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Ecosystems and Life:
Under the Sea

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Letter from the Editor-in-Chief

UNDER THE SEA

By: Maissa Azab

Growing up and till this day, animation movies have always fascinated me; some of them becoming all-time favorites for me that I never tire of watching. The first one I had fallen in love with and still holds a special place in my heart is *The Little Mermaid*.

That said, I do agree with the modern sentiment against the message of the movie: a young girl leaving everything and sacrificing herself to pursue the love of someone she fell in love with from afar. The movie came out when I was already a teenager and it has not influenced my beliefs in any way; I cannot really say how much of an influence the story could have on small children. What I like about the movie is the goofiness of the characters, hilariously manifested in the lyrics of the songs, which are my favorite part.

The Little Mermaid might not have influenced how I think about love and the way I should live my life, but it had made me curious about the magic "Under the Sea". It is truly fascinating to think that there is a completely different world under the waters that cover more than 70% of Planet Earth. As a matter of fact, thinking of that number, that world, hidden deep under the seas, is much vaster than the world we are more familiar with on land. Not only is it much bigger, its secrets are much more securely sealed from us because of the challenges we face to get through its medium, which we are not naturally equipped to inhabit.

In the first of two special issues dedicated to Ecosystems and Lifeforms, we had a close look at life on land, which is easier to explore. We talked about invasive, extinct, endangered, and restored lifeforms. We also tackled topics like the impact of pollution, the coronavirus, and the weather, as well as the relation between biodiversity and wellbeing, among several other interesting subjects.

In this second issue, we dive deep to make a similar, yet much more challenging, journey to discover underwater realms. We look at different water bodies with the myriad of diverse environments under and around them. We also talk about a variety of marine lifeforms of the past and present, including mermaids, as well as the challenges they faced or are facing. Finally, we tackle a diversity of intriguing related cultural and technological topics.

As always, we wish you an enjoyable and hopefully inspiring reading experience. Please do not forget to visit our online magazine at www.bibalex.org/sciplanet, and follow us on Facebook, Instagram, and Twitter.

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ENVIRONMENT AND CLIMATE CHANGE

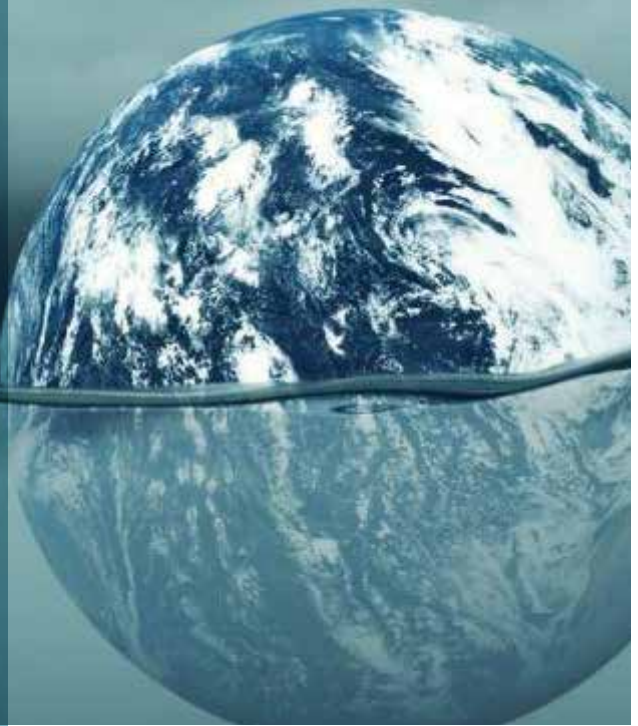
Now, everyone around the world is familiar with the dangers of climate change and its impact of the different aspects of life.

We invite you to go through this theme to read different articles that discuss the impacts of climate change on the environment and how we, as individuals, can have a role in facing this life-threatening issue.



When Oceans Lose Their Memory

By: Summer Ashraf



Oceans cover over two-thirds of Planet Earth, with a 50-meter-deep layer of warm water near the surface, topping deep cold water beneath. Although this layer is relatively shallow, the high specific heat of water—compared to the temperature of the atmosphere above—preserves the stability of water temperature for longer periods. Specific heat is the heat energy needed to raise the temperature of one gram of matter by one degree.

Whereas we witness rapid changes in atmospheric weather, the ocean temperature changes slowly. It is probable that the temperature of ocean water tomorrow will be only slightly different from its value today, thanks to the good memory of the ocean water. This memory is often used to predict the future conditions of the oceans. According to a recent study published in *Science Advances*, most oceans are losing their memories, year after year, due to global warming and the increasing concentrations of greenhouse gases.

Greenhouse gases exist in the Earth atmosphere and can absorb and preserve the infrared rays reflected from the surface of the Earth, which raises the air temperature and aggregates the greenhouse effect and global warming. Through studying climate models, researchers found that the ocean's memory deteriorates in response to global warming induced by human activity. As the concentrations of greenhouse gases increase, scientists expect that ocean memory loss will become more articulate in the coming decades. Climate models indicate that ocean memory will vanish by the end of this century. Researchers discovered this phenomenon by investigating differences in ocean surface temperature from one year to another, being a simple indicator of ocean memory.

It is worth mentioning that climate models are mathematical representations that predict climate and environmental changes in the coming decades. There are many types of climate models that differ in terms of complexity. They include several variables such as the condition of the atmosphere, oceans, Earth surface, soil changes, vegetation, man-made infrastructure, social and environmental management mechanisms, and environmental policy decisions.

Researchers link ocean memory loss to the regression of the top layer of most oceans, which is becoming shallower due to the continuing climate changes. Changes in ocean currents and in energy exchange between the atmosphere and oceans also affect ocean memory.

These alternations pose a huge challenge for scientists; they have to make fundamental changes to climate system models to be able to predict climate in the future in light of global warming. The challenge is also represented in our decreasing ability to predict weather and prepare for changes that take place in oceans. This includes the marine heatwaves known for causing sudden evident changes in marine ecosystems around the world. Ocean memory loss will not impact oceans only, but also the management of fisheries, or fish-rich areas that are used for commercial purposes.

For example, researchers need to assess the fish stock in these areas. The factors used for this assessment are based on pre-supposedly stable environmental conditions. The deterioration of ocean memory can make these assessments inaccurate, and necessitate a new approach to the management of fisheries.

The impact of ocean memory deterioration could also affect different species in different biological systems, depending on their ability to adapt to the changing environmental conditions. Prediction of temperatures, rainfall, and snowfall might also be affected since it depends on the stability of the ocean surface temperature.

As ocean memory deteriorates, researchers would face the challenge of finding new methods to predict the condition of the oceans. While researchers exert much effort to ensure the accuracy of climate predictions, the information we obtain from climate models is still experimental. No one knows for sure what the future looks like, but these models help us better prepare for what may lie ahead.

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Illustration by Luisa Rivera/Yale E360

Moving Poleward

By: Naglaa Hassan

God has designed the elements of nature and life, on and around the Earth, to be continuously and closely interrelated. There is a tight bond between the living and non-living elements in natural environments. This bond manifests in multiple functional factors, forming what is known as an ecosystem. The term “environmental balance” refers to these elements being in a state of stability. There are many reasons—natural and man-made—that may disturb the environmental balance.

Huge numbers of fish migrate across the seas and oceans for several reasons, including the search for food, mating, nesting, giving birth, or laying eggs, as well as escaping climate changes and human threats. As such, the distribution of marine species, including the ones we depend on for food, is changing. According to the most accurate analyses, the distribution of marine animals has been gradually shifting away from the equator and toward the Poles of the Earth during the past decades.

Life on land is closely connected to water bodies on the Planet; the seas, rivers, and oceans provide humans with plentiful supplies of oxygen, food, and energy, as well as entertainment. So, how would the phenomenon of marine species moving to the Poles affect this connection?

Fishermen in Narragansett Bay in Rhode Island State, USA, noticed a decline in herring fish populations at the southern end of their range. Herrings are small schooling fish that are key in the food chain of the region. Meanwhile, they turned up more often at the northern edges of their range, which negatively affected fisheries in the south. This behavior is not limited to herrings but is also evident in many other marine species that are moving polewards.

This phenomenon is mainly urged by the gradual increase in ocean temperature due to global warming. High temperatures threaten species that are adaptable only to a narrow range of temperatures. Moreover,

they cause the depletion of vital nutrients, which urges living organisms to migrate in search of food and more favorable climatic conditions. Phytoplankton, zooplankton, and bony fishes are more responsive to temperature changes; on the other hand, species that fail to adapt or move poleward face serious extinction threats.

Terrestrial species are also moving towards the Poles, but at a slower rate than the ocean inhabitants. This might be due to the fact that water conducts heat better than air, which means that climate change takes place at a faster pace in oceans compared to terrestrial areas. Also, terrestrial species can perform thermo-regulation easier. Additionally, migration for long distances is easier for marine species, since there are no hills, valleys, cities, or human activities to obstruct their way.

Researchers state that the increase in ocean temperature rearranges their biological composition; it pushes marine species polewards six kilometers per year. On the other hand, terrestrial species move poleward at a rate of 1.8 meters per year. The phenomenon of marine species migration to the Poles might have consecutive effects on environmental balance; a significant example is threatening local fisheries on which millions of people depend. Moreover, most temperature-sensitive marine animals form the base of food chains for predators. The loss of such species means marine

predators losing their prey, making it more difficult for them to survive.

To cope with this phenomenon and handle its negative impacts, scientists rely on techniques they developed and used in researching it. These techniques include acoustic sensors used for tracing marine animals over wide ranges, utilizing marking devices that operate using satellites to study the animal life history, experiments that measure the impact of climate change on marine life, as well as studies that collect physical and chemical data from the oceans to trace migration roots and determine feeding and mating spots.

These measurements help protect marine species and enable policy-makers and managers of ocean resources to establish protected areas, modify navigational routes, and regulate fishery resources. It is worth mentioning that marine species are suffering stress factors other than climate change, such as human threats including overfishing and pollution. Therefore, programs targeting these factors should be developed and proper protection for marine resources should be enforced. Perhaps the situation requires a radical change in the way we handle marine environment.

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In Depth:

An Interview with Dr. Emad Khalil

By: Shahenda Ayman

Dr. Emad Khalil

Senior Researcher and Supervisor of the Alexandria Center for Hellenistic Studies and the Alexandria and Mediterranean Research Center (Alex Med), Bibliotheca Alexandrina.



