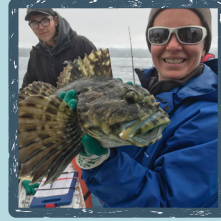




SPIRIT OF DISCOVERY

HIGHLIGHTS FROM CAPE PERPETUA ECOLOGICAL MONITORING



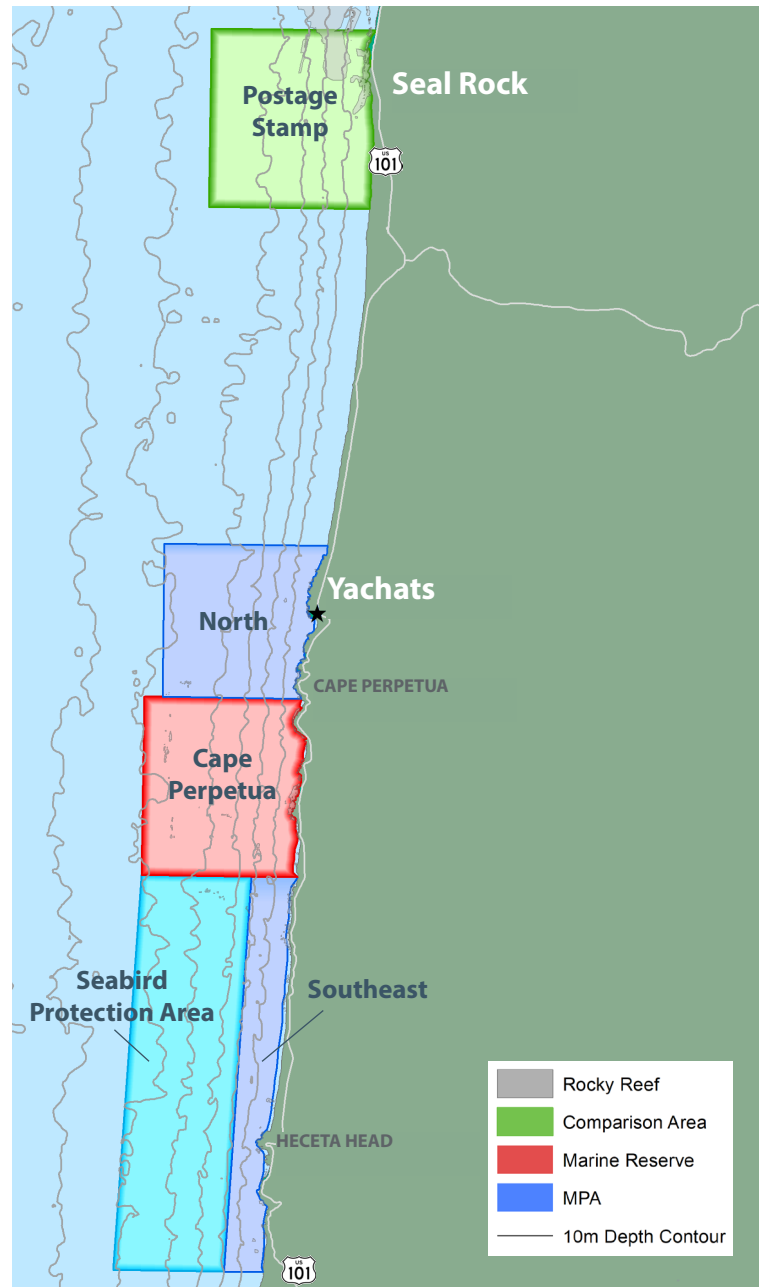
WHAT MAKES CAPE PERPETUA UNIQUE?

The Cape Perpetua Marine Reserve is Oregon's largest marine reserve at 37 km² and is located between the towns of Yachats and Florence. The site also includes two MPAs and a Seabird Protection area, which encompass an additional 49 km². Researchers have been monitoring the oceanographic conditions and intertidal habitats here for decades, well before the reserve was established in 2014.

The ocean waters around Cape Perpetua experience episodes of 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 ocean changes impact marine life.

The Cape Perpetua Marine Reserve hosts some of the most biologically diverse rocky intertidal areas anywhere in the Pacific Northwest. The reserve also has the smallest percentage of rocky habitat compared to Oregon's other reserves. This is a deep, isolated rocky reef with no similar habitat in the nearby area. Prior to closure, there was regular crabbing in sandy habitats and moderate fishing for groundfish.

ODFW tailors the research tools used for monitoring at Cape Perpetua based on the site's unique characteristics. Since there is no nearby rocky reef habitat that is at a similar depth with comparable oceanographic conditions and fishing pressure, our sampling explores how this isolated biological community changes through time. We are also sampling outside the reserve, in shallower rocky habitats near Seal Rock, to see if any changes we're seeing at the reserve are also happening elsewhere - an indication of larger ocean changes occurring.



