

Intertidal and Off-shore island Ecosystems: “Marine Garden” **speaker notes**

These notes are for the presenter and include additional information not displayed on the slides. The speaker may include as much detail as they wish, these notes are provided so that the speaker can go in depth or answer questions about the interesting animals and plants shown in the presentation.

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Title slide

No additional notes

Slide 2: What is an ecosystem?

No additional notes

Slide 3: Intertidal zone ecosystem

The tides are based both on the gravitational pull from the moon and the sun, but more so the moon due to its proximity to the earth. *The side of the earth closest to the moon experiences high tide. This high tide also occurs on the side of the earth opposite the moon.*

In Oregon: mixed semi-diurnal tide means there are two high tides and two low tides each day and the high and low tides differ in height.

Annual, monthly and daily tidal fluctuations

ANNUAL: Annual differences occur because of the sun's position relative to the equator and distance from the earth. We get low lows in summer, high highs in winter

BIMONTHLY: A spring tide is caused by the lining up of the earth, moon and sun. These will cause the high high tides and low low tides.

BIMONTHLY: Neap tides occur when the sun and moon are at perpendicular angles to the earth. These will cause lower high tides and higher low tides.

DAILY: *The side of the earth closest to the moon experiences high tide. This high tide also occurs on the side of the earth opposite the moon.* Additionally, the side of the

earth closer to the moon will feel a stronger pull than the opposite side. This is why, in a single day, there is a higher high tide and a lower high tide.

Largest tide disparity is the Bay of Fundy: 53ft range

Slide 4: Oregon coast geology

Northern Oregon coasts are dominated by volcanic **basalt** rock formed from by volcanic eruptions 15 – 16 million years ago! In some places the basalt rock is 2 miles thick! Geologists call this rock formation “Columbia River Basalt Group.”

Basalt is very hard rock and erodes slower than most other kinds of rock. Volcanic rock often forms with natural hollows which can easily transform into tidal pools. Tide pools form in natural depressions, crevices, or basins formed by waves and wind eroding the rock over time. Example of volcanic rock type is Yaquina head, near Newport, OR.

Southern Oregon, near Bandon, the coast is made up of old **sedimentary** rock, some as old as 66 – 145 million years ago (Cretaceous period- when flowering plants evolution took off and dinosaurs dominated!)

Some south coast beaches are a mix of sedimentary rock: sand, volcanic ash, and river origin silt which was formed 25-30 million years and then uplifted from the Pacific Ocean tectonic plate movement.

Rock type influences the type of life that inhabits it, for example clams, sand dollars, and worms only inhabit areas that are rich in sediments.

Sources: Oregon state edu, Waterbury 2026

Slide 5: The tiny but mighty backbone of ocean ecosystems: plankton

Both the diatom and dinoflagellate are a kind of plankton

Slide 6: Influential winds

No additional speaker notes

Slide 7: Exploring the tidal zones

Here's an overview of the four tidal zones. Each is inhabited by a different set of creatures depending on their ability to withstand air, wind, and sunshine when the tide is out.

Splash Zone:

Just like it sounds: only wet in the splash of high tide.

Usually small limpets, snails and barnacles. Occasionally small crabs like Purple Shore Crabs.

Creatures that either have great ability to withstand drying-out, or can move to water when necessary.

High Tide Zone:

The zone covered only by the highest tides.

Creatures that can withstand extended periods out of water.

California mussels, acorn barnacles, chitons, seaweed, some urchins, hermit and shore crabs species, and few aggregating and giant green anemones (usually closed).

Mid-Tide Zone:

The zone which is exposed at low tides, about twice a day.

More anemones, some sea stars, mussels, barnacles, seaweed, urchins, and the occasional nudibranch.

These animals have less ability to withstand prolonged exposure, and usually a good ability to hold on tight to rocks in the crashing surf.

Low Tide Zone:

The zone exposed only at the lowest tides.

Open anemones, sea stars, urchins, fish, hermit crabs, nudibranchs. Very few barnacles, mussels, or (non-hermit) crabs.

These animals have minimal ability to withstand prolonged air exposure.