Since the beginning of time, and since God gave humankind the Earth to live on alongside the rest of His creatures, mankind has been a destroyer of all the beauty around. The pollution humans cause to the environment inevitably destroys unutterably, and this destruction negatively affects human lives and the lives of animals and plants that share life on Earth with them. In the following lines, we reveal how humans are their own worse enemy and the adversary of all other lifeforms on the planet. In this mind-opening interview, Dr. Emad Khalil shares with us valuable information on the issues of pollution and global warming, and the challenges facing the environment and marine life in particular as a result of this global crisis.

Dr. Emad Khalil is a Professor at the Department of Archaeology and Graeco-Roman Studies at the Faculty of Arts, Alexandria University; he is also the Director of the Alexandria Center for Maritime Archaeology and Underwater Cultural Heritage at Alexandria University, in addition to being a Professor of the UNESCO Chair for Underwater Cultural Heritage. Moreover, he was elected deputy of the UNESCO Scientific and Technical Committee for the 2001 Convention for the Protection of Underwater Cultural Heritage. Dr. Emad was one of the first Egyptians to be trained in scuba diving and has worked in the field of discovering sunken antiquities in Egypt since the early 1990s.

First of all, we would like to understand the impact of human activity on marine life.

In the past, fishing was limited to using nets and hooks; also fishing boats were small in size and storage capacity. However, with the technological progress that our world is witnessing nowadays, fishing techniques and tools have accordingly evolved.



The boats have become bigger and their storage capacity has become greater. They are also now equipped with devices that can detect where fish gather underwater, their sizes, water depth, the nature of the sea floor, and other information. All this has contributed to the continuation of fishing trips for months at sea, unlike in the past.



With the lack of control over water bodies and what is happening in them, many practices that are severely harmful to water bodies and marine organisms have emerged. In East Asia, tens of thousands of sharks are hunted for their fins, which are used in preparing shark fin soup, a dish that symbolizes wealth

and prestige in several countries in that region. Sharks are thrown back into the sea after their fins are cut off, but they cannot survive without them and eventually die. This negatively affects the marine ecosystem and fishing communities in the region because sharks are extremely important to their environments.



Pollution is another aspect of human activities that harms the marine environment, whether because of petroleum spills due to ship accidents, sewage pollution, or inorganic waste such as plastic. Plastic is used in huge quantities worldwide, and it often ends up in the seas and oceans, whether by dumping it directly into the water or carried by the wind to the water. What is very dangerous about plastic is that it is a non-biodegradable material; it is broken down into microplastics that fish eat, consequently reaching our bodies by eating fish.

On the international level, and with the increase in fish consumption by humans as a healthy, beneficial, and safe food compared to red meat and poultry, we are facing the danger of consuming plastic through fish. Back to marine organisms, fish ingestion of plastic causes major digestive problems that can lead to their death. Some creatures, such as sea turtles, mix plastic bags that float on the water surface with jellyfish, which represent their favorite meal, so they rush to eat them, then suffocate and die. When plastic covers the coral reefs, it leads to their death because they cannot breathe well and consequently die.

Hence, plastic consumption must be limited or rationed by limiting the availability of free plastic bags as is usual in the Egyptian market, replacing them with reusable bags that have already

begun to spread in some stores or using bags made of cloth or paper.

Moreover, the movement of marine vehicles affects the migration of fish; for example, dolphins and whales confuse the vibrations caused by the propellers and engines of ships and submarines with the waves they emit to communicate with each other. This affects how these creatures distinguish directions, so they deviate from their intended destinations during their migration from one place to another. They may mistakenly head to the beach and eventually die, a phenomenon we have witnessed for years as whales approach the coasts of the Mediterranean Sea.

Do human activities affect marine organisms' behavior?

In general, marine organisms' behavior is always a response toward humans. Fish stimulated by shiny objects can attack divers wearing shiny gear; fish stimulated by the smell of sunscreens can attack swimmers who smell, not to mention that some fish die from the chemicals in these lotions. One of the most erroneous behaviors that have a very negative and deadly effect is throwing food to fish in the Red Sea. This behavior destroys the nature of marine organisms, making them dependent on humans when it comes to nutrition; they may even lose their innate ability to hunt and die if they do not find someone to provide them with food.



Similarly, the types of food that a person throws to fish are not part of their natural diet, as there is no type of fish that eats bread, eggs, or other human foods. This habit led to disastrous results, as stated in a report published after sharks attacked some divers in the Red Sea in 2012. When a person throws food to small fish, they gather in huge numbers

to eat it, which leads to an unusual movement in the water, creating waves that stimulate large fish to attack these small fish that are considered food for the larger ones. When predatory fish arrive at these gatherings, they eat what they find along with the fish; in other words, they attack humans as food. After the recurrence of these incidents, this deadly behavior was prevented in the Red Sea to preserve the fish instinct and their lives, in addition to their ability to hunt again.

You must have heard the statements about Alexandria sinking in 30 years; how accurate are these statements?

According to studies and research conducted over the past years, it is expected that several coastal cities in the Mediterranean, including Alexandria, will be exposed to severe tidal waves (tsunamis), which usually occur after earthquakes, but their strength and effects cannot be predicted. Undoubtedly, all the facilities located near the shore are subject to sinking. When the notorious tsunami that hit Alexandria during the fourteenth century occurred, large parts of Alexandria sank, and many buildings were destroyed, including the famous Lighthouse of Alexandria.



Over the past years, humans have changed the shape of the Alexandrian coastline devastatingly, whether by increasing the beach or building facilities very close to the coast. Those facilities are annually flooded with water during severe storms the city is exposed to. Aside from depriving the Alexandrians of seeing the Sea, a scenery they used to enjoy since ancient times, the facilities near the shore and the beach-filling work increase the sea currents in the area, which causes erosion and sedimentation

along the coastline. This assists in the vulnerability of more extensive parts of the coast to sink in case the city is hit by tidal waves (tsunamis).

During the past two thousand years, the seafloor has dropped six meters due to the earthquakes that Alexandria has been exposed to; in return, the sea level has risen by two meters as a result of global warming and the melting of ice.

Back to the statements about the sinking of the city, no one can assert that this will happen in 30 years, or less or more. However, given the current situation and the current practices, the situation is serious; all concerned parties must be prepared to face this catastrophe, which seems inevitable, whether after 30 years or more.



When the tsunami occurs, will today's Alexandria sink like the ancient Alexandria did?

Of course not; the city of Alexandria is built on top of a limestone hill; therefore, if the coasts are hit by tidal waves resulting from earthquakes, only the facilities near the coast will be affected. Moreover, earthquakes are often accompanied by land subsidence, which can result in the sinking of some parts of the coast. Returning to the tsunami that struck ancient Alexandria in the fourteenth century, it was caused by a strong earthquake that occurred in the Mediterranean Sea. It resulted in a crack in the seafloor, which in turn led to movement in the Earth's crust and pushed a layer of seawater upwards,



forming a giant tsunami moving towards the coasts, inundating everything in its path. At that time, the city facilities were mainly built near the coast, which led to the sinking of large parts of the ancient Alexandria coast.

On the other hand, global warming is currently causing an increase in the gradual rise in the sea level rates, which is also considered a threat to the coasts leading to their drowning, especially the lower ones. The most vulnerable region to drowning is the North Delta region, for example.

Despite the various devices and equipment that predict the occurrence of natural disasters, it is impossible to predict from now the exact location of their occurrence during the upcoming years. Nevertheless, it is necessary to mobilize the efforts of all stakeholders now to reduce global warming and the melting of ice in all possible ways to protect these areas and preserve the lives of future generations.

Talking about global warming and its effects, how has the behavior of marine organisms been affected by this phenomenon?



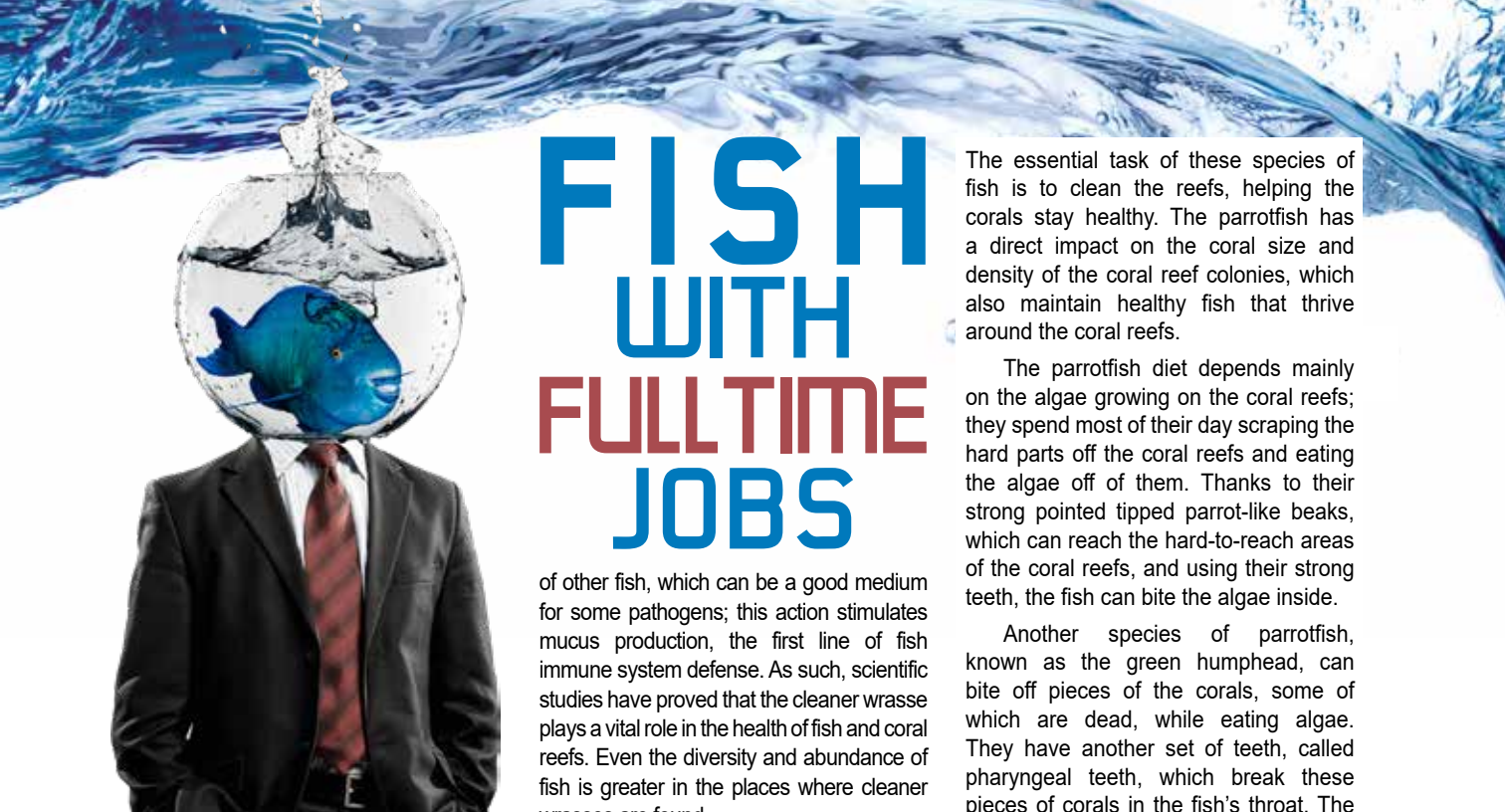
All marine organisms lived in a stable environment for millions of years before humans existed on Earth. Any change in the marine environment disrupts the marine ecosystem. For example, a half-degree rise in the water temperature exposes coral reefs to bleaching, leading to their death. In addition, any change in water temperature in general, whether high or low temperatures, drive marine organisms to migrate from their environment to new places that are more suitable for them, and some fish that do not tolerate these changes die.