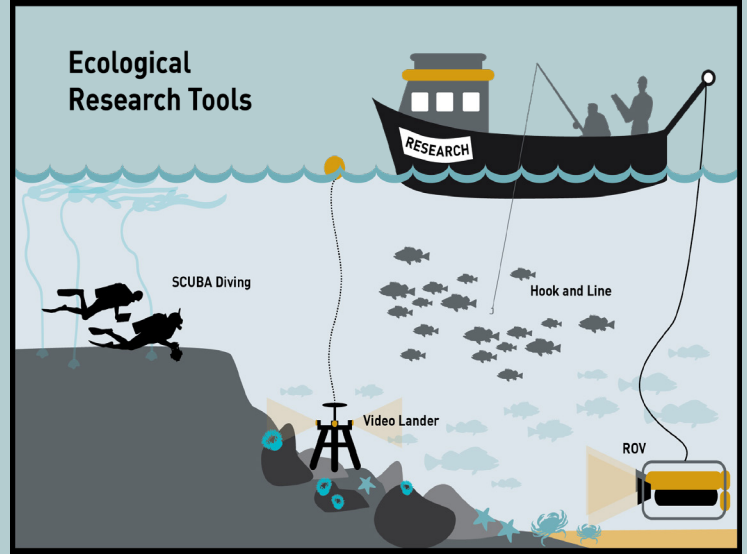
WHAT, HOW, AND WHEN DO WE MONITOR AT CAPE PERPETUA?

WHAT?

We are monitoring five components of the marine ecosystem and looking to see if or how they change over time. We are monitoring fish, invertebrates, macroalgae, habitats, and oceanographic conditions.

HOW?

To monitor ecological changes over time we are using several monitoring tools. These include hook and line surveys and Remotely Operated Vehicle (ROV) surveys. We do not use the video landers or SCUBA divers at Cape Perpetua because the site is too limited and deep for these tools.



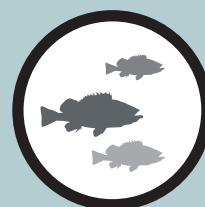
Invertebrates



Habitat



Macroalgae



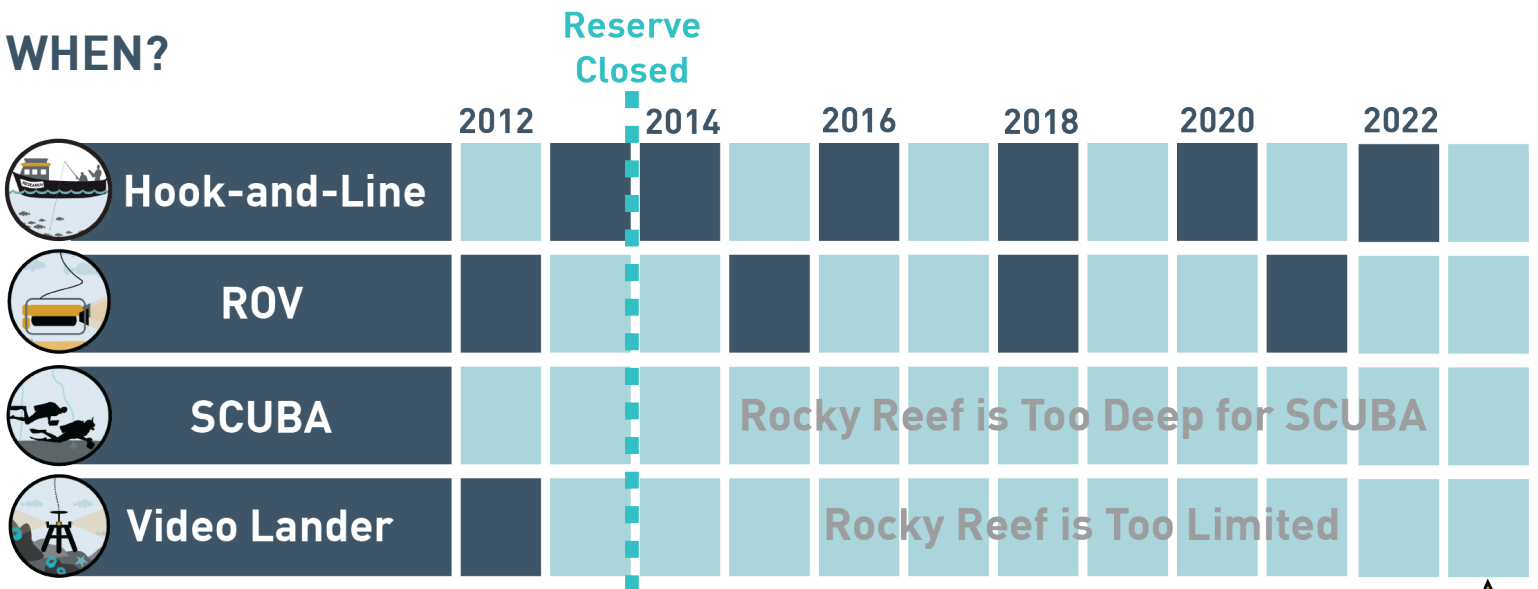
Fish



Oceanographic

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

WHEN?



