

## Glossary Pages

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## Glossary of Terminology: A

**abalone** - a univalve mollusk (class Gastropoda) of the genus *Haliotis*. Abalones are harvested commercially for food consumption. The shell is lined with mother-of-pearl and used for commercial (ornamental) purposes



Ron McPeak

Sea otters are in direct competition with humans for abalone. (Photo: Ron McPeak)

**abductor** - a type of muscle whose function is to move an appendage or body part away from the body of an animal. Abductors work antagonistically with adductors

**abiogenic** - refers to things not involved with or produced by living organisms

**abiotic** - refers to nonliving objects, substances or processes

**abnormal** - not normal; contrary to the usual structure, position, behavior or rule

**aboral** - situated opposite to, or away from the mouth; normally used to describe radially symmetrical animals, such as starfishes, sea urchins, and jellyfishes



Spines protect the aboral surface of a sea urchin. (Photo: NOAA)

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**abbranchiate** - lacking gills

**absorption** - the taking in of water, dissolved minerals, and nutrients across cell membranes

**absorption** - the biological process that follows digestion, by which the products of digestion are transferred into the organism's internal environment, enabling them to reach the cells

**absorptive feeder** - an animal, such as a parasitic tapeworm, that absorbs digested food products through the body wall



A parasitic tapeworm is an absorptive feeder. The narrowest point is the "head" or scolex which attaches the parasite to the intestinal lining by means of suckers and/or little hooks. Predigested nutrients are absorbed through the wall of each of the progressively larger segments. These animals have no digestive canal. (Photo: HHS/ Centers for Disease Control and Prevention)

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**Acanthaster** - the Crown-of-Thorns starfish genus. *Acanthaster planci* is a voracious Indo-Pacific predator of corals



Crown-of-Thorns starfish (*Acanthaster sp.*), a voracious predator of corals.

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**acanthocaulus** - a juvenile coral of some species that is attached to the substrate either directly or on a stalk

**acaudal** - lacking a tail

**accessory pigment** - a photosynthetic pigment which absorbs light and transfers energy to chlorophylls during photosynthesis

**acclimation (acclimatization)** - a change that occurs in an organism to allow it to tolerate a new environment

**accretion** - growth by virtue of an increase in intercellular material

**acellular** - describes the construction of an organism or tissue that is a mass of protoplasm which is not divided into cells, e.g., some structural parts of slime molds and fungi

**acid** - a substance that increases the hydrogen ion concentration in a solution

**acid rain** - the precipitation of sulfuric acid and other acids as rain. The acids form when sulfur dioxide and nitrogen oxides released during the combustion of fossil fuels combine with water and oxygen in the atmosphere

**acidic** - having a pH of less than 7

**acoelomate** - an animal that does not have a true coelom or body cavity, i. e., a body cavity between the outer wall and the gut and lined with mesoderm. Acoelomate phyla include the flatworms (Platyhelminthes), ribbonworms (Nemertea), and jaw worms (Gnathostomulida)



Acoelomate flatworms such as this *Pseudoceros* sp. lack a coelom (body cavity). (Photo: Adam Petrusek)

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**acolonial coral** - a solitary coral that does not form a colony

**aconitum** - a thread-like part of a coral polyp's or anemone's digestive system and employed as defensive or aggressive structures when extruded

**acquired character** - a non-inherited character, of function or structure, developed in an organism as a result of environmental influences during the individual's life

**Acropora** - a genus of hard (stony) corals that contain the elkhorn and staghorn corals



Staghorn coral (*Acropora* sp.).

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**acrorhagus** - a sac, covered with nematocysts, that protrudes from below the sweeper tentacles or on the column of certain anthozoans

**Actinopterygii** - a class of bony fishes comprising the ray-finned fishes, which make up about half of all vertebrate species known. They are found in most aquatic habitats from the abyssal depths of the ocean, greater than 10,000 m, to high altitude freshwater streams and ponds; a few species can even move about on land for short periods of time. Ray-finned fishes constitute a major human food source



This squirrel fish is a member of the class Actinopterygii, the ray-finned fishes. Note the hard and soft rays in its fins.

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**action potential** - the stimulus-triggered change in the membrane potential of an excitable cell, such as a neuron, caused by selective openings and closings of ion channels

**active site** - a specific region of an enzyme where a substrate binds and catalysis takes place

**active transport** - the pumping of molecules or ions through a membrane against their concentration gradient. This action requires the expenditure of energy through ATP hydrolysis

**acuminate** - a shape which gradually tapers to a point



The fierasfer, *Carapus bermudensis*, possess an acuminate shape. The tapered end allows the fish to retreat tail first, for protection, into the digestive canal of a sea cucumber when threatened. (Photo: D. Flescher, NOAA/National Marine Fisheries Service)

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**adaptation** - changes in gene frequencies resulting from selective pressures being placed upon a population by environmental factors. This results in a greater fitness of the population to its ecological niche

**adaptive behavior** - any behavior that enables an organism to adjust to a particular situation or environment

**adaptive radiation** - the evolution of a single evolutionary stock into a number of different species

**adductor** - a type of muscle whose function is to pull an appendage or body part inwards, towards the body of an animal

**adenine** - one of the four nitrogenous bases in DNA that make up the letters ATGC. Adenine is the "A". The others are guanine, cytosine, and thymine. Adenine always pairs with thymine

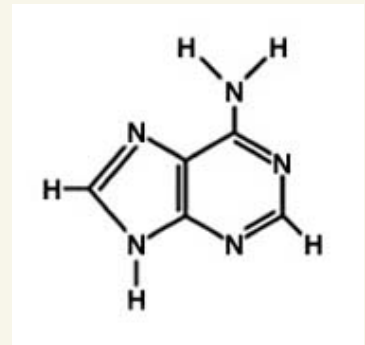


Diagram of the chemical structure of adenine, one of the four nitrogenous bases in DNA.

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**adenosine triphosphate (ATP)** - a nucleoside triphosphate, ATP is the predominant supplier of metabolic energy in living cells. ATP supplies the chemical energy to drive endergonic reactions (requiring work or the expenditure of energy), perform mechanical work, provide heat and even produce bioluminescence

**adipose fin** - in fishes, a small fleshy fin which lacks fin rays. It is found in fishes such as salmon, and most catfishes



The adipose fin of this chum salmon lies between the dorsal and caudal fins. (Image: U.S. Fish and Wildlife Service)

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**adult** - a fully developed and sexually mature animal, physically capable of reproducing under appropriate physiological, ecological and sociobiological conditions



An adult Nassau grouper. It is sexually mature and capable of reproducing.

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**advanced** - new, unlike the evolutionary ancestral or primitive condition

**aerenchyma** - a specialized parenchymous tissue in seagrass leaves that has regularly arranged air spaces or lacunae. These internal air spaces serve for flotation and exchange of gasses

**aerial photography** - photographs taken from an aircraft or satellite utilized to interpret environmental conditions and geographic features

**aerobic** - deriving energy from a process requiring free oxygen

**aerobic respiration** - a form of respiration in which molecular oxygen is consumed and carbon dioxide and water are produced

**age class** - a group of individuals of a species all of the same age

**age distribution** - the frequency of different ages or age groups in a given population

**age structure** - the relative proportion of individuals in each age group in a population

**aggregate** - a group of species, other than a subgenus, within a genus, or a group of subspecies within a species. An aggregate may be denoted by a group name

**aggressive mimicry** - a type of mimicry which results in a deceived species being preyed upon or parasitized by a predator species. The mimic's cues may be visual, auditory, olfactory or behavioral

**Agnatha** - agnathans are the most primitive and ancient of the vertebrates. As the name "Agnatha" implies, they lack jaws. Paired fins are also generally absent, and the adult retains the notochord. The skeleton is cartilaginous. The agnathans include the lampreys and hagfishes



The mouth of a jawless agnathan, the sea lamprey. Adults feed by attaching themselves to their prey, rasping a hole in the skin, and consuming blood and body fluids. (Photo: Minnesota Sea Grant)

**agonistic behavior** - aggressive, negative behaviors, such as fighting, threatening, and fleeing

**AGRRA (Atlantic and Gulf Rapid Reef Assessment)** - an international collaboration of scientists and managers aimed at determining the regional condition of reefs in the Western Atlantic and Gulf of Mexico

**ahermatypic coral** - a coral that lacks zooxanthellae and does not build reefs

**air bladder** - an air sac located in the coelomic cavity of many fishes. In some fishes it may retain a tubular connection with the pharynx or esophagus; also known as a gas bladder or swim bladder, it functions variously as a hydrostatic organ, a sound conductor, a sound production organ, and in respiration. It is absent in sharks and rays, and some bony fishes

**alcohol** - any of a class of organic compounds in which one or more hydroxyl groups are attached to a carbon compound

**alcyonarian** - a soft coral of the order Alcyonacea, class Anthozoa, phylum Cnidaria. They consist of a firm body, throughout which calcareous spicules are dispersed. The surface is studded with polyps. They are closely related to the scleractinian (hard or stony) corals but lack the rigid, stony exoskeleton



Alcyonarians are colonial soft corals that lack the  $\text{CaCO}_3$  exoskeleton of the hard or stony corals. An endoskeleton of calcareous spicules provide support for the body, which is studded with polyps.

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**algae** - unicellular, multicellular, solitary, or colonial organisms that contain chlorophyll. They lack roots, stems, leaves, flowers, and seeds. Algae are in the Kingdom Protista

**algal bloom** - a sudden spurt of algal growth that can indicate potentially hazardous changes in local water chemistry

**algal galls** - a response of gorgonia (*Pseudoplexaura spp.*) to tissue invasion by the algae, *Entocladia endozoica*, in Florida and Caribbean waters. The host gorgonia react to the algal filaments by producing capsules (galls) composed of skeletal elements that isolate the algae from the host tissue, at the expense of the skeletons' tensile strength and elasticity. The gorgonium readily breaks apart at the sites of the weakened skeleton. For more information and illustrations, see: [http://www.coral.noaa.gov/coral\\_disease/algal\\_galls.shtml](http://www.coral.noaa.gov/coral_disease/algal_galls.shtml)

**algal reef** - a reef, usually exposed to wave action, composed of coralline algae and vermatid gastropods. The coralline algae occur in forms of cups or funnels



Coralline algae makes up part of an algal reef.

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**algal ridge** - a low ridge at the seaward margin of a reef flat, largely composed of skeletons of calcareous algae. A synonym of **Lithothamnion ridge**

**algal turf** - densely packed algae, usually filamentous, which rise less than one centimeter above the



substratum upon which they are growing. A synonym of turf algae

**alien species** - a species which does not naturally occur within an area and which has usually arrived as a result of deliberate or accidental human intervention. Alien species often have adverse effects on native species as a result of competition

**alimentary canal** - the canal, including the stomach and intestines, leading from the mouth to the anus

**alkaline** - having a pH of more than 7. Alkaline solutions are also said to be basic

**all-or-none law** - an action that occurs either completely or not at all, such as the generation of an action potential by a neuron, or the contraction of a muscle cell

**allantois** - a vascularized extra-embryonic membrane of amniote embryos that forms as a narrow outgrowth of the hind portion of the gut. In birds and reptiles, it stores waste products of embryonic metabolism. The allantois fuses with the chorion to form the chorio-allantoic membrane in birds and reptiles, and a part of the placenta in mammals

**allele** - one of the variant forms of a gene at a particular locus, or location, on a chromosome. Different alleles produce variation in inherited characteristics. In an individual, one form of the allele (the dominant one) may be expressed more than another form (the recessive one)

**allometric growth** - growth of one part of the body relative to another part in which there is a change in relationships of proportions and/or shape

**allopatric species** - species occupying mutually exclusive geographical areas

**allopolyploid** - a type of polyploid species resulting from two different species interbreeding and combining their chromosomes

**allotype** - in taxonomy, a paratype of the opposite sex to the holotype

**almost atoll** - an atoll whose rim is less than 75 percent complete as a circle at low tide

**alternation of generations** - a life cycle in which a multicellular diploid stage is followed by a haploid stage, and so on; found in land plants and many algae and fungi

**altimetry** - a technique to measure the height of the sea surface from radar pulses transmitted from a satellite

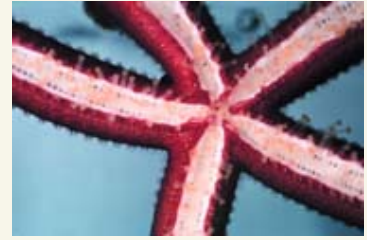


Artist's rendition of a satellite measuring altimetry.

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**ambulacrum** - a row of tube feet of an echinoderm



The ray of a starfish revealing the ambulacral groove and tube feet.

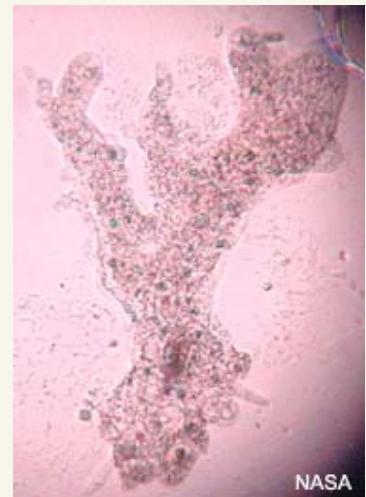
**amensalism** - a type of symbiosis where two (or more) organisms from different species live in close proximity to one another, and where one of the members suffers as a result of the relationship while the other is unaffected by it

**amino acid** - the building block of a protein. Twenty different amino acids are used to synthesize proteins. The shape and other properties of each protein is dictated by its precise sequence of amino acids. Humans must include adequate amounts of 9 of the 20 amino acids in their diet. These "essential" amino acids cannot be synthesized from other precursors

**amnion** - a non-vascular extra-embryonic membrane of amniote embryos that forms a fluid-filled cavity surrounding the embryo. It protects the embryo by functioning as a shock absorber

**amniote** - a vertebrate whose embryo is surrounded by a fluid-filled sac, the amnion; characteristic of reptiles, birds, and mammals

**amoeba** - a naked freshwater or marine protozoan protist that forms temporary pseudopodia for food and water capture, and locomotion



An amoeba thrusting out pseudopodia (false feet). (Photo: NASA)

**amoebocyte** - a phagocytic cell found circulating in the body cavity of coelomates, particularly annelids and mollusks, or crawling by amoeboid movement through the interstitial spaces of sponges; an amoeboid cell in sponges that transports nutrients and is found in the matrix between the epidermal and collar cells; any cell having the shape or properties of an amoeba

**amoeboid** - amoeba-like

**amoeboid movement** - a type of motility of a cell in which cytoplasmic streaming (directional flow of cytoplasm) extrudes outward of the cell to form pseudopodia (false feet) so that the cell can change its location

**anabolism** - the metabolic processes that consumes energy and involve the synthesis of larger, complex molecules from simpler ones

**anadromous species** - a species that spends its adult life in the ocean but swims upriver to freshwater spawning grounds in order to reproduce, e.g., Pacific salmon



The chinook salmon is an anadromous fish which spends most of its life in the ocean, but returns to fresh water streams for spawning

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**anaerobic** - deriving energy from a process that does not require free oxygen

**analogous structure** - a body part that serves the same function in different organisms, but differs in structure and embryological development, e.g., the wing of an insect and a bird

**anamniote** - an aquatic vertebrate whose embryonic stage is not surrounded by an amnion. Fishes and amphibians are anamniotes



Fish eggs and larvae. These aquatic vertebrates do not possess an amnion during embryonic development. (Photo: NOAA/National Marine Fisheries Service)

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**anastomose** - a term that refers to coral branches which grow back together after the initial division

**anastomosis** - the union or connecting of branches forming a meshwork or a network

**ancestor** - any organism, population, or species from which some other organism, population, or species is descended

**ancestral trait** - a trait shared by a group of organisms as a result of descent from a common ancestor

**androgen** - a principal male steroid hormone, such as testosterone, which stimulates the development and maintenance of the male reproductive system and secondary male sexual characteristics

**anemone** - a cnidarian of the class Anthozoa that possesses a flexible cylindrical body and a central mouth surrounded by tentacles



A sea anemone of the Phylum Cnidaria, Class Anthozoa. The tentacles bear stinging cells which are used for food capture and defense.

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**animal hemisphere** - the half of an oocyte or egg which contains less yolk, or the corresponding half of an early embryo with the more actively dividing cells

**animal pole** - the pole of a spherical oocyte or egg that is closest to the nucleus and contains most of the cytoplasm. The opposite pole is the vegetal pole, which, depending upon the type of egg, contains most of the nutritive or yolk granules. There is a graded distribution of cytoplasm and yolk along an axis between the poles that passes through the nucleus. After the fertilized egg undergoes cleavage and develops into a blastula, the same "geographic" points or reference are used

**Animalia** - the kingdom of multicellular heterotrophic eukaryotes that are capable of motility during some stage of their life history

**animated GIF (Graphics Interchange Format) file** - a graphic image on a Web page that moves

**anisogamous** - characterized by reproducing by the fusion of gametes that differ only in size, as opposed to gametes that are produced by oogamous species. Gametes of oogamous species, such as egg and sperm cells, are highly differentiated

**Annelida** - an animal phylum that comprises the segmented worms, and includes earthworms, leeches, and a number of marine and freshwater species



A marine segmented worm of the phylum Annelida.

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**Annual Composite HotSpot map** - a map that composites all of the average monthly HotSpot (see HotSpot) images for a given year

**anomaly** - the deviation of a particular variable (e.g., temperature) from the mean or normal over a specified time

**anoxic** - the absence of free oxygen

**antenna** - one of the paired, flexible, and jointed sensory appendages on the head of a crustacean, an insect, or a myriapod (e.g., a centipede)



A spiny lobster displaying its paired uniramous antennae and biramous antennules. (Photo: Copyright Corel Corporation)

**antennule** - a small antenna, especially the first pair of antennae in crustaceans

**anterior** - morphologically, toward the head or front end of an individual, or proximal portion of a bodily part



Close up of the anterior end of a spotlight parrotfish supermale.

**anthocaulus** - a polyp that develops asexually on the skeletons of some coral species

**Anthozoa** - a class of Cnidaria that includes the stony corals, soft corals, sea anemones, gorgonians, and corallimorpharians



A deep-sea anemone photographed by the *Alvin 2001* during a survey of Blake Ridge off the U.S. Georgia coast (Deep

**anthropogenic** - made by people or resulting from human activities

**anthropomorphism** - attributing a human characteristic to an inanimate object or a non-human species

**antibiotic** - a chemical substance, e.g., penicillin, that kills or inhibits the growth of bacteria

**antigen** - a foreign macromolecule introduced into a host organism that elicits an immune response

**anus** - the posterior opening of the digestive tract, through which waste products of digestion are released

**aphotic zone** - that portion of the ocean where light is insufficient for plants to carry on photosynthesis

**apical** - relating to or located at the tip (an apex)

**Aplacophora** - a class of Mollusca. They are a small group (less than 300 species) of wormlike mollusks that lack a shell. Some are associated with soft corals. Creeping species feed on cnidarians. Burrowing species are deposit feeders and carnivores

**apobiosis** - the local death of a part of an organism

**aposematism** - conspicuous warning coloration



A venomous lionfish (*Pterois volitans*) with conspicuous coloration. (Photo: Copyright Corel Corporation)

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**appendicular** - relating to the appendages, as opposed to axial, which refers to the trunk and head of an organism

**apron reef** - the initial stage of a fringing reef. It is discontinuous and covers a small area

**aqueous solution** - a solution in which water is the solvent

**aragonite** - a mineral species of calcium carbonate ( $\text{CaCO}_3$ ) with a crystal structure different from the other two forms of  $\text{CaCO}_3$  (vaterite and calcite). It is precipitated from ocean surface waters mainly by organisms (e.g., coral) that use it to make their shells and skeletons

**aragonite skeleton** - skeletons primarily composed of the aragonite form of calcium carbonate

**arborescent colony** - a coral colony with a tree-like growth structure

**Archaeobacteria** - an ancient group of prokaryotes, over 3.5 billion years old; sometimes this group is placed into a separate kingdom, the Archaea. Most biologists currently place it within the Kingdom Monera. Archaeobacteria inhabit extreme environments

**archenteron** - the primitive endoderm-lined gut of an animal embryo formed during gastrulation. It is formed by the invagination of blastula cells (blastomeres) into the blastocoel. The archenteron develops into the digestive tract of the adult animal

**archetype** - the plan or fundamental structure on which a group of organisms, or their systems of organs, are assumed to have been constructed; as, for example, the vertebrate archetype

**Aristotle's lantern** - a highly developed chewing apparatus used for feeding in some sea urchins

**Arthropoda** - an animal phylum that contains lobsters, crabs, shrimp, mantis shrimp, barnacles and copepods, fairy shrimp (all crustaceans), insects, centipedes, millipedes, spiders, scorpions, horseshoe crabs, pycnogonids (sea spiders), ticks and mites. Approximately three quarters of a million species are described, many more than all the other animal phyla combined. The crustaceans are the arthropods associated with coral reefs



A spiny lobster (phylum Arthropoda).

**artificial reef** - an artificial structure placed on the ocean floor to provide a hard substrate for sea life to colonize. Artificial reefs are constructed by sinking dense materials, such as old ships and barges, concrete ballasted tire units, concrete and steel demolition debris and dredge rock on the sea floor within designated reef sites



These concrete blocks were the first artificial structures deployed to provide a substrate for reestablishing colonies of Oculina coral (*Oculina varicosa*) and simulating fish habitat on Oculina Bank (central Florida Atlantic coast), which were destroyed by bottom trawling in the 1990s.

**artisanal fishing** - fishing which is typically a small-scale operation that uses simple fishing methods; fishing for subsistence by coastal or ethnic island groups using traditional methods; fishing with the purpose of catching/collecting aquatic products for sale

**ascanoid** - simplest body form of sponges, with canals leading directly from the surrounding water to the interior spongocoel



**ascidian** - a solitary or colonial sea squirt of the phylum Chordata, class Ascidiacea. The adult form does not resemble vertebrate chordate animals but the larval stage possesses all basic chordate characteristics. Adult ascidians are sedentary, filter-feeding, cylindrical or globular animals, usually found attached to a substrate. The soft body is surrounded by a thick gelatinous to leathery test, or tunic (which also gives them the name of tunicate), often transparent or translucent. The test is secreted by the body wall of the adult animal. It is composed of cellulose, a carbohydrate unique in the animal kingdom



These adult ascideans (sea squirts) resemble invertebrates, but they are closely related to vertebrates and other members of the phylum Chordata.

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**ASCII (American Standard Code for Information Interchange)** - a set of codes for representing alphanumeric information (e.g., a byte with a value of 77 represents a capital M). Text files, such as those created with the text editor of a computer system, are often referred to as ASCII files

**asexual reproduction** - reproduction that does not involve the union of sex cells (gametes) to produce a zygote. Examples in corals are budding and fragmentation

**aspergillosis** - a widespread fungal infection of Caribbean soft corals. It affects six species of sea fans and sea whips. The pathogen is *Aspergillus sydowii*, a terrestrial fungus which infects gorgonia after germination of spores on the coral surface. This is followed by penetration and spread of hyphae in coral tissue, resulting in highly visible lesions which may be associated with complete loss of tissue and skeleton. Lesions often occur at multiple sites across an infected colony. Purple galls may be produced by the coral host to encapsulate fungal hyphae. For more information and illustrations, see: [http://www.coral.noaa.gov/coral\\_disease/aspergillosis.shtml](http://www.coral.noaa.gov/coral_disease/aspergillosis.shtml)

**atoll** - a horseshoe or circular array of reef islets, capping a coral reef system that encloses a lagoon, and perched around an oceanic volcanic seamount



A small Pacific atoll. Note the coral reef encircling the calm and shallow lagoon.

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**atom** - the smallest component of an element, made up of neutrons, protons, and electrons

**ATPase** - an enzyme that functions in producing or using adenosine triphosphate (ATP)

**auricularia** - the primary larval stage in holothuroid (sea cucumber) development

**autecology** - the ecology of a single species

**author** - in taxonomy, the person(s) to whom a work, a scientific name, or a nomenclatural act is attributed



**automated bleaching early warning system** - automated bleaching alerts/warnings directly from satellite and/or in situ derived indices

**autosome** - any chromosome that is not a sex chromosome; distinguished from a sex chromosome

**autotomy** - the voluntary shedding of an appendage by snapping it off the base; in corals, some, reproduce asexually by autotomy (fragmentation), for example, *Fungia sp*

**autotrophic** - relating to organisms that have a type of nutrition in which organic compounds used in metabolism are obtained by synthesis from inorganic compounds

**available name** - in taxonomy, any name which conforms to all mandatory provisions of the Code. There are general requirements of publication and date, language, name formation etc. An available name is not necessarily a valid name, as an available name may be in synonymy. Conversely a valid name must always be an available one

**AVHRR (Advanced Very High Resolution Radiometer)** - a broad-band, four or five channel (depending on the model) scanner, sensing in the visible, near-infrared, and thermal infrared portions of the electromagnetic spectrum. This sensor is carried on NOAA's Polar Orbiting Environmental Satellites (POES). AVHRR is used for studying and monitoring vegetation conditions. Applications include agricultural assessment, land cover mapping, producing image maps of large areas and tracking regional and continental snow cover. AVHRR data are also used to retrieve various geophysical parameters such as sea surface temperatures (SST) and energy budget data



Artist's rendition of POES satellite.

**axial corallite** - a corallite which forms the tip of a branch

**azooxanthellate coral** - a coral which does not have symbiotic zooxanthellae in its tissues

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## Glossary of Terminology: B

**bacillus** - a bacterium with a rod-like shape

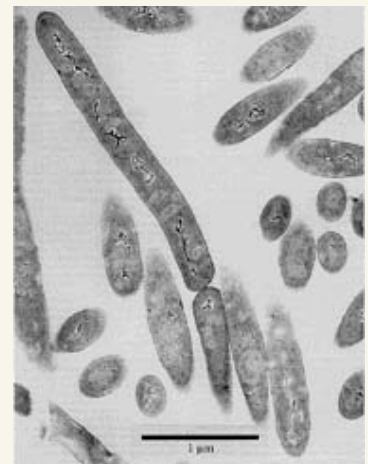
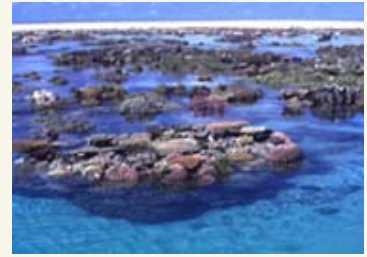


Image of rod-shaped bacterium, *Bacillus infernus*, collected from deep (20-2800 meters) terrestrial

subsurface. (Photo: U.S. Dept. of Energy/Subsurface Microbial Culture Collection)

**back reef** - the shoreward side of a reef, including the area and sediments between the reefcrest/algal ridge and the land. It corresponds to the reef flat and lagoon of a barrier reef and platform margin reef systems



Emergent coral heads in a back reef zone. (Photo: Great Barrier Reef Marine Park Authority)

**bacterial bleaching** - loss of zooxanthellae with resultant bleaching caused by a specific bacterial infection, as opposed to environmental stress. The bacteria (*Vibrio sp.*) produce a toxin which cause lysis of the zooxanthellae. For additional information and illustrations, see: [http://www.coral.noaa.gov/coral\\_disease/bacterial\\_bleaching.shtml](http://www.coral.noaa.gov/coral_disease/bacterial_bleaching.shtml)

**bacterial chlorophyll** - chlorophylls (bacteriochlorophylls a, b, c, d, e, and g) found in photosynthetic bacteria. They differ from plant chlorophyll in chemical construction and absorption spectra characteristics

**bactericide (bacteriocide)** - a substance that kills bacteria

**bacteriophage (phage)** - a virus that attacks and infects bacterial cells. Phages consist of a protein coat enclosing the genetic material, DNA or RNA, that is injected into the bacterium. Upon infection, synthesis of host DNA, RNA and proteins ceases and the phage genome is used to direct the synthesis of phage nucleic acids and proteins using the host's transcriptional and translational apparatus

**balanced polymorphism** - a type of polymorphism in which the frequencies of the coexisting forms do not change noticeably over many generations

**bank** - a broad elevation of the sea floor around which the water is relatively shallow but not a hazard to surface navigation

**bank reef** - large reef growths, generally having irregular shape, which develop over submerged highs of tectonic or other origin and are surrounded by deeper waters

**bank/shelf** - deepwater area extending offshore from the seaward edge of the fore reef to the beginning of the escarpment where the insular shelf drops off to the deep, oceanic water. If no reef crest is present, it is the flattened platform between the fore reef and the deep ocean waters or between the intertidal zone and open ocean

**bar** - an elongate submarine shoal

**barbel** - a slender elongate sensory structure protruding from the lips or jaws of certain fishes, such as catfishes, goatfishes, drums, cods, and many deep-sea fishes. Barbels may appear singly or in groups. They are primarily tactile in function but may also bear tastebuds, allowing the fish to taste its environment



A yellow goatfish with two prominent barbels protruding from its chin. (Photo: NOAA)

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**barophile** - a microorganism which grows best (or can only grow) in high-pressure environments, such as deep-sea environments

**barren zone** - the region of a coral reef seaward of the lower palmata zone and just landward of the buttress or mixed zone

**barrier island** - a long, usually narrow accumulation of sand, that is separated from the mainland by open water (lagoons, bays, and estuaries) or by salt marshes



Cape Lookout National Seashore currently consists of 4 barrier islands. (Photo: U.S. National Park Service)

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**barrier reef** - a long, narrow coral reef, roughly parallel to the shore and separated from it by a lagoon of considerable depth and width. It may lie a great distance from a continental coast. It is often interrupted by passes or channels



Healthy *Acropora* coral in Australia's Great Barrier Reef. (Photo: Ray Berkelmans/Great Barrier Reef Marine Park Authority)

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**basal plate** - lower part of the coral cup, separating the polyp from the substratum. A synonym of pedal disc

**basalt** - a dark, fine-grained igneous rock composed of minerals rich in ferromagnesian silicates

**base** - a substance that reduces the hydrogen ion concentration in a solution

**base pair** - two nitrogenous bases which form a "rung of the DNA ladder." A DNA nucleotide is made of a molecule of sugar, a molecule of phosphoric acid, and a base molecule. The bases are the "letters" that spell out the genetic code. In DNA, the code letters are A, T, G, and C, which stand for the chemicals adenine, thymine, guanine, and cytosine, respectively. In base pairing, adenine always pairs with thymine, and guanine always pairs with cytosine. In RNA, thymine is replaced by uracil

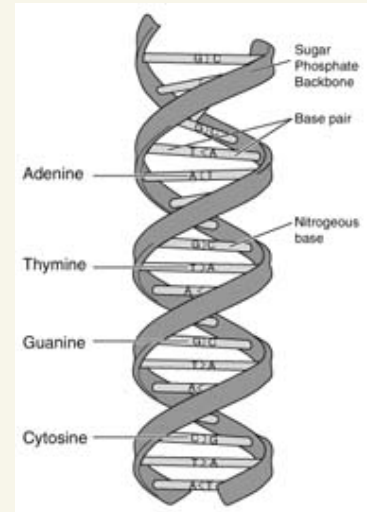


Diagram of a DNA molecule.  
(Diagram: U.S. NIH/Human Genome Project)

**base sequence** - the order of nucleotide bases in a DNA molecule

**Batesian mimicry** - a type of mimicry in which a harmless species resembles a different species that is unpalatable, poisonous, or otherwise noxious or harmful to a predator

**bathymetry** - the science of measuring ocean depths to determine the topography of the sea floor

**beach** - an aggregation of unconsolidated sediment, usually sand, that covers the shore

**beche-de-Mer** - commercially harvested sea cucumbers (Class Holothuroidea). In Asia, it is considered to be a delicacy



Image of the commercially harvested "beche de mer".

**belt transect** - a linear or circular transect with the observation area being a specified distance on either side of the transect line

**benthic** - bottom dwelling; living on or under the sediments or other substrate

**benthic organism (benthos)** - an organism whose habitat is on or near the bottom of a stream, lake, or ocean

**benthic region** - the bottom layer of a body of water



A benthic crab (phylum Arthropoda).

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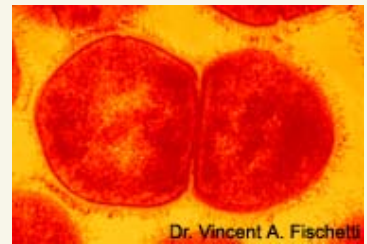
**bifacial** - describes plates which have corallites on both sides

**bifurcate** - a coral branch that divides into two equal branches

**bilateral symmetry** - a bilaterally symmetric organism is one that is symmetric about a plane running from its frontal end to its caudal end (head to tail), and has nearly identical right and left halves. Most animals are bilaterally symmetrical. The exceptions are sponges (no symmetry), cnidarian polyps and medusae, and ctenophores (radial symmetry), and echinoderms (partial radial symmetry).

**bimodal curve** - a frequency curve characterized by two peaks

**binary fission** - type of cell division found in prokaryotic cells, in which dividing daughter cells each receive a copy of the parental chromosome



A bacterial cell reproducing by binary fission. The two resultant daughter cells are genetically identical. (Photo: Dr. Vincent A. Fischetti, Laboratory of Bacterial Pathogenesis and Immunology, Rockefeller University)

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**binding site** - the reactive part of a macromolecule that directly participates in its specific combination with another molecule

**binomen** - a two-part name given to a species in which the first part is the name of the genus and the second is the specific name

**binomial nomenclature** - a system of nomenclature where each animal has a dual name consisting of genus and species, e.g., the boulder coral, *Montastrea annularis*

**bioaccumulation** - the buildup of chemical substances in the cells or tissues of an organism

**bioacoustics** - a discipline of zoology that is concerned with sounds of biological origin: their mechanisms of production, physical properties, receptors and reception physiology, and the role of the sounds in behavior

**bioassay** - an assay for the activity or potency of a substance that involves testing its activity on living

materials

**biochemical cycle** - the flow of an element through the living tissue and physical environment of an ecosystem, e.g., the carbon, hydrogen, oxygen, nitrogen, sulfur, and phosphorus cycles

**biochemical oxygen demand (BOD)** - the amount of oxygen taken up by microorganisms that decompose organic waste matter in water. It is therefore used as a measure of the amount of certain types of organic pollutant in water. A high BOD indicates the presence of a large number of microorganisms, which suggests a high level of pollution

**biochore** - a group of similar biotopes

**biocoenose** - an assemblage of diverse organisms inhabiting a common biotope

**biocoenosis** - a community or natural assemblage of organisms. The term often is used as an alternative to ecosystem, but strictly it is the fauna/flora association excluding physical aspects of the environment

**biodiversity** - the total diversity and variability of living things and of the systems of which they are a part. This includes the total range of variation in and variability among systems and organisms at the bioregional, ecosystem and habitat levels, at the various organismal levels down to species, populations and individuals and at the level of the population and genes



A coral reef contains a great variety of species of all major kingdoms of living forms. (Photo: Dr. Anthony Picciolo)

**biodiversity hot spot** - an area that features exceptional concentrations of species, including many endemics. Many such hot spots also experience large habitat losses, putting these ecosystems at risk

**bioerosion** - erosion of the physical/geological environment by organism activities such as boring, scraping, etching, etc.

