

## Glossary

**Acclimation:** adjustment by an individual organism to a gradual change in its environment, such as increasing temperature.

**Accretion:** build-up of sediment typically on floodplains, which results in progressive increases in the elevation of floodplain habitats.

**Acidosis:** increased acidity (i.e. increased hydrogen ion concentration) in the blood, usually in the plasma.

**Adaptation:** (**autonomous**) evolutionary process whereby a population becomes better suited to its changing habitat; (**planned**) a strategic change in anticipation of a variation in climate.

**Aerobic:** needing air, particularly oxygen.

**Alluvial:** loose or unconsolidated sediment deposited by flowing water, typically used to describe floodplain sediments or terraces formed from material deposited by floods.

**Altimetric measurement:** height measurement in relation to the centre of the Earth. Height is defined using an ellipsoid approximating the Earth's shape. It can be measured from space by radar or laser at accuracies of 1–3 cm.

**Amphidromy:** migration to the sea as larvae of fish or invertebrates that live in fresh water as adults, and then return to fresh water as juveniles to develop (e.g. some species of gobies).

**Anoxic:** total loss of oxygen, an extreme form of hypoxia or low oxygen (see also **hypoxic**<sup>i</sup>).

**Aphotic zone:** area of the water column in the ocean beneath the **photic zone** where light intensity is not sufficient for **photosynthesis**.

**Aquaculture:** the farming of aquatic organisms, including fish, molluscs, crustaceans and aquatic plants using some form of intervention in the rearing process to enhance production.

**Aquaculture commodity:** raw material or primary product from **aquaculture**, which can be bought and sold.

**Aquatic animal health:** measures required to diagnose risks to animal health and responses needed to minimise the spread of any detected disease.

i Words in bold represent terms defined in the glossary.

**Aragonite:** one of the two commonly occurring crystal forms of **calcium carbonate** ( $\text{CaCO}_3$ ), which make up the skeletons of organisms such as reef-building corals.

**Aragonite saturation:** levels of dissolved **calcium carbonate** in the ocean, which are available for calcifying organisms (e.g. corals) to build their skeletons as they grow.

**Artisanal fishing:** small-scale harvesting of fish and invertebrates for consumption or local trade.

**Atmospheric (surface) pressure:** pressure exerted by the weight of the air above a point on the Earth's surface. Horizontal variations of atmospheric pressures can drive winds, storms and other processes.

**Autotroph:** an organism capable of synthesising its own energy/food from **inorganic** substances using light (e.g. **photosynthesis**) or chemical energy. Examples include **phytoplankton** (microalgae), **macroalgae**, seagrass and certain bacteria.

**Barrier layer:** area in the vertical structure of the ocean where variation in salinity occurs within a zone of uniform temperatures and where density changes only as a result of changes in salinity.

**Bathymetry:** measurement of the depths of oceans and seas.

**Bêche-de-mer:** processed (boiled and dried) sea cucumbers.

**Benthic organisms:** plants or animals living on the bottom or in the sediment (infauna).

**Biodiversity:** variability among living organisms from all sources including, *inter alia*, terrestrial, marine and other aquatic **ecosystems** and the ecological complexes of which they are a part; includes diversity within species, between species, and of **ecosystems** (also known as biological diversity).

**Bioerosion:** erosion of hard ocean substrates, particularly **calcium carbonate** (e.g. coral skeletons), by living organisms such as worms, bivalves, fish and barnacles.

**Biofloc technologies:** techniques that facilitate intensive aquaculture while reducing investment and maintenance costs and incorporating the potential to recycle feeds. Techniques are based on zero or minimal water exchange to maximise **biosecurity**, while minimising the environmental effects of **aquaculture**.

**Biofuel:** fuel derived from living organic matter.

**Biogeochemical processes:** chemical interactions between the atmosphere, water and land, and the organisms inhabiting these components of the Earth's biosphere.

**Biomass:** mass of living biological organisms (including microorganisms, plants and animals) in a given area or **ecosystem** at a given time; includes the mass of one or more species, or the mass of all species in the community.

**Biosecurity:** set of preventive measures designed to reduce the risk of transmission of infectious diseases, quarantined pests, invasive alien species and living modified organisms.

**Blood-oxygen affinity:** amount of oxygen that can be carried in the blood, usually determined by the quantity of oxygen-carrying pigments within red blood cells.

**Bycatch:** fish and other species caught unintentionally while intending to catch other fish. Bycatch also includes undersized individuals of the target species.

**Calcification:** process by which **calcium carbonate** is precipitated to form hard crystalline materials that make up the skeletons of many marine organisms (e.g. corals, molluscs).

**Calcium carbonate:** a chemical compound with the formula  $\text{CaCO}_3$ ; this common substance is found in rocks in all parts of the world, and is the main component of shells of marine organisms, e.g. corals and molluscs.

**Carbon footprint:** a measurement of the amount of carbon dioxide or other carbon compounds (**greenhouse gases**) emitted to the atmosphere by the activities of an individual, enterprise, nation, etc.

**Carbon labelling:** marking of products to specify the total carbon (**greenhouse gases**) emissions involved in all aspects of production and the **supply chain** from manufacturer to purchaser, to the treatment of waste.

**Carbon sequestration:** a process by which carbon dioxide is removed from the atmosphere and typically stored in the tissues of plants.

**Carbonate buffering:** partial offsetting of pH increase (due to ocean acidification) by free carbonate ions ( $\text{HCO}_3^-$ ,  $\text{CO}_3^{2-}$ ), which may originate from eroding coral skeletons, sand or other sources.

