30 Vulnerable marine ecosystems (VMEs)

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Oceans cover 70% of our planet and represent over 95% of the biosphere. Marine and coastal habitats include coral reefs, mangrove forests, sea grass beds, estuaries, hydrothermal vents, seamounts and soft sediments on the ocean floor deep below the surface. Apart from source of food, the ocean is one of the largest natural reservoirs of carbon. It stores about over 15 times more CO_2 than the terrestrial biosphere and soils, and plays a significant role in climate moderation.

Deep-seabed habitats host between 500,000 and 10 million species. Deep-sea life is essential to life on Earth because of its crucial role in global biogeochemical cycles, including nutrient regeneration and oxygen. Oceans are seriously under-protected, with only about 0.8% of the oceans and 6% of territorial seas being in protected areas. About 80% of world fish stocks, for which assessment information is available, are fully exploited or overexploited and thus require effective and precautionary management

What is Vulnerability?

Vulnerability is related to the likelihood that a population, community, or habitat will experience substantial alteration from short-term or chronic disturbance, and the likelihood that it would recover and in what time-frame. These are, in turn, related to the characteristics of the ecosystems themselves, especially biological and structural aspects (FAO 2009).

Due to increasing worldwide concern about the significant impacts of bottom fishing on fragile habitats, slow-growing and long-lived species that are vulnerable to overexploitation, UN General Assembly adopted a resolution in 2006 establishing conditions for bottom fishing to take place in the high seas. In 2006, the United Nations General Assembly (UNGA) Resolution 61/105 called upon Regional Fisheries Management Organizations (RFMOs including NAFO) to adopt conservation measures to protect Vulnerable Marine Ecosystems (VMEs) from significant adverse impacts (SAIs) of bottom fishing activities or to cease bottom fishing activities in areas where VMEs are likely to occur.

To assist RFMO/As and States, the International Guidelines for the Management of Deep-Sea Fisheries in the High Seas (the FAO Deep-sea Guidelines; FAO, 2008) were developed to provide guidance on the long-term conservation and sustainable use of marine living resources in the high seas. The implementation of these measures by RFMOs was reviewed by the General Assembly in 2011, and as a result, UNGA Resolution 66/68 (2011) highlighted that despite the progress made, the urgent actions called for by the previous resolutions have not been fully implemented in all cases.

UNGA Resolution 66/68 called for:

(a) Strengthening procedures both for carrying out assessments to take into account individual, collective and cumulative impacts, and for making the assessments publicly available, recognizing that doing so can support transparency and capacity-building globally;

(b) The establishment and improvement of procedures to ensure that assessments are updated when new conditions or information so require;

(c) The establishment and improvement of procedures for evaluating, reviewing and revising, on a regular basis, assessments based on best available science and management measures; and

(d) The establishment of mechanisms to promote and enhance compliance with applicable measures related to the protection of VMEs.

The implementation of the VME provisions of these three UNGA resolutions will be reviewed in 2015.

FAO has developed a full programme to support the implementation of the FAO Deep-sea Guidelines consistent with the ecosystem approach to fisheries (EAF). This includes a VME database that will raise awareness on VMEs to fishery policy-makers, managers and scientists, conservationists, the fishing industry, and the public at large.

At the same time, the Convention on Biological Diversity (CBD), principally through Conference of the Parties (COP) decision IX/205 adopted in 2008, has also embarked upon regional workshops to facilitate the description of ecologically or biologically significant areas (EBSAs) in the oceans. These scientific criteria help define important ocean areas. COP at its 11th meeting in Hyderabad, India, described areas that meet the EBSA criteria in the western south Pacific region, the wider Caribbean, western mid-Atlantic region, and areas that could meet the criteria in the Mediterranean region (COP Decision XI/17)6.

What is a Vulnerable Marine Ecosystem (VME)?

The FAO Guidelines adopted a list of criteria for the identification of VMEs:

1. Uniqueness or rarity due to the species, communities or habitats they contain;
2. Functional significance of the habitat necessary for the survival, function, spawning/reproduction or recovery of fish stocks, particular life history stages (e.g. nursery grounds or rearing areas), or of rare, threatened or endangered marine species;
3. Fragility;
4. Life-history traits of component species that make recovery difficult; or
5. Structural complexity

Management of VMEs

- High resolution bathymetric data and VME-predicting models can produce maps that could provide information for management and planning.
- Areas with significant concentrations of VMEs, areas of patchy VMEs and areas without VMEs could then be indicated as well as areas that are suitable or unsuitable (unsafe to deploy gear) for fishing.
- Identification of areas suitable for fishing and those areas where VMEs are determined present could reduce reliance on reactive mitigation measures to prevent significant impact on VMEs.
- A move-on rule is based on the premise that a fishing vessel will move a minimum distance from a location where species indicating the presence of a VME are captured by the gear. RFMOs have set threshold weights or volumes that are considered (by the respective RFMO science processes and participants) to constitute "evidence of a VME" for such cases, as well as distances vessels must move upon an encounter. For example, in the NAFO area, if a vessel brings on board more than 60 kg of live corals or 800 kg of sponges, it must move a minimum of 2 nautical miles from the fished area