For example, most sharks live in warm tropical waters and do not live in

cold waters, but with global warming and the rise in temperature everywhere, most water bodies have become warm, which allowed sharks to move in areas they did not approach before freely. This example applies to all marine organisms that used to live only in warm waters. The lionfish is another example. It used to live in the Red Sea and is not found in the Mediterranean Sea at all, but now, unfortunately, it is epidemically spreading in the Mediterranean Sea. This fish feeds on fish fry in the Mediterranean Sea, and there are international calls to hunt it when found in the Mediterranean Sea because it has become a threat to its ecosystem. The third example is the starfish that have invaded the beaches in an epidemiological manner; because they feed on coral reefs and snails, they represent a significant threat to marine organisms in the Red Sea.



Awareness is the critical word in this dilemma; no problem can be solved without spreading awareness about its severity. It is necessary to enact laws and penalties to combat the pollution of water bodies; it is also necessary to find alternatives to the use of plastic, and most importantly, to spread awareness among people through all available channels to inform people about the problem, its dangers, and dire consequences. We should not rely on the governmental institutions' efforts alone. Every citizen from their position should contribute to spreading awareness and try to change the wrong behaviors and habits that harm not only those who do them but also the entire world, in addition to threatening the future of our children, which we aim to secure.



FISH WITH FULLTIME JOBS

By: Sara Khattab

Fish do not serve as a food source for humans only, but for other marine species as well. Other than this, some fish species have important roles in the aquatic ecosystem; some contribute directly to the health of other fishes, specially reef fish. In this article, I introduce two important fish species that are tasked with vital fulltime jobs.

Cleaner Wrasse



Cleaning symbiosis is common among fish, where there is a mutual beneficial association between two individuals of two species; one (usually named the cleaner) removes and eats parasites from the surface of the other (usually known as the client). An example of this is the relationship between the cleaner wrasse and other fish, where the wrasse fish gets its food from the parasites on the surface of the other fish while the client gets cleaned.

Wrasse also remove dead and damaged scales and tissues off the surface

of other fish, which can be a good medium for some pathogens; this action stimulates mucus production, the first line of fish immune system defense. As such, scientific studies have proved that the cleaner wrasse plays a vital role in the health of fish and coral reefs. Even the diversity and abundance of fish is greater in the places where cleaner wrasses are found.

Most wrasses live in the tropical and subtropical waters of the Atlantic, Indian, and Pacific Oceans. Cleaner wrasses set up cleaning stations where they can work for hours cleaning more than 2000 clients of larger fish. One of the wrasse fish species enter sharks' mouths to eat leftovers the sharks did not swallow. Surprisingly, sharks do not swallow the wrasses while they are cleaning their teeth.

Cleaner fish can be employed in salmon farms to combat sea-lice infestations and for pest control. Moreover, some people tend to transfer cleaner wrasse to huge aquariums to keep them clean. This decreases the population of the fish that depend on them and also affects the variety of reef fish.

Ironically, there is another species of fish that looks like the Blue Streaked Cleaner Wrasse; this is the sabretooth blenny, known as the False Cleaner Wrasse. Fish get confused between the two and approach the sabretooth blenny for cleaning services; when they get close to the false cleaner fish, it bites a chunk off their flesh and runs away.

Parrotfish

Parrotfish are colorful fish that belong to the Scaridae family; they are usually present around the tropical reefs of all the world's oceans. There are around 80 species of parrotfish, ranging in size between 30 cm and 120 cm; their average lifespan can reach up to 7 years.

The essential task of these species of fish is to clean the reefs, helping the corals stay healthy. The parrotfish has a direct impact on the coral size and density of the coral reef colonies, which also maintain healthy fish that thrive around the coral reefs.

The parrotfish diet depends mainly on the algae growing on the coral reefs; they spend most of their day scraping the hard parts off the coral reefs and eating the algae off of them. Thanks to their strong pointed tipped parrot-like beaks, which can reach the hard-to-reach areas of the coral reefs, and using their strong teeth, the fish can bite the algae inside.

Another species of parrotfish, known as the green humphead, can bite off pieces of the corals, some of which are dead, while eating algae. They have another set of teeth, called pharyngeal teeth, which break these pieces of corals in the fish's throat. The digested corals turn into sand and the fish excretes it back to the corals and the sea. It is estimated that one large green humphead parrotfish can break up corals enough to create up to 360 kilograms of soft white sand a year. Scientists and researchers discovered that parrotfish contribute to up to 70% of the white sand found on some beaches in Hawaii and the Caribbean.

Just like most marine creatures and fish, parrotfish are facing the danger of overfishing throughout the Caribbean, which is negatively impacting the health of coral reefs. There are many conservation programs dedicated to raise awareness of the importance of protecting the parrotfish.



It is fascinating to discover there are little creatures in the deep sea with fulltime jobs and vital roles that impact the marine ecosystem. Even though they are not paid in return, they certainly receive benefits from their jobs.

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WHALES

on the DECLINE:

A Threat to Planet Earth

Whales are the largest and smartest ocean creatures; they roam all the world's oceans and communicate through complex and mysterious sounds. Some whales are remarkably huge; the blue whale—the largest creature on Planet Earth—can exceed 30 meters in length and can weigh 200 kilograms. Whales belong to the Cetaceans infraorder, under the Mammalia Class; this infraorder includes whales, dolphins, and porpoises. One common thing between these species is that they all need our help.

Industrial revolutions and human economic interests have posed serious threats to whales. Over half of the whale species were included on the International Union for Conservation of Nature (IUCN) Red List of Threatened Species in the late 20th century. These species include humpback whales, blue whales, and southern right whales. So, how do these threats impact the environment? How can we address them to preserve these invaluable supporters of the environment? Let us find out.

The Role of Whales in Protecting Planet Earth

Whales play a significant role in supporting marine ecosystems, combating climate change, as well as maintaining the atmosphere and ocean health. Their waste, rich in iron and nitrogen, provides nutrition for planktons that absorb 40% of the total CO₂ amounts on the Planet.

Moreover, the body of each one of these giant marine mammals can store about 33 tons of CO₂, which is 1500 times more than what a tree can absorb annually. The economic value of this service is estimated at a trillion US dollars. The carbon capture potential of whales is truly startling. They accumulate carbon in their massive bodies during their long lives, which can last up to 200 years. When they die, their bodies sink to the bottom of the ocean carrying along with them these man-made carbon emissions. In simple terms, we need more whales in the oceans. The more whales we have, the less CO₂ in the atmosphere, and the healthier oceans and marine species get.

Why are Whales Declining in Number?

Researchers estimate that whales natural ability to capture carbon has decreased by nine million tons. This is due to several reasons; mainly due to commercial hunting practices that killed three-quarters of the whale populations by the end of the past century. Strikes by large ships can also be lethal to whales. The biggest threats to whales are incidental hunting and entanglement in huge fishing gear. They sometimes have to pull these heavy instruments for long distances, which consumes their energy, reduces the fat reserves needed for reproduction, and makes them more vulnerable to some diseases.

Moreover, the recurrent entanglement in fishing gear poses reproduction challenges to female whales. A study conducted on the North Atlantic right whale, published in the *Current Biology* journal, realized that getting snared in fishing nets leads to stunting their growth. This has resulted in their low birth rates in recent years since female whales need to have a proper weight for reproduction and nursing the calves. Even if smaller female whales succeeded in producing offspring, their calves are weaker and around one meter shorter than average, which means they have a lesser opportunity of survival.

Joshua Stewart, a marine researcher involved in the study, told *The Guardian* that he saw “pictures of 10-year-old whales that are the size of two-year-old whales”, which proves these whales suffer poor growth.

By: Naglaa Hassan

Whale numbers are also declining due to the rapid changes in ocean and sea temperatures, which do not allow enough time for some whale populations to adapt. Ocean acidification, pollution, and scarce food resources also drive whales to take long journeys that carry more threats.

Protection Policies and Efforts

Since the late 20th century, many countries around the world are exerting vigorous efforts to protect whale species against extinction. These efforts have actually succeeded in crossing out some species from the list of endangered whales. Endeavors are still going on through lobbying governments and policymakers to take action, and raising awareness of the role whales play in restoring the health of the oceans and the Planet.

Programs of conservation organizations encourage developing financial mechanisms to promote the recovery of the world's whale population. This is achieved through supporting whale sanctuaries, whale monitoring, and tracking the data of natural growth and reproduction. Furthermore, governments are undertaking efforts to address the potential threats posed by large ships and fishing ports, and to impose severe penalties to ban killing or wounding whales.

On the personal level, we can make simple changes in our lives that would make a significant impact, such as reducing the amount of plastic we use daily, using the car less, or saving electricity. These simple behaviors can make big positive differences to the environment around us.

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Whales Valley:

From Ocean to Desert

By: Henda Fathy

The features of Planet Earth change across the ages; a prime example is the Whales Valley at the heart of the Western Desert of Egypt. What was once part of the ocean has become a barren—but not empty—desert. It embraces invaluable fossils that has enabled scientists to explore the past and study the geological and biological history of Planet Earth.

The Whales Valley is located north-west of Wadi El-Rayan protectorate in Fayoum Governorate in the Egyptian Western Desert. Since its discovery in the early twentieth century, the Valley has revealed the greatest fossil findings of the ancestors of whales. According to UNESCO, the Valley is an exceptional global reference site for studying the evolution of whales and their environment, as it hosts a large number of complete skeletons in good quality.