Slide 8 Forms of life: sessile, mobile, free swimming

Sessile animals must be especially resilient to harsh conditions because they cannot move to more ideal conditions and have to wait out things like exposure (outside the water), heat, wave power, etc.

Free swimming life could be harmed if they get trapped in a tidal pool during low tide and it is too low of water conditions or gets too warm.

As you go through the different tidal zones, think about which animals would be attached, mobile, or free swimming and what the advantages could be for each style.

Slide 9: low tide zone

Typical low tide zone: anemones, sea stars, urchins, fish, hermit crabs, nudibranchs. Very few barnacles, mussels, or (non-hermit) crabs.

Sea urchins, like their relatives sea stars, sea cucumbers, and sand dollars, do not have a brain or heart.

Sea urchins are found in rocky subtidal habitats up to 300 ft deep and generally avoid habitats with a lot of sand or mud.

Sea urchins eat seaweed and kelp, by holding onto them with their tube feet. They prefer bull or brown kelp, which is significant for reasons you will find out later in the presentation.

Originally scientists thought sea urchins lived up to 7-10 years old, but recent research in British Columbia by Canadian scientists found red sea urchins that were about 200 years old!

(Source: Aquarium of the Pacific 2026)

Opalescent nudibranchs only live for 1 year and are very territorial and will fight another nudibranch if they cross paths! (source: Monterey Bay Aquarium 2026)

Tube worms, krill, and shrimp are suspension feeders, eating small organic particles in the water

Slide 10: Nudibranchs “sea slugs”

Nudibranchs, sometimes called “sea slugs” eat hydroids and anemones, which have defensive nematocysts, stinging capsules. However, this does not harm the

nudibranchs and in fact they take their prey's weapon and incorporate it into their own defense system!

Their bright colors warn predators not to eat them the same way a Monarch butterfly's beautiful orange color warns predators not to eat it because it's poisonous. Bright colors in the animal kingdom can often be a signal of "don't bother to try to eat me, I'm not worth the trouble (you might die!)"

Often found on rocky shores, they are sensitive to pollution like from motor oils, paints, and other harmful materials.

(Source: Monterey Bay Aquarium 2026)

Slide 11: California sea hare

Hermaphroditic: have both male and female sex organs

Can lay up to 80 million eggs at a time

Live on rocky shores

When threatened they can release a dark purple "ink"

(Source: Monterey Bay Aquarium 2026)

Slide 12: More low tide free swimming animals

Gunnels

Saddleback gunnel fish inhabit bays and estuaries (where rivers meet the sea) often in mud, rocks, or in eelgrass or seaweed. They can be found in tides or up to 200 feet deep. They eat small mollusks, crustaceans, and worms. (Source Oregon coast aquarium 2026) Both males and females will guard eggs! (Source: Edmondsunderwaterpark.com)

Penpoint gunnel often like to camouflage in sea lettuce, eel grass or algae. They will hide under rocks. Fun fact: they can breathe air out of water when the tide goes out! They have a narrower habitat range than the saddleback, inhabiting intertidal ecosystems and only up to 65 feet deep. (Source: Edmondsunderwaterpark.com)

Hermit crab. There are 10 species of hermit crabs in Oregon, pacific hairy hermit crabs are the most common. Pacific hairy hermit crabs live in the intertidal zone and up to depths of 360 feet. They like rocky and silty habitats and are commonly found in tidal

pools. They mostly eat “**detritus**” aka **organic material** aka ‘**ocean recyclers**’ as well as seaweed. Female hermit crabs can carry up to 5 broods a year- a singly brood can have up to 660 eggs!! (Source: Oregon coast aquarium)

Think of animals that eat detritus as the vultures or fungi of the underwater world!

Slide 13: East pacific red octopus

Only species of octopus in Oregon. Octopus are amazing, intelligent animals that can change color to blend into their environment to avoid predators and hunt prey.

They have 3 hearts, 1 to circulate blood and the other 2 to pump blood through their 2 gills.

This species is often found on hard substrates like rocks, reefs, ship wreckage, or in bottles on sand or mud. They live in the intertidal zone, up to depths of 300 ft.

Often hide during the day to hunt at night.

They eat many things like clams, crabs, scallops, and even sea urchins.

They can inject venom into their prey to kill them and use their sharp beak to open shells.