List of VME indicator species, identified by the NAFO Scientific Council

Benthic Invertebrate VME Indicator Species			
Common name of taxonomic group	Known Taxon	Family	Phyllum
Large-sized sponges	*Iophon piceum*	Acarnidae	Porifera
	Stelletta normani	Ancorinidae	
	Stelletta sp.	Ancorinidae	
	Stryphnus ponderosus	Ancorinidae	
	Axinella sp.	Axinellidae	
	Phakellia sp.	Axinellidae	
	Esperiopsis villosa	Esperiopsidae	
	Geodia barretti	Geodiidae	
	Geodia macandrewii	Geodiidae	
	Geodia phlegraei	Geodiidae	
	Mycale (Mycale) lingua	Mycalidae	
	Thenea muricata	Pachastrellidae	
	Polymastia spp.	Polymastiidae	
	Weberella bursa	Polymastiidae	
	Weberella sp.	Polymastiidae	
	Asconema foliatum	Rossellidae	
	Craniella cranium	Tetillidae	

Stony corals (known seamount species may not occur in abundance in the NRA)	*Lophelia pertusa*	Caryophylliidae	Cnidaria
	Solenosmilia variabilis	Caryophylliidae	
	Enallopsammia rostrata	Dendrophylliidae	
	Madrepora oculata	Oculinidae	
Small gorgonian corals	*Anthothela grandiflora*	Anthothelidae	Cnidaria
	Chrysogorgia sp.	Chrysogorgiidae	
	Radicipes gracilis	Chrysogorgiidae	
	Metallogorgia melanotrichos	Chrysogorgiidae	
	Acanella arbuscula	Isididae	
	Acanella eburnea	Isididae	
	Swiftia sp.	Plexauridae	
	Narella laxa	Primnoidae	
Large gorgonian corals	*Acanthogorgia armata*	Acanthogorgiidae	Cnidaria
	Iridogorgia sp.	Chrysogorgiidae	
	Corallium bathyrubrum	Coralliidae	
	Corallium bayeri	Coralliidae	
	Keratoisis ornata	Isididae	
	Keratoisis sp.	Isididae	
	Lepidisis sp.	Isididae	
	Paragorgia arborea	Paragorgiidae	
	Paragorgia johnsoni	Paragorgiidae	
	Paramuricea grandis	Plexauridae	
	Paramuricea placomus	Plexauridae	
	Placogorgia terceira	Plexauridae	
	Calyptrophora sp.	Primnoidae	
	Parastenella atlantica	Primnoidae	
	Primnoa resedaeformis	Primnoidae	
	Thouarella grasshoffi	Primnoidae	
Sea pens	*Anthoptilum grandiflorum*	Anthoptilidae	Cnidaria
	Funiculina quadrangularis	Funiculinidae	
	Halipteris cf. *christii*	Halipteridae	
	Halipteris finmarchica	Halipteridae	
	Halipteris sp.	Halipteridae	
	Kophobelemnon stelliferum	Kophobelemnidae	
	Pennatula aculeata	Pennatulidae	
	Pennatula grandis	Pennatulidae	
	Pennatula sp.	Pennatulidae	
	Distichoptilum gracile	Protoptilidae	
	Protoptilum sp.	Protoptilidae	
	Umbellula lindahli	Umbellulidae	
	Virgularia cf. *mirabilis*	Virgulariidae	
Tube-dwelling anemones	*Pachycerianthus borealis*	Cerianthidae	Cnidaria
Erect bryozoans	*Eucratea loricata*	Eucrateidae	Bryozoa
Sea lilies (Crinoids)	*Trichometra cubensis*	Antedonidae	Echinodermata
	Conocrinus lofotensis	Bourgueticrinidae	
	Gephyrocrinus grimaldii	Hyocrinidae	
Sea squirts	*Boltenia ovifera*	Pyuridae	Chordata
	Halocynthia aurantium	Pyuridae	

What are deep sea corals?