**Carbonate saturation:** carbonate ion concentration threshold below which the ambient water becomes corrosive to **calcium carbonate** shells and skeletons.

**Carnivore:** a species that feeds on fish or invertebrates.

**Catadromy:** migration to the sea to breed of fish species that live in fresh water as adults, and then return to fresh water as juveniles (e.g. barramundi).

**Catch per unit effort:** quantity of fish or shellfish taken by a given amount of fishing effort. Often used as an indirect measure of the abundance of a target species. An unchanging catch per unit effort indicates sustainable harvesting.

**Catchment:** land bounded by natural features such as hills or mountains, from which all runoff water flows to the same low collection point.

**Chlorophyll:** photosynthetic pigment common to all plants including **phytoplankton** cells; also used extensively as a proxy for measuring the biomass of **phytoplankton**.

**Climate-proofing:** measures taken to reduce the risk of damage to infrastructure that could occur as a result of projected changes to surface climate and the ocean.

**Climax species (equilibrium species):** slower growing, structurally large species, which are good competitors but poor colonisers and appear late in the succession of an **ecosystem**, and eventually come to define older, more stable communities.

**Climate change:** a change of climate attributed directly or indirectly to human activity, which alters the composition of the global atmosphere and which is in addition to the natural climate variability observed over comparable time periods (see **climate variability**).

**Climate model:** mathematical model based on the laws of physics constructed to understand and predict the dynamics of the Earth's climate, through the simulation of key variables, such as air and **sea surface temperature**, precipitation, and wind.

**Climate variability:** variations in the mean state and other statistics of the climate (such as the occurrence of extremes) on all temporal and spatial scales beyond that of individual weather events. Variability may be due to natural internal processes in the climate system, or to variations in natural or anthropogenic external forcing (see also **climate change**).

**Coastal fisheries:** harvesting of fish and invertebrates from inshore marine habitats to a depth of 50 m, as well as pelagic fish caught in near shore waters within 10 km of the coast.

**Cold tongue:** large zonal band along the equator characterised by high productivity due to the equatorial divergence bringing nutrient-rich waters to the surface layer, also called equatorial upwelling or Pacific Equatorial Divergence (PEQD).

**Commercial fisheries:** harvesting of fish and invertebrates for the purpose of making or intending to make a profit. Commercial fisheries often involve large-scale industrial fishing fleets but may also include small-scale fisheries that target species exclusively for local sales or export.

**Community-based management:** arrangements under which a community takes responsibility, usually with government or NGO assistance, for managing its coastal environment and fisheries.

**Confidence:** an evaluation of the level of scientific understanding in support of a conclusion.

**Connectivity:** combination of processes, which provide physical and biological connections between habitats and maintain suitable conditions for fish and invertebrates to move between habitats (including through **larval dispersal**). High levels of connectivity confer increased **resilience** to local populations as a result of larval replenishment from remote populations following severe exploitation or **habitat degradation**.

**Continental effect:** the effect of continental lands on local climate, which results in a greater daily and annual range in surface air temperature, and in runoff of rainwater to marine habitats.

**Coral bleaching:** the paling of corals and other animals with symbiotic **zooxanthellae**, caused by disintegration of symbiosis and loss of the symbionts. Bleaching occurs in response to physiological stress due primarily to periods of increased water temperature and high light levels (see **mass coral bleaching**). Bleaching can also be caused by changes in salinity or turbidity.

**Corallivore:** any animal that eats coral polyps (e.g. butterflyfish, crown-of-thorns starfish).

**Coral reefs:** underwater structures made from the **calcium carbonate** secreted mainly by scleractinian corals. These structures are usually dominated by reef-building corals and are typified by high levels of accompanying **biodiversity**.

**Cost–benefit analysis:** economic decision-making approach to assess the merit of a proposed project or investment, or to choose between alternatives. Such analysis involves comparing total expected costs with total expected benefits to determine whether benefits outweigh costs or vice versa, and by how much.

**Cross-sectoral management:** managing coastal fisheries with the aid of all sectors (e.g. forestry, agriculture, public works, water supply and sanitation, waste disposal) with responsibility for use of land and water resources that directly affect fish habitats and fish stocks.

**Crustose coralline algae:** red algae from the order Corallinales, characterised by a thallus (body) that is dominated by calcareous deposits. Red algae can play an important ecological role in forming coral reefs by binding the calcareous parts of other organisms, such as corals, into the broader reef framework.

**Deep Chlorophyll Maximum (DCM):** depth at which the greatest amount of **chlorophyll** occurs; is rarely seen just below the surface and is affected by nutrient availability, adaptation of **phytoplankton** cells to low light intensity, and specific differences in the populations of **phytoplankton**.

**Demersal fish:** species of fish that live close to the ocean floor (substratum). In the tropical Pacific these species are strongly associated with coral reefs (e.g. coral trout, groupers), seagrasses (e.g. emperors) or mangroves (e.g. mullet).

**Destructive fishing:** fishing activities (usually involving dynamite, derris root and cyanide) that deplete both target and non-target species, and also contribute to **habitat degradation**.

**Diazotrophy (or nitrogen-fixation):** biological process allowing some plants to use molecular nitrogen ( $N_2$  or diazote); it is achieved by cyanobacteria in ocean regions.

