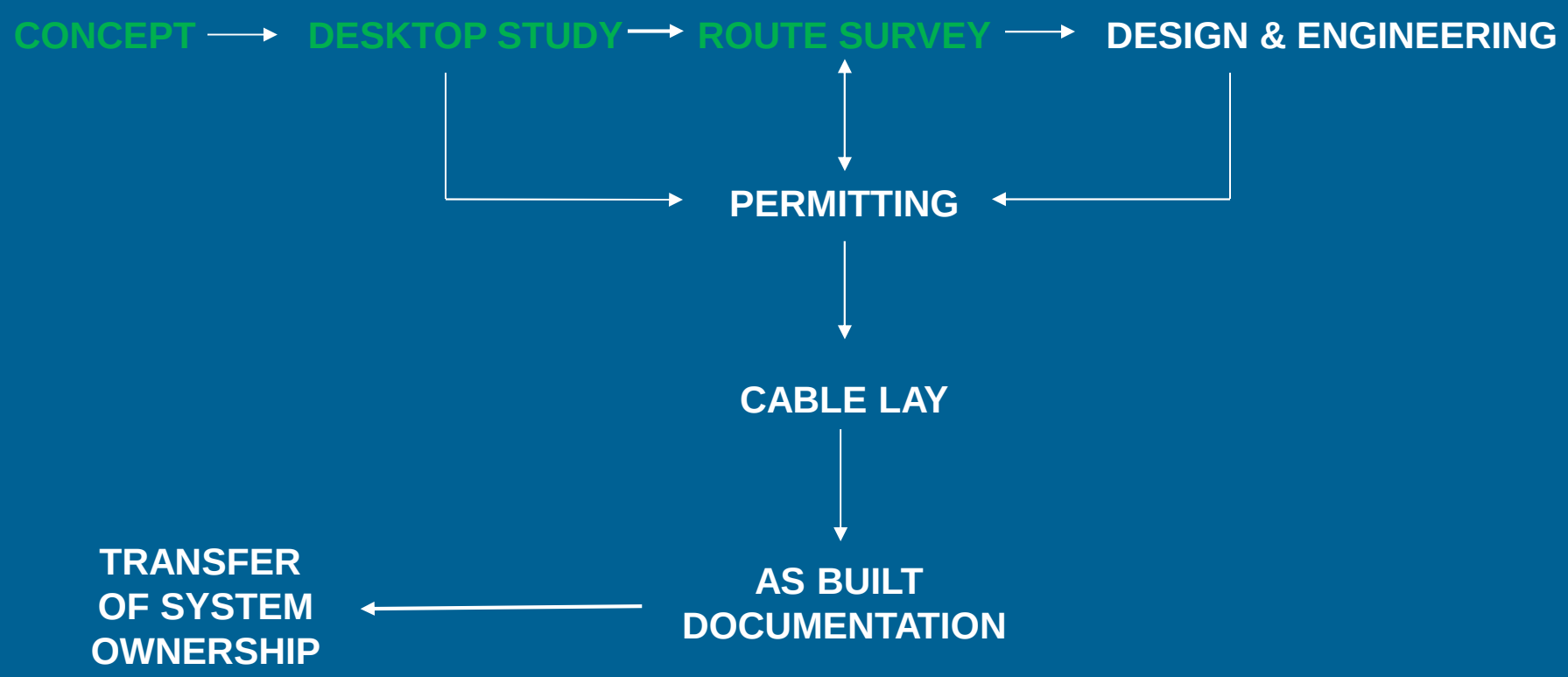


- Contain & protect optical fibers and electrical conductor for 25 years
- Durable, yet flexible, enough to support system deployment, recovery, repair, and re-deployment
- Are non-threatening to the undersea environment (MDPE and asphalt is inert and non-toxic). No anti-fouling agents are used.
- Survive a variety of stresses: Temperature, tension, torsion, pressure, chemical exposure, bending/flexing

Repeaters (Optical Amplifiers)

- Amplify (boost) the optical signal at regular intervals so that signal can be transmitted over long distances
- Distance of optical (light) signal transmission is limited because of signal loss
- Spacing ranges from 61 km to as much as 120 km depending on system optical requirements
- Powered by terrestrial cable stations via direct current (DC) carried by the copper conductor within the subsea fiber-optic cable
- Dimensions
  - Length: 4.98 m including bend-limiting boots
  - Diameter: 33 cm (13 in) max.

Marine Process Overview



Desktop Study (DTS)

- Geography
- Geology
- Oceanography
- Meteorology
- Biology
- Environmental Sensitivities
- Offshore Mineral, Oil & Gas Activities
- Shipping and Anchoring
- **Fishing Activities**
- Wrecks & Hazards
- Restricted Areas
- Military Activities
- Maritime Claims
- Permitting Requirements
- Regional Cable Systems
- **Cable Fault Histories**
- Local Resources
- Recreational Activities
- Landing Sites (Site Visits)

Final DTS will summarize the information collected, make recommendations with respect to identified hazards, provide a viable route for survey operations, propose cable type selections, and present charts depicting the proposed cable route.

Cable Route Survey

Description	Water Depth	Survey Corridor Width	Side Scan Sonar (SSS)	Multi-Beam Echo Sounder (MBES)	Sub-Bottom Profiler	Cone Penetrating Test (CPTs) & Gravity Cores (alternate every 5 km)	Magnetometer
Landing site survey	BMH to MLWM	250 m					
Diver swim survey	MLWM - 3 m	250 m					
Inshore (smallboat)	3-15 m	250 m	X	X	X	Every 10 km	At cable crossings
Shallow (nearshore survey)	15-500 m	250 m	X	X	X	Every 10 km	At cable crossings
Shallow (nearshore survey)	500-1,000 m	500 m	X	X	X	Every 10 km	At cable crossings
Deep water survey	1,000-1,500 m	1000 m	X	X	X	Every 10 km	At cable crossings
Deep water survey	>1,500 m	2.5 x water depth or max. of 10 km swath (lesser of two)		X			

- Survey underway and ongoing (August 7 thru October 2015)
  - >15 m water depth to EEZ already completed by EGS' R/V Geo Explorer
  - <15 m water depth and landing site survey planned for Sept./Oct.
- **Oregon Fishermen's Cable Committee (OFCC) consulted during route planning/survey**
  - **Avoidance of rockfish and Ling Cod fishing area in ~50 m water depth. Created 100 m route buffer to address Dorymen's concern.**
  - **Avoidance of pockmarks in water depths ranging from 150 m to 950 m to address concern/potential for cable suspension**
- OFCC approval of the surveyed route provided on August 29th.

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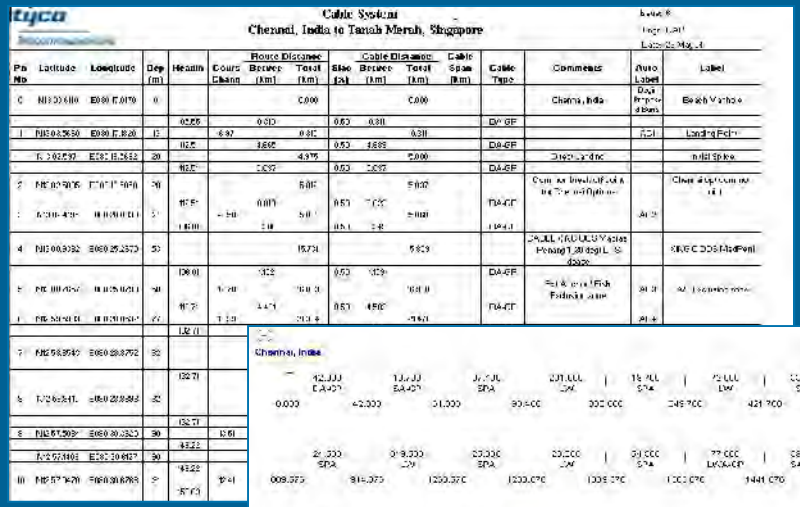
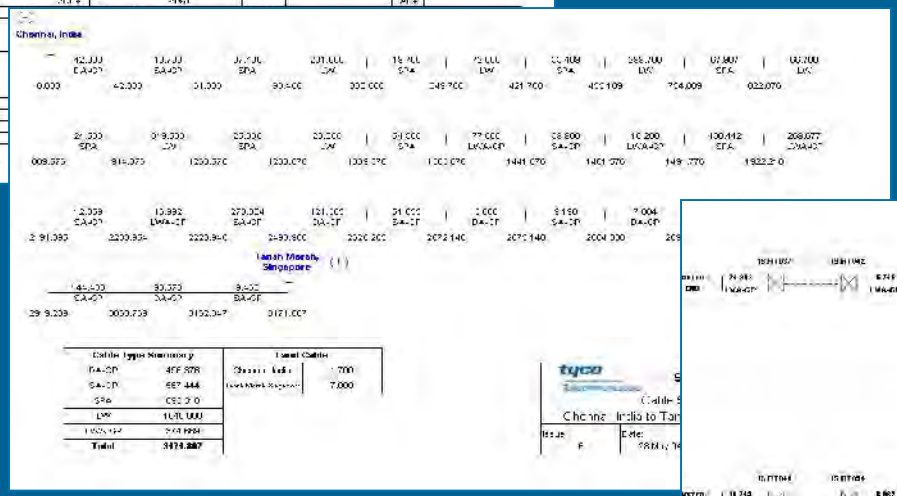
Cable Engineering - Engineering Documentation

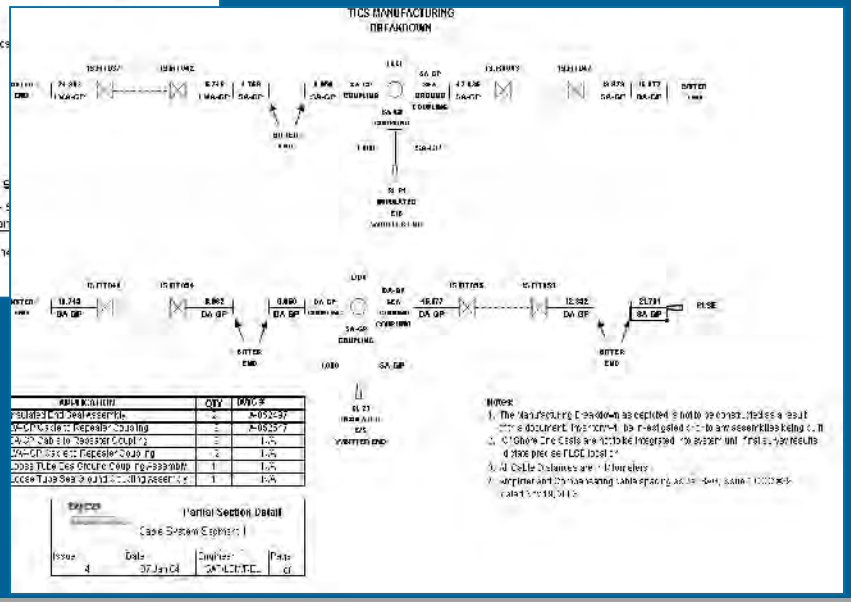


ROUTE POSITION LIST (RPL)

MANUFACTURING DOCUMENTATION / PARTIAL SECTION DETAIL (PSD)



STRAIGHT LINE DIAGRAM (SLD)



Marine Installation Overview

- Beach Construction Operations (BMH, HDD)
- Route Clearance (RC) of Out of Service (OOS) Cables
- Pre-Lay Grapnel Run (PLGR) Operations
- Direct Landing Operations
- Main Lay and Sea Plow Operations
- Post Lay Inspection and Burial (PLIB) Operations via Remotely Operated Vehicle (ROV)

Shore End Installation - Beach Construction Operations

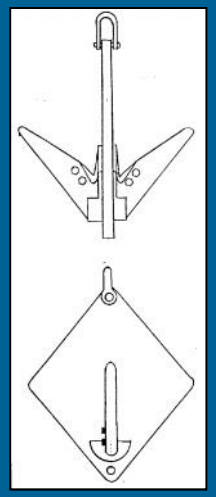
Excavation showing existing Pacific City BMH and OOI cable installations with articulated split-pipe protection between BMH and HDD.

Marine Installation
Route Clearance (RC) & Pre-Lay Grapnel Run Operations (PLGR)

- **Overview**:
  - Prior to sea plow burial operations, Route Clearance and Pre-lay Grapnel Run activities are undertaken to clear the cable route of an obstacles that may impede burial
  - The vessel conducting these ops will utilize DGPS

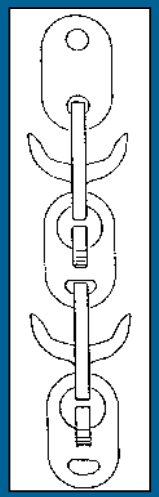
- **Route Clearance (RC)**
  - Conducted prior to sea plow burial operations using a grapnel
  - Goal is to establish a safe corridor 2X WD or 500m at Out-Of-Service (OOS) cable Xings to maximize burial
  - Cut and Remove OOS cables
  - OOS cable recovered and cable ends anchored (if possible)

- **Pre-Lay Grapnel Run (PLGR)**
  - Conducted prior to sea plow burial operations using a grapnel
  - Grapnel towed/dragged along entire length of route centerline in an attempt to clear the sea bed of debris, (e.g.,. wires or hawsers, derelict fishing gear)



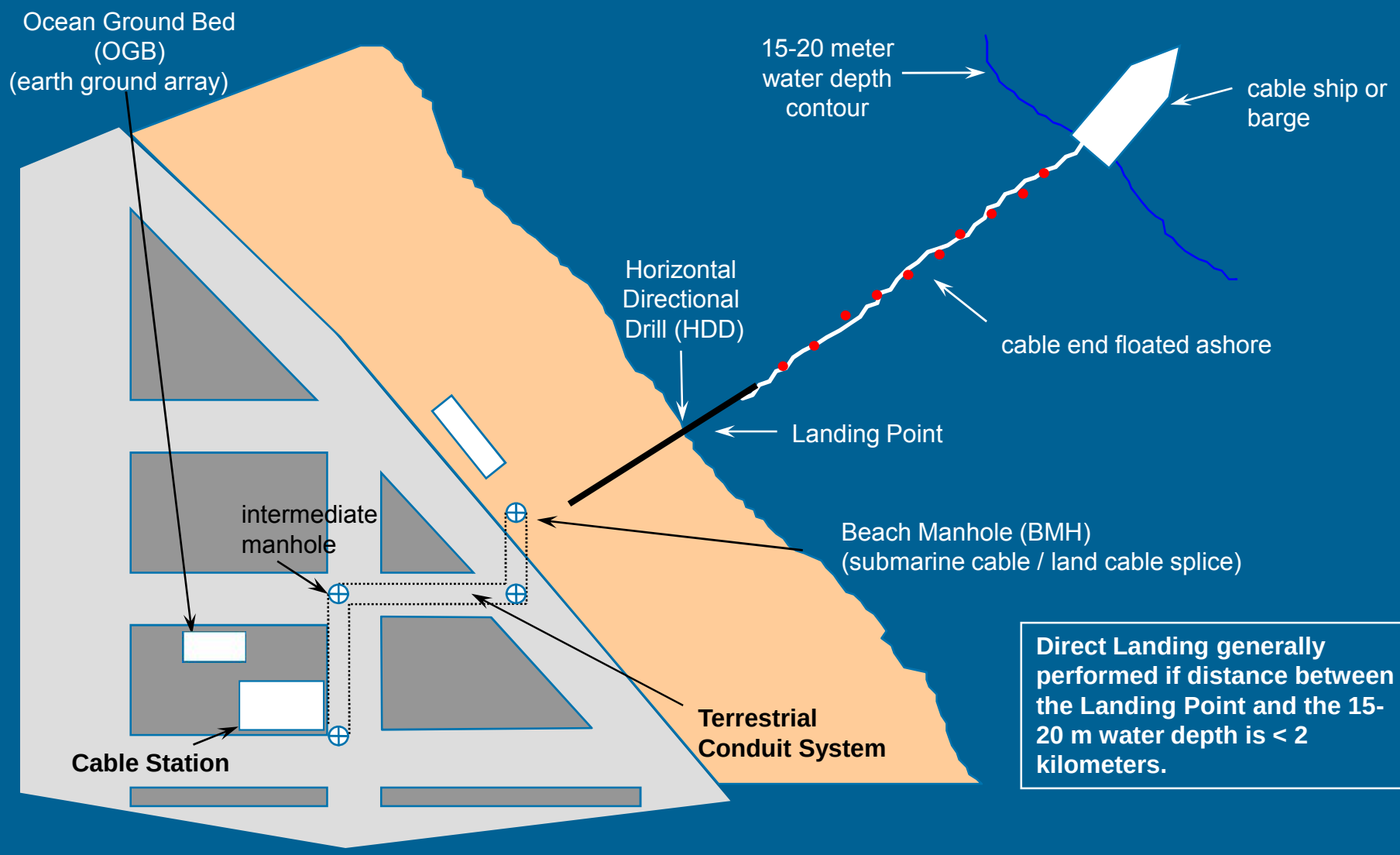
Flat-Fish

Giffords



Rennies

Marine Installation - Direct Landing Operations



Direct Landing generally performed if distance between the Landing Point and the 15-20 m water depth is < 2 kilometers.

