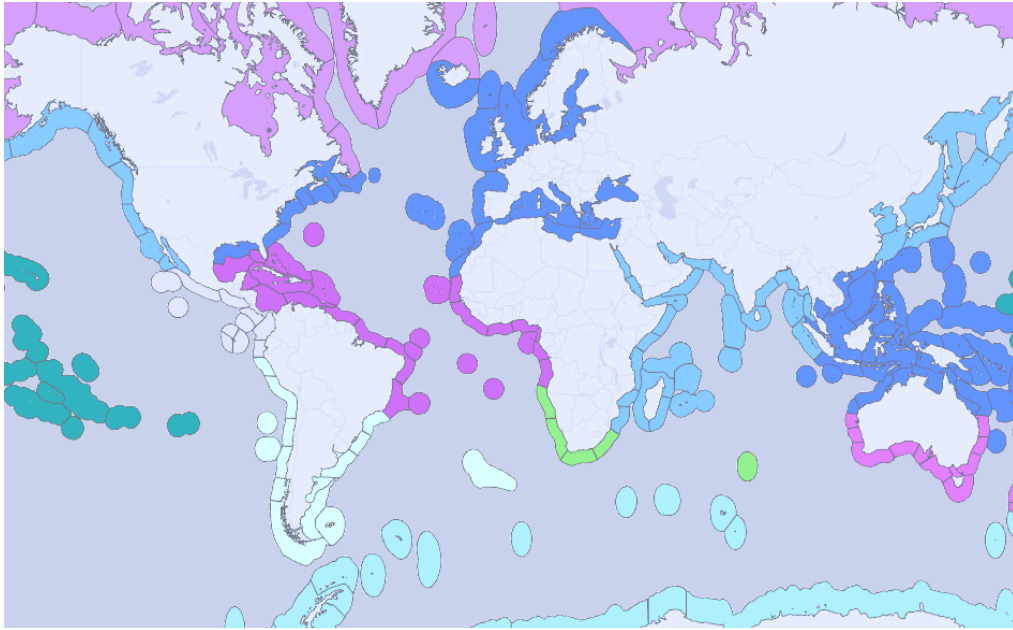
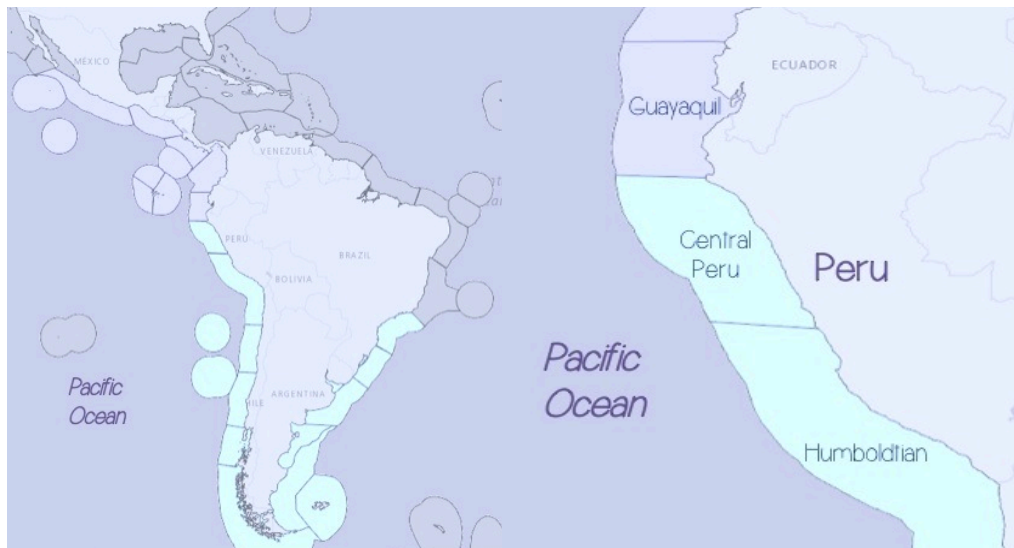


THE ECOSYSTEM

The Marine Ecoregions of the World (MEOW) is a nested system of 12 realms, 62 provinces and 232 ecoregions that classify coastal areas around the world.