**Dinoflagellates:** large group of unicellular organisms, about half of which are **photosynthetic**. Dinoflagellates are an important component of the **phytoplankton**. Some species, called **zooxanthellae**, are endosymbionts of marine animals and play an important part in the biology of **coral reefs**.

**Diurnal (variations):** fluctuations that occur during a 24-hour period.

**DNA:** deoxyribonucleic acid, which contains the genetic instructions used in the development and functioning of all known living organisms (with the exception of RNA viruses). The sequence of nucleotides determines individual hereditary characteristics.

**Domestication of fisheries:** increasing the proportion of the industrial fish catch taken by local fleets and processed in national facilities.

**Downscaling:** techniques that take outputs from numerical models and add information at scales smaller than the grid spacing. Global climate models (GCMs) are run at coarse spatial resolution and are unable to resolve important sub-grid scale features such as clouds and topography. Downscaling methods have been developed to obtain local-scale surface weather from regional-scale atmospheric variables provided by GCMs.

**Downwelling:** physical process where surface waters sink deeper, as opposed to **upwelling**.

**Economic development:** sustained increase in the production levels of goods and services and standard of living of a nation's Population resulting in a greater real **gross domestic product** (GDP), but measured in more ways than increases in GDP.

**Ecosystem:** a dynamic entity comprising a biological community, made up of all the organisms living in a particular area, which interacts with the non-living, physical components of its environment such as air, soil and water.

**Eddies:** formations of swirling water caused when a bend in a surface ocean current lengthens and eventually makes a loop which separates from the main current.

**Ekman transport:** near surface ocean current that moves perpendicular to the prevailing wind direction as a result of Earth's rotation.

**El Niño:** the 'warm' phase of ENSO (see below) characterised by unusually warm **sea surface temperatures** in the eastern equatorial Pacific associated with a weakening of the **Walker Circulation** and trade winds. Eastward shift towards the dateline of the centre of maximum tropical convection results in the western Pacific experiencing unusually dry conditions, whereas the central and eastern Pacific have unusually wet conditions. Changes also occur in the main location of tropical cyclone activity and the South Pacific Convergence Zone (**SPCZ**).

**El Niño-Southern Oscillation (ENSO):** the major source of interannual tropical climate variability characterised by periodic variations evolving over 12–18 months in the coupled ocean-atmosphere system of the tropical Pacific. These variations result in distinct and different surface climate (temperature, rainfall, tropical cyclone activity) anomalies during ENSO's two phases, **El Niño** and **La Niña**.

**Emissions scenario:** plausible description of future emissions of greenhouse gases, based on a coherent and internally consistent set of assumptions ('scenario logic') about the key relationships and driving forces (e.g. rate of technology change or prices).

**Energy audit:** an evaluation of energy consumption, as in a home or business, to determine ways in which energy can be conserved.

**Energy budget:** equation describing how energy consumed by an individual is balanced through the different vital functions of the organism.

**Epibiota:** organisms living, usually parasitically, on the surface of plants or animals, for example, fungi.

**Epifauna:** benthic animals that live on a surface, such as sediment, other organisms or objects.

**Epiphytes:** plants living on other plants. In marine ecosystems, epiphytic plants are typically algae.

**Euryhaline:** species able to tolerate a wide range of salinities (e.g. most estuarine species).

**Eutrophic:** habitats with high nutrient loads, which typically result in increased development of aquatic plants, especially **phytoplankton**.

**Eutrophication:** natural or artificial addition of nutrients to bodies of water resulting in negative effects, such as excessive growth of algae and oxygen depletion (see **anoxic**).

**Exclusive economic zone (EEZ):** UN-granted rights and responsibilities of coastal states to control, exploit, manage, and conserve the living and non-living resources of the sea up to 200 nautical miles off their coasts, while allowing freedom of navigation to other states beyond 12 nautical miles of their coasts.

**Extensive aquaculture:** farming of fish or invertebrates at low densities and without the addition of formulated feeds. Organic and inorganic fertilisers are often used to promote the growth of **phytoplankton**, zooplankton, and other living food for fish and invertebrates leading to production.

**Fingerling:** a young fish about a 'finger' long, usually less than ~ 50 mm long.

**Fish aggregating device:** also commonly known as FAD, and consisting of buoys or floats near the surface which are either anchored or drifting. FADs attract and temporarily retain pelagic fish, increasing the probability of catching them. Anchored FADs are used by small-scale coastal fishers and drifting FADs are used by industrial tuna fleets.

**Fish stock:** exploited portion of a fish population.

**Fishing effort:** a measure of the amount of fishing done with a particular type of gear, calculated by multiplying fishing capacity by the time that this capacity is in use.

**Fishing mortality at MSY (FMSY):** the level of fishing mortality, or intensity of exploitation, that results in the **maximum sustainable yield** (MSY).

**Floodplain habitat:** flat land bordering a river and made up of alluvium (sand, silt and clay) deposited during floods. When a river overflows, the floodplain is covered with water.

**Food security:** sufficient availability of food to ensure that all people have physical and economic access to safe and nutritious food to meet their dietary needs and food preferences for an active and healthy lifestyle.

**Food web:** the sum of pathways between consumers and their prey in an **ecosystem**; usually a complex network.

**Fry:** very young and recently-hatched fish which have absorbed their yolk sacs and can hunt and consume live food.

**Functional process zone:** the part of a river within the hierarchical arrangement of habitats where discharge, channel gradient and sediment regimes are similar.