Program Evaluation ★

CAPE PERPETUA HOOK-AND-LINE HIGHLIGHTS

4 Years Surveyed



2013-- 9 days
2014-- 8 days
2016-- 8 days
2018-- 8 days

→ **33** Trips
278 Volunteer Anglers

5,019 Fish Caught:
18 Species from
4 Families

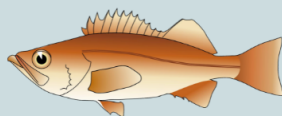
RECORD **LARGEST** and **smallest** catches from Cape Perpetua



BLACK ROCKFISH
minimum: 16 cm (6 in)
maximum: 59 cm (23 in)



BLUE ROCKFISH
minimum: 13 cm (5 in)
maximum: 37cm (19 in)



BOCCACIO
25 cm (10 in)



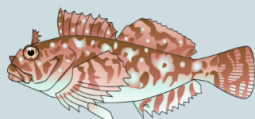
BROWN IRISH LORD
15 cm (6 in)



BROWN ROCKFISH
minimum: 33 cm (13 in)
maximum: 46cm (18 in)



BUFFALO SCULPIN
minimum: 19 cm (7 in)
maximum: 37 cm (15 in)



CABEZON
minimum: 36 cm (14 in)
maximum: 73 cm (29 in)



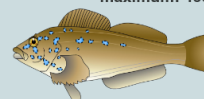
CANARY ROCKFISH
minimum: 14 cm (6 in)
maximum: 51 cm (20 in)



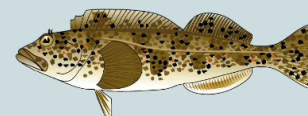
COPPER ROCKFISH
minimum: 24 cm (9 in)
maximum: 51 cm (20 in)



DEACON ROCKFISH
minimum: 21 cm (8 in)
maximum: 42 cm (17 in)



KELP GREENLING
minimum: 23 cm (9 in)
maximum: 42 cm (17 in)



LINGCOD
minimum: 28 cm (11 in)
maximum: 101 cm (40 in)



PACIFIC STAGHORN SCULPIN
minimum: 21 cm (8 in)
maximum: 23 cm (9 in)



QUILLBACK ROCKFISH
minimum: 18 cm (7 in)
maximum: 54 cm (21 in)



SPOTTED RATFISH
46 cm (18 in)



TIGER ROCKFISH
41 cm (16 in)



YELLOWEYE ROCKFISH
minimum: 24 cm (9 in)
maximum: 69 cm (27 in)



YELLOWTAIL ROCKFISH
minimum: 16 cm (6 in)
maximum: 46 cm (18 in)



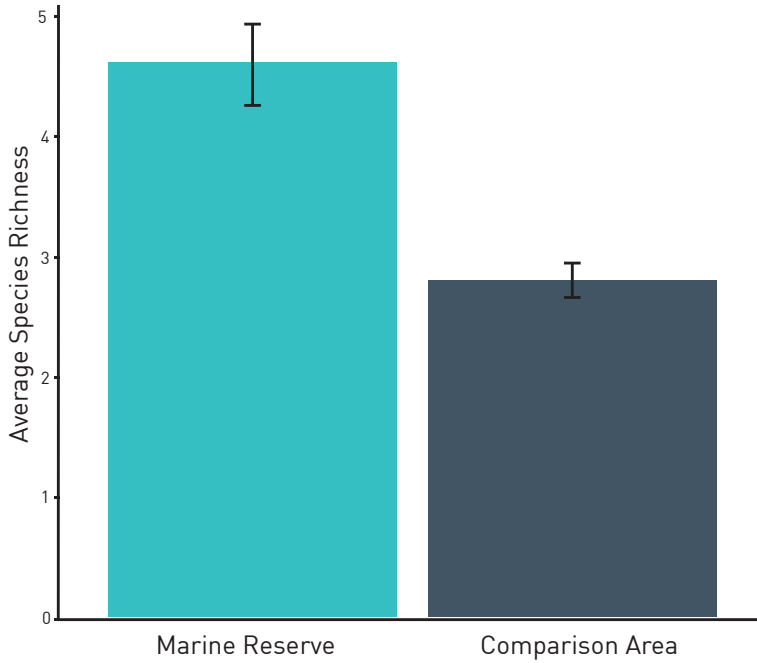
Fish graphics courtesy of the Oregon Coast Aquarium and Dr. Larry Allen (CSUN)

HOW MANY SPECIES WERE THERE?

WHAT SPECIES RICHNESS AND COMPOSITION TELL US

The graphs below summarize the average species richness (number of different species observed) and the catch composition for across the four years of monitoring in the reserves and comparison areas.