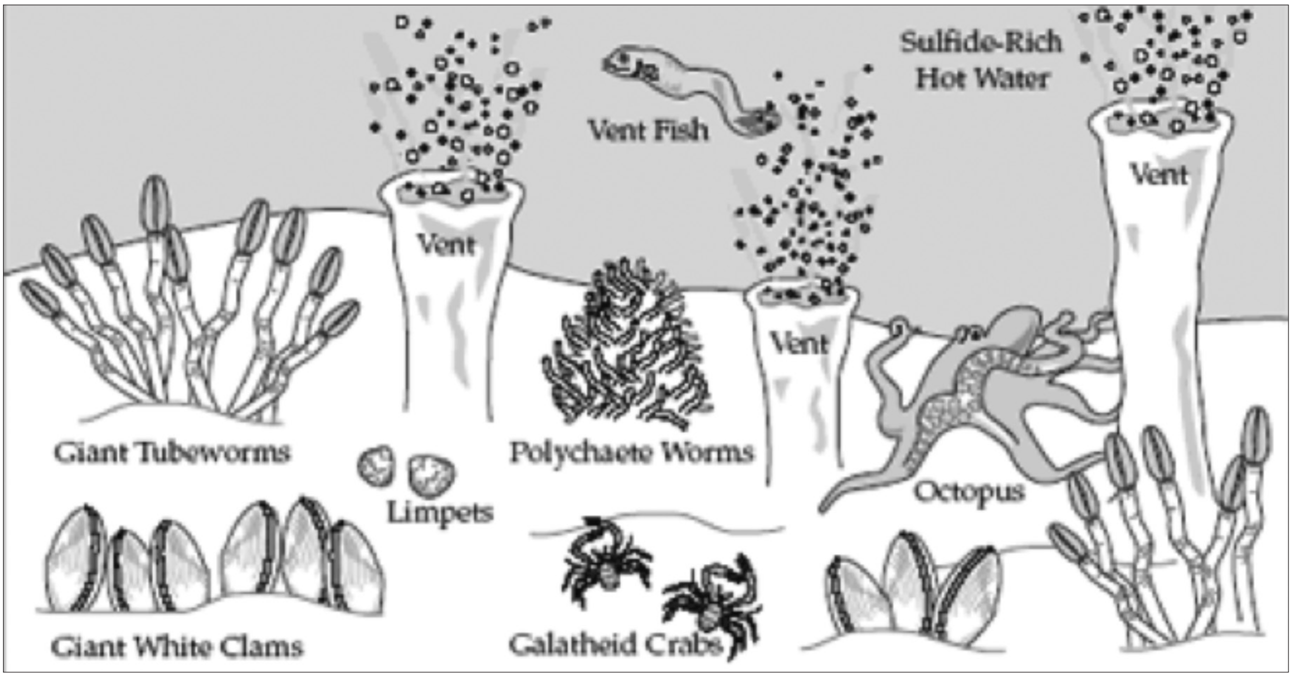
Deep sea corals are large accumulations of stony corals forming a complex three dimensional skeletal framework. They occur in waters between 200m and 1,500m deep often on continental slopes, submarine plateaus, ridges and seamounts. Coral frameworks contain many sub habitats occupied by other species of marine animal. Deep sea coral reefs can be very large and spectacular, the biggest is over 40km long and 2 -3km wide.

Why are deep sea corals important?

Deep water coral reefs host communities of associated animals that are distinct from the surrounding deep sea and which have a high species diversity and sometimes a high level of endemism. Deep water reefs host the early life stages of many deep sea animals including juvenile fish of commercial value Some species of commercially valuable deep sea fish, such as redfish, are associated with deep sea coral reefs as adults.

The main threat to deep sea coral reefs is trawling by modern fishing vessels. Direct evidence of destruction of deep sea coral reefs includes submersible observations of complete removal of the coral framework in some areas, trawl scars running into reefs and high by catches of deep sea corals in the nets of deep sea trawlers Deep sea coral reefs are

Hydrothermal Vent Community



vulnerable to fishing because they are very fragile and easily broken. Deep sea corals grow slowly; mature deep sea coral reefs take many thousands of years to accumulate. Recovery from trawling impacts is likely to be slow and where corals are completely destroyed and habitats altered by trawling, recovery are unlikely. Destruction of deep sea coral reefs also mean the destruction of the associated animal communities and in some cases essential habitat for commercially valuable species.

DEEP SEA HYDROTHERMAL VENTS

In 1977, scientists exploring the Galápagos Rift along the mid-ocean ridge in the eastern Pacific noticed a series of temperature spikes in their data. They wondered how deep-ocean temperatures could change so drastically—from near freezing to 400 °C (750 °F)—in such a short distance. The scientists had made a fascinating discovery—deep-sea hydrothermal vents. They also realized that an entirely unique ecosystem, including hundreds of new species, existed around the vents. Despite the extreme temperatures and pressures, toxic minerals, and lack of sunlight that characterized the deep-sea vent ecosystem, the species living there were thriving. Scientists later realized that bacteria were converting the toxic vent minerals into usable forms of energy through a process called chemosynthesis, providing food for other vent organisms.

The ability of vent organisms to survive and thrive in such extreme pressures and temperatures and in the presence of toxic mineral plumes is fascinating. The conversion of mineral-rich hydrothermal fluid into energy is a key aspect of these unique ecosystems. Through the process of chemosynthesis, bacteria provide energy and nutrients to vent species without the need for sunlight.

Cold seeps are areas similar to hydrothermal vents. Though the cold seep waters are about the same temperature as the surrounding waters, they are called cold seeps in contrast to the extremely hot fluids from hydrothermal vents. The cold seeps support organisms similar to the hydrothermal vents though the exact make-up of the biological community surrounding them depends on the chemicals, such as hydrogen sulfide, methane, iron, manganese and silica, found in the cold-seep fluid.