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Impact of Anthropogenic Activity on Red Sea Diversity and its Vicinity

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The Red Sea is an extension of the Indian Ocean, lying between the Arabian Peninsula and Africa. The only natural connection between the Red Sea and the rest of the Indian Ocean is Bab el Mandeb, a narrow strait that transitions into the Gulf of Aden. To the north, the Red Sea splits into two narrow branches (the Gulf of Suez and the Gulf of Aqaba) that flank the Sinai Peninsula. Overall, the Red Sea is a comparatively shallow body of water with an average depth of only about 1600 feet. However, it is in reality a young ocean in the early stage of formation. As the African and Arabian continents slowly rift apart, new oceanic crust is formed and slowly but surely the Red Sea is gradually widening. The tectonic forces at work are most evident in the deep narrow trench (Rift Valley) that runs most of the length of the sea at its center, reaching a maximum depth of over 8,600 feet (2,600 m) below sea level.

The region surrounding the Red Sea is one of the hottest, driest areas on earth. The extreme air temperatures result in very high levels of evaporation, making this one of the hottest and saltiest bodies of seawater in the world.

A unique ecology, Formed around 38 million years ago, the Red Sea's connection with the Mediterranean

closed around 5 million years ago, causing the Red Sea to evaporate and become increasingly saline. Years later, the Red Sea opened at its southern end to the Indian Ocean and, as water flooded in, fish from the Indo-Pacific filled the sea.

But due to its narrow, shallow mouth, the Red Sea is a partially isolated body of water and has a higher temperature and average salinity than the neighboring Indian Ocean. These localized conditions have triggered a unique evolutionary process that has led to a high proportion of endemic species, many of which are closely related to those in the adjacent Indian Ocean. The average salinity is 40 parts per thousand (ppt), as compared to about 35-36 (ppt) in the tropical Indian, Pacific, and Atlantic Oceans. Recent measurements found surface water temperatures to be 28 degrees C. (82 degrees F.) in winter and up to 34 degrees C. (93 degrees F.) in summer.

The **Red Sea** got its name because of a type of algae called *Trichodesmium erythraeum*, which is found in the sea. When these blooms of algae die off they appear to turn the blue-green **color** of the ocean to a reddish-brown.

The diversity in the Red sea

The red sea is a home to more than 1100 species of fish, more than 200 species of coral reefs, 125 of which are soft corals, 40 species of sea star, 25 species of sea urchins, more than a 100 specie of mollusk and 150 species of crustaceans can be found.

An abundance of marine life inhabit colorful reefs and leave anyone with unforgettable memories.

The land masses around the Red sea are also interesting in a useful way. The Tiran and Sanafir is an important breeding area for population of the threatened and endemic white eyed Gull *Larus leucophthalmus* and sometimes, one get to see the majestic Osprey, *Pandion haliaetus*.

The turtles of the Red sea also come to lay their eggs on these land masses around it.

The Red Sea has a huge number of endemic species. Some experts say as many as 20% of 1100 species living here are unique to this location. It can be difficult to pinpoint the exact figures, as new species are discovered each year and our understanding of the global distribution of marine-species is still incomplete. With such rich and diverse marine-life, it's no surprise that the Red Sea is so popular with scuba holidays and Red Sea Liveboards.

Most endemic species are inhabitants of the Red Sea's colorful coral reefs and some have their own unique location in the sea. The highest levels of endemism in the Red Sea are found in the dotted backs, triple fin blennies and butterfly fish – around half of these species are thought to be unique.

Red Sea endemic fishes and other forms

The red sea is a host to number of endemic fishes, species that call this reef system their home.

There are about 170 species of fishes which are labelled as endemic. This figure is not precise as new species are still being discovered. Hence our knowledge is not yet up to date.

The untouched reefs of the southern portion of red sea are bursting with life. 20% of species of fishes found

in this region are native species. They cannot be found anywhere else in the world. One of the rare species of fish found in this region is solitary sailfish. The length of these ranges up to one meter long and these are the world's fastest fish with a speed of 68mph.

Rare sharks are also seen in these waters. One of the few examples of these are- Silky shark which grows up to 3 meters. Schools of up to 30 scalloped hammerhead sharks have also been witnessed in these waters.