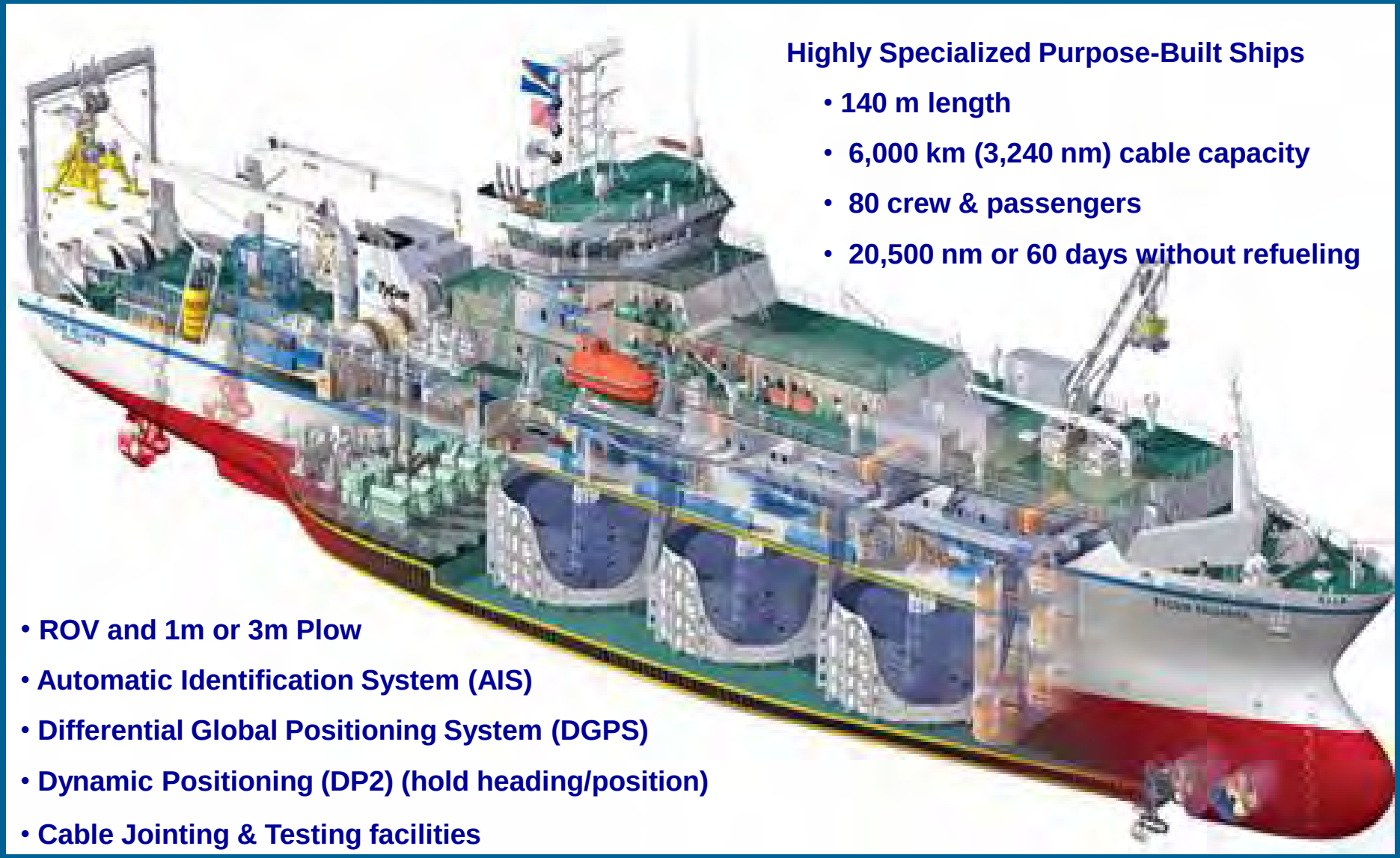
Marine Installation -Direct Landing Shore End Operation

DIRECT LANDING FROM SUBCOM RELIANCE CLASS CABLE SHIP

ATTACHING FLOATS TO CABLE

Marine Installation - Main Lay Vessel Operations

Cable Ships – TE SubCom Reliance Class



Highly Specialized Purpose-Built Ships

- **140 m length**
- **6,000 km (3,240 nm) cable capacity**
- **80 crew & passengers**
- **20,500 nm or 60 days without refueling**

- **ROV and 1m or 3m Plow**
- **Automatic Identification System (AIS)**
- **Differential Global Positioning System (DGPS)**
- **Dynamic Positioning (DP2) (hold heading/position)**
- **Cable Jointing & Testing facilities**

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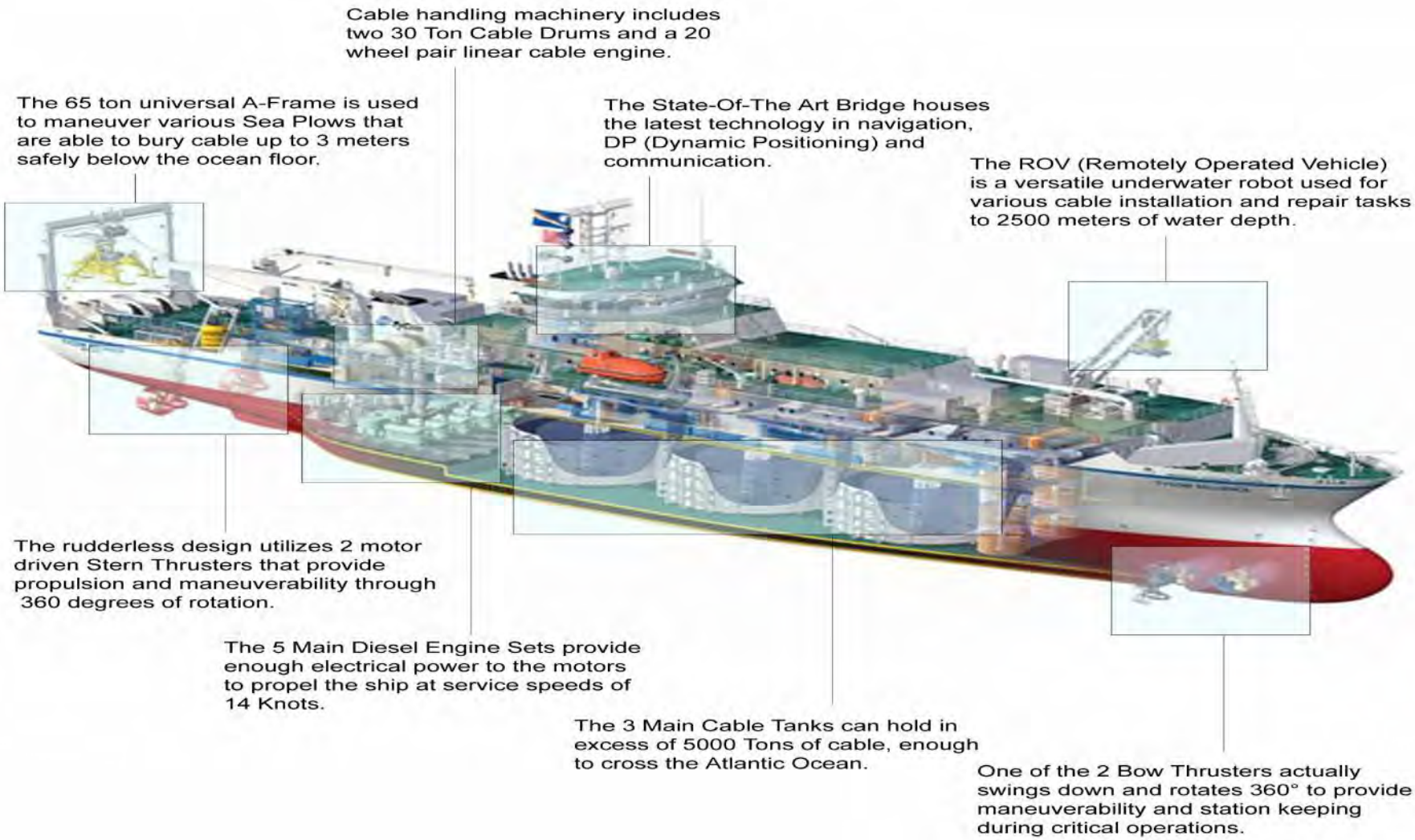
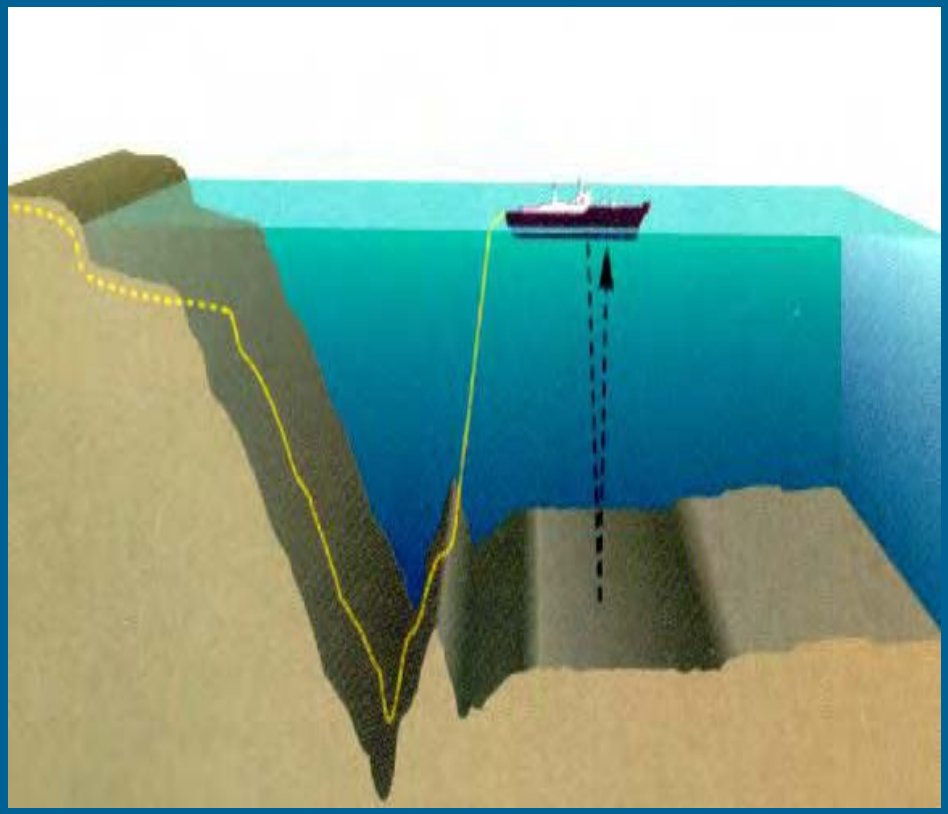
Cable Ships – TE SubCom Reliance Class



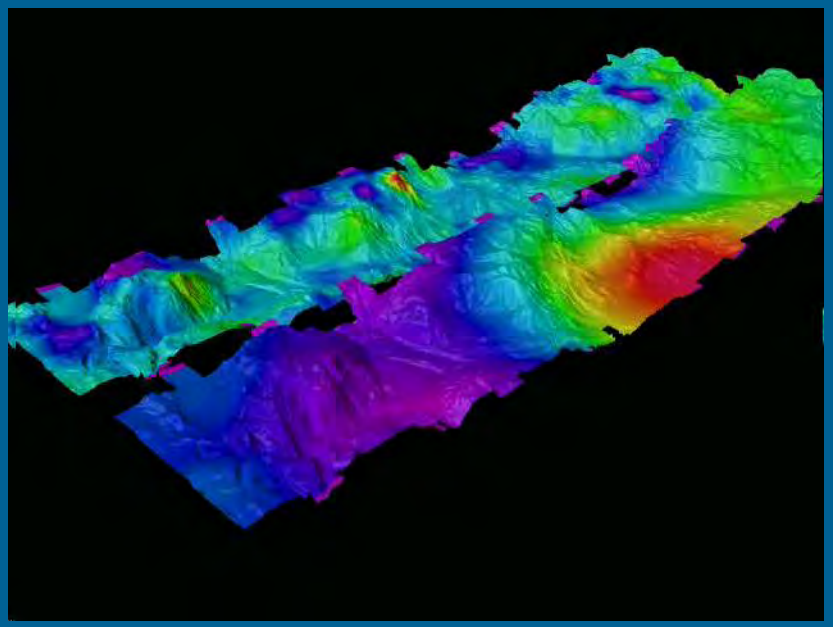
Cable Ship - Main Lay

Main Lay Goal: Install cable in accordance with the engineered plan (i.e., Makai 3D cable modeling software).



Main Lay Objectives

- Execute Engineered Plan
- Complete burial where required
- Deploy cable along planned route
- Deploy proper slack
- Install in conformance with seabed



Marine Installation - Sea Plow

Marine Installation - Rationale for Plow Burial Operations

- Sea plow burial operations are performed to protect areas of the cable system that are at risk of being damaged by external aggression:
  1. Bottom fishing gear (trawl doors)
  2. Ship anchors

- Depth of burial required to provide adequate protection is greatly influenced by the type of seabed material.

- A sea plow deployed from the main lay vessel is the most effective way to achieve effective burial.

- Burial depth continuously varies along the burial route depending on the composition of the seabed material being plowed.

- As seabed conditions along the route are sometimes limiting, there may be areas along the route where the cable is exposed or buried less than the targeted burial depth.

Seabed Penetration Depths of Marine Activities

Threat	Hard ground (clay >72kPa, rock)	Soft-firm soils (sand, gravel, clay 18-72kPa)	Very soft-soft soils (mud, silt, clay 2-18kPa)
Trawl boards, beam trawls, scallop dredges	<0.4m	0.5m	>0.5m
Hydraulic dredges	<0.4m	0.6m	N/a
Stow net fishing anchors	N/A	2.0m	>2.0m
Ships' anchors up to 10,000t DWT (50% of world fleet)	<1.5m	2.1m	7.3m
Ships' anchors up to 100,000t DWT (95% of world fleet)	<2.2m	2.9m	9.2m

NCP has a target burial depth of 1.0 m below the seabed seaward to the 1,500 m water depth contour.

Marine Installation – Oregon Territorial Sea Plan

Oregon Territorial Sea Plan
Adopted December 1, 2000

PART FOUR:
Uses of the Seafloor

3. Implementation Requirements

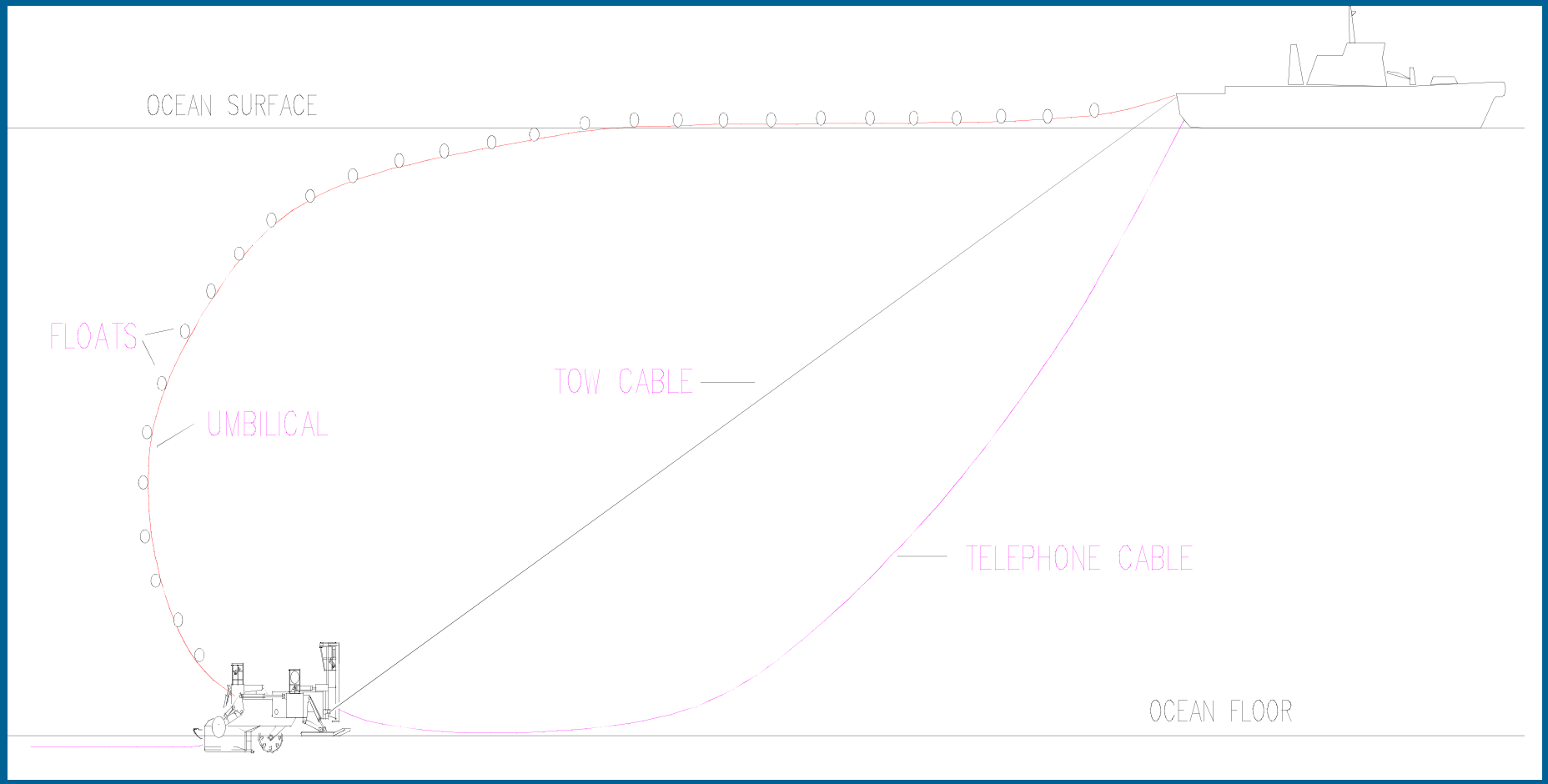
When approving the routing, placement, or operation of a seafloor utility, state and federal agencies shall avoid or reduce conflicts or adverse effects on other ocean users through the use of one or more of the following:

a. Burial.