**Geographic range:** spatial extent where a species lives. For marine organisms, a distinction must be made between geographical locations that constitute the normal or permanent range of the species, versus locations where the species is a 'vagrant' and infrequently found or fails to establish a permanent population.

**Geomorphology:** scientific study of landscapes and the processes that form them, particularly the role of flowing water in forming rivers, lakes and estuaries.

**Geostrophic flow:** motion in the ocean due to pressure forces on a rotating planet.

**Global climate model:** a numerical representation of the global climate system based on the physical, chemical, and biological properties of its components, their interactions and feedback processes, and accounting for all or some of its known properties.

**Global warming:** an increase in the average temperature of the Earth over the past 100 years, attributed to the accumulation of **greenhouse gases**, including carbon dioxide, as a result of human activities such as the burning of fossil fuels and agricultural activities (also embodied in the term **climate change**).

**Government revenue:** income available to a government, obtained mostly from taxation and licence fees.

**Greenhouse gases:** atmospheric gases that contribute to the 'greenhouse effect' (trapping energy in the climate system). Naturally occurring greenhouse gases include water vapour, carbon dioxide, methane, nitrous oxide and ozone. Certain human activities, such as burning fossil fuels, have increased the concentrations of these gases in the atmosphere, particularly carbon dioxide, causing **global warming**.

**Gross domestic product (GDP):** total value of goods produced and services provided in a country during one year.

**Habitat degradation:** decline in the quality or quantity of habitats used by fish and invertebrates for reproduction and/or survival.

**Habitat patches:** units within the hierarchical arrangement of river habitats that describes discrete habitats, such as macrophytes, mangroves and sandbars.

**Hadley Circulation:** main meridional (north–south) atmospheric circulation of the tropics, characterised by rising moist air near the equator, and high poleward air flow that sinks and dries in the subtropical high pressure cells and returns to the equator as the surface trade winds.

**Herbivore:** a species that feeds predominantly on plant material, including phytoplankton, benthic algae and macrophytes.

**Heterotrophs:** organisms that cannot make their own food from **inorganic** molecules and depend on **organic** compounds either soluble (bacteria) or particulate (e.g. zooplankton, fish) for growth and energy.

**Hierarchical habitat patches:** arrangement of habitat units at increasing spatial and temporal scales, e.g. macrophyte beds, mangroves or sandbars within the hierarchical arrangement of river habitats. At larger scales, habitat units include pools and riffles, river reaches, functional process zones, salinity realms and marine catchment basins.

**High nutrient–low chlorophyll regions:** areas where **phytoplankton** production is not limited by macronutrients (e.g. nitrate), but by a micronutrient, presumably iron, such as the Pacific Equatorial Divergence.

**Homeostasis:** the ability or tendency of an organism or cell to maintain internal equilibrium by adjusting its physiological processes.

**Hypersaline habitats:** conditions where salinity exceeds normal marine salinities of around 36 practical salinity units (PSU). Hypersaline conditions typically arise in tropical coastal wetlands and estuaries where freshwater inflows or tidal mixing are insufficient to diminish the salt-concentrating effects of water loss through evaporation.

**Hypoxic:** deficient or starved of oxygen. Hypoxic habitats have low availability of dissolved oxygen that most animals find stressful (see also **anoxic**).

**Industrial fleet:** purse-seine fishing vessels targeting tuna for sale to canneries, and longline vessels catching tuna for the sashimi market or for canneries.

**Infauna:** aquatic benthic animals that live in the substrate, especially in soft sediment. Marine infauna usually construct tubes or burrows and are commonly found in deeper and subtidal waters. Examples include clams, tubeworms, burrowing crabs and mantis shrimp.

**Inorganic:** chemical compounds of a mineral, not of biological origin (see also **organic**).

**Integrated coastal zone management:** process for the management of the coast using a **cross-sectoral** approach to minimise the effects of development in any one sector on all other sectors.

**Intensive aquaculture:** farming operations for fish and invertebrates that are almost totally dependent on the use of commercial feeds. Stocking densities are usually limited not by the availability of food but rather by the tolerance of species to crowding, and by the ability of the farmer to maintain environmental parameters in optimal ranges for fish growth and survival.

**Intergovernmental Panel on Climate Change (IPCC):** an intergovernmental body which has been tasked by the United Nations and World Meteorological Organization to review and assess the most recent scientific, technical and socio-economic information on anthropogenic **climate change** and its impacts on **ecosystems** and society.

**Internal wave:** a gravity wave, generally linked to the tide, which oscillates within, rather than on, the surface of the ocean. Internal waves move water particles up and down several dozens of metres.

**Intertidal zone:** region between the high tide mark and the low tide mark.

**Intertidal gleanng:** opportunistic gathering of seafood from intertidal and shallow subtidal habitats mostly undertaken as a **subsistence** activity, although some gastropods are sold for their shells, while sea cucumbers are dried and sold as **bêche-de-mer**.

**Intertropical Convergence Zone (ITCZ):** region near the equator where trade winds from the two hemispheres converge and the air rises, resulting in a distinctive cloud band and enhanced rainfall (the ascending branch of the **Hadley Circulation**).

**Introduced species:** a species that lives outside its native **geographic range** as a result of human activity, either deliberate or accidental. Some introduced species cause damage to the ecosystem into which they are introduced, but others have no negative effect and can be beneficial to aquaculture and fisheries.

**Invasive species:** introduced species that spread within the habitats they colonise, and which can create adverse environmental, social or economic effects by disrupting habitats or through negative interactions with other species.