**biogenesis** - a central concept of biology that all living organisms are descended from predecessor living organisms

**biogenic** - refers to things which came about as a result of the activities of living organisms

**biogenic reef** - a mound-like layered structure built by and predominantly composed of organic remains such as shells and skeletons of sedentary organisms

**biogenic rock** - an organic rock produced by the physiological activities of plants or animals

**biogeochemical cycle** - the chemical interactions among the atmosphere, biosphere, hydrosphere, and lithosphere

**biogeography** - a branch of biology that deals with the geographical distribution of organisms

**bioherm** - a body of rock built up by or composed mainly of sedentary organisms, e.g., hard corals, calcareous algae or mollusks, and enclosed or surrounded by rock of different origin

**biolimiting** - relating to the environmental factors determining or restricting the growth of a particular life

form

**biological clock** - an internal biological mechanism which controls certain biological rhythms and biocycles, such as metabolism, sleep cycles, and photosynthesis

**biological control** - the use of living organisms, such as parasites, disease agents, and predators, to control or eliminate other unwanted living organisms, rather than by using toxic chemicals or other means of elimination

**Biological Data Profile of the Content Standard for Digital Geospatial Metadata** - provides a common set of terminology and definitions for the documentation of biological data through the creation of extended elements and a profile of the FGDC Content Standard for Digital Geospatial Metadata. Its purpose is to provide a user-defined or theme-specific profile of the FGDC Content Standard for Digital Geospatial Metadata to increase its utility for documenting biological resources data and information. This standard can be used to specify metadata content for the full range of biological resources data and information. It also serves as the metadata content standard for the National Biological Information Infrastructure (NBII)

**biological half-life** - the time required for one-half of the total amount of a particular substance in a biological system to be consumed or broken down by biological processes when the rate of removal is approximately exponential. Toxic chemicals with a long biological half-life will tend to accumulate in the body and are more likely to be harmful. A substance with a short biological half-life may still accumulate if a portion of it it becomes tightly bound to bone or other tissues, even if most of it is quickly eliminated from the body

**biological indicator** - an organism, species or community whose characteristics show the presence of specific environmental conditions. Other terms used are indicator organism, indicator plant and indicator species

**biological navigation** - the ability of certain animals to navigate by instinct to specific sites. Depending upon the species, the cues involved may be related to star patterns, sun angle, polarized light, chemical scents or tastes, or the Earth's magnetic field

**biological productivity** - the amount of organic matter, carbon, or energy content that is accumulated during a given time period

**bioluminescence** - light produced by organisms as a result of conversion of chemical energy to light energy



A bioluminescent comb jelly of the phylum Ctenophora.

**biomagnification** - the accumulation and amplification of chemical substances at each succeeding trophic level

**biomass** - an estimate of the amount of living matter per some unit volume or area

**biome** - a community of animals and plants occupying a climatically uniform area on a continental scale

**biometrics** - the use of statistics for the study of biological events



**biophysics** - the scientific study of the physics of organisms, their biological structure and processes

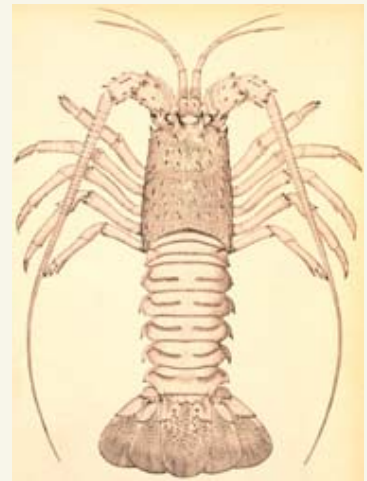
**biosphere** - the thin region surrounding the Earth that is capable of supporting life

**biota** - all life forms of a given area

**biotope** - an area of relatively uniform environmental conditions, occupied by a given plant community and its associated animal community

**bioturbation** - the rearrangement of sediments by organisms that burrow through them and ingest them

**biramous appendage** - a type of appendage that is characteristic of crustaceans. It forks from the basal protopodite to form two branches, the inner endopodite and the outer exopodite. Each of these branches can be composed of either one or more segments. There are many variations on this generalized structure; the branches often possess highly specialized extensions



Note the biramous antennules of the spiny lobster.

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**bit** - the smallest unit of information that a computer can store and process. A bit has two possible values, 0 or 1, which can be interpreted as yes/no, true/false, or on/off

**bitmap image** - also called raster or paint images. They are made of individual dots called pixels (picture elements) that are arranged and colored differently to form a pattern. Compared to a vector image, bitmap images are great for photographs because they tend to offer greater subtleties for shading and texture but require more memory and take longer to print. Vector images are best for drawings that need sharper lines, more detail, and easy modification. Vector images require far less printing resources than bitmap images

**Bivalvia (Pelecypoda)** - a class of Mollusca that includes clams, oysters and mussels. Bivalves are laterally compressed and possess a shell composed of two valves that hinge dorsally and enclose the body. They are common inhabitants of coral reefs



A scallop (class Bivalvia) displays its rows of light-sensitive eyespots.

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**black coral** - black corals are colonial cnidarians in the Order Antipatharia. They are found throughout the world's oceans, but are most common in tropical deep water habitats from 30-80 m depth. These species of black coral have rigid, erect skeletons that form branched, bush-like colonies. Black coral is commercially harvested primarily for jewelry, and may be globally threatened in many parts of the world as a result of over-harvesting



Black coral isn't really black. The name refers to the black color of their proteinaceous skeletons. The living colonies are made up of thousands of tiny coral polyps whose colors may be yellow, green or orange. (Photo: Dr. A. Bruckner, NOAA)

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**black-band disease** - a world-wide disease of corals that is characterized by a dark ring, or band, that separates apparently healthy coral tissue from freshly exposed coral skeleton. It migrates across coral colonies and completely degrades coral tissue. The infecting agent is a synergistic assortment of photosynthetic and non-photosynthetic bacteria. For more details and illustrations, see: [http://www.coral.noaa.gov/coral\\_disease/black\\_band.shtm](http://www.coral.noaa.gov/coral_disease/black_band.shtm)



Black band disease. (Photo: Dr. A. Bruckner, NOAA)

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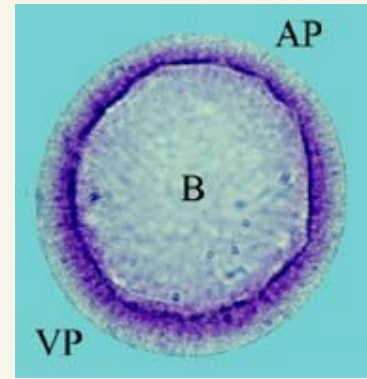
**blade** - a leaf-like structure

**blastocoel** - the fluid-filled cavity formed within the mass of cells of the blastula of many animals during the later stages of cleavage

**blastomere** - an undifferentiated cell of a cleaving embryo, and of the morula and blastula stages of embryonic development

**blastopore** - the opening into the archenteron (primitive gut) of a gastrula. In some animals it develops into the mouth and, in others, into the anus

**blastula** - a stage of embryonic development of animals near the end of cleavage (cell division), but before gastrulation. In animals where cleavage involves the whole egg, the blastula usually consists of a hollow ball of cells (blastomeres) surrounding a fluid-filled central cavity, the blastocoel



A late blastula characterized by a single layer of cells surrounding the central hollow area - the blastocoel (B). The blastomeres at the vegetal pole (VP) are taller than those at the animal pole (AP), making the vegetal pole appear slightly thicker. (Photo: Cell and Developmental Biology Online website (University of Guelph); URL: <http://www.uoguelph.ca/zoology/devobio/>)

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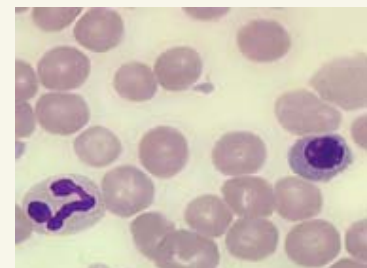
**bleaching index** - index based on the strength and duration of local HotSpots to monitor bleaching events

**bleaching outbreaks** - development of bleaching events

**bleaching stressors** - environment-induced stress that results in bleaching, e.g., disease, excessive or insufficient light, increased levels of ultraviolet radiation, sedimentation, pollution, salinity changes, and increased temperatures

**blind test** - a method of testing or experimentation, in which an independent observer records the results of any test, drug, placebo, or procedure without knowing the identity of the samples or what result might be expected

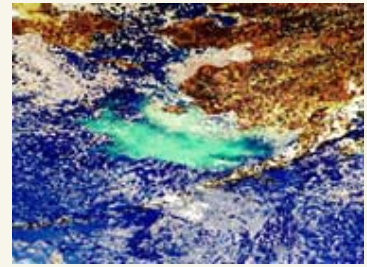
**blood** - a circulating tissue composed of a fluid portion (plasma) with suspended formed elements (red blood cells, white blood cells, and platelets)



Red and white blood cells. The white blood cells are the larger ones with irregular nuclei. The small particles are platelets. (Photo: U.S. National Institutes of Health)

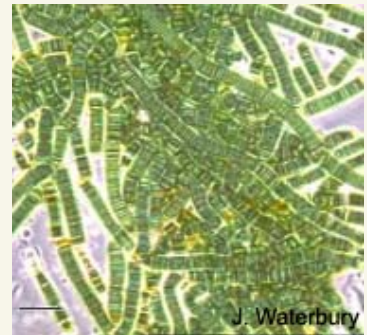
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**bloom** - a sudden increase in the biomass of phytoplankton or benthic algae in a given area



A SeaWiFS (Sea-viewing Wide Field-of-view Sensor) image of a coccolithophore bloom in the Bering Sea.

**blue-green algae** - the former name for the blue-green bacteria, now classified as Cyanobacteria. A group of prokaryotic cells that use chlorophyll on intracytoplasmic membranes for photosynthesis. The blue green color is due to the presence of phycobiliproteins. they occur as single cells, colonies or simple filaments



Blue-green algae (Cyanobacteria). (Photo: J. Waterbury, Woods Hole/NASA Astrobiology Institute)

**BOD (Biological (or Biochemical) Oxygen Demand)** - the oxygen used in meeting the metabolic needs of aerobic microorganisms in water rich in organic matter (as water polluted by sewage)

**bond** - a physicochemical association between atoms

**boring sponge** - a sponge that chemically digests the limestone skeletons of corals during its search for food and living space, which breaks down the structure of the reef

**boss** - a columnar, flat-topped coral-algal growth or erosion structure usually found on the upper surfaces of spurs and buttresses

**bottlebrush branching** - describes a branch with compact radial sub-branches

**bottom trawler** - a fishing vessel that uses an open-mouthed fishing net drawn along the sea bottom. This type of fishing is destructive to shallow water and deep sea coral reef communities



Small stern trawler fishing.  
(Photo: David Comb/New England Biolabs)

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**brachial** - pertaining or belonging to the arm

**brachy-** - a prefix from the Greek, meaning "short"

**branchial** - pertaining to gills

**branchial plume** - a respiratory structure or external gills, usually located on the dorsal side toward the posterior of dorid nudibranchs. This plume surrounds the anus and in some species, it may be retracted. The branchial plume is the major respiratory structure in nudibranchs



The feathery structure toward the posterior of this nudibranch gastropod (marine sea slug) is its respiratory organ.

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**branching colony** - a coral growth pattern where branches are formed

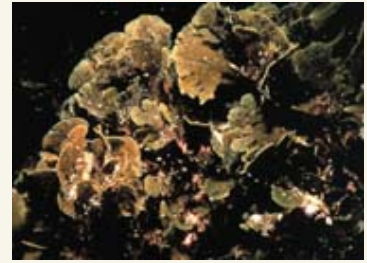
**breaker zone** - the area of a coral reef most exposed to breaking waves

**broadcast spawner** - an organism that releases gametes directly into the sea for external fertilization

**brooder** - a coral which harbors or broods developing larvae within its polyps

**brooding** - the development of larvae within the gastrovascular cavity of an adult coral polyp

**brown algae** - brown algae belong to the Division Phaeophycophyta, whose approximately 1,500 species are almost exclusively marine. They include the largest of the seaweeds and the kelps. The brown algae have chlorophyll a and c, as well as carotenes and xanthophylls, but the green chlorophyll coloration is masked by the brown and yellow pigments. Brown algae are among the largest photosynthetic organisms on earth. The largest kelps may grow to more than 60 meters in length, forming dense underwater forests in colder waters. Many microscopic brown algae grow as epiphytes on underwater vegetation, forming networks of branched filaments, or broad encrustations. All species are multicellular and do not form colonies. Their life cycles are complex, involving alternation of generations. In general, they are not free-floating organisms, but are attached to rock, coral, or other firm surfaces. Sargassum weed, however, is a floating brown algae that stays afloat by producing gas-filled bladders



Brown algae. (Photo: NOAA)

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**Bryozoa** - an animal phylum that contains approximately 5,000 living species. They are all sessile colonial forms composed of zooids. Zooids are tubular, oval or box-like structures that contain a lophophore, which is a circular or horseshoe-shaped fold of the body wall that encircles the mouth and bears numerous ciliated tentacles. Most species form erect or encrusting colonies. They occur in many different habitats, including coral reefs



Bryozoa colony.

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**bubblegum coral** - a deep water gorgonian, *Paragorgia arborea*, found in the North Pacific and North Atlantic Oceans at depths that may exceed 1400m. It can grow to 5m in height and 8 m in width. It is called the bubblegum coral because because it is usually orange or pink in color, and has a lumpy surface texture



Bubble gum coral on Gulf of Alaska Seamounts. (Photo: NOAA Ocean Explorer )

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**buccal** - pertaining to the cheek or oral cavity

**budding** - a type of asexual reproduction in which new individuals develop from the parent organism, forming a swelling similar in appearance to a bud, which separates from the parent as it grows; budding is a form of asexual reproduction in corals where a parent corallite forms daughter corallites

**buoy** - a floating platform for navigational purposes or supporting scientific instruments that measure environmental conditions

**buttress** - see spur and groove



**bycatch** - organisms taken in a fishery which are not of the species intended for harvest. For example, mammals or turtles captured in trawl or seine fishing

**byssal thread** - one of many thin, hairlike filaments secreted by certain mollusks for attachment to a substrate



The byssal gland is located within the foot of the mussel. It produces secretions which are used to form byssal threads for attachment to substrates. (Photo: Great Lakes Sea Grant Network Exotic Species Library, Ontario Ministry of Natural Resources)

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**byte** - a memory and data storage unit composed of contiguous bits, usually eight. For example, file sizes are measured in bytes or megabytes (one million bytes). Bytes contain values of 0 to 255 and most often represent integer numbers or ASCII characters

[\(Top\)](#)

## Glossary of Terminology: C

**CaCO<sub>3</sub> (calcium carbonate)** - a molecule consisting of calcium, carbon and oxygen secreted by corals to their skeleton. It is also secreted by mollusks to form their protective shells



This Queen Conch (*Strombus gigas*) utilizes calcium carbonate in forming its protective shell. (Photo: Andy Bruckner)

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**calcareous** - composed of or containing a substance made of calcium carbonate

**calcification** - the process by which corals and calcareous algae extract calcium from seawater and produce it as calcium carbonate

**calcite** - a mineral made up of a crystalline form of calcium carbonate



**calcite skeleton** - a skeleton composed of the calcite form of calcium carbonate

**calorie** - a unit of measurement defined as 4.184 absolute joules or the amount of energy it takes to raise the temperature of one gram of water from 15 to 16 degrees Celsius (or 1/100th the amount of energy needed to raise the temperature of one gram of water at one atmosphere pressure from 0 degrees C to 100 degrees C). Food calories are actually equal to 1,000 calories (1 food calorie = 1 kilocalorie)

**calyx (pl. calices)** - the upper or open end of the corallite or coral polyp cup

**capsid** - the protein coat of a virus particle

**carapace** - a hard shield, or shell covering, found over all or part of the anterior dorsal portion of an animal. In lobsters, shrimps, crayfish, and crabs, the carapace is the part of the exoskeleton that covers the head and thorax and protects the dorsal and lateral surfaces. In many crustaceans, the term carapace is also used to describe the hard, protective covering of the cephalothorax, as that of the horseshoe crab. The carapace of a turtle's shell is composed of expanded ribs and vertebrae overlain by dermal plates and horny scales



The carapace is the hard shell covering of the cephalothorax of this spiny lobster.

**carbohydrates** - organic compounds composed of carbon, oxygen, and hydrogen; includes the simple sugars, double sugars, and complex sugars (starches)

**carbon compensation depth** - the level in the ocean below which the solution rate of calcium carbonate exceeds its deposition rate

**carbon cycle** - the cycling of carbon in the form of carbon dioxide, carbonates, organic compounds, etc., between various reservoirs, e.g., the atmosphere, the oceans, land and marine biota and, on geological time scales, sediments and rocks

**carcinogen** - a chemical substance that causes cancer

**CARICOMP (Caribbean Coastal Marine Productivity)** - a regional coral reef, seagrass and mangrove monitoring program and network involving a number of Caribbean laboratories, parks and reserves to study land-sea interaction processes in the wider Caribbean region. Twenty-seven institutions in 17 countries participate in CARICOMP

**carnivore** - an organism that feeds upon animals



A carnivore (barracuda) caught in the act.

**carotenoid** - any of a group of red, orange, and yellow accessory pigments of plants or algae

**carpogonium** - the female gamete-producing reproductive organ in red algae, consisting of a single cell and its extension, the trichogyne

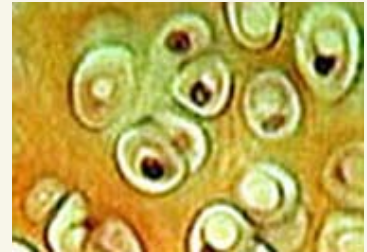
**carposporangium** - a single-celled structure in red algae that produces diploid carpospores on the carposporophyte

**carpospore** - a non-motile diploid spore formed on the carposporophyte stage of the red algae life cycle which germinates to form the tetrasporophyte stage

**carposporophyte** - the diploid stage of red algae which develops after fertilization of the carpogonium

**carrying capacity** - the maximum population size that can be regularly sustained by an environment; the point where the population size levels off in the logistic growth model

**cartilage** - a type of connective tissue where the functional component is the rubbery intercellular matrix that is secreted by cartilage-producing cells called chondrocytes. Cartilage exists in several forms, from glassy to fibrous in appearance



A microscopic section of hyaline cartilage. The cartilage cells (chondrocytes) exist in little cavities (lacunae) in the smooth, glassy cartilaginous matrix. (Photo: NIH/National Cancer Institute)

**CASI (Compact Airborne Spectrographic Imager)** - a digital airborne multispectral sensor

**catabolism** - a destructive metabolic process by which organisms convert substances into excreted compounds

**catadromous species** - a species that spawns in the ocean but lives parts of its life in fresh water, e.g., American eel



The American eel is a catadromous species that spawns in the ocean, near the Sargasso Sea, but grows to maturity in freshwater streams.

**catalysis** - the acceleration of a chemical reaction by a catalyst.

**catalyst** - a substance that accelerates a chemical reaction, but is not consumed or changed in the process

**catenation** - linking of multiple copies of a macromolecule to each other

**cation** - a particle that carries a positive electrical charge. The cation gets this positive charge from losing negatively charged electrons

**caudal** - pertaining to the tail; denoting a position more toward the tail of an animal, e.g., the tail fin of a fish is called the caudal fin. Caudal vertebrae are the vertebrae which extend into the tail of an animal



Caudal fin of a shark. The dorsal lobe of the caudal fin is elongated. (Photo: Copyright Corel Corporation)

**cay** - a small, low coastal island or emergent reef of sand or coral; flat mound of sand and admixed coral fragments built upon a reef flat or just above high tide level. A synonym of **key**, as in the Florida Keys

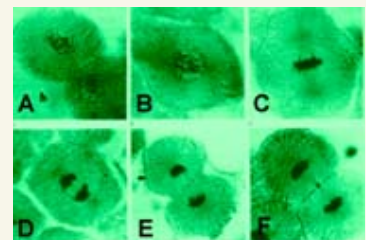
**CD-ROM (Compact Disk-Read Only Memory)** - an optical medium. A CD-ROM 5.25-inch disk can hold about 650 megabytes of information

**cell** - the smallest unit of living matter. All organisms are composed of cells and cell products (Cell Theory). Organisms exist either as single cells (unicellular) or as multicellular units



This example of a single-celled organism, the dinoflagellate *Gambierdiscus toxicus*, produces toxins including ciguatoxin and maitotoxin. The toxins are associated with ciguatera fish poisoning.

**cell division** - the separation of one cell into two daughter cells, involving both nuclear division (karyokinesis) and subsequent cytoplasmic division (cytokinesis). Genetically, the daughter cells are identical to the mother cell (mitosis); however, in gametogenesis (meiosis), the resultant daughter cells (gametes) have the chromosome number reduced by one-half



Cell division by mitosis. A-B: Prophase - the replicated (daughter) chromosomes (chromatids) undergo extensive condensation. They are greatly

thickened and shortened but are still contained within the nuclear membrane. Prophase ends with the sudden breakdown of the nuclear membrane. C: Metaphase - the replicated chromosomes converge toward the center of the cell. D: Anaphase - sister chromatids split at their centromeres. These daughter chromosomes then begin to separate from each other, and move toward one of the two spindle polar regions. E-F: Telophase/Cytokinesis - Chromatids arrive at opposite poles of cell, and new membranes form around the daughter nuclei. The chromosomes disperse and are no longer visible. Cytokinesis or the partitioning of the cell may also begin during this stage. In animal cells, cytokinesis results when a fiber ring composed of a protein (actin) around the center of the cell contracts and pinches the cell into two daughter cells, each with one identical nucleus. Chromosomal replication occurs during the interphase between mitotic activities. (Photo: Dept. of Biology, University of New Mexico)

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**cell membrane** - the structure enveloping a cell, enclosing the cytoplasm and forming a selective permeability barrier which permits the passage of solvents and solutes into and out of cells. It consists of lipids, proteins and some carbohydrates

**cell wall** - an extracellular material that forms the outer surface of plant, fungus, and certain bacterial cells. It is external to the cell membrane and serves in a structural and supporting role. The cell wall is composed primarily of cellulose and lignin in plants, chitin in Fungi, and peptidoglycans in bacteria

**cellular differentiation** - genetically-induced divergence in the structure and function of cells as they become specialized during a multicellular organism's development

**cellulose** - a polysaccharide that is composed of unbranched chains of glucose. It is the major structural carbohydrate of plants

**cement** - the chemically precipitated calcium carbonate present in spaces within skeletons or between grains of internal sediment

**Cenozoic** - the current geologic era, which began 66.4 million years ago and continues to the present

**centrifugation** - the spinning of a mixture at very high speeds to separate substances of different densities



A centrifuge used to "spin down" materials.

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**cephalic** - pertaining to the head

**cephalization** - the localization of neural coordinating centers and sensory organs at the anterior end of the body

**Cephalopoda** - a class of the phylum Mollusca that includes squids, octopods, cuttlefishes and nautili. Many species are inhabitants of coral reefs



Squid (class Cephalopoda) with egg mass.

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**cephalothorax** - the region of the body in decapod crustaceans that is covered by the carapace, with the boundary between the fused head and thorax indicated by the cervical groove. In lobsters, the cephalothorax is called the "body"; in shrimps, it is called the "head"

**ceras** - one of many multifunctional horn or lobe-shaped or leaf-like process on the back or side of a nudibranch mollusk (sea slug). It has a major function as a respiratory organ (a gill), and with a branch of the digestive gland, it also serves as an organ for the exchange of gases and other molecules with the blood. The ceras also stores stinging nematocysts in a structure called the cnidosac, from the cnidarians upon which they feed, which gives it a defensive function. Its ability to change color also gives it a protective camouflage function



Cerata (plural of ceras) of *Aeolidiella foulisi* showing the brown duct of the digestive gland and the whitish cnidosac at the tip.

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**cetacean** - a marine mammal of the Order Cetacea. The Cetacea includes whales, dolphins and porpoises



The killer whale is actually a dolphin in the cetacean family, Delphinidae

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**chaeta ( pl. chaetae)** - stiff hairs or bristles, made of chitin, characteristic of annelid worms. In the earthworm they occur in small groups projecting from the skin in each segment and function in locomotion. The chaetae of marine polychaete worms are borne in larger groups on paddle-like appendages called parapodia

**Chaetodontidae** - a family of fishes (butterfly fish) whose number and behavior may serve as indicators of reef health



A pair of butterfly fishes (Chaetodontidae). Their presence and behavior serve as biological indicators of reef health.

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**chain transect** - a linear transect where a chain is used to mark the line under study. By following the surface contour of the reef, chain transects provide data that may be used to calculate the estimated spatial

index (the ratio of reef surface contour to linear distance of the reef)

**CHAMP (Coral Health And Monitoring Program )** - a NOAA program whose mission is to provide services to help improve and sustain coral reef health throughout the world. Long term goals are: establish an international network of coral reef researchers for the purpose of sharing knowledge and information on coral health and monitoring; provide near real-time data products derived from satellite images and monitoring stations at coral reef areas; provide a data repository for historical data collected from coral reef areas; and add to the general fund of coral reef knowledge

**character** - in taxonomy, any attribute of organisms used for recognizing, differentiating or classifying taxa

**chela** - a pinching claw of a decapod crustacean, composed of a moveable finger, the dactylus, and a fixed finger, a distal extension of the propodus



The large pinching claw of this crustacean is the chela. The entire leg bearing the chela is termed the cheliped. (Photo: NOAA)

**Cheliceramorpha** - an order of arthropods that includes horseshoe crabs, daddy-longlegs, and extinct "sea-scorpions, spiders and scorpions, mites and ticks, " Most of its marine representatives are extinct, but were prominent in the Paleozoic



The horseshoe crab is an arthropod in the order Cheliceramorpha

**cheliped** - one or more pairs of thoracic legs of decapod crustaceans that terminate in a chela, or claw. The entire cheliped is often referred to as a claw



A cheliped of this American lobster (*Homarus americanus*) is a leg bearing a pinching claw.

**chemical bond** - the link between two atoms within a molecule. Different types of chemical bonds include hydrogen bonds, covalent bonds, and ionic bonds

**chemokinesis** - the response by a motile cell to a soluble chemical that involves an increase or decrease in



speed, or frequency of movement, or a change in the frequency or magnitude of turning behavior

**chemosynthesis** - the formation of organic compounds with energy derived from inorganic substances such as ammonia, sulfur and hydrogen

**chemotaxis** - a unidirectional response of motile cells or organisms in which the direction of movement is affected by the gradient of a diffusible substance

**chemotrophs** - organisms (usually bacteria) that derive energy from inorganic reactions; also known as chemosynthetic organisms

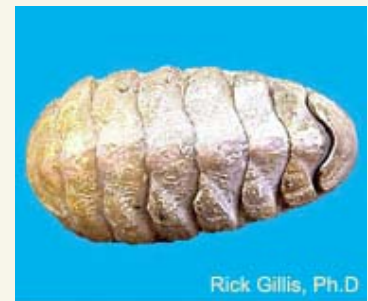
**chi-square** - a statistical technique whereby variables are categorized to determine whether a distribution of scores is due to chance or experimental factors

**chi-square distribution** - a distribution in which a variable is distributed like the sum of the the squares of any given independent random variable, each of which has a normal distribution with a mean of zero and a variance of one

**chi-square test** - a statistical test based on the comparison of a test statistic to a chi-square distribution. It is used to reject or not reject the hypothesis that two or more population distributions do not differ from one another

**chitin** - a polysaccharide made up of chains of N-acetyl-D-glucosamine, a derivative of glucose. Chitin is structurally very similar to cellulose and serves to strengthen the supporting structures of various invertebrates. It also occurs in fungi

**chiton** - a marine mollusk of the Subclass Polyplacophora, which contains about 600 species of sedentary animals commonly known as chitons. They are found from shallow waters to depths of about 400 m. A chiton has a broad foot and a shell consisting of eight overlapping plates



A dorsal view of a chiton shell. Chitons are distinguished from all other mollusks by the presence of their convex shell, which is divided into eight articulating plates (valves). (Photo: Rick Gillis, Ph.D., Biology Dept., University of Wisconsin-La Crosse)

**chlorofluorocarbons (CFC)** - gases that can be dissociated by solar radiation, which release chlorine, which in turn destroys ozone

**chlorophyll** - a green pigment present in green plants and cyanobacteria. Chlorophyll is essential in the transformation of light energy to chemical energy in photosynthesis

**chlorophyll a** - the major photosynthetic pigment found in all oxygen-evolving photosynthetic organisms (higher plants, and red and green algae)

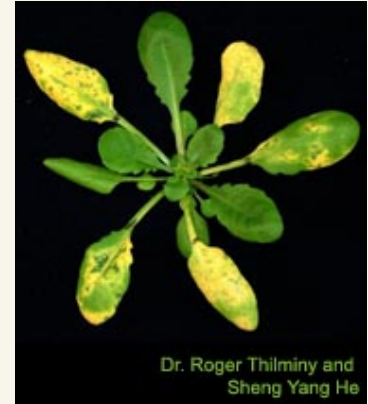
**chlorophyll b** - the chlorophyll generally characteristic of higher plants and green algae .It is absent in other types of algae

**chlorophyll c** - the chlorophyll present in brown algae, diatoms, and flagellates

**chlorophyll d** - the chlorophyll present in red algae, together with chlorophyll a

**chloroplast** - a disk-like organelle with a double membrane, found in some protists and all green plant cells, that contains chlorophyll and is the site of photosynthesis

**chlorosis** - the yellowing or bleaching of plant tissues due to the loss of chlorophyll or failure of chlorophyll synthesis. It can be caused by insufficient light or nutrients, and also by certain diseases



Disease symptoms (necrotic lesions surrounded by chlorosis) caused by a bacterial infection. (Photo: Dr. Roger Thilminy and Sheng Yang He, Michigan State University)

**choanocyte (collar cell)** - a flagellated cell that lines the interior of the central cavity (spongocoel) of a sponge. Choanocytes have a tubular collar with an extended flagellum that faces the spongocoel and creates currents that force water into the interstices of the sponge. Suspended food particles, such as plankton, are trapped by the choanocytes and passed to an amoebocyte that carries the food to other cells

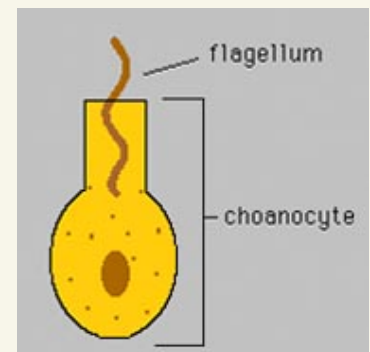


Diagram of choanocyte. The flagella create water currents that bring nutrients into the interior of a sponge. (Diagram: U.S. Environmental Protection Agency)

**Chondrichthyes** - the class of cartilaginous fishes that includes sharks, rays, skates, and chimaeras. Their skeleton is composed of cartilage, not bone



A manta ray, a member of the class Chondrichthyes. (Photo: NOAA)

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**Chordata** - an animal phylum that includes sea squirts (tunicates), lampreys and hagfishes, fishes, amphibians, reptiles, birds and mammals. Many species of marine chordates play prominent roles in the ecology of coral reef ecosystems



The phylum Chordata includes the mammals such as this large humpback whale (*Megaptera novaeangliae*).

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**chorion** - a thick, vascularized extra-embryonic membrane of amniote embryos that forms around the entire undersurface of the eggshell in birds and reptiles, and in direct contact with the uterine wall in mammals. It unites with the allantois to form the major structure for exchange between the embryo and the outside (birds and reptiles) or the maternal circulation (mammals)

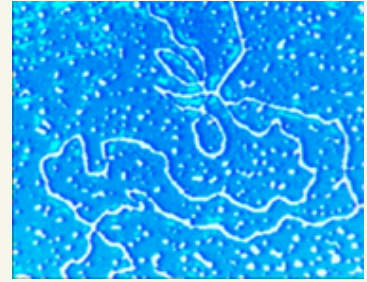
**chromatophore** - a cell whose cytoplasm contains pigment granules that can be rapidly concentrated or dispersed, producing an overall effect of altering the color, color pattern or tone of the whole or part of an animal



This flounder is rarely noticed unless disturbed because of its remarkable ability to change color to match the substrate, by concentrating or dispersing pigment granules in its chromatophores.

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**chromosome** - one of the threadlike "packages" of genes and other DNA in the nucleus of a cell. Different species of organisms have different numbers of chromosomes. In sexually reproducing species, each parent contributes one chromosome of each pair, so offspring get half of their chromosomes from the maternal parent and half from the paternal parent. Bacterial cells do not possess a nucleus, therefore their chromosomes are located in the cellular cytoplasm



Highly magnified view of cell chromosomes.

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**chronology** - the age-depth relationship in ice, sediment, or another deposit. Ages are usually measured for discrete samples, and the ages of intermediate samples are interpolated between samples with measured ages

**ciguatera** - a food poisoning of humans caused by eating some species of tropical fishes whose flesh is contaminated with toxins obtained through the food chain



Ciguatera food poisoning may be contracted by eating the flesh of a contaminated barracuda.