1.) In state waters: All telecommunication cables, pipelines and other fixtures, crossing or affixed to state lands of the territorial sea lying seaward of Extreme Low Water (which is the seaward boundary of the Ocean Shore Recreation Area) shall be buried so as to ensure continuous burial unless the approving state agencies make findings that burial cannot be practically achieved and all affected parties agree that adverse effects of not burying the cable, pipeline, or fixture have been reduced, avoided, or mitigated to the extent practicable

2.) In federal waters: Decisions to permit burial of cables, pipelines, or other fixtures crossing or affixed to the seabed of the outer continental shelf (beneath federal waters) to a depth of 2,000 meters off Oregon will be deemed consistent with this state policy. When a federal agency does not require burial in waters to this depth, the state may concur that the decision is consistent with state policy only if the federal agency makes findings that burial cannot be practically achieved and all affected parties agree that adverse effects of not burying the cable, pipeline, or fixture, have been reduced, avoided, or mitigated to the extent practicable.

Marine Installation –Cable Ship & Plow Configuration



Marine Installation
-Post Lay Inspection & Burial Operations (PLIB)

- Follows main lay and sea plow operations
- Provides supplemental cable burial via a Remotely Operated Vehicle (ROV).
- The ROV typically uses a jetting tool to fluidize the seabed in order to bury the cable to the required depth.
- ROV burial is performed:
  - at planned recoveries of the burial tool (“plow ups”)
  - at splicing positions within buried sections
  - **at crossings of other cables** and pipelines within buried sections
  - at unplanned recoveries locations due to burial tool breakdown, weather delay, etc.

Marine Installation -Post Lay Inspection & Burial

ROVs used for burial, inspection, cable burial measurements, and fault location.

Proposed NCP Route within U.S. EEZ

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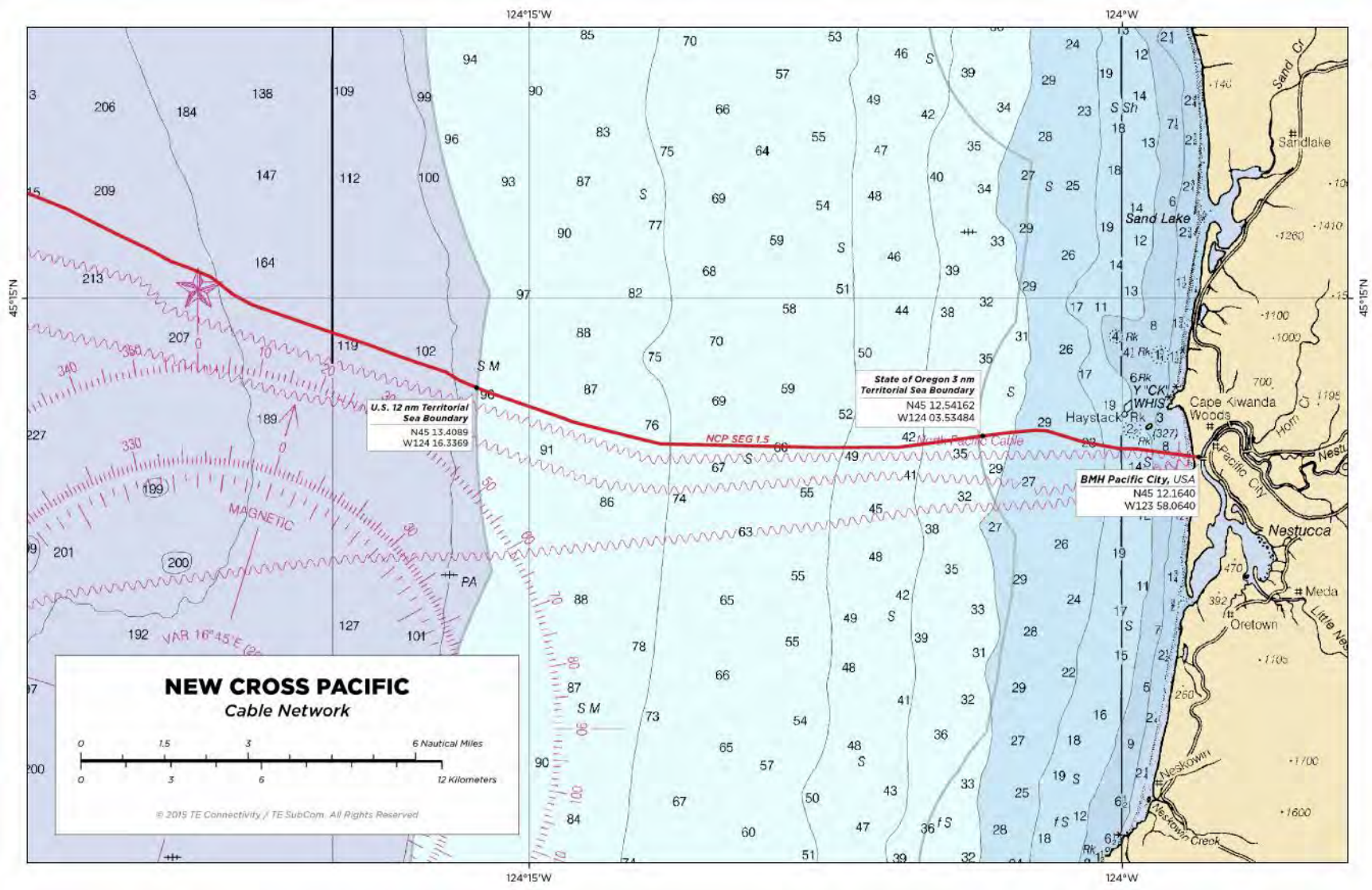
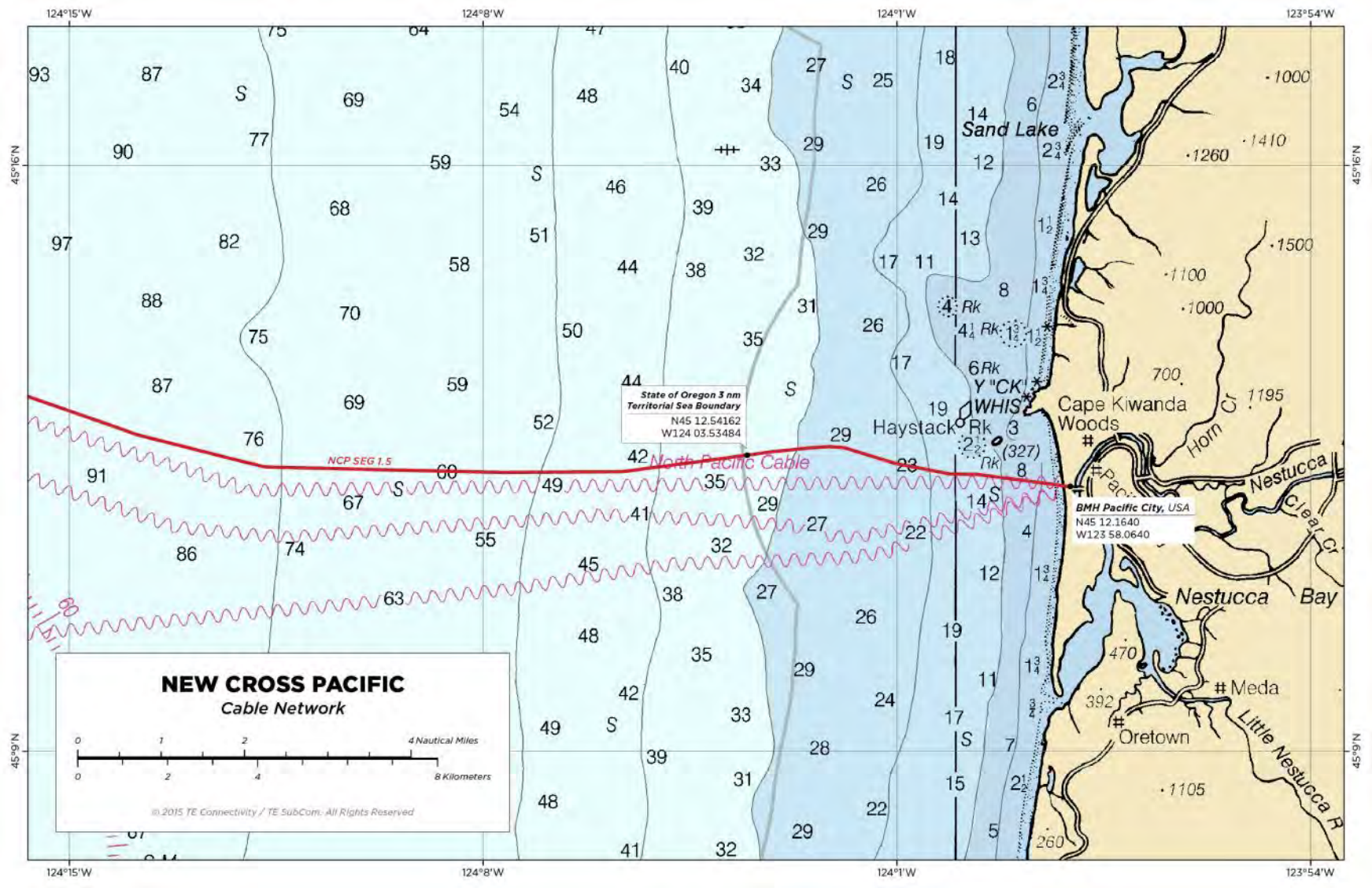
Proposed NCP Route within U.S. Territorial Sea



TE connectivity SUBCOM

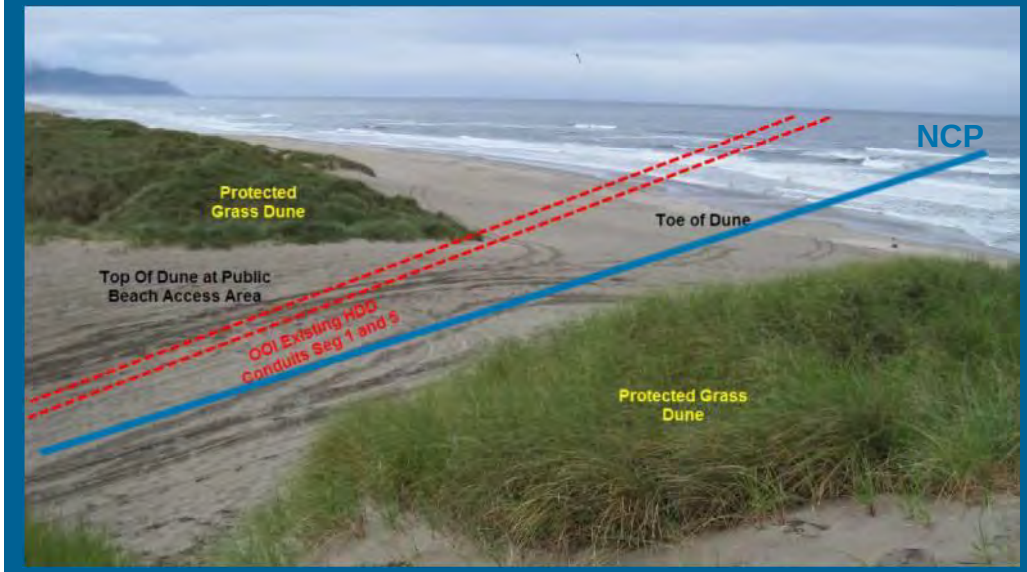
Proposed NCP Route within State of OR Territorial Sea

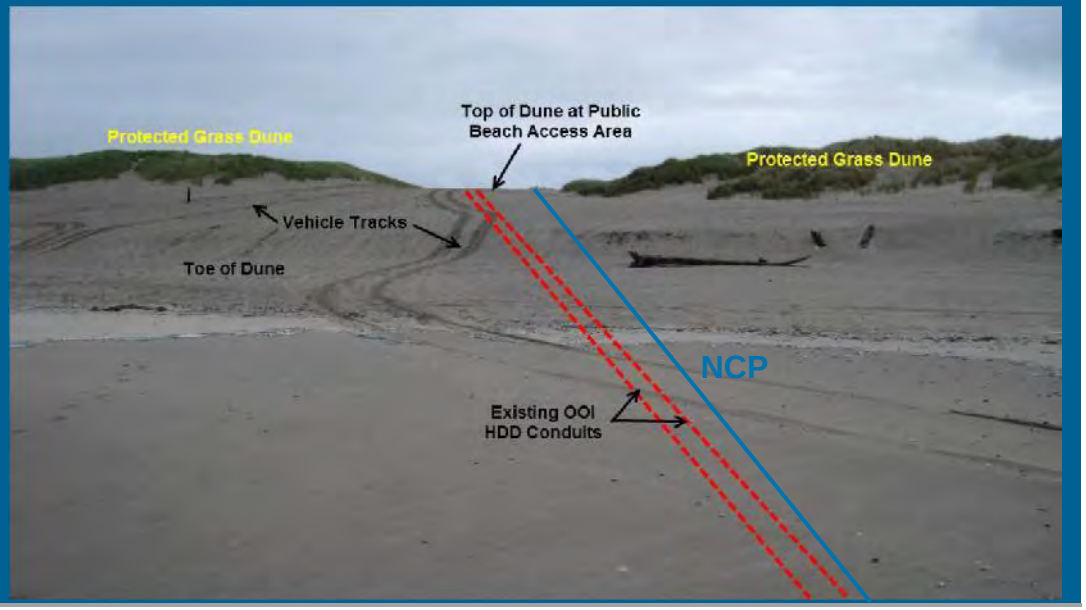


TE connectivity SUBCOM

Shore End Installation - Beach Construction Operations

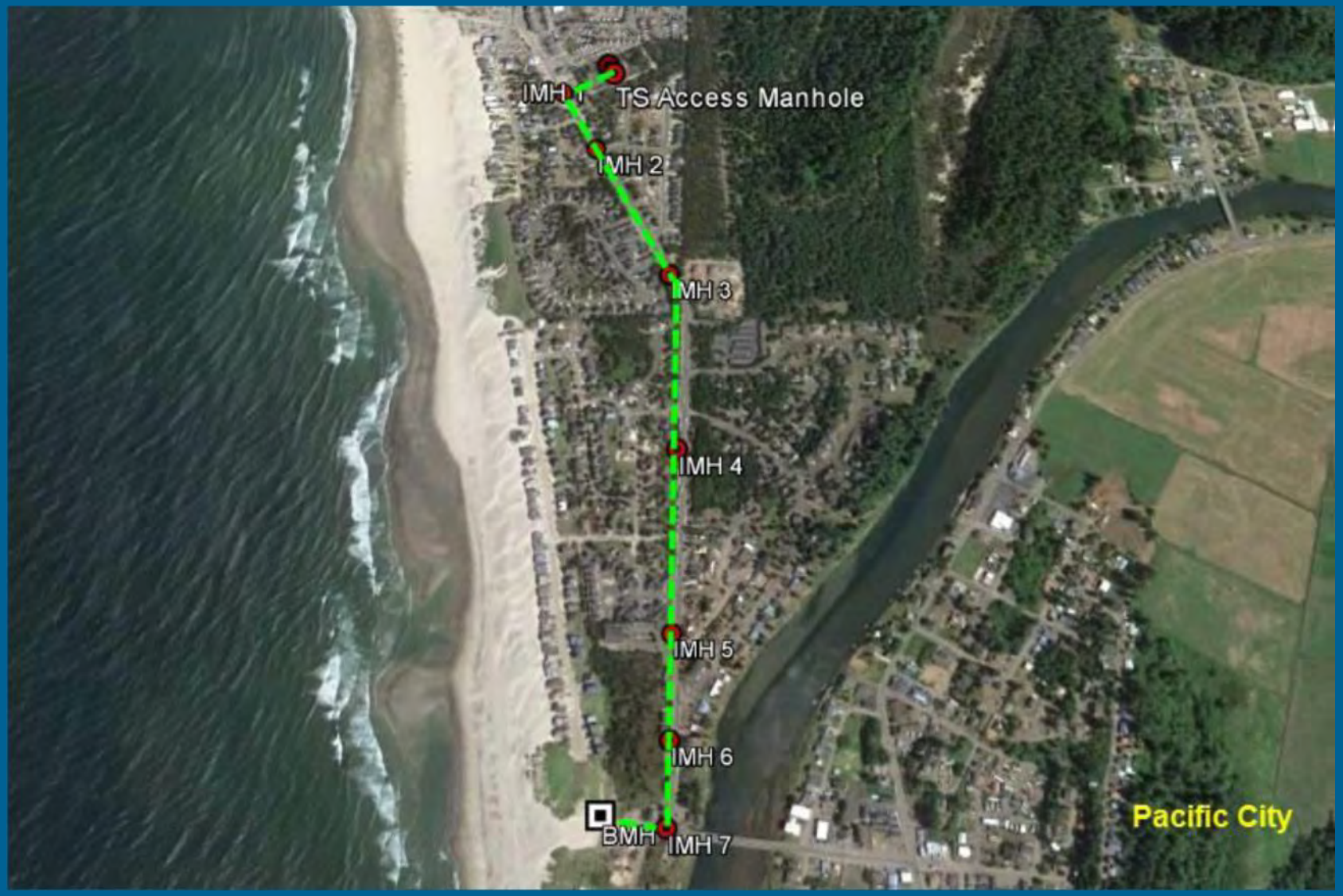
Shore End Installation - Beach Construction Operations





TE connectivity SUBCOM

Proposed NCP Terrestrial Route (Outside Plant (OSP)



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Proposed NCP Terrestrial Route (Cable Station)

TE connectivity SUBCOM

NCP Survey & Installation Program

- **Marine Route Survey (Q3/Q4 2015)**

- **Joint Permit Application Submittal (Q1 2016)**

- **Beach Operations (Q1 2017)**
  - 60 days to construct horizontal directional drill (HDD)

- **Beach Operations (Q3 2017)**
  - Cable Landing: 24-48 hours including trenching of the beach from BMH to HDD landward terminus and application of split-pipe cable protection in between.

