Glossary

aphotic zone—In the oceans, the stratum of water where there is inadequate light to support photosynthesis (see also euphotic zone).

Beverton-Holt model—The model or method of fisheries management developed by Ray Beverton of the Fisheries Laboratory in Lowestoft, England, and Sidney Holt of the United Nations Food and Agriculture Organization in Rome, Italy. The model uses the population dynamics of the stock of fish to predict the sustainable yield as a function of the size of the adult stock.

boundary current—A current that flows parallel to and close to a continental coastline. Most boundary currents result from the deflection of transoceanic zonal currents by continental land masses.

Clupeids—A family of fish including anchovies, sardines, and herring. A primitive form of marine fish, the clupeids account for the largest percentage of world catch of all fish, shellfish, and other aquatic organisms.

Coriolis force—An apparent force that acts on particles and fluids moving over the surface of the Earth, because the Earth is a rotating sphere. The force deflects moving objects to the right of their direction of motion in the Northern Hemisphere and to the left in the Southern Hemisphere. It is zero at the equator and reaches its maximum value at the poles. The Coriolis force is a weak force, and its effect becomes apparent only if objects are moving very rapidly or (in the case of ocean currents) over great distances.

Countercurrent—An ocean current that flows in the opposite direction to the dominant, wind-driven surface current. Countercurrents may exist at the surface, as in the case of the Equatorial Countercurrent but more commonly are subsurface currents, like the Equatorial Undercurrent or the Peru Undercurrent.

Detritus—Nonliving organic particles, including fecal material, molts, dead organisms, or parts of dead organisms.

Ekman transport—movement of surface ocean currents at an angle to the direction of the wind, due to the effect of the Coriolis force. The currents flow at an angle to the right of the direction of the wind in the Northern Hemisphere and to the left in the Southern Hemisphere. Also referred to as Ekman drift.

El Niño—an oceanic event that occurs roughly every three to seven years, when warm surface seawater of relatively low salinity moves southward from the region of the equator along the coast of Peru to as far as 12 degrees S latitude. It is frequently associated with a significant reduction in productivity of the coastal current system, either because upwelling physically ceases or because the upwelled water is no longer rich in nutrients. The intruding water may overflow the Peru Coastal Current to a depth of as much as 30 meters.

ENSO—(El Niño Southern Oscillation) An irregular meteorological oscillation characterized by two extreme conditions, a warm phase (El Niño) and a cool phase (La Niña), that is driven by exchanges of heat and water between the ocean and atmosphere in the tropical Pacific.

essential nutrients—Those elements required by virtually all living organisms. The major essential nutrients are oxygen, carbon, nitrogen, hydrogen, phosphorus, sulfur, potassium, magnesium, and calcium.
Essential nutrients required in lesser amounts include iron, manganese, copper, zinc, boron, silicon, molybdenum, chlorine, vanadium, cobalt, and sodium.

euphotic zone—In the oceans, the stratum of water where there is adequate light to support photosynthesis. The euphotic zone usually extends from the surface to the depth where the light intensity is approximately 0.1–1.0% of surface irradiance, depending on the season of the year and latitude.

Ferrel cell—An atmospheric circulation cell in the region of the westerlies (between roughly 30 and 60 degrees latitude) caused by the differential heating of the Earth-atmosphere system.

Finfish—Fish with fins, as opposed to shellfish.

Fishery—The industry or occupation of catching, processing, and selling fish. The term is also sometimes used to refer to fishing grounds.

Gadoids—A family of fish including cod, pollock, haddock, and hake. Gadoids live mostly in the shallow to moderate depths of northern seas, where they form the basis for extensive commercial fisheries.

guano birds—Fish-eating birds whose droppings, called guano, are utilized in the production of fertilizer. This designation is regional. The guano birds consist primarily of cormorants and to a lesser extent of gannets and pelicans. They inhabit offshore islands along the coast of Peru. The guano bird population, which in the past has approached 30 million, has in recent years been as low as half a million due to the impact of the anchovy fishery and El Niño. Guano birds feed primarily on anchovies.

gyre—In oceanography, a basin-wide continuous current system formed by alternating boundary currents and wind-driven, transoceanic zonal currents.

Hadley cell—An atmospheric circulation cell in the region of the trade winds (between roughly 30 degrees latitude and the equator) caused by the differential heating of the Earth-atmosphere system.

Kelvin wave—An internal wave whose dynamics are affected by the Coriolis force and whose maximum amplitude occurs at the equator. The wavelength of Kelvin waves is on the order of thousands of kilometers, and their existence requires the presence of a barrier to the right of their direction of motion in the Northern Hemisphere and to the left in the Southern Hemisphere. For coastal Kelvin waves, the barrier is the coastline. For equatorial Kelvin waves, the barrier is the equator.