They can release an ink “sepia” when threatened by predators (sea lions, seals, dolphins, whales, seabirds, sharks, fish, etc) (Source: Mexican Marine Life.org)

Slide 14: Cool as a cucumber

A lot of life that cannot take long periods of drying out or heat are found in the low tide zone, where they are covered with water most of the time. You won’t find cucumbers in the high tide zone! They are too soft, cool, and moist 😊

Sea cucumbers have a soft outer body wall covered in mucous and move with tub feet on the underside of the body.

Giant sea cucumbers are found in tidal pools and up to depths of more than 90 feet. They play an important ecological role in nutrient recycling (eat detritus) and oxygenating the sea floor sediment through the process of sifting through sediments for food. They eat organic detritus/ aka organic decaying life found in the sediment and they also burrow in the sediment. Their nutrient cycling can benefit the growth of microalgae, which in turn helps the cucumber since they will eat microalgae (detritus.) Sea cucumbers are a favorite food for sea stars and sea otters. (Source: CDFW 2026)

Stiff footed cucumbers inhabit low intertidal zones and up to depths of 180 feet, often areas with strong currents. They like to inhabit rocky crevices. Sea stars are their major predator. (source wallawalla.edu)

Slide 15 The “stars” of the low tide zone

Sea stars (generally)

- Are important predators of sea urchins (as well as historically sea otters which are no longer present in the area)
- Sea star wasting disease and climate change have been devastating for sea star populations and many are endangered because of it. This will be discussed in more detail later.
- Sea stars are also very sensitive to pollution.
- Sea stars have an eyespot at the end of each arm that can detect light.
- If they lose an arm, they can regrow it!
- When they want to digest food they “spit out” their stomach and digest the food externally.
- Ochre sea stars will be pictured/discussed in the mid tide zone (but are also present in the low tide zone.)

Bat stars

- Have 2 stomachs! They can even spit out their stomach into the water column like a net to catch microorganisms.
- Eat tunicate worms, other sea stars, algae, and decomposing organic matter
- Cover their body in a bad tasting mucus to ward off predators, which only works some of the time. Some of their predators include other sea stars, mollusks (like octopus), and crustaceans (like crabs)
- Bat stars can reproduce sexually or asexually, meaning they can make clones of themselves! They will guard their eggs under their bodies or between their arms until they hatch
- Can live to be 35 years old
- Bat stars are territorial and will “arm wrestle” other sea stars for prime space.
- (Source: National Marine Sanctuary Foundation)

Sunflower sea stars

- Largest sea stars (up to 3.3 feet), and they may also be the fastest.

- Mostly carnivorous, they will eat sea urchins (21-98% of their diet), fish, mussels, or crustaceans (barnacles or crabs). They have a very good sense of smell.
- They live in the intertidal zone, typically up to 394 feet deep, but they have been found up to depths of 1,427 feet!
- They can live from 20-65 years old.
- Decimated by sea star wasting disease ☹ More on this later.
- (Source: Aquarium of the Pacific)

Daisy brittle star

- More brittle star species than just the daisy (this one's scientific name is *Ophiopholis aculeata*)
- Inhabits rocky or lower intertidal zones, up to about 5,000 feet deep!
- They eat decaying organic matter, sometimes polychaete worms and small crustaceans
- (Source: Animaldiversity.org)

Morning sun stars

- Eat other sea stars, sea cucumbers, and nudibranchs. Sometimes sea urchins, or scaleworms
- Inhabit intertidal to depths of 1,358 feet! Usually on rocky bottoms, sometimes gravel or sand.
- (Source: wallawalla.edu)

Slide 16 Kelp crabs

Discuss camouflage as an adaptation. How does it benefit a species to blend in with its environment? (Prey vs predator, both use camouflage for different reasons.) Do you think these crabs are prey or predator?

6 species of kelp crab, 2 not pictured (foliate kelp crab and longhorn decorator crab rarely observed)

Red rock crabs (rock crab, not a kelp crab) are also in the low tide zone but are pictured/will be discussed later in the midtide zone.