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**ciguatoxin** - a toxin found in flesh of marine animals, especially some fishes, at some times, in some localities. It is probably of algal origin and causes paresthesia, gastrointestinal symptoms, neuromuscular blockade, and respiratory paralysis due to interference with membrane function



Barracuda (*Sphyraena* sp.) are often the culprits in ciguatera food poisoning, caused by ciguatoxin. (Photo: Copyright Corel Corporation)

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**cilia** - short, motile, generally microscopic, hairlike projections found on many protists and larvae of some invertebrates. Cilia are used for locomotion, the generation of a current, or filter feeding; A cilium is made up of microtubules and has basically the same internal structure as a flagellum. Movement is caused by the interactions of the microtubules. In higher animals, cilia are found projecting from cells that line certain tubes and passages, such as the tracheae (windpipe) of mammals

**ciliary** - relating to any cilia or hairlike processes; can relate to muscles concerned with visual focusing

**ciliated epithelium** - any epithelium having motile cilia on the free surface



Pseudostratified ciliated columnar epithelium - the ciliated epithelium that lines the trachea (windpipe) of mammals. (Photo courtesy of Dr. Franklin S. Carman III, donated from URL: <http://tooldoc.wncc.edu>)

**Ciliophora** - a group of protists bearing cilia



The stalked ciliate, *Stentor*. (Photo: Jon Houseman/BIODIDAC)

**circadian rhythm** - the regular recurrence, in cycles of about 24 hours, of biological processes or activities

**cirrus** - a slender, flexible appendage or part of an organism, usually having a tactile function

**clade** - a group of species with a common evolutionary ancestry

**cladistics** - the systematic classification of groups of organisms on the basis of the order of their assumed divergence from ancestral species

**cladogram** - a tree-like diagram, resulting from a cladistic analysis, which depicts a hypothetical branching sequence of lineages leading to the taxa under consideration. The points of branching within a cladogram are called nodes. All taxa occur at the endpoints of the cladogram

**clasper** - a rod-like modification of the pelvic fin of a male elasmobranch that is used to transfer sperm into the female during mating

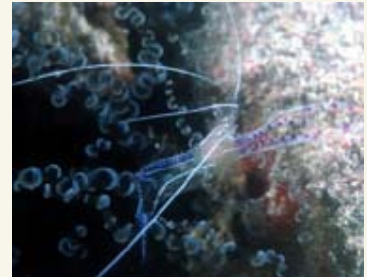


NOAA scientist measuring the length of a ray's clasper.

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**classification** - a system of nested hierarchical categories used to efficiently store information about biological diversity

**cleaning behavior** - mutualistic behavior in which larger animals, usually fishes, permit smaller animals, usually other species of fishes or invertebrates, to clean them of external parasites



Pederson's Cleaning Shrimp (*Periclimenes pedersoni*) on a reef in the Virgin Islands. This small (to 1 inch) shrimp favors habitat and a steady food supply offered by Ringed and Giant Caribbean anemones.

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**cleaning station** - a site visited by fishes where, in a mutually symbiotic relationship, cleaning shrimp or fish remove parasites from their bodies

**cleavage** - the early mitotic cellular divisions of the fertilized egg (zygote)



A four-cell stage of a cleaving sea urchin embryo. (Photo: Copyright Dr. Leland Johnson, Augustana College, Illinois)



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**climate** - long-term characteristics of weather

**climate change** - the long-term fluctuations in temperature, precipitation, wind, and all other aspects of the Earth's climate. It is also defined by the United Nations Convention on Climate Change as "change of climate which is attributed directly or indirectly to human activity that alters the composition of the global atmosphere and which is in addition to natural climate variability observed over comparable time periods"

**climate variability** - changes (variability/trends) in the long-term characteristics of weather

**climate-induced bleaching** - coral bleaching as a result of changing climate patterns, e.g., temperature

**climax** - the final stage in ecological succession that is able to persist in the absence of environmental change

**cline** - the gradual variation, in a character of a species, in geographical space

**cloaca** - the common passage for fecal, urinary and reproductive discharge in most lower vertebrates

**CLOD (Coralline Lethal Orange Disease)** - a disease which infects coralline algae

**clone** - an individual genetically identical to the parent organism, created by the splitting off or budding of cells from the parent organism

**clone cells** - a group of genetically identical cells all descended from a single common ancestral cell by mitosis in eukaryotes, or by binary fission in prokaryotes. Clone cells also include populations of recombinant DNA molecules all carrying the same inserted sequence of bases

**cloning** - the process of asexual reproduction in an otherwise multicellular organism

**closed circulatory system** - a circulatory system in which blood flows through blood vessels at all times. Blood flows from arteries to capillaries and through veins, but the tissues surrounding the vessels are not directly bathed by blood. Some invertebrates and all vertebrates have closed circulatory systems

**cnida** - an organelle located in cnidocytes that is capable of eversion

**Cnidaria** - a multicellular animal phylum, with a tissue grade of construction, that contains the stony (hard) corals, anemones, sea fans, sea pens, hydroids, and jellyfish



An Atlantic coast cnidarian, a dahlia sea anemone (*Tealia* sp.)  
(Photo: Andy Bruckner)

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**cnidocyte** - a stinging cell of jellyfish, hydroids, sea anemones and corals. The cnidocyte contains the eversible cnida. The most common type of cnidocyte is the stinging structure known as the nematocyst.

Nematocysts are located throughout the epidermis, but are especially abundant on the tentacles

**cnidosac** - a sac located in a ceras of a nudibranch gastropod which contains undischarged nematocysts (obtained through feeding upon cnidarians) passed from the slug's digestive system. When a predator attacks the nudibranch, the nematocysts may discharge as a defensive mechanism



Section through the ceras of *Aeolidiopsis ransonii* showing the cnidosac with three nematocysts. (Photo: Dr. Bill Rudman)

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**coalesce** - to come together so as to form one whole; to fuse

**coastal area** - the areas of land and sea bordering the shoreline and extending seaward through the breaker zone. Coastal areas throughout the world are under enormous environmental stress, which is caused by a wide range of factors, including pollution and the destruction and deterioration of marine habitats

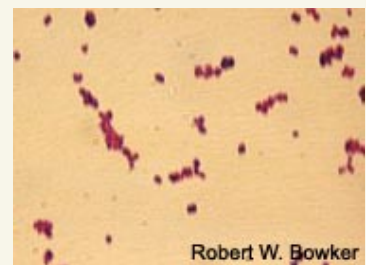


Rainbow over Hawaii, HI coast (Photo: Dr. James P. McVey, NOAA Sea Grant Program)

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**coastal reef** - a coral reef occurring near and parallel to a coastline

**coccus** - a bacterium with a spherical shape



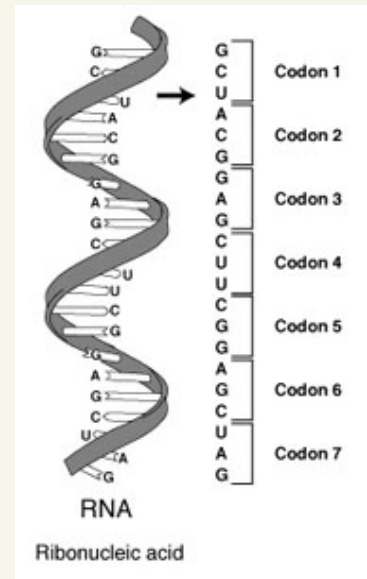
Coccus bacteria. (Photo: Robert W. Bowker, Glendale Community College Glendale, AZ)

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**Code** - in taxonomy, the International Code of Zoological Nomenclature. An authoritative document

containing a system of rules and recommendations to be followed in giving a scientific name to an animal or animal group

**codon** - three bases in a DNA or RNA sequence which specify a single amino acid



RNA codons. A = adenine; C = cytosine; G = guanine; U = uracil. (Diagram: NIH/Human Genome Project)

**Coelenterata** - an older name for the phylum Cnidaria

**coelenteron** - the gastrovascular (digestive) cavity of a cnidarian or ctenophore

**coelobite** - an organism that lives in pores and spaces within a reef

**coelom** - an internal fluid-filled body cavity within a coelomate organism. It lies between the gut and the outer body wall, and is lined entirely with tissue (peritoneum) derived from the mesoderm. Most internal organs are located within the coelom. The structure and development of the coelom is an important taxonomic character for recognizing major groups of animals

**coenenchyme** - all of the mesenchymal tissue, perforated with channels, that is common to all polyps of a colonial cnidarian

**coenosarc** - the living tissue of a cnidarian polyp, consisting of the outer, nonciliated epidermis and the inner, ciliated gastrodermis with the thin, acellular mesoglea in between. The coenosarc connects the coral polyps of a coral colony. It spreads along the surface of the calcareous exoskeleton

**coenosteum** - the common surface of corallum between calices

**coenosteum pit** - the point of insertion or commencement of septa in some corals

**coenzyme** - an organic nonprotein molecule that binds with the protein molecule to form the active enzyme

**coevolution** - two or more organisms evolving, each in response to the other

**cohort** - individuals all of the same age

**coliform bacteria** - bacteria whose presence in water is an indicator of pollution and of potentially dangerous contamination



A coliform-caused fish kill. Fecal coliforms originate from sewer overflows, septic tank seepage and animal defecation. They are indicators of fecal contamination which could also contain bacteria and viruses responsible for cholera and typhoid infections, hepatitis and gastroenteritis. (Photo: Pine River Shire Environmental Services, Australia)

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**collagen** - the protein substance of the collagenous fibers (white fibers) of skin, tendon, bone, cartilage and all other connective tissue. Collagen also serves as skeletal support in some sponges

**collagenous** - producing or containing collagen

**collagenous fiber** - white connective tissue fiber that occurs in bundles. They possess a high tensile strength and make up the principal element of irregular connective tissue, tendons, and aponeuroses, and occur in the matrix of cartilage and bone tissue

**collection** - an assemblage of specimens compiled and maintained for purposes of study and/or display

**collencytes** - a contractile, collagen-secreting amoebocyte in sponges

**colloid** - a stable suspension of particles that, though larger than in a true solution, do not settle out

**colonial coral** - a coral composed of many individuals

**colonized hardbottom** - a substrate formed by the deposition of calcium carbonate by reef building and other organisms. Habitats within this category have some colonization by live coral

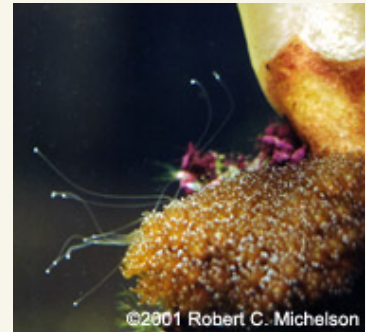
**columella** - the central structure of the calyx formed by fusion of the septa

**columnar colony** - a coral colony formed into one or more columns

**commensal** - having benefit for one member of a two-species association but neither positive nor negative effect on the other

**compact branching** - a growth pattern where the coral branches are close together

**competition** - a biological interaction that can limit population growth. Competition occurs when two or more populations vie for the same limited resource



Sweeper tentacles from a *Galaxia* colony. The stinging cells kill neighboring "non-self" corals in the competition for space. Mesenterial filaments which dissolve neighboring non-self corals are another means of competitive tactics by scleractinian corals. (Photo: Copyright 2001 Robert C. Michelson)

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**competitive exclusion** - the principle that when the populations of two species compete for resources, one will use the resources more efficiently, therefore outcompete and eventually eliminate the other population

**compound** - a material made up of two or more elements combined in a fixed ratio

**compound eye** - the eye of arthropods, most highly developed in insects and crustaceans. It consists of a group of functionally related visual elements (ommatidia), each having its own refractive system and each forming a portion of an image

**compressed** - a body shape which is flattened laterally, bringing the right and left sides closer together, e.g., a butterfly fish or a flounder



The compressed body shape of a garibaldi. (Photo: Copyright Corel Corporation)

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**confidence interval** - the probability, based on statistics, that a number will be between an upper and

lower limit

**conjugation** - the process of genetic recombination between two bacterial or protist organisms via a cytoplasmic bridge between them, across which, genetic material is exchanged

**Conservation** - under the NOAA Coral Reef Conservation program, the term 'conservation' means the use of methods and procedures necessary to preserve or sustain corals and associated species as diverse, viable, and self-perpetuating coral reef ecosystems, including all activities associated with resource management, such as assessment, conservation, protection, restoration, sustainable use, and management of habitat; mapping; habitat monitoring; assistance in the development of management strategies for marine protected areas and marine resources consistent with the National Marine Sanctuaries Act (16 U.S.C. 1431 et seq.) and the Magnuson-Stevens Fishery Conservation and Management Act (16 U.S.C. 1801 et seq.); law enforcement; conflict resolution initiatives; community outreach and education; and that promote safe and ecologically sound navigation

**conservation** - the political/social/economic process by which the environment is protected and resources are used wisely

**conspecific** - of the same species

**consumer** - an organism which must consume other organisms (living or dead) in order to satisfy its energy needs

**Content Standard for Digital Geospatial Metadata** - provides a common set of terminology and definitions for the documentation of digital geospatial data. The standard establishes the names of data elements and compound elements (groups of data elements) to be used for these purposes, the definitions of these compound elements and data elements, and information about the values that are to be provided for the data elements

**continental margin** - the water-covered edges of continents consisting of the continental shelf, the continental slope, and the continental rise

**continental rise** - the enormous wedge of sediment deposited at the base of the continental slope

**continental shelf** - the shallow, near-horizontal sea floor extending from the coast to the upper continental slope

**continental slope** - the sloping sea bottom of the continental margin that begins at a depth of about 100 to 150 m at the shelf edge and ends at the top of the continental rise or in a deep-sea trench

**contour** - on a map or chart, a line connecting points of equal surface value

**contour interval** - the difference in surface values between contours

**convergent evolution** - the development of superficially similar structures in unrelated organisms, e.g., the wings of insects and birds

**copepodid** - postnaupliar developmental stages of copepods



**coral** - a general term used to describe a group of cnidarians; indicates the presence of skeletal material that is embedded in the living tissue or encloses the animal altogether



Finger coral (*Porites compressa*) in Hawaii (Photo: M. White)

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**coral assemblage** - a group of corals

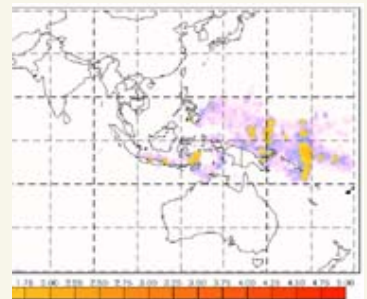
**coral bleaching** - the process in which a coral polyp, under environmental stress, expels its symbiotic zooxanthellae from its body. The affected coral colony appears whitened



Bleached *Acropora* coral in Florida Keys (Photo: Larry Benvenuti)

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**coral bleaching hotspot** - a region of sea surface temperature (SST) that exceeds the climatological maximum for a region by 1 deg C or more. These conditions may cause sufficient stress to coral reefs to result in coral bleaching



Section of a graphic depicting areas of elevated ocean temperatures that may result in coral bleaching events.

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**Coral Bleaching HotSpot monitoring program** - a NOAA program that uses satellite and in situ monitoring stations to monitor high sea surface temperature events and to analyze conditions that may lead to coral bleaching

**coral growth line** - a minute growth line on the outer surfaces of corals that have a calcified outer wall. The carbonate is produced by zooxanthellae which create a series of diurnal growth increments

**coral product** - any living or dead specimens, parts, or derivatives, or any product containing specimens, parts, or derivatives, of any species of coral in the cnidarian Orders: Antipatharia (black corals), Scleractinia

(stony corals), Gorgonacea (horny corals), Stolonifera (organpipe corals and others), Alcyonacea (soft corals), and Coenothecalia (blue coral), of the Class Anthozoa; and all species of the Order Hydrocorallina (fire corals and hydrocorals) of the Class Hydrozoa

**coral reef** - a wave-resistant structure resulting from cementation processes and the skeletal construction of hermatypic corals, calcareous algae, and other calcium carbonate-secreting organisms

**coral reef bleaching monitoring product** - near real-time information derived from data either from satellite images or in situ monitoring stations at coral reef areas to help improve and sustain coral reef health throughout the world

**Coral Reef Watch** - see CRW (Coral Reef Watch) Program

**Coral Stress Index** - an index that indicates the relative accumulated thermal stress experienced by a given coral reef

**Corallimorpharia** - an order of the subclass Zoantharia (Hexacorallia) of the phylum Cnidaria. They are mostly solitary species (some are colonial) that resemble true corals, but lack a calcareous skeleton

**coralline algae** - algae that form solid calcium carbonate accretions



Coralline algae remove calcium from water. This calcium carbonate gives them a coral-like look. As they die, they turn white. (Photo: Nancy Sefton)

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**corallite** - a coral cup; the skeleton of an individual polyp

**corallivore** - an organism that eats coral



Parrotfish are often corallivorous, scraping the coral polyps with beaklike jaws.

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**corallum** - a complete coral colony; a coral head

**CoRViL (Coral Reef Virtual Laboratory)** - a joint venture of the National Oceanic and Atmospheric Administration (NOAA), the Great Barrier Reef Marine Park Authority (GBRMPA), and the Australian Institute of Marine Science (AIMS). This venture will provide an automated, cooperative exchange of electronic data, computer processing power and remote sensing tools for the purpose of monitoring the coral reef environment on the Great Barrier Reef. It is anticipated that this effort will eventually provide a model for monitoring physical processes at other sensitive coral reef areas throughout the world

**corymbose** - describes coral colonies with horizontal interlocking branches and short upright branches

**cosmopolitan distribution** - worldwide distribution within habitat limits

**costa** - the extension of the septa outside the calyx into the coenosteum

**counter shading** - protective body coloration where the dorsal surface (above) is dark and the ventral surface (below) is lighter



Counter shading in a white shark. The darker dorsal surface and lighter ventral surface allows the shark to blend in with the environment when viewed from above or below. (Photo: NOAA)

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**covalent bond** - a bond between two or more atoms that is provided by electrons that travel between the atoms' nuclei, holding them together but keeping them a stable distance apart

**crenulate** - a shape in which the edge is slightly scalloped

**crepuscular** - most active at low light levels during dusk and dawn



The large eyes of a squirrelfish hint about its crepuscular behavior, allowing it to be active and feed during periods of diminished light. (Photo: Copyright Corel Corporation)

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**CREWS (Coral Reef Early Warning System)** - *in situ* NOAA meteorological and oceanographic monitoring sites that collect data continuously which are transmitted hourly via satellite to a data archival site. An automated system (hardware and software) that monitors select oceanographic and meteorological parameters and produces specialized alerts when conditions may result in environmental stresses conducive of coral bleaching. NOAA plans to expand the CREWS from the Florida Keys/ Bahamian sites to many remote coral reef sites throughout the world



A CREWS station on site.

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**critical depth** - the depth at which phytoplankton photosynthesis for the water column is equal to phytoplankton respiration for the water column

**Crustacea** - a subphylum of Arthropoda that includes shrimp, mantis shrimp, lobsters, crabs, water fleas, copepods, crayfish and wood lice. There are almost 40,000 described species of crustaceans. The Crustacea are mainly aquatic, but include some semi-terrestrial and terrestrial groups



A marine shrimp (Crustacea).

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**CRW (Coral Reef Watch) program** - formed in 2000, NOAA's CRW maximizes NESDIS's coral reef resources by joining and building on existing NESDIS coral reef strengths under a more coordinated program. It seeks to develop a long-term coral reef monitoring system with the ability to predict coral bleaching episodes in all major U.S. coral reef areas

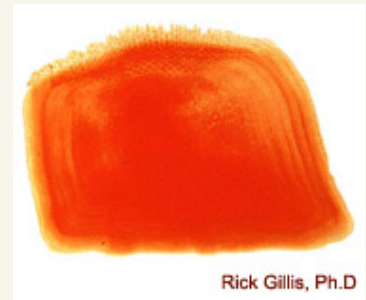
**crypsis** - protective camouflage coloration where the individual resembles its background

**cryptic** - pertaining to concealment, usually in reference to color pattern or behavior (e.g., hiding in reef crevices)



The viper moray is a cryptic fish, concealing itself in crevices and holes in the coral reef. (Photo: Dr. Anthony Picciolo)

**ctenoid** - comb-shaped; with a comb-like margin



A ctenoid scale of a bony fish. It is thought that the combed edge helps to reduce hydrodynamic drag during swimming. (Photo: Rick Gillis, Ph.D., Biology Dept., University of Wisconsin-La Crosse)

**ctenophore** - a member of the animal phylum Ctenophora. A small phylum (about 50 species) whose members, known as comb jellies and sea walnuts, superficially resemble jelly fishes. These planktonic organisms are thought to have evolved from a medusoid cnidarian

**cue** - in animal behavior, a signal from one animal which acts as a stimulus to elicit a behavioral response in another. The cue may be visual, acoustic, or chemical

**cutaneous** - pertaining to the skin

**cuticle** - an extracellular, protective external body covering, secreted by the epidermis, of some invertebrate animals, usually composed of fibrous material, such as chitin or collagen; the waxy layer of epidermal cells of plant parts, such as leaves, stems, and fruit

**cyanide fishing** - a destructive fishing technique in which sodium cyanide or some other cyanide compound is used to stun and capture coral reef fishes for the aquarium and live food trade

**cyanobacteria** - photosynthetic aquatic bacteria, often called blue-green algae, but have no relationship to algae. Cyanobacteria get their name from the bluish pigment phycocyanin, which they use to capture light for photosynthesis. They also contain chlorophyll a, the same photosynthetic pigment found in the chloroplasts of plants. Not all "blue-green" bacteria are blue; some common forms are red or pink, resulting from the pigment phycoerythrin



A bloom caused by cyanobacteria ("blue-green algae").

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**cycloid** - having a smooth-edged margin

**cyclosystem** - a system of very small tubules that links the polyps of calcareous colonial hydrozoans

**cystid** - the exoskeleton and body wall of the stationary trunk of bryozoans

**cytokinesis** - the division of the cytoplasm of a cell during cell division

**cytoplasm** - the protoplasm of a cell exclusive of that of the nucleus. It consists of a continuous aqueous solution (cytosol) and the organelles and inclusions suspended in it. The cytoplasm is the site of most of the chemical activities of the cell

**cytosine** - one of the four nitrogenous bases in DNA that make up the letters ATGC. Cytosine is the "C". The others are adenine, guanine, and thymine. Cytosine always pairs with guanine

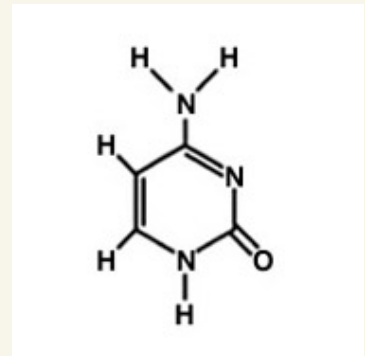


Diagram of the chemical structure of cytosine, one of the four nitrogenous bases in DNA.

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**cytoskeleton** - the network of microtubules, microfilaments, and larger filaments that provides a eukaryotic cell with its structural support, shape, and its capacity to move and arrange its organelles within the cell

**cytosol** - the fluid, less structured part of the cytoplasm of a cell, excluding organelles and membranous structures; the portion of the cytoplasm which remains after removal of particulate components

**CZCS (Coastal Zone Color Scanner)** - a scanning radiometer with six spectral channels centered at 0.443, 0.520, 0.550, 0.670, 0.750 and 11.5 micrometers and selected to allow measurement of ocean color and temperature, suspended sediment and chlorophyll concentrations, and ocean pollutants

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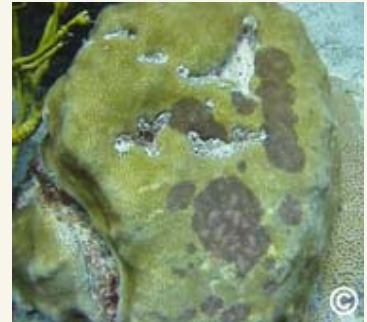


## Glossary of Terminology: D

**dactylozoid** - a colonial hydrozoan polyp that possesses a large, nematocyst-bearing fishing tentacle, and functions in defense and in food capture

**dark-field microscope** - a microscope that has a special condenser and objective with a diaphragm that scatters light from the observed object. The object appears bright on a dark background

**dark-spots disease** - a coral disease characterized by darkly pigmented areas of tissue on stony corals. At present, there is no known pathogen. The coral tissue remains intact, although at times lesions and coral tissue death are observed in the centers of the pigmented areas. Tissue loss is minimal, if present. This disease is widespread throughout the Caribbean. For additional information and illustrations, see: [http://www.coral.noaa.gov/coral\\_disease/dark\\_spots.shtml](http://www.coral.noaa.gov/coral_disease/dark_spots.shtml)



Dark spots disease infecting *Stephanocoenia intersepta*.  
(Photo: NOAA; image copyrighted)

**Darwin Mounds** - two areas of hundreds of sand and cold-water coral mounds at depths of about 1,000 m, in the northeast corner of the Rockall Trough, approximately 185 km northwest of the northwest tip of Scotland. The Darwin Mounds cover an area of approximately 100 sq. km. The tops of the mounds are covered with *Lophelia pertusa* corals and coral rubble

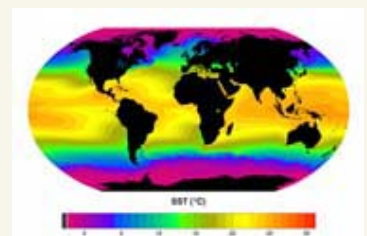
**data** - multiple facts (usually but not necessarily empirical) used as a basis for inference, testing, models, etc.; the word is plural (sing. datum) and takes a plural verb

**database** - a structured file of information or a set of logically related data stored and retrieved using computer-based means

**database management system (DBMS)** - a set of computer programs for organizing the information in a database. A DBMS supports the structuring of the database in a standard format and provides tools for data input, verification, storage, retrieval, query, and manipulation

**daughter cell** - one of the two cells formed by the division of a parent cell

**Day/Night SST** - observations of sea surface temperature obtained during both daytime and nighttime orbits from the Advanced Very High Resolution Radiometer (AVHRR) on NOAA's polar satellite



1985-2000 average sea surface temperature from AVHRR Pathfinder.

**decadal** - refers to a climatic process that re-occurs every decade or once every few decades

**decapod crustacean** - a members of the Order Decapoda, Class Malacostraca, Superclass Crustacea, Phylum Arthropoda; has five pairs of thoracic legs. Examples are shrimps, lobsters, crabs, and hermit crabs



A spider crab is a decapod crustacean.

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**decomposer** - a heterotrophic organism that breaks down dead biological matter and uses some of the products and releases others for use by consumer organisms

**decomposition** - the breakdown of organic matter by bacteria and fungi

**decompression chamber** - a hyperbaric steel enclosure used to treat victims of decompression sickness (the "bends") in which the air pressure is first gradually increased and then gradually decreased. This shrinks the nitrogen bubbles and allows the nitrogen to safely diffuse out of the victim's tissues



A NOAA decompression chamber.

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**decompression sickness (the bends)** - a dangerous and potentially lethal condition of divers precipitated by rapid changes in ambient atmospheric pressure, mostly in rapid ascent from underwater, but can also result from flying in an aircraft too soon after a dive. It occurs because at high pressures (such as SCUBA divers experience while underwater) the blood can contain more dissolved nitrogen than at lower pressures. When the diver ascends too rapidly, the blood can no longer contain this dissolved nitrogen and tiny gas bubbles begin to form in the blood. Symptoms include: body pain (mainly in the joints), headache, confusion, itchy skin rash, visual disturbances, weakness or paralysis, dizziness, or vertigo. Treatment involves the administration of oxygen and placing the patient into a decompression chamber until the nitrogen bubbles shrink and safely diffuse from the tissues

**deep fore reef** - the deepest seaward part of a coral reef; a vertical cliff beginning at a depth of about 60 m

**deep-sea corals** - stony, soft, gorgonian, black, and horny corals that inhabit the colder deep waters of continental shelves and offshore canyons, ranging from 50 -1000m+ depths. They lack zooxanthellae and may build reef-like structures or occur solitarily



*Lophelia pertusa*, a deep-sea stony coral.

**definitive host** - in a parasite's life cycle, it is the host organism in which the parasite reproduces sexually

**Degree Heating Week accumulation** - accumulated thermal stress that coral reefs experience over a typical 12-week period

**Degree Heating Week (DHW)** - the NOAA satellite-derived Degree Heating Week (DHW) is an experimental product designed to indicate the accumulated thermal stress that coral reefs experience. A DHW is equivalent to one week of sea surface temperature 1 deg C above the expected summertime maximum. For example, 2 DHWs indicate one week of 2 deg C above the expected summertime maximum

**degrees of freedom** - in statistics, the number of independent comparisons that can be made between the members of a sample; in a contingency table it is one less than the number of row categories multiplied by one less than the number of column categories. The number of degrees of freedom is defined as the number of observations that can be chosen freely, i.e., an estimate of the number of independent categories in a particular statistical test or experiment

**delta notation** - the absolute abundance of an isotope is difficult to measure with accuracy. Therefore, we compare isotopic ratios in a sample with those in a standard resulting in the delta-notation:  $d(x) = \left[ \frac{R_x - R_{st}}{R_{st}} \right] \times 10^3$ , where  $d(x)$  is the delta-value of a sample,  $R_x$  and  $R_{st}$  are the isotopic ratios in sample ( $R_x$ ) & standard ( $R_{st}$ ). The d-value is the relative difference in the isotopic ratio of the sample and the standard. It is expressed in part per mille (o/oo); that is why the right-hand side of the equation is multiplied by 103 (1000). Carbon and oxygen data from carbonates are usually referred to the PDB standard (a belemnite, *Belemnitella americana*, from the Late Cretaceous PeeDee Formation in South Carolina)

**deme** - a local interbreeding population of a species

**demersal** - pertains to an organism that is essentially bottom living but may feed and swim in the water column

**dendriform** - having a structure that resembles a tree or shrub

**dendritic** - branched like a tree



Black coral is dendritic in shape.  
(Photo: Waikiki Aquarium)

**dendrogram** - a branching tree-like diagram used to represent phylogenetic paths of evolution

**denitrify** - to remove nitrogen from any substance or chemical compound

**deposit feeder** - an animal that feeds on nutrients in the sediments

**depressed** - a body shape which is flattened dorso-ventrally, e.g., a ray, skate, monkfish

**determinate cleavage** - cleavage resulting in blastomeres each capable of developing only into a particular embryonic structure, not into a complete organism

**detritus** - the particulate decomposition or disintegration products of plankton, including dead cells, cell fragments, fecal pellets, shells, and skeletons, and sometimes mineral particles in coastal waters



Low tide along South Carolina  
shoreline with bits of sea shells  
and other detritus (Photo:  
Richard B. Mieremet, NOAA)

**detrivore** - an animal that eats detritus

**deuterostome** - one of two distinct evolutionary lines of coelomates, consisting of the echinoderms and chordates and characterized by radial cleavage of the early embryo. The cleaving cells are indeterminate (if early embryonic cells are separated, each one develops into a complete organism). The anus develops from the blastopore

**development** - the chronological series of changes, from a lower to a higher state of organization, which

multicellular organisms undergo from the fertilized egg (zygote) to maturity

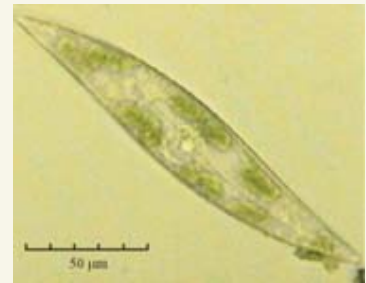
**dextral** - right, as opposed to sinistral, or left

**diadromous species** - a species which undertakes a spawning migration from ocean to river or vice versa

**diagnostic characters** - in taxonomy, the characters, or most important characters, which distinguish a taxon from other similar or closely related taxa

**diapause** - a period of suspended development in an organism

**diatom** - a unicellular alga that consists of two interlocking valves composed of silica



A living diatom (*Pleurosigma angulatum*) from Arctic seas.

**diatomaceous** - pertaining to diatoms or their fossil remains

**dichotomous key** - a tool to help identify taxa. It is made up of pairs of choices. Each choice is between statements describing specific traits of the taxa under consideration. Only one statement will be true for each choice. Each choice points to another set of choices until finally only one choice remains

**diel** - pertaining to the day-night cycle

**diffusion** - the movement of particles from an area of higher concentration to an area of lower concentration

**digestion** - the breakdown, by hydrolysis, of complex ingested nutrient compounds (carbohydrates, fats, proteins) into their building blocks, i.e., the conversion of food, in the alimentary canal, into soluble and diffusible products, capable of being absorbed into the circulating fluid and the cells

**dimorphism** - having two different distinct forms of individuals within the same species or two different distinct forms of parts within the same organism. It could refer to different colors or color patterns, sizes, anatomical parts, etc. Sexual dimorphism is a common case, where the two sexes have different shapes, sizes, etc.

**dioecious** - having separate sexes. Individuals within the species contain only one or the other of male and female reproductive systems

**diploid** - the condition in which a cell contains a nucleus with two complete sets of chromosomes, one set inherited from each parent. The diploid condition is often abbreviated as  $2n$ . Most plants and animals are diploid. The term also represents the number of chromosomes in most cells except the gametes, which are haploid in chromosome number

**disaccharide** - a sugar (carbohydrate) formed by the covalent bonding of two monosaccharides. Table sugar, sucrose, is a disaccharide

**discrimination** - differential response to different stimuli

**disease** - any impairment of an organism's vital functions or systems, including interruption, cessation, proliferation, or other malfunction



Coral with yellow band disease, which results in serious losses of coral tissue.

**disease vector** - an organism which transmits infective organisms from one host to another

**dispersal** - the spread of a species to a new location. In many organisms, this happens at a particular stage in the life cycle, and is often critical for the species' survival. Organisms may disperse as spores, seeds, eggs, larvae, juveniles, or adults

**displacement behavior** - a behavioral response that is appropriate for one situation appears in another situation, for which it is inappropriate

**dissociation** - the temporary or reversible chemical process in which a molecule or ion is broken down into smaller molecules or ions

**dissolved oxygen** - the concentration of oxygen dissolved in water, expressed in mg/l or as percent saturation, where saturation is the maximum amount of oxygen that can theoretically be dissolved in water at a given temperature and pressure

**distal** - the direction away from the midline of the body; the opposite of proximal

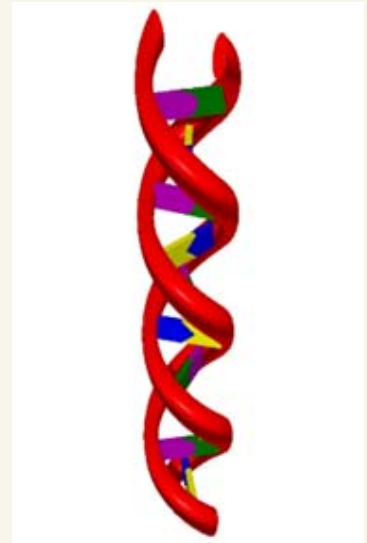
**diurnal** - active during the day light hours

**divergent evolution** - the evolution from one species of organism into a number of different species. As the original population increases in size, it spreads out from its center of origin to exploit other habitats and ecological niches. In time, this results in a number of populations, each adapted to its particular habitat. Eventually these populations, genetically may differ from each other sufficiently to become new species. Divergent evolution has also been termed "adaptive radiation"

**diverticulum** - a blind sac branching off a cavity or canal



**DNA (deoxyribosenucleic acid)** - also termed deoxyribonucleic acid. The molecule that encodes genetic information in the cells. It resembles a double helix held together by weak bonds of four nucleotides (adenine, guanine, cytosine, and thymine) that are repeated ad infinitum in various sequences. These sequences combine into genes that govern the production of proteins. The DNA located within the nuclear membrane of eukaryotic cells is sometimes referred to as nDNA



Graphic of DNA shows the spiral double helix structure of the molecule.