**Isotherm:** a line drawn on a weather map or chart linking all points of equal or constant temperature.

**Key functional groups:** ecologically equivalent species that perform a critical role in maintaining the normal state and function of a given **ecosystem**.

**La Niña:** the 'cool' phase of **ENSO** characterised by unusually cool **sea surface temperatures** in the eastern equatorial Pacific associated with a strengthening of the **Walker Circulation** and trade winds. Westward shift of the centre of maximum tropical convection results in unusually dry conditions in the eastern Pacific and unusually wet conditions in the western Pacific. Changes also occur in the main locations of tropical cyclone activity and the **SPCZ**.

**Larval dispersal:** development and growth of the larvae of marine organisms in the water column before transition to a more site-attached life stage (see **larval settlement**). Most marine larvae are capable of dispersing long distances from their release site, usually aided by ocean currents. Many larvae also have the ability to return to the general area where they were spawned (see also **pelagic dispersive phase**).

**Larval replenishment:** addition of new individuals to local populations of marine organisms through the arrival of larvae, which may have been released by the local population or by a distant population.

**Larval settlement:** process by which larvae of marine **benthic** or **demersal** species end their **pelagic dispersive phase** and adopt site-attached behaviour. Successful settlement relies on detecting and locating suitable habitats. Many marine larvae face very high levels of mortality (predation) during this transitional phase.

**Latent heat flux:** movement of heat from the Earth's surface to the atmosphere associated with evaporation or condensation of water vapour at the surface.

**Latitudinal range:** latitudinal extent of the **geographic range** of a species.

**Life cycle:** period involving all different development steps from egg to adult of a given species; a period from one generation of organisms to the next generation.

**Life-span:** average or maximum length of time an organism can be expected to live, or a material or object can be expected to last.

**Likelihood:** the probability that a future projection or prediction will occur.

**Live rock:** decorative, small coral boulders covered in encrusting organisms and coralline algae which act as biological filters in marine ornamental aquaria.

**Livelihood:** the capacity, assets (including both material and social resources) and activities required to earn an income or acquire resources that can be used or exchanged to satisfy the needs of an individual, family or social group.

**Macroalgae:** a collective term used to describe multi-cellular algae that are also known as seaweeds.

**Macrophytes:** aquatic plants that grow as fully submerged or emergent forms extending above the water surface. Includes both attached and floating plant species.

**Mangrove associates:** other plants such as shrubs, vines, herbs and epiphytes generally found at the back of mangrove communities, defined by their ability to survive in mangrove environments.

**Marine ornamentals:** marine fish, such as damselfish (Pomacentridae), butterflyfish (Chaetodontidae), triggerfish (Balistidae) and cardinalfish (Apogonidae), and invertebrates such as giant clams, cleaner shrimp and hard and soft corals, collected or cultured for export as aquarium specimens.

**Marine protected area:** an intertidal or subtidal area dedicated to protect part or all of its physical and biological components.

**Mass coral bleaching:** coral bleaching extending over large spatial scales as a result of usually high **sea surface temperatures** (see also **coral bleaching**).

**Maximum Sustainable Yield (MSY):** maximum average long-term catch that can be taken from a fishery assuming that the productivity characteristics of the stock do not change over time.

**Melanesia:** one of the three subregions of the Pacific Islands region, including Fiji, New Caledonia, Papua New Guinea, Solomon Islands and Vanuatu.

**Metabolic demand:** the energy and oxygen needed by an organism for normal life functions.

**Microbial loop:** tight coupling in **oligotrophic** waters between small **phytoplankton** cells, detritus, bacteria and small flagellates, making them largely independent of the rest of the food chain.

**Micronesia:** one of the three subregions of the Pacific Islands region, including Federated States of Micronesia, Guam, Kiribati, Marshall Islands, Nauru, Commonwealth of the Northern Mariana Islands and Palau.

**Mineralisation:** transformation of **organic** matter into **inorganic** compounds, such as nitrate or phosphate, via bacterial activity or other biological and chemical processes.

**Mixed layer:** upper layer of the ocean where the density and temperature of the water are both uniform. The top of the **pycnocline** and the **thermocline** start at the base of the mixed layer.

**Nacre:** iridescent internal layer of a mollusc shell formed by deposits of **calcium carbonate**. In pearl oyster shells, this layer is known as 'mother-of-pearl', and forms the outer layers of cultured pearls.

**Near shore pelagic fish:** fish that typically live in the upper layers of the open sea, but are attracted to near shore environments for food or shelter.

**Net primary production (NPP):** growth of **phytoplankton** per day; equivalent to primary production as long as the latter does not include **phytoplankton** catabolic compounds, such as carbon dioxide or exudates.

**New production:** the part of **primary production** based on nutrients brought to the **photic zone** by **upwelling** and other physical processes, or on atmospheric dinitrogen (N<sub>2</sub>).

**Non-extractive use:** activities used to derive economic and social benefits from a resource without removing or altering that resource, e.g. scuba diving tourism.

**Nursery habitats:** shelter and feeding areas used by newly-settled or juvenile life-stages of marine organisms before they move (recruit) to habitats occupied by adults. Many species of fish use mangroves and seagrass meadows as nursery habitats before recruiting to coral reefs as adults.