Ecoregions are areas that present similar species composition and are distinct from adjacent systems. Peru's coast is allocated in the Tropical Eastern Pacific and Temperate South America realms.



Peru's northern ecoregion, Guayaquil, is inside the TEP realm and is distinct from the southern ecoregions due to the warm surface temperatures, which range from 19-22 °C. The TSA realm nests two ecoregions: Central Peru and Humboldtian. These ecoregions are formed by the Peruvian Current (also called the Humboldt Current) and has temperatures ranging from 13-14 °C in winter to 15-17 °C in summer.

THE UPWELLING

The Peruvian current produces an upwelling that transports deep waters full of nutrients to the surface. The upwelling process makes the Peruvian sea one of the most productive in the world. Scientists have identified 750 species of fish, 872 species of mollusks, 412 species of crustaceans, 45 species of echinoderms, and 240 species of algae. The anchovy is a small fish that can be found along the Peruvian Current, from Piura to southern Chile. The anchovy feeds mainly on phytoplankton but also feeds on zooplankton. Due to the high primary production in the ecosystem, the abundance of anchovy is very high, and a great variety of species like fish, mammals, and birds feed almost exclusively on this fish. The anchovy is considered a keystone species in this ecosystem because so many animals depend on them as a food source. If the anchovy disappears the whole ecosystem would collapse.



FOOD CHAIN CONCEPTS

A food chain or food web describes the feeding relationships between different species located at different trophic levels. The primary producers are at the lowest trophic level which is at the base of the game. They are called autotrophs since they do not feed on other organisms and instead take energy from the sun to grow. These organisms are usually small and abundant. The next level, the primary consumers, feed on the primary producers. The next level, the secondary consumers, feed on the primary consumers and so on. As the trophic chain levels go higher the abundance of the organisms decrease because the energy available to each successive level becomes less and less, this is why the food web is often called a food pyramid.

The last trophic level is composed of animals known as top predators. These animals have no natural enemies. Humans are considered to be top predators in many communities. A keystone species is one that is critical to maintaining a balanced ecosystem. A keystone species is the glue that holds the food web together. Humans are considered to be top predators in many communities. A keystone species is one that is critical to maintaining a balanced ecosystem. A keystone species is the glue that holds the food web together.

MODELS & THEIR ROLE IN SCIENCE

Models help us understand events and processes. Models allow us to make predictions. Models come in different forms. Most models can be classified as either a computational model or a physical model. Computational models use mathematical equations (and oftentimes computers) to understand and predict. Physical models use things that we can touch to understand and predict. There is usually a balance between how easy a model is to use and how accurately it reflects the real system. Simple models might be quick to use, but always lead to the best predictions. Complex models may allow us to make good predictions, but may not be simple to use.

CHALLENGES TO THE ECOSYSTEM: NATURE & HUMANS

During an El Niño event, the waters along the Peruvian coast get warmer decreasing the upwelling. The anchovy, under normal conditions, can be found near the surface during the night and around 50 m deep during the day. So, during an El Niño event, the anchovy goes deeper, 100 to 150 m, looking for colder waters. This makes the anchovy inaccessible to predator species and many individuals die from starvation. For instance, the sea lion population decreased 72% during the 1997/98 El Niño event. Unfortunately, the anchovy has also been heavily exploited since the mid-1950s. Since 1960, the total catch by weight has exceeded any other single fishery in the world. The anchovy is mainly used to produce fishmeal as food for poultry. More than four tons of anchovy is needed in order to produce one ton of fishmeal. In past years, the direct consumption of anchovy by people has been promoted since it possess good-quality proteins and essential fatty acids like Omega-3 and Omega-6.

Sharks are also considered keystone species. As top predators, a trophic cascade may occur if sharks are removed from the food chain. The absence of top predators would affect not only the organisms at a lower trophic level but could affect significantly several lower trophic levels.