- **Offshore Installation (from HDD seaward terminus out to U.S. EEZ) (Q3 2017)**
  - Pre-lay Grapnel Run (PLGR) of ~88 kms = ~2 days
  - Route Clearance (RC) of one (1) Out Of Service (OOS) (NPC) = ~1 days
  - Cable ship simultaneous install/bury of ~**88** kms to 1,500 m water depth (end of burial) = ~5 days
  - Post Lay Inspection and Burial (PLIB) = ~3 days
  - ~21 days total for offshore work excluding weather downtime & contingency.

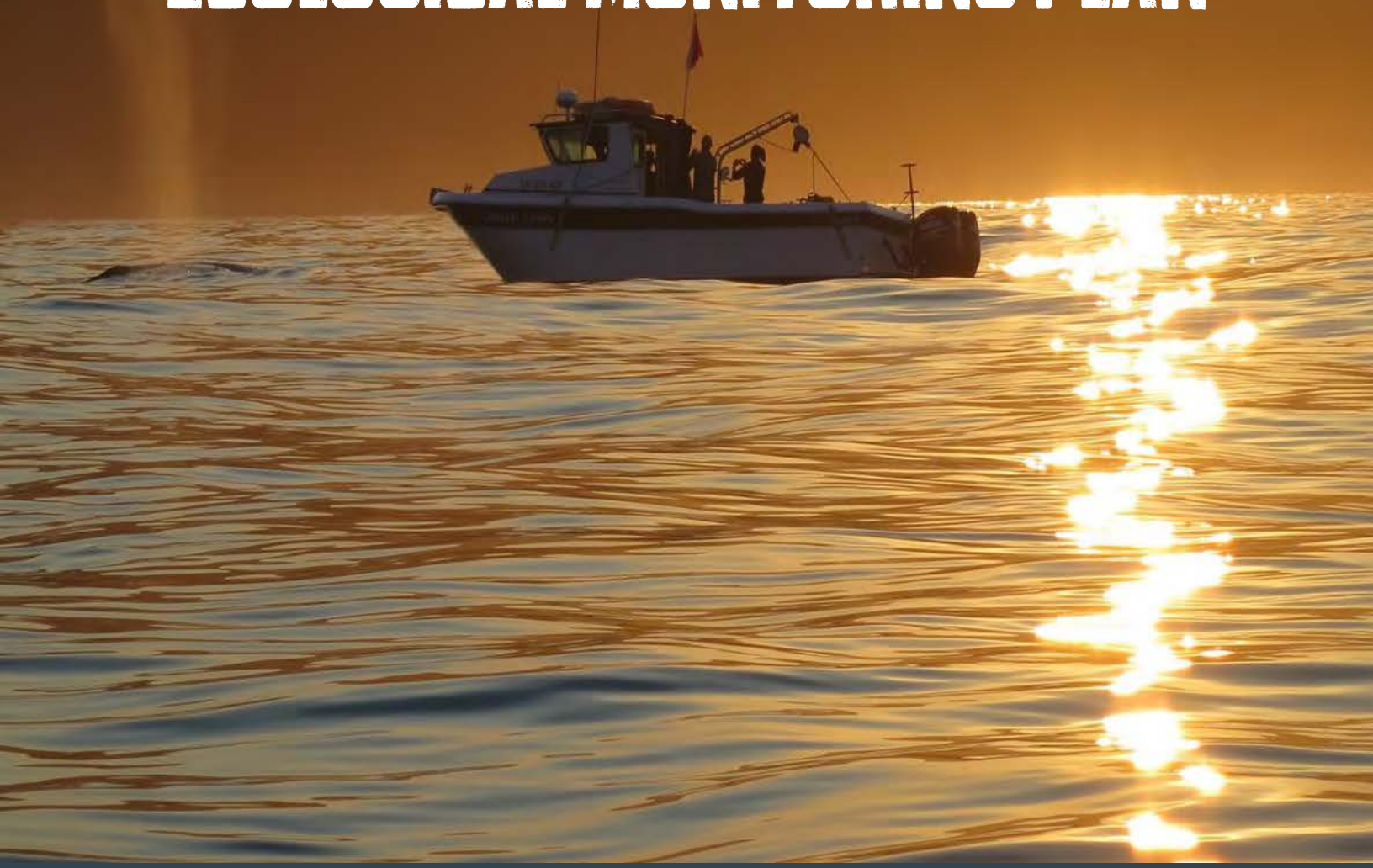
END OF PRESENTATION

THANK YOU FOR YOUR PARTICIPATION!

Attachment 309-1-5

OREGON
MARINE RESERVES
OREGON DEPARTMENT OF FISH & WILDLIFE

ECOLOGICAL MONITORING PLAN



OREGON
MARINE RESERVES

2015

OREGON
Fish & Wildlife

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Oregon Department of Fish and Wildlife
Marine Reserve Program
Ecological Research Project

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97365
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HOW TO USE THIS DOCUMENT

This ecological monitoring plan describes the Marine Reserve Program's primary monitoring tools as well as collaborations that expand ODFW-led efforts. Individual monitoring plans for each marine reserve describe the unique attributes of each site. These were considered when developing sampling tools and intervals best suited for long-term monitoring of the marine communities at each site.

TABLE OF CONTENTS

I. OREGON'S MARINE RESERVE PROGRAM

Marine Reserves Goals & Objectives

Programmatic Themes

Unique Attributes of the Reserves

Reserve Sites Map

II. ECOLOGICAL MONITORING

Comparison Areas

Ecological Study Design

ODFW's Primary Monitoring Efforts

Collaborative Monitoring Efforts

III. SITE SPECIFIC MONITORING PLANS

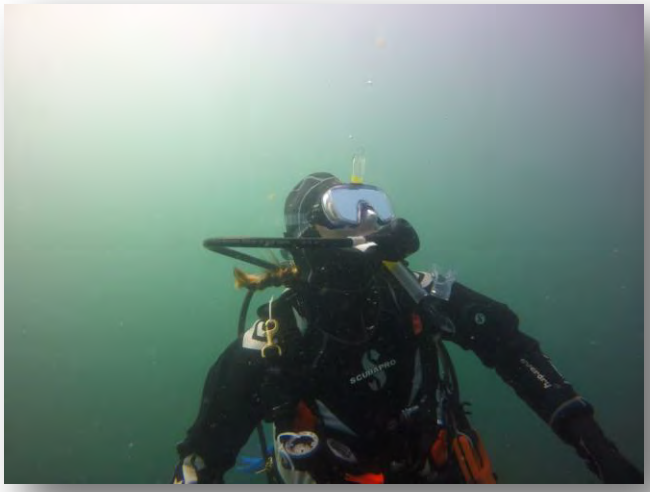
Redfish Rocks

Otter Rock

Cascade Head

Cape Perpetua

Cape Falcon



BRINGING DEEPER UNDERSTANDING TO THE SURFACE

In Oregon, marine reserves are areas within the state's coastal waters dedicated to conservation and scientific research. In 2012, Oregon completed designation of five marine reserve sites with help from community groups working together with state officials. All removal of marine life is prohibited in these marine reserves, as is ocean development. Marine Protected Areas (MPAs), that allow certain specified extractive activities, are also included in Oregon's limited system of reserves.

The Oregon Department of Fish and Wildlife (ODFW) Marine Reserves Program is responsible for overseeing the management and scientific monitoring of Oregon's system of five marine reserves. Here we provide an overview of the ecological monitoring underway for each of the five sites. This plan reflects the ongoing, adaptive management in the Marine Reserves Program, and therefore replaces the original ecological monitoring plan from 2012.

WHERE WE ARE NOW

Currently, ODFW's Marine Reserves Program is focused on collecting robust and reliable data that characterize the marine communities present in the reserves and comparison areas (nearby monitoring sites open to fishing). Meeting this goal entails refining sampling methods and tools, evaluating alternative study designs, increasing data collection over space and time, and working with partners to expand monitoring efforts. This learning and adapting process has led to a redesign of the Ecological Monitoring Plan. We no longer adopt a one-size-fits-all approach to monitoring the five reserves in Oregon. Instead, the Marine Reserves Program acknowledges the unique attributes of each reserve, and has developed individual ecological monitoring plans for each reserve tailored to that reserve's characteristics. The five monitoring plans presented here serve to reflect the adaptive management process ODFW is taking to manage Oregon's marine reserves.

EVALUATION IN 2023

In 2023, the Oregon Legislature will evaluate the Marine Reserves Program. At this point in time, the state will consider all aspects of marine reserve implementation, and evaluate whether and how Oregon's marine reserves will continue to be used as a nearshore resource management tool into the future. There is general agreement from the scientific community that this evaluation timeframe is too brief to detect substantive ecological changes due to marine reserve protection. With Oregon's cold-water, temperate, marine ecosystem, scientists project a minimum of 10-15 years after extractive activities (e.g., fishing) have ceased before we might begin to scientifically detect any ecological changes. However, this duration will allow time to establish a monitoring program, expand research activities, and begin a multi-year data series that will inform marine resource management here in Oregon.

OREGON'S MARINE RESERVE GOALS

CONSERVATION

Conserve marine habitats and biodiversity

RESEARCH

Serve as scientific reference sites to learn about marine reserves and inform nearshore management

COMMUNITIES

Avoid significant adverse impacts to ocean users and coastal communities

MARINE RESERVE OBJECTIVES

The Ecological Monitoring team is devoted to implementing the marine reserve mandates provided by the Oregon Legislature and the Ocean Policy Advisory Council. The following are the policy mandates that drive ecological monitoring efforts in Oregon's marine reserves:

- Protect areas within Oregon's territorial sea that are important to the natural diversity and abundance of marine organisms, including areas of high biodiversity and special natural features.
- Protect key types of marine habitat in multiple locations along the coast to enhance resilience of nearshore ecosystems to natural and human-caused effects.
- Site fewer than ten marine reserves and design the system in ways that are compatible with the needs of ocean users and coastal communities. These marine reserves, individually or collectively, are to be large enough to allow scientific evaluation of ecological effects, but small enough to avoid significant adverse social and economic impacts on ocean users and coastal communities.
- Use the marine reserves as reference areas for conducting ongoing research and monitoring of reserve condition, effectiveness, and the effects of natural and human-induced stressors. Use the research and monitoring information in support of nearshore resource management and adaptive management of marine reserves.

ODFW'S APPROACH TO MARINE RESERVES

EACH SITE IS UNIQUE – FIVE CASE STUDIES

The five marine reserve sites in Oregon are unique. They differ in their spatial configurations, habitat attributes, and the demographics of the coastal communities tied to each site. The uniqueness of each marine reserve presents us with an opportunity to use each of Oregon's marine reserves as a case study. Because of these unique characteristics, reserve effects will likely differ at each site and therefore these reserves will offer differing conservation value. By studying these unique cases over time, we can better understand if, where, and how different marine reserve designs and placements align with Oregon's programmatic goals, as well as inform how marine reserves might continue beyond the year 2023.

DESIGN AND PLACEMENT MATTER

Oregon's marine reserves vary in size, depth range, habitats present, and past fishing pressure – important attributes that can influence ecological responses to reserve protection. Where possible, we collect comparable datasets using identical survey tools among all reserves to allow for comparisons across the entire reserve system. However, the unique attributes of each reserve dictate the need for different study designs as well as survey tools to sample the communities present in each site. As such, there is no one-size-fits-all monitoring strategy that can be universally applied to Oregon's marine reserves. While we strive to use similar sampling methods where possible, we recognize the need to tailor the monitoring strategy to each site, resulting in five individual ecological monitoring plans. These plans consider the unique habitats, placement, and research potential of each reserve to develop both the tools and sampling intervals best suited for sampling the marine communities found within that particular reserve.

BRINGING DEEPER UNDERSTANDING TO THE SURFACE

LIVING LABORATORIES

Marine reserves enable ODFW and collaborators to both research the effects of protection (i.e. cessation of fishing) on underwater ecosystems and learn about Oregon's nearshore ocean environment. We conduct robust, long-term monitoring and novel research in these living laboratories to provide information that enhances our understanding of marine reserves science and nearshore management.

RESEARCH PARTNERS

We are working in collaboration with a variety of research partners to scientifically monitor Oregon's marine reserves. Our research partners provide expertise, tools, methods, and personnel to supplement and expand ODFW's monitoring efforts. Partners currently include university scientists and students, non-government organizations such as the Oregon Coast Aquarium, consultants, governmental agencies, the fishing industry, and volunteers.

LEARNING AND ADAPTING

Marine reserves are a new management tool in Oregon. Based on what we learn, our long-term monitoring strategies will evolve over time to produce the best possible data. We will continue to ask questions about the ability of our monitoring methods to generate robust, valid, and unbiased data about the marine ecosystems in the reserves. We will explore what environmental, habitat, or oceanographic features could confound or influence our datasets. Our goal is to constantly improve our monitoring methods based on the best available science and our experiences. Ultimately, we aim to develop and innovate monitoring approaches that will be used through time to determine the effects of marine reserve protection in Oregon and, more generally, for managing Oregon's nearshore ecosystems.

SHARING WHAT WE LEARN

An important component of ODFW's Marine Reserves Program is sharing what we learn along the way. Our monitoring plans will be reviewed and updated at least every five years, to reflect the adaptations as our monitoring evolves. We will provide monitoring reports every other year, to keep people apprised of our monitoring efforts and what we are learning. We will also regularly share stories on our website and list-serve about the research that we and our partners are conducting.

WHERE WE ARE NOW

ODFW began ecological monitoring of the marine reserves in 2010. During the first five years, method development and adaptation have guided the Marine Reserves Program to consider several new approaches to monitoring.

While we strive to use similar sampling methods among all reserves where possible, we recognize the need to tailor the monitoring strategy to each site, resulting in five individual ecological monitoring plans. By considering each reserve as a distinct case-study, we aim to inform stakeholders about how specific reserves may vary in response to protection based on their characteristics and placement. The outcome of this case-study approach will enable Oregonians to learn and adapt how to best use marine reserves as a management tool into the future.

The table below is a relative comparison of the characteristics of the five reserves with regards to each other. These relative comparisons are based on habitat and placement--visually highlighting the differing attributes of the five sites. A full circle indicates a specific attribute is well-represented, a half circle indicates an attribute is somewhat represented, and a hollow circle indicates an attribute is poorly represented.

	Habitat				Placement			
	Large Size	Broad Depth Range	Diversity of Habitats	Large Rocky Habitats	Suitable Comparison Area	Easily Enforced	High Previous Groundfish Fishing Effort	High Previous Urchin/ Crab Fishing Effort
REDFISH ROCKS MARINE RESERVE	◑	◑	●	●	●	●	●	◑
CASCADE HEAD MARINE RESERVE	●	●	●	●	●	●	●	○
CAPE PERPETUA MARINE RESERVE	●	●	◑	◑	○	◑	◑	●
OTTER ROCK MARINE RESERVE	○	○	○	◑	◑	●	○	◑
CAPE FALCON MARINE RESERVE	◑	●	◑	○	◑	◑	○	◑

THERE'S MORE BENEATH THE SURFACE

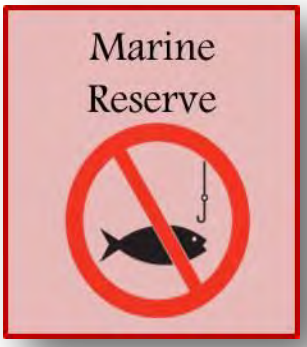
OREGON
MARINE RESERVES

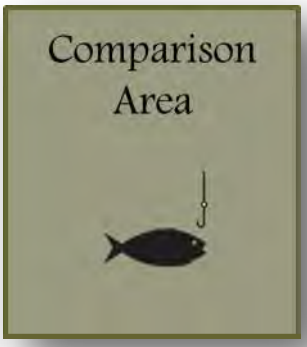
COMPARISON AREAS:

Tools for understanding changes over time

WHAT ARE COMPARISON AREAS?