SPECIES RICHNESS



TAKEAWAYS

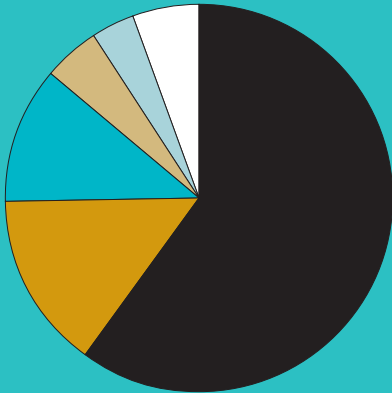
For the Marine Reserve and Comparison Areas:

- Species richness is higher in the marine reserve
- We find more canaries, lingcod and quillbacks in the marine reserve

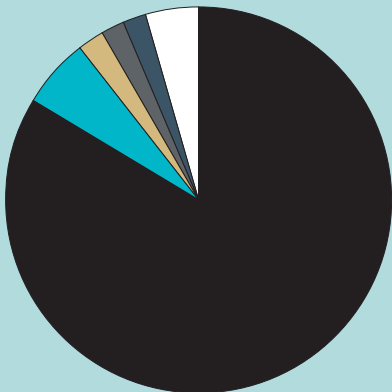


SPECIES COMPOSITION

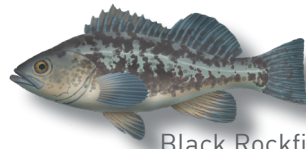
Marine Reserve



Comparison Areas



- Black Rockfish
- Canary
- Lingcod
- Yellowtail Rockfish
- Quillback
- Kelp Greenling
- Buffalo Sculpin
- Other



