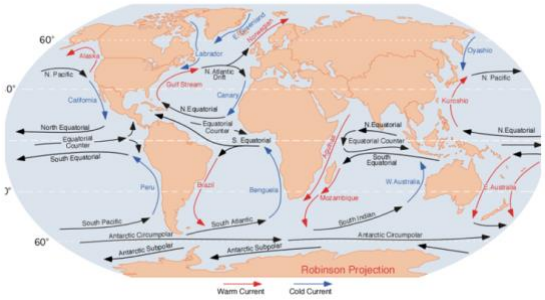
STATION 3

coastal dynamics

First, **Dr. Seeksalot** should review the physical factors that affect the Oregon Coast. Where does the water come from? What does wind have to do with it? Does the water look the same from year to year? Is the water changing due to climate change? What's different about this crabbing season compared to last year's season? Understanding ocean circulation is critical to understanding the chemistry and biology happening in the ocean.

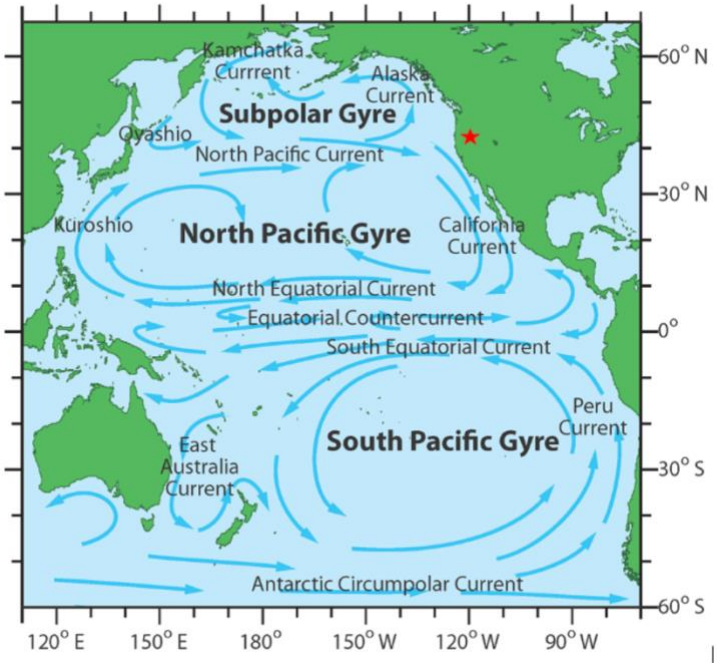
Perhaps answering these questions can give us a clue about the problem we are trying to solve for **Fisher Crabbins**. How can we answer these questions? Scientific research isn't free and collecting data is *expensive*. Thankfully, there are databases with all kinds of data from the ocean online! But where does the data come from? Scientists at universities are funded by money distributed by government organizations. But in order for those government organizations to fund researchers like **Dr. Seeksalot**, policymakers have to agree on a budget and allocate money for scientific advancement. Funding science research is a way to keep the economy thriving by providing jobs and developing new technologies to address the world's problems.

Dr. Seeksalot has worked closely with the office of **Representative Wordsmith**. If **Rep. Wordsmith** has the power to influence budgets.. but isn't a scientist... and funding is critical for research and the advancement of society... how does **Rep. Wordsmith** decide who to give money to?! Scientists collaborate with policymakers to share what's so important about their work. This relationship between the scientist and policymaker can influence the types of research the state of Oregon or the federal government is most interested in funding. Luckily, here in Oregon, marine science research has been generously funded meaning there is a lot of publicly available data for us to analyze to solve the problem of the missing crabs.



Ocean Currents

First things first. We need to think about *how* water moves in the ocean before we think about the organisms living in the water. Ocean currents are the continuous, predictable, directional movement of seawater driven by gravity, wind, and the density of water →

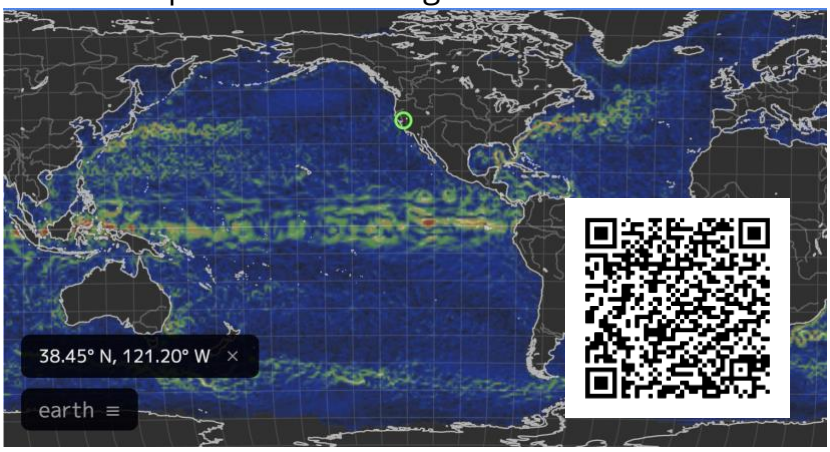


Ocean currents are an integral part of the Earth system. Knowledge of currents provide us with a better understanding of global climate and weather patterns, as well as living conditions, migration patterns, and life cycle journeys of plants and animals, including humans. Studying ocean currents can also be useful in ship navigation, which has a direct impact on the economy, in search and rescue operations, and in tracking oil spills.