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**dormancy** - a period of suspended growth and metabolic activity. Many plants, seeds, spores, cysts, and some invertebrates become dormant during unfavorable conditions

**dorsal** - refers to the upper or back surface of an animal



The upper or "back" surface of this queen angelfish is the dorsal surface, as opposed to the opposite "belly" surface, which is the ventral surface. (Photo: Chris Huss, Florida Keys National Marine Sanctuary)

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**dorsoventral** - an axis extending from the dorsal to ventral surface of an animal body

**dot grid** - a technique used to analyze a photograph of a quadrat (photo-quadrat), in which a grid of random dots is placed over an image of the photo-quadrat. It assumes that the proportion of dots that lies on a substrate is equal to the proportional area of the substrate

**downwelling** - a downward current of surface water in the ocean, usually caused by differences in the density of seawater

**dredge** - a metal collar with an attached collecting bag that is dragged along the bottom to obtain samples of rock, sediment, or benthic organisms

**drop root** - an adventitious root in mangroves that originates from the branches, and roots in the surface sediments

[\(Top\)](#)

## Glossary of Terminology: E

**Echinodermata** - an animal phylum that contains starfishes, sea cucumbers, sand dollars, brittlestars, basket stars, sea lilies, feather stars, and sea urchins. Adults exhibit pentamerous radial symmetry, secondarily derived from a bilateral ancestor. They are not at all related to the other radiate phyla, such as the Cnidaria



A pencil urchin of the phylum Echinodermata.

**echinopluteus** - a larval form of some echinoderms

**Echiura** - an animal phylum that contains the echiurans or spoonworms. Some species inhabit coral crevices. Echiurans are deposit feeders

**ecological isolation** - a form of reproductive isolation in which two closely-related species are separated by what is often a slight difference in the niches they occupy

**ecology** - the study of the interrelationships between organisms and their environment, including the biotic and abiotic components

**ecosystem** - an ecological community considered together with the non-living factors of its environment as a unit

**ecotone** - a transitional area between two adjacent ecological communities

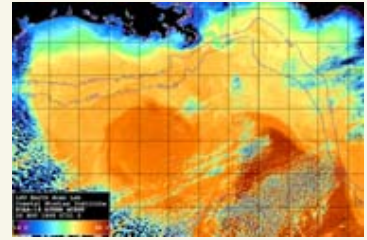
**ectoderm** - the outer germ layer of cells in an embryo that gives rise to the outer layer of skin (epidermis) and neural tissue

**ectodermis** - the outer cellular covering of a polyp

**ectoplasm** - the clear, nongranular portion of the cell cytoplasm just inside the cell membrane

**Ectoprocta** - an animal phylum synonymous with the phylum Bryozoa, the "moss animals"

**eddy** - a circular movement of water formed on the side of a main current



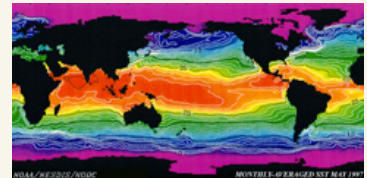
AVHRR image of eddy in the Gulf of Mexico. (Image: NOAA-14 Polar Orbiting Satellite/LSU Earth Scan Lab, Coastal Studies Institute)

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**egg** - a female sex cell or gamete with the haploid number of chromosomes. It may be fertilized by a sperm cell to produce a zygote with the diploid number of chromosomes for that particular species. The eggs of some species may develop into multicellular individuals without being fertilized by a sperm cell. This is the process of parthenogenesis

**Ekman layer** - the thin horizontal layer of water riding on top of the ocean that is affected by wind

**El Niño** - an irregular variation of ocean current that from January to March flows off the west coast of South America, carrying warm, low-salinity, nutrient-poor water to the south. It is associated with the Southern Oscillation. These two effects are known as the El Niño Southern Oscillation (ENSO). El Niño usually occurs during the Christmas season when the equatorial counter current strengthens and flows eastward to overlie the cold, nutrient-rich waters of the Peru current. It does not usually extend farther than a few degrees south of the equator, but occasionally it does penetrate beyond 12 deg S, displacing the relatively cold Peru Current. The effects of this phenomenon are generally short-lived, and fishing is only slightly disrupted. Occasionally, the effects are major and prolonged



Graphic of sea surface temperatures show El Niño, May 1997.

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**elasmobranch** - a member of the Subclass Elasmobranchii of cartilaginous fishes. These include sharks, rays, and skates



The manta ray is a large, graceful, mostly plankton-feeding elasmobranch. They also feed on small fishes. (Photo: Jackie Reid/ Flower Garden Banks National Marine Sanctuary)

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**electromagnetic radiation** - energy that travels through space in the form of waves. The highest frequencies in the spectrum of electromagnetic radiation are gamma-rays; the lowest frequencies are radio waves. All electromagnetic radiation travels at the speed of light. Shorter wavelength radiation (eg,

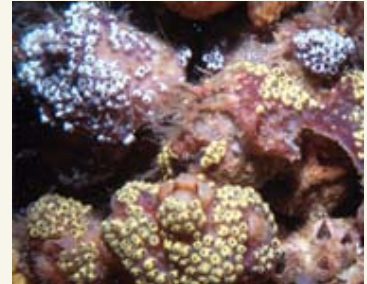
ultraviolet) carries more energy and is likely to be more harmful to living tissue

**embayment** - an indentation in the shoreline that forms a bay

**embryo** - the stage of early growth and differentiation of tissues and the formation of primitive organs and organ systems of a multicellular organism, from fertilization until birth or hatching. In seed plants, it is the young sporophyte that resulted from the union of the egg and one of the two tube nuclei

**encrustation** - a crustlike deposit or growth over a substratum

**encrusting colony** - a thin colony which adheres closely and is attached to the substrate



Encrusting tunicates at Gray's Reef off Sapelo Island, Georgia (Photo: Karen Angle).

**Endangered Species Act (ESA)** - an Act of Congress passed in 1966 that establishes a federal program to protect species whose survival is threatened by habitat destruction, overutilization, disease, etc.

**endangered taxa** - taxa in danger of extinction and whose survival is unlikely if causal factors continue operating. Included are taxa whose numbers have been drastically reduced to a critical level or whose habitats have been so drastically impaired that they are deemed to be in immediate danger of extinction. Also included are those that possibly are already extinct, in so far as they have not been seen in the wild in the past 50 years

**endemic species** - a species whose distribution is restricted to a particular area

**endobenthic** - refers to meiofaunal-sized organisms that move within the sediments

**endoderm** - the inner germ layer of diploblastic and triploblastic embryos that gives rise to internal tissues such as the gut and gut derivatives, e.g., air bladder, lungs, and the lining of the digestive tract

**endolithic** - growing within a rock or any other hard inorganic substratum

**endoplasm** - the granular portion of the cell cytoplasm between the ectoplasm and nuclear membrane

**endoskeleton** - skeleton, or support structure, which is on the inside of the organism's body. All vertebrates possess an endoskeleton that is made of either bone and/or cartilage



Endoskeleton of a 35-ton, 13-m gray whale on the floor of the Santa Cruz Basin.

**endosymbiotic** - being symbiotic and living within the body of an individual of the associated species

**endozooic** - living inside an animal

**energy flow** - the movement of energy through a community via feeding webs

**ENSO (El Niño Southern Oscillation)** - see El Niño and Southern Oscillation

**enteron** - the alimentary canal or the gut of an embryo. Some structures of the enteron may not be completely developed or differentiated in early embryonic growth

**environment** - everything external to the organism

**environmental impact assessment** - detailed studies which predict the effects of a development project on the environment. They also provide plans for the mitigation of adverse impacts

**environmental stress** - severe environmental effects on the natural ecosystem



A catastrophic environmental stress-the 1989 grounding of the *Exxon Valdez*, which spilled an estimated 11 million gallons of crude oil over 1,300 miles of coastline.

**enzootic** - an infectious disease constantly present in an animal population but having low incidence

**enzyme** - an organic catalyst

**ephyra larva** - a jellyfish (Scyphozoa) larval stage that develops into the adult medusa or jellyfish



Ephyra larva of the jellyfish Aurelia. (Photo: Rick Gillis, Ph.D., Biology Dept., University of Wisconsin-La Crosse)

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**epibenthic (epifaunal or epifloral)** - refers to organisms living on the surface of the substrate

**epibiont** - an organism that lives on the outside of another organism

**epidemic spawning** - the simultaneous shedding of gametes by a large number of individuals



Star coral shedding gametes in an epidemic spawning event.

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**epidermis** - the outer epithelial layer of the body

**epifauna** - animals that live upon or are associated with substratum features

**epiphyte** - microalgal organism living on a surface (e.g., on a seaweed frond); a plant living on the surface of another plant

**epitheca** - a layer of calcium carbonate that grows outside corallite walls

**epithelium** - a tissue layer of cells which lines body cavities and tubules, or covers surfaces. The cells may be ciliated or non-ciliated, and may be squamous (flat, scale-shaped), cuboidal (cube-shaped), or columnar (column-shaped) in shape. The cells may occur in a single layer, or may be multi-layered (stratified)

**epizoite** - an animal that lives on the surface of another organism

**epizootic** - a temporal pattern of disease occurrence in an animal population in which the disease occurs with a frequency clearly in excess of the expected frequency in that population during a given time interval; an outbreak (epidemic) of disease in an animal population

**epoch** - a division of geologic time next shorter than a period. Example: the Pleistocene epoch is in the Quaternary period

**era** - a division of geologic time next smaller than the eon and larger than a period. Example: The Paleozoic era is in the Phanerozoic eon and includes, among others, the Devonian period

**errant** - motile or free swimming



The polychaete *Nereis sp.* is an errant species of worm. (Photo: U. S. Geological Survey)

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**etiology** - the science that is concerned with origins and causes of disease

**eukaryotic** - descriptive of organisms with cells having a distinct nucleus with nDNA, and intracellular membranes. This includes all protists, fungi, plants and animals. The organisms are termed eucaryotes

**eumetazoa** - all multicellular animals excluding the sponges

**euphotic zone** - the layer of the ocean that receives sufficient sunlight for photosynthesis. The depth to which 1% of incident light penetrates (1% is the minimum amount of light required for photosynthesis)

**euryhaline** - pertaining to an aquatic organism that can withstand a broad salinity range

**eurythermal** - pertaining to an aquatic organism that can withstand a broad temperature range

**eutrophic** - a situation in which the increased availability of nutrients such as nitrate and phosphate stimulates the growth of plants such that the oxygen content is depleted and carbon sequestered



Eutrophic conditions can result in large fish kills, as many fish die from reduced levels of oxygen in the water.

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**Exclusive Economic Zone (EEZ)** - the sovereign waters of a nation, recognized internationally under the United Nations Convention on the Law of the SEA as extending out 200 nautical miles from shore. Within the U.S. the EEZ typically is between three and 200 miles from shore

**Executive Order 13089** - on June 11, 1998, President Clinton issued Executive Order 13089 directing all agencies to increase their efforts to protect our nation's coral reef resources. The executive order calls for the establishment of a U.S. Coral Reef Task Force, cochaired by the Secretaries of the Interior and of Commerce. The Task Force will develop and implement a comprehensive program of inventory, monitoring, and research to map and identify the major causes and consequences of degradation of coral reef ecosystems

**Executive Order 13158** - on May 26, 2000, President Clinton signed Executive Order 13158 on Marine Protected Areas (MPAs) to strengthen the protection of U.S. ocean and coastal resources. This significant milestone in ocean conservation directs the Departments of Commerce and the Interior, and other federal agencies, to strengthen and expand a national system of MPAs by working closely with state, territorial, local, tribal, and other stakeholders

**exoskeleton** - an external skeleton or supportive covering of an animal formed from the ectoderm, as for example, the shell coverings of a crustacean, the calcium carbonate secretions of stony corals, or the bony plates of an armadillo

**exotic species** - an introduced, non-native species

**explainate coral colony** - a colony that spreads horizontally as the branches fuse into a solid or near solid plate

**extant** - of a taxon: having living representatives; of a specimen: still in existence

**extant species** - species which are now living

**extinct** - of a taxon: having no living representatives.

**extinct species** - species for which there are no living representatives

**extinction coefficient** - a coefficient measuring the rate of extinction, or diminution, with distance of transmitted light in sea water

**extra-embryonic membrane** - membranes possessed by amniote (reptiles, birds, and mammals) embryos that allow these classes of vertebrates to be free of aquatic habitats for reproduction, and in their evolution, occupy terrestrial habitats. The membranes are the amnion, yolk sac, allantois and chorion

**extracellular digestion** - a form of digestion that takes place within the lumen of the digestive system. The resulting nutrient molecules are transferred into the blood or body fluids through the process of absorption

**extratentacular budding** - an asexual form of reproduction where daughter corallites grow from the outside wall of the parent corallites

**exumbrella** - the upper surface of the bell of a medusa or jellyfish



The rounded upper surface of this jellyfish is the exumbrella.

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[\(Top\)](#)

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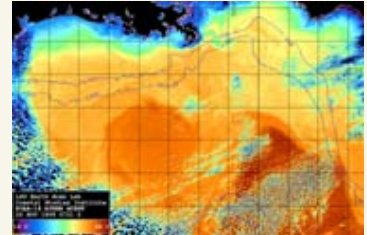
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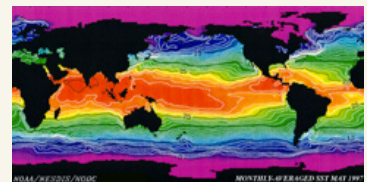


AVHRR image of eddy in the Gulf of Mexico. (Image: NOAA-14 Polar Orbiting Satellite/LSU Earth Scan Lab, Coastal Studies Institute)

**egg** - a female sex cell or gamete with the haploid number of chromosomes. It may be fertilized by a sperm cell to produce a zygote with the diploid number of chromosomes for that particular species. The eggs of some species may develop into multicellular individuals without being fertilized by a sperm cell. This is the process of parthenogenesis

**Ekman layer** - the thin horizontal layer of water riding on top of the ocean that is affected by wind

**El Niño** - an irregular variation of ocean current that from January to March flows off the west coast of South America, carrying warm, low-salinity, nutrient-poor water to the south. It is associated with the Southern Oscillation. These two effects are known as the El Niño Southern Oscillation (ENSO). El Niño usually occurs during the Christmas season when the equatorial counter current strengthens and flows eastward to overlie the cold, nutrient-rich waters of the Peru current. It does not usually extend farther than a few degrees south of the equator, but occasionally it does penetrate beyond 12 deg S, displacing the relatively cold Peru Current. The effects of this phenomenon are generally short-lived, and fishing is only slightly disrupted. Occasionally, the effects are major and prolonged



Graphic of sea surface temperatures show El Niño, May 1997.

**elasmobranch** - a member of the Subclass Elasmobranchii of cartilaginous fishes. These include sharks, rays, and skates



The manta ray is a large, graceful, mostly plankton-feeding elasmobranch. They also feed on small fishes. (Photo: Jackie Reid/ Flower Garden Banks National Marine Sanctuary)

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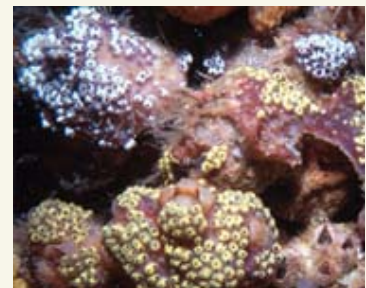
**electromagnetic radiation** - energy that travels through space in the form of waves. The highest frequencies in the spectrum of electromagnetic radiation are gamma-rays; the lowest frequencies are radio waves. All electromagnetic radiation travels at the speed of light. Shorter wavelength radiation (eg, ultraviolet) carries more energy and is likely to be more harmful to living tissue

**embayment** - an indentation in the shoreline that forms a bay

**embryo** - the stage of early growth and differentiation of tissues and the formation of primitive organs and organ systems of a multicellular organism, from fertilization until birth or hatching. In seed plants, it is the young sporophyte that resulted from the union of the egg and one of the two tube nuclei

**encrustation** - a crustlike deposit or growth over a substratum

**encrusting colony** - a thin colony which adheres closely and is attached to the substrate



Encrusting tunicates at Gray's Reef off Sapelo Island, Georgia (Photo: Karen Angle).

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**Endangered Species Act (ESA)** - an Act of Congress passed in 1966 that establishes a federal program to protect species whose survival is threatened by habitat destruction, overutilization, disease, etc.

**endangered taxa** - taxa in danger of extinction and whose survival is unlikely if causal factors continue operating. Included are taxa whose numbers have been drastically reduced to a critical level or whole habitats have been so drastically impaired that they are deemed to be in immediate danger of extinction. Also included are those that possibly are already extinct, in so far as they have not been seen in the wild in the past 50 years

**endemic species** - a species whose distribution is restricted to a particular area

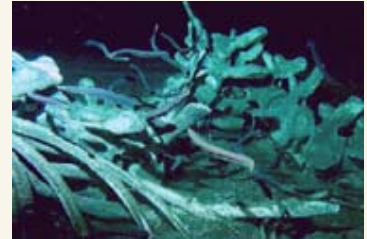
**endobenthic** - refers to meiofaunal-sized organisms that move within the sediments

**endoderm** - the inner germ layer of diploblastic and triploblastic embryos that gives rise to internal tissues such as the gut and gut derivatives, e.g., air bladder, lungs, and the lining of the digestive tract

**endolithic** - growing within a rock or any other hard inorganic substratum

**endoplasm** - the granular portion of the cell cytoplasm between the ectoplasm and nuclear membrane

**endoskeleton** - skeleton, or support structure, which is on the inside of the organism's body. All vertebrates possess an endoskeleton that is made of either bone and/or cartilage



Endoskeleton of a 35-ton, 13-m gray whale on the floor of the Santa Cruz Basin.

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**endosymbiotic** - being symbiotic and living within the body of an individual of the associated species

**endozoic** - living inside an animal

**energy flow** - the movement of energy through a community via feeding webs

**ENSO (El Niño Southern Oscillation)** - see El Niño and Southern Oscillation

**enteron** - the alimentary canal or the gut of an embryo. Some structures of the enteron may not be completely developed or differentiated in early embryonic growth

**environment** - everything external to the organism

**environmental impact assessment** - detailed studies which predict the effects of a development project on the environment. They also provide plans for the mitigation of adverse impacts

**environmental stress** - severe environmental effects on the natural ecosystem



A catastrophic environmental stress-the 1989 grounding of the *Exxon Valdez*, which spilled an estimated 11 million gallons of crude oil over 1,300 miles of coastline.

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**enzootic** - an infectious disease constantly present in an animal population but having low incidence

**enzyme** - an organic catalyst

**ephyra larva** - a jellyfish (Scyphozoa) larval stage that develops into the adult medusa or jellyfish



Ephyra larva of the jellyfish Aurelia. (Photo: Rick Gillis, Ph.D., Biology Dept., University of Wisconsin-La Crosse)

**epibenthic (epifaunal or epifloral)** - refers to organisms living on the surface of the substrate

**epibiont** - an organism that lives on the outside of another organism

**epidemic spawning** - the simultaneous shedding of gametes by a large number of individuals



Star coral shedding gametes in an epidemic spawning event.

**epidermis** - the outer epithelial layer of the body

**epifauna** - animals that live upon or are associated with substratum features

**epiphyte** - microalgal organism living on a surface (e.g., on a seaweed frond); a plant living on the surface of another plant

**epitheca** - a layer of calcium carbonate that grows outside corallite walls

**epithelium** - a tissue layer of cells which lines body cavities and tubules, or covers surfaces. The cells may be ciliated or non-ciliated, and may be squamous (flat, scale-shaped), cuboidal (cube-shaped), or columnar (column-shaped) in shape. The cells may occur in a single layer, or may be multi-layered (stratified)

**epizoite** - an animal that lives on the surface of another organism

**epizootic** - a temporal pattern of disease occurrence in an animal population in which the disease occurs with a frequency clearly in excess of the expected frequency in that population during a given time interval; an outbreak (epidemic) of disease in an animal population

**epoch** - a division of geologic time next shorter than a period. Example: the Pleistocene epoch is in the Quaternary period

**era** - a division of geologic time next smaller than the eon and larger than a period. Example: The Paleozoic era is in the Phanerozoic eon and includes, among others, the Devonian period

**errant** - motile or free swimming



The polychaete *Nereis sp.* is an errant species of worm. (Photo: U. S. Geological Survey)

**etiology** - the science that is concerned with origins and causes of disease

**eukaryotic** - descriptive of organisms with cells having a distinct nucleus with nDNA, and intracellular membranes. This includes all protists, fungi, plants and animals. The organisms are termed eucaryotes

**eumetazoa** - all multicellular animals excluding the sponges

**euphotic zone** - the layer of the ocean that receives sufficient sunlight for photosynthesis. The depth to which 1% of incident light penetrates (1% is the minimum amount of light required for photosynthesis)

**euryhaline** - pertaining to an aquatic organism that can withstand a broad salinity range

**eurythermal** - pertaining to an aquatic organism that can withstand a broad temperature range



**eutrophic** - a situation in which the increased availability of nutrients such as nitrate and phosphate stimulates the growth of plants such that the oxygen content is depleted and carbon sequestered



Eutrophic conditions can result in large fish kills, as many fish die from reduced levels of oxygen in the water.

**Exclusive Economic Zone (EEZ)** - the sovereign waters of a nation, recognized internationally under the United Nations Convention on the Law of the SEA as extending out 200 nautical miles from shore. Within the U.S. the EEZ typically is between three and 200 miles from shore

**Executive Order 13089** - on June 11, 1998, President Clinton issued Executive Order 13089 directing all agencies to increase their efforts to protect our nation's coral reef resources. The executive order calls for the establishment of a U.S. Coral Reef Task Force, cochaired by the Secretaries of the Interior and of Commerce. The Task Force will develop and implement a comprehensive program of inventory, monitoring, and research to map and identify the major causes and consequences of degradation of coral reef ecosystems

**Executive Order 13158** - on May 26, 2000, President Clinton signed Executive Order 13158 on Marine Protected Areas (MPAs) to strengthen the protection of U.S. ocean and coastal resources. This significant milestone in ocean conservation directs the Departments of Commerce and the Interior, and other federal agencies, to strengthen and expand a national system of MPAs by working closely with state, territorial, local, tribal, and other stakeholders

**exoskeleton** - an external skeleton or supportive covering of an animal formed from the ectoderm, as for example, the shell coverings of a crustacean, the calcium carbonate secretions of stony corals, or the bony plates of an armadillo

**exotic species** - an introduced, non-native species

**explainate coral colony** - a colony that spreads horizontally as the branches fuse into a solid or near solid plate

**extant** - of a taxon: having living representatives; of a specimen: still in existence

**extant species** - species which are now living

**extinct** - of a taxon: having no living representatives.

**extinct species** - species for which there are no living representatives

**extinction coefficient** - a coefficient measuring the rate of extinction, or diminution, with distance of transmitted light in sea water

**extra-embryonic membrane** - membranes possessed by amniote (reptiles, birds, and mammals) embryos that allow these classes of vertebrates to be free of aquatic habitats for reproduction, and in their evolution, occupy terrestrial habitats. The membranes are the amnion, yolk sac, allantois and chorion

**extracellular digestion** - a form of digestion that takes place within the lumen of the digestive system. The

resulting nutrient molecules are transferred into the blood or body fluids through the process of absorption

**extratentacular budding** - an asexual form of reproduction where daughter corallites grow from the outside wall of the parent corallites

**exumbrella** - the upper surface of the bell of a medusa or jellyfish



The rounded upper surface of this jellyfish is the exumbrella.

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[\(Top\)](#)

## Glossary of Terminology: F

**facultative** - able to exist under more than one set of environmental conditions. For example, a facultative parasite may exist either as a parasite or as a saprotroph (gaining nutrients from dead organic matter)

**falcate** - scythe-shaped



Falcate-shaped dorsal fin of an *Orca Whale*. (Photo: Robyn Angliss, NOAA/NMML)

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**falciform** - curved like a long, narrow scythe

**falculute** - a shape that is curved and sharp-pointed, like a claw

**farctate** - a filled or solid structure, as opposed to one that is tubular or hollow

**faro** - a rhomboid-shaped, steep-sided, continental shelf atoll

**fat** - a triglyceride (lipid) that is usually solid at room temperature

**fatty acid** - any of a class of saturated aliphatic monocarboxylic acids that form part of a lipid molecule; a product of fat hydrolysis

**fauna** - the entire group of animals found in an area

**Federal Geographic Data Committee (FGDC)** - coordinates the development of the National Spatial Data Infrastructure (NSDI). The NSDI encompasses policies, standards, and procedures for organizations to cooperatively produce and share geographic data. The 17 federal agencies that make up the FGDC are developing the NSDI in cooperation with organizations from state, local and tribal governments, the academic community, and the private sector

**fertilization** - the process where a spermatozoan (sperm cell) penetrates the cell membrane of an egg cell and the nuclei of the sperm and egg cells join together and their chromosomes combine to form a diploid zygote

**filiform** - thread-shaped

**filter feeder** - an organism that feeds by capturing particles suspended in the water column. A synonym of suspension feeder.

**fimbriate** - a structure that is fringed at the margin



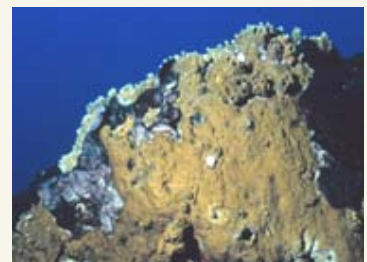
The papillae of this scorpion fish possess a fimbriate appearance.

**finlet** - one of several small non-retractable fins located dorsally and ventrally between the second dorsal and anal fins and the caudal fin of scombroids (mackerals, tuna) and some other fishes, e.g., sauries and snake mackerals. Finlets appear to have a hydrodynamic function in fishes that have been studied for this character



A series of small finlets between the dorsal and anal fins and the tail of a bluefin tuna. (Photo: NOAA)

**fire coral** - a species of hydroid (*Millepora sp.*) that frequently is brownish to orange-yellow in color and forms encrusting colonies that can assume the shape of its support structure. Their nematocysts release a virulent toxin which causes painful welts on human skin. Fire corals are not true corals (see Hydrozoa)



Fire coral in the Flower Garden Banks National Marine Sanctuary (Photo: Jackie Reid)

**fish census** - the collection of data over time concerning the species of fishes in an area, their relative abundances, and population densities

**fissure** - a deep and narrow depression cutting across the reef front with origins relating to jointing planes in the reef limestone or non-limestone bedrock

**flagellum** - a whip-like appendage used for locomotion in sperm cells and some bacteria, fungi, and protists



A bacterium with a whip-like flagellum. (Photo: U.S. National Institutes of Health)

**flaring corallite** - a corallite with expanding, trumpet-like curves to the outer corallite wall

**flora** - the entire group of plants found in an area

**fluorescence** - the emission of light from a substance caused by exposure to radiation from an external source

**fluorescent pigment** - a pigment that absorbs light at one wavelength and emits it at a different wavelength. The emitted light usually has a lower energy than the light absorbed by the pigment

**foliose coral** - a coral whose skeletal form approximates that of a broad, flattened plate

**food chain / food web** - all the interactions of predator and prey, included along with the exchange of nutrients into and out of the ecosystem. These interactions connect the various members of an ecosystem, and describe how energy is converted and passes from one organism to another

**Foraminifera** - planktonic and benthic protozoan protists that have a test (shell) composed of calcium carbonate



These foraminiferans have a test composed of calcium carbonate. (Photo: Rick Gillis, Ph.D., Biology Dept., University of Wisconsin-La Crosse)

**fore reef** - the portion of a reef seaward of reef crest. A synonym of reef slope

**fore reef escarpment** - a slope or cliff seaward of the fore reef terrace, at a depth of about 25-30m

**fore reef slope** - a sand covered, gradual or sharply descending slope; the next-to-deepest part of the fore reef

**fore reef terrace** - the uppermost portion of the fore reef; a flat plain beginning at the base of the buttress or mixed zone, at a depth of about 60 m

**formal metadata** - metadata that follows an FGDC approved standard

**fossa** - a hole or cavity in the coral skeleton

**foveolate corallite** - a corallite of some species which is located at the base of a funnel-shaped depression

**fragmentation** - a type of asexual reproduction common in branching corals. Branches break off from the parental colony to establish other colonies nearby

**framework** - a rigid, wave resistant calcareous structure constructed by sessile organisms such as sponges, corals, and bryozoans, in a high energy environment

**free-living coral** - a coral which is not attached to a substrate

**frequency distribution** - a graphical, tabular, or mathematical representation of the manner in which the frequencies of a continuous or discrete random variable are distributed over the range of its possible value

**fringing reef** - a shelf reef that grows close to shore. Some develop around oceanic islands. A synonym of shore reef



A fringing reef off a South Pacific Island.

**frond** - a leaf-like thallus, such as the body of a kelp

**Fungi** - the Kingdom of usually multicellular, heterotrophic eukaryotes that have multinucleated cells enclosed within cell walls. Nutrition is obtained by decomposing dead and dying organisms and absorbing the decomposition products



Fungi growing in an Oregon woodland. (Photo: Carol Baldwin, NOAA/OMAO)

**furcate** - a forked structure

**fusiform** - a shape that is tapered at both ends; spindle-shaped; torpedo-shaped, like a mackerel

[\(Top\)](#)

## Glossary of Terminology: G

**gall** - an abnormal outgrowth caused by infection or irritation by certain fungi or bacteria

**gamete** - a sex cell, e.g., a spermatozoan or egg cell, produced by sexually reproducing organisms

**gametocyte** - a reproductive cell capable of dividing by meiosis to produce gametes, e.g., a spermatocyte or oocyte

**gametophyte** - a life cycle stage in certain algae that produces male and female reproductive organs

**gap analysis** - a Geographic Information System (GIS) methodology to identify the distribution of biodiversity over large spatial areas. It was developed in 1988 by the U.S. Geological Survey in an effort to ensure that regions rich in species diversity are conserved with the hope that this will eliminate the need to list species as threatened or endangered in the future. The gap analysis approach uses maps of vegetation and predicted animal distributions to locate centers of species richness outside areas currently managed for biodiversity protection. These are considered the "gaps" of gap analysis. Thus far, its use primarily has been in the terrestrial sphere

**gas chromatography** - the separation of a mixture of compounds (solutes) into separate components, which then can be analyzed by a mass spectrometer to yield detailed empirical molecular information regarding the chemistry of the samples

**gastric** - pertaining to the stomach

**gastrodermis** - the epithelial lining of the gastrovascular (digestive) cavity of cnidarians and ctenophores (comb jellies)

**Gastropoda** - a class of the phylum Mollusca that includes snails, sea slugs, nudibranchs, limpets, and cone shells. There are approximately 30,000 living species described. Many species are inhabitants of coral reefs and nearby seagrass beds



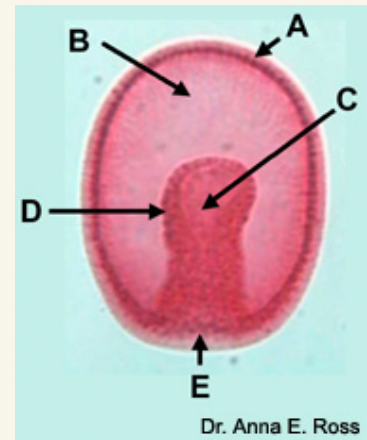
A sea slug of the Class  
Gastropoda, Phylum Mollusca.