CREATE A FOOD CHAIN

Unpack the blocks, sort them by species, and create a stack with the blocks corresponding to the lowest trophic level at the base and those of the highest trophic level on top.

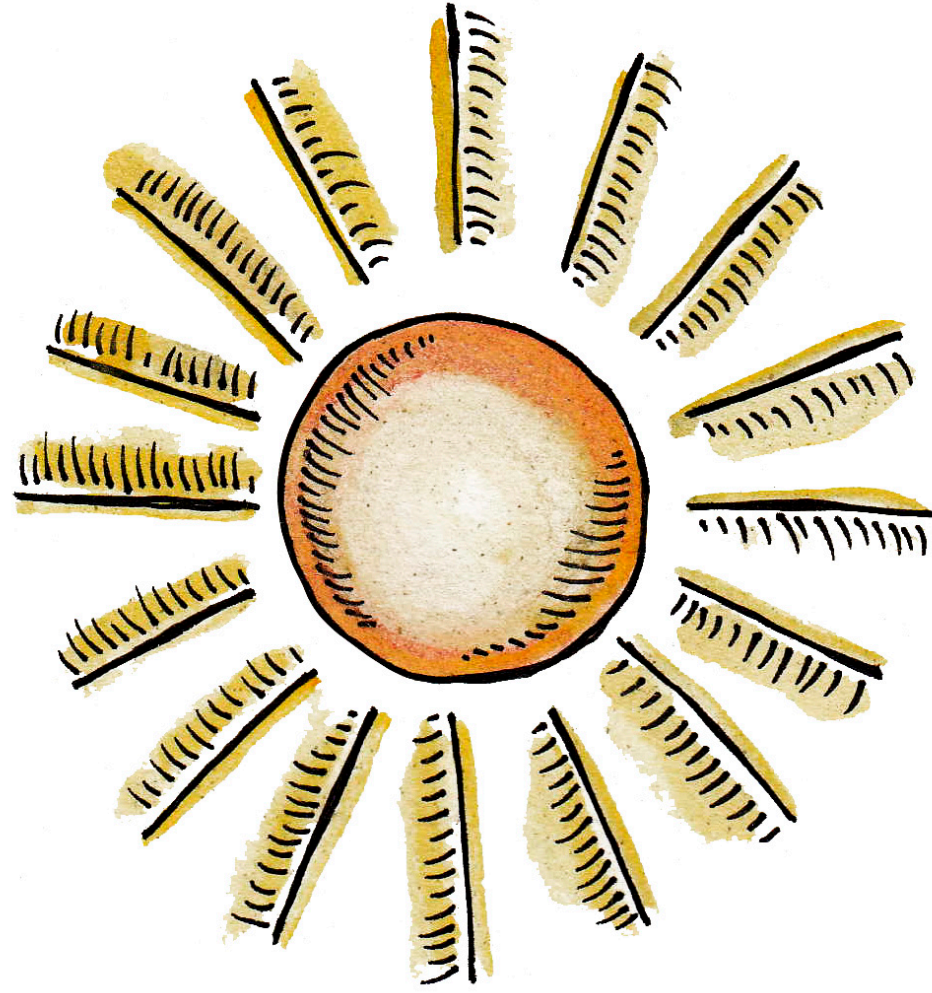
USE THE MODEL

Take turns pulling a card and reading the event. Predict what would happen to the primary trophic level and an adjacent trophic level. Have the other team check your answer. Make your moves. Continue until the food chain collapses.

Used cards

Place used cards here

_____ because
_____ that
If _____ then I



If _____ then I
predict that _____
because _____.

CREATE A FOOD CHAIN

Unpack the blocks, sort

them by species, and

create a stack with the

blocks corresponding to the

lowest trophic level at the

base and those of the

highest trophic level on top.

USE THE MODEL

Take turns pulling a card

and reading the event.

Predict what would happen

to the primary trophic level

and an adjacent trophic

level. Have the other team

check your answer. Make

your moves. Continue until

the food chain collapses.

Place new
cards here

New cards