**Nutricline:** nutrient gradient, generally located within the **pycnocline** at the base of the **mixed layer**.

**Ocean acidification:** reduction in the pH of the ocean, caused by greater concentrations of atmospheric carbon dioxide dissolved in sea water, resulting in the formation of carbonic acid (H<sub>2</sub>CO<sub>3</sub>). The carbonic acid then dissociates to form hydrogen ions (H<sup>+</sup>) and bicarbonate ions (HCO<sub>3</sub><sup>-</sup>). The potential for acidification is reduced because some of the hydrogen ions combine with carbonate ions (CO<sub>3</sub><sup>2-</sup>). This combination, however, reduces the availability of carbonate ions to form **calcium carbonate** (CaCO<sub>3</sub>), required by calcifying organisms (e.g. the scleractinian corals that build **coral reefs**) to construct their shells and skeletons.

**Oligotrophic:** water bodies with low concentrations of nutrients, resulting in low biological productivity.

**Organic:** chemical compounds of biological origin, i.e. made of carbon, hydrogen and other elements; as opposed to **inorganic** compounds.

**Ornamental trade:** sale of wild or cultured marine or freshwater fish and invertebrates to hobbyists or enterprises for display in aquariums.

**Orographic effects:** influence of mountains, especially on high oceanic islands, to capture water vapour and form clouds around their peaks which then create rainfall on the windward side, with a drier rain shadow on the leeward side.

**Osmoregulation:** physiological process by which fish regulate the internal salt content of their bodies at a different concentration from their surrounding water. Freshwater fish need to pump salt into their bodies to maintain required tissue concentrations, whereas saltwater fish need to prevent accumulation of excessive salt concentrations in their tissues.

**Otoliths:** small calcareous formation found in the inner ear of fish used in sensorial detection of movement.

**Overfishing:** depletion of a fish stock at a rate that is greater than the potential of the population to replenish itself.

**Pacific Decadal Oscillation (PDO) or Inter-decadal Pacific Oscillation (IPO):** a Pacific basin-wide pattern of **sea surface temperature** anomalies (with associated patterns of atmospheric variability), which operates on decadal and longer time scales. It persists in either a warm or cool phase for several decades and these phases appear to modulate the inter-annual variability associated with ENSO events. During PDO/IPO 'warm' phases (e.g. 1920s–1940s) **ENSO** events tend to have a weaker effect on tropical inter-annual climate variability compared with 'cold' phases (e.g. 1940s–1970s).

**Paleo-environmental:** reconstructing past natural environments including vegetation, climate and human impacts using microfossil (or other botanic) information.

**Partial pressure of carbon dioxide ( $p\text{CO}_2$ ):** pressure exerted by carbon dioxide on the other gases in the (mixed gas) atmosphere and ocean.

**Pathogen:** a biological agent that causes disease or illness to its host.

**Pelagic species:** organisms that live near the surface of the water or in the water column itself.

**Pelagic dispersive phase:** important phase in the **life-cycle** of most marine organisms, which facilitates the movement of individuals among habitats and between different geographical regions. Marine organisms release eggs or larvae into the water column, which develop and grow in the **pelagic** environment and are capable of dispersing long distances from the release site (see also **larval dispersal**).

**pH:** a logarithmic scale used to measure the acidity or basicity of an aqueous solution. Pure water is said to be neutral, with a pH close to 7.0. Solutions with a pH less than 7 are said to be acidic and solutions with a pH greater than 7 are basic or alkaline.

**Phase-shift:** fundamental and persistent changes in the state of an **ecosystem**, which indicates a lack of resilience. A well known phase-shift on coral reefs represents declines in the abundance of habitat-forming corals and marked increases in the abundance of **macroalgae**.

**Photic (or euphotic) zone:** sunlit part of the upper ocean that is exposed to sufficient sunlight for **photosynthesis** to occur. The depth of the **photic zone** can be greatly affected by seasonal turbidity, and the lower boundary is generally considered to receive 1.0% (or 0.1% in tropical waters) of the surface light.

**Photo-acclimation:** adaptation of reef-building corals to changes in solar radiation (light levels), which can happen in a matter of days.

**Photosynthesis:** biological process by which plants produce carbohydrates and oxygen from carbon dioxide and water using solar radiation as an energy source.

**Phytoplankton:** the **autotrophic** component of the plankton community (drifting organisms that inhabit the pelagic zone of oceans).

**Planktivore:** animals that feed on plankton, e.g. most fish larvae and many pelagic fish.

**Poikilotherm:** an organism whose body temperature varies with that of the surrounding environment.

**Polynesia:** one of the three subregions of the Pacific Islands region, including American Samoa, Cook Islands, French Polynesia, Niue, Pitcairn Islands, Samoa, Tokelau, Tonga, Tuvalu, and Wallis and Futuna.

**Pond aquaculture:** farming of aquatic organisms in freshwater earthen ponds.

**Pool habitats:** deep lengths of river channels characterised by slow flow, with an unbroken water surface. Such habitats are typically interspersed by riffles to form pool-riffle sequences.

**Post-harvest processing:** procedures used to increase the shelf life of fish and shellfish, often involving drying and smoking for small-scale fisheries in rural areas, and canning and loining for industrial tuna catches.

**Postlarval fish:** fish that have undergone transformation from pelagic larvae into the first juvenile stage of their adult form. In coral reef fish species, this transformation usually occurs just before or just after settlement to reefs or other coastal habitats.

**Potamodromy:** migration of fish or invertebrates solely within freshwater habitats (e.g. river herring in Papua New Guinea).

**Prediction:** a statement that something will happen in the future, based on known conditions at the time the prediction is made, and assumptions about the processes that will lead to change.