The list of endemic fishes:

Arabian angelfish: *Lophius piscatorius* or the Arabian anglerfish is abundant in red sea but as this species is a common collector item due to its appearance, so it's numbers have decreased in the recent history.

Masked butterfly fish: They are sometime called 'Red sea butterfly fish'. These belong to the genus *Chaetodon*. They appear bright yellow in appearance fish and are often seen swimming in pairs.

Parrotfish: They belong to genera *Scaridae*. Several species of parrot-fish are endemic to the Red Sea, including the dotty, green band, rusty and purple-stripe parrotfish.

Picasso triggerfish: They belong to genus *Rhinecanthus*. They are upto 30cm in length and found on the reefs of Red Sea

Red Sea anemonefish: They belong to genus *Amphiprion*. A member of the Damselfish family and a relation to the Asia-Pacific anemonefish, also known as the Clownfish

Spanish triplefin: Their genera is *Notoclinops*. These are weeny little fishes and can only be found in red sea. With a maximum size of 2.5cms, these are hard to spot.

Springer's dottyback: These belong to the genera *Pseudochromis*. These shy little fish are surprisingly fast. They have dark bodies and bright turquoise faces.

Striped anthias: They belong to the genera *Pseudanthias*. Found only in the northern Red Sea. They are usually seen swimming amongst the common anthems.

The striped anthias: It is commonly known as red sea anthias.

Wrasse: These belong to the genera *Labridae*. Several species of wrasse are endemic to the Red Sea, including the broomtail, social and Red Sea bird wrasse, as well as the shy and colorful Red Sea flasher wrasse.

Red sea pipefish: They belong to the genera *Corythoichthys*. These are tiny and dull brown in color. When the artificial light is flashed on them, they show their true colors. When there are lots of pipefish, the stonefish and scorpionfish are also found in that area as the pipefish is their favorite prey.

Yellow-ear angelfish: They belong to the genera *Antennarius*. Found in the northern Red sea and in areas such as Dahab and Egypt.

Red sea top shell: These belong to the genera *Cittarium*. These are dull, grey creatures. These can only be found in red sea. They are often found growing with algae

Sharks

White Tip reef Shark: Belongs to genus *Triaenodonobesus*, with a size of about 140cm to 160cm. Often found sleeping in caves during the day.

Whale shark: These belong to genus *Rhincodontypus*. These attain a maximum size of about 1200cm. In summers they are found all over the red sea.

Zebra shark: These belong to genus *Stegostomafasciatum*. Their maximum size is about 350cm. Found all year around on sandy bottoms, shelves and plateaus.

Grey reef shark: These belong to *Carcharhinusamblyrhynchos*. Their maximum size is about 170 cm. They can be seen all year round

Silvertip shark: Their genera is *Carcharhinusalbimarginatus*. Their maximum size can be reached up to 200-250cm.

They are rare and found all over the red sea especially on southern liveborard dive sites.

Blacktip shark: Their genera is *Carcharhinuslimbatus*. Their maximum length reaches up to 255cm and weighs around 18kgs. Seen ocaasionally around red sea in mid-summer.

Oceanic Whitetip shark: their genera Is *Carcharhinuslongimanus*. Their maximum size can be possibly up to 390cm. They are found in October –December on Eliphinstone.

Silky Shark: *Carcharhinusfalciformis* is their genera. Their maximum length can be 330cm. They are found especially in summer time around May-July

Thresher Shark: Their genera is *Alopiasvulpinus*. Their maximum size can be 610cm and they can weigh upto 450kg. They are found in wintertime on southern liveaboard.

Shortfinmako: Their genera is *Isurusoxyrinchus*. Their maximum total length can be 400cm and their weight can be 570kgs. They are pelagic and can show up by chance.

They have spool shaped body and small fins.

Scalloped hammerhead: Their genera is *Sphyrnalewini*. Their maximum size can be 420cm. Their schools of up to 40 individuals are seen on Daedalus in the months of May-July. They have huge dorsal fins located in the front of the center of the body. Their tail lobe is large size

Great hammerhead: Their genera is *Sphyrnamokarran*. Their maximum length can be 610cm. They can be seen on southern livaboard dive sites, They have even bigger dorsal fin located well in the front center of the body. They have large sized tail lobe.