**gastrovascular cavity** - the internal digestive cavity of cnidarians and ctenophores that is lined with the gastrodermis

**gastrozoid** - a polyp in hydrozoans and other colonial cnidarians which is specialized for feeding



**gastrula** - the embryonic stage of an animal that has cells differentiated into germ layers. Sequentially, It follows the blastula stage



An echinoderm gastrula. It was formed by the invagination of blastomeres at the vegetal pole area of the blastula to produce the archenteron, which will become the digestive system. The opening into the archenteron is the blastopore, which will become the anus of the adult. The cavity of the archenteron is the gastrocoel. The roof of the archenteron, which forms the mesoderm, will expand and pinch off mesodermal vesicles with an internal cavity that will become the coelom (see: mesoderm). A - ectoderm; B - blastocoel; C - archenteron; D - endoderm; E - blastopore. (Photo: Dr. Anna E. Ross, Christian Brothers University, TN)

**gastrulation** - during embryonic development of most animals, a complex and coordinated series of cellular movements occurs at the end of cleavage. The details of these movements vary among species, but usually result in the formation of an embryonic stage termed the gastrula. The gastrula has two primary germ layers, the ectoderm and endoderm in diploblastic animals, and three primary germ layers with the development of the mesoderm in triploblastic animals

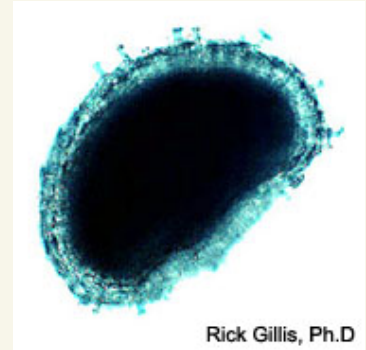


An early gastrula. The cells at the vegetal hemisphere have begun to invaginate into the blastocoel, forming the archenteron. (Photo: Dr. Anna E. Ross, Christian Brothers University, TN)

**GCRMN (Global Coral Reef Monitoring Network)** - a global network whose aim is to improve management and sustainable conservation of coral reefs for people by assessing the status and trends in the reefs and how people use and value the resources. It does this by providing many people with the capacity to assess their own resources, within a global network, and to spread the word on reef status and trends

**gel** - a jelly-like substance formed by the coagulation of a colloidal liquid; a cytoplasmic phase

**gemmule** - an asexual, spore-like reproductive unit in sponges, capable of overwintering and developing into an adult sponge the following summer



A sponge gemmule. Calcareous spicules projecting from the covering of the gemmule provide additional protection. (Photo credit: Rick Gillis, Ph.D., Biology Dept., University of Wisconsin-La Crosse)

**gene** - the functional and physical unit of heredity passed from parent to offspring. Genes are pieces of DNA, and most genes contain the information for making a specific protein

**gene flow** - the movement of genes through or between populations as the result of out-crossing and natural selection

**gene frequency** - the relative occurrence of a gene in a given population, usually expressed as a percentage

**gene pool** - the sum total of genes, with all their variations, possessed by a particular species at a particular time

**generalist** - an organism which can survive under a wide variety of environmental conditions, and does not specialize to exist under any particular set of circumstances

**generation** - offspring from the same parental group going through their life cycle together

**genetic drift** - random changes in the frequency of alleles in a population. In small populations, it can lead to the elimination of a particular allele by chance alone. It is thought to be one cause of speciation when a group of organisms is separated from its parent population

**genetic mutation** - a permanent structural alteration in DNA. In most cases, DNA changes either have no effect or cause harm, but occasionally a mutation can improve an organism's chance of surviving and passing the beneficial change on to its descendants

**genome** - all the DNA contained in an organism or a cell, which includes both the chromosomes within the nucleus and the DNA in mitochondria

**genotype** - the genetic constitution of an individual or group. In taxonomy, the genotype is the type species

of a genus

**geochemistry** - the study of the chemical elements, their isotopes, and related processes with respect to the abundance and distribution of materials within the Earth's waters, crust, and atmosphere

**geographical isolation** - a form of reproductive isolation in which members of a population become separated from another population by geographical barriers that prevent the interchange of genes between the separated populations

**geologic time scale** - a relative time scale based upon fossil content. Geological time is divided into eons, eras, periods, and epochs

**geostationary satellite** - satellite whose orbit around the equator equals that of the Earth's rotation, making it possible for them to view the same disc of Earth's surface below continuously



Artist's rendition of GOES I/M, geostationary satellites whose mission includes data collection and broadcasting, and environmental sensing. (Image: NASA/Goddard Space Flight Center)

**geostrophic current** - a flow that sustains a balance between Coriolis deflection and a pressure gradient

**germ layers** - distinct layers of cells, produced during the early embryonic developmental process of gastrulation, which gives rise to all cells, tissues, organs, and organ systems of the organism's body. The three types of germ layers are the ectoderm, endoderm, and mesoderm. Diploblastic organisms (e.g. cnidarians) have two layers, ectoderm and endoderm; triploblastic organisms (all higher animal groups) have mesoderm between these two layers

**gestation period** - the period of development of the young in viviparous animals, from the time of zygote formation (fertilization) until birth

**GIF (Graphics Interchange Format)** - a bit-mapped digital image graphics file format suitable for efficiently importing image data into computer files or for transmitting or displaying the formatted image on a computer monitor or printing it out. GIF supports color and various resolutions. It also includes data compression, making it especially effective for scanned photos

**gill** - a highly vascularized respiratory organ with a large surface area in aquatic animals. Gills are in direct contact with the surrounding water for gas exchange



The gill cover (operculum) of this fish is lifted to expose the gills, which are the respiratory organs of fishes and many other aquatic animals.

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**GIS (Geographic Information System)** - a system that allows automatic location of information suitable for mapping. Usually involves a software system that takes geographic position data and other data (e.g., type of bottom sediment) in order to create a map. Data on processes (e.g., current speed) can be incorporated to make a geographic model of flow

**global change** - a transformation which occurs on a worldwide scale (for example, an increase in CO<sub>2</sub> in the atmosphere) or exhibits sufficient cumulative effects to have worldwide impact (for example, local species extinction resulting in global loss of biodiversity)

**global warming** - an increase in temperature that occurs globally

**globular** - globe-shaped; having the form of a sphere, or nearly so



The porcupine fish, when threatened, swallows water and takes on a globular shape. (Photo: Copyright Corel Corporation)

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**glucose** - a monosaccharide, C<sub>6</sub>H<sub>12</sub>O<sub>6</sub>, that is the end product of carbohydrate metabolism and is the chief source of energy for living organisms

**gnathic** - pertaining to the jaw

**Gnathostomata** - the group of vertebrates that possess jaws; includes fishes, amphibians, reptiles, birds, and mammals

**GOES (Geostationary Operational Environmental Satellite)** - a class of satellite operated by NOAA, positioned in a nearly stationary orbit over the equator at an altitude of about 22,500 miles. GOES-8 is currently the operational "east" spacecraft at 75 degrees West longitude, while GOES-10 is the "west" spacecraft located at 135 degrees West. GOES-11 is in standby at 110 degrees West

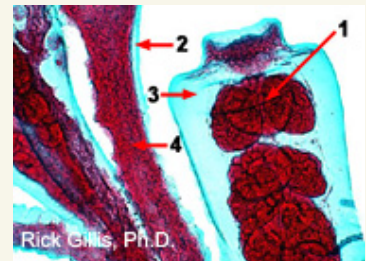


Image developed by NASA from GOES data-Hurricane Floyd at the U.S. coast on September 15, 1999 (Hal Pierce, NASA Goddard Space Flight Center)

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**gonads** - the primary sex organs of an animal. In males they are the testes, and in females, the ovaries

**gonangium** - a reproductive polyp of a colonial hydrozoan. It consists of a stalk containing medusa buds surrounded by a thin membrane, the gonotheca



A gonangium of the hydrozoan *Obelia*. 1= medusa bud; 2= perisarc; 3=gonotheca; 4= coenosarc. (Photo: Rick Gillis, Ph. D., Biology Dept., University of Wisconsin-La Crosse)

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**gonochoric** - having separate sexes. Individuals within the species contain only one or the other of male and female reproductive systems

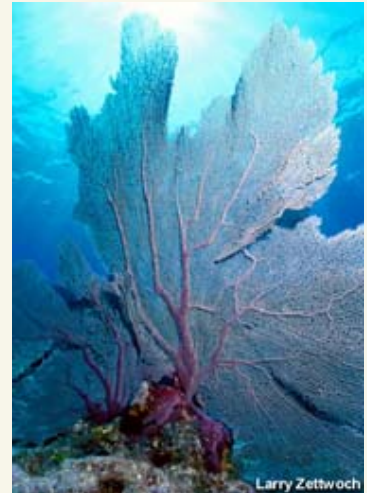
**gonophore** - a sexual zooid produced as a medusa bud upon a hydroid, sometimes becoming a free hydromedusa and sometimes remaining attached

**gonopodium** - a term given to the anal fin (or the anterior portion of it) of a male fish when it is modified to function as a copulatory organ, e.g., in guppies

**gonotheca** - a thin membrane covering the body of a gonangium, the reproductive polyp of a colonial hydrozoan

**gonozooid** - a reproductive polyp of a colonial hydrozoan

**gorgonian** - an anthozoan of the subclass Octocorallia, commonly called sea fans and sea whips



A sea fan, *Gorgonia ventalina*, in the Florida Keys.

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**gorgonin** - a fibrous protein in the mesoglea which provides skeletal support for sea fans and other members of the Order Gorgonacea

**GPS (Global Positioning System)** - a network of satellites and receiving devices used to compute accurate geographical positions on the Earth. A GPS is used in navigation, and its precision supports cadastral surveying



Portable GPS unit utilized in surveying.

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**Gram's stain** - a method for differential staining of bacteria; Gram-positive cells stain purple-black and Gram-negative cells stain pink; useful in bacterial taxonomy and identification

**gravid** - pregnant; heavy with young; full of ripe eggs or distended by such fullness



Gravid green crab with egg mass on the abdomen. (Photo: Gary Weber)

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**grazer** - an animal which feeds on plants



Sea urchins are important grazers, feeding on seaweed. Their diet, however, is not totally restricted to plants and algae. (Photo: Copyright Digital Stock Corporation)

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**green algae** - green algae belong to the Division Chlorophycota. These algae contain photosynthetic pigments similar to those in higher plants (chlorophylls a and b, as well as secondary pigments: carotenes, lutein, and zeaxanthin) and have a green color. Green algae include unicellular forms, filamentous forms, and leaf-like thalluses.



The green alga *Caulerpa taxifolia* with feather-like branches. The leaf is 5-65 cm in length. (Photo: NOAA)

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**greenhouse effect** - the heating that occurs when gases such as carbon dioxide trap heat escaping from the Earth and radiate it back to the surface

**greenhouse gases** - atmospheric gases, primarily carbon dioxide, methane, and nitrous oxide restricting some heat-energy from escaping directly back into space

**gross primary production** - the total amount or weight of organic matter created by photosynthesis over a defined time period (total product of photosynthesis)

**growth band** - a band formed yearly on coral by the secretion of  $\text{CaCO}_3$ ; one yearly growth band contains two smaller bands representing winter growth and summer growth



**guanine** - one of the four nitrogenous bases in DNA and RNA that make up the letters ATGC, guanine is the "G". The others are adenine, cytosine, and thymine. Guanine always pairs with cytosine

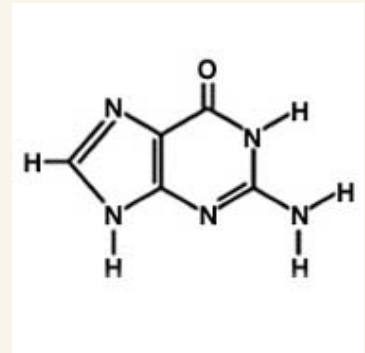


Diagram of the chemical structure of guanine, one of the four nitrogenous bases in DNA.

**gulf** - a portion of an ocean or sea that extends into the land; a partially land-locked sea, e.g., the Gulf of Oman

**gustation** - pertains to the sense of taste

**gut** - the digestive tube formed between the mouth and anus in which food is digested and nutrients absorbed; it consists of the mouth, pharynx, esophagus, stomach, intestine, and anus, though some animals do not have all these regions

**guyot** - a flat-topped submarine mountain

**gyre** - a large water-circulation system of geostrophic currents rotating clockwise in the Northern Hemisphere or counterclockwise in the Southern Hemisphere

[\(Top\)](#)

## Glossary of Terminology: H

**habitat** - the place or environment where a particular organism, population, or species lives

**habitat diversity** - the number of different types of habitats within a given area

**habituation** - in animal behavior, the temporary waning or disappearance of an innate response when it is elicited many times in succession

**half-life** - the time required for a radioactive substance to lose half of its nuclei

**Halimeda** - an important genus of calcareous green algae in coral reef environments

**halophile** - an organism which lives in an environment of high salt concentration. Halophiles have special adaptations to permit them to survive under these conditions

**halophyte** - a plant that grows in soils that have a high content of various salts



A black mangrove is an example of a halophyte, a plant that thrives in a saline environment.

**haploid** - a haploid cell contains a nucleus with a single complete set of chromosomes. The haploid condition is often abbreviated as  $n$ . Most fungi, protists, and algae are haploid, as are some insects, bryophytes, and the gametes of all organisms

**hard bottom** - a substrate formed by the deposition of calcium carbonate by reef building corals and other organisms or existing as bedrock or volcanic rock usually of minimal relief

**hard coral** - a coral in the anthozoan order Scleractinia. Also known as the stony corals, these organisms possess a hard external calcareous skeleton. A synonym of **stony coral**



Skeleton of a hard coral colony.

**hard coral forms** - may be conveniently summarized as: encrusting (lichen-like); branched (staghorn-like); massive (rock-like); sub-massive (pillar-like); tabulate (table-like); foliose (scroll-like); and solitary

**Hardy-Weinberg Law** - the frequency of a given genotype will reach equilibrium in a randomly mating population and will stay constant over many generations in the absence of selection pressures

**heavy metal** - an inorganic substance, such as mercury, cadmium, lead, zinc, and copper, that becomes highly toxic when concentrated in the environment

**hemocoel** - the extensive spaces of an arthropod's body through which the hemolymph (blood) circulates

**hemolymph** - the circulating and tissue-bathing fluid of the arthropod open circulatory system. It is composed of cells and plasma and often loosely termed as blood

**herbivore** - an animal that feeds on plants

**hermaphrodite** - an animal or plant which is equipped with both male and female reproductive organs

**hermatypic coral** - a reef-building coral with zooxanthellae in its tissues

**heterotroph** - an organism that cannot manufacture its own food, and therefore requires external sources of energy

**hexamerous** - having six parts, or parts in multiples of six arranged radially, as found in anthozoans in which the tentacles and mesenteries are in multiples of six

**high-resolution satellite SST climatology** - 9 km monthly or yearly averages of satellite-derived (see AVHRR) sea surface temperatures obtained over periods of 10 years or longer

**histology** - the branch of biology that studies the microscopic structure of animal or plant tissues. The four basic types of animal tissues are: epithelial tissue, nervous tissue, muscular tissue and connective tissue (bone, cartilage, blood, fat, and areolar (fibrous)). The three basic plant tissues are: dermal tissue, ground tissue, and vascular tissue

**hoa** - a channel or pass connecting the atoll lagoon with the open ocean

**holdfast** - a root-like structure for attachment that anchors attached seaweeds and other algae to the substratum

**Holocene epoch** - an epoch of the Quaternary period dating from the end of the Pleistocene approximately 8,000 years ago until the present

**holothurian** - a sea cucumber in the echinoderm class Holothuroidea



A holothurian (sea cucumber), *Holothuria atra*.

**holothurin** - a toxic substance released by some holothuroids (sea cucumbers)

**holotype** - in taxonomy, a single specimen designated or indicated the type specimen by the original author at the time of publication of the original description

**homeostasis** - the ability to maintain a relatively constant internal environment

**homonym** - in taxonomy, each of two or more identical but independently proposed names for the same or different taxa. A junior homonym is the later published of two homonyms. A senior homonym is the earlier published of two homonyms

**horizontal classification** - in taxonomy, classification which stresses grouping together taxa in a similar stage of evolution, rather than location on the same phyletic line

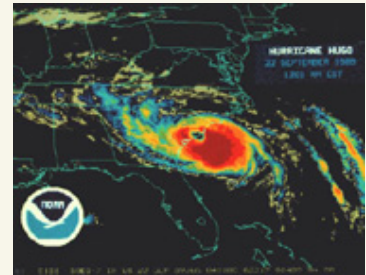
**host** - an organism which serves as the habitat for a parasite or symbiont. The host may provide nutrition to the parasite or symbiont, or simply a place in which to live

**HotSpot animation** - animations from HotSpot imagery denoting coral reef bleaching events over time

**HotSpot charts** - charted regions that highlight sea surface temperature (SST) anomalies that are greater

than 1 deg C above the maximum monthly climatological SST. See also coral bleaching and coral bleaching hotspot

**hurricane** - an intense tropical cyclone in which winds tend to spiral inward toward a core of low pressure, with maximum surface wind velocities that equal or exceed 33.5 m/sec (75 mph or 65 knots) for several minutes or longer at some point

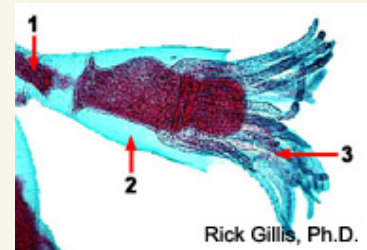


Infrared image of Hurricane Hugo making landfall September 22, 1989. (Image: NOAA)

**hybrid** - an individual with parents of different species

**hybrid name** - in taxonomy, names of progeny of two individuals belonging to different taxa. Names given to hybrids are not normally available, as they are individuals, not populations, and hence not taxa

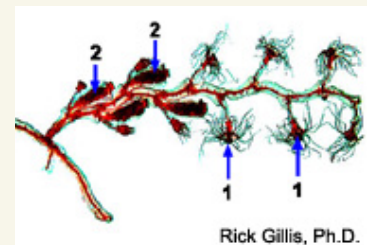
**hydranth** - a feeding polyp of a colonial hydrozoan. It bears tentacles armed with nematocysts, a mouth and a thin outer covering, the hydrotheca



Hydranth of the hydrozoan, *Obelia*. 1=coenosarc; 2=hydrotheca; 3=tentacles. (Photo: Rick Gillis, Ph.D., Biology Dept., University of Wisconsin-La Crosse)

**hydrocarbon** - an organic molecule, such as methane ( $\text{CH}_4$ ), which consists only of carbon and hydrogen atoms

**hydrocaulus** - the main stem of a colonial hydrozoan which consists of a cylindrical tube of living tissue (coenosarc) covered by a thin outer membrane (perisarc)



Hydrocaulus of the hydrozoan, *Obelia*. (Photo credit: Rick Gillis, Ph.D., Biology Dept., University of Wisconsin-La Crosse)

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**hydrogen bond** - a relatively weak chemical bond consisting of a hydrogen atom between two electronegative atoms (e.g., oxygen or nitrogen), with one side being a covalent bond and the other being an ionic bond

**hydrolysis** - the breaking down of a compound into fragments by the addition of a molecule of water. The hydroxyl group is incorporated in one fragment and the hydrogen atom in the other

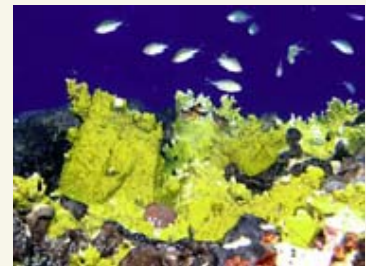
**hydrophilic** - having a strong affinity for water; tending to dissolve in, mix with, or be wetted by water

**hydrostatic skeleton** - a type of skeleton found in many soft-bodied invertebrates which consists of a turgid column of liquid within one of the body spaces that provides support or rigidity to the organism or to one of its parts. Hydrostatic skeletons are found in echinoderms (starfish, sea urchins), annelids (worms), nematodes (roundworms), and a number of other wormlike invertebrate phyla

**hydrotheca** - a thin outer covering of a hydranth, the feeding polyp, of a colonial hydrozoan

**hydroxyl group** - an [-OH] or alcohol group on a larger molecule. The oxygen is single-bonded to the hydrogen and has one free bond to the rest of the molecule

**Hydrozoa** - a class within the phylum Cnidaria. The Hydrozoa contains five orders that include: small medusae with no polyp generation; colonial forms with alternating polyp and medusa stages and a chitinous exoskeleton; solitary polyps that lack a medusoid stage; colonial forms with massive aragonite skeletons (e.g., fire coral); and complex colonial forms, with individual polyps specialized for feeding, swimming, prey capture, and reproduction. Some, but not all, float by means of a large pneumatophore, or gas bag



White-tipped mustard-colored fire coral in the Flower Garden Banks.

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**hypersaline** - referring to water with a salinity higher than that of natural seawater

**Hyperspectral AVIRIS (Airborne Visible/Infrared Imaging Spectrometer)** - a hyperspectral image is a very high resolution image which was acquired with a hyperspectral scanner. These instruments acquire data in 224 contiguous channels of approximately 10nm bandwidth. They are spanning the visible, near-infrared and mid-infrared portion of the electromagnetic spectrum

**hypha** - one of the long, branching filaments that forms the mycelium of a fungus

**hyposaline** - referring to water with a salinity lower than that of natural seawater

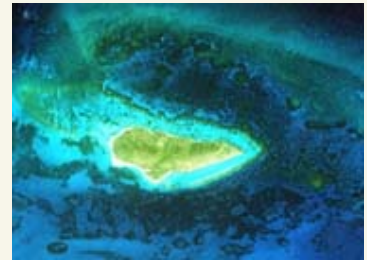
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## Glossary of Terminology: I

**ICRI (International Coral Reef Initiative)** - an environmental partnership and network that brings all the stakeholders together with the objective of sustainable use and conservation of coral reefs for future generations. ICRI is an informal mechanism that allows representatives of over 80 developing countries with coral reefs to sit in equal partnership with major donor countries and development banks, international

environmental and development agencies, scientific associations, the private sector and non-governmental organizations (NGOs) to decide on the best strategies to conserve the world's coral reef resources

**IKONOS satellite** - high-resolution (1-2 meter resolution) imaging satellite; the world's first commercial satellite for imagery of this type



Four-meter true color IKONOS image of Buck Island Reef National Monument shows an extensive underwater coral reef ecosystem.

**immersed corallite** - a corallite that is embedded in the surrounding coenosteum

**in situ** - in the natural or original position

**in situ data** - measurements made at the actual location of the object or material measured, in contrast to remote sensing

**indigenous** - native to a particular country or area

**infauna** - animals that inhabit the sandy or muddy surface layers of the ocean bottom, i.e., those that live buried or dig into the substrate

**infraspecific name** - in taxonomy, a general term for any name below the rank of species. The term includes subspecific and infrasubspecific names

**ingestion** - the intake of water or food substances by "swallowing" them, taking them into the body cavity or into a cell vacuole

**insolation** - the amount of solar radiation received on a given body or in a given area

**instar** - a discreet, in-between molt stage, during the metamorphosis of an arthropod from larva to adult

**instinct** - an unlearned, genetically coded behavior pattern that is internally motivated and characteristic of the species; the innate capacity of an animal to respond to a given stimulus in a relatively fixed way

**integer** - a number without a decimal (0, 1, 25, 173, 1032, etc.). Integer values can be less than, equal to, or greater than zero

**integrated coastal zone management** - the process of combining all aspects of the human, physical and biological aspects of the coastal zone within a single management framework

**interannual** - refers to a climatic process that re-occurs every three to ten years. El Niño is an example of a climatic process that re-occurs every 4-6 years

**intermediate host** - in a parasite's life cycle, it is a host organism in which a parasite undergoes a stage of asexual development

**interstitial fauna** - animals that live in the spaces within sediment particles (interstitial spaces)

**intertidal zone** - the region between the highest water line and the mean low tide level



Sea anemones crowd a rocky intertidal zone (Photo: Nancy Sefton)

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**intratentacular budding** - a type of asexual reproduction where daughter corallites grow from the inside wall of parent corallites, usually by division of the parent corallite

**intromittent organ** - a copulatory structure employed by the males of species that practice internal fertilization to transfer sperm cells into the reproductive tube of the female, e.g., the clasper of a shark, skate or ray; penis; modified anal fin (gonopodium) of live-bearer fishes

**invagination** - an inward folding of a layer of cells forming an interior pocket



The cells at the vegetal hemisphere of this starfish blastula have begun to push into the blastocoel (invagination), forming a diploblastic embryo with a new cavity, the primitive gut, or archenteron. The cells lining the archenteron are endodermal cells. (Photo: Dr. Anna E. Ross, Christian Brothers University, TN)

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**invertebrate** - an animal that lacks a vertebral column (backbone)



Feathery invertebrate tube worms in the Caribbean Sea (Photo: Dr. Anthony Picciolo).

**ion** - a positively or negatively charged atom produced through loss or gain of one or more electrons

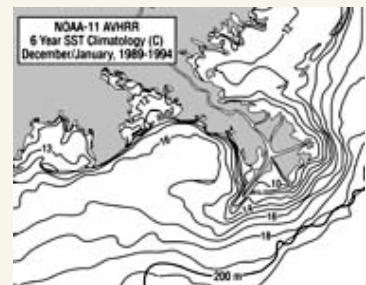
**ionic bond** - a chemical bond in which one atom loses an electron to form a positive ion and the other atom gains an electron to form a negative ion

**IR (infrared) radiation** - earth-emitted radiation over thermal wavelengths: 3-15 micrometers. Used for satellite remote sensing because it can be used to monitor weather and oceanographic conditions 24 hours a day

**isobath** - a line on a map or chart that connects all points having the same depth below a water surface

**isogamous** - having haploid gametes that are similar in size, structure and motility. An isogamete can unite with another to form a zygote

**isoline** - a line on a surface connecting points of equal value



Isobars are utilized to depict NOAA-11 AVHRR SST climatology in this diagram.

**isotope** - one of two or more species of atoms of the same chemical element that have the same atomic number and occupy the same position in the periodic table. They are nearly identical in chemical behavior, but they differ in atomic mass or mass number. Therefore, they behave differently in the mass spectrograph, in radioactive transformations, and in physical properties, and may be separated or detected by means of these differences

**ITCZ (Intertropical Convergence Zone)** - the region near the equator where the trade winds of the Northern and Southern Hemispheres converge

**ITIS (Integrated Taxonomic Information System)** - a partnership of U.S., Canadian, and Mexican agencies, other organizations, and taxonomic specialists cooperating on the development of an online,

scientifically credible, list of biological names. ITIS is also a participating member of Species 2000, an international project indexing the world's known species

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## Glossary of Terminology: J

**joint probability** - the probability of two or more things occurring together

**JPEG (Joint Photographic Experts Group)** - the original name of the committee that wrote the standard. It is a lossy compression technique for color images. Although it can reduce files sizes to about 5% of their normal size, some detail is lost in the compression

**jugular** - pertaining to the throat area



Blennies have their pelvic fins in the jugular position, anterior to the pectoral fins. (Photo: South Florida Water Management District)

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**juvenile** - a young animal that has not reached sexual maturity

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## Glossary of Terminology: K

**karyogamy** - a process of fusion of the nuclei of two sex cells or gametes; the second step in syngamy

**karyotype** - the entire chromosome complement of an individual cell, as seen during the mitotic phase

**key** - a small, low coastal island or emergent reef of sand or coral; flat mound of sand and admixed coral fragments built upon a reef flat or just above high tide level. A synonym of **cay**



A number of small keys (cays) in Jobos Bay, Puerto Rico.

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**keystone species** - a species that is disproportionately important in the maintenance and balance of its community integrity

**kingdom** - in taxonomy, the highest ranked category in the taxonomic hierarchy. All organisms are classified into one of five kingdoms: Monera (the prokaryotic Kingdom. Includes archaeobacteria, eubacteria and cyanobacteria); Protista (unicellular eukaryotes); Fungi (yeasts and mushrooms); Plantae (plants); and Animalia (animals). Some scientists recognize slightly different classification schemes

**knee root** - an aerial root of a mangrove that emerges from the ground then loops back in. It is also called a peg root. It is not clear whether knee roots have a role in respiration

**knob** - a projecting structure on the reef margin or reef front wherein the upper surface flares outward, giving the surface a greater diameter than the basal section

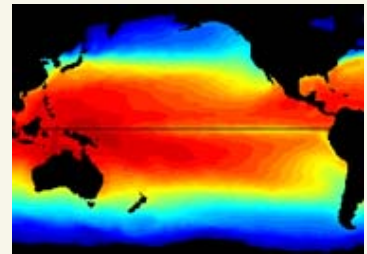
**knoll** - a small reef within the lagoon or on shallow shelves

**knot** - The unit of speed used in navigation that is equal to 1 nautical mile (6,076.115 ft or 1,852 m) per hour

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## Glossary of Terminology: L

**La Niña** - a phenomenon characterized by unusually cold ocean temperatures in the eastern Equatorial Pacific, compared to El Niño, which is characterized by unusually warm ocean temperatures in the eastern Equatorial Pacific



Graphic showing December 1998 La Niña event.

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**labial** - pertaining to the lips

**lacuna** - a cavity ("little lake") in a matrix-like substance. For example, cartilage cells (chondrocytes) are located in lacunae in the cartilaginous matrix; bone cells (osteocytes) are located in lacunae in bone matrix

**lagoon** - a warm, shallow, quiet waterway separated from the open sea by a reef crest



A lagoon in Bora Bora. (Photo: Dr. Anthony Picciolo)

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**lagoon slope** - the back reef on a barrier or atoll reef

**Landsat satellite** - U.S. satellite used to acquire high-resolution (500-800m) remotely sensed multi-spectral images of the earth's land surface and surrounding coastal regions



Artist's rendition of LANDSAT satellite.

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**larva** - a sexually immature juvenile stage of an animal's life cycle. However, there are a few exceptions, where the larval form never metamorphoses into the adult stage and is sexually mature (neoteny)



Microscopic photograph of a crab larva (megalops stage) from a plankton collection.

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**lateral** - refers to the side or flank of an animal

**least squares** - a statistical criterion for the estimation of the goodness of fit in correlation analysis. Least squares methods aim to minimize the sum of squared differences between the observations and the predictions from a model

**lectotype** - in taxonomy, one of several syntypes, designated by any author after the original publication of a species name as the 'type specimen' for the taxonomic name. Designated only where there was no original holotype

**leeward** - referring to the side of an island or reef that faces away from the prevailing wind

**lenticel** - aerial roots (pneumatophores) of mangroves contain spongy tissue connected to the exterior of the root via small pores called lenticels. During low tide, when lenticels are exposed to the atmosphere, oxygen is absorbed from the air and transported to and even diffused out of the roots below ground. This diffusion of oxygen maintains an oxygenated microlayer around the roots that enhances nutrient uptake.

**lesion** - any pathological or traumatic discontinuity of tissue, or loss of function of a part

**leuconoid** - the body form of highest complexity in sponges. The leuconoid form is highly irregular, displays the greatest degree of folding of the body wall, and has lost radial symmetry. The choanocytes line the pockets formed by the convoluted body wall

**LIDAR (Light Detection And Ranging)** - a remote-sensing technique that uses a laser light source to probe the characteristics of a surface target. A laser emission may be directed downward from a low flying aircraft. Information about the target is derived from back-scattered reflectance or fluorescence of the target. Chlorophyll pigments in coral reef organisms (e.g., algae, seagrasses, coral), when excited by shorter

(blue or green) wavelength light, emit light at longer (red) wavelengths, i.e., it fluoresces

**line intercept transect** - a linear transect protocol where a tape is secured at each end of the transect with the tape draped over the reef in between. Observations are collected on each species and substrate component and their length under the tape

**lineage** - a genetically continuous line of evolutionary descent

**linear reef** - a linear coral formation that is oriented parallel to the shore or the shelf edge

**linear transect** - a line of specified length laid out within a study site. They are generally positioned parallel to the shore along depth contours. Measurements and observations may be taken along the entire surface beneath the line (line intercept transect) or at specified intervals along the line (point intercept transect)



A NOAA scientist laying out a linear transect line.

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**Lithothamnion ridge** - a synonym for algal ridge. The algal genus *Lithothamnion* is important in maintaining reef integrity by cementing various pieces of calcium carbonate

**littoral** - intertidal; between low and high tide levels



This sea slug is a denizen of northwest U.S. rocky littoral (intertidal) zones.

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**lobate** - lobe-shaped



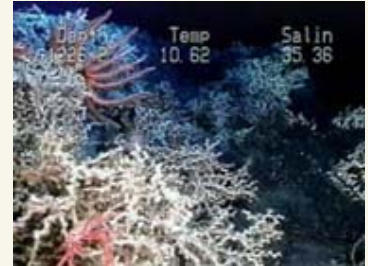
This comb jelly (ctenophore) possesses a lobate shape. (Photo: NOAA)

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**long term monitoring** - the repeated surveying of organisms, populations, communities, or environmental parameters over time to help us understand a variety of natural processes

**longshore current** - a current that flows parallel to the shore just inside the surf zone. It is also called the littoral current

**Lophelia reef** - a reef formed by *Lophelia pertusa*, a deep-sea coral found in all oceans except the Arctic Ocean



This photo of a *Lophelia* coral garden was taken via a manned submersible on the ocean floor. (Photo: NOAA)

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**lower palmata zone** - the part of a reef crest that is seaward of the palmata zone. It consists primarily of elkhorn coral (*Acropora palmata*) at a depth of about 3-6 m in Caribbean reefs



A young *Acropora palmata* colony in St. Croix, U.S. Virgin Islands (Photo: J. Halas)

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**lunate** - crescent-shaped



Blue tangs with lunate-shaped caudal fins. (Photo: NOAA)

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[\(Top\)](#)

## Glossary of Terminology: M

**macro** - a text file containing a sequence of commands that can be executed as one command.

**macroalgae** - algae that project more than one centimeter above the substratum



Macroalgae are important habitat on temperate and northern reefs.

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**macrobenthos (macrofauna or macroflora)** - benthic organisms (animals or plants) whose shortest dimension is greater than or equal to 0.5 mm

**macronutrient** - a nutrient, such as a nitrate or phosphate, that is required by plants in relatively large quantities in order to undergo photosynthesis and growth

**madreporite** - a perforated platelike structure in most echinoderms that forms the intake for their water vascular systems



The white spot in the middle of the central disc of the starfish is the madreporite, the opening into the echinoderm's water vascular system.

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**makatea** - a fossil coral reef

**mandible** - pertains to mouth parts; the lower jaw

**mangal** - relating to a shoreline ecosystem dominated by mangrove trees, with associated mud flats



**mangrove** - a general name for several species of halophyte belonging to different families of plants (including trees, shrubs, a palm tree and a ground fern) occurring in intertidal zones of tropical and subtropical sheltered coastlines and exceeding one half meter in height. The term is applied to both the individual and the ecosystem, the latter of which is termed mangal. Mangroves provide protected nursery areas for juvenile reef fishes, crustaceans, and mollusks. They also provide a feeding ground for a multitude of marine species. Many organisms find shelter either in the roots or branches of mangroves. Mangrove branches are nesting areas for several species of coastal birds. The root systems harbor organisms that trap and cycle nutrients, organic materials and other important chemicals. Mangroves also contribute to higher water quality by stabilizing bottom sediments, filtering water and protecting shorelines from erosion. They protect reefs from land runoff sedimentation. Conversely, coral reefs protect mangroves and seagrasses from erosion during heavy storms and strong wave action



Mangrove nursery area, Puerto Rico.

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**manta tow technique** - a technique used to provide a general description of large areas of reef and to gauge broad changes in abundance and distribution of organisms on coral reefs. The technique, widely used in Australia, involves towing a snorkel diver (observer) at a constant speed behind a boat. The observer holds on to a 'manta board' attached to a small boat by a 17-meter length of rope. This person makes a visual assessment of specific variables during each manta tow (2 minutes duration), and records these data when the boat stops, on a data sheet attached to the manta board. The manta tow technique is used to provide a general description of large areas of reef and to gauge broad changes in abundance and distribution of organisms on coral reefs. The advantage of manta tow over other survey techniques is that it enables large areas of reefs to be surveyed quickly and with minimal equipment

**mantle** - a membranous or muscular structure in mollusks that surrounds the visceral mass and secretes a shell if one is present



A cowrie, *Cypraea* sp., with partially extended mantle.

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**mariculture** - the cultivation of marine organisms under controlled conditions; a synonym for marine aquaculture



Shrimp farms and their waste runoff have resulted in the destruction of coastal habitats and added to pollution in critical estuarine waters.