The history of the Whales Valley dates back 40–50 million years ago, when the water of the Tethys Ocean covered the area currently south of the Mediterranean Sea. This area inhabited by whales ancestors turned into a marine environment, rich in different forms of life. Then, the water retreated leaving behind layers of sediments that preserved the fossils of these creatures in good condition until today. Besides whales, there are fossils of sea cows, shark teeth, turtles, and crocodilians. The fossils of these creatures have maintained their shapes and features until today. Even some stomach contents are intact, enabling paleontologists to study them.

You may be wondering how these giant marine creatures we know today could live on land. In fact, the Valley hosts hundreds of skeletons of whale ancestors belonging to the Archaeoceti; these whales represent the initial amphibious stages in the evolution of cetacean. This means that whales

were terrestrial mammals that walked on limbs; then, they gradually evolved and lost these limbs, turning into marine animals with fins. Yet, whales lost neither their lungs nor reproduction method; these two features distinguish them from other marine species that use gills to absorb dissolved oxygen and reproduce by laying eggs. As such, the fossils of the Whales Valley serve as hard evidence that documents how species evolve and adapt with the changing environment for survival.

Prominent Fossils of the Whales Valley

Discoveries of fossils in the Whales Valley started in early twentieth century; yet, they flourished as of the 1980s. Now, let us shed light on two of the most prominent fossil discoveries.

In 2005, the accomplishment of the excavation work of a complete *Basilosaurus isis* fossil was announced. The excavation was a joint research project between the University of Michigan and the Egyptian Environmental Affairs Agency. This whale was 18 meters long, and swam in an S pattern, like a snake moves. This distinguished fossil was chosen to be the masterpiece of the Fossil and Climate Change Museum, inaugurated in Whales Valley in 2016, to be the first of its kind in the Middle East.

In 2008, an Egyptian research team from Mansoura University Vertebrate Paleontology Center (MUVPC) discovered a fossil of a new species and genus of whales in the Valley. The fossil belongs

to a predator amphibious whale with four limbs and is the most primitive fossil from the Protocetidae family. The whale was three meters long, and weighed about 600 kilograms. Researchers dubbed it *Phiomicetus anubis*, after the ancient Egyptian god of death, since the whale's skull bears a resemblance to the skull of the jackal-headed Anubis. The team carried out extensive research before publishing the paper announcing its discovery in the *Proceedings of the Royal Society Journal*, in August 2021.

Indeed, the Whales Valley is an exceptionally significant and distinguished site. In 1997, the Egyptian Government announced it a Special Protected Area within Wadi El-Rayan Protected Area. Also, UNESCO has inscribed it on the Natural World Heritage Sites list in 2005. The area has also received a Guinness World Record for containing the highest concentration of Eocene whales in 2010. In addition to the importance of the Valley for studying natural history, it is also home for some threatened species, such as the Egyptian gazelle and the fennec fox, and is an Important Bird Area (IBA) for rare migrating birds, such as the peregrine falcon and the osprey.

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Mermaid

between

Myth, Culture, and Fact

By: Jailane Salem

Water bodies have always inspired myths and legends because of the central role they play in most societies. Myths are different from folktales in that, at one point, people believed myths and they are linked to how early history is told and passed down from one generation to the next. On the other hand, folktales are fictional stories told to either offer a moral lesson, give commentary on society, or explore what it means to be human, and can include fantastical and magical elements.

One enduring myth is that of the mermaid. While there are many mythical creatures that have captured our imagination, mermaids have had quite a strong hold being quite prominent until this day. The idea of the existence of a half human and half fish creature is one that is found in many different cultures around the world. Mermaids were sometimes believed to be divine beings. One of the earliest myths, dating back to 1000 BCE, was that of the goddess Atargatis; it originated from what we now know as modern-day Syria where archaeologists found coins depicting Atargatis as a mermaid.

Whether in myths or folktales, the symbolism of mermaids has never been the same. Sometimes, they were harbingers of bad luck, luring sailors to their demise or forewarning oncoming floods or storms; some other times, they symbolized good luck, fertility, and abundance. Interestingly, a 14th century Swedish mapmaker known as Olaus Magnus drew mermaids and sea monsters to denote dangerous geographic areas. Later on, from the 16th century to the 20th century, European sailors adopted a positive view of mermaids and often used them as the figurehead of their ships. They believed that mermaids could help them have a safe passage and help make navigation easier.

Mermaids were described differently in different cultures; some had one fish tail while others had two. Some looked just like humans but could live underwater, like in the story of “Julnar”, the sea-born, and her son, “King Badr Basim” of Persia, which is told in the *One Thousand and One Nights*. The storyteller, “Shahrazad”, recounts the story of “Julnar”, a mermaid who ends up leaving her underwater kingdom and marrying a king on land, giving birth to a future king who can go between the underwater kingdom and the kingdom on land. Thus, she creates a bridge between those two realms; through her story we see how people from different backgrounds can come

together and create a mutually respectful relationship.

In Literature and Cinema

The Middle Eastern folktale mentioned above is very different from the well-known European story, *The Little Mermaid*, which was written by the Danish author Hans Christian Andersen and published in 1837. The latter recounts the story of a young mermaid who falls in love with a human prince; she drinks a potion to turn her fish tail into legs and in return she becomes mute. In order to remain alive, she has to get the prince





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fall in love with her; alas, he does not. To regain her fish tail and preserve her life, she would have to kill him; however, she cannot go through with it and dies. This story highlights different themes, one of them is sacrificing oneself for love, and another is how being different can marginalize you.

Due to its worldwide popularity and many translations, this story has had great worldwide influence, and has had quite the impact on other retellings of mermaid tales. In popular culture, when we think of mermaids, the Disney movie, *The Little Mermaid*, which was released in 1989, comes to mind. While it used Andersen's story as its source material, it took quite a few liberties in its retelling so that it has a happy ending.

Encounters and Revelations

In real life, many of the accounts of mermaid sightings were given by sailors and fishermen. One of the most well-known accounts is that of the famous explorer Christopher Columbus, found in *The Northmen, Columbus and Cabot, 985–1503*, where he wrote: "[o]n the previous day, when the Admiral went to the Rio del Oro, he saw three mermaids, which rose well out of the sea; but they are not so beautiful as they are painted, though to some extent they have the form of a human face. The Admiral says that he had seen some, at other times, in Guinea, on the coast of the Manequeta".

It is believed that what sailors saw were actually dugongs; marine mammals belonging to the Sirenian family. Dugongs come to the surface to

breathe and are mistaken for mermaids because of their round heads, their ability to turn their heads, and their tails, which resemble those of whales. If, in the dark or from a distant point, a sailor spots the head come up to breathe and then sees the tail as it swims back down, then it is not far-fetched that they would think that what they saw was the culturally-rooted half-human half-fish creature: a mermaid.

Dugongs live in warm shallow coastal waters in the Indian Ocean and Pacific Ocean. They are native to the Red Sea in Egypt and are sometimes seen in Marsa Abu Dabbab. Dugongs can grow up to 3 meters in length and weigh up to 500 kilograms; they can live up to more than 50 years. Dugongs are also known as sea-cows because they graze the seabed grass.

Their feeding behavior perform a major role in their coastal marine ecosystems. The constant grazing of the seagrass encourages its regrowth, which sustains this critical habitat, and reinsures the feeding sites for other marine species, including sea turtles. However, due to their slow reproductive rate and habitat loss, their numbers are decreasing and the species is marked as vulnerable.

In Egypt, aggressive coastal development without much foresight to the environmental impact poses threats to the Dugong population. These creatures need sufficient amounts of seagrass to feed on; yet, chemical pollutants resulting from coastal development end up in the sea, damaging their delicate ecosystem and threatening their food

supplies. Dugongs end up putting off mating and reproduction, which is trouble to their population size and their numbers dwindle dramatically.

Some organizations champion the dugongs of Egypt, one of which is an NGO known as Hurghada Environmental Protection and Conservation Association (HEPCA). In 2007, HEPCA joined hands with the Red Sea Governorate and the Ministry of Environment to develop a management strategy to protect the Bay of Marsa Abu Dabbab. They agreed to prevent the free ranging of motorized boats in the area, since dugongs can be hit or caught in fishing nets. They also stationed rangers whose job is to enforce the management strategy and raise public awareness about dugongs and the need to protect and conserve their environment.



The sea is a wonderful resource of lore and marine life. While stories keep us captivated across the ages, we must not forget the actual source that inspired them in the first place. Especially when it is sorely in need of protection as pollution and climate change take their toll. While mermaids are not real, dugongs are, and we owe it to them to keep it that way.

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Kelp Forests:

The Jewel of Marine Ecosystems

By: Basma Fawzy

Whenever the word ecosystem is mentioned, most people think of terrestrial systems; many often forget that ecosystems also exist underwater. An ecosystem, according to *National Geographic*, “is a geographic area where plants, animals, and other organisms, as well as weather and landscape, work together to form a bubble of life”. Ecosystems underwater are different from those on land, but they are not of any less importance. Let us find out more about underwater ecosystems; where they exist, and how they look like.

Underwater ecosystems are known as marine ecosystems; each characterized by its unique animals, plants, and microbes. Differences between marine ecosystems can be related to the amount of sunlight in the ecosystem, if it is near the land or deep in the ocean, the temperature, etc. There is disagreement among scientists when it comes to their diverse types; some of the agreed-upon marine ecosystems include estuaries, mangrove forests, coral reefs, kelp forests, salt marshes, the deep-sea ocean, and the open ocean.

If you have watched Disney Pixar’s *Finding Dory*, you would probably be familiar with how kelp forests look like. Yes, it is that place with long dense plants at Morro Bay, California, next to the fictional Marine Life Institute, where Dory searches for her parents. In fact, Kelp forests do exist at the same location, along the West Coastlines of the Americas, beside other areas around the globe. Kelp depends on light to perform photosynthesis, so they mainly exist in relatively shallow waters.

Kelps are giant fast-growing marine algae; they belong to the brown algae group known as Phaeophyta. Kelp forests are highly dynamic and productive ecosystems that provide a living environment for invertebrates, fish, and marine mammals. Gray whales use them as a shelter for their young.

Kelp is covered with a slimy mucus rich in organic compounds, which encourages the growth of bacteria and eventually forms the building blocks of the food chain. If there is one word that can perfectly describe the kelp forest, it is “diversity”; it hosts numerous types of marine animals and plants.

A significant and unique example of these sea forest ecosystems is the **Great African Sea Forest**, which extends for 1000 kilometers from Cape Town, South Africa, to Namibia, and is almost 100 meters wide. This is one of the most important sea forests in the world, as it provides shelter and food for many species including sharks and the abalone, an endangered sea snail. In an article published in the CNN website, Craig Foster, a filmmaker and a diver, talks about the wonders of this Sea Forest and the need to conserve it. So, what makes the African Sea Forest unique? It is simply the “only forest of giant bamboo kelp on our planet”.