Tiger Shark: Their genera is *Galeocerdocuvier*. Their maximum length can reach up to 800cm. In summertime these can be seen all over the red sea. They are characterized by their big teeth.

Red Sea Coral reefs

The Red Sea reef platforms are more than 5000 years old and the entire coastal reef consisting of these various colorful and complex reefs extends along 2,000 km (1,240 miles) of the entire shoreline. Most such reefs grow directly from the shoreline. The dominant and the most actively growing corals in the Red Sea include the most notably highly branched species of the genera *Acropora*.

The Red Sea also contains numerous offshore reefs that defy classic reef type categorization.

Included in this category are atoll-like rings of coral and elongated coral ridges that rise abruptly from considerable depths on both the sides, and form peculiar complex reef patterns of odd shapes.

Such Red Sea coral reef formations are almost certainly the result of the active and unusual tectonic forces that have been at work here for millennia and continue even today.

There are a few true atolls in the Red Sea but no true barrier reefs are found in this area.

Characteristics

Red Sea reefs have developed a number of features that distinguish them from reefs found throughout most of the rest of this vast oceanic area.

Despite the extreme conditions characteristic of the region, Red Sea coral reefs are generally healthy. Coral reefs range widely in condition and cover, with up to 85% living coral cover at the best sites and over 50% live coral cover at many other locations. There is usually minimal coral bleaching evident, although some localized outbreaks are reported from time to time.

Also, water clarity is exceptional in the Red Sea because of the lack of river discharge and low rainfall. Thus, Red Sea reefs are not heavily impacted by the suspension and dissipation of fine sediments that plague reefs in tropical oceans near large land masses.

Red Sea coral reefs are particularly well developed in the north and central portions (off the coasts of Egypt, Saudi Arabia, Sudan), with large sizable offshore reef complexes containing small islands, fringing reefs, and a variety of reef-associated habitats.

Further south, coral growth is somewhat inhibited by the influx of nutrient laden water where the Indian Ocean enters the Red Sea. This surface waters of the more southerly areas are also subject to far greater mixing with deeper water caused by strong winds coming off a high mountainous coast.

In general, the marine biota of Red Sea coral reefs is characterized by high endemism. For example, of the 1200 or so coral reef fish species recorded, about 10% are endemic (found nowhere else). About 300 hard coral species have been recorded from the Red Sea as a whole.

Many Red Sea coral reefs situated near urban centers and other developed parts of the coast have been heavily damaged or lost due to the predictable effects of poorly planned or regulated population expansions and coastal development, along with associated declines in water quality.

In some of the once most pristine reef areas, insufficiently managed dive tourism (damage from anchors and recreational scuba divers) has also taken its predictable toll on the reefs.

A growing number of marine number of protected areas (MPAs) have been established in the Red Sea to help alleviate some of these problems. Ras Mohammad National Park was established by Egypt in 1983 and includes miles of healthy fringing reefs. The Red Sea Marine Peace Park in the Gulf of Aqaba was founded in 1994 by the governments of Jordan and Israel to preserve and protect the area's coral reefs.

Cause of extinction

As Carbon Dioxide (CO₂) concentrations in the environment increase, the CO₂ is converted into Carbonic Acid. Since many of the coral reef species are composed of Calcium Carbonate, which is chemically considered a base, increasing Carbonic Acid levels will dissolve the exoskeletons (external skeleton) of many coral species and mollusks (snails, clams, oysters).

Of course, the same thing will happen outside the oceans in the form of Acid Rain. Acid Rain eats away at things like marble, limestone, steel, concrete, plants, skin..pretty much everything.

Carbonic Acid is what makes Coca Cola able to dissolve a steel nail within a few days

Turtles of the Red Sea

The turtles are the marine reptiles which belong to its order *Chelonia*. They have lungs, which is an adaption for breathing on land as they come on the surface to lay their eggs. They can live for hundred of years.

Four species of turtles are found in the Red Sea: the green- *Chelonia mydas* (green turtle), *Eretmochelys imbricata* (hawksbill). These turtles make their nest on the coast and lay eggs.