Comparison areas are monitoring sites in close proximity to the marine reserve that remain open to fishing. These sites are as similar to the reserve as possible (in depth range, size, habitat types, oceanographic conditions, and fishing pressure) to enable comparison of ecological changes occurring inside the reserve to outside. The same long–term monitoring will be conducted in both the reserve and comparison areas through time.





HOW DO WE CHOOSE COMPARISON AREAS?

Ideally, a comparison area would be identical to the marine reserve in all ways except that it remains open to fishing. In reality, it is impossible to find two identical areas in the ocean. Instead, we find areas as similar as possible using the metrics shown below, often selecting more than one comparison area per reserve.

SIZE

OCEANOGRAPHY

DEPTH

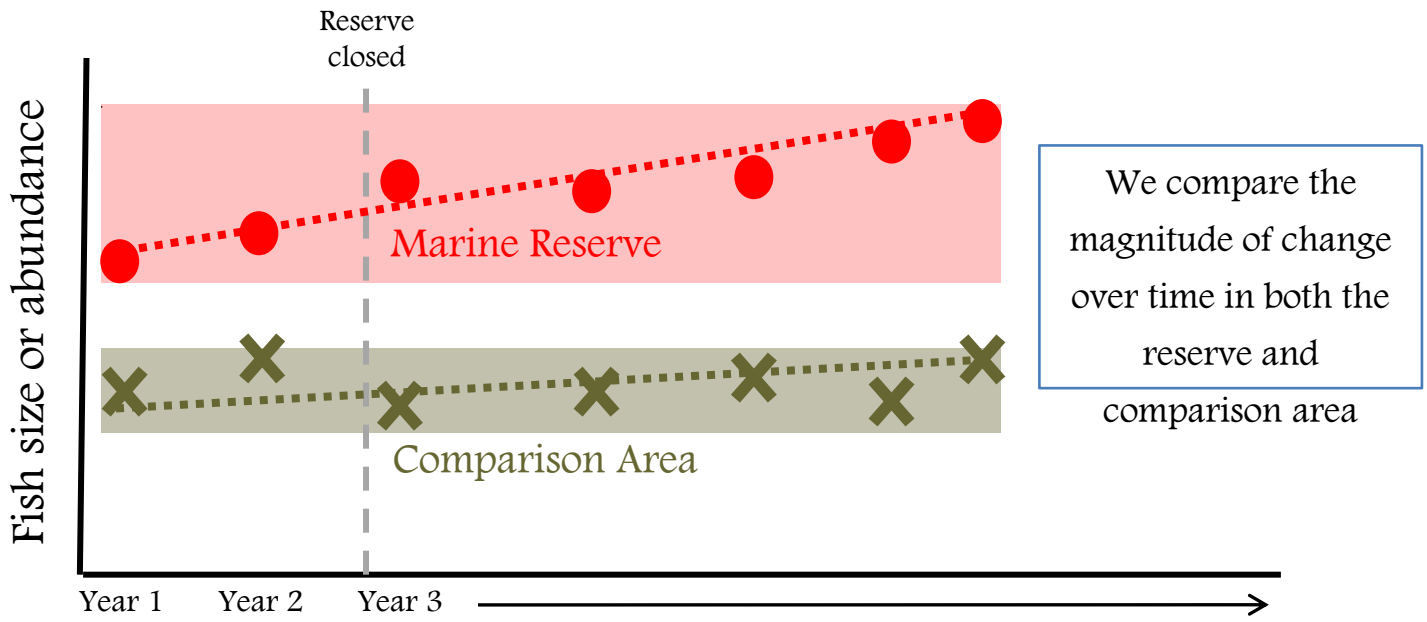
HABITATS

FISHING PRESSURE

UNDERSTANDING CHANGES OVER TIME

DETECTING CHANGE OVER TIME

Prior to the prohibition of fishing, we sampled in the reserve (red) and the comparison areas (green) to quantify the initial conditions of these areas. This allows us to identify differences that already exist between the marine reserves and comparison areas and track how these differences in trajectories change over time. We use multiple comparison areas when possible across a broad range of fishing gradients in order to account for the impact of fishing effort on marine reserve performance.



WHAT ECOSYSTEM COMPONENTS DO WE MONITOR?

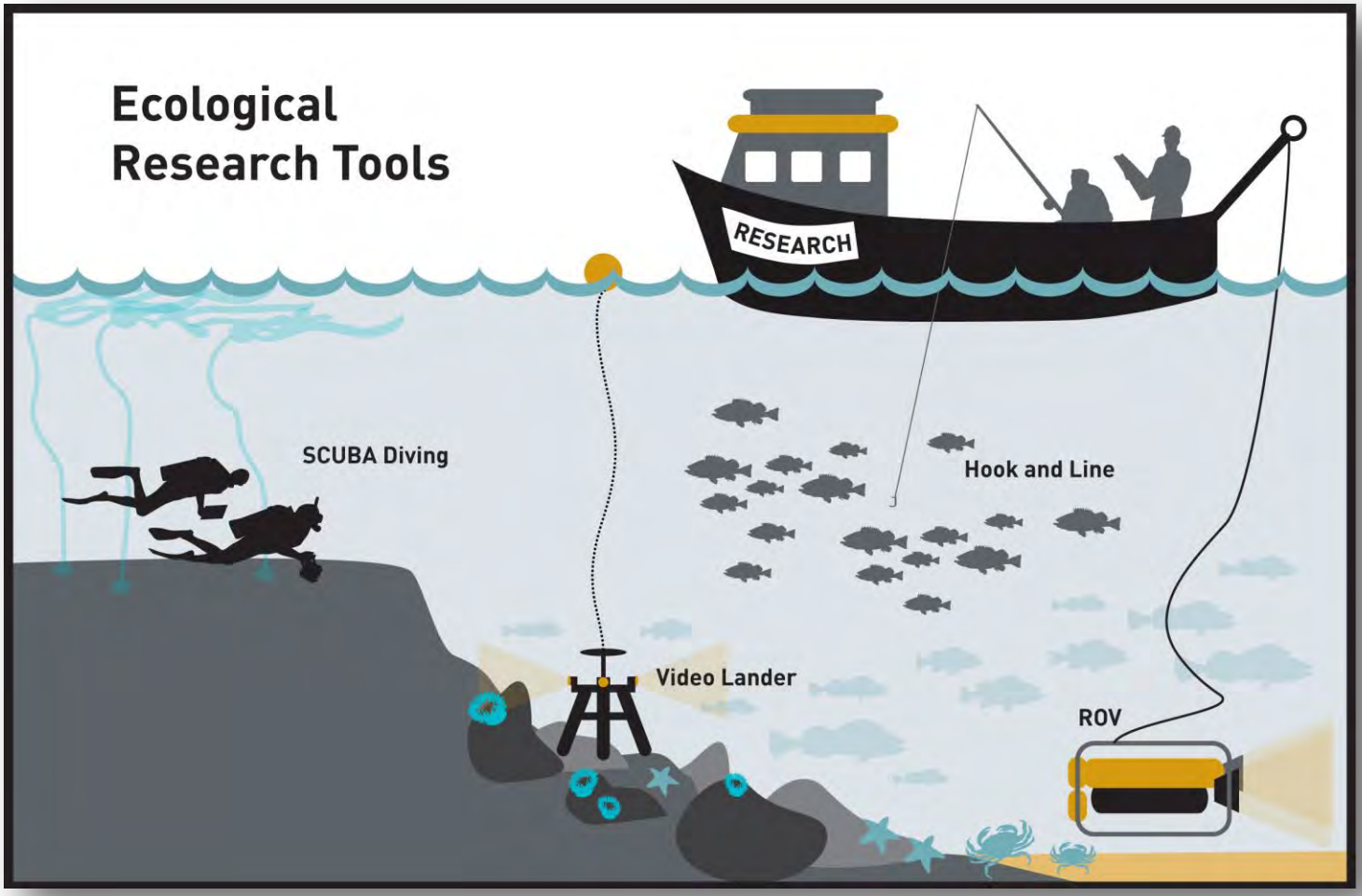
In order to detect ecological changes over time, we use several monitoring tools to collect data on five main components of the marine ecosystem. These five areas include fish and invertebrate species, algal community composition, habitat characteristics, and oceanographic conditions.

We track the changes over time in organism size, organism abundance, and community composition. We then compare the magnitude and direction of any observed changes between the reserve and comparison areas to separately identify changes that are due to marine reserve management and those due to natural variations in the ocean.

PRIMARY ECOLOGICAL MONITORING TOOLS

ODFW's ecological monitoring in Oregon's marine reserves began in 2010. During the past five years of baseline data collection, ODFW and partners experimented with sampling tools, study designs, and approaches to best establish a robust baseline of the marine communities found within Oregon's marine reserves.

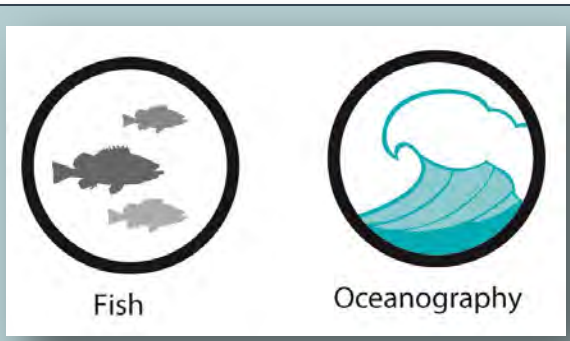
The Marine Reserves Program focuses monitoring efforts on four sampling tools: video lander surveys, remotely-operated video (ROV) surveys, fishery-independent hook and line surveys, and subtidal SCUBA surveys. These four sampling efforts build upon the existing capacity and expertise at ODFW to survey the habitats, fish, invertebrate, and macroalgal communities of Oregon's nearshore.



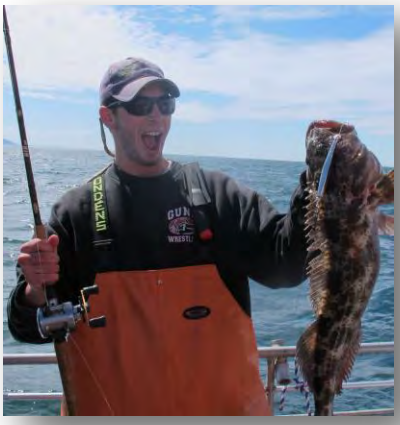
HOOK AND LINE SURVEYS

We collect fish data through the help of volunteer anglers aboard chartered fishing boats to ***catch and release*** fish. We divide the study area into 500m x 500m grid cells. Local fishing knowledge helps ensure grid cells are placed in locations where fish are commonly caught in rocky habitats. On a survey day, five cells are randomly selected and anglers fish using standardized gear for a fixed amount of time. All fish caught by the volunteers are measured and released. Hook-and-line surveys enable us to have fish in hand to take accurate length measurements. We will look at differences in average fish length **before** and **after** the reserve is closed to fishing, both **inside** the reserve and **outside** in the comparison areas (monitoring sites open to fishing). By sampling over time, we can determine whether fish sizes as well as catch rates (catch per unit effort) are changing due to cessation of fishing.

Data collected:



Tool Usage	
Depth Range	10-40m
Habitats	Rocky reefs
Sampling Limitations	Calm sea states, availability of volunteer anglers



SCUBA VISUAL SURVEYS

We use diver based underwater visual census (UVC) methods to identify and count macroalgal, invertebrate, and fish communities. SCUBA divers conduct surveys in rocky reef habitats at depths of 5m, 12.5m and 20m. Divers work in pairs for safety. SCUBA divers survey a $60m^2$ transect counting observed organisms and noting the type of habitat and topographic relief of the substrate encountered. Invertebrate and macroalgal surveys occur along the bottom only. Fish transects occur both along the bottom and mid-way up in the water column. In addition to fish counts by species, each individual's size is estimated to the nearest cm, and species densities are calculated. These methods are based on those developed by the Partnership for Interdisciplinary Studies of Coastal Oceans (PISCO) and are currently being used to survey subtidal communities in California's marine reserves.

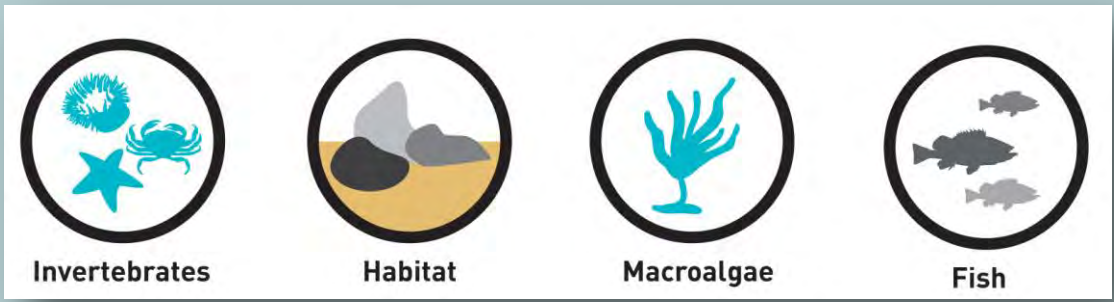
Data collected:

Tool Usage	
Depth Range	10-20m
Habitats	Shallow rocky reefs
Sampling Limitations	Calm sea states and a minimum of 3m visibility

VIDEO LANDER SURVEYS

The video lander is a stationary, underwater camera system. This platform is used in rocky habitats as the high-definition GoPro™ cameras and metal frame are built to withstand being dropped into complex rocky habitats. The video lander is deployed for approximately eight minutes of video collection at a time. We then review the video to estimate relative abundance for select invertebrates species and all fishes observed. The habitat characteristics, which include the depth, geologic substrate, topographic relief, and biogenic habitat (including macroalgae and sessile invertebrates) present, are recorded. The lander can be deployed across a wide range of depths. The affordable lander design and ability to use several landers simultaneously to survey an area, make this tool a cost-effective way to generate large amounts of video data. Future directions, include adding stereo-video cameras to the lander fleet to enable estimation of individual fish sizes during video review.

Data collected:

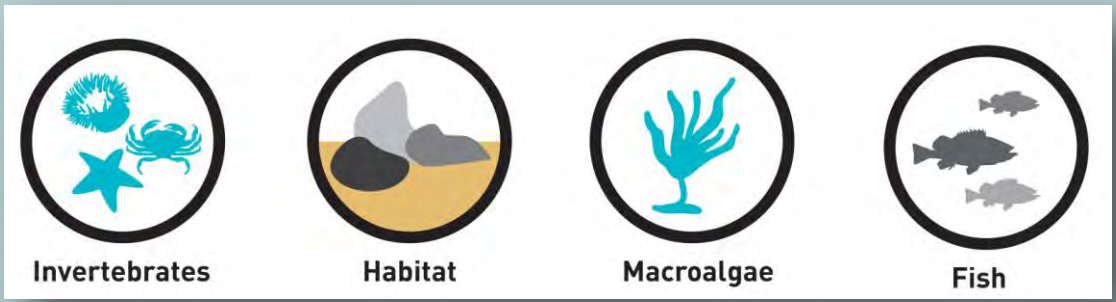


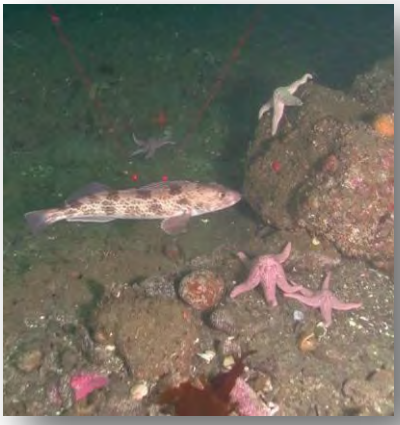
Tool Usage	
Depth Range	5-20m
Habitats	All habitat types
Sampling Limitations	Calm sea states and a minimum of 3m visibility

REMOTELY OPERATED VEHICLE SURVEY

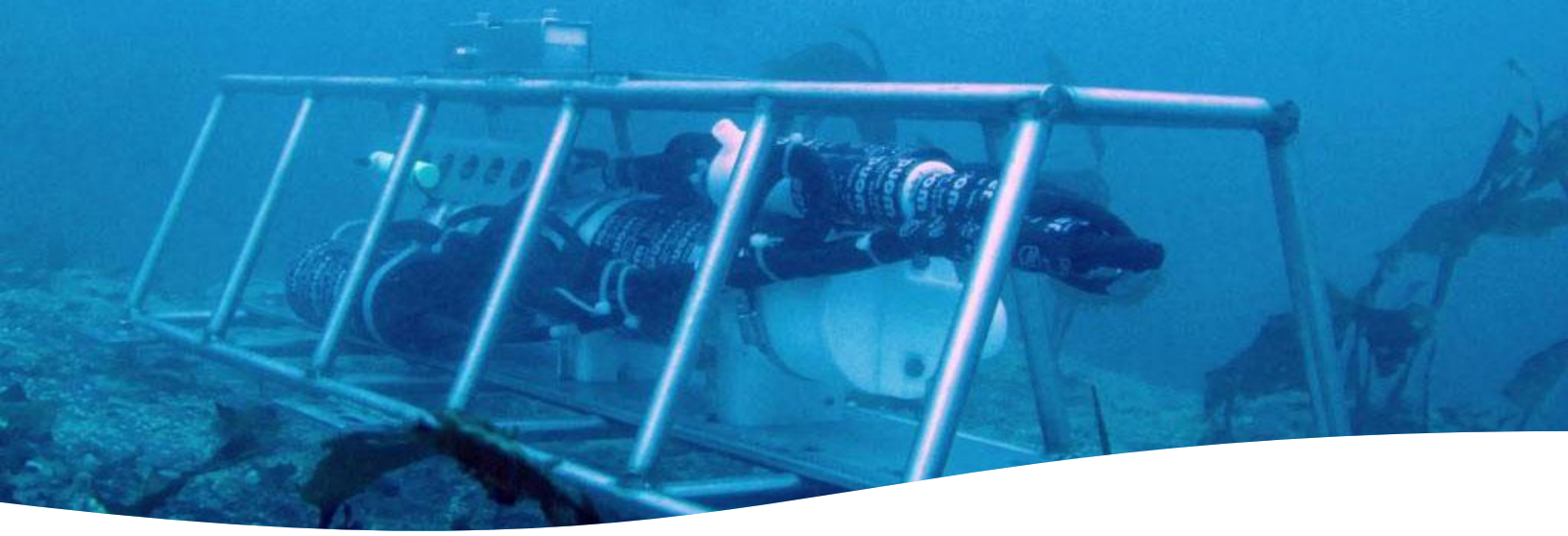
The remotely operated vehicle (ROV) is our most complex video tool. It is driven by an operator from a boat, controlled via an umbilical cable. The ROV can swim up, down, and around obstacles and follow along a transect line, like a SCUBA diver. The high-definition video is later analyzed for fish, invertebrates, and habitat type. We measure the abundance of select invertebrates and each species of fish observed. We also estimate the size of fish when possible using paired lasers spaced 10cm apart as a size reference. Biogenic habitat such as macroalgae, sponges, deep water corals, and gorgonians are quantified as living habitat that may play a role in structuring the observed fish community. The ROV is perfect for surveying rocky habitats all the way out to the deepest parts of the reserves.