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**marsh** - a soft, wet area periodically or continuously flooded to a shallow depth, usually characterized by a particular group of grasses, cattails and other low plants



Coastal marsh in Monterey Bay National Marine Sanctuary, CA. (Photo: Kip Evans)

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**mass spawning** - spawning events where many different species spawn simultaneously

**mass spectrometer** - a laboratory instrument that measures the mass-to-charge ratio of individual molecules that have been converted into ions. This information is then used to determine the masses of the molecules

**massive colony** - a coral colony that is solid and typically hemispherical in shape

**maxilla** - pertains to mouth parts; the upper jaw

**maximum sustainable yield** - the maximum number of a food or game population that can be harvested without harming the population's ability to grow back; the largest average catch or yield that can continuously be taken from a stock under existing environmental conditions

**meandroid colony** - a massive colony that has corallite mouths aligned in valleys, such that there are no individual polyps

**medusa** - the free swimming stage of some corals, jellyfish, anemones, hydroids and comb jellies, shaped like a bell or umbrella and swims by pulsations of the body



A jellyfish (medusa stage) showing its oral or subumbrella surface. The hanging tentacles bear stinging cells, used for food capture.

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**medusa bud** - one of the buds of a hydroid, destined to develop into a gonophore or medusa. Medusa buds are released from the gonangium through a central opening, the gonopore

**meiobenthos (meiofauna or meioflora)** - benthic organisms whose shortest dimension is less than 0.5 mm but greater than or equal to 0.1 mm

**meiosis** - a two-stage type of cell division in sexually reproducing organisms that results in the development of sperm and egg cells. In meiosis, a diploid cell divides to produce four haploid cells, each with half the original chromosome content. In organisms with a diploid life cycle, the products of meiosis are called gametes. In organisms with an alternation of generations, the products of meiosis are called spores

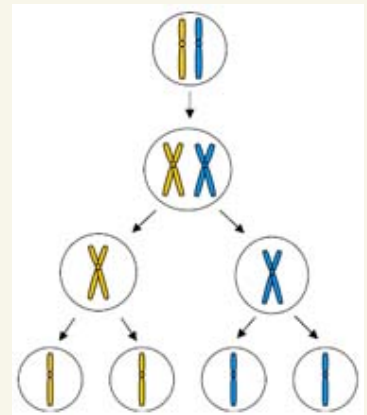


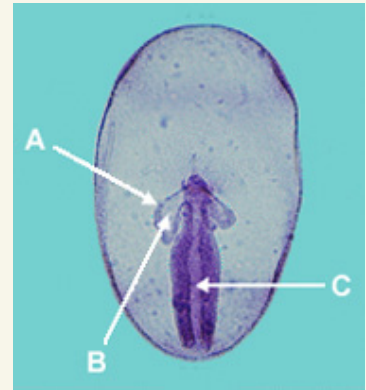
Diagram showing the meiotic division of a diploid cell, which in two divisions, results in the production of four haploid daughter cells. This process is also termed gametogenesis because it results in haploid sperm and egg cells.

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**mesenchyme** - in cnidarians, a primitive "connective tissue" located between the epidermis and the gastrodermis. If it contains no cell components, it is termed "mesoglea"; undifferentiated cells of an embryo,

derived from mesoderm, which give rise to connective tissue and the circulatory and lymphatics systems; amoebocytic cells often embedded in a gelatinous matrix

**mesoderm** - the middle of the three germ layers of a triploblastic embryo that gives rise to the skeletal and support, muscular, blood vascular, urogenital and reproductive systems, and contributions to some glands



Late gastrula. This photograph is a dorsal view of the embryo, with the anterior being toward the animal pole and the posterior toward the vegetal pole. Note the beginning of the formation of enterocoelic (mesodermal) pouches, from which the mesoderm is derived, on the right and left side of the anterior end of the gastrocoel. A - mesoderm; B - coelom; C - archenteron (Photo: Cell and Developmental Biology Online website (University of Guelph) <http://www.uoguelph.ca/zoology/devobio/>)

**mesoglea** - the connective tissue layer between the epidermis and gastrodermis of cnidarians and ctenophores (comb jellies)



Inner tissues of this Giant Green Anemone (*Anthopleura xanthogrammica*) are separated by the mesoglea. (Photo: Lisa Eschenbach)

**mesohyl** - the gelatinous non-cellular layer between the inner and outer body walls of sponges; also called mesenchyme

**Mesozoic** - an era of time during the Phanerozoic eon lasting from 245 million years ago to 66.4 million ago

**metabolism** - the sum of all the physical and chemical processes by which living organised materials are produced and maintained (anabolism), and also the destructive transformation processes by which energy is made available for the uses of the organism (catabolism)

**metadata** - information about data or other information. Metadata or "data about data" describe the content, quality, condition, and other characteristics of data

**metagenesis** - an alternation of sexual and asexual generations. When metagenesis occurs in cnidarians, the polyp is the asexual generation and the medusa is the sexual generation. A generalized life cycle occurs as follows: medusae produce gametes which unite to form zygotes. Each zygote divides repeatedly and develops into a free-swimming planula larva, which eventually settles and develops into a polyp. Each polyp then asexually produces medusae to complete the life cycle

**metamorphosis** - change of body shape, e.g., the change from a larval form to a juvenile or adult form

**metanauplius larva** - postnaupliar larva of crustaceans with the same general body and limb morphology as the nauplius, but having additional appendages



Crustacean metanauplius larva.  
(Photo: Dep.de formation des maitres. Physiologie animale, Universite Pierre & Marie Curie, Paris VI.)

**metazoa** - multicellular animals

**microatoll** - a circular colonial corallum up to 1 m height and 4 m diameter. Growth is mainly lateral, as upward growth is limited by aerial exposure

**microbenthos (microfauna or microflora)** - benthic organisms whose shortest dimension is less than 0.1 mm

**microenvironment** - a specific set of physical, biological, and chemical factors immediately surrounding the organism

**microhabitat** - a smaller part of a habitat that has some internal interactions allowing it to function self-sufficiently within a generally larger habitat, such as a patch reef in a lagoon

**micronutrient** - a nutrient, such as iron, copper, or zinc, that is required in very small amounts by plants in order to photosynthesize and thrive

**microtubule** - a long, hollow rod composed of the protein, tubulin. Microtubules make up portions of the cytoskeleton of cells and help to maintain cell shape. They are also found in cilia and flagella

**midlittoral zone** - the portion of the intertidal zone that is covered and uncovered by water each day



Tidal pools in the midlittoral zone.  
(Photo: Susan Scott)

**migration** - the large-scale movement of a population for some specific purpose



Humpback whales (*Megaptera novaeangliae*) migrate from near the poles to tropical waters.  
(Photo: R Wicklund)

**mimicry** - the appearance or characteristics of one organism that copies or "mimics" another in order to gain some advantage; the organism may resemble some other natural object as an aid in concealment

**mini-atoll** - a ring-shaped patch reef with a central area (lagoon) containing sand

**mitosis** - the process of nuclear division in eukaryotic cells that produces two daughter cells from one mother cell, all of which are genetically identical to each other. See cell division

**mixed layer** - near-surface waters subject to mixing by wind and waves; there is little variation in salinity or temperature below the mixed layer

**mixed zone** - the populous region of most bank/barrier reefs seaward of the lower palmata zone. It begins at a depth of 6-8 m

**MMM (Maximum Monthly Mean SST climatology)** - the highest expected (climatological) monthly SST expected at all ocean locations based on 15 years of monthly mean SST data (serves as the input threshold for the Coral Bleaching HotSpot charts)



**Mollusca** - an animal phylum that includes bivalves, squids, octopuses and snails. They are distinguished by a muscular foot, a calcareous shell secreted by the underlying body wall (the mantle) and a feeding organ (the radula). Many species are common inhabitants of coral reefs



Atlantic deer cowrie (*Cypraea cervus*) grazing in the Flower Garden Banks National Marine Sanctuary. (Photo: Frank and Joyce Burek)

**molt** - to shed part or all of a coat or outer covering, such as, shell, feathers, cuticle or skin, which is replaced periodically by a new growth

**Monera** - the Kingdom composed of prokaryotic organisms. They have a cell wall, and lack both membrane-bound organelles and multicellular forms. The Archaeobacteria, the most ancient of this Kingdom, are so different that they may belong to a separate kingdom. Monera include the cyanobacteria and eubacteria

**monitoring** - the systematic collection of data over time

**monoecious** - having combined sexes. Individuals of monoecious species contain the reproductive systems of both males and females

**monophyletic group** - a group of organisms descended from a common ancestor

**monosaccharide** - a sugar that does not hydrolyse to produce other sugars; the simplest group of carbohydrates

**monotype** - in taxonomy, a situation where a genus group taxon is established with only one immediately subordinate taxon, e.g., a genus containing only one species

**monsoon** - a periodic wind caused by the effects of differential heating, with the largest being the Indian monsoon found in the Indian Ocean and southern Asia

**Montastraea** - a genus of hard (stony) coral that includes the boulder coral and the great star coral



Great star coral (*Montastraea*)



*cavernosa*) is one of four species of *Montastraea* found at the Flower Garden Banks in the Gulf of Mexico. (Photo: Dr. Stephen Gittings)

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**morphology** - a branch of biology that deals with the form and structure of organisms, apart from their functions (physiology)

**morula** - a stage of embryonic development in which the cleaving cells (blastomeres) appear as a cluster of blastomeres without a cavity; precedes the blastula stage of embryonic development

**motile** - capable of self-locomotion

**motu** - a coral island in the lagoon of an atoll

**mouthparts** - a collective term for the appendages around the mouth of crustaceans which are concerned with feeding: mandibles, maxillae and maxillipeds

**MPA (Marine Protected Area)** - Executive Order 13158 defines a marine protected area (MPA) as "any area of the marine environment that has been reserved by Federal, State, territorial, tribal, or local laws or regulations to provide lasting protection for part or all of the natural and cultural resources therein." MPAs are used as a management tool to protect, maintain, or restore natural and cultural resources in coastal and marine waters. There are many different types of MPAs in U.S. waters

**MSS (Multispectral Scanner)** - a scanner system that simultaneously acquires images of the same scene in various wavelength bands

**mucus** - a gelatinous material secreted by specialized mucous cells. In corals, it functions in protection from bacterial invasion, food capture, and removal of sediment particles. Mucus is usually moved by cilia (motile hair-like extensions of the cell membrane)

**mud** - a fine sediment often associated with river discharge and buildup of organic material in areas sheltered from high-energy waves and currents

**mud flat** - a relatively level area of fine silt along a shore (as in a sheltered estuary) or around an island, alternately covered and uncovered by the tide, or covered by shallow water



Nutrient-rich mudflats at the Gulf of the Farallones National Marine Sanctuary in California. (Photo: Dan Howard)

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**Mullerian mimicry** - a form of protective mimicry in which noxious species evolve through convergent evolution to resemble each other

**mutation** - changes in the nature of single genes or segments of chromosomes, which are then inherited by successive generations

**mutualism** - a symbiotic interaction between two species in which both derive some benefit

**mycelium** - the mass of filamentous growth (hyphae) from which the vegetative part of a fungus develops



Drawing of the mycelium of a fungus. (Photo: Jon Houseman \BIODIDAC)

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## Glossary of Terminology: N

**National Biological Information Infrastructure (NBII)** - a broad, collaborative program to provide increased access to data and information on the nation's biological resources. The NBII links diverse, high-quality biological databases, information products, and analytical tools maintained by NBII partners and other contributors in government agencies, academic institutions, non-government organizations, and private industry

**natural climate record** - a record of climatic events found by examining the natural environment (e.g., coral growth bands, tree rings, layers of ice in glaciers)

**natural selection** - a natural process by which organisms (and their genes) that adapt to their environment survive while those that do not adapt become eliminated progressively

**nauplius larva** - a free-swimming, planktonic larval stage of many crustaceans

**nautical mile** - the length of a minute of arc, 1/21,600 of an average great circle of the Earth. Generally one minute of latitude is considered equal to one nautical mile. The accepted United States value as of 1 July 1959 is 1,852 meters (6,076.115 feet)

**nekton** - organisms with swimming abilities that allow them to move actively through the water column and to move against currents



Fish are a large component of marine nekton. (Photo: Dr. Anthony Picciolo)

**nematocyst (cnidocyte)** - a specialized stinging cell found in cnidarians

**neoplasm** - a cancerous growth

**neotype** - in taxonomy, a specimen selected as type specimen subsequent to the original description in cases where the original holotype, or lectotype, or all paratypes, or all syntypes are lost or destroyed, or suppressed by the Commission (Zoology)

**neritic** - refers to the ocean environment landward of the shelf-slope break

**NESDIS (National Environmental Satellite, Data and Information Service)** - the NOAA agency that operates and manages the U.S. civilian weather satellites and the national environmental data centers, such as the National Oceanographic Data Center (NODC), the National Climatic Data Center (NCDC), and the National Geophysical Data Center (NGDC)

**neuston** - planktonic organisms associated with the air-water interface

**niche** - the role of an organism in an ecological community; the environmental requirements and tolerances of a species; sometimes seen as a species' "profession" or what it does to survive

**NOAA Coral Reef Conservation Program** - a NOAA program whose purposes are: (1) to preserve, sustain, and restore the condition of coral reef ecosystems; (2) to promote the wise management and sustainable use of coral reefs; (3) to develop sound scientific information on the condition of coral reef ecosystems and the threats to such ecosystems; (4) to assist in the preservation of coral reefs by supporting conservation programs, including projects that involve affected local communities and nongovernmental organizations; (5) to provide financial resources for those programs and projects; and (6) to establish a formal mechanism for collecting and allocating monetary donations from the private sector to be used for coral reef conservation projects

**NOAA (National Oceanic and Atmospheric Administration)** - the National Oceanic and Atmospheric Administration (NOAA) is a federal agency within the US Department of Commerce that is dedicated to predicting and protecting the environment. NOAA's overall mission is to understand and predict changes in the Earth's environment, protect life and property, provide decision makers with reliable scientific information, conserve and manage the Nation's living marine and coastal resources to meet our Nation's economic, social, and environmental needs, and foster global environmental stewardship. To achieve its mission, NOAA's focus through 2008 will be on four mission goals:

1. Protect, restore, and manage the use of coastal and ocean resources through ecosystem-based management
2. Understand climate variability and change to enhance society's ability to plan and respond

3. Serve society's needs for weather and water information
4. Support the Nation's commerce with information for safe, efficient, and environmentally sound transportation



The National Oceanic and Atmospheric Administration (NOAA) is a federal agency within the U.S. Department of Commerce that is dedicated to predicting, protecting, and providing information about the marine environment.

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**nocturnal** - being primarily active at night

**nomenclature** - the description of new taxa or alterations to the concept of previously described taxa which involve changes in the names of taxa

**nominal taxon** - in taxonomy, a named taxon, objectively defined by its type taxon. Thus the nominal family Chaetodontidae is always the one to which its nominal type genus, *Chaetodon*, belongs

**notochord** - a flexible rodlike structure that forms the supporting axis of the body in the lowest chordates, (e.g., tunicates and lancelets) and lowest vertebrates (e.g., lampreys), and in the embryos of all higher vertebrates, where it is replaced by the vertebral column; a prime defining characteristic of the phylum Chordata

**nuchal** - pertaining to the neck

**nuchal organ** - a sense organ on upper side of head in many branchiopods; photoreceptor-like sensory cells in the nuchal region (posterodorsal region of the head) of some cephalopods; paired chemosensory structures in some annelids

**nucleotide** - one of the structural components, or building blocks, of DNA and RNA. A nucleotide consists of a base (one of four nitrogenous bases: adenine, thymine, guanine, and cytosine) plus a molecule of sugar and one of phosphoric acid

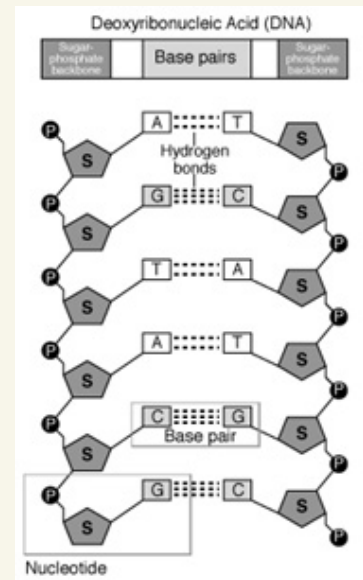
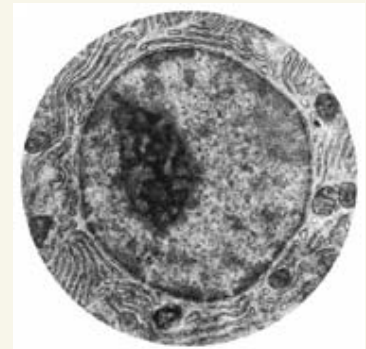


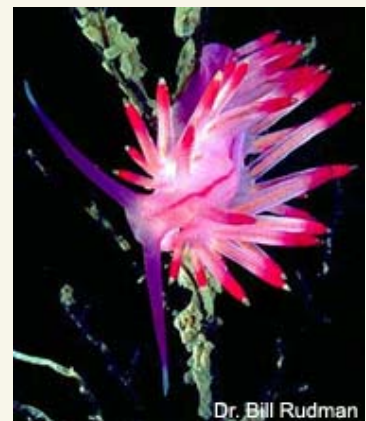
Diagram of DNA shows nucleotide structure. (Diagram: NIH/Human Genome Project)

**nucleus** - a central cell structure that contains the chromosomes, and as such, controls the activities of the cell



A cell with a large central nucleus. The dark mass within the nucleus are the chromosomes.

**nudibranch** - a opisthobranchiate mollusk (sea slugs), having no shell except while very young. The gills are naked and situated upon the back or sides



A Pacific nudibranch. (Photo: Dr.

**numerical taxonomy** - study of the relationships of taxa by the application of numerical similarity values to characters so as to rank into categories based on degree of overall similarity

**numericlature** - an attempt to express the natural order (i.e. classification) of organisms in numbers, so that each taxon name is represented by a numerical code, the structure of which indicates its taxonomic position, rank and affinities

**nutrient** - any substance assimilated by organisms that promotes growth. Marine scientists typically measure nitrites, nitrates, phosphates, and silicates as nutrients for plant growth

**nutrient cycling** - all the processes by which nutrients are transferred from one organism to another. For instance, the carbon cycle includes uptake of carbon dioxide by plants, ingestion by animals, and respiration and decay of the animal

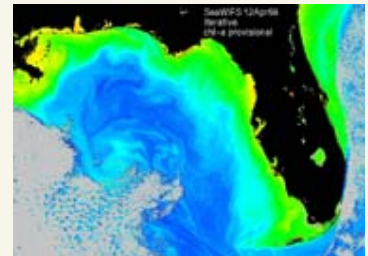
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## Glossary of Terminology: O

**obligatory** - obligate or required. For example, an obligatory cleaner fish relies entirely on this feeding mode to obtain nutrients; opposite of facultative

**obtuse** - blunt or rounded at the end

**ocean color** - a term that refers to the spectral dependence of the radiance leaving a water body



SeaWiFS (Sea-viewing Wide Field-of-view Sensor) ocean color image of chlorophyll-a in the Gulf of Mexico.

**ocean color sensor** - an instrument for the remote sensing of ocean color, usually from aircraft or satellite



This SeaWiFS (Sea-viewing Wide Field-of-view Sensor) is an ocean color sensor.



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**oceanic** - associated with sea-water environment seaward of the shelf-slope break

**oceanic crust** - that part of the Earth's crust underlying the ocean basins. It is composed of basalt and has a thickness of about 5 km

**oceanic reef** - a reef that develops adjacent to deeper waters, often in association with oceanic islands

**ocellus** - an eye-like spot, usually surrounded with a ring of a lighter color, e.g. the ocellus toward the caudal peduncle of some butterflyfish. It may function to deflect attacks to the eyes in agonistic encounters. Ocelli are also present in other animal groups, especially insects



These butterflyfish have a prominent ocellus (pl. ocelli), which may serve to deflect predator attacks from the head region of the fish.

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**Octocorallia** - a subclass of the Anthozoa that contains the sea pens, sea pansies, sea fans, whip corals, and pipe corals. Octocorals always possess 8 tentacles and 8 complete septa (hard corals and anemones possess 12 or more tentacles and septa). They are colonial cnidarians whose polyps are connected by a tissue mass called the coenenchyme. This tissue connects the gastrovascular (digestive) cavities of all the polyps in the colony



An octocorallian (sea fan) with brain coral (sceractinian) in the foreground.

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**Oculina Banks** - a series of deepwater coral pinnacles and ridges, 15 to 30 miles off the east coast of Florida, extending from Ft. Pierce to Cape Canaveral. Formed by a single species of coral, the Ivory Tree Coral, *Oculina varicosa*, they form pinnacles of up to 100 feet tall, growing below the Gulf Stream at depths of approximately 70 to 100 meters. This is a slow-growing, branching coral often associated with high biodiversity because they provide ideal habitats and spawning sites for numerous species of fishes and invertebrates



The Oculina Banks are deep water coral reefs occurring along the shelf edge off the central east coast of Florida. The *Oculina varicosa* habitat hosts a diverse array of macroinvertebrates and fishes. The habitat also comprises significant spawning grounds for economically important species of reef fishes.



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**off-reef** - a synonym of reef slope

**offshore current** - any current flowing away from shore

**offshore wind** - a wind blowing seaward from the land in the coastal area.

**oligotrophic** - refers to water bodies with low concentrations of nutrients

**omnivore** - an organism whose diet consists of a wide variety of foodstuffs, including plants and animals

**onshore** - a direction landward from the sea

**onshore wind** - a wind blowing landward from the sea in the coastal area

**ontogeny** - the development, growth, and maturation of an individual

**oogamous** - characterized by reproducing by the fusion of small motile male gametes and large nonmotile female gametes

**oolitic limestone** - rock composed primarily of petrified corals or the skeletons of other calcareous animals

**open circulatory system** - a circulatory system, characteristic of some invertebrates, e.g., arthropods, in which blood flows through an interconnected system of open sinuses rather than blood vessels. The tissues and cells are directly bathed by the blood for gaseous exchange and nutrient uptake. The circulatory fluid is called the hemolymph

**opisthobranch** - a marine gastropod, many of which have lost or reduced their shell, mantle and gills

**oral** - pertaining to the mouth



The oral surface of some sea urchins. The central opening is the mouth.

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**oral disc** - the area around the mouth of an anthozoan polyp that bears from eight to several hundred tentacles

**organ** - a collection of tissues which performs a particular function or set of functions in an animal's body. Organs are composed of tissues, and may be organized into larger organ systems

**organ system** - collection of organs which have related roles in an organism's functioning. The nervous system, circulatory system, and muscle system are all organ systems

**organelle** - a structurally discrete component of a cell, e.g., the nucleus or a mitochondrion

**organic** - refers to those substances produced by the metabolism of a living organism, especially carbon-containing compounds

**osculum** - the main opening through which filtered water is discharged in sponges



The opening into the central cavity of these sponges is the osculum (Photo: Dr. Anthony Picciolo)

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**osmoregulation** - the process of controlling the amount of water in tissues and cells

**osmosis** - the passage of water through a semipermeable membrane from a solution with a lower concentration of solute to one with a higher concentration of solute

**osmotic pressure** - the pressure that is needed to counteract the osmotic passage of water molecules across a semipermeable membrane into the more concentrated solute

**ostium** - in sponges, a microscopic pore through which water enters the sponge body

**outer slope** - a synonym of reef slope. It is sometimes used to represent the lower reef slope

**overfishing** - a level of fishing effort or fishing mortality such that a reduction of this level would, in the medium term, lead to an increase in the total catch

**oviparity** - the reproductive mode where eggs are released from the body and later hatch

**oviposition** - the process of depositing eggs



A marine turtle depositing eggs (oviposition) on a tropical beach. (Photo: Seaturtle Preservation Society of Brevard County, FL)

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**ovoid** - egg-shaped

**ovoviviparity** - the reproductive mode where the eggs hatch and develop in the female's reproductive tract (or a specialized pouch in the males of some species), are not nourished in any way by the female, and are

free-swimming when released from the parent

**oxygen isotope ratio ( $^{18}\text{O}$ )** - an expression for the ratio of the  $^{18}\text{O}$  to  $^{16}\text{O}$  atoms in a sample relative to a standard, defined as:  $\delta^{18}\text{O} = (^{18}\text{O}/^{16}\text{O} \text{ sample} - ^{18}\text{O}/^{18}\text{O} \text{ standard}) / ^{18}\text{O}/^{16}\text{O} \text{ standard}$

**oxygen isotopes** - oxygen atoms that have the same atomic number (protons) but different mass numbers (and different numbers of neutrons). The two stable isotopes of oxygen are  $^{16}\text{O}$  and  $^{18}\text{O}$

[\(Top\)](#)

## Glossary of Terminology: P

**paleobiogeography** - the distribution of organisms as revealed by the fossil record

**paleoclimatology** - the study of past climates throughout geological history, and the causes of the variations among them

**paleoecology** - the study of the relationship of extinct organisms or groups of organisms to their environments



A paleoecological microfossil, this rotifer (*Callindina angusticollis*) is from the Beringia region of the Arctic. (Photo: Wendy Eisner)

**paleoenvironmental proxy** - an environmental remnant of the past (pollen grains, tree rings, lake sediments, pack rat middens, ice cores, coral skeletons) used to assist researchers in deciphering past climatic conditions

**paleothermometer** - a proxy that provides absolute estimates of past temperature. An example is the Sr/Ca ratio found in coral skeletons

**Paleozoic** - an era of geologic time lasting from 570 to 245 million years ago

**paliform crown** - a circle of paliform lobes that surround the columella

**paliform lobe** - an upright skeletal rod or plate at the inner margin of septa formed by upward growth of the septum

**palmata zone** - the region of a reef crest of a bank or barrier reef that is closest to the water surface. It is composed almost completely of elkhorn coral (*Acropora palmata*) in the Caribbean



*Acropora palmata* in a shallow reef zone.

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**Pangea** - a supercontinent that existed from about 300 to 200 million years ago. It included most of the continental crust of the Earth

**papilla** - a raised bump or nipple-like projection on a tissue surface; a cellular outgrowth. Papillae have the appearance of little bumps or fingers on the surface of cells

**papillose** - covered with papillae

**PAR (Photosynthetically Active Radiation)** - those wavelengths of light that can be absorbed by chlorophyll or other light harvesting pigments

**parapodium** - one of the short unsegmented processes located on each side of most of the body segments in many annelid worms. Parapodia (pl) function in locomotion and often also as tactile or branchial organs. In some marine snails (e.g., sea hares and pteropods) it is a broad lateral expansion of either side of the foot, forming a broad swimming organ



A polychaete worm showing a pair of parapodia per segment. Note the bristle-like chaetae borne by each parapodium. (Photo: Dr. Anthony Picciolo)

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**paratype** - in taxonomy, every specimen in a type series, other than the holotype, which were before the author at the time of preparation of the original description, and were so designated and indicated there

**parenchyma** - the primary tissue of higher plants composed of thin-walled cells that remain capable of cell division, even when mature. Parenchyma constitutes the greater part of leaves, roots, the pulp of fruits, and the pith of stems. They are fundamental plant tissues as opposed to more highly differentiated tissues. In animals, the parenchyma constitutes the essential functional part of an organ, as contrasted with the organ's connective tissue, nerves, and blood vessels

**paresthesia** - abnormal neurological sensations which include: numbness, tingling, burning, prickling and hyperesthesia (increased sensitivity); one possible symptom of ciguatera poisoning

**parthenogenesis** - reproduction without fertilization; the development of an unfertilized ovum, seed, or spore. It occurs naturally in several species and may also be induced artificially by chemical or mechanical means

**patch reef** - a coral boulder or clump of corals formed on a shelf, usually of less than 70 m depth, often in

the lagoon of a barrier reef or atoll. It is unattached to a major reef structure

**patchiness** - the condition where organisms occur in aggregations

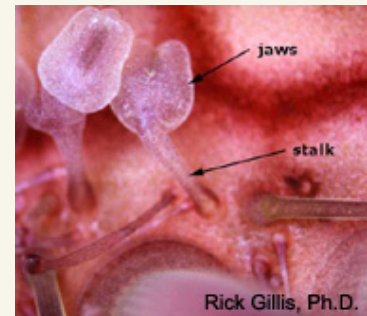
**pathogen** - an organism which causes a disease within another organism

**pavement** - rock exposed at the Earth's surface in the form of a more or less horizontal surface, usually with crevices or joints

**pedal disc** - a disc at the aboral end of the body trunk used for attachment. A synonym of basal plate

**pedal laceration** - a type of asexual reproduction in some sea anemones in which parts of the pedal disc break off and are left behind as the anemone moves

**pedicellarium** - a forceps-like organ which occurs in large numbers on starfishes and sea urchins. Pedicellariae, in general, are multifunctional appendages involved in defense, feeding, and cleaning. They are mainly used to keep small organisms from settling on the aboral surface, to capture small prey, and to discourage predators from feeding on soft tissue. The basic structure of pedicellariae consists of a head, neck, and stalk. The head usually has three jaws and, in some pedicellariae, contains poison glands



A single pedicellarium from a starfish. (Photo: Rick Gillis, Ph.D., Biology Dept., University of Wisconsin-La Crosse)

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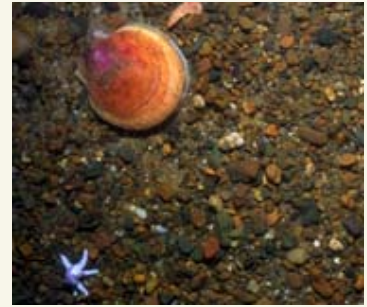
**pelagic** - refers to organisms that inhabit open water, as opposed to benthic



An ocean sunfish, *Mola mola*, is a pelagic species, frequently seen basking at the surface of the water.

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**Pelecypoda (Bivalvia or Lamellibranchia)** - a class of Mollusca that includes clams, oysters and mussels



A member of the Pelecypoda, a live scallop (*Placopecten magellanicus*) in the Stellwagen Bank National Marine Sanctuary. (Photo: Dann Blackwood and Page Valentine, USGS)

**pentamerous** - divided into five parts; a characteristic of the body plan of echinoderms



Bright orange seastar (*Pseudarchaster myobranchius*) with a typical pentamerous body shape.

**peptide** - two or more amino acids joined by a peptide bond

**peptide bond** - the bond between two amino acids formed when a carboxyl ( $\text{-COOH}$ ) group of one amino acid joins an amino ( $\text{-NH}_2$ ) group of another amino acid, releasing water in the process

**Period** - in the geologic time scale, a unit of time less than an era and greater than an epoch

**perisarc** - the chitinous outer coat of common tissue connecting individuals in some colonial hydrozoans

**peritoneum** - the mesodermally-derived membrane that lines the coelom and covers the coelomic viscera

**petabyte** - a measure of data size. One petabyte is equivalent to 1,000 terabytes

**petaloid septa** - primary septa which have a tapered or curved shape because they are enclosed by other septa

**pH** - the logarithm of the reciprocal of hydrogen-ion concentration in gram atoms per liter; provides a measure on a scale from 0 to 14 of the acidity or alkalinity of a solution (where 7 is neutral and  $<7$  is acidic and  $>7$  is basic)

**phaceloid coral** - a coral that has corallites of uniform height which are adjoined toward their base

**phenetic classification** - classification based on degree of overall similarity

**phenotype** - the total characteristics of an individual, i.e., its appearance, resulting from interaction between its genotype (genetic constitution) and its environment

**photic zone** - the vertical zone in the ocean extending from the surface to that depth permitting photosynthetic activity

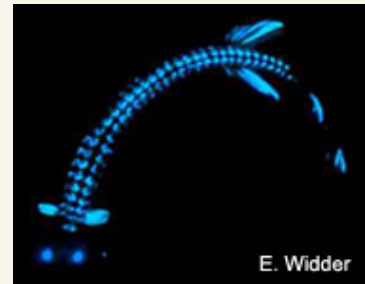
**photo-quadrat** - a quadrat that is photographed for purposes of later analysis and permanent record for species monitoring or measurement

**photomosaic** - an assemblage of photographs, each of which shows part of a region, and put together in such a way that each point in the region appears once and only once in the assemblage, and scale variation is minimized



Photomosaic of St. John, U.S. Virgin Islands. Images such as these are valuable in studying and managing coral reefs and other habitats. (Courtesy of NOAA National Ocean Service)

**photophore** - a light-producing organ, found especially in marine fishes and cephalopods. Photophores emit light from intrinsic structures, or derive light extrinsically from symbiotic luminescent bacteria



This bright bluish lights are given off by photophores on this black dragonfish (Photo: E. Widder, Harbor Branch Oceanographic Institution)

**photosynthesis** - process by which autotrophic chlorophyll-containing organisms manufacture their own energy sources (simple sugars) from the intracellular chemical reaction of carbon dioxide and water in the presence of sunlight and chlorophyll. Oxygen is a photochemical byproduct of photosynthesis

**photosynthetic pigment** - a pigment that efficiently absorbs light within the 400-700 nm range and is essential for photosynthesis

**phylogenetics** - the field of biology that deals with the relationships among organisms

**phylogeny** - the evolutionary relationships among organisms

**phylum** - a major division of a biological kingdom, consisting of closely- related classes; represents a basic fundamental pattern of organization and, presumably, a common descent



**phytoplankton** - microscopic green plant component of the plankton which is responsible for most of the photosynthetic activity in the ocean



A phytoplankton species of the genus *Ceratium*.

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**picture element** - in a digitized image, this is the area on the ground represented by each digital value. Because the analogue signal from the detector of a scanner may be sampled at any desired interval, the picture element may be smaller than the ground resolution cell of the detector. It is commonly abbreviated as pixel

**pinnacle reef** - a nearly cylindrical reef with vertical sides; may be up to 200 m diameter and 50 m in height

**pinnate** - having side branches

**pinnule** - a side branch structure on the tentacle of soft corals, giving them a feathery appearance

**piscivore** - an animal that feeds on fishes

**pixel** - abbreviation of picture element

**plague (white plague disease)** - a coral disease characterized by a sharp line between apparently healthy coral tissue and freshly exposed coral skeleton. There is no obvious microbial band present. The infective pathogen is a bacterium. Plague is currently epidemic throughout the Caribbean, and affects stony corals. For more information and illustrations, see: [http://www.coral.noaa.gov/coral\\_disease/white\\_plague.shtml](http://www.coral.noaa.gov/coral_disease/white_plague.shtml)



White plague disease. (Photo: Dr. A. Bruckner, NOAA)

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**planktivorous** - feeding on planktonic organisms

**plankton** - the passively floating or weakly motile aquatic plants (phytoplankton) and animals (zooplankton)



This large copepod (*Neocalanus sp.*) is part of the Arctic marine plankton community.

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**Plantae** - the kingdom of immobile multicellular eukaryotes that obtain energy through photosynthesis, and have cells encased in cell walls composed of cellulose



Green plants in a Hawaiian intertidal community.