Unfortunately, kelp has seen a 75% reduction in some areas due to pollution, human activity, climate change, among other reasons. Among the dangers that face kelp is the “Sea Star Wasting Disease”. Sea urchins feed on kelp; normally, sea stars, a predator of sea urchins, keep their number balanced. However, this disease causes the predator numbers to decrease and the prey to feast on kelp.

Like terrestrial forests, sea forests are vital habitats for huge numbers of marine species; they are a vital source of food for sea animals. Not to mention their importance for human settlements and bird nesting sites near the shores, which they protect by dampening the effects of waves and preventing erosion of the coastline. Without doubt, kelp forests deserve and need our protection.

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Aquatic Plants: Friend or Foe?

By: Ahmed Adel

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Aquatic plants can live in saltwater or freshwater; they grow in or near water. They are also sometimes known as macrophytes—large plants—to distinguish them from the microphytes that are common in aquatic environments. Being an essential component of life in seas and rivers, native aquatic plants play a vital role in maintaining balanced aquatic ecosystems. They are an essential source of oxygen, which they produce during photosynthesis, for the respiration of marine organisms. They also form the bases of aquatic food chains.

Moreover, they perform major tasks serving humans and wildlife, including resisting beach erosion. They also help keep sediments on the bottom, keeping the water clearer. Aquatic plants absorb pollutants from water and compete with harmful algae for nutrients; thus, reducing their reproduction. They are also a food source for creatures other than fish, such as turtles, frogs, ducks, and birds. Last but not least, the best fishing spots are usually near aquatic plant beds. The fish eat the insect larvae, snails, and other organisms living on the plants. Some fish also consider them hiding spots from predators or for spawning.

Aquatic Plant Types

There are great differences among aquatic plants; some are quite similar to terrestrial plants, while others are totally different. Aquatic plants can be divided into four types, according to the position of their roots and leaves in water: algae, floating plants, submerged plants, and emerged plants.

- **Algae** are the oldest and most common type of aquatic plant; they have no roots, stems, or leaves. Although algae

are tiny, they are the basis of the ocean food chain; musk grass is an example of freshwater algae.

- The leaves of **floating plants** float on the water surface; their roots absorb water, and they live in freshwater or saltwater. The leaves of these plants are hard and flat, which helps them absorb more sunlight. Water lilies are an example of floating freshwater plant.
- **Submerged plants** are completely submerged under the water surface and their leaves are thin; hydrilla is an example.
- **Emerged plants** are rooted on the water bottom, but most of their leaves are above the water surface. They need constant exposure to sunlight; an example is the knotweed herb.

When can aquatic plants become a foe?

Overgrowth of aquatic plants can cause problems in the aquatic environment, especially when they die and decompose. Invasive plants—Eurasian watermilfoil algae is a well-known example—are a major problem

in aquatic environments. They are not indigenous, or native, to the ecosystem; their introduction may cause harm. Invasive species include microalgae or microphytes, and macrophytes; they may invade both freshwater and saltwater environments, as well as wetlands, lakes, rivers, estuaries, coastal areas, and even extend into irrigation systems, hydroelectric systems, and aquaculture facilities.

Unlike native plants that are an essential part of their aquatic environment, invasive aquatic plants pose a serious threat. They spread so quickly, forming dense mats of plants that harm fish and the aquatic environment, and hinder navigation, swimming, and other human activities. The widespread also enables it to replace other useful plant species indigenous to the area; even more dangerous is the extreme difficulty, perhaps impossibility, of controlling it.

One of the most famous invasive floating aquatic plants in Egypt is the water hyacinth (*Eichhornia crassipes*), commonly known as the “Nile rose”, which consume 10 million cubic meters of the Nile river annually due to transpiration. In one square meter, water loss from water hyacinths is about a hundred times that from the sunheat. Apart from the huge loss of water, air will have higher relative humidity.

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STILL WATERS RUN DEEP

Oceans, seas, and rivers are the best known water bodies on Planet Earth. Nevertheless, by no means are they the only water bodies worth marveling at. Water bodies constitute areas of water, salt and fresh, large and small, which are distinct from one another in various ways.

As we cannot possibly cover every single water body type, I decided to focus on those I have been lured to by beloved works of fiction inspired by the mystery and magic of those water bodies.

By: Maissa Azab

Tales of the Lake

Sometimes, it is difficult to pinpoint the type of a water body. For example, some classify the Caspian Sea as a lake, which in general terms represents a body of either freshwater or saltwater completely enclosed by land. Lakes may be huge—such as the Great Lakes of North America or Russia’s Lake Baikal, which is the deepest—or tiny; there is not a clear-cut distinction between “lake” and “pond”. A great number of processes create lakes; from glacial erosion and volcanic eruption to the damming—natural or manmade—of rivers.

One of the most famous Scottish Gaelic words, a “loch” is almost always a lake; in fact, nearly all freshwater bodies in Scotland are called lochs. Some lochs are not freshwater lakes; they are sea lochs, which are essentially tidal inlets. There are many sea lochs in Scotland, most of which along the Western Coast of the Island.

Reports of a monster inhabiting Loch Ness date back to Ancient Times. Notably, local stone carvings depict a mysterious beast with flippers. The first written account appears in a biography of St. Columba from 565 CE. Over the centuries, only occasional sightings were reported. Many of these alleged

encounters seemed inspired by Scottish folklore, which abounds with mythical water creatures.

In 1933, the Loch Ness monster legend began to grow, when a couple saw an enormous animal, which they compared to a “dragon or prehistoric monster”. A big-game hunter was commissioned to locate the sea serpent; along the lake’s shores, he found large footprints that he believed belonged to “a very powerful soft-footed animal about 20 feet [6 meters] long”. Upon closer inspection, zoologists at the Natural History Museum determined that the tracks were identical and made with an umbrella stand or ashtray that had a hippopotamus leg as a base.



In 1934, the iconic image—known as the “surgeon’s photograph”—appeared to show the monster’s small head and neck. Many speculated the creature was a plesiosaur, a marine reptile that went extinct some 65.5 million years ago. Several sonar explorations, notably

in 1987 and 2003, were undertaken to locate the creature, but none were successful. In 1994, it was revealed that the photograph was a hoax; the “monster” was a plastic-and-wooden head attached to a toy submarine.

In 2018, researchers conducted a DNA survey of Loch Ness to determine what organisms live in the waters. No signs of a plesiosaur or other such large animal was found, though the results indicated the presence of numerous eels. This finding left open the possibility that the monster is an oversized eel. Despite the lack of conclusive evidence, the Loch Ness monster remained popular—and profitable.

Marsh Magic

To kick off my summer readings, I started with a highly praised novel that was just turned into a movie, released this summer. *Where the Crawdads Sing* is the enthralling story of a little girl abandoned in the marshes of North Carolina in the fifties of the past century. “The Marsh Girl” raises herself hidden away from society, spending her days exploring and documenting the kaleidoscope of aviary and marine life surrounding her. Of course, there is more to the novel than that, but these settings have played a major role in the magic of the tale.



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Marshes are a type of wetland—a unique type of water body where standing water covers large areas of the local soil for all or most of the year. Wetlands are not what most of us think of when we picture a body of water; yet, they can be quite large and they often support aquatic animals, so they can certainly be classified as bodies of water. Marshes are important habitats for many species; they are particularly vital habitats for waterfowl, amphibians, and even fish, all of which find a safe haven in calm marshy waters.

Unlike swamps, which are dominated by trees, marshes are usually treeless and dominated by herbaceous plants—plants that have no woody stem above ground, and which grow and die back on a regular cycle. Marshes are common in deltas, where rivers empty into a larger body of water. Marsh plants grow in the waterlogged, but rich, soil deposited by rivers; roots bind to the muddy soil and slow the water flow, encouraging the spread of the marsh. Although all are waterlogged and dominated by herbaceous plants, they each have unique ecosystems.

Marshy Shields

Tidal saltwater marshes form a grassy fringe near river mouths, bays, and along coastlines protected from the open ocean. Ocean tides fill the marsh with salty water and cause the water level to rise and fall twice a day. Plants such as sawgrass and pickleweed can tolerate fluctuating tidal waters, which are too salty for most trees and bushes.

Tidal freshwater marshes lay farther inland, but are close enough to the coast to be affected by tidal fluctuations. They are fed by freshwater streams and do not have a large salt content; they are common boundaries between forests

and rivers. Herbaceous plants known as sedges dominate the tidal freshwater marsh ecosystem; they include water chestnut and papyrus.

Marshy papyrus is one of the most important plants in the development of civilization: Papyrus growing in the marshy delta of the Nile River was dried, treated, and used as an early form of paper by ancient Egyptians.

Both saltwater and freshwater tidal marshes serve many important functions. They buffer stormy seas, slow shoreline erosion, offer shelter and nesting sites for migratory water birds, and absorb excess nutrients that would lower oxygen levels in the sea and harm wildlife.



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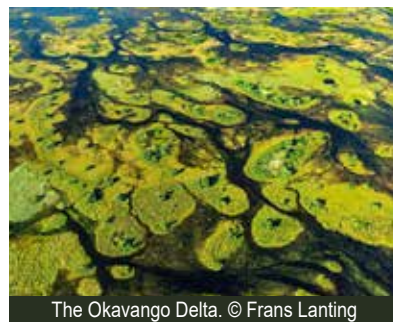
As marshes are drained for industrial and agricultural development, this layer of protection is diminished. Storm surges have no marshy “sponge” to absorb the water and wind. Fisheries are also reduced; the reduced habitat for fish decreases their population as more animals compete for fewer resources.

Draining marshes also increases saltwater intrusion, which reduces the amount of freshwater for hygiene, drinking, industry, and irrigation. Saltwater intrusion also changes the chemistry of the tidal marsh, making it much more saline. Some species, such as cordgrass, can adapt to these changes, but more delicate species are unable to adapt quickly and may become endangered.

Finally, draining marshes increases the direct runoff flowing to the ocean. Marshes are able to absorb toxic chemicals that leach into waterways from pesticides used in agriculture, as well as industrial pollutants. Without the marshy sponge, runoff flows directly to the ocean, often creating coastal “dead zones” where there is little life below the water’s surface.

Marshy Wonderland

Inland freshwater marshes form along the borders of lakes and rivers where the water table, the upper surface of underground water, is very high. They vary in size, from bowl-shaped depressions called prairie potholes, to the vast, watery grasslands of the Florida Everglades. Vegetation in freshwater marshes depends on the presence of water. Wet meadows, for instance, do not have standing water for most of the year; they do not support aquatic plants. Plants establish seeds on a yearly basis, and only bloom with annual or biannual flooding of the meadow. Other freshwater marshes are much more aquatic.