Northern kelp crabs are part of a group of crabs called spider crabs

- Omnivorous meaning they eat both plants and animals, but they mostly eat algae and kelp. Sometimes scavenge, especially in the winter when there is less algae, on mussels, barnacles, and marine worms

- Live in intertidal systems, up to 246 feet deep
- (Source: National Marine Sanctuary Foundation)

Graceful kelp crabs

- are also omnivorous and will eat kelp or snails.
- Kelp and eel grass meadows are very important habitats. Eelgrass is especially important for juveniles (great for hiding when you are small and tasty!)
- Sometimes will hook setae on their shell for decoration (/camouflage) but they are “minimal” decorators, especially compared to their (relative) species like the decorator crab!
- (Source: Oregon Coast Aquarium)

Cryptic kelp crab are similar to graceful kelp crabs, they also live in kelp forests or eelgrass meadows and are omnivorous, eating algae, detritus, and small invertebrates. (Source: Monterescubaboard.com)

The sharpnose crab uses sponges and tunicates as decoration to camouflage from predators (Source: Reef species of the world)

Slide 17 Kelp

Bull kelp

- Bull kelp is actually a kind of algae!
- One of the species makes up “kelp forests” especially from Central Ca to Alaska. These are ‘keystone ecosystems’ meaning many marine animals depend on them at some point in their life cycle. Many juvenile fish take shelter here, seals hide from sharks and hunt for fish, sea otters [historically] depended on them for sanctuary and food.
- Sea kelp “detritus” “feeds countless organisms, such as shrimp, isopods, snails, crabs, urchin, and abalone. These low-level detritivores are important food sources for herring, rockfish, juvenile salmon, lingcod and then these in turn build the food web important for marine birds and mammals such as seals, sea otter, murre, pelicans, and even whales.” (Mysterious world of bull kelp)
- Can grow up to 60 feet in one growing season!
- (Source: Mysterious world of bull kelp)

Sea palm

- A type of brown algae that grows up to 30 inches tall and lives for a year

- Grows on intertidal rocky shorelines in areas exposed to wave action (middle to upper intertidal zone)
- Eaten by red and purple sea urchins, as well as some snails
- (Source: ODFW)

Slide 18 Low tide zone plants

Eelgrass and **surfgrass** provide important cover for a lot of marine life

Juvenile fish, crabs, and many more animals, use it for habitat and sometimes also for food.

Red algae is an important food source for lots of marine life.

10 species of red algae in Oregon

Slide 19 Low tide zone visitors at high tide! (fish)

45 species of sculpins and allies in Oregon

-4 of them greenlings

8 species of surfperches

Rock greenling

- Habitat: estuaries nearshore rocky areas, often near algae and usually at 66 feet deep
- Huge variety in their diet including (but not limited to) crabs, shrimps, worms, snails, bivalves, brittle stars, octopus, other fish and fish eggs.
- Spawn from June – September, females will lay about 3 batches of eggs with a total of 5,800 to 103,000 eggs! Parents guard the nest.
- Juvenile fish use subtidal and intertidal algae beds and rocky bottoms
- Many seabirds love to snack on rock greenlings, including horned and tufted puffins, rhinoceros auklets, bald eagles; and also stellar sea lions!
- (Source: Oregon Coast Aquarium)

Mosshead sculpin

- “Bottom dwelling fish” (**Benthic zone**)
- Eat crustaceans and small fish
- Prey for seabirds and larger fish

- Males have elaborate courtship rituals to woo females
- They can “walk” on the ocean floor with their pectoral fins
- “Small dog energy” will stand their ground against much larger fish to protect their territory
- (Source: Marine Life Identification)

Low tide sculpin/ Tidepool sculpin

- Adaptation to live in tidepools: they can breathe directly from the air! No worries about tide pools running out of oxygen in the water when you can just breathe outside of the water.
- Small home range they live in their entire lives and can return if they are displaced by their sense of smell!
- Diet of worms and small crustaceans
- Can tolerate warm or brackish water
- They can change color to camouflage themselves!
- (Source: Aquarium of the Pacific)

Striped surfperch

- Found in estuaries and subtidally, up to depths of 165 feet. Often in habitats of kelp beds, rocky reefs, or docks.
- Source of prey for many predators including (but not limited to): rockfish, sculpin, cormorants, common murre, and harbor seals
- (Source: Oregon Coast Aquarium)

Slide 20 Mid tide zone

Classic mid zone life: Blue Mussels, gooseneck barnacles, Ochre Sea Stars, Aggregating Anemones, sea lettuce, Black Chiton, Wrinkled Whelk, some sea stars, seaweed, urchins, and the occasional nudibranch.