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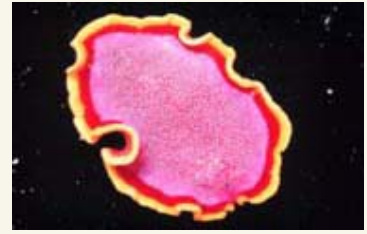
**planula** - a planktonic larval form produced by some anthozoans

**plasmogamy** - a process of fusion of the cytoplasm of two sex cells or gametes; the first step in syngamy (fertilization)

**plastid** - a membrane-bound organelle in plant cells that functions in storage (of food or pigments) or food production. Chloroplasts contain the pigments for photosynthesis

**platform reef** - a large reef of variable shape lacking a lagoon, seaward of a fringing reef and/or a barrier reef, for which the width is more than half its length

**Platyhelminthes** - an animal phylum containing four classes of flatworms. Three are parasitic (tapeworms, flukes) and one, the Turbellaria, is free-living and contains coral reef inhabiting species



A free-living polyclad flatworm.

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**Pleistocene epoch** - an interval of the Quaternary period, from 1.8 million years before present to 10 thousand years before present

**Pliocene epoch** - an interval of the late Neogene period, from 5.3 to 1.8 million years before present

**plocoid colony** - a coral colony which has conical corallites with their own walls

**pluteus larva** - a free-swimming, bilaterally symmetrical, ciliated larva of some echinoderms, such as sea urchins and brittlestars



Pluteus larva of an Australian sea urchin. (Photo: Ellen Popodi and Rudolf A. Raff)

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**pneumatocyst** - one of many gas-filled bladders found in some algae that act as a buoys. In some large brown algae, such as kelp, they act to raise the blades closer to the surface where photosynthesis can occur. Pneumatocysts keep the brown alga, *Sargassum*, afloat in the Sargasso Sea



The pneumatocysts are the swellings at the bases of the blades in this kelp. (Photo: Monterey Bay Aquarium Research Institute)

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**pneumatophore** - a modified aerial root rising above ground that may function as a respiratory organ in plant species such as mangroves, which are subjected to inundation or soil saturation. Such evolutionary adaptations enable trees to obtain oxygen directly from the air and also helps consolidate swamp sediments. They have special air channels (lenticels) for gas exchange in the atmosphere and there is an internal pathway for getting oxygen into the root and to supply submerged roots. The aerial loop of a mangrove root is sometimes called a "knee" or "peg root"



Mangrove pneumatophores emerging from the sediments. These structures, also known as rhizophores, have bark rich in lenticels to function in gas exchange for roots that are constantly in water-saturated soil. (Photo: Copyright Dr. Joseph E. Armstrong, Illinois State University)

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**point intercept transect** - a linear transect protocol where a tape is secured at each end of the transect with the tape draped over the reef in between. Observations are collected on each species and substrate component at specified points along the line

**PointCount** - PointCount for Coral Reefs is a Windows/Win95-based program developed to utilize the random point count method to accurately estimate percent coverage of corals, sponges, and associated substrate from frame grabbed underwater video imagery

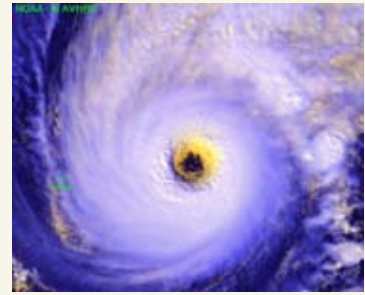
**poisonous** - an organism that contains poison in its tissues that can be harmful if the organism is ingested



The liver, gonads, intestines, and skin of puffer fish (and other related and unrelated animals) contain high concentrations of tetrodotoxin, a powerful neurotoxin that can cause respiratory paralysis and death, in approximately 60% of persons who ingest it. (Photo: NOAA)

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**polar-orbiting satellite** - a satellite traveling in a near-polar orbit around the globe; civilian satellite program managed and operated by NESDIS



Polar-orbiting satellite data was used to derive this image of Hurricane Erin, September 2001.

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**Polychaeta** - a class of the segmented worm phylum Anellida. There are approximately 8,000 species of polychaetes which include errant (free-moving) forms and sedentary ones that live in stabilized burrows, galleries or tubes of various degrees of complexity. Some burrow into coral. Many species are common inhabitants of coral reefs, such as the Christmas tree worms, feather duster worms, fanworms, fireworms, scaleworms, threadworms, and others



A marine polychaete worm grazing on the surface of a coral head. (Photo: Dr. Anthony Picciolo)

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**polyclad flatworm** - a free-living flatworm belonging to the order Polycladida (Class Turbellaria; Phylum Platyhelminthes). Many species are coral reef inhabitants

**polymer** - a compound of high molecular weight consisting of up to millions of repeated linked light and simple molecules

**polymorphic species** - species which have a variety of morphological types

**polyp** - an individual of a solitary cnidarian or one member of a cnidarian colony



Cnidarian polyp.

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**polyp bail-out** - the dissociation and dispersal of coral polyps from adult colonies

**polyphyletic group** - a group of species that resemble each other but are evolved from different ancestors. A polyphyletic group is composed of members that originated, independently, from more than one evolutionary line

**polyploid** - cells or organisms having more than twice the haploid number of chromosomes

**polysaccharide** - any of a class of carbohydrates whose molecules contain chains of monosaccharide molecules

**population** - a group of individuals of the same species living in the same area at the same time and sharing a common gene pool; a group of potentially interbreeding organisms in a geographic area

**population density** - the number of organisms per unit area or volume

**population dynamics** - the study of the factors that affect the growth, stability, and decline of populations, as well as the interactions of those factors

**population (statistics)** - any entire collection of animals, plants, people, or things from which we may draw a sample and collect data. It is the entire group we are interested in, which we wish to describe or draw conclusions about. In order to make any generalizations about a population, a sample, that is meant to be representative of the population, is often studied. For each population there are many possible samples. A sample statistic gives information about a corresponding population parameter. For example, the sample mean for a set of data would give information about the overall population mean

**Porifera** - an animal phylum that contains the sponges. They are the most primitive of the multicellular animals. Sponges assume many sessile body forms, such as finger, branching, bushy, spherical, tubular, vase and tube-like, encrusting, amorphous and massive. Some bore into coral and mollusk shells. Many of the 5,000 species are colorful and prominent inhabitants of coral reefs



A barrel sponge (Porifera).  
(Photo: Dr. Anthony Picciolo)

**Porites** - an important and dominant genus of hermatypic coral. Porites brood or release live young rather than sperm and egg packets like most corals

**posterior** - morphologically, toward the rear or back end of an individual, or distal portion of a bodily part





The prehensile tail at the posterior end of the seahorse's body allows it to hold on to aquatic plants

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**potential coral reef bleaching episode** - potential for coral bleaching occurs when the sea surface temperature is at least 1 degree C above the maximum expected summertime temperature

**Primary male or female** - a male or female that is genetically determined at birth or hatching and is not the result of sex change

**primary production** - a synonym of primary productivity

**primary productivity** - the rate at which new plant biomass is formed by photosynthesis. Gross primary productivity is the total rate of photosynthetic production of biomass; net primary productivity is gross primary productivity minus the respiration rate

**probability** - a quantitative description of the likely occurrence of a particular event. Probability is conventionally expressed on a scale from 0 to 1; a rare event has a probability close to 0; a very common event has a probability close to 1

**proboscis** - an elongated tubular organ of varying use and form, usually associated with the oral region of many invertebrates

**producers** - the first level in a food pyramid; usually consist of photosynthetic organisms that generate the food used by all other organisms in the ecosystem

**prokaryote** - an organism whose chromosomes are not enclosed within a nuclear membrane, e.g., a bacterium or cyanobacterium

**prokaryotic** - descriptive of organisms with cells possessing no distinct nucleus. Prokaryotes include bacteria and cyanobacteria



**prop root** - an adventitious root that grows from and supports the trunk above the ground in plants, such as mangroves



The intertidal understory of a mangrove forest shows the muddy soil, the fairly high density of stems, and the tangle of prop and drop roots. (Photo: Copyright Dr. Joseph E. Armstrong, Illinois State University)

**propagule** - a structure for mangrove reproduction. After a mangrove is pollinated, it produces a propagule, which grows on a parent plant and requires carbon dioxide and water from the parent, but produces its own sugars from photosynthesis. After a while, it separates from the parent tree and falls into the water where it can be transported great distances. Propagules can resist dessication and survive for long periods of time until they root in a suitable environment.



Cigar-shaped propagule of the red mangrove, *Rhizophora mangle*. It may reach 15 cm in length. (Photo: Bill Keogh)

**prostomium** - the anteriormost, presegmental region of the body of an annelid worm, sometimes bearing eyes and antennae; the portion of the head in annelids that is situated anterior to the mouth

**prostrate colony** - a coral colony which sprawls horizontally over the substrate

**protandry** - a state in hermaphroditic systems characterized by the development of male reproductive organs, or maturation of their gametes, before the appearance of the corresponding female product, thus insuring against self-fertilization

**protected area** - an area set aside for the preservation, protection, and management of highly important natural and cultural features and for the regulation of the scientific, educational and recreational use



This brilliant sea anemone is from the protected Gulf of the Farallones National Marine Sanctuary.

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**protected species** - species which are protected by federal legislation such as the Endangered Species Act, Mammal Protection Act, and Migratory Bird Treaty Act

**protein** - a large complex molecule made up of one or more chains of amino acids. A typical protein contains 200-300 amino acids but some are much smaller and some much larger, e.g., titin, a protein found in skeletal muscle contains approximately 27,000 amino acids in a single chain. Proteins perform a wide variety of essential activities in cells: they largely form the physical structure of cells and cellular matrices; catalysts for all biochemical reactions are enzymes, which contain protein; the transport of materials in body fluids depends of proteins; the receptors for hormones and other signaling molecules are proteins; motion and locomotion of cells and organisms depends on contractile proteins; the transcription factors that turn genes on and off are proteins; proteins are an essential nutrient for heterotrophs; and many more - the activities of cells and organisms are largely reflections of the activities of their proteins

**Protista** - earliest evolved eukaryotic kingdom. It includes the protozoans, the slime molds, the unicellular algae, and the multicellular algae. However, some consider the multicellular marine algae (seaweeds) as belonging to the kingdom Plantae

**protogyny** - a state in hermaphroditic systems characterized by the development of female reproductive organs, or maturation of their gametes, before the appearance of the corresponding male product, thus insuring against self-fertilization

**protoplasm** - the complex colloidal substance which constitutes the living matter of cells and performs the life process functions. The protoplasm found between the cell (plasma) membrane and the nuclear membrane is termed the cytoplasm; the protoplasm within the nucleus and separated from the cytoplasm by the nuclear membrane is termed the nucleoplasm

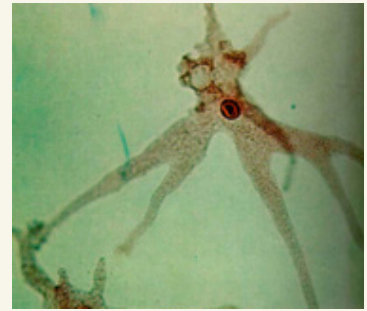
**protostome** - an evolutionary line of coelomates that include mollusks, annelids, and arthropods. They develop their embryo by spiral cleavage, and the blastopore of the gastrula develops into the mouth. The group exhibits bilateral symmetry

**protractile** - capable of being protruded or thrust out

**proximal** - the direction towards center of the body; opposite of distal

**proxy signal** - paleoclimatic evidence that can be used to indirectly infer or estimate some aspect of the paleoenvironment, such as precipitation or temperature

**pseudopodium (pseudopod)** - a protoplasmic filament or irregular process that can project from any unicellular organism. Formation of pseudopodia (or pseudopods) assist in feeding and locomotion



An amoeba thrusting out pseudopodia (false feet). (Photo: NASA; from: <http://ares.jsc.nasa.gov/astrobiology/biomarkers/timeline2.htm>)

**punctuated equilibrium** - an evolutionary model in which change occurs in relatively rapid bursts, followed by little or no discernible change in a lineage (stasis)

**pycnogonid** - pycnogonids, or sea spiders, are benthic, marine arthropods, with a superficial resemblance to true spiders, to which they are probably only distantly related. They are carnivores and use a muscular pharynx to suck soft food into the gut. The mouth is at the end of a large proboscis. Digestion is intracellular and most feed on sponges, cnidarians, or bryozoans from which they suck fluids. There are no excretory organs, respiratory organs, or body cavity (coelom)



The pycnogonid *Anoplodactylus evansi* is a predator of small marine gastropods as well as other soft bodied invertebrates. (Photo: Dr. Bill Rudman)

**pyrosome** - a large barrel-shaped colony of colonial pelagic tunicates belonging to the genus *Pyrosoma*. The colony propels itself through the water by means of cilia that pump water through the individual tunicates. It responds to mechanical, chemical, and light stimuli by moving and by spectacular blue-green bioluminescent displays

[\(Top\)](#)

## Glossary of Terminology: Q

**quadrat** - a square or rectangular sampling unit of known area (e.g., 1 m<sup>2</sup>) within which organisms are counted or measured. Quadrats can be used to estimate the percent cover of each species or other reef components and obtain information about density, abundance, colony size, and biodiversity



Scientist conducting a quadrat survey.

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**Quaternary period** - the second period of the Cenozoic era containing the Pleistocene epoch and the Holocene epoch, and dating from 1.8 million years to the present

[\(Top\)](#)

## Glossary of Terminology: R

**Røst Reef** - the world's largest known deep-water *Lophelia* coral complex. It lies in depths between 300-400m west of Røst Island in the Lofoten archipelago, Norway. It covers an area approximately 40 km long and 3 km wide

**radial corallite** - a corallite on a side of a branch as opposed to an axial corallite on the tip of the branch

**radial symmetry** - a basic morphological plan of organisms that have their body parts arranged around a central axis. Such organisms tend to be circular or cylindrical in shape, e.g., a coral polyp, or have projections around a central disc, e.g., starfish



Radial symmetry, illustrated by this starfish (Echinodermata).

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**radii** - inconspicuous septal elements which connect septa with the columella

**radioactivity** - the spontaneous decay of the nucleus of an element. It involves the change in the number of protons in the nucleus and therefore creates an atom of a new element

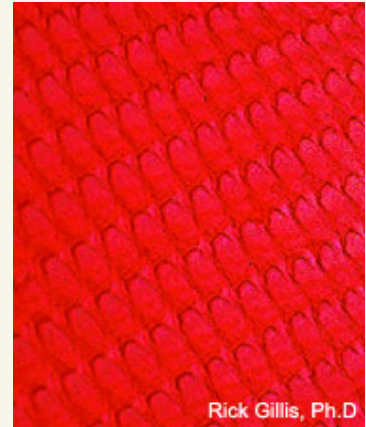
**radiocarbon age** - the age of plant or animal remains, determined by measuring the remaining activity of the <sup>14</sup>C atoms in the sample:  $A = A_0 e^{-t}$  where A is the measured activity, A<sub>0</sub> is the initial activity, e is the decay constant, and t is the sample age

**radiocarbon dating** - a dating method used to determine the age of samples containing carbon. The method measures the disintegration of the <sup>14</sup>C atom. <sup>14</sup>C is produced in the atmosphere by cosmic ray bombardment, and has a half-life of 5,570 years, making it useful for dating samples in the range of 0-40,000 years

**radiocarbon time** - regular known rates of radiocarbon decay that are used to determine the exact ages of

carbon-based life

**radula** - a scraping organ for mastication in certain mollusks, such as snails. In many gastropods the radula consists of a variable number of chitinous teeth, of different shape and size, located in the anterior portion of the pharynx. In the cone shell family it has been reduced to a sharp and grooved tooth, fit to harpoon and inject prey with a powerful venom, which is also potentially fatal to humans



A stained section of a snail radula. The numerous chitinous teeth on this ribbon-like membrane are used to scrape, pierce, tear or cut off small pieces of food that are then directed in a continuous stream toward the digestive tract by conveyor belt like movements of the membrane. (Photo: Rick Gillis, Ph. D., Biology Dept., University of Wisconsin-La Crosse)

**rampart** - a narrow ridge, 1-2 m high, built by waves along the seaward edge of a reef flat. It consists of boulders, shingle, gravel or reef rubble, commonly capped by dune sand

**random sample** - a sample in which each individual in a population has the same chance of being selected as any other

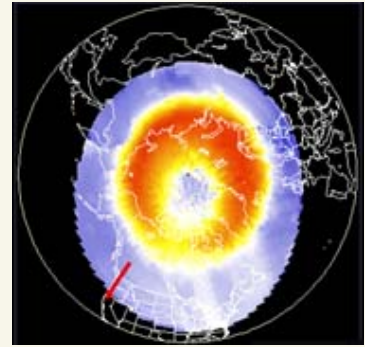
**random sampling** - a sampling technique where a group of subjects (a sample) is selected for study from a larger group (a population). Each individual is chosen entirely by chance and each member of the population has a known, but possibly non-equal, chance of being included in the sample. By using random sampling, the likelihood of bias is reduced

**raster** - an abstraction of the real world where spatial data is expressed as a matrix of cells or pixels, with spatial position implicit in the ordering of the pixels. With the raster data model, spatial data is not continuous but divided into discrete units. This makes raster data particularly suitable for certain types of spatial operation. The term may also refer to the region of a CRT (cathode-ray tube) or LCD (liquid crystal display) monitor that is capable of rendering images

**raster map** - a map or chart encoded in the form of a regular array of cells

**RDBMS (Relational database management system)** - a database management system with the ability to access data organized in tabular files that can be related to each other by a common field (item). An RDBMS has the capability to recombine the data items from different files, providing powerful tools for data usage

**real time** - time in which reporting of events or recording of events is simultaneous with the event



The auroral oval in the northern hemisphere, extrapolated from real-time data taken during the May 12, 2003 polar pass of the NOAA POES satellite.

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**recruitment** - the influx of new members into a population by reproduction or immigration

**red algae** - red algae belong to the Division Rhodophycota. Most of the over 4000 species are marine. They range in complexity from simple unicellular organisms to unbranched and branched filaments to complex multiaxial uprights and crusts. Their pigments include chlorophyll a and the phycobiliproteins, red phycoerythrin (often the dominant pigment) and blue phycocyanin, as well as carotenes, lutein, zeaxanthin. Most red algae have a complex life history with three phases: tetrasporophyte, gametophyte and carposporophyte



Red algae. (Photo: Dept. Natural Resources and Parks, Water and Land Resources Division, Kings County, WA; from <http://dnr.metrokc.gov/wlr/waterres/marine/algae.htm>)

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**red tide** - discoloration of surface waters, most frequently in coastal areas, caused by large concentrations of microorganisms, such as algae or cyanobacteria



Image of red tide taken from the NOAA vessel *Ron Brown*, April 5, 2001 during the Aerosols Characterization Experiments (see <http://www.ogp.noaa.gov/ace-asia/index.htm>.) (Photo: NOAA)

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**red-band disease** - a disease of corals manifested by a narrow band of filamentous cyanobacteria that advances slowly across the surface of a coral, killing tissue as it progresses. The band is reddish to maroon in color



Red-band disease on a sea fan.  
(Photo: Dr. A. Bruckner)

**reef base** - the area below the consolidated slope extending up to 1 km but no deeper than 50 m. A synonym of talus slope

**reef block** - a large, isolated rock section that has been displaced from the reef platform, reef margin, reef front zones or the non-calcium carbonate bedrock, usually resulting from storm waves

**reef complex** - the entire reef structure, including reef surface lagoon deposits and off-reef deposits

**reef crest** - the sharp break in slope at seaward margin or edge of reef flat

**reef flat** - the shallow area between the shoreline intertidal zone and the reef crest of a fringing reef



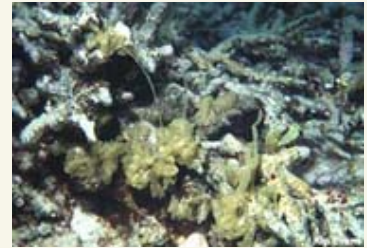
Reef flat, Palau Archipelago, Micronesia, containing various species of branching coral (*Acropora*). (Photo: Jerry Wellington)

**reef front** - a synonym of reef slope

**reef mound** - a structure that lacks reef characteristics, such as diversification and domination stages



**reef rubble** - dead, unstable coral pieces often colonized with macroalgae. This habitat often occurs landward of well-developed reef formations in the reef crest or back reef zone



Coral reef rubble from storm damage. (Photo: Kip Evans)

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**reef slope** - the portion of a reef seaward of reef crest



Reef slope covered with live corals.

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**reef system** - a cluster of reefs

**reef top** - the area comprising the reef flat and reef crest

**relational database** - a method of structuring data as collections of tables that are logically associated to each other by shared attributes. Any data element can be found in a relation by knowing the name of the table, the attribute (column) name, and the value of the primary key

**relict** - a persistent remnant of an otherwise extinct taxon; a biological or geological feature that has survived in a considerably changed environment

**remote sensing** - the collection of information about an object or event without being in physical contact with the object or event. Remote sensing is restricted to methods that record the electromagnetic radiation reflected or radiated from an object, which excludes magnetic and gravity surveys that record force fields



This remote sensing (SeaWiFS) image shows sediment stirred up

**remote sensing tool** - an instrument used in remote sensing often combined with a geographic information system to provide synoptic and objective views and data of the environment

**reproductive isolating mechanism** - a mechanism that prevents reproduction from occurring between two populations. Pre-zygotic reproductive isolating mechanisms (which take effect before fertilization) include environmental, temporal, behavioral, mechanical, and physiological barriers that prevent individuals of different populations from producing viable progeny. Post-zygotic reproductive isolating mechanisms (which take effect after fertilization) include gamete incompatibility, hybrid inviability, and hybrid sterility

**reproductive isolation** - a species is an interbreeding natural population that is reproductively isolated from other such groups. Species are usually separated by discontinuities, which constitute barriers that prevent, or at least inhibit, an interspecific gene flow and gene exchange. Establishment of reproductive isolation is essential for development of a new species

**resolution** - the ability to distinguish closely spaced objects on an image or photograph. It is commonly expressed as the spacing, in line-pairs per unit distance, of the most closely spaced lines that can be distinguished

**respiration** - a biochemical process by which living organisms take up oxygen from the environment and consume organic matter, releasing both carbon dioxide and heat energy

**rhizome** - a horizontal stem

**ribbon reef** - a large offshore linear reef, seaward of a fringing reef, which is linear but does not form a barrier to the land. A synonym of shelf-edge reef and sill reef

**riparian** - having to do with living or being located on the edges or banks of streams or rivers



This healthy riparian habitat includes undercut banks, woody debris in the water, and a clean stream bottom.

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**rosette** - rose-shaped in appearance; arranged in a fashion resembling a rose flower

**rostrum** - an elongate or extended snout



Most dolphins have an elongated beak called a rostrum. (Photo: Copyright Corel Corp.)

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**rubble zone** - the shallowest part of a reef crest landward of the palmata zone. It consists of broken pieces of coral washed back by storms

**rugose** - having a rough or ridged surface

**rugose corals** - an extinct group of non-scleractinian corals

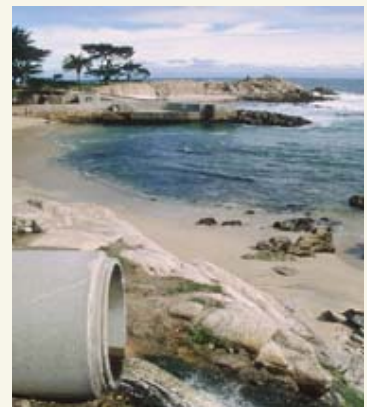
**rugosity** - an important coral reef parameter that describes the amount of "wrinkling" or roughness of the reef profile. It is an index of substrate complexity. Areas of high complexity are likely to provide more cover for reef fishes and more places of attachment for algae, corals and various sessile invertebrates



A coral reef with a high degree of rugosity.

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**runoff** - water that has been on land and moves seaward as a result of rain, flooding, irrigation or flushing . Runoff is frequently high in nutrients and suspended sediments, as well as toxicants



Urban runoff or 'storm drain pollution' is one of the leading causes of water pollution in this country. (Photo: NOAA/NOS/ Monterey Bay National Marine Sanctuary)

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[\(Top\)](#)

## Glossary of Terminology: S

**salinity** - a measure of the salt concentration of water

**salt marsh** - a marsh periodically flooded by marine water



A salt marsh. (Photo: NOAA)

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**sampling** - the probabilistic, systematic, or judgmental selection of a sub-element from a larger population, with the aim of approximating a representative picture of the whole

**sampling bias** - the tendency of a sample to exclude some members of the sampling universe and over-represent others

**sampling unit** - the sub-element of the total population selected for sampling

**sampling universe** - the largest entity to be described, of which the sample is a part

**sand** - coarse sediment typically found in areas exposed to currents and wave energy



Tidal current patterns in the sand and sea grass at low tide.

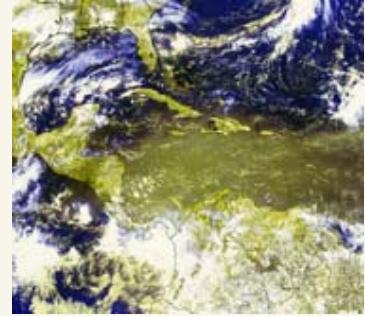
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**saprophyte** - any plant that lives and feeds on dead organic matter

**saprotroph** - an organism which feeds on dead and decaying organisms, allowing the nutrients to be recycled into the ecosystem. Fungi and bacteria are two groups with saprophytic members

**satellite colony** - a colony that develops within the tissue of a parent colony and which has its own unattached skeleton

**satellite imagery** - a representation of the measurement of energy emitted or reflected by the Earth in a variety of wavelengths. Earth observation imagery takes a number of forms, of which the most traditional are optical and near-infrared radiation, from about 0.4 (blue) to 2.0 (IR) micrometers. Apart from visual and near-infrared, other bands of the spectrum commonly used include thermal infrared (heat) and microwave (radar). Each of these has its own applications

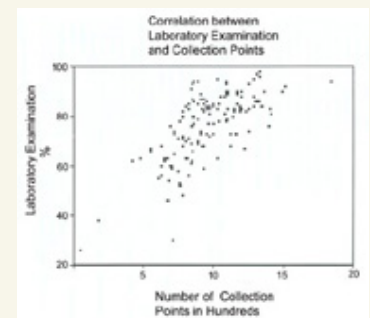


GOES-8 (May 1999) image of airborne dust over the Caribbean Sea. This dust originated in the Sahara Desert where it was carried off the coast by strong winds.

**satellite mapping** - digital maps derived from satellite images

**scale-like corallites** - corallites that form a pattern which resembles fish scales

**scatter diagram** - a two-dimensional histogram showing the joint probability density of two variables within a data sample; it is used to interpret data by graphically displaying the relationship between two variables



A scatter diagram.

**science** - a method of learning about the physical universe by applying the principles of the scientific method, which includes making empirical observations, proposing hypotheses to explain those observations, and testing those hypotheses in valid and reliable ways; also refers to the organized body of knowledge that results from scientific study

**scientific name** - the Linnaean binomial. A name of a species composed of two words: the genus (or generic) name and the species (or trivial) name, e.g., *Acropora palmata*. The scientific name is always written in italics. The first letter of the generic name is always capitalized; that of the species name is never capitalized

**Scleractinia** - an order of Cnidaria, usually producing calcareous skeletons with hexameral symmetry



A scleractinian - elkhorn coral (*Acropora* sp.)

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**sclerosepta** - the radiating calcareous partition in the corallite of stony corals

**SCUBA (Self-Contained Underwater Breathing Apparatus)** - a diving mode independent of surface air supply in which the diver uses open circuit self-contained underwater breathing apparatus which supplies air or breathing gases at ambient pressure



Diver training with a full face mask and underwater communications.

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**scute** - an external horny, chitinous or bony plate or scale, such as those on the shell of a turtle



Sea turtle with shell comprised of hard, platelike scutes.

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**sea snake** - a member of the family Hydrophiidae. Sea snakes are common in the Indo-Pacific. Related to cobras, these live-bearing reptiles are highly venomous but not aggressive by nature



This sea snake was photographed and released during a 1998 cruise of the NOAA ship *McARTHUR* to South America.

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**sea state** - a description of the sea surface with regard to wave action



Fishing vessel battles through rough conditions (sea state).  
(Photo: NOAA/National Weather Service/Ocean Prediction Center)

**seagrass** - a flowering plant, complete with leaves, a rhizome (an underground, usually horizontally-oriented stem) and a root system. They are found in marine or estuarine waters. Most seagrass species are located in soft sediments. However, some species are attached directly to rocks with root hair adhesion. Seagrasses tend to develop extensive underwater meadows



Seagrass bed.

**seaward slope** - the area of a barrier reef or atoll from the reef crest. It includes spurs, grooves, terraces, reef walls, etc.

**SeaWiFS** - Sea-viewing Wide Field-of-view Sensor carried on the SeaStar satellite

**Secchi depth** - the depth at which a Secchi disk disappears from view as it is lowered in water. Secchi disk is a white disk 20-30 cm in diameter, used as a qualitative way of measuring water clarity. It is lowered from a vessel and viewed from above the surface in full solar illumination to estimate the light attenuation in the water column. This is done empirically by relating the depth at which the disk disappears to the attenuation of light

**secondary male or female** - a male or female that is the result of sex change. A secondary male would be derived from a protogynous female, while a secondary female would be derived from a protandrous male

**secondary production** - the production of living material per unit area (or volume) per unit time by herbivores. It is usually expressed as grams carbon per meter square per year

**sedentary** - not moving. Many organisms, both plants and animals, spend the majority of their lives in one place

**segmentation** - in many animals, the body is divided into repeated subunits called segments, such as those in centipedes, insects, and annelid worms. Segmentation is the state of having or developing this type of body plan

**sensor** - a device that receives electromagnetic radiation and converts it into a signal that can be recorded and displayed as numerical data or as an image



**septum (pl. septa)** - the skeletal plate that projects into the calyx from the theca. Septa may be subdivided into primary, secondary, and tertiary structures



Skeleton of a coral polyp. Notice the septa radially arranged around a central axis.

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**sequential hermaphrodite** - a form of hermaphroditism where individuals can change sex, but the sexes are separate

**serrate** - saw-like; notched

**sessile** - describes an immobile organism because of its attachment to a substrate. The term has also been applied to organisms, such as anemones, that move very slowly



A sessile colonial anemone (*Epizoanthus americanus*) living in Gray's Reef off Sapelo Island, GA.

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**seston** - minute particulate material moving in water that is composed of both living organisms, such as plankton, and non-living matter such as plant debris and suspended soil particles

**seta** - a cuticular hair arising from the outside of the exoskeleton of an invertebrate

**sex chromosome** - a heteromorphic chromosome that plays a role in sex determination, such as the X and Y chromosomes, whose distribution in a zygote determines the sex of the organism; a chromosome whose DNA determines sexual characteristics in females (X) and males (Y)

**sexual dichromatism** - pertaining to differences in color and color pattern between the sexes of a particular species



Sexual dichromatism in the freshwater southeast Asian dwarf gourami, *Colisa lalia*. The male is to the left of the female.

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**sexual dimorphism** - pertains to systematic differences between males and females. The two sexes are markedly dissimilar in appearance



Female (above) and male (below) sockeye salmon (*Oncorhynchus nerka*) show extreme sexual dimorphism (color, male hump).

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**shelf escarpment** - the edge of the bank/shelf where depth increases rapidly into deep oceanic water

**shelf reef** - a reef that forms on the continental shelf of large land masses

**shelf-edge reef** - a synonym of ribbon reef

**shellfish** - a term that includes both molluscs, such as clams and oysters, and crustaceans, such as lobsters and shrimp



Edible crabs, shrimp, lobsters, crayfish, clams, mussels, scallops, and oysters are considered shellfish.

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**shoal** - a submerged expanse of coral reef, surrounded by deep water, which does not form a part of a barrier or fringing reef

**shore reef** - a synonym of fringing reef

**shoreline** - the line separating land and water. It fluctuates as water rises and falls



Shoreline of Fanning Island in the South Pacific.

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**sibling species** - closely-related species that are nearly morphologically indistinguishable

**siliceous** - composed of silicon or primarily of silicon

**sill reef** - a synonym of ribbon reef

**simultaneous hermaphrodite** - a form of hermaphroditism where individuals simultaneously possess functional testes and ovaries, and can release either male or female gametes during spawning

**sinistral** - left, as opposed to dextral, or right

**siphon** - an opening in molluscs or in urochordates (tunicates) which draws water into the body cavity. In many molluscs, such as octopods and squids, the siphon may be used to forcibly expel water, providing a means of propulsion



An octopus rapidly swimming by forcibly expelling water through the tubular siphon projecting from the head. (Photo: Jeff Jeffords)

**Sipuncula** - an animal phylum that contains the peanut or starworms. They are small, non-segmented benthic animals (they are not worms), some of which live in coral crevices, empty mollusk shells or marine worm tubes. Several species bore into coralline rock

**skeletal density** - certain massive coral species (e.g. *Porites*) exhibit annual variations in the density of their calcium carbonate ( $\text{CaCO}_3$ ) skeleton, similar to tree rings. The annual density bands are revealed when slices of coral skeleton are X-rayed

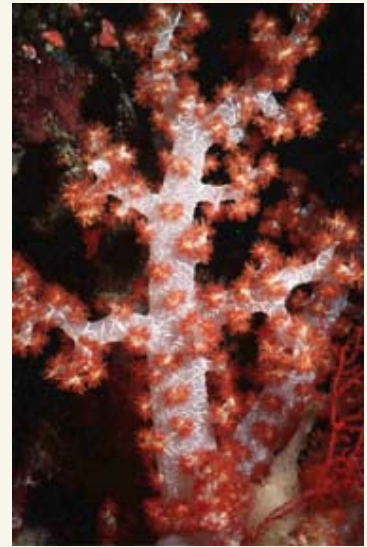
**skeleton** - a supportive or protective structure or framework of an animal, a plant, or part of an animal or plant. In animals it is an external (exoskeleton) or internal (endoskeleton) support structure, against which the force of muscles acts. Vertebrates have a skeleton of bone or cartilage; arthropods have one made of chitin; corals have one of calcium carbonate; sponges have a mass of spicules; many other invertebrates use a hydrostatic skeleton, which is an incompressible fluid-filled region of their body. In plants, the skeleton may be a rigid protective covering, as in the shell of a diatom, or the vascular system of a vascular plant

**slug** - a pulmonate or opisthobranch gastropod in which the shell is absent, or reduced and buried within the mantle



Lettuce sea slug (*Tridachia crispata*) from the Florida Keys National Marine Sanctuary.