The Okavango Delta. © Frans Lanting

The Okavango Delta in Botswana is probably the largest freshwater marsh in the world. The Okavango River empties into the Kalahari Desert, forming a delta in an arid region instead of near an ocean or lake; the Okavango Delta is a series of marshes totaling about 15,000 km². Okavango marshes are made up of dense beds of papyrus, water lilies, and underwater plants such as bladderworts. The Okavango Delta is a haven for a diverse number of animal species. Some animals live directly in and around the marshes, such as hippopotamuses and crocodiles. Other animals, such as giraffes and elephants, use the marshes as a source of freshwater in the middle of the dry Kalahari Desert.

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BEST FISH FOR YOUR DISH

By: Ahmed Adel

Eating fish is a healthy habit; fish provide nutrients, proteins, and Essential Fatty Acids (EFAs) that the body needs. They also provide high levels of vitamin D, vitamin B12, selenium, and protein. Fish are also the best food source of Omega-3, which are essential fats that our bodies do not produce and play an essential role in brain and heart health. They have been proven to have anti-inflammatory properties, reduce the risk of heart disease, and are essential for the development of fetuses.

There are several health benefits of eating fish regularly, such as reducing depression and risks of autoimmune diseases; increasing focus; resisting Alzheimer's; reducing risks of heart attacks and strokes; improving sleep quality; and preventing insomnia, lower blood pressure, and cancer. Since fish are a low-fat protein source, incorporating it into the diet leads to weight loss. The American Heart Association recommends eating fish at least twice a week; especially fish rich in Omega-3 fatty acids.

On the other hand, some other types of fish are not safe to eat, including those with high levels of mercury or contaminated with certain types of bacteria or harmful compounds that can cause health problems. Thus, one should be cautious when consuming such types, especially when nursing or pregnant. Dangerous types include

Spanish mackerel, eel, tilefish, shark, and swordfish.

Fish that are considered healthy are:

- 1) **Salmon:** all types of salmon contain Omega-3 fatty acids, which are beneficial for heart health, and are also a good source of vitamin D and calcium.
- 2) **Tuna:** eating tuna moderately is safe, as it is low in calories and high in vitamins and proteins. Some tuna types, such as canned white or albacore tuna, have a higher mercury content than canned light, or skipjack, tuna. Consumers, thus, should make sure not to overeat items that contain higher mercury levels.
- 3) **Cod:** it is a good source of phosphorus, niacin, and vitamin B12, and high in protein; yet, low in fat and calories. This makes it an ideal choice for people who are trying to control their body weight. Each 85 grams of cooked cod portion contains 15–20 grams of protein.
- 4) **Mackerel:** it has more Omega-3s and vitamin B12 than other types of fish. It is a high-mercury fish, so one should be careful not to overeat it, and it is preferable to choose smaller mackerel.
- 5) **Herring:** it is a beneficial source of Omega-3 fatty acids; each 100 grams contain 18 grams of protein and 14 micrograms of vitamin B12. People should be aware when eating pickled or

smoked herring because it contains a high percentage of sodium.

Famous Egyptian Fish Dishes

Egyptian fish vary between saltwater fish from the Red Sea and the Mediterranean, and freshwater fish from the Nile River, Egyptian lakes, and fish-farms. In 2020, Egypt's fish production reached two million tons from fish-farms and fisheries; to rank the first in Africa and the sixth worldwide in fish-farm production.

Egypt's saltwater fish comprise sardine, grey mullet, coral, red bourbon, *Argyrosomus regius*, brushtooth lizardfish, greasy grouper, and lethrinus. Egypt's freshwater fish comprise Nile tilapia, the African sharptooth catfish, the grass carp, and the African bayad. As for fish-farms in Egypt, they comprise tilapia, mullet, European seabass, and gilt-head bream.

The tilapia fish is one of the most famous Egyptian fish. It is inexpensive and is rich in protein; each 100 grams contain 26 grams of protein and 128 calories only. Tilapia also contains good amounts of vitamins and minerals; it is rich in niacin, vitamin B12, phosphorous, selenium, and potassium. Yet, each 100 grams contain 240 milligrams of Omega-3 fatty acids only; that is, ten times less than salmon. Tilapia is also high in Omega-6 fatty acids, which are not recommended for cholesterol and heart patients, rather than it does Omega-3. Generally, freshwater fish are low in beneficial Omega-3 fatty acids; unlike most saltwater fish.

Now that you learned several health benefits of eating fish, I advise you, dear reader, to consider fish an essential part of your diet. It is vital to be careful about fish with high levels of mercury, not to mention the importance of following the instructions of local health authorities regarding avoiding eating some types of poisonous fish; the best examples in Egypt are takifugu or rabbitfish.

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By: Seham Elsherif

ALGAE AND DRUGS DEVELOPMENT

The seas and oceans are teeming with hidden treasures that have not been discovered yet. Marine life is characterized by the diversity of its living creatures, whether plants or animals. As technology flourished and underwater diving equipment developed, humans have a greater opportunity to explore this world now. In recent years, researchers have been able to extract many drugs from marine creatures, such as sponges, corals, and algae.

Algae belong to the kingdom of protozoa; they are either unicellular, such as diatoms; or multicellular, such as seaweed, like brown, red, and green algae. Algae are similar to plants, as they contain chloroplasts and perform photosynthesis to obtain energy; however, they do not have roots, stems, and leaves like plants. Some species are similar to animals, as they move using false feet or flagella.

Microalgae live suspended in water, forming phytoplankton, which is the main food for most ecosystems. Multicellular algae can grow as big as trees forming kelp forests, which is the main source of food for cold water ecosystems. Algae can live in extreme conditions due to chemicals deposited in the wall of the cell.

Algae have a vital role on Earth, as they maintain the levels of carbon dioxide and protect against climate change. As for their uses in industry, they are

included in the manufacture of biofuels, food, medicine, cosmetics, and nutritional supplements. Algae are used as food supplements because they contain substances such as carotenoids, which have antioxidant properties. Algae also contain all kinds of amino acids that are not created by the human body and are necessary to protect against free radicals.

Moreover, algae are used in drug development because they contain chemical and biological compounds with diverse properties. Some algae contain fibers and proteins that are anti-inflammatory, anti-bacterial, anti-fungal, and anti-viral. Furthermore, they contain many compounds such as fats, steroids, polysaccharides, fatty acids, and vitamins. However, the field of algae-based drug development is still in the bud. Hereunder, we will introduce some different studies on algae and their use in drug development.

Researchers at the University of Florida and the Smithsonian National Museum of Natural History have been studying blue-green algae, which are single-celled organisms that live both in water and on land. These algae communicate and defend themselves by secreting chemical compounds. By studying these compounds and their medicinal properties, they discovered that a type of blue-green algae secretes a substance called Gatrobulin-1, which has an anti-cancer effect. The researchers studied this compound and

how it eliminates cancer, and found that it targets the tubulin protein, which has a role in cell division. Even though there is an available anti-cancer drug targeting the tubulin, researchers found that it works in a different way.

Algae can be used in producing certain proteins that are used in the manufacture of biopharmaceuticals. Researchers at the University of California, San Diego, used genetic engineering techniques to insert some genes into the green algae *Chlamydomonas reinhardtii* to produce several proteins.

Recombinant protein-based biologics began to enter the market in 1982. In order to produce these drugs, bacterial or yeast cells or mammalian cell cultures, such as Chinese hamster ovary cells, are used. Establishing a single factory costs 400 million dollars; however, an algae-based factory would cost 20 million dollars only, as it only needs to complete photosynthesis from sunlight, carbon dioxide, and water, in addition to the low cost of green algae. If algae are used in the production of biological drugs for cancer and multiple sclerosis, the price of these drugs will decrease.

In a study at the University of South Australia, researchers using genetic engineering were able to use algae to deliver cancer drugs to the target cells. Usually, nanotechnology-based drug delivery systems use graphene; however, in this study the researchers used a type of diatoms instead of graphene. These diatoms are made of silica, a material that does not corrode quickly and is biodegradable. The diatoms were modified and coated with a layer of antibodies that target the cancer cells. This system has been tested in the laboratory and on mice; the results indicate its efficacy.

The future of pharmaceutical industry, related to algae-based drugs, is promising. We hope that these drugs will compete their well-known counterparts in the market in terms of efficiency and cost.

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THE SECRET COLOR OF THE DEEP

By: Marwa Gaber
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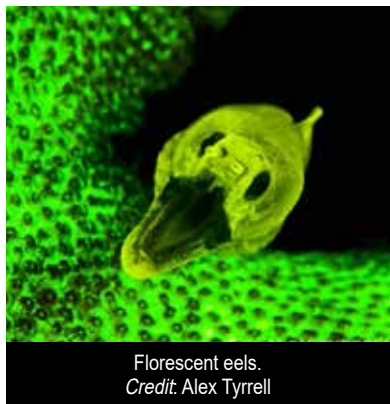
Over the past decade, scientists have discovered that the seemingly dark deep sea is actually ablaze with color!

There is a lot of confusion between the phenomena of fluorescence and bioluminescence. These two “escences” are distinct but related; some people have even made up a term “Biofluorescence”, which some feel just adds to the confusion. Bioluminescence is the animal’s ability to produce light in complete darkness. In contrast, fluorescence only happens as long as there is an excitation light shining; it is not visible in total darkness.

According to David Gruber who is a marine biologist and National Geographic Explorer at Harvard University, bioluminescence is the equivalent of glow sticks that we crack open on various celebrations and fluorescence is more akin to fluorescent paint glowing under a blacklight. From corals to sea turtles to eels, countless marine species are fluorescent, or have the ability to reflect the blue light hitting a surface and re-emit it as a different color.

Fluorescence is a passive physical property of many molecules; unlike bioluminescence, it is not something that animals can actively turn on and off. Fluorescence is a process where high-energy light temporarily excites

electrons in a molecule. When the molecule relaxes, the energy is re-emitted as a lower-energy photon with a longer wavelength. For example, blue or violet light is often used to excite green, yellow, or red fluorescent emission.



Fluorescent eels.
Credit: Alex Tyrrell

Look beneath the ocean’s surface and you will immediately notice how water transforms light. Colors appear differently here, because water absorbs warm colors such as red and orange (known as long wavelength light) and scatters the cooler colors (known as short wavelength light).