Notice that as we get further up the shore and the animals are exposed for longer periods of time, they are less likely to have soft parts that would dry out. (No sea cucumbers here!)

Black leather chiton are very common in middle and low tidal zones. They attach to rocks where there is heavy wave actions. They eat brown and red algae and benthic diatoms. (Source: wallawalla.edu)

Gutweed is a kind of green algae.

Gooseneck barnacles

- Live on rocky cliffs from the mid tide up to the splash zone.
- They can withstand wave action very well and often grow in colonies and on each other. Will live with California mussels as well.
- Filter feeder, mostly plankton, small clams, and other small organisms.
- Hermaphroditic (male and female sex organs) and can self fertilize if there are no other barnacles within 8 inches.
- Born as larvae that are weak swimmers and eat phytoplankton until they reach the “cyprid” stage and are strong swimming, non-feeding larvae that find a place to settle. They usually follow chemical cues to established barnacles with good conditions and room for another barnacle. Temperature, surface texture (rock type) and current, are all considerations for their permanent home.
- Reach maturity at age 5 and considered fully grown at 20 years old!
- Staple diet for Glaucous-winged gulls
- (Source: Animal Diversity Web)

Ochre sea star

- Ochre sea star populations have been ravaged by sea star wasting disease, more on this later in the presentation
- Live on rocky intertidal shores of the Pacific Coast from Alaska to California. Typically in the middle and low intertidal zones but can occur up to depths of about 300 feet!
- A single female can produce up to 40 million eggs in the breeding season
- Can live up to 20 years old
- Prey on many species including mussels
- Fun fact: ochre sea star is the origin of the “keystone species” concept. Ecologist R.T. Paine performed an experiment in the 1960s where he removed ochre sea stars from tidepools in Washington State and recorded the effects. He found mussels took over the pools without the sea stars and outcompeted other species and upset the ecological balance. This term has been applied to many other species since then, including wolves in Yellowstone when their removal in the 1900s led to ecological collapse (until they were reintroduced.) “Keystone” refers to the key stone in ancient stone bridges where without it the bridge collapses. Keystone species function the same way, if they are removed the ecological balance is upset and leads to ecosystem collapse.
- (Source: Aquarium of the Pacific)

California mussel

- Inhabit mostly the middle intertidal zone, but they can live subtidally up to 328 feet! They prefer habitat areas with low sediment, strong waves, and areas with pre-existing mussels, filamentous algae, and barnacles.
- “Foundation species” provide shelter and food to many other intertidal species.
- One mussel filters 35-75 liters of water per day! Filter feeder, extract plankton and fine detritus from the water. As they clear the water it increases algae growth (sunlight can penetrate water better) which in turn attracts more animals that feed on the algae.
- They clean (and accumulate in their body) contaminants from the water include flame retardants, pesticides, trace metals, and pharmaceuticals.
- Sensitive to ocean heating and acidification, softens and thins their shells which makes them more vulnerable to predation by crabs and carnivorous snails.
- Fun fact: indigenous peoples have been harvesting and eating California mussels for at least 10,000 years! (probably longer)
- (Source: Aquarium of the Pacific)

Slide 21 Frilled dogwinkle

- Found in low and mid intertidal zones
- “A most peculiar species because it can vary so much in shape, color, and texture from one individual to the next”
- Carnivorous snail, love to eat gooseneck barnacles especially
- Predators include the ochre sea star and the red rock crab. If they smell ochre sea stars in the area for long periods, they can actually grow larger spines on their shell to ward off the predator!
- (Source: wallawalla.edu)

Slide 22 Aggregating anemone

- What do you notice about the underwater anemone compared to the exposed? How might this be helpful for their survival? (Keeps them from drying out)
- Some anemones can even be found in the high tide zone, but that is unusual. Mostly in the (rocky) mid tide zone
- “Very hardy”
- Sexual or asexual (cloning) reproduction
- Tentacles have stingers to defend themselves or to fight for territory with other anemones. Aggregating anemone clone colonies can be very territorial against other clone colonies and will have “clone wars”

