

# Fingertip Facts about Deep Waters and High Seas



Stony corals, such as this *Enallapsammia* specimen, provide an important three-dimensional – but very fragile – habitat for many species. Photo courtesy of Deep Atlantic Stepping Stones Science Team/IFE/URI/NOAA.

## Geomorphology and physical facts

- 95% of the ocean area is below 130m deep, the average ocean depth is approximately 3,800m.
- Photosynthetically useful light penetrates the water column usually only down to 200m.
- Of the Earth's area, about 5% are continental shelves from 0-200m depth, 13% are continental margins (slopes and rises) from 200–3,000m, 51% abyssal depths between 3,000-6,000m. The deepest parts of the oceans (including many of the ocean trenches) constitute less than 2%.
- The mid-oceanic ridge system spans around 64,000km, four times longer than the Andes, the Himalayas and the Rocky Mountains combined.
- More than 100 hydrothermal vent systems have been documented, mostly along the mid-ocean ridge system.
- There are 37 trenches, mostly around the periphery of the world's oceans.
- The number of large seamounts is estimated to be over 100,000, 54% are in international waters. Less than 200 have been studied.
- Sediment accumulation rates in the abyssal zones are low, approximately 0.5mm per thousand years.
- Manganese nodules 'grow' about 1mm in 10,000 years.
- Water temperatures at depths of 1,000m and below ranges mostly between -0.9°C and 5°C.
- While significant in total area, the rocky substrates of mid-ocean ridges, seamounts and submarine canyons are rare habitats in the enormous expanses of the deep sea, occupying 4% of the sea floor.

### Life in the deeper water and high seas

- The volume of living space provided by the waters of the oceans is 168 times larger than that of terrestrial habitats.
- More than 90% of the planet's living biomass is found in the oceans. Models estimate that bacteria in deep sea sediments alone account for almost 10% of the Earth's biomass. Single cell and microbial species make up 90% of the oceans' biomass.
- There are 43 marine phyla and only 28 terrestrial ones. Of the 33 phyla of animals, 32 are found in the oceans, and 15 are exclusively marine.
- 90% of the oceans are unexplored. Only some 0.0001% of the deep seafloor has been subject to biological investigations.
- A bluefin tuna crossed the Pacific three times in 600 days. The fish traveled 40,000km, equivalent to the distance around the world.
- Orange roughy matures after around 32 years. A specimen of this species was recently found to be approximately 240 years old.
- Manta rays can travel over 2,200km at speed above 11 knots, diving to depths of 450m.
- A Northern Royal Albatross can fly up to 1,800km in 24 hours. A Grey-headed Albatross can circle the globe in 46 days.
- Offshore, where it is too deep for enough sunlight to reach the seabed to fuel photosynthesis, phytoplankton suspended in near-surface waters are solely responsible for the primary production, apart from the estimated 0.03% produced by chemosynthetic communities.
- About 50% of animals collected from areas deeper than 3,000m are new species.
- Cold-water coral reefs have been found so far off the coast of 41 countries from the poles to deep equatorial waters. These reefs can be up to 35m high, 40km long, 3km wide, and 8,500 years old.
- Two-thirds of all known coral species live in deeper and cold waters, but only less than 10 cold-water coral species form reef structures, compared to around 800 coral species found in tropical, shallow water reefs.
- Individuals of gold corals (*Gerardia* spp.) found on seamounts may have been alive for up to 1,800 years, making them the oldest known animals on Earth.
- Communities living on hydrothermal vents and cold seeps obtain their energy from chemicals seeping from the Earth's crust or ancient sediments. They are examples of life on Earth which does not depend directly on energy from the sun.
- Out of the 500 species described from hydrothermal vents, 90% are endemic. Biomass around vents can be 500–1,000 times higher than in the surrounding deep sea and includes the fastest growing animals in the sea (tube worms grow up to 2.5cm in 10 days).
- Only 200-300 species associated with cold seeps have been identified so far, many remain undescribed.
- At any given time, there are thousands of whale carcasses on the bottom of the oceans. 400 species have been documented to live and feed mainly, or exclusively, on these remains.
- So far, around 1,970 species have been recorded from 171 seamounts, with a large number of new species. 16 to 36 per cent of the 921 species of fish and other benthic macrofauna collected on 24 seamounts in the Tasman and Coral Seas in the South Pacific were new to science.