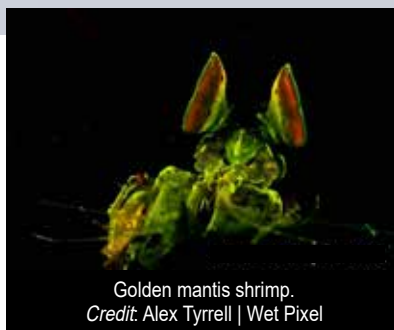
Jervis Bay Australia. Source: InsideHook

If you take a red object under water with you, the deeper you go the less red it will appear. This happens because there is a small amount of red light available to reflect back to your eye. Remember that a red apple appears red because it absorbs all other colors and reflects red light. If there is no red light available, the apple will look gray or black.

You can demonstrate this for yourself; cover a flashlight with a blue filter and use it to look at a red object in a

dark room. Against a black background the red object will seem to disappear. It is important to remember this fact when you see pictures of bright red animals in the deep ocean. We can see they are red, because we use bright white lights on the submersible to illuminate them. However, in the dim blue light, which is their natural environment, they will appear gray or black.

Water not only changes the color of sunlight, it dramatically changes its intensity. In clear ocean water, visible light decreases approximately 10-fold for every 75 m that you descend. This means that at 75 m the light is 10% as bright as it was at the surface; and at just twice that depth, 150 m, it is another 10-fold dimmer, or 1% of surface light. Below this depth there is insufficient light for photosynthesis, but there is still plenty of light for seeing.



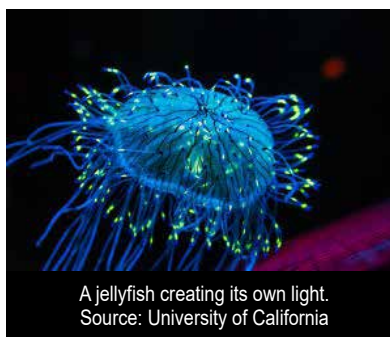
Golden mantis shrimp.
Credit: Alex Tyrrell | Wet Pixel

Light conditions affect the functionality of both human eyes and fish eyes. Human eyes, for example, are functional in bright sunlight at high noon and under dim starlight on a moonless night. This is a range of about 12 “orders of magnitude” with each order of magnitude representing a 10-fold difference. Under water (where light decreases 10-fold with every 75 m of descent), the human eye theoretically can detect light down to almost 900 m. The eyes of deep-sea fish, however, may be functional down to 1000 m. Their eyes show remarkable adaptations and may be 10 times to 100 times more sensitive than ours. Even below 1000 m there are many animals with functional eyes. These eyes that have evolved to detect bioluminescence (the emission of light by a living organism).

Ocean animals that can make light are everywhere, often in very high abundance. Bioluminescence is common because it provides a significant survival advantage in the dim dark depths. (On land, bioluminescence is a relatively rare phenomenon, with fireflies being the best-known light-producers.) It helps animals find food, either with the aid of a built-in “flashlight” or by means of a “lure”, and it is used to attract mates and to defend against predators.

Bioluminescent beach in the Yellow Sea, which is one of the areas that have the most incredible upwelling systems on the planet, and thus the highest regions of phytoplankton productivity and bioluminescence. Bioluminescence is exhibited presumably as a defense mechanism; when zooplankton comes up and starts to chew on it, it flashes in hopes of scaring predators.

Bioluminescence serve many functions in the ocean. However, many of the functions are still unknown, because experimental evidence has been gathered for only a few of the many proposed roles. Luminescence can serve two or more purposes, both offensive and defensive, within a single organism. Here we summarize the range of functions that have been proposed for marine bioluminescence.



A jellyfish creating its own light.
Source: University of California

The light is the product of a very efficient chemical reaction, in which the chemicals are synthesized by living organisms. These chemicals are referred to as luciferin and luciferase, which often leads people to assume that all animals produce the same light-producing chemicals. However, there are a number of different luciferins

and luciferases, which indicates that bioluminescence evolved multiple times during evolutionary history; a clear indication of what an important survival advantage it provides.

The unique bioluminescence exhibited by certain species of catsharks is generated by a novel family of metabolites (chemical substances produced in the body itself, during processes such as respiration or digestion) not identified until recently, and which are present exclusively in the dark stripes of the skin of these sharks—specifically the chain catshark (*Scyliorhinus retifer*) and the swell shark (*Cephaloscyllium ventriosum*).



Bioluminescence of swell shark.
Source: Wikimedia.

The survival advantage of bioluminescence in many mid-water animals seems apparent, but the same cannot be said of the bioluminescence of the animals that live on or near the bottom of the ocean. There is much we still have to learn about how animals have adapted to survive in these dim depths.

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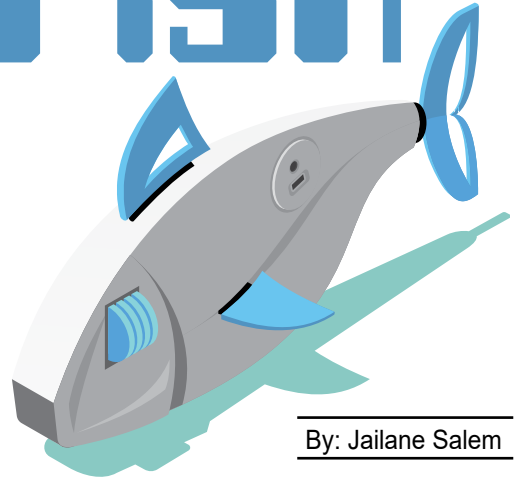


Robot-Fish



to the

Rescue



By: Jailane Salem

Our planet is plagued with numerous problems; some are old, some are new, and many are manmade. One problem we are facing is that of Invasive Alien Species (IAS). These are plants, animals, and organisms that find their way into ecosystems they are not native to. Sometimes they are introduced by accident and sometimes they are introduced on purpose, for example as a pest control method.

The issue that can arise is that—as the name suggests—they become invasive and a pest themselves. They can negatively impact the new ecosystem by attacking native species or outcompeting for food sources. As a result, native species encounter the danger of extinction or have to move elsewhere because their habitat has become so altered that it is no longer livable for them. In short, IAS have a detrimental effect on biodiversity.

One IAS that was introduced on purpose in places around the world is the mosquitofish. As the name suggests, the little fish was thought to help in decreasing mosquito populations by preying on its eggs. It was introduced in the early 20th century to fresh waterways as a way to limit the spread of malaria-carrying mosquitos.

Yet, how did the little fish, which was supposed to help, land on the 100 world's worst invasive species list by the International Union for Conservation of Nature (IUCN)? Well, it turned out that the mosquitofish was no better at fighting off mosquitos than the mosquito's natural predators. Alternatively, the mosquitofish was good at colonizing the new ecosystem, outcompeting other native species for food, and attacking and damaging the tails of other fish and tadpoles. Mosquitofish are highly predatory and eat the eggs of economically desirable fish, which impacted the fishing industry. It also pushed many rare and indigenous species to becoming endangered, in countries such as Australia and Spain.

The optimal way to deal with IAS is to prevent them from occurring in the first place, because once they become established in a given ecosystem, they are extremely difficult and expensive to remove. One of the reasons the mosquitofish became an IAS is that the new ecosystems lacked a natural predator to keep their numbers in check. However, as innovative technologies are developed, researchers are finding novel ways to deal with the problem.

An international team of researchers from the University of Western Australia (UWA), University of Padova, and New York University, led by Dr. Giovanni Poverino, have been developing a robotic predator that can curb the spread of mosquitofish. They created a robot-fish in the likeness of the natural predator of the mosquitofish, the largemouth bass, and designed it to exhibit the predatory mannerisms that would scare off mosquitofish.

The robot is equipped with an algorithm to attack mosquitofish if they approach tadpoles, making them flee in fear. In this way, the endangered tadpoles can develop in safety without being harassed by the predatory behavior of mosquitofish. Dr. Poverino and his team realized the opportunity that this provided and designed the robot-fish to affect the mosquitofish behavior.

By introducing this robotic predator, the mosquitofish became more preoccupied with survival and exhibited more anxious responses; their health deteriorated and their fertility decreased. What is interesting is that those effects lasted weeks after the robot-fish was removed from the tank where the experiments took place. Instinctively, the mosquitofish flight or fight response is programmed to respond to their natural predator, even though they lived in ecosystems where they have never encountered them. The robot-fish was able to switch on these instinctive fear responses.

In an interview, Dr. Poverino said: "Our approach also has a non-lethal effect. We are stressing them in a very natural way by replicating predator-prey dynamics. . . We developed a robotic tool, but we also established a piece of knowledge: by injecting fear, you can cause a long list of collateral effects on the long term."

While the research team discovered an effective way to control, and maybe eradicate, the mosquitofish population, they are still working on how to translate their findings and solution from the lab into the real world. Hopefully, this work comes to fruition; if it does, it would be a great asset to have in the fight against invasive species, and different models can be developed for various IAS.

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FISH-INSPIRED INNOVATION

By: Hend Fathy

Humans are but a single part in a massive natural system that encompasses an infinite myriad of creatures and natural elements. However, God has bestowed the magnificent gift of the intellect only on mankind, which has enabled us to build our longstanding civilization.

Throughout history, the human mind has always drawn inspiration from the surrounding natural elements to find solutions for challenges and design novel creations—from tools, inventions, architecture, materials, to artworks. In scientific terms, this process is known as biomimetics or biomimicry. Although it is an ancient practice, the scientific concept of biomimetics was first introduced in the 1950s by American biophysicist and inventor Otto Schmitt, giving rise to a multidisciplinary field of scientific research based on the simple idea that nature is the wisest teacher and innovator could ask for.

Just like silkworms inspired the silk industry, pigeons inspired aviation, and the footpads of reptiles and insects inspired super adhesive substances, creatures of the hydrosphere also have their valuable input in human innovations. Let us investigate some of these.

Whale Flippers



It was wonderous for me to find out that the research work aiming to enhance the aerodynamics of wind turbines has actually been inspired by the hydrodynamics of the flippers of humpback whales. The bumps located on the front edge of the flippers change the distribution of pressure along the limb, helping the whales reduce drag and generate more lift.

Frank Fish, biologist at West Chester University, USA, published two research

papers in 2008 and 2011, in the *Integrative and Comparative Biology* Journal, tackling hydrodynamic flow control in marine mammals and the relevant biomimetic technological applications. A North American company put research into action, developing wind turbine blades that mimic the whales flippers. They advised the biomimetic blades more stable, quiet, and durable than conventional turbines. Also, they can produce the same amounts of energy at much lower wind speeds.

Shark skin



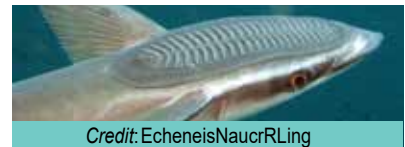
Credit: Sharklet Technologies 2007-2022

In Summer 2018, I wrote an article entitled "Athlete by Nature", where I tackled how shark skin is covered with tiny v-shaped structures that make them unbeatable swimmers. Known as dermal denticles, these structures create a vortex that sucks the shark forward and increase thrust. There have been several research trials to produce shark skin-like membranes to take advantage of the speeding effect.