- Eat zooplankton but also (can but not always) host two different types of algae inside of them which photosynthesize (like plants) and produce sugars for them! This is a **mutualist symbiotic relationship- symbiotic meaning two species with a relationship in which (at least) one benefits. Mutualism means both benefit- anemone gets some extra food and the algae gets protection!**
- Inhabit the rocky mid intertidal zone
- Can reach densities of up to 500 anemones per 3 feet (1 meter)!
- Predators include mosshead sculpins, sea stars, sea slugs, and some other snails
- If in stable conditions they are technically “immortal” (documented 100+ years old) especially given that they can clone themselves.
- This species has existed for 500 million years!!
- (Sources: Aquarium of the Pacific, Bay Nature)

Slide 23 High tide zone

- Common high tide zone life: fingered limpet, turban snail, acorn barnacle, rock crab, striped shore crab, sea lettuce (not pictured)
- (Covered in previous zones, also in high tide) California mussels, acorn barnacles, chitons, seaweed, some urchins, hermit and shore crabs species, and few aggregating and giant green anemones (usually closed.)
- **Fingered limpet** feeds on algae and newly settled barnacles. Only in the high or splash zone. Sometimes they live with gooseneck barnacles. (Source: wallawalla.edu)

Black tegula

- Feeds on algae.
- Sometimes forms a symbiotic mutualistic relationship with the black limpet which grazes on the microalgae on the black tegula's shell.
- Large individuals may be 20 – 30 years old!
- Flee ochre sea stars, escapes predatory snails by climbing on top of their shells or if on a slope detaches and rolls downhill!
- Their empty shells are a favorite of hermit crabs
- (Source: wallawalla)
- **Rockweed** are brown algae and a **foundation species** (like California mussels.) Important nursery and feeding habitat. Dense fronds of rockweed can create “microclimates” which provide shelter for wildlife to reduce sun exposure and desiccation (drying out.) Rockweed communities 7-9 times more productive than seagrass dominated communities! (Source: National Parks Service)

Slide 24 Giant acorn barnacle

- Their hard plates are called opercula and the (6) feathery tentacle looking appendages are called cirri, which are used to direct food towards the body (opercula)
- Habitat is mostly rocky areas and intertidal ecosystems and subtidal, up to depths of 300 feet. Prefer areas with strong wave action and currents
- Hermaphroditic, male and female sex organs. Can produce asexually but usually don't. Eggs are brooded in the mantle cavity for 4 months and hatch as nauplii. A single brood can have thousands. There are a total of 7 larval stages, the last of which they find a location to attach to the rock and build its shell, after which it won't move again.
- Can live for over 25 years.
- Predators include ochre sea star, predator sea snails, etc.
- Dead barnacles can provide important habitat for animals like rock crabs, octopus, or grunt sculpin.
- (Source: Oregon Coast Aquarium)

Slide 25 Rock crabs (and some shore crabs)

Dungeness crabs are also rock crabs (not pictured)

Pacific rock crab

- Intertidal and subtidal habitats up to 300 feet deep. Uses a variety of habitats including rocky or gravelly areas, estuaries, kelp beds, and sometimes sandy bottoms
- Predator and scavenger- eat snails, sea stars, sea cucumbers, sea urchins, mussels and other bivalves, and more.
- Male carries around female ready to molt. A single egg mass may have 410,000 to 2,790,000 eggs. Larvae at hatching start life as plankton and continue to grow through 6 larvae stages before becoming a proper crab and living closer to shore.
- Eaten by many animals including sea otters, sharks, octopus, and large sea bass
- (Source: Oregon Coast Aquarium)

Pygmy rock crab

- Intertidal and subtidal habitats up to 1,430 feet deep. Usually hiding under rocks or in dead barnacles. Sometimes in lower estuary rocky areas.