- Seamounts can have a high rate of species endemism, 35% on seamounts off Tasmania, 36% for seamounts on the Norfolk Ridge, 31% on the Lord Howe Island seamounts, and 44% for fishes and 52% for invertebrates on the Nasca and Sala-y-Gomez seamount chain off Chile.
- Species richness on unfished seamounts in southern Tasmania was found to be 46% higher than on fished seamounts, and biomass was more than 7 times higher.
- Trench faunas are highly endemic, with 56% of the species only found in trenches, and 95% occurring only in a single trench.

### Human activities and impacts

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- Seafood provides almost 20% of the world's total animal protein intake.
- In the last 42 years, capture of wild marine fish for human consumption increased from 20 million tonnes to 84.5 million tonnes, with more than 40% entering international trade.
- Global by-catch amounts to 20 million tons a year, approximately 25% of the fish caught.
- Over half (52%) of the global fish stocks are fully exploited. Overexploited and depleted species have increased from about 10% in the mid 1970s to 24% in 2002.
- The percentage of fish caught on the high seas in relation to the global marine catch rose from 5% in 1992 to 11% in 2002.
- Catch from high seas bottom trawl fishing in 2001 was worth an estimated US\$300-400 million, equal to approximately 0.5% of the value of global marine catch. The sector employs an estimated 1,000-2,000 people using around 250-300 boats (on a full time-equivalent basis).
- The worldwide value of IUU catches is estimated between US\$4.9-9.5 billion. Up to 30% of IUU fishing (US\$ 1.2 billion) occurs beyond national jurisdiction.
- Each year, illegal longline fishing kills over 300,000 seabirds, including 100,000 albatrosses.
- Around 3.5 million fishing boats use the world's ocean. 1% of these are classified as large, industrial vessels, which have the capacity to take around 60% of all the fish caught globally.
- 15 million people work aboard fishing boats globally, 90% work from small-scale, non-industrialized vessels.
- 15% of the world's large-scale fishing fleet is operating under a flag of convenience (FOC) or listed as flag 'unknown'.
- Government subsidies — estimated at US\$15-20 billion per year — account for nearly 20% of revenues to the fishing industry worldwide.
- Populations of large fish with high commercial value, such as tuna, cod, swordfish and marlin, have declined by as much as 90% in the past century.
- Southern bluefin tuna, Western Atlantic Northern bluefin tuna, South Atlantic albacore are classified as 'Critically Endangered' in IUCN's Red List. Northern Atlantic swordfish, Pacific bigeye tuna and Eastern Atlantic Northern bluefin tuna are classified as 'Endangered'.
- Every year 100 million sharks and related species are caught in fisheries, mostly for their fins.
- Stocks of two north Atlantic deepwater sharks -- the Leafscale gulper shark and Portuguese dogfish -- have crashed by 80% in just 10 years. Both species are listed as 'Endangered'.