In 1992, an accidental experiment began when a container ship in the North Pacific accidentally released over 28,000 bath toys. Because the toys float, the yellow ducks began their journey around the world's oceans, aided only by the ocean's current and where it would take them. Named the "Friendly Floatees", these bath toys have helped oceanographers map the currents and are still being discovered today (30 years later!).

Video:
Friendly Floatees and how ocean currents work.

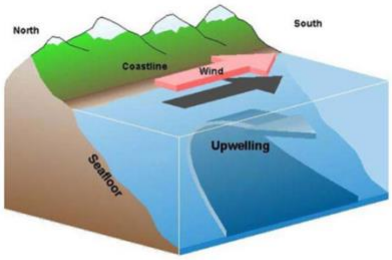
Check out the ocean currents in real time by visiting Earth Nullschool at the link below. Zoom in and toggle with the map to view the Oregon Coast.



Now that we know about global currents, we can start to think about the water off the Oregon Coast. This water is part of the **"California Current"** system in the North Pacific. Watch the video on the left to see how water from across the ocean makes its way to Oregon's shores.

In a later part of this lesson, you will discover how ocean currents and wind patterns can influence life cycles of microbes and animals in the ocean.

Video:
Watch min 2:22-3:30



Source: NOAA Ocean Explorer

Currents in the open ocean aren't obstructed by land. But what happens when there is a windy coastline? Winds can push the water from the shore and deeper water rises to fill the gap. This process is called **upwelling**. Coastal upwelling occurs along the west coast of the U.S. and a few other places in the ocean. Coastlines where upwelling occurs are some of the most productive ecosystems and support many of the world's most important fisheries.

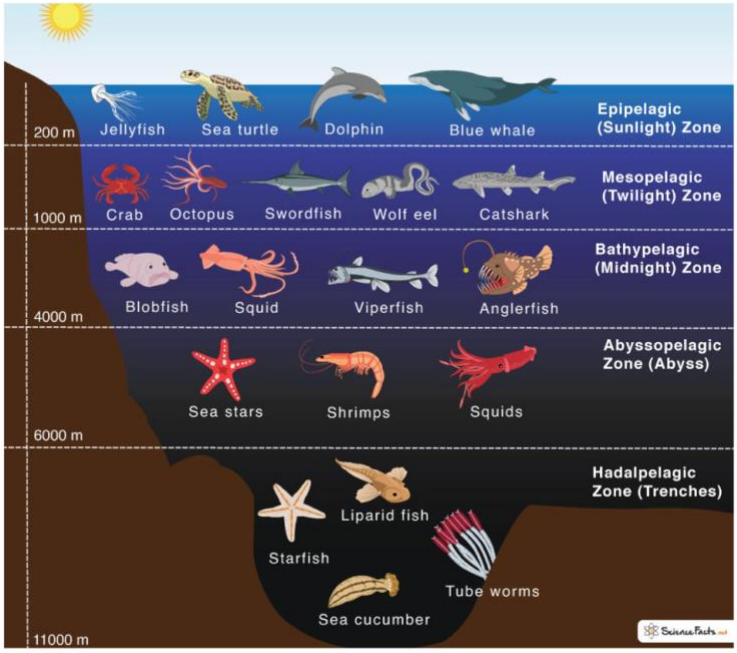
Ocean Temperature

You've probably heard that the ocean is warming. This is due to excess greenhouse gas emissions. The video below is a good explanation for how the Earth is warming. Think about how this may be contributing to the observations **Crabbins** is noticing.

Video:
Giant tetris

Ocean Layers

While you may think the ocean is just a big bathtub that's sloshed around randomly, that's not true! The ocean has layers that are driven by both temperature and density. Warmer waters lie on top of the colder, deeper waters. The layers do mix but in an orderly fashion that's driven by currents.



Now that you know about marine microbes and the physical ocean, isn't it remarkable how abundant these tiny yet adaptable these organisms are? Microbes are swept away and forced to survive wherever the current takes them. Unlike a shark or an octopus, it's very difficult for bacteria to move around in the water because they are so small. (But being small isn't all bad. Can you think of some advantages to being a small organism in the open ocean?)

Dr. Seeksalot has been pondering, how might microbes or ocean currents be involved with the missing crabs reported by **Crabbins**? There's been a lot of buzz in the news about hypoxia here in Oregon. Perhaps there is some publicly available data on oxygen concentrations that would help us inch closer to a solution.

Test your knowledge:

1. Water coming up from the depths of the ocean is high in _____ and low in _____.
2. What are 3 effects of climate change from rising levels of carbon dioxide in the atmosphere and ocean?