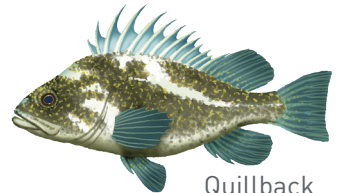
Black Rockfish



Yellowtail



Lingcod



Quillback



Kelp Greenling



Buffalo Sculpin

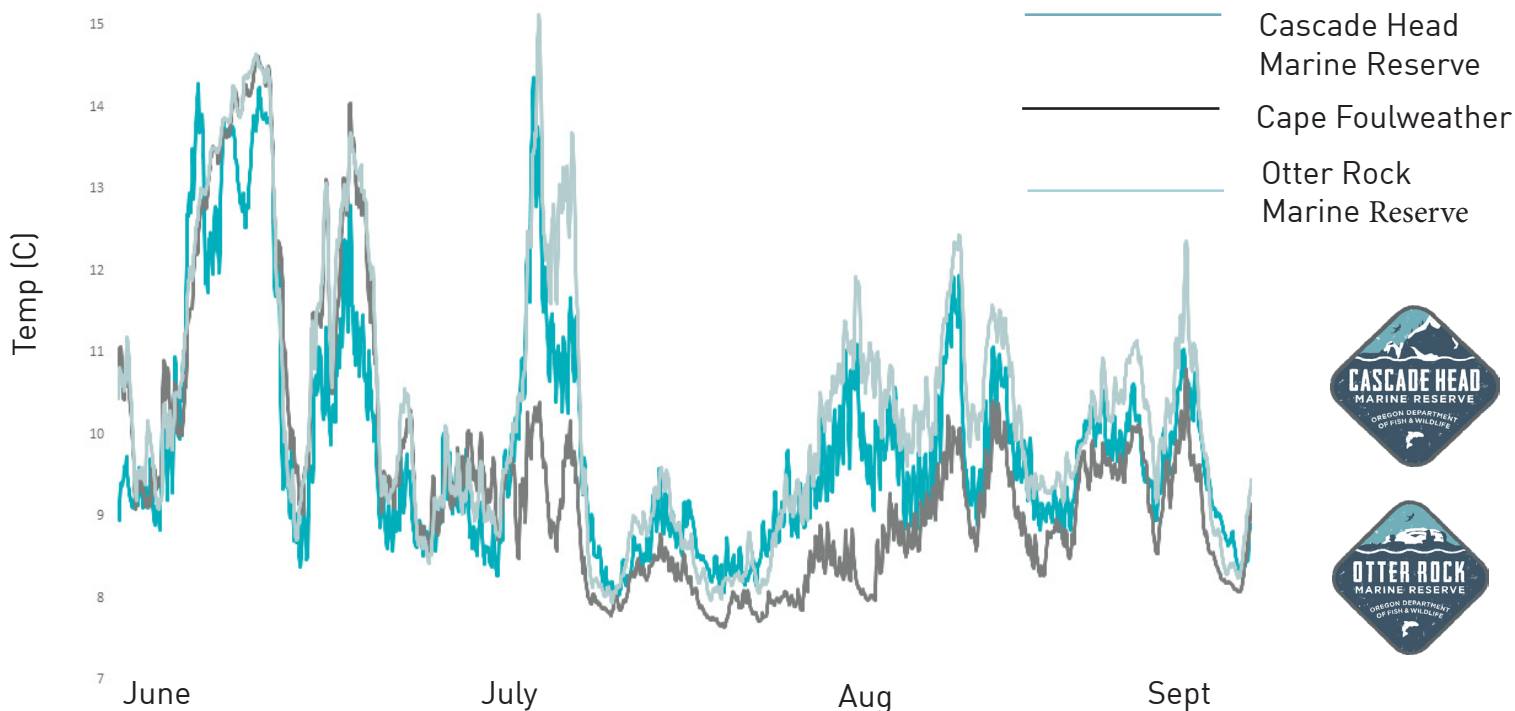


Canary

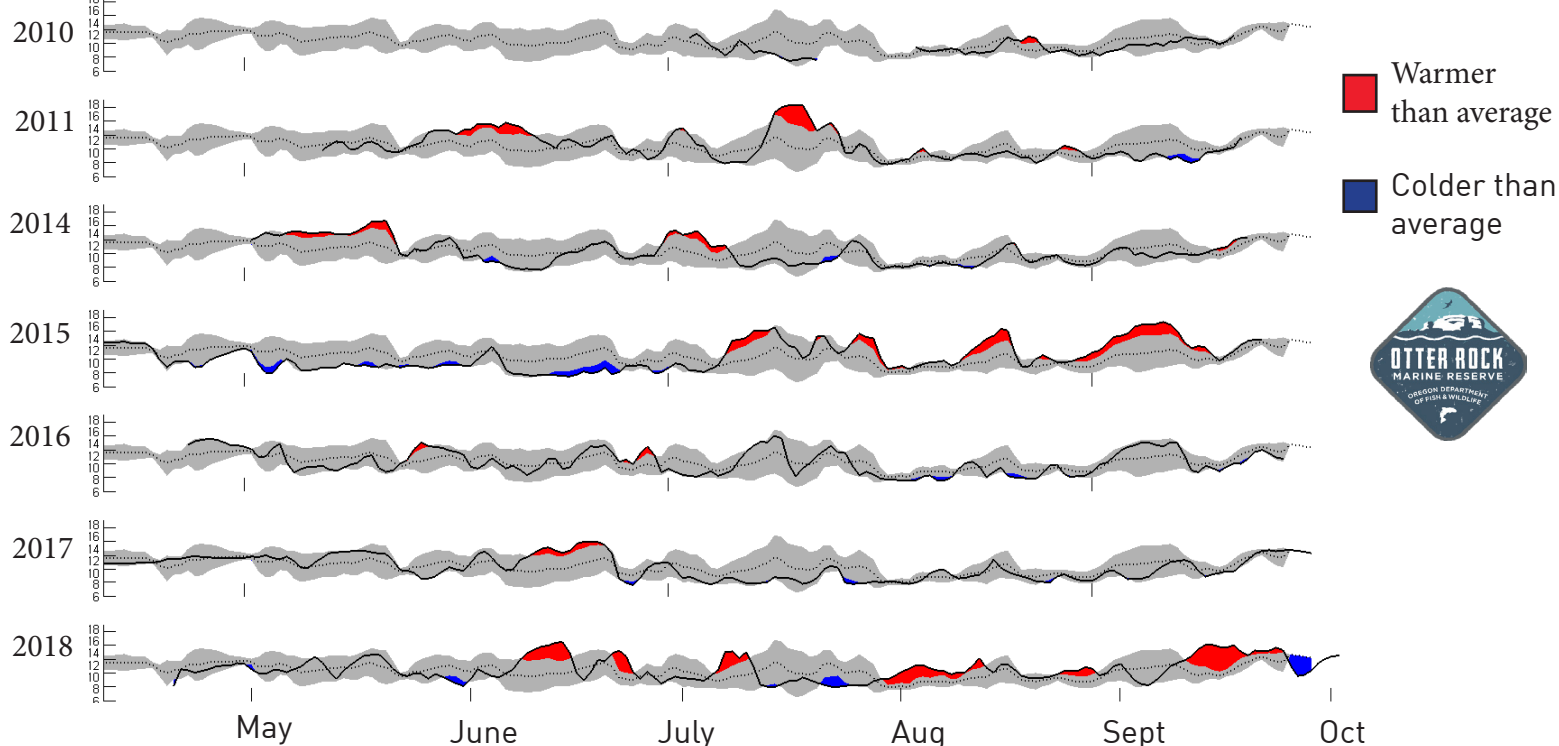
Fish graphics courtesy of the Oregon Coast Aquarium

PRELIMINARY OCEANOGRAPHY HIGHLIGHTS

HOW DID OCEAN TEMPERATURE VARY IN 2018?