- Stocks of two species of northwest Atlantic deep sea fish – the onion eye grenadier and round-nose grenadier – declined 93.3% and 99.6% between 1978 and 2004.
- In the first year of the orange roughy fishery in the South Tasman Rise, trawl nets brought up 1.6 tons of coral per hour as bycatch, with an estimated total of around 10,000 tons of coral by-catch over the year. The catch of orange roughy in the same time was 4,000 tons.
- Most deep sea fisheries peak within 5 years and collapse within 15 years. The unregulated orange roughy fishery in the Southwest Indian Ocean collapsed within less than 4 years.
- 19 of 21 albatross species are under global threat of extinction.
- In 2000, more than 200,000 loggerhead sea turtles and 50,000 leatherbacks were accidentally caught in fishing gear worldwide. Populations of both species have fallen by 80-90% over the past decade.
- Most cold-water coral reefs in the North East Atlantic show signs of, or have been destroyed by, bottom trawling.
- The operation of a deep sea research vessel with equipment can cost around US\$30,000 a day.
- In 2002-2003, 80% of new chemicals introduced globally as drugs can be traced to, or were inspired by, natural products.
- Profits from a compound derived from a sea sponge to treat herpes were estimated to be worth US\$50-100 million annually, and estimates of the value of anti-cancer agents from marine organisms are up to US\$1 billion a year.
- The substance 'Neosaxitoxin' derived *inter alia* from dinoflagellates, blue-green algae and toxic shellfish is valued at US\$21,400 per mg.
- It takes 2,400kg of sponge to produce less than 1mg of the substance 'Spongistatin'.
- In the last 50 years, levels of human-generated noise have increased dramatically in our oceans, doubling every decade for five decades running in some coastal areas.
- Intense undersea noise can kill and injure wildlife and decrease commercial fish catch rates by as much as 40-70% as shown by a study on cod and haddock around an oil and gas seismic survey in the Barents Sea.
- More than 90% of goods traded between countries are transported by sea.
- Oil tankers transport 60% (approximately 2,000 million tons) of oil consumed in the world.
- Due to an oversupply of vessels, tanker companies have the lowest price-to-earnings valuation of any sector within the energy industry.
- 25% of the natural gas and 30% of the oil used domestically in the US comes from the Gulf of Mexico Outer Continental Shelf (OCS). 3.9 seconds of OCS production would allow a car to travel around the earth's equator.
- 50% of leased acreage in the Gulf of Mexico OCS is in deep water (greater than 300m), and a first exploratory well has been drilled in over 3,000m of water. Seven of the top 20 oil fields in the US (ranked by liquids proved reserves) are now located in federal deep water areas.

- Each year 10 billion tons of ballast water is transferred around the globe and released into foreign waters.
- Ballast water often contains species that as 'aliens' colonize new environments to the detriment of native species and local economies.
- Today 95% of the Black Sea's biomass is made up by the Atlantic comb jellyfish. This species was accidentally introduced by ballast water and has severely affected the commercial fishery in the six states surrounding the Black Sea.
- Wastes created per day vary from 4,400kg (cruise ships), 60kg (cargo ships) to 10kg (fishing vessels). About 1/3 of the waste from cruise ships visiting the Caribbean is deliberately dumped.
- The total input of marine litter into the oceans was estimated at approximately 6.4 million tonnes per year, of which nearly 5.6 million tonnes came from merchant shipping.
- Some 8 million items of marine litter have been estimated to enter the sea every day, about 5 million of which have been thrown overboard or lost from ships.
- Over 46,000 pieces of plastic litter are floating on every square mile of ocean today. In the Central Pacific, there are up to 6 pounds of marine litter to every pound of plankton.
- Plastic waste kills up to 1 million sea birds, 100,000 sea mammals and countless fish each year.
- Between 1949 and 1970, 50,201 metric tonnes (equivalent to about 100,000 drums) of low-level radioactive waste was dumped in the Northeast Atlantic. A further 64,525 tonnes (122,732 barrels) was dumped between 1971 and 1982, when this dumping stopped. The US deposited 34,282 drums in the Western Atlantic between 1949 and 1967, and another 56,261 containers in various places of the Pacific Ocean between 1946 and 1970.
- The Gulf Stream flow has declined 30% in the last half century, with the rate of decline accelerating in the past five years.
- About 38,000 gigatonnes of carbon (Gt C) are stored in the oceans, compared with about 2,000 Gt in the terrestrial biosphere and 700 Gt in the atmosphere.
- Oceans act as an important carbon sink, including a significant proportion of the 6 Gt C which originates from human activities each year, and absorb 2 Gt C per year more CO<sub>2</sub> than they are releasing.
- If CO<sub>2</sub> emissions continue to rise, by 2100 the entire Southern Ocean, the subarctic Pacific Ocean and large parts of the deeper waters in the North Atlantic will be undersaturated with aragonite (a form of calcium carbonate), which will impair coral and mollusc growth.

*This list is taken from various literature sources and does not attempt to be exhaustive. The author is not responsible for the accuracy of these facts.*