**Primary productivity (or production):** rate at which light energy is used by **autotrophs** to form **organic** substances that become food for consumers.

**Projection:** a set of future conditions, or consequences, derived from explicit assumptions, such as scenarios.

**Pycnocline:** depth of maximum density (salinity) changes in the ocean; often co-located with the **thermocline**.

**Recruitment:** process by which juvenile marine organisms effectively join the adult population. Recruitment in species that use distinct **nursery habitats** is the stage at which individuals leave the **nursery habitat** and start living in habitats or locations occupied by adult individuals of the same species.

**Regenerated production:** part of primary production based on nutrients regenerated by **heterotrophs** (bacteria and animals).

**Remineralisation:** transformation of **organic** molecules to **inorganic** forms, akin to **mineralisation**.

**Resilience:** the capacity of a system to absorb disturbance and reorganise while undergoing change so as to still retain essentially the same function, structure, identity and feedbacks.

**Rete mirabile (latin for 'wonderful net'):** network or mesh of arteries and veins lying very close to each other; the countercurrent blood fluxes within this net allow for an increase in muscle temperature and provides fish with some capacity for **thermoregulation**.

**Riffle habitats:** shallow lengths of river channels characterised by increased velocities and broken water surface as water flows over rock, cobble or gravel beds.

**Runoff:** water from rain or irrigation that flows over the land surface and is not absorbed into the ground, instead flowing into streams or other surface waters or land depressions.

**Saturation horizon:** ocean depth layer below which carbonate is saturated (see **carbonate saturation**).

**Scenario:** a plausible outline or model of an expected or supposed sequence of events.

**Sea-level rise:** changes in the height of the ocean as a result of changes in its volume. Human activities that have driven increased global temperatures have resulted in an accelerating rate of sea-level rise due to thermal expansion and the addition of water from melting glaciers and other land-locked ice bodies, such as the Greenland ice sheet.

**Sea surface temperature (SST):** water temperature close to the surface of the ocean; 'surface' generally refers to depths of less than 5–10 metres.

**Seed set (mangroves):** the production of seeds after flowering.

**Semi-intensive aquaculture:** farming operations characterised by addition of supplementary feed to ponds, which increases fish production above the levels achievable in **extensive aquaculture**. This production also depends on the natural food in the pond, however.

**Shoaling:** behaviour of waves as they approach a shelving shore: the sinusoidal, deepwater waves become asymmetrical and steeper. Also refers to the bottom of the **mixed layer** or **thermocline** moving closer to the surface.

**Small pelagic fish:** species of small fish (< 500 g weight) caught near the surface, which are seasonally abundant and opportunistically exploited by coastal fisheries for food or bait.

**Small-scale fishery:** fisheries usually aimed at obtaining fish for household consumption or sale at local markets based on simple technology, often involving traditional and artisanal methods. Exceptions in the tropical Pacific are the fisheries for sea cucumbers and trochus as export commodities. Small-scale fisheries are typically poorly understood and governed.

**Soluble reactive phosphorus (SRP):** phosphorus fraction that consists of **inorganic** orthophosphate (PO<sub>4</sub>), a form of phosphorus that is directly taken up by algae for growth.

**Southern Annular Mode (SAM):** major source of variability in the atmospheric circulation of the mid-high latitudes of the Southern Hemisphere operating on

time scales longer than ~ 50 days. SAM is a zonal pattern with sea-level pressure anomalies of opposite sign between about 45°S and 65°S. Fluctuations between the two phases affect the strength of the westerly winds over the Southern Ocean. Anomalies in surface atmosphere and ocean climate, primarily in mid-high latitudes of the Southern Hemisphere, are also associated with SAM.

**Southern Oscillation Index (SOI):** an atmospheric index of the strength of **ENSO** activity based on the difference in sea-level pressure between Darwin, Australia (representing the ascending branch of the **Walker Circulation**) and Tahiti, French Polynesia (representing the sinking branch of the **Walker Circulation**). Sustained high positive values characterise **La Niña** events and sustained negative values characterise **El Niño** events.

**South Pacific Convergence Zone (SPCZ):** an extension of the **Intertropical Convergence Zone** located between the **Western Pacific Warm Pool** and French Polynesia associated with low-level wind convergence and ascent. SPCZ creates a distinctive cloud band and enhanced rainfall.

**Spat:** young of oysters or other bivalve molluscs, both before and after they first adhere to a surface.

**Spawning biomass at MSY,  $SB_{MSY}$ :** level to which the spawning biomass of a **fish stock** will fall if the **maximum sustainable yield** is harvested on a continuous basis.

**Sporulation:** process of asexual reproduction in which any cell of an organism (e.g. **macroalgae** or seaweed) produces one or more reproductive cells inside its cell walls. The original cell is termed a sporangium and the new cells are termed spores. Spores are often produced in large numbers, resulting in a rapid increase in population size.

**Stenohaline:** species able to tolerate only a narrow range of salinities. Most freshwater species that do not migrate to sea are stenohaline.

**Stocking density:** number of individual organisms that are stocked per m<sup>2</sup> or m<sup>3</sup> in aquaculture operations.

**Stratification:** formation of distinct water layers based on differences in density (due to water temperature and/or salinity) with reduced mixing between warm surface waters and cool, nutrient-rich, deeper waters. Increasing ocean stratification, due to global **climate change**, is expected to reduce the productivity of the oceans.

**Subduction:** ocean process in which surface waters enter the ocean interior from the **mixed layer**.

**Suboxic:** a state (in the ocean) between oxygenated and anoxic conditions, where the oceanic concentration of oxygen is very low.