Data collected:





Tool Usage	
Depth Range	20-50m
Habitats	All habitat types
Sampling Limitations	Calm sea states and a minimum of 3m visibility

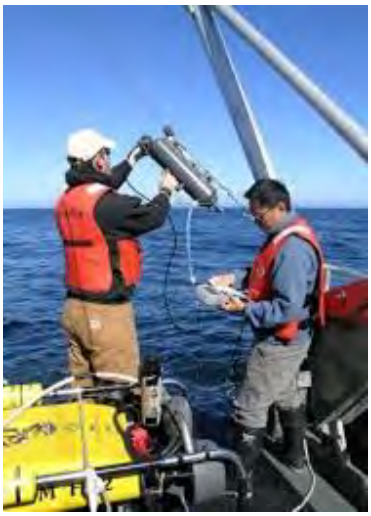


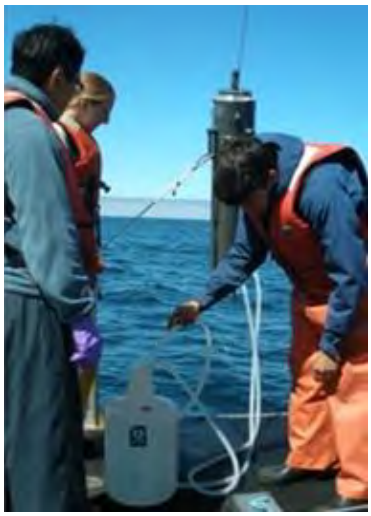
COLLABORATIVE MONITORING EFFORTS

The four previous primary sampling efforts build upon the existing capacity and expertise at ODFW to survey the habitats, fish, invertebrate, and macroalgal communities of Oregon's nearshore. However, we recognize that several other sampling approaches would complement these Marine Reserves Program efforts. Hence, ODFW's monitoring strategy is to encourage expanded research and monitoring efforts through partnerships and collaborations. Currently, these collaborations include: intertidal surveys, oceanographic monitoring, and fish recruitment studies. These collaborations help fill in where ODFW's limited team and budget cannot reach. We aim to continue to build collaborative partnerships, seek creative funding sources, and consider citizen science efforts as part of a well-rounded, inclusive framework to monitor the ecological conditions in Oregon's marine reserves.

OCEANOGRAPHIC SURVEYS

Oceanographic parameters such as water temperature affect the growth rate of fish species such as rockfish. So, quantifying any potential differences in oceanographic conditions between our reserves and associated comparison areas will help us isolate reserve effects, such as increase in fish size, from oceanographic effects. To do this ODFW partners with PISCO. PISCO deploys oceanographic moorings in multiple areas along the Oregon coast.



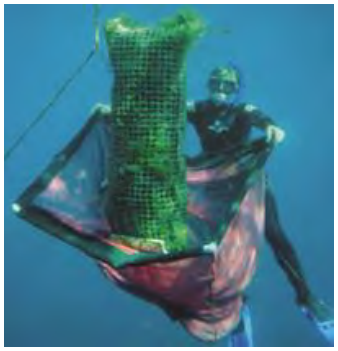


OSU Oregon State University

PISCO

SMURF SAMPLING

To maximize marine reserve conservation benefits, it is important to protect both juvenile and adult habitats from extractive activity. In 2013, ODFW began a partnership with Dr. Kirsten Grorud-Colvert at Oregon State University (OSU) in an ongoing study to quantify abundance and diversity of pelagic juveniles fishes settling into the nearshore habitats. SMURF (Standard Monitoring Units for the Recruitment of Fishes) devices attached to moorings are currently in use in two marine reserves to sample these juvenile fishes. While monitoring fish settlement is still in its infancy along the Oregon coast, eventually this information can be used to inform managers how to best design, place, and manage these reserves into the future.



INTERTIDAL SURVEYS

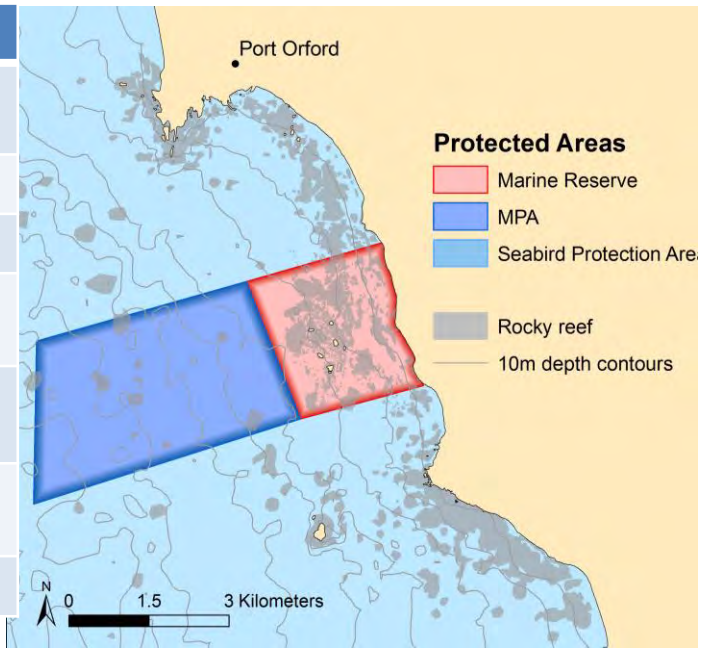
ODFW has partnered with the two largest rocky intertidal monitoring programs on the west coast - PISCO and Multi-Agency Rocky Intertidal Network (MARINe). These programs have long-term data sets that in some cases span more than 20 years. These groups monitor community structure of target assemblages, as well as quantify abundances and sizes of key species. They also record biodiversity hotspots, species – habitat associations, invertebrate larval recruitment, and effect of oceanographic factors on intertidal communities. With this baseline data, these scientists may be able to detect changes in intertidal areas associated with marine reserves.

FIVE ECOLOGICAL MONITORING PLANS

CAPE FALCON • CASCADE HEAD • OTTER ROCK • CAPE PERPETUA • REDFISH ROCKS

OREGON
MARINE RESERVES

Monitoring Began	2010
Closure Date	January 1, 2012
Size	6.8km^2 (2.6mi^2); MPA: 13.2km^2 (5.1mi^2)
Depth Range	0–80m
Habitat Connectivity	Rocky habitats extend beyond reserve
Fishing Pressure	Relatively high fishing pressure due to active local fishery (including live fish trade)
Habitats Present	Emergent rocks, kelp beds, complex rocky reef, and soft bottom
Comparison Areas	Humbug, Orford Reef, and McKenzie Reef



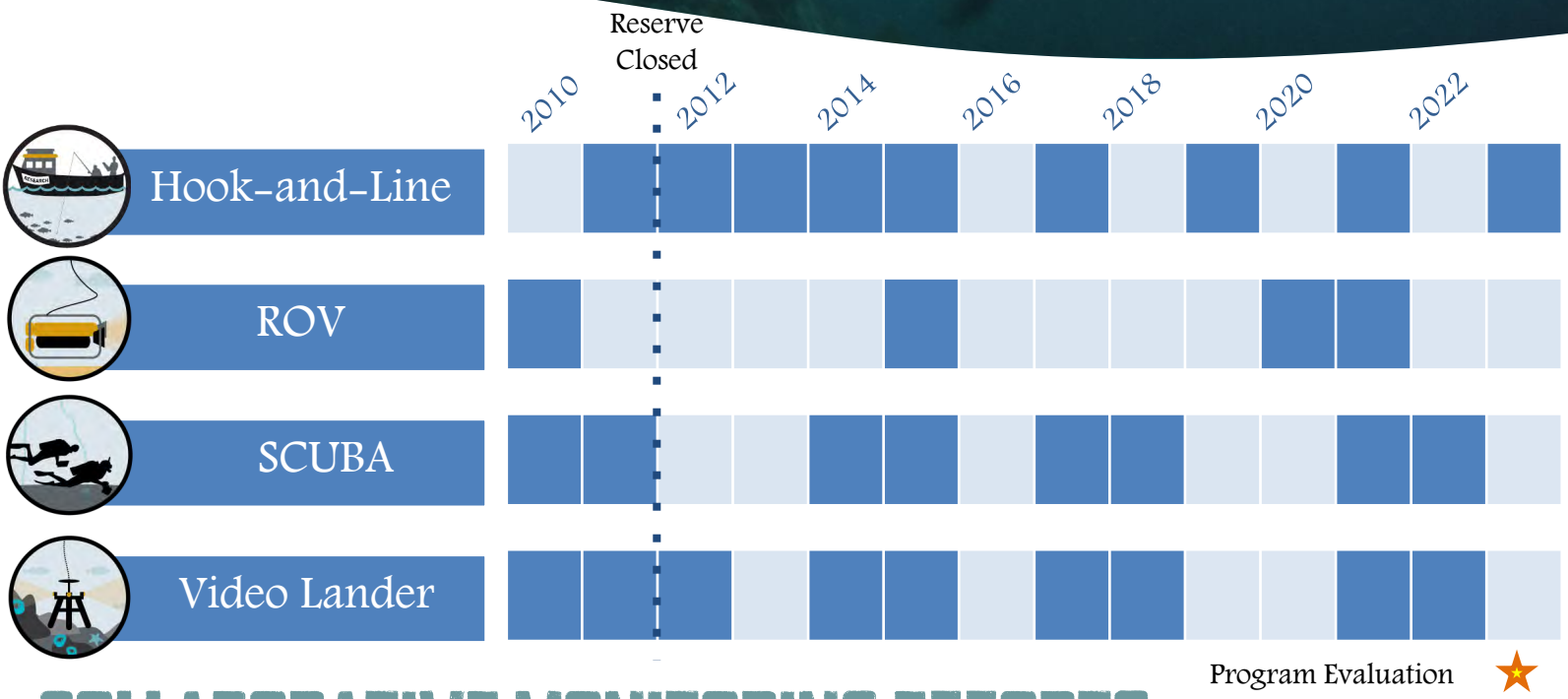
WHAT MAKES REDFISH ROCKS UNIQUE?

Active Local Fishery

Members of the Port Orford fishing fleet, as well as boats hailing from other ports, fish Port Orford's nearshore waters, targeting groundfish, sea urchin, crab, and salmon. This localized fishing effort exerted relatively high extractive pressure on the marine reserve before its closure and continues to exert extractive pressure within the selected comparison areas nearby.

Design and Placement Matter

Redfish Rocks is Oregon's only marine reserve south of Cape Blanco, a known biogeographic break along the Oregon coast. The reserve also has an adjacent MPA that provides further protection to nearshore groundfish by only allowing crabbing and salmon trolling to occur within its boundaries. The reserve encompasses the Redfish Rocks reef complex, featuring emergent rocks and islands surrounded by high relief rocky reef. The subtidal reaches between the islands and the shoreline support extensive kelp beds and diverse invertebrate, algal, and fish communities. At Redfish Rocks Marine Reserve, we can readily employ a BACI (Before–After–Control–Impact) study design to evaluate how marine organisms respond to reserve protection (cessation of fishing) compared to comparison areas still open to fishing that contain similar habitats.



COLLABORATIVE MONITORING EFFORTS

SMURFs

SMURF sampling began in 2014 in Redfish Rocks and will continue annually between April- September to quantify young fishes recruiting into these nearshore habitats.

Longline Pilot Study

In collaboration with local commercial fishermen, this study compares fish composition, size, and abundance derived from longline and hook-and-line fishery independent surveys.

Fish Surveys: A 3-Method Comparison Pilot Study

By simultaneously sampling with three methods currently used for surveying fishes (hook-and-line, SCUBA, and video lander), we can better understand how to integrate information from these datasets.

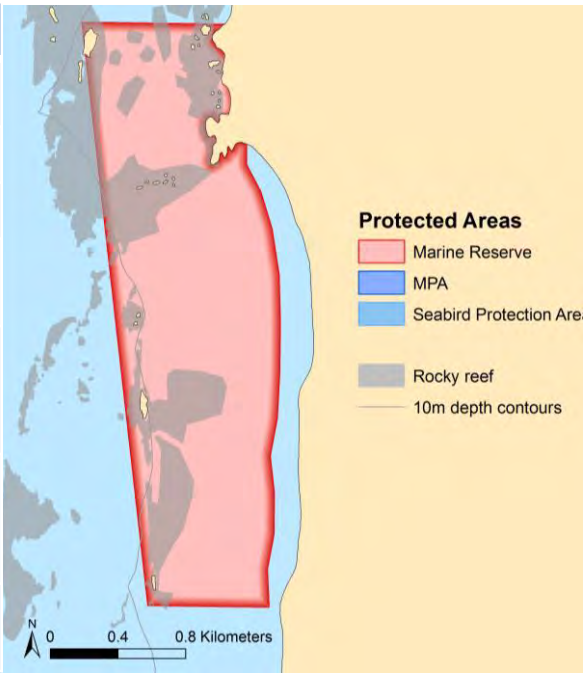
Urchin and Abalone Surveys

ODFW's Shellfish Program conducts surveys in Redfish Rocks. These surveys consist of belt transects where all urchin and abalone species are counted and measured.

Fishtracker Telemetric Movement Study

In collaboration with the Department of Fisheries and Wildlife at OSU and local fishermen, this project studies the movement patterns of the fishes in the reserve and MPA.