Te leatherback turtle or *Dermochelys coriacea* is called the gentle giant turtle

by some, and the olive-ridley turtle (*Lepidochelys olivacea*), the smallest of the turtle species and which

prefers to stay far from the coast and, like the leatherback, is only rarely seen. A fifth species, the loggerhead turtle (*Caretta caretta*), known for its big head, can usually be spotted in the Gulf of Aden but rarely reaches the Egyptian Red Sea. At present, the International Union for nature conservation lists them as **critically endangered** (leatherback and hawksbill turtles), **endangered** (green and loggerhead turtles) and **vulnerable** (olive-ridley turtle).

In the Red Sea, the main threats to sea turtles come from **irresponsible coastal development** that destroys nesting beaches and feeding grounds such as sea-grass beds and coral reefs; **artificial lighting** on main nesting beaches that disorients both nesting turtles and hatchlings; **garbage and plastic bags** which could be ingested by mistake by turtles and will provoke a slow and painful death; **pollution** in the water that is often associated with diseases like the fibropapilloma tumor; **irresponsible anchoring** that destroys both sea-grass beds and coral reefs; **high speed boats and jet-skis** that can seriously wound sea turtles and cause their death; **incidental fishing** in particular in industrial trawlers and purse seines.

Sea turtles play an essential role in keeping the Red Sea healthy and full of life. Green turtles, also known as “sea cows”, maintain **healthy seagrass beds** which host spawning fish, their juveniles and a great number of other invertebrates like mollusks and crustaceans that are at the bottom of the food chain. Hawksbill turtles feed on corals and sponges and they help keeping a balance between these two populations. This balance has proven to be **critical for healthy coral reefs**. So **sea turtle conservation is not just about turtles**, but also about protecting all the habitats they use and that human beings enjoy as well, like the coral reefs. A healthy sea turtle population depends on us and how we use the resources we share with these animals.

Researches for the preservation of Turtles of the Red Sea

At present no data is available on sea turtles or their feeding grounds in the Red Sea. However, this information is fundamental to implement a proper management plan for the conservation of these animals. Thus, the overall goal of this project is to characterize both green and hawksbill turtle populations which live and lay eggs on the shore of red sea and the Southern Egyptian coast of the Red Sea, focusing on in-water behavior, feeding ecology, reproductive biology and causes of mortality to come out with a clear applicable plan to conserve marine turtles, their nesting and feeding grounds, as well as to reduce the mortality causes.

The results will include:

Assessment of the status of marine turtle populations, demarking nesting beaches and feeding grounds;
Quantification of level of human impact due to recreational activities, coastal development, fisheries and pollution;

Reduction in the mortality causes in marine turtle populations;

Increased public awareness and the participation of the local community on turtle conserve

Dugong

The **dugong** a large marine mammal, is one of four living species of the order *Sirenia*, which also includes three species of manatees. It is the only living representative of the once-diverse family *Dugongidae*; its closest modern relative, Steller's sea cow (*Hydrodamalis gigas*), was hunted to extinction in the 18th century. The dugong has been hunted for thousands of years for its meat and oil. Traditional hunting has great cultural significance throughout its range. The eastern side of the Red Sea is the home of large populations numbering in the hundreds, and similar populations are thought to exist on the western side. In the 1980s, it was estimated there could be as many as 4,000 dugongs in the Red Sea. The Persian Gulf has the second-largest dugong population in the world, inhabiting most of the southern coast, and the current population is believed to be around 7,500.

Discussion

Other Causes of extinction of marine biodiversity

Environmental pollution on the Red Sea shore has caused the loss of up to 70 percent of its fishing wealth. Despite government efforts, fish stock has depleted.

Losses in commercial fishing have led to the industry importing fish. The domestic fishing industry doesn't cover more than 40 percent of local demand, which witnessed an increase during the summer. During that time, demand is high and catch low as a result of fish migration because of high temperatures.

"Fish production in the Red Sea has decreased during the past 20 years because of environmental pollution," said Khalid Al-Shweiki, director-general of the Fishermen's Cooperative Society.