La Niña—the phase of the ENSO cycle characterized by cool sea surface temperatures in the eastern tropical Pacific, stronger-than-usual trade winds, vigorous upwelling and high biological productivity in the equatorial upwelling system and coastal upwelling system along the west coast of both North and South America, humid and wet conditions in the western tropical Pacific, and cool and very dry conditions along the coastlines of both North and South America.

lantern fish—Small marine fish belonging to the family Myctophidae that live in the deep sea during the day and migrate to the surface or near-surface at night.

match/mismatch hypothesis—A hypothesis developed by David Cushing of the Fisheries Laboratory in Lowestoft, England, to explain the highly variable
recruitment observed in many important commercial fish stocks. The hypothesis holds that there is often a temporal or spatial mismatch between the availability of food for larval fish and the larval fish’s greatest need for food. A good match between supply and demand is followed by spectacular recruitment, but during most years recruitment is much reduced due to the mismatch between supply and demand at a critical stage in larval development.

**maximum sustainable yield**—The maximum fish catch that can be sustained year after year, more or less indefinitely, without destroying the stock of fish.

**meridional circulation cell**—A semiclosed atmospheric circulation cell that results from the differential heating of the Earth’s atmosphere by the Sun. Air tends to rise at the equator and at 60 degrees latitude and to sink at the poles and at 30 degrees latitude. The rising or sinking air then moves either toward the poles or toward the equator to complete the circulation cell. Both the trade winds and the westerlies are surface manifestations of meridional circulation cells. These circulation cells have a major influence on the distribution of precipitation over the surface of the Earth.

**mixed layer**—The surface layer of the ocean where the chemical and physical characteristics of the weather are rather uniform due to turbulent mixing caused by winds blowing over the surface of the ocean. The mixed layer usually extends from the surface to a depth of tens of meters to perhaps several hundred meters, depending on the latitude and season of the year.

**phytoplankton**—Minute, floating aquatic plants. Phytoplankton are the base of the food chain in the ocean. They synthesize virtually all of the organic matter produced in the ocean.

**polar cell**—An atmospheric circulation cell in polar latitudes caused by the differential heating of the Earth-atmosphere system.

**protein utilization efficiency**—The percentage of the protein in a particular food that is retained by human beings, assuming they are provided with an adequate diet in all other respects. Differences in protein utilization efficiency between different foods largely reflect differences in the amino acid composition of protein.

**purse seine**—A usually very large net hung like a curtain in the water and drawn around a school of fish by the fishing boat. A line at the bottom of the net is drawn tight (pursed) to prevent the fish from escaping through the bottom. The net is then pulled in until the fish are sufficiently concentrated, and the fish are removed either with suction pumps or a brail (dip net).

**recruitment**—The attainment by fish of a size sufficient to be caught by fishing gear. Being recruited to the stock of catchable fish does not mean that a fish is caught but only that it is big enough to be caught.

**renewable resource**—A resource that can be replaced as fast as it is exploited, as opposed to a nonrenewable resource. Fish, along with most foods, are considered renewable resources. Petroleum and metal ores are not.

**Rossby wave**—An internal wave whose dynamics are affected by the Coriolis force and whose wavelength is on the order of thousands of kilometers. Rossby waves propagate off the equator, and their speed is strongly dependent on latitude. Near the equator a Rossby wave moves at about 50—
60 kilometers per day, but at 12 degrees latitude the speed is only about 10 kilometers per day. The Rossby waves associated with El Niño invariably propagate in a westerly direction.

**Schaefer model**—A model or method of fisheries management developed by Milner Schaefer of the Scripps Institution of Oceanography in La Jolla, California. The model uses information on fish catch and population size to estimate the sustainable yield as a function of the size of the adult stock.

**Southern Oscillation Index**—The difference in sea level pressure between the subtropical high-pressure region at about 30 degrees S latitude in the southeastern Pacific and the Indonesian equatorial low-pressure region in the western Pacific. Frequently the Southern Oscillation Index is reported as the difference in pressure between Easter Island and Darwin, Australia.

**subtropical gyre**—A very large surface circulation system driven by the trade winds and westerlies and extending from roughly the equator to a latitude of about 45°. The subtropical gyres cover approximately 40% of the ocean’s surface area. Their rotation is clockwise in the Northern Hemisphere and counterclockwise in the Southern Hemisphere.

**sustainable yield**—A yield that can be sustained year after year, more or less indefinitely. See also maximum sustainable yield.

**trade winds**—The surface winds that blow out of the east toward the equator between the subtropical high-pressure region near 30 degrees latitude and the low-pressure region near the equator.

**upwelling**—The upward movement of water from depths of typically 40–80 meters at speeds of approximately 1–3 meters per day, resulting from the lateral movement of surface water. Upwelling is especially well developed along the coast of Peru, where it may supply virtually all of the nutrients to the euphotic zone.

**virgin stock**—The stock of fish prior to any commercial fishing activity.

**Walker cell**—An atmospheric circulation cell near the equator with an east-west motion that results from air-sea interactions and the westward movement of the trade winds. The circulation is associated with the rising of warm, moist air at the western edge of the ocean basin and the sinking of relatively cool, dry air at the eastern edge. The vertical extent of the circulation is approximately 15 kilometers.

**water column**—A hypothetical column extending from the surface to the bottom of a body of water.

**westerlies**—The surface winds that blow out of the west and away from the equator between the subtropical high-pressure region near 30 degrees latitude and the subpolar low-pressure region near 60 degrees latitude. The westerlies are much more variable temporally and spatially than the trade winds.
Suggested Additional Reading


References


Murphy, R. C. *Bird Islands of Peru. The Record of a Sojourn on the West Coast*. New York: Putnam, 1925.