Monitoring Began	2010
Closure Date	January 1, 2012
Size	3.0km^2 (1.2mi^2)
Depth Range	0–18m
Habitat Connectivity	Rocky habitats extend beyond reserve
Fishing Pressure	Relatively low fishing pressure due limited rocky reef and shallow depths
Habitats Present	Emergent rocks, bedrock and boulders, patches of kelp beds, extensive areas of soft bottom, and bands of sand dollar beds
Comparison Area(s)	Cape Foulweather



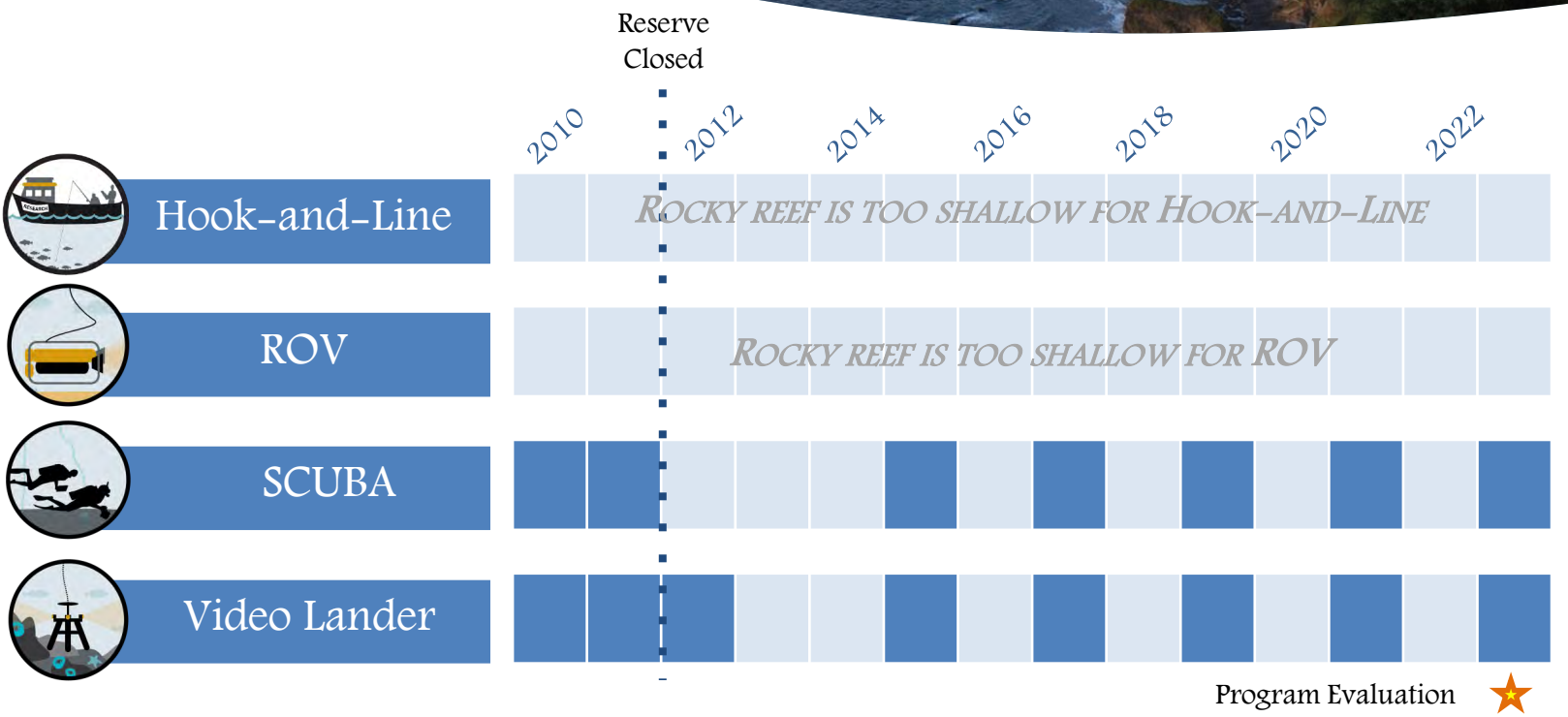
WHAT MAKES OTTER ROCK UNIQUE?

Scientific Training Ground

The Otter Rock Marine Reserve provides local scientists with the perfect training ground to try out new approaches, hone skills, and learn more about coastal ecosystems in general. Volunteer science divers train in this area, the Marine Reserves Ecological Monitoring team conducts method refinement pilot studies here, and Oregon State University conducts juvenile rockfish settlement studies in this reserve.

Design and Placement Matter

Otter Rock Marine Reserve is the smallest of the five marine reserves. This small, shallow, reserve can be viewed easily from shore. However, its small size, shallow depth, and limited rocky habitat make a reserve effect unlikely due to the limited fishing activity that occurred in this area prior to closure. Although we may anticipate minimal changes in the reserve compared to open fished areas, this area is an important site for long-term data collection to track how this community changes through time in a before-after comparison and to track changes in the nearshore environments of Oregon at large.



COLLABORATIVE MONITORING EFFORTS

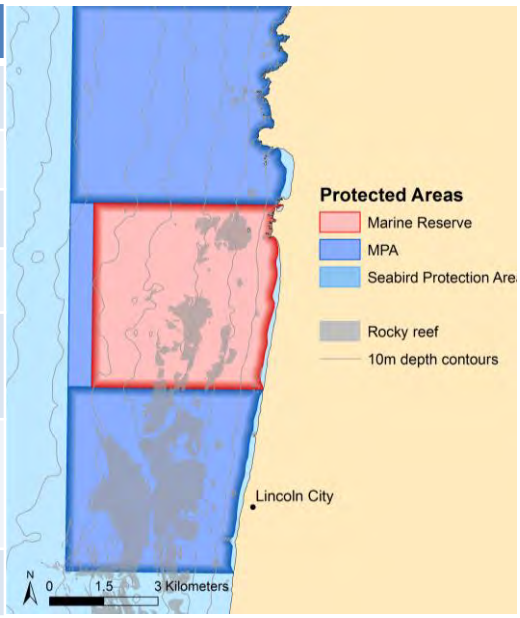
SMURFs

SMURFs are designed to quantify abundance and diversity of larval fishes and pelagic juvenile fishes settling to nearshore habitats. SMURF sampling began in 2011 in the reserve and Cape Foulweather Comparison Area and will continue annually every two weeks from April – September.

Intertidal Surveys

Long-term biodiversity and abundance plots were established in July 2015 within Otter Rock Marine Reserve by MARINe researchers from Dr. Pete Raimondi's laboratory at University of California Santa Cruz. These permanent plots will be re-sampled through time every 4-5 years using methods identical to those being used at over 100 sites along the west coast. Additionally, sea star wasting surveys are ongoing in this intertidal habitat.

Monitoring Began	2012
Closure Date	January 1, 2014
Size	25.1km^2 (9.7mi^2); MPAs: 59.7km^2 (23.1mi^2)
Depth Range	0-50m
Habitat Connectivity	Rocky reef habitats extend beyond reserve
Fishing Pressure	Relatively high fishing pressure due to active local fishery
Habitats Present	Emergent rocks, large boulders and flat bedrock extending out into deeper waters with soft bottom habitats in shallower areas
Comparison Areas	Schooner Creek and Cavalier



WHAT MAKES CASCADE HEAD UNIQUE?

Active Local Fishery

The Siletz Reef tract in the Cascade Head area is known as a premier fishing destination for recreational, charter, and commercial boats hailing out of Depoe Bay. The Siletz Reef spans the marine reserve and comparison areas to the south which allows for the direct comparison of effects on reef communities with the removal of extractive pressure.

Design and Placement Matter

Cascade Head Marine Reserve is considered well-placed as it incorporates complex habitat in an area of known fishing pressure. The boundary of the reserve encompasses a variety of habitats and depths allowing for the protection of a multitude of previously harvested fish species. The northern section of Siletz Reef is enclosed within the marine reserve and extends south into the MPA. Due to these unique attributes of Cascade Head Marine Reserve, we can readily employ a BACI (Before-After-Control-Impact) study design to evaluate how marine organisms respond to reserve protection (cessation of fishing) compared to areas still open to fishing.

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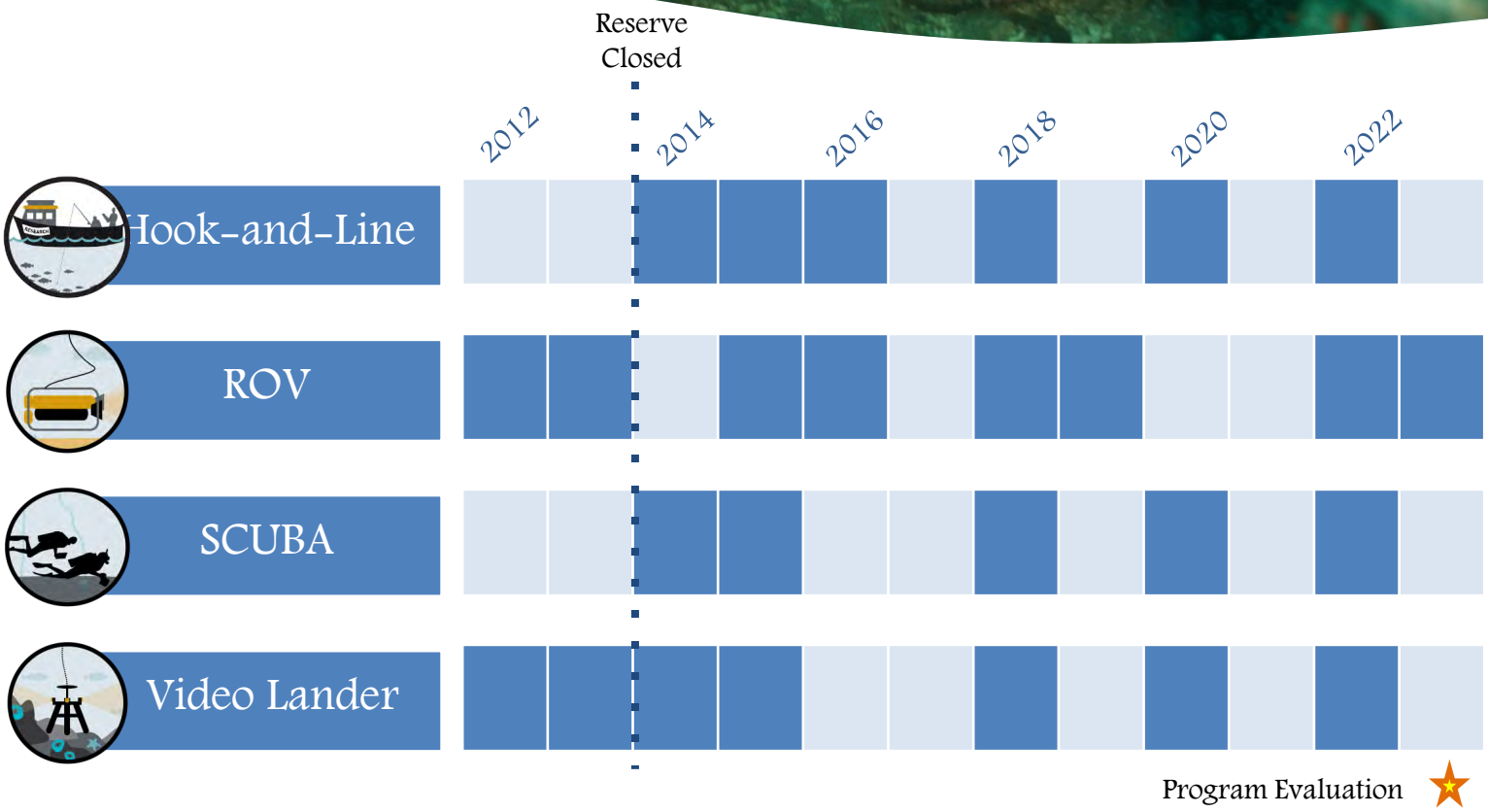
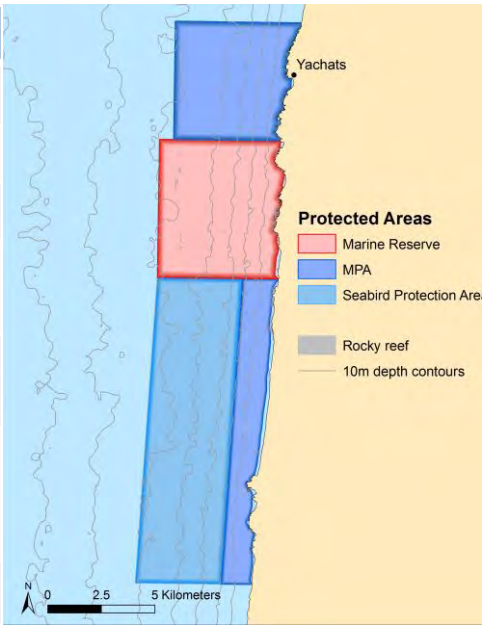


COLLABORATIVE MONITORING EFFORTS

Intertidal Surveys

Long-term biodiversity and abundance plots were established in July 2015 within Cascade Head Marine Reserve by MARINe researchers from Dr. Pete Raimondi's laboratory at University of California Santa Cruz. These permanent plots will be re-sampled through time every 4-5 years using methods identical to those being used in over 100 sites along the west coast. Additionally, sea star wasting surveys are ongoing in this intertidal habitat.

Monitoring Began	2012
Closure Date	January 1, 2014
Size	36.5km^2 (14.1mi^2); MPAs 48.7km^2 (18.8mi^2)
Depth Range	0–55m
Habitats Present	Mostly soft sediments with a small, low-relief rocky reef in deeper water
Habitat Connectivity	Isolated rocky reef entirely contained within reserve
Fishing Pressure	Low fishing pressure on reef due to distance from port and limited habitat; popular crabbing grounds on soft sediments
Comparison Areas	Seal Rock and Tokatee



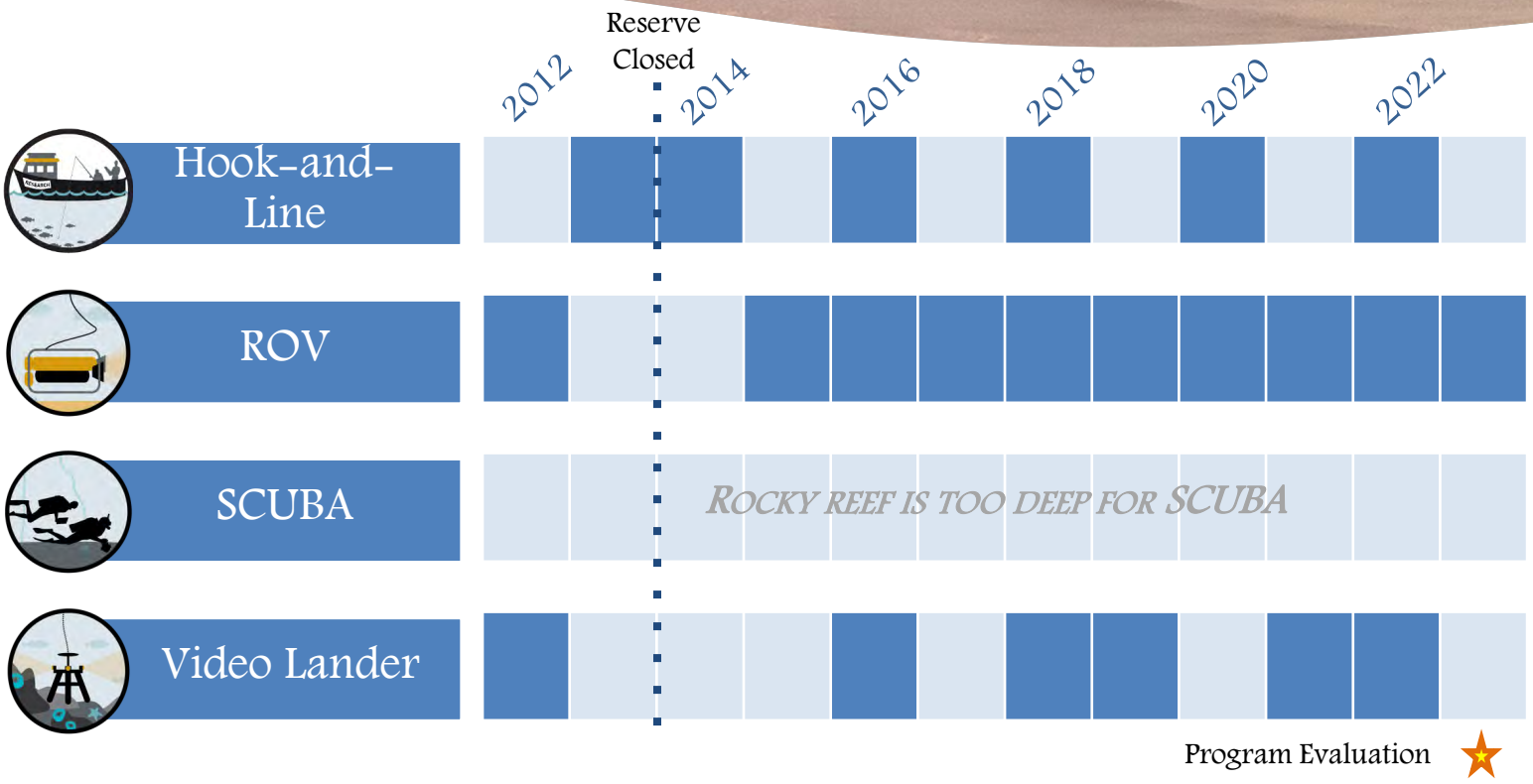
WHAT MAKES CAPE PERPETUA UNIQUE?

Long-term Research Hotspot

Compared to other areas along the Oregon coast, the rocky intertidal habitats in Cape Perpetua Marine Reserve are a hotspot of biodiversity. Researchers have been monitoring the dynamics and species of this intertidal habitat for decades. The waters around Cape Perpetua experience episodic hypoxia (low oxygen) and acidification (low pH) associated with strong summer upwelling activity. These oceanographic events are considered indicators of climate change and make this an extremely unique research site to investigate how changes in seawater chemistry can impact marine life.

Design and Placement Matter

Cape Perpetua Marine Reserve contains a deep, isolated rocky reef unique to the area. Since there is no nearby rocky reef habitat that is at a similar depth with comparable oceanographic conditions and fishing pressure, we will explore how this isolated community changes through time in a before-after comparison. Additionally, we will determine how these trajectories of change compare to other, albeit shallower, rocky habitats in the surrounding area.



COLLABORATIVE MONITORING EFFORTS

Hypoxia-Ecology Study

Since 2002, ODFW scientists using their ROV and oceanographers from Oregon State University (OSU) have been investigating the impacts of hypoxia on the rocky reef communities in this area.