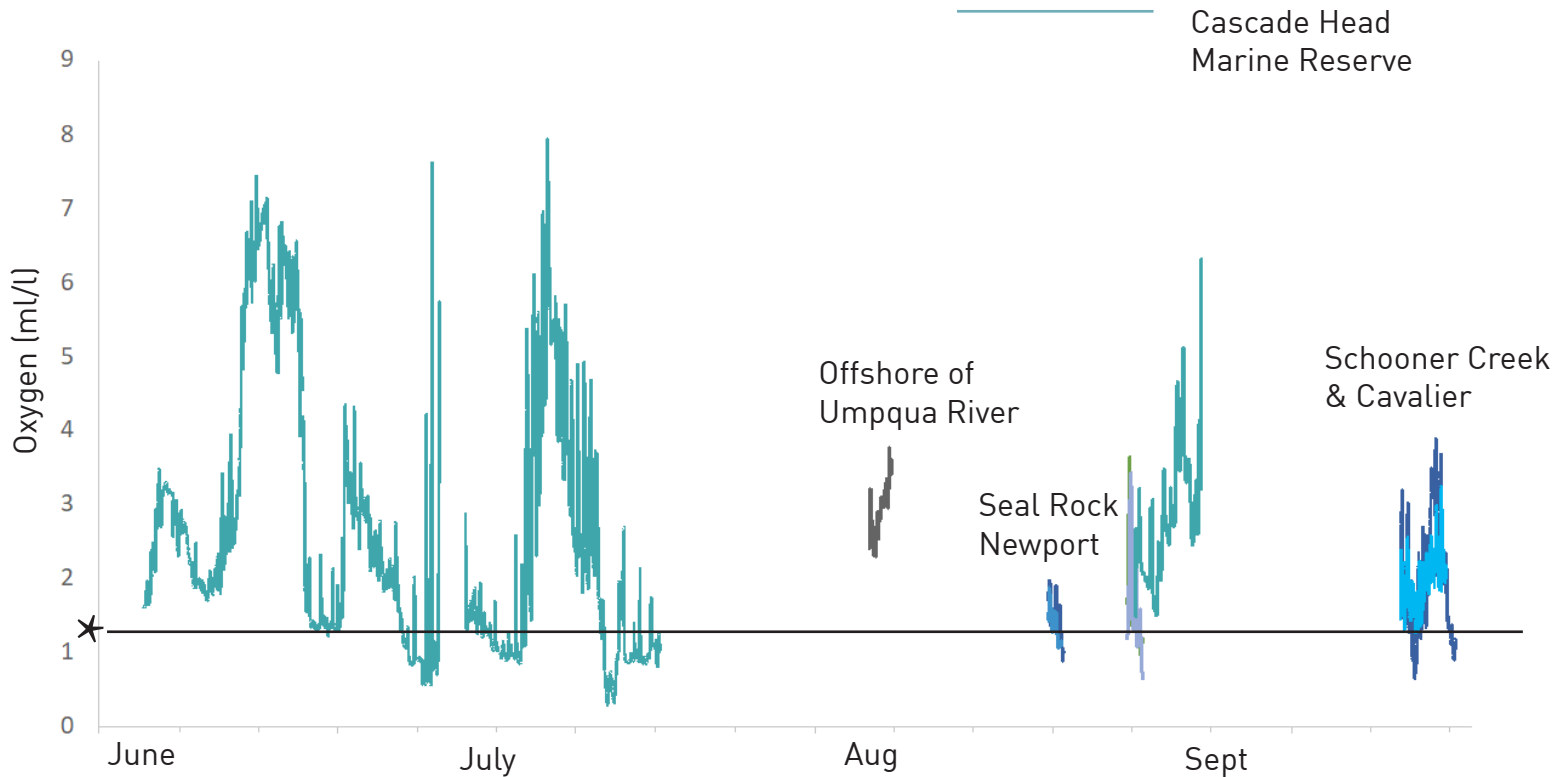
HOW DOES THIS YEAR COMPARE TO PREVIOUS YEARS AT OTTER ROCK?



TAKEAWAY: THIS YEAR APPEARS WARMER AT TIMES THAN AVERAGE AT OTTER ROCK MARINE RESERVE

PRELIMINARY OCEANOGRAPHY HIGHLIGHTS

DID WE SEE LOW OXYGEN LEVELS IN 2018?
COLLABORATIVE EFFORTS IN THE NEARSHORE HELP US
ANSWER THIS QUESTION



SUMMARY

We worked collaboratively with OSU to place oxygen sensors in the nearshore environment