"Government authorities are preventing the disposal of sewage water into the sea. These efforts contributed to stabilizing production percentages over the past five years, but these quantities can't meet the increasing demand," he added.

"Despite the efforts of the Ministry of Agriculture and its partnership with social security experts in establishing fishing ports at various locations on the Red Sea shore, only a few Saudis continue to work in the fishing profession as compared to their forefathers," he said, adding fishing doesn't provide enough income to meet their daily expenses.

Even though expatriates have not been allowed to work in fishing for the past four years, they still represent the majority of those who work in the sector. Out of 20,000 fishermen, only 25 to 30 percent are Saudis. "The entire expanse of sea lying between Jeddah and Qunfuda is polluted and has resulted in the depletion of the fish resources and the total disappearance of tuna. Reckless fishing damages the fish-breeding environment," says Abdullah Al-Sayed, a fisherman in Jeddah.

He added that sewage-pumping is another major factor that has led to the destruction of habitats of fish and other sea organisms. Even locations away from coastal areas are not free from the ravages caused by coastal pollutants. "Undersea currents and wind carries coastal pollutants to distant parts of the sea include locations where various types of fish grow in large number"

Pollution in the Red Sea has reached epic proportions. Coral reefs spanning thousands of kilometers along the coastline in the region are under threat of extinction. It has recently come under severe pressure due to illegal fishing, the depositing of untreated sewage, the shipping of waste including toxic substances and increased shipping activities carrying chemicals and crude oil.

Environmental activists say an oil spill off the coast of Egypt's Red Sea, which has left turtles and sea birds covered in oil, is continuing even though the government says it has been contained.

Prevention of Pollution by Oil

Oil tankers transport some 1,800 million tonnes of crude oil around the world by sea including 50 percent of U.S. oil imports (crude oil and refined products). Most of the time, oil is transported quietly and safely. Measures introduced by IMO have helped ensure that the majority of oil tankers are safely built and operated and are constructed to reduce the amount of oil spilled in the event of an accident. Operational pollution, such as from routine tank cleaning operations, has also been cut.

The most important regulations for preventing pollution by oil from ships are contained in Annex I of the International Convention for the Prevention of Pollution from Ships, 1973, as modified by the Protocol of 1978 relating thereto (MARPOL 73/78), The International Convention for the Safety of Life at Sea (SOLAS), 1974 also includes special requirements for tankers.

Conclusion

The coastal areas is protected from the storms due to its narrow elongated shape, its semi-enclosed character and its circulation patterns. It has a complex reef ecosystem which provides habitats for a wide range of marine species including endemic species. The Red Sea received its first biota from the Mediterranean Sea but not it closely resembles to that of the Indian Ocean.

The coast offers opportunities for economic development in the area of fisheries, trade, petroleum and tourism. Tourism (Marine recreation, snorkeling and diving) attracts thousands of tourist each year. Also local fisheries have for centuries provided food and employment to the people of the Red Sea.

Various species are found in the Red sea, among them are *Raja fullonica*, *Sciaena aquila*, and *Syndnathus algerienensis*. Endemic species include *Sphyrna mokarran*, Torpedo panther and *Terapon jarbua*. The catch of tunas, bonitos and billfishes is increasing, as is the catch of herrings, sardines and anchovies. Unregulated fishing is a threat to ecosystem health. One commercial species is lobster. A positive move is the replacement of gillnets with lobster traps, which will enable fishermen to release egg-bearing female lobsters.

The key environmental threats in the Red Sea are unregulated fishing, uncontrolled development, and oil pollution. There is a pollution hotspot in the sea's Gulf of Aqaba. Tankers make their way into this Sea through the Suez Canal. It is a high-risk area in terms of navigation, and it required the establishment of official traffic lanes and separation schemes for heavy flow of traffic. The extensive coral reefs, sea grass beds and mangroves suffer from excess tourism, pollution discharges and industrial development. There is a need to establish more marine protected areas, to serve as havens for fish and for repopulation purposes. A marine park has been established by Israel and Jordan.

Various regulations have been imposed on the traffic on the Red Sea. Controlled development, tourism as well as fishing are some of the major steps that can be taken to save its ecosystem.

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