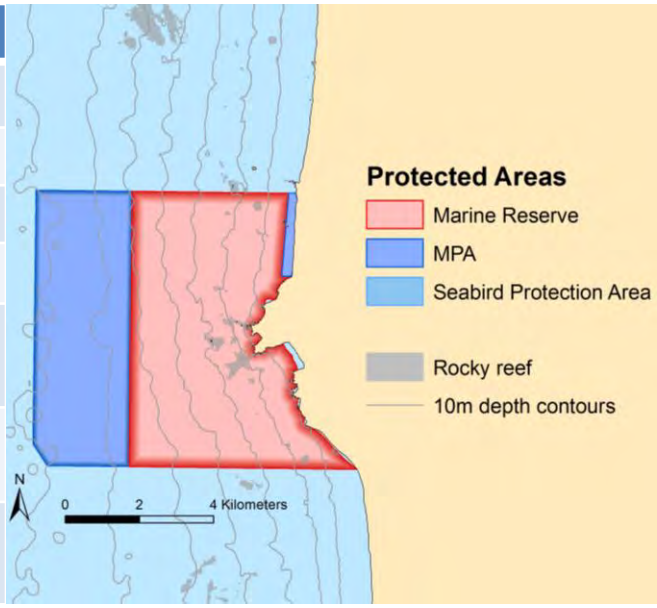
Oceanographic Surveys

Oceanographic surveys have been conducted at Cape Perpetua since early 2000s and will continue to be conducted based on funding.

Intertidal Surveys

Since the early 1990's PISCO researchers from Bruce Menge's laboratory at OSU have conducted intertidal surveys in this area at sites like Strawberry Hill and Bob Creek. These ongoing surveys provide long-term datasets that inform our monitoring of the rocky intertidal.

Monitoring Began	2014
Closure Date	January 1, 2016
Size	32.0km^2 (12.4mi^2); MPAs 19.7km^2 (7.6mi^2)
Depth Range	0–55m
Habitat Connectivity	Small, isolated, low-relief rocky reef
Fishing Pressure	Relatively low fishing pressure due to distance from port and habitats present
Habitats Present	Mostly soft sediments with isolated rocky reef
Comparison Area(s)	No area with comparable habitat and fishing pressure



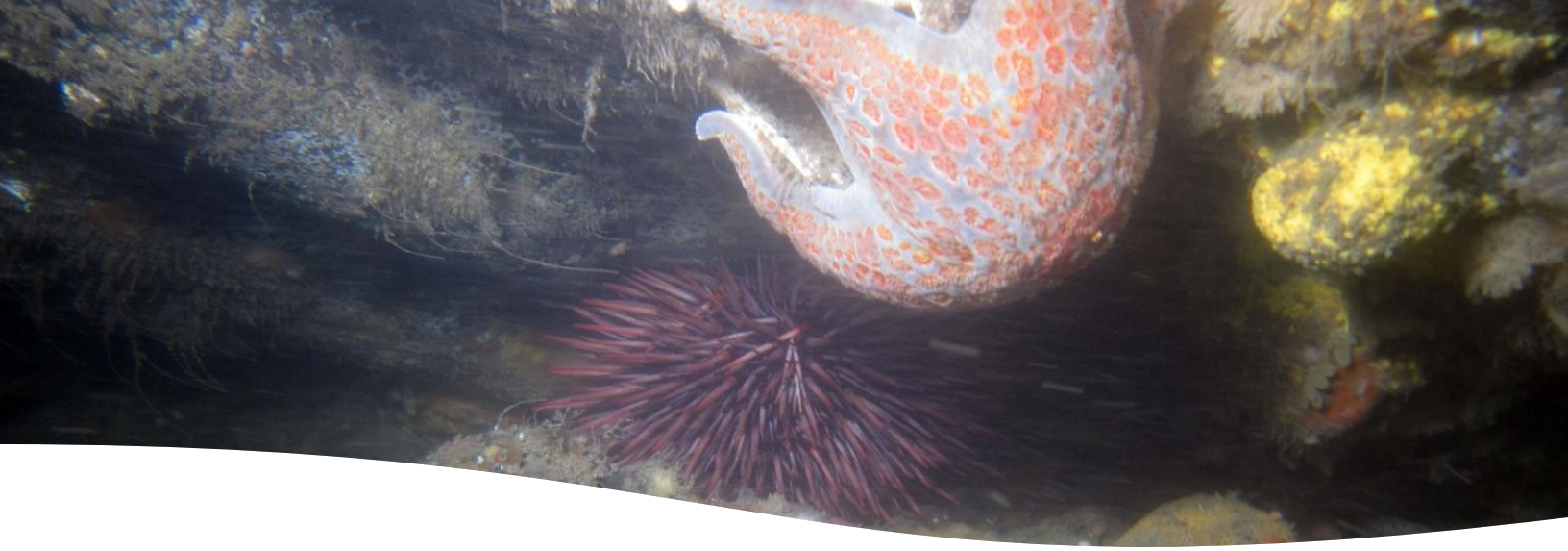
WHAT MAKES CAPE FALCON UNIQUE?

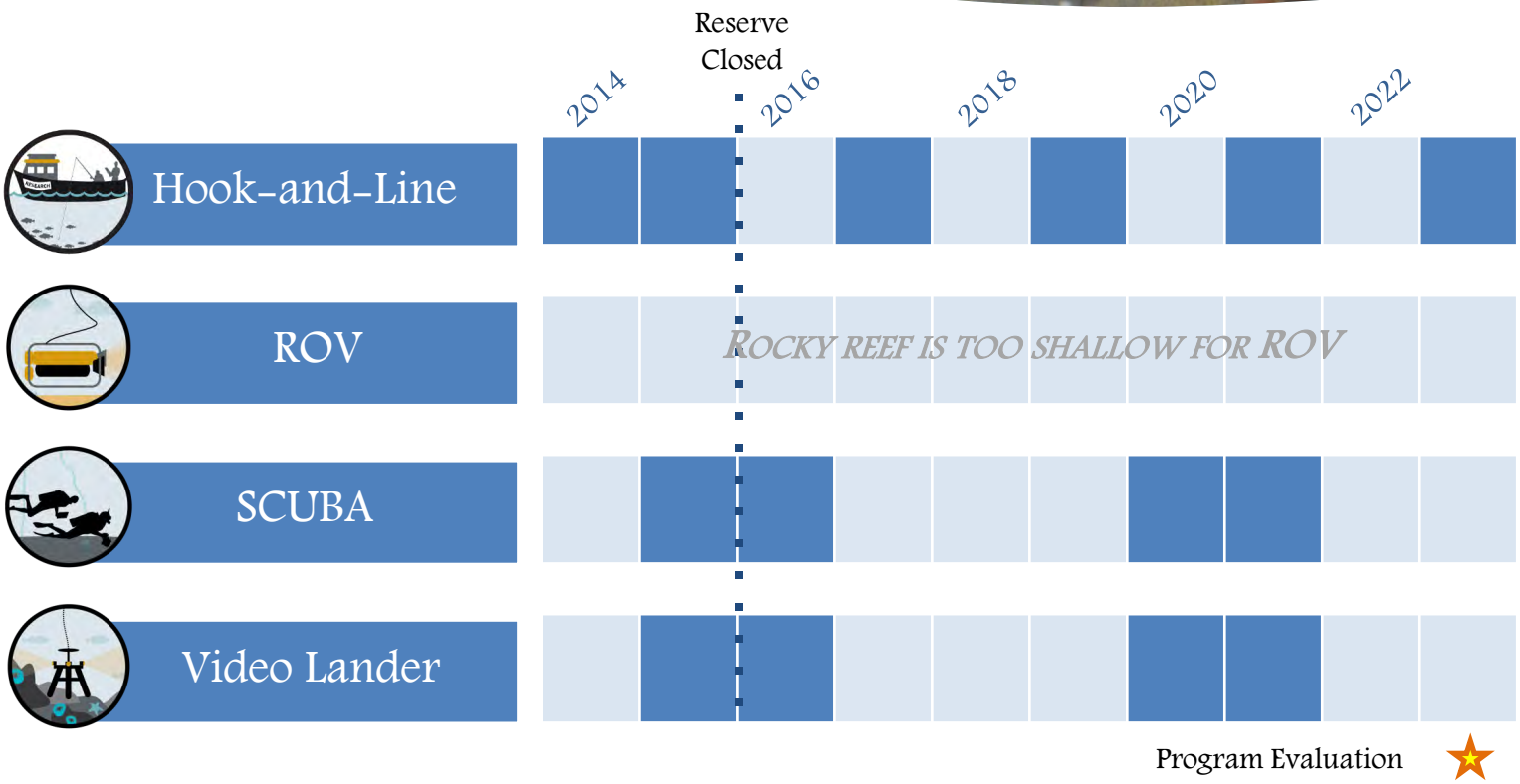
Design and Placement Matter

Due to these unique attributes, the sampling approach for Cape Falcon entails surveying numerous small reefs along a gradient of fishing pressure. The reefs within the reserve represent light fishing pressure, while the patch reef immediately north and south of the reserve boundaries as well as reefs closer to the port of Garibaldi experience higher levels of extraction. We will evaluate change over time along this gradient to explore how levels of extractive pressure influence rates of change in rocky reef marine communities.

Fishing Pressure

Cape Falcon Marine Reserve is located north of the port of Garibaldi. The Cape Falcon Marine Reserve is not a highly fished area historically for rocky reef fish. Three Arch Rocks, located south of Cape Mears, has had the highest fishing pressure for the area. Light crabbing occurs in the sandy habitats of the reserve. As total extractive pressure on this marine reserve is considered light, we anticipate little change over time in the marine communities due to the cessation of fishing.





COLLABORATIVE MONITORING EFFORTS

Currently there are no supplemental monitoring efforts being conducted in this area.

Future research and monitoring activities are currently being explored to sample the soft sediment habitats within Cape Falcon Marine Reserve.

OREGON
MARINE RESERVES
2015

OREGON
Fish & Wildlife

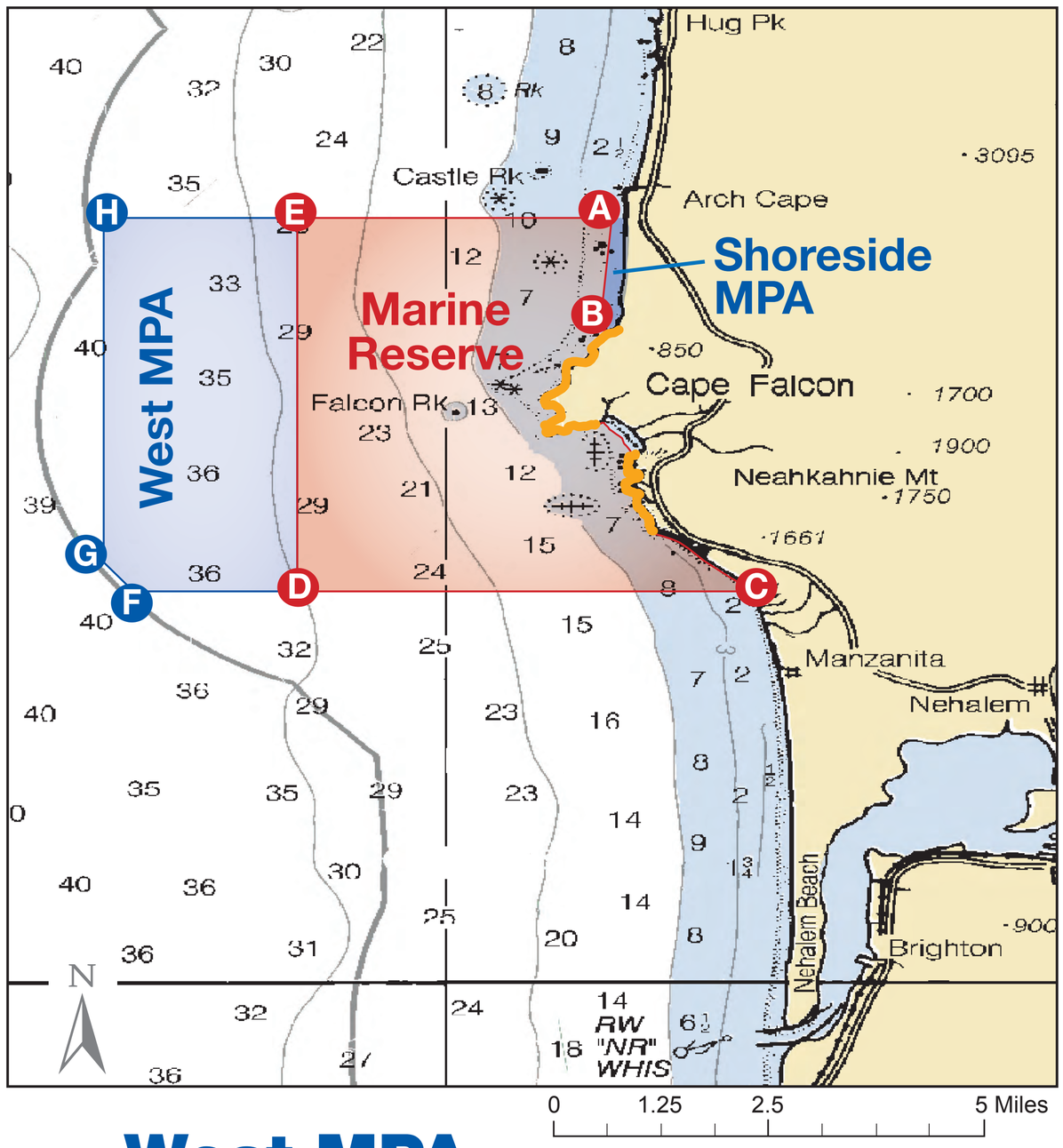
Attachment 309-1-6

Harvest Restrictions

Cape Falcon

Effective Jan. 1, 2016

Marine Reserve and Marine Protected Areas (MPA)



Marine Reserve

NO

- Take of any fish, invertebrates, seaweed or wildlife
- Deployment of any fishing gea

You Can

- Remove fishing gear that has drifted into th area (call Oregon State Police for permission)
- Transit with catch onboard

Shoreside MPA

NO

- Take of any fish, invertebrates, seaweeds o wildlife except:

You Can

- Recreationally use hook and line from the shore
- Participate in all legal take, not otherwise restricted, above the low tide line

Shoreline Area

NO

- Take of invertebrates, seaweeds or wildlife living on shore in areas marked orange

You Can

- Take of species living on shore in areas not marked orange, above the low tide line

West MPA

NO

- Take of any fish, invertebrates seaweeds or wildlife except:

You Can

- Take crab
- Take salmon by troll

Point	Latitude	Longitude
A	45°48.00'	-123°58.10'
B	45°46.80'	-123°58.17'
C	45°44.00'	-123°56.77'
D	45°44.00'	-124°01.50'
E	45°48.00'	-124°01.50'
F	45°44.00'	-124°03.19'
G	45°44.31'	-124°03.50'
H	45°48.00'	-124°03.50'

This summary does not replace the official regulatory language ound in the Oregon Administrative Rules. Please consult the complete text of the regulations in OAR 635-012 (ODFW), OAR 141-142 (DSL) and OAR 736-029 (OPRD).
To report violations please call OSP dispatch 1-800-452-7888.
For any take not specified please consult the current fishing regulation or call ODFW 541-867-4741.

www.oregonocean.info/marinereserves

OREGON DEPARTMENT OF FISH AND WILDLIFE

OREGON Fish & Wildlife

Attachment 309-1-7

Oregon
Kate Brown, Governor

Oregon Coastal Management Program
Department of Land Conservation and Development
635 Capitol Street, Suite 150
Salem, Oregon 97301-2540
Phone (503) 373-0050
FAX (503) 378-6033
http://www.oregon.gov/LCD/OCMP

Notice of Routine Program Change

From the OREGON COASTAL MANAGEMENT PROGRAM
of the OREGON DEPARTMENT OF LAND CONSERVATION & DEVELOPMENT

DATE: JULY 28, 2015

NOTICE: Pursuant to 15 CFR Section 923.84 (federal Coastal Zone Management Act regulations), notice is hereby given that the Oregon Department of Land Conservation & Development (DLCD) has submitted a routine program change request to the federal Office for Coastal Management (OCM). The request seeks to incorporate the **Geographic Location Description (GLD) and update the Table 7 – Federal Licenses and Permits Subject to Federal Consistency Review** into the federally-approved Oregon Coastal Management Program (OCMP).

DLCD has determined that these updates constitute a routine program change to DLCD's federally-approved coastal management program because the action does not make any substantial change to any enforceable policies or authorities related to: (1) uses subject to management; (2) special management areas; (3) boundaries; (4) authorities and organization; or (5) coordination, public involvement and national interest. DLCD has requested that OCM concur with this determination.

ADDITIONAL INFORMATION: Additional information and related documents are available on the OCMP website at: http://www.oregon.gov/LCD/OCMP/PublicNotice_Intro.shtml

COMMENTS: Comments regarding whether this program modification does or does not constitute a routine program change may be submitted to OCM within three weeks of the date of this notice. Please send all notices to:

Ms. Joelle Gore
Office for Coastal Management
Chief, Stewardship Division
1305 East-West Highway
SSMC4, Room 10622
Silver Spring, MD 20910

If you have questions regarding this notice, please contact DLCD at 503-934-0029.