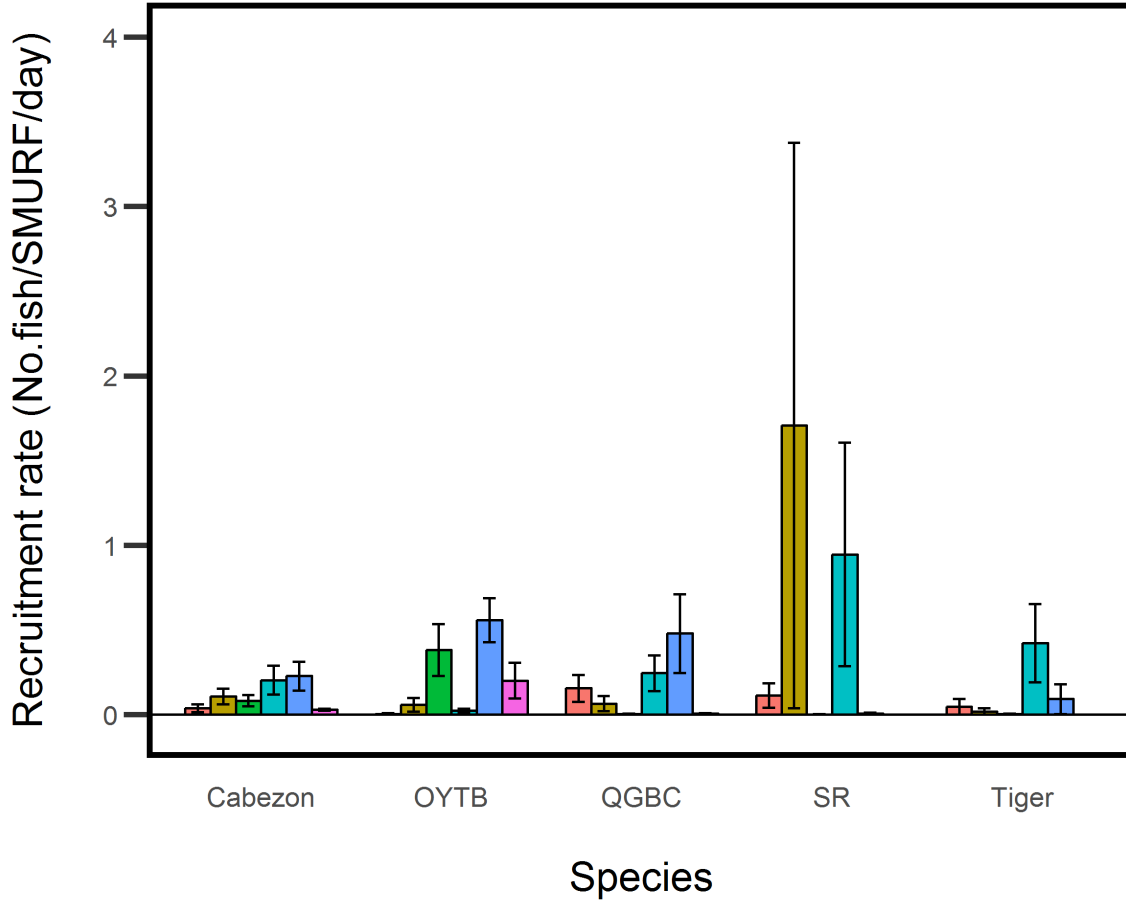
- Hypoxia occurs when oxygen levels drop below 1.4 ml/l
- Our sensor in Cascade Head was clogged with sediment for the month of August, therefore no data were available to report.
- Collaborative efforts along the coast provide a better understanding of changing oxygen levels in the nearshore.

TAKEAWAY:

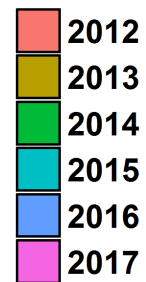
THESE EFFORTS HELP US TO UNDERSTAND HYPOXIA IN THE NEARSHORE

JUVENILE FISH (SMURF) RESEARCH UPDATE

DIFFERENT SPECIES, DIFFERENT PATTERNS DIFFERENT YEARS, DIFFERENT PATTERNS



Data summarized from Otter Rock Marine Reserve



OYTB = Olive, Yellowtail, Black Rockfishes

QGBC = Quillback, Gopher, Black and Yellow, Copper, China Rockfishes

SR = Splitnose, Redband Rockfish

SUMMARY

Recent summaries of juvenile fish (SMURF) data support the following:

- Different species have different recruitment patterns
- Cabezon have moderate recruitment that is relatively steady from year to year.
- Other species like the splitnose-redband complex tend to have boom and bust cycles.
- Patterns of recruitment vary over time.
- In total, 8,608 fishes have been collected in 6 years of research