- Omnivores, eat small barnacles, snails, bivalves, worms, and green algae.
- Male carries around female ready to molt. Eggs (20,500) are deposited on the abdominal pouch where they are brooded until hatching. Emerge as planktonic larvae and go through several molts.
- Predators include pacific cod, river otters, and red rock crabs
- (Source: Oregon Coast Aquarium)

Red rock crab (*Cancer productus*)

- Prefer rocky habitat but will also be found in eelgrass, soft-bottom habitat, and shellfish beds in the tidal and intertidal zone, up to 260 feet deep (WDFW)

Striped shore crab

- Inhabit rocky coastal shores
- Female carries fertilized eggs on her mantle (up to 50,000)
- Diet mostly algae, but also eats diatoms, worms, mussels, small dead fish, snails, hermit crabs, etc.
- Can sometimes cannibalize, especially after molting when they have a soft shell
- (Source: Animal Diversity Web)

Purple shore crab

- Habitat rocky coast, some brackish estuaries
- Mostly eat algae, but also eat diatoms, newly growing bivalves, snail eggs
- (Source: Puget Sound)

Slide 27 Would you step here? Intertidal challenges

No additional speaker notes

Slide 28 Intertidal Challenge- Sea Star Wasting Syndrome

This background picture highlights how abundant the now critically endangered sunflower stars were before the 2013 outbreaks. Credit Sunflower stars- neilmcdaniel

- Since 2013 this disease has killed billions of sea stars and affects up to 20 species of sea stars. This disease has wiped out more than 90% of once common species and caused some to go endangered.

- In 2025 the cause was first identified: a strain of bacterium called *Vibrio pectenica*. The bacteria genus *Vibrio* also causes diseases in coral, shellfish, and even humans (*Vibrio cholerae* causes cholera in humans)
- Other sea stars affected: mottled stars (*Evasterias troschellii*), leather stars (*Dermasterias imbricate*), six-armed stars (*Leptasterias*), sunflower stars (*Pycnapodia helianthoides*), rainbow stars (*Orthasterias koehlerii*), giant pink stars (*Pisaster brevispinus*), giant stars (*Pisaster giganteus*), sun stars (*Solaster*), vermillion stars (*Mediaster aequalis*), and bat stars (*Patria miniata*). (Oregon coast conservation strategy)
- From 2017-2020 5.75 billion sunflower sea stars died :(
- Sea star wasting **symptoms** begin as lesions which turns into decay (arms “melt” off), fragmentation of the body, and then death. The sea stars often look like they are melting. After first onset symptoms, the sea stars may die in a few days.
- There is evidence that warmer water temperatures may be a factor that increased disease rates and mortality in ochre stars in some areas (Eisenlord et al. 2016), but in Oregon that did not appear to be the case (Menge et al. 2016).
- Sea stars are a very important predator in the intertidal ecosystems eating mussels, sea urchins, etc, and without this balance their prey species will take over areas and throw off the balance between other non-predatory species. In particular, losing predators of urchins like the sunflower sea star has contributed to out of control urchin populations which has led to the complete deforestation of kelp forests by the urchins.
- Sources: Oregon coast conservation strategy, Aquarium of the Pacific, University of Washington

Slide 29 The missing link: sea otters

No additional speaker notes

Slide 30 Sea otter historical vs current range

Notice in the Pacific Northwest of the United States the only remaining population is in the Monterey area of California. (Source: indigenouaquaculture.org)

Slide 31 Offshore rock ecosystem/ Oregon Islands National Wildlife Refuge

All Oregon rocks and offshore islands are part of the national wildlife refuge (Oregon islands) and are PROTECTED. Climbing on off shore rocks is ILLEGAL because this disturbs wildlife, it can “flush” nesting birds (leaving their babies and eggs vulnerable to predation) and stress and disturb sea lions and harbor seals.

Slide 32 Important seal haul out and pupping habitat

Seals will “haul out” and hang out on rocks to take naps and rest

Did you know it is illegal to touch or harass marine mammals!? The Marine Mammal Protection Act of 1972 protects marine mammals and creates policy to maintain their population and significant parts of their marine ecosystems.