**Subsistence fishing:** harvesting of fish and invertebrates to meet basic food requirements of households, usually with no surplus fish available for sale at local markets.

**Subtidal habitats:** areas beneath the water surface at low tide.

**Supply chain:** all parties and processes involved in obtaining or manufacturing a product and delivering it to a customer.

**Supratidal habitats:** estuarine habitats that are above the high spring tide level and are only inundated by sea water during storms at high tide.

**Surface mixed layer:** see **mixed layer**.

**Surplus production yield curves:** method used to estimate **sustainable** fishing limits based on the relationship between fishing effort and long-term changes in the size of the **fish stock**.

**Sustainable:** long-term maintenance of the diversity, structure and productivity of an **ecosystem**; can also be applied to economic and social dimensions.

**Symbiodinium:** genus of **dinoflagellates** that form symbiotic associations with reef-building corals and a large range of other marine invertebrates (see also **zooxanthellae**).

**Symbiont shuffling:** process by which the coral host selectively changes its **zooxanthellae** (*Symbiodinium*) community to increase the proportion of thermally tolerant **dinoflagellates**.

**Temperature performance:** typical relationship between individual performance and temperature, whereby performance (e.g. growth, reproduction, or movement) increases with increasing temperature until a certain point (the **thermal optima**) and then declines.

**Teragram:** one million metric tonnes, often used as a measure of CO<sub>2</sub> emissions.

**Thermal optima:** range of temperatures in which individual performance (e.g. growth, reproduction, movement) is maximised.

**Thermal stratification:** formation of water layers of different temperatures in a pond, lake or ocean, which can inhibit mixing between layers, and thereby lead to depletion of oxygen in the bottom layer.

**Thermocline:** abrupt change in temperature occurring at the base of the mixed layer, typically found in oceans and lakes, which marks the separation between warmer surface water layers and the colder layers below.

**Thermoregulation:** ability of an animal to control its body temperature.

**Topographic complexity:** variation in the elevations of a landscape due to physical (abiotic) features and gradients.

**Trade winds:** easterly surface winds of the tropical Northern (north east trades) and Southern (south east trades) Hemispheres; originating in the sinking air of the subtropical high pressure belt of each hemisphere as a result of the **Hadley Circulation**. Trade winds are characterised by the constancy of their speed and direction.

**Transboundary stock:** fish stocks with distributions that span the EEZs of at least two countries or territories.

**Transfer efficiency:** ratio between consumer and prey production in the **food web**, which indicates the percentage of food transformed into the **biomass** of the consumer.

**Translocated species:** species that have been transported within their natural distribution to establish populations in new habitats.

**Transshipment:** moving fish landed in one port or at sea to another vessel for delivery to another port.

**Tropical cyclone:** non-frontal low pressure systems developed over warm waters with organised convection and maximum wind speeds of greater than 115 km/hr (63 knots). Tropical cyclones are the most destructive weather systems affecting tropical regions (also known as typhoons and hurricanes). They are particularly destructive when making landfall, bringing strong winds, high rainfall, storm waves and destructive storm surges. They rarely form within 5–10° of the equator.

**Underwater visual census:** survey methods used to record the size, abundance and biomass of fish and invertebrates without depleting local stocks. The general method involves swimming over a pre-defined area of habitat to record the local density of a given species.

**Unsustainable:** activities pertaining to fishing and harvesting or **habitat degradation**, which lead to long-term declines in the abundance of a species or population.

**Upwelling:** physical process (vertical advection) created by a divergence of surface waters, bringing deep, nutrient-rich waters to the ocean surface. Upwelling regions are often associated with high primary productivity and associated fisheries production (see also **downwelling**).

**'Vehicle':** fisheries and aquaculture operations used to catch or produce fish allocated for economic development, government revenue, food security or livelihoods.

**Vortex:** a spinning, often turbulent, flow of fluid. Includes ocean **eddies**.

**Vulnerability (to climate variability and change):** extent to which a natural or human system is susceptible to sustaining damage resulting from climate variability and change, despite human actions to moderate or offset such damage. Vulnerability is a function of the character, magnitude and rate of climate variation to which a system is exposed, the sensitivity of the system and its adaptive capacity.

**Walker Circulation:** zonal (east-west) atmospheric circulation of the tropical Pacific operating within about 20° of the equator. Characterised by rising moist air over Indonesia, which travels eastwards aloft and then sinks and dries in the region of French Polynesia. Closely linked with **ENSO**.

**Wave setup:** increase in water level over reef flats due to the persistent arrival and breaking of waves on the shore.

**Western Pacific Warm Pool:** near-equatorial region of the western Pacific with low sea surface salinity and temperatures greater than 28°C throughout the year. It is the warmest part of the tropical oceans.

**Wind curl:** rotational motion caused by wind, primarily related to north-south variations in the east-west wind stress. Regions of high wind curl correspond to regions of surface water convergence or divergence (due to changing **Ekman transport**), resulting in downward or upward vertical motion, respectively. Wind curl is dynamically related to the large-scale horizontal circulation of the ocean.

**Zooxanthellae:** microscopic algae that live as symbionts in the intracellular tissue of various marine hosts, including scleractinian (hard) corals, tropical sea anemones and giant clams. As plants, zooxanthellae photosynthesise and provide energy to the host organism which, in return, provides protection and access to sunlight (see also genus *Symbiodinium*).