TAKEAWAY: DIFFERENT SPECIES, DIFFERENT YEARS = DIFFERENT PATTERNS

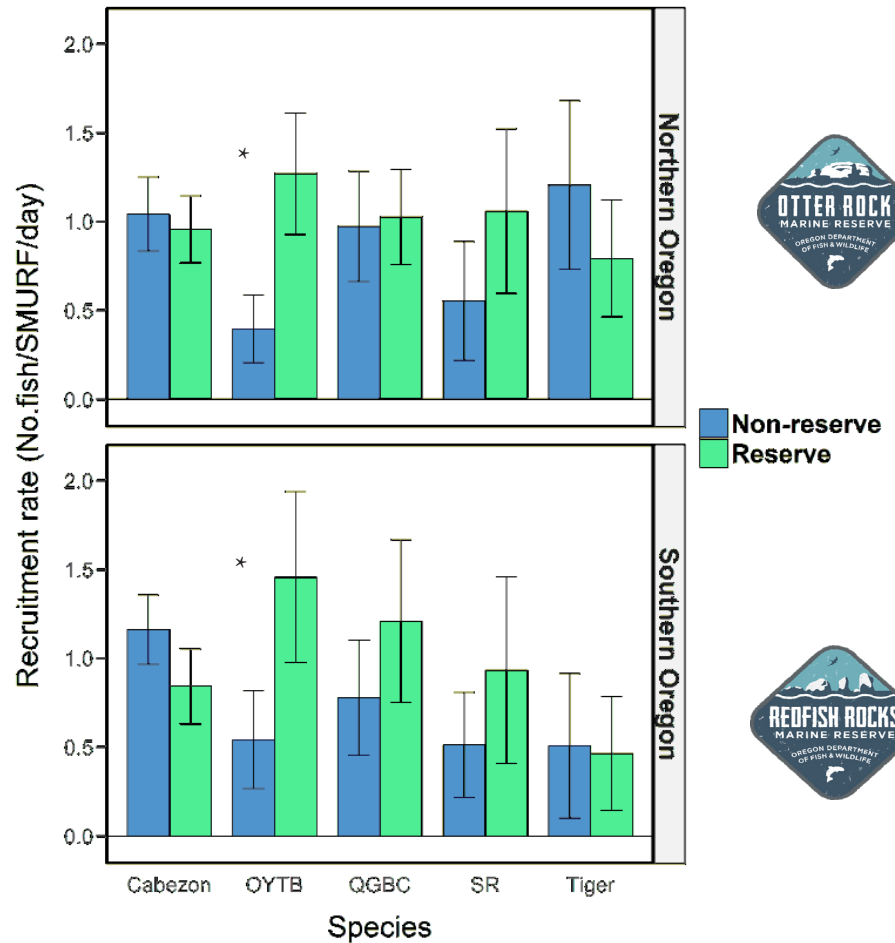
JUVENILE FISH (SMURF) RESEARCH UPDATE

DOES RECRUITMENT VARY INSIDE VS. OUTSIDE RESERVES? NO STRONG PATTERN HAS EMERGED

OYTB = Olive, Yellowtail,
Black Rockfishes

QGBC = Quillback, Gopher,
Black and Yellow,
Copper, China Rockfishes

SR = Splitnose, Redband Rockfishes



SUMMARY

Data were combined for all years, 2011-2017, to compare settlement inside marine reserves compared to comparison areas outside.

- Within each region, OYTB exhibit greater settlement to marine reserves than comparison areas
- Settlement of remaining taxa does not differ significantly between reserve and comparison areas.

TAKEAWAY: THERE IS NOT A STRONG PATTERN OF RECRUITMENT INSIDE COMPARED TO OUTSIDE MARINE RESERVES

CAPE PERPETUA ROV HIGHLIGHTS

3 Years Surveyed



2012 - 1
2015 - 3
2017 - 1

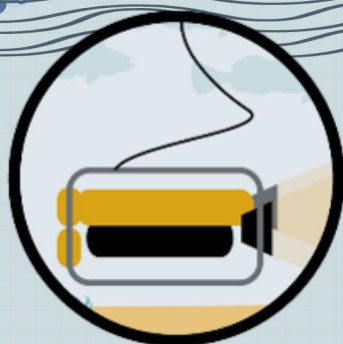
DAYS

ROV

13 Dives

10.5 Miles

8 Transects



2017 ONLY

818 Fish Observed:
11 Species

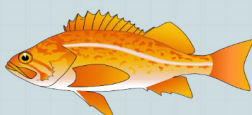
2017 ONLY

39,340 Inverts Observed:
49 Species

243 Black Rockfish



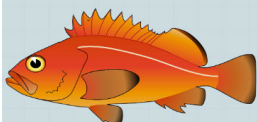
140 Canary Rockfish



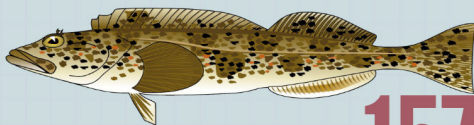
65 Quillback Rockfish



65 Yelloweye Rockfish



157 Lingcod



13,216 Burrowing Sea Cucumber



4,941 Giant Plumose Anemone



2,391 Blood Star



Basket Star 1,956



2,027 Dungeness Crab



TAKEAWAY: THE ROV PROVIDES VALUABLE DATA ON DEEP SUBTIDAL FISH AND NVERTEBRATE COMMUNITIES