Pacific harbor seals (was pictured on previous slide)

- On average they can be 5-6 feet long and weigh up to 300 points
- Live north of the equator in both the Atlantic and Pacific Ocean
- Pups are born February – April. They can swim at birth but will sometimes ride on mom’s back when tired! Weaned off their mother’s milk at 4 weeks old. Mom will leave her pup on the beach while she goes hunting. However, if the mom and pup are disturbed too often she may leave her favorite haul-out sites and may even abandon her own pup. This is why it is so important to not disturb harbor seals (and sea lions), especially during pupping season.
- Pacific harbor seals can dive up to 1,500 feet and can hold their breath for up to 40 minutes, although they prefer dive lengths of 3-7 minutes. Sometimes they even take naps in the water!
- Diverse diet: sole, flounder, sculpin, hake, cod, herring, octopus, squid, etc.
- (Source: Marine Mammal Center)

California sea lions

- Females can be 6 feet long, 240 pounds; males 7.5 feet long, 700
- Threats include biotoxins from harmful algal blooms, disease, entanglement with fishing gear, and human caused injuries.
- Diverse diet: squid, anchovies, mackerel, rockfish, sardines
- Males are polygamous and establish breeding territories with up to 14 females. Males do not become mature “territory holders” until they are 9-12 years old.
- Most pups born June – August. Females can identify her pup among hundreds of other by their unique vocalizations and smell.

- Mothers will feed at sea for 2-5 days before returning to pup on shore to nurse.
- (Source: NOAA Fisheries)

Stellar sea lions (endangered)

- Males can weigh up to 2,500 pounds and be 11 feet long, females can weigh up to 800 pounds and get up to 9.5 feet long.
- Threats: Effects of fisheries on prey, Climate change, Predation, Toxic substances, Contaminants, Incidental take due to interactions with active fishing gear, Illegal shooting, Disturbance, Disease and parasites, Entanglement, Illegal feeding
- Live 20-30 years
- (Source: NOAA Fisheries)

Slide 33 Seabird nesting and resting

Many more species than just these!

Seabirds are special because they spend most of their time on the open ocean

Seabirds that nest on rocks and islands NOT in colonies: black oystercatchers, black turnstones, surfbirds

Tufted puffin spend most of their life at sea. Nests in burrows on cliffs!

Rhinoceros auklet hunt small schools of fish underwater by “flying” after them with strong wingbeats. Their horn is ultraviolet and may help each other see one another underwater or when foraging at night. Delivers food to nests mostly at night, probably to avoid stealing gulls.

Pelagic cormorant (also Brandt’s and double crested cormorants in the area) Can hold their breath for up to 2 minutes and can dive as deep as 138 feet! Nest on rocky cliffs.

Common murre Can swim up to 100 feet deep hunting fish! Spend most of their time on open ocean, mostly come to land to nest.

(Source: All About Birds, Cornell University)

Slide 34 Small but mighty plants

No additional speaker notes

Slide 35 Oregon islands challenges

Foxes and minks have been introduced to many islands for the fur trade (during peak fur trade) and their populations have persisted.

Bald eagle populations crashed because of pesticide called DDT that was widely used in the 1900s and led to massive bird population crashes. This is because the poison accumulated in animals, particularly predators like eagles, which caused their eggs to break. Because of the DDT ban eagle populations have recovered, which is great news. However, their diet has shifted from their historic norm (salmon), because the salmon populations are crashing, to a relative more abundant population, seabirds. This is a big problem for seabirds because they are already struggling with ocean pollution, decreased fish availability because of humans, and plastic trash in the ocean.

Slide 36 Who manages these lands?

No additional speaker notes

Slide 37 How can I help?

Birds like snowy plovers and black oystercatchers that like to nest in the sand may leave their nest unattended and chase off any perceived threat. Black oystercatchers are especially sensitive to drones and may chase them for up to an hour. This is bad because 1. It wastes their valuable energy they could have spent feeding or incubating their young. 2. When they leave their nest, it leaves their young vulnerable to predation and gulls may quickly gobble up their eggs or chicks.

Seabirds may eat trash on the beach or ocean, sometimes fish can be full of trash, and this may fill up their stomach and kill them.

Feeding wildlife may fill their stomach with food that is not nutritious (like bread) which can lead to health problems in the long term.

Slide 42

The pictures in these slides were found from citizens posting their observations to the citizen website iNaturalist!

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