**soft coral** - common name for species of the anthozoan order Alcyonacea of the subclass Octocorallia. In contrast to the hard or stony corals, most soft corals do not possess a massive external skeleton



Beautiful specimen of soft coral

**sol** - a liquid colloidal dispersion; a cytoplasmic phase (the other phase is a gel)

**solar radiation** - the amount of radiation or energy received from the sun at any given point

**solute** - the chemical substances dissolved in a solution, such as salts in seawater

**solution** - a liquid mixture in which the minor component, the solute, is uniformly distributed within the major component, the solvent

**solvent** - the liquid in which a solute is dissolved to form a solution

**sorus** - a group or cluster of sporangia

**Southern Oscillation** - a large-scale atmospheric and hydrospheric fluctuation centered in the equatorial Pacific Ocean. It exhibits a nearly annual pressure anomaly, alternatively high over the Indian Ocean and high over the South Pacific. Its period is slightly variable, averaging 2.33 years. The variation in pressure is accompanied by variations in wind strengths, ocean currents, sea-surface temperatures, and precipitation in the surrounding areas. El Niño occurrences are associated with the phenomenon

**spat** - tiny single corallites that form immediately after the metamorphosis of planula larvae

**spatial data** - information about the location and shape of, and relationships among, geographic features, usually stored as coordinates and topology

**spatial index** - the ratio of reef surface contour to linear distance. As part of a monitoring program employing a chain transect protocol, the spatial index provides a way to quantify changes in the topographical complexity of the reef

**spawn** - to produce or deposit eggs; the eggs of aquatic animals; offspring in great numbers or masses; to give forth young in large numbers

**spawning** - in corals, the release of gametes into the water

**specialist** - an organism which has adopted a lifestyle or niche specific to a particular set of conditions

**speciation** - the evolutionary process that gives rise to a new species

**species** - in sexually reproducing organisms, a species is a group of genetically related organisms, usually similar in physical appearance, that actually or potentially interbreed and are reproductively isolated from other groups

**species diversity** - the number of different species in an area and their relative abundance

**species richness** - the number of species in an area or biological collection

**specific name** - the second name in a binomen and in a trinomen

**spermatangium** - the male gamete-producing reproductive organ in certain algae

**spermatium** - a non-motile male gamete produced by a spermatangium in red algae

**spermatophore** - a packet containing sperm cells which is produced by the male genital system for transfer to the female. This method of sperm transfer is found in some vertebrates (salamanders) as well as invertebrates

**spicule** - one of the numerous small to minute calcareous or siliceous bodies occurring in and serving to stiffen and support the tissues of various invertebrates, as in the majority of sponges, alcyonarians, and many radiolarians, holothurians and compound ascidians

**spinate** - spine-like or composed of spines

**spiny lobster** - a crustacean of the Family Palinuridae; it lacks large claws and has a flexible, leathery tail fan



Spiny lobsters in a seagrass bed.

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**split spawning** - spawning occurring over consecutive nights or consecutive lunar cycles within a reef

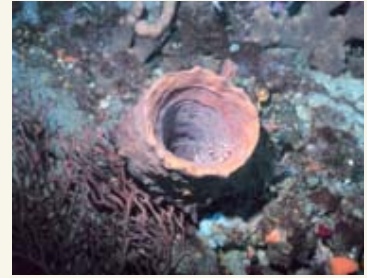
**sponge** - a multicellular animal (metazoa) below the tissue grade of construction. Sponges belong to the phylum Porifera. There are approximately 5,000 living species classified in three distinct groups, the Hexactinellida (glass sponges), the Demospongia, and the Calcareo (calcareous sponges). They are important components of a coral reef ecosystem



Tube sponges (Phylum Porifera) with sea fans (gorgonia) in background.

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**spongocoel** - the central body cavity of sponges, which opens to the outside by way of the osculum.



The central cavity of this sponge is the spongocoel. Note the banded shrimp in the spongocoel. (Photo: Dr. Anthony Picciolo)

**sporangium** - an organ containing or producing spores in some algae and fungi

**spore** - a small reproductive cell produced by certain bacteria, algae, fungi and nonflowering plants. Spores contain at least one genome and are highly resistant to heat excess and dehydration

**sporophyll** - a fertile blade in attached brown algae

**spur and groove** - a system of shallow ridges (spurs) separated by deep channels (grooves) oriented perpendicular to the reef crest and extending down the upper seaward slope

**SST (Sea Surface Temperature)** - the temperature of the layer of seawater (approximately 0.5 m deep) nearest the atmosphere

**stable isotope** - an isotope of a chemical element which is not spontaneously radioactive. Elements can exist in both stable and unstable (radioactive) forms. Most elements of biological interest (including C, H, O, N, and S) have two or more stable isotopes, with the lightest of these present in much greater abundance than the others. Among stable isotopes the most useful as biological tracers are the heavy isotopes of carbon and nitrogen. These two elements are found in the earth, the atmosphere, and all organisms

**standard deviation** - a measure of the spread or dispersion of a set of data. It is calculated by taking the square root of the variance

**statistical analysis** - the application of probability theory to quantified descriptive data

**stellate** - star-shaped



The diver is holding a stellate-



shaped starfish. (Photo: Copyright Corel Corp.)

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**stenohaline** - pertaining to an aquatic organism that can withstand a narrow salinity range

**stenothermal** - pertaining to an aquatic organism that can withstand a narrow temperature range

**stipe** - stalk or erect portion, as in some brown algae

**stochastic** - random; exhibiting variability due to random events

**stolon** - in corals, a horizontal polyp outgrowth from which daughter polyps are budded

**stony coral** - a synonym of hard coral

**storm surge** - a rise above normal water level on the open coast due to the action of wind stress on the water surface

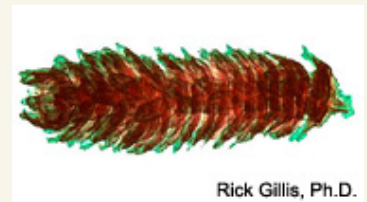


Storm surge swamps a house.  
(Photo: NOAA)

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**stratigraphy** - the branch of geology that deals with the origin, composition, distribution and succession of strata

**strobila** - a stage in the jellyfish life cycle. Free-swimming scyphozoan (true jellyfishes) medusae produce gametes which give rise to small polyps called scyphistomae. After a period of growth, a scyphistoma divides transversely to become a strobila that resembles a stack of discs. Each of the "discs" becomes an ephyra larva, detaches from the strobila and swims freely in the plankton. The ephyra larva will eventually grow into an adult medusa



Rick Gillis, Ph.D.

The late strobila stage of the jellyfish *Aurelia*. This sessile stage contains numerous discs stacked on top of one another.

Eventually, each of these discs will break free from the stack as free-swimming ephyra larvae.  
(Photo: Rick Gillis, Ph.D., Biology Dept., University of Wisconsin-La Crosse)

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**stromatolite** - a layered, fossilized deposit, mainly of limestone, formed by photosynthesizing colonial cyanobacteria and other microbes. They are the oldest known fossils, dating back more than 3 billion years. Stromatolites are prokaryotes that thrived in warm aquatic environments and built reefs much the same way as coral does today. They were common in Precambrian time (i.e., more than 540 million years ago). Although stromatolites continue to form in certain areas of the world today, they grow in greatest abundance



in Shark Bay in western Australia

**submarine groove** - a troughlike depression with vertical to overhanging walls which cut across the reef front at right angles

**subspecies** - a taxonomic subdivision of a species; a population of a particular region genetically distinguishable from other such populations and capable of interbreeding with them

**substrate** - the material making up the base upon which an organism lives or to which it is attached

**subumbrella** - the lower or oral surface of a medusa or jellyfish

**Sula Reef** - a deep water *Lophelia* reef located on the Sula Ridge on the Mid-Norwegian shelf at depths of 200 - 300 m. A very large deep water coral reef, it is about 13 km long, 700 m wide, and up to 35 m high

**Sundarbans** - the world's largest mangrove forest located in Bangladesh at the edge of the delta where the Ganges, Brahmaputra and Meghna Rivers come together

**surge channel** - a deep channel in the windward side of a coral reef through which water moves in and out of the reef

**suspension feeder** - an organism that feeds by capturing particles suspended in the water column. A synonym of filter feeder



Suspension-feeding sponge among corals.

**sustainable yield** - the number or weight of organisms in a population that can be harvested without reducing the population biomass from year to year, assuming that environmental conditions remain the same

**sweeper polyp** - a polyp that acts in an aggressive manner by stinging neighboring corals and sessile invertebrates

**sweeper tentacle** - A coral polyp tentacle that has an increased number of nematocysts and elongates in order to 'sting' neighboring corals and sessile invertebrates. A tool in the competition for space and resources



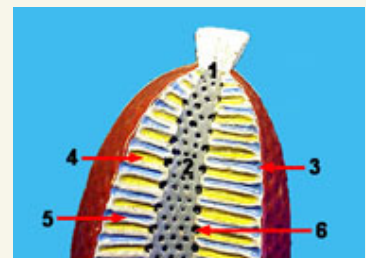
A hammer coral (right) thrusts out a sweeper tentacle towards a mushroom anemone (left). (Photo: Scott Brooks)

**swell** - the persistence of a wind-formed wave after the wind ceases



An ocean swell

**syconoid** - a body form of medium complexity in sponges where the body wall has become folded and the choanocytes (flagellated collar cells) are not located along the spongocoel, but along radial canals. Water enters the sponge through a series of incurrent canals and passes through internal pores called prosopyles into the radial canals, which are lined with flagellated choanocytes. It is the action of these choanocytes that keeps water moving through the sponge. From the radial canals, water then enters the central spongocoel through pores called apopyles, to exit to the environment through a single opening, the osculum.



Anterior end of a syconoid sponge in which the body wall has been folded into a series of internal and external canals. 1 = osculum; 2 = spongocoel; 3 = ostium; 4 = radial canal; 5 = incurrent canal; 6 = apopyle. (Photo: Rick Gillis, Ph.D., Biology Dept., University of Wisconsin-La Crosse)

**symbiont** - a symbiotic organism; either of two organisms participating in a symbiotic relationship



These clownfish exist in a symbiotic relationship with the sea anemone; the anemone provides protection and the clownfish feed and clean the anemone. Different clownfish species choose particular anemone species for their hosts. (Photo: Copyright Corel Corp.)

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**symbiosis** - a relationship between two species of organisms in which both members benefit from the association (mutualism), or where only one member benefits but the other is not harmed (commensalism), or where one member benefits at the expense of the well-being of the other (parasitism)



A clownfish has a symbiotic relationship with a sea anemone, finding protection within the clump of stinging cell-bearing tentacles.

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**sympatric species** - different species that live in the same area but are prevented from successfully reproducing by a reproductive isolating mechanism

**synecology** - the branch of ecology that deals with whole communities and the interactions of the organisms within them

**syngamy** - the process of union of two gametes, also called fertilization. It encompasses both plasmogamy and karyogamy.

**synonym** - in taxonomy, one of two or more scientific names that are spelled differently, but refer to the same organism

**synonymy** - in taxonomy, the relationships between different names applied to the same taxon; a chronological list of taxonomic names which have been applied to a single taxon, including authors and dates

**syntype** - in taxonomy, each specimen of a type series from which neither a holotype nor a lectotype has been designated. The syntypes collectively constitute the name-bearing type

[\(Top\)](#)

## Glossary of Terminology: T

**table reef** - an isolated flat-topped coral reef which reaches the surface but lacks a lagoon

**talus slope** - a synonym of reef base

**taxon** - a taxonomic group or entity

**taxonomic group** - a taxon with all its subordinate taxa and their individuals; e.g. the taxonomic group Crustacea consists of all crustaceans and their taxa

**taxonomic key** - a tabulation of diagnostic characters of taxa in dichotomous couplets to facilitate rapid identification

**taxonomy** - the science and methodology of classifying organisms based on physical and other similarities. Taxonomists classify all organisms into a hierarchy, and give them standardized Latin or Latinized names. There are seven main levels of classification in the hierarchy. They are, from most to least inclusive: Kingdom; Phylum (or Division for algae, fungi, and plants); Class; Order; Family; Genus; and Species. Taxonomists describe new species, classify organisms, and study speciation, the evolution of new species

**temperate** - region in which the climate undergoes seasonal change in temperature and moisture. Temperate regions of the earth lie primarily between 30 and 60 degrees latitude in both hemispheres

**tentacle** - a finger-like evagination of the body wall. Tentacles surround the mouths of coral polyps, anemones and other invertebrates. They are used for capturing prey, defense, reproduction, gas exchange, and light absorption



Tentacles of a sea anemone. Each tentacle contains stinging cells (nematocysts) used for defense and food capture. (Photo: Dr. Anthony Picciolo)

**tentacle-tube-foot suspension feeder** - a suspension feeder that traps particles on distinct tentacles or tube feet (in echinoderms)

**tentacular lobe** - a lobe at the point of insertion (beginning) of a septum

**terabyte** - a measure of data size. A terabyte of data is equivalent to 1,000 gigabytes of data or 1,000,000 megabytes of data. One petabyte equals 1,000 terabytes

**terminal** - at the end position

**terpenoid** - a class of organic compound produced by soft corals for defense and for aggressive colonization of new substrates

**territoriality** - the defense of a given area

**tessellated** - a checkered appearance



A tessellated blenny. (Photo: NOAA)

**test** - shell or hard outer covering of echinoderms and ascidians



Dorsal view of sea urchin test.

**tetraspore** - a haploid spore in the red algae life cycle which is the meiotic product of the tetrasporangium of a diploid tetrasporophyte. The tetraspores are released, settle, and grow into gametophytes

**tetrasporophyte** - diploid phase in the life cycle of red algae which produces haploid tetraspores. The tetrasporophyte is the site of meiosis, more specifically, the tetrasporangia where haploid tetraspores are produced. These tetraspores are released, settle, and grow into the gametophyte, completing the basic red algal life history

**tetrodotoxin (TTX)** - tetrodotoxin (TTX) is an especially potent marine neurotoxin, named after the order of fish from which it is most commonly associated, the Tetraodontiformes (includes the puffers, porcupine fish, blowfish, cowfish, boxfish). The toxin appears in high concentrations in the gonads, liver, intestines and skin of pufferfish. The fatality rate when injected may be as high as 60 percent. Tetrodotoxin is more than 10,000 times deadlier than cyanide. Other marine and terrestrial organisms have been found to store TTX, for example, the Australian blue-ringed octopus, parrotfish, triggerfish, gobies, angelfish, ocean sunfish, globefish, seastars, starfish, xanthid and other crabs, a horseshoe crab, a number of marine snails, flatworms, tunicates, ribbonworms, mollusks and marine algae (*Jania spp.*) Terrestrial organisms include the Harlequin frogs (*Atelopus spp.*), three species of California newt and other eastern salamanders



A specially licensed Japanese chef prepares fugu, the ever-so-slightly tainted fillet of the extremely poisonous blowfish, whose internal organs contain tetrodotoxin.

**thallus** - the vegetative body of a plant or alga that is not differentiated into organs, such as roots, stems and leaves

**theca** - the calcareous wall of the corallite

**thermocline** - the region below the surface layer of the ocean or lake, where the temperature gradient increases abruptly (i.e. where temperature decreases rapidly with increasing depth). A thermocline may reach the surface and become a front. It is usually an ecological barrier and its oscillations have significant consequences on population distribution and ocean productivity

**thermohaline circulation** - the density-driven convective circulation system of the world's oceans. Warm Atlantic water moves northward along the axis of the Gulf Stream, and evaporation increases water density while releasing heat to the colder atmosphere in the North Atlantic. Once significantly dense, the water sinks into the deep ocean, forming a downward limb of a giant conveyor-like circulation that extends around the world's oceans

**thoracic** - pertaining to the chest area

**thorax** - the central region of a crustacean body

**thymine** - one of the four bases in DNA that make up the letters ATGC, thymine is the "T". The others are adenine, guanine, and cytosine. Thymine always pairs with adenine

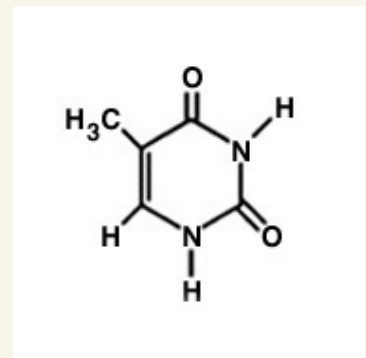


Diagram of the chemical structure of thymine, one of the four nitrogenous bases in DNA.

**tidal delta** - a delta formed at both sides of a tidal inlet

**tidal inlet** - a waterway from the open ocean into a lagoon

**tide** - the periodic rising and falling of the water that results from the gravitational attraction of the moon and sun acting on the rotating earth



High tide combined with a storm threaten a pier. (Photo: Mary Hollinger)

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**TIFF (Tag Image File Format)** - a common format for exchanging raster graphics (bitmap) images between application programs, including those used for scanner images

**Tisler Reef** - a deep water *Lophelia* reef located in the Skagerrak, the submarine border between Norway and Sweden, at depths of 74 to 155 m. It has the world's only known yellow *Lophelia pertusa* corals

**tissue** - a group of cells with a specific function in the body of an organism. Tissues are composed of nearly identical cells and their products, and are organized into larger units called organs

**topographic map** - a map containing contours indicating lines of equal surface elevation (relief)

**topotype** - in taxonomy, a specimen collected at the type locality

**topotypical population** - in taxonomy, a population occurring at the type locality

**toxicant** - any substance which is potentially toxic

**trade winds** - a system of relatively constant low level winds that occur in the tropics. The trade winds blow from the northeast to the equator in the Northern Hemisphere and from the southeast to the equator in the Southern Hemisphere

**transect** - a line used to survey the distribution of organisms or substrate across a given area. Sample plots or points are established along the transect for collecting data



NOAA divers collect data along a transect line.

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**trichogyne** - receptive elongation of the carpogonium (female reproductive structure) in red algae where male gametes become attached

**triglyceride** - a complex molecule which is the main component of dietary and body fat. It is made up of a combination of glycerol and three fatty acids

**trinomen** - in taxonomy, the combination of a generic name, a specific name, and a subspecific name, that together constitute a scientific name subspecies

**trochophore** - a type of larva found in annelids, mollusks, echiurans and other invertebrate groups. They are characterized by having the larval body ringed with a girdle of cilia ( the prototroch) and possessing a tuft of cilia at the apical end

**trophic** - related to or functioning in nutrition

**trophic dynamics** - the complex biological processes whereby energy and matter are passed up to successive levels of food webs



**trophic group** - a group of organisms consuming resources from a similar level in the energy cycle

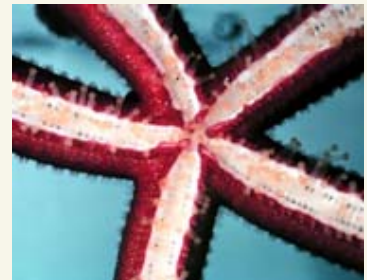
**trophic level** - a classification system of organisms according to their means of obtaining nutrition. A segment of the food chain in which all organisms obtain food and energy in basically the same manner (e.g., photosynthesis, herbivory, or carnivory) and in which all organisms are the same number of links from the photosynthetic segment

**tropical** - region in which the climate undergoes little seasonal change in either temperature or rainfall. Tropical regions of the earth lie primarily between 30 degrees north and south of the equator

**Tropical Ocean Coral Bleaching Indices** - indices of selected coral reef sites/regions (maintained by NOAA/NESDIS) that present satellite-obtained measurements of relevance to coral reef ecosystems

**tropical storm** - a tropical cyclone with maximum winds less than 34 m/sec (75 mile per hour)

**tube feet** - extensions of the water-vascular system of echinoderms, protruding from the body and often ending in suckers. They may be used for locomotion and/or for maintaining a tight grip on prey or on the substrate



The ventral side of a Pacific starfish shows its tube feet.

**tubercle** - any small, usually hard, knobby excrescence or lump. In pycnogonids and some cheliceramorph arthropods, the central eyes are carried on a tubercle

**tubiform** - a shape resembling a tube



The trumpetfish has a snout which is tubiform or tubular in shape. (Photo: Copyright Digital Stock Corp.)

**type** - in taxonomy, the standard of reference for determining the precise application of a name. Each taxon has, actually or potentially, a type: type of a nominal species is a specimen (type specimen or holotype); type of a nominal genus is the nominal species (type species); type of a nominal family is the nominal genus (type genus)

**type locality** - in taxonomy, the geographical (and, where relevant, stratigraphical) location of the occurrence of the population from which the type specimen (i.e. holotype, lectotype or neotype) was taken

**type series** - in taxonomy, the series of specimens which either constitutes the name-bearing type (syntypes) of a nominal species or subspecies or from which the name-bearing type has been or may be designated

**type species** - in taxonomy, the nominal species that is the name-bearing type of a nominal genus or subgenus

**type specimen** - in taxonomy, any specimen of the type series

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## Glossary of Terminology: U

**U.S. Coral Reef Task Force (USCRTF)** - established by President Clinton in June, 1998, through Executive Order 13089 on Coral Reef Protection, to lead the U.S. response to this growing global environmental crisis. Chaired by the Secretary of the Interior and the Secretary of Commerce, the USCRTF is composed of the heads of 11 federal agencies and the Governors of 7 states, territories or commonwealths with responsibilities for coral reefs. The USCRTF is responsible for overseeing implementation of the Executive Order, and developing and implementing coordinated efforts to: map and monitor U.S. coral reefs; research the causes and solutions to coral reef degradation; reduce and mitigate coral reef degradation from pollution, overfishing and other causes; and implement strategies to promote conservation and sustainable use of coral reefs internationally

**umbrella** - describes the body of a jellyfish or medusa



The transparent umbrella of this jellyfish makes it less obvious to predators.

**uniramous appendage** - a type of appendage that is characteristic of insects and other members of the arthropod subphylum Uniramia. It consists of an unbranched series of segments

**upwelling** - the process by which warm, less-dense surface water is drawn away from a shore by offshore currents and replaced by cold, denser water brought up from the subsurface

**uracil** - one of the four bases in RNA. The others are adenine, guanine, and cytosine. Uracil replaces thymine, which is the fourth base in DNA. Like thymine, uracil always pairs with adenine

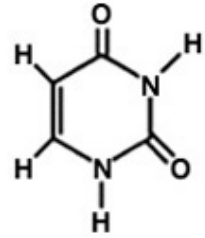
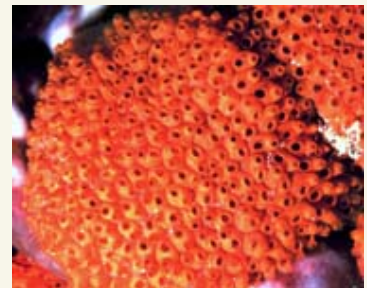


Diagram of the chemical structure of uracil, one of the four nitrogenous bases in RNA.

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**Urochordata (Tunicata)** - a subphylum of the animal phylum Chordata that contains the ascideans (sea squirts). Most adults are sessile and bear little resemblance to the other chordates. They are common inhabitants of coral reefs and mangrove roots



Orange colonial tunicates (Urochordata) at Gray's Reef National Marine Sanctuary.

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**uropod** - fan-shaped, paired posterior abdominal appendage in certain crustaceans, e.g., lobsters or shrimp, that are used for swimming

**UV (ultraviolet) radiation** - the region of the electromagnetic spectrum consisting of wavelengths from 1 to 400 nm

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## Glossary of Terminology: V

**valid name** - in taxonomy, the correct name for a given taxon, which may have several available names, one of which (usually the oldest) is chosen as the valid name. The valid name is always an available name, but an available name is not always a valid name

**valve** - the shell or shells of certain organisms, such as clams, oysters, and snails



A giant *Tridacna* clam with its two valves open.

**variance** - the population variance of a random variable is a non-negative number which gives an idea of how widely spread the values of the random variable are likely to be; the larger the variance, the more scattered the observations on average. It is a measure of the 'spread' of a distribution about its average value

**vector** - an abstraction of the real world where positional data is represented in the form of coordinates. In vector data, the basic units of spatial information are points, lines and polygons. Each of these units is composed simply as a series of one or more coordinate points. For example, a line is a collection of related points, and a polygon is a collection of related lines. Vector images are defined mathematically as a series of points joined by lines. Vector-based drawings are resolution independent. This means that they appear at the maximum resolution of the output device, such as a printer or monitor. Each object is self-contained, with properties such as color, shape, outline, size, and position on the screen

**vegetal hemisphere** - the half of an oocyte or egg with more yolk, or the corresponding half of an early embryo with the slower dividing yolk-laden cells

**vegetal pole** - the portion of an oocyte or egg that is opposite the animal pole and contains most of the yolk granules. See "**animal pole**"

**veliger** - a molluscan larva in which the foot, mantle and shell first make their appearance

**velum** - a circular shelf of tissue attached to the underside of the umbrella in a hydrozoan mesusa. It functions in locomotion

**veneer reef** - a reef with very little calcium carbonate accretion. A non-reef coral community

**venomous** - pertaining to an organism that has a venom, usually secreted by a gland, that is injected through hollow spines or teeth



A venomous cone shell. When close to its prey, usually another gastropod mollusk, it expands its long proboscis exploring for soft parts. A radular dart, bearing venom, is injected into the prey; death quickly results. (Photo: Dr. James P. McVey, NOAA Sea Grant Program)

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**ventral** - pertaining to, or situated near, the belly, or underside, of an animal

**vernacular name** - the colloquial or common name of a taxon, i.e., in any language or form other than that of biological nomenclature. Vernacular names have no status in nomenclature

**verruca (pl. verrucae)** - a small cylindrical projection arising from the corallum that contain calices; found in Pocillopora

**vertebrate** - an animal that possesses a vertebral column (back bone), such as fishes, amphibians, reptiles, birds and mammals



Vertebrate animals of the fish class Osteichthyes. (Photo: Dr. Anthony Picciolo)

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**vertical classification** - classification which stresses common descent and tends to unite ancestral and descendant groups of a phyletic line in a single higher taxon, separating them from contemporaneous taxa having reached a similar grade of evolutionary change

**video transect** - a nondestructive, repeatable procedure for assessing and monitoring diurnally active fishes and other macroscopic marine organisms. Videotaping along a linear transect reduces the variance in error inherent with visual observations made by a diver or snorkeler, and allows virtually unlimited time for study of the images by many individuals

**virus** - a sub-microscopic, obligate intracellular parasite that replicates itself only within cells of living hosts; many are pathogenic; the structure of a virus is basically a strand of nucleic acid (DNA or RNA) wrapped in a thin protein shell. A virus is not a cell, and is "lifelike" only when replicating itself at the expense of the host cell

**viscera** - the internal organs, collectively, of an coelomate organism, especially those located within the abdominal cavity, but also to the organs within the thoracic and mediastinal cavities

**visible radiation** - energy at wavelengths from 400 - 700 nm that is detectable by the human eye

**Vitareef program** - a program that was established in order to provide a standardized method of characterizing the conditions of reef corals. It can and has been used by both researchers and non-scientists to document observations of reefs at specific points in time, which can be followed up in subsequent observations to assess changes in the state of individual coral colonies, selected coral species, or a reef as a whole

**viviparity** - a form of reproduction where the offspring are nourished in the reproductive tract of the female (other than by a yolk sac) and then expelled from the mother as free-swimming young. Mangrove reproduction by means of propagules is also a form of viviparity in plants

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## Glossary of Terminology: W

**water column** - the open-water environment, distinct from the sea bed or shore, which may be inhabited by swimming organisms

**water vascular system** - in echinoderms, a system of internal canals and appendages that are water-filled and functions as a means of locomotion

**watershed** - an area of land that drains downslope to the lowest point. The water moves through a network of subterranean and surface drainage pathways which converge into streams and rivers, eventually reaching an estuary and finally the ocean. Because water moves downstream, any activity that affects the water quality, quantity, or rate of movement at one location can affect locations downstream to the ocean and out to coral reefs



Angel Falls, Venezuela. This great waterfall contributes to the Orinoco River watershed. Nutrients and minerals from the rainforests and savannas of the Orinoco River basin are transported with the Orinoco current and may effect coral reefs in the southeastern Caribbean. (Photo: Copyright Dr. Anthony R. Picciolo, NOAA)

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**wave crest** - the top of a wave

**wave height** - the vertical distance between the crest and adjacent trough of a wave

**wave length** - the distance between two successive wave crests or troughs

**wave trough** - the low spot between two successive waves

**weather** - temperature, precipitation, and wind speed and direction that occur on a daily basis

**wetland** - an area that, at least periodically, has waterlogged soils or is covered with a relatively shallow layer of water. Bogs, freshwater and saltwater marshes, and freshwater and saltwater swamps are examples of wetlands



Wetlands provide for valuable nursery areas for many organisms.

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**white hole** - an area along the spur and groove system (zone) where the sand channel widens considerably



A scientist stands in a sand channel within a reef spur-and-groove zone.

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**white pox disease** - a coral disease characterized by circular lesions with coral tissue degradation on the Caribbean elkhorn coral, *Acropora palmata*. The pathogen is a bacterium, *Serratia marcescens*. For more information and illustrations, see: [http://www.coral.noaa.gov/coral\\_disease/white\\_pox.shtml](http://www.coral.noaa.gov/coral_disease/white_pox.shtml)



White pox disease is characterized by white circular lesions on the surface of infected colonies (Photo: Dr. A. Bruckner, NOAA)

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**white skeleton** - the exposed white calcium carbonate skeleton of a coral colony



**white-band disease** - a coral disease characterized by complete coral tissue degradation of Caribbean acroporid corals. Two species of Acroporidae are affected, the elkhorn coral, *Acropora palmata*, and the staghorn coral, *A. cervicornis*. The disease exhibits a sharp demarcation between apparently healthy coral tissue and exposed coral skeleton. These signs are identical to plague, except that white band is acroporid specific (and plague has not been found on acroporids). Tissue loss usually proceeds from the base of the colony branch to the tip, although it can begin in the middle of a branch in *A. cervicornis*. White band disease affects acroporid corals throughout the Caribbean and has decimated populations at a regional scale. The infective agent has not yet been isolated. For more information and illustrations, see: [http://www.coral.noaa.gov/coral\\_disease/white\\_band.shtml](http://www.coral.noaa.gov/coral_disease/white_band.shtml)



Elkhorn coral populations have suffered widespread declines from white-band disease (Photo: Dr. A. Bruckner, NOAA)

**windward** - refers to the side of an island or reef that faces the prevailing wind

**worm reef** - a massive structure composed of clusters of oval, table-like mounds constructed by marine polychaete worms in the family Sabellariide. They consist of all sorts of sediments consolidated by a mucoprotein cement produced by the worm. This reef may start in the intertidal zone and extend into the subtidal zone. Some are in deeper water. Unlike the colorful and ornate coral reefs, worm reefs are drab, monotonous and rounded clusters, mounds and platforms that grow upward and outward from the durable substrate from which their colonies develop. Worm reefs offer several ecological benefits. They provide feeding and browsing grounds for a diverse community of marine organisms and an ideal home for attaching plants, sponges and shelter-seeking animals. Also, unlike coral reefs, worm reefs are not restricted to the tropics

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## Glossary of Terminology: X

**xenophyophore** - a giant protozoan protist (*Syringammina fragilissima*), up to 25 cm in diameter, that inhabits deep-sea habitats. Large aggregations of xenophyophores appear on the Darwin Mounds



A xenophyophore photographed on the Blake Ridge. They construct complex, golf-ball-sized tests from sand and sediment grains. (NOAA photo)

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## Glossary of Terminology: Y

**yellow-band disease** - a coral disease characterized large rings or patches of bleached, yellow tissue on Caribbean stony corals, although tissue loss is minimal (cm/yr). It affects the star corals, *Montastraea annularis* and *M. faveolata* and is widespread throughout the Caribbean region. No pathogen has been isolated. For more information and illustrations, see: [http://www.coral.noaa.gov/coral\\_disease/yellow\\_band.shtml](http://www.coral.noaa.gov/coral_disease/yellow_band.shtml)

**yolk sac** - a vascularized extra-embryonic membrane of amniote embryos that forms around the yolk of the egg cell in birds and reptiles. In mammals, the yolk sac membrane grows out around the empty blastocoel (blastula cavity) formed within the inner cell mass in the cleaving embryo. The blastocoel is renamed the yolk sac. In birds and reptiles, the blood vessels in its walls transport yolk nutrients to the embryo. In mammals, these vessels still form even though they don't supply nutrients to the embryo. They remain to form blood vessels in the digestive tract

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## Glossary of Terminology: Z

**zoanthid** - an anemone of the family Zoanthidae, usually found in intertidal areas and coral reefs . In some species the polyps separate from each other almost completely after budding, while in other species, the polyps are all interconnected by a common mat of tissue

**zoarium** - the form of a bryozoan colony

**zoea** - a free-swimming larval stage of various crustaceans



A zoea larva. (Photo: Marine Ecology Laboratory, Shimoda Marine Research Center, University of Tsukuba)

**zonation** - the occurrence of single species or groups of species in recognizable bands that might delineate a range of water depth or a range of height in the intertidal zone

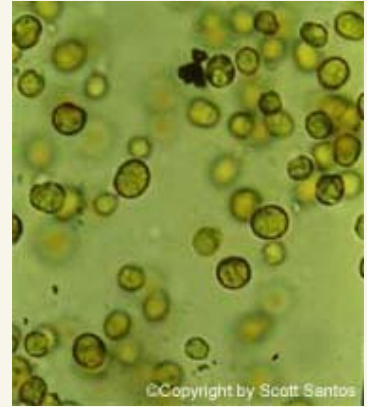
**zone** - a large-scale physical feature within the ecosystem. Reef zones are determined by currents, wave surge, exposure to sunlight and water depth, and may be comprised of a number of habitats

**zooid** - of the distinct individuals forming a colonial invertebrate animal, such as a hydrozoan

**zoology** - the scientific study of animal life. Zoological sciences include the studies of evolution, systematics, cell biology, biochemistry, micro and macro anatomy, development, genetics, physiology, ecology, biogeography, biodiversity, behavior and sociobiology

**zooplankton** - animal component of the plankton community

**zooxanthellae** - a group of dinoflagellates living endosymbiotically in association with one of a variety of invertebrate groups (e.g., corals). In corals, they provide carbohydrates through photosynthesis, which are used as one source of energy for the coral polyps. They also provide coloration for the corals



Zooxanthellae. (Photo: Scott Santos)

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**zooxanthellate coral** - a coral that has zooxanthellae in its tissues

**zygote** - a fertilized egg with the diploid number of chromosomes formed by the union of the nuclei of male and female gametes

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