Yet another merit of the dermal denticles have caught the attention of innovators; namely, inhibiting bacterial growth. Anthony Brennan, Professor of Materials Science and Engineering, was in a research mission aiming to keep algae from coating the hulls of submarines and ships when he observed that microorganisms such as bacteria tend not to land on shark skin. This inspired him to design adhesive films with dermal denticle micro-patterns.

When tested, these films successfully repelled more than 90% of bacterial attachment on high-touch surfaces, without the use of chemicals. Sharklet films, as Brennan dubbed them, can be particularly useful in hospitals and other health care facilities, enormously increasing overall surface hygiene and reducing contagion risks.

Suckerfish Disc



Credit: EcheneisNaucrRLing

Remoras, also known as suckerfish, are phoretic creatures; they depend on attaching themselves to hosts that offer them free rides, a safe haven, and a food source. Suckerfish is equipped with a suction organ in disc form—rather than a dorsal fin—on its head, which enables it to adhere itself by suction to other creatures. The disc is made of sturdy, yet flexible, membranes known as lamellae. These membranes have spinules that the fish control through muscles to form a low-pressure zone and generate suction.

A team of American and Chinese researchers took the remoras as an inspiration for engineering a biomimetic suction disc, and published the details of their innovation in the *Science Robotics* journal in 2017. To fabricate the main disc structure, they used multi-material three-dimensional printing techniques. Then, they added spinules made of carbon fibers.

The prototype successfully attached to different surfaces and generated considerable sucking force, up to 340 times the weight of the disc. This new adhesive gadget has promising applications such as attaching sensors and other equipment to the bodies of marine creatures to monitor and study them.

Mother nature does it best; this concludes it all. Now that Biomimetics has established its status as an essential field of research that has its own scientific journals and commercial technology companies, we only need to look out for other lessons nature can teach humans.

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AQUARIUMS:

By: Esraa Ali

An Ethical Debate as Deep as Ocean

I have fond childhood memories of aquariums that have shaped my perspective on marine life. I recall my first visit to the “Alexandria Aquarium” near Qaitbay Fort, and how I was deeply captivated by the beauty of the exhibited marine and freshwater species; as much as I was by real-life dolphins jumping out of the water at the then newly-established “Magic Land” amusement park in Giza. As I grow older, I remember those moments and wonder: Is taking marine creatures from the wild and keeping them in captivity for the sake of human entertainment ethical? Do aquariums have any other purpose beyond entertainment? Let us see!

Deep Dive

People have always been fascinated by underwater life, and always wish for an opportunity to get a good look at it in deep water. That was not possible before the invention of diving tools in the 19th century. However, naturalists and scientists came up with the idea of aquariums, which have changed people’s perspectives about marine life as they observed it up close—on land.

An aquarium is simply a tank, regardless of its size, filled with water to mimic the natural habitat of marine creatures. It may refer to a goldfish bowl, a small tank, or even a building; there are other types of open-air aquariums, where the climate permits. In these tanks, several different forms of aquatic life are put on display.

The history of aquariums dates back to early cultures, such as the Chinese, Egyptian, and Roman. In ancient aquariums, fishes were kept in artificial ponds that served as a place to breed fishes and for entertainment. Thousands of years later, aquarium-keeping became a well-established science as more studies furthered on the relationship between oxygen and marine creatures, based on studies of the photosynthetic reactions of plants, which were often performed with aquarium plants.

The concept is simply based on the exchange of oxygen and carbon dioxide by plants and animals. In an aquarium, it may be simply stated that fish utilize dissolved oxygen from the water in their respiratory process,

returning carbon dioxide, which plants absorb in the presence of sunlight and return oxygen to water.

In the 1800s, the term “aquarium”—the Latin root “aqua” means “water”, and the suffix “-arium” means “a place for”—started to be used after being coined by the British scientist Philip Gosse (1810–1888) in *The Aquarium: An Unveiling of the Wonders of the Deep Sea* (1854). It described creating a glass enclosure for marine life to inspire other scientists interested in the natural world in their exploration. Gosse, together with the English chemist Robert Warington (1807–1867), developed the “aquarium principle” on how adding plants to water in a container would produce enough oxygen to support animals, as long as their numbers do not grow too large.

This principle was applied to the first public aquarium in London, which was opened in 1853 and included around 200 specimens of marine animals and plants. Studies on aquarium science sparked widespread interest in the marine world, and the London aquarium was followed by others in Berlin, Naples, and Paris; amounting to 45 aquariums worldwide by 1928. This craze led to

a wide interest in studying underwater life by naturalists and discovering new marine species. Today, there are more than 200 marine aquariums and ocean life centers worldwide, according to Vancouver Aquarium.



An illustration by Gosse of anemones (a genus of flowering plants).
Credit: Heini Schneebeli/horniman.ac.uk

Cast Net

We all crave fun, but aquarium purposes go far beyond simple entertainment and profit-generation. Unquestionably, aquariums affect the degree of animal welfare, but this is balanced by conservation objectives.

Aquariums provide services such as the rescue and rehabilitation of sick and injured marine animals that are found locally. Aquariums provide these animals with the most effective and advanced care before returning them to their homes. Aquariums also provide access to living species for scientific research projects, as researching marine species in their natural habitats could be impossible. Such projects also serve animals wellbeing and conservation.

Beyond support for scientific research projects, aquariums can connect the society with nature. The details and modern construction techniques they offer for the exhibits go beyond mere shows. Aquariums simulate features and aesthetics of natural habitats, touching visitors and making them feel connected, so that, afterwards, they may support more actively.

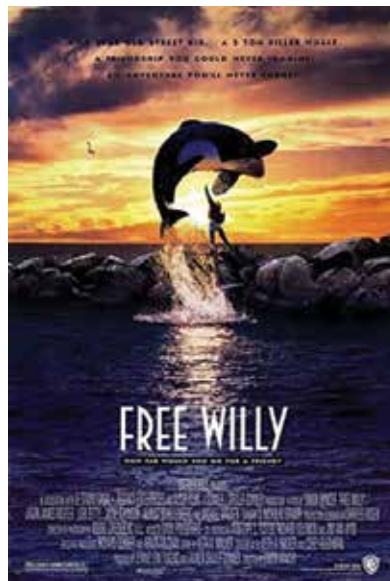
The aquarium is also one of the most useful teaching tools as it provides unique educational experiences for students of all ages. Within its transparent walls exists a whole world of exploration. Fortunate indeed is the child who gets an opportunity to discover its gems with the assistance of teachers, to experience science and get the real meaning of the balance of nature.

Fish in Distress

Since the 1990s, family motion pictures starring humanized colorful fishes, have greatly increased public interest in marine life. I recall, for example, the young blue dolphin *Delfy and His Friends* (1992) defending their habitat against greedy sharks, as well as the clown fish captured by scuba divers from the ocean to be placed in an aquarium in a dentist's office in *Finding Nemo* (2003). Similarly, *Free Willy* (1993) tells the story of a killer whale, or orca, rescued by a young boy from a tiny tank to rejoin its family into the wild. Sadly, the true story of the whale Keiko, which played Willy, did not end happily as it did in the movie.

Keiko was captured from the wild at the age of three, in 1979, and had been locked up for most of its life, living in a number of aquatic parks. The movie led to launching a campaign in 1998 to rescue Keiko from its tank. After five years of reintegration to adapt to its natural habitat, Keiko was released into the wild. After one year only, Keiko, which had been used to being fed by human handlers, sadly died of pneumonia at the age of 27, in 2003—orcas live an average of 35 years in the wild.

That wide interest of media in displaying marine life in various stories has led to a noticeable rise of interest in ecotourism, marine display and visitation. Aquarium visitors started to expect certain behavior from fishes, such as dancing or acrobatic displays, which lead



Credit: IMDb

to an increased pressure on the marine creatures themselves. The death of Keiko has raised a debate between aquarium supporters opposing animal rights activists.

The documentary *Blackfish* (2013) explores the devastating living conditions of dolphins and whales in zoos, aquariums, and parks. Several aquariums feature shows in which a trainer interacts or even rides the animal. These tricks and behaviors are unnatural to their instinctive behaviors, causing animals to react by injuring or even killing their trainers. All this leads to question: Why do we choose to keep and display these huge and very intelligent animals?

Fish in Tanks... No, thanks!

From my personal experience, I have raised two fish in a small bowl; the first died after two weeks and the second survived for a whole month. Despite my grief and seeing my dreams of setting up a larger fish tank vanish, the pet seller told me that it is a miracle to have a fish for such a period. I later learned that the lifespan of fish raised at home is much shorter and I decided to abandon such an idea as I realized the mistake was taking a fish from its own habitat to my home!

Nothing is similar to life in the sea; aquatic creatures are born to dwell in the majestic water and travel endlessly rather than the borders of a glass tank. Robbed of their natural habitat, delicate fish suffer when forced to live in those few inches of water; whatever the width of the aquarium, compared to their natural habitat. Now, after presenting the advantages and disadvantages of aquariums, what do you think?

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UNDERWATER MUSEUMS

By: Mahmoud Hagra
 Head, Temporary Exhibitions Unit
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Since ancient times, life underwater has captured human imagination; endless stories, old and new, of underwater cities and creatures with their own narratives have been told. Who among us has not heard stories like that of the submerged city of Atlantis, the inhabitants of which used advanced technologies and weapons, or stories of sailors about mermaids that called them by name and dragged them to the bottom of the ocean. Some of these stories were adapted in live or animation movies that imagined and tackled this mythical world.



The entire Earth has been effected as humanity evolved; even outer space has not escaped human tampering and the massive pollution caused by the industrial revolution as of the beginning of the twentieth century. The impact on the seas has led to the destruction of vast areas of coral reefs, negatively affecting marine life. Luckily, some attributes of human civilization can contribute to redressing coral reefs, by serving as artificial reefs that encourage coral growth, and ultimately promote marine biodiversity. A case in point are submerged cities and sunken ships, which also serve as underwater museums.

The Arab Republic of Egypt is rich with such sites. For example, the city of Heracleion—located around 2.5 kilometers from Abu-Qir Bay—encompasses remains of palaces, as well as several unique statues that feature a combination of ancient Egyptian and Ptolemaic sculpture styles. The United Nations Educational, Scientific, and Cultural Organization (UNESCO), in collaboration with several institutions in Alexandria, is planning to establish a large museum to showcase these monuments to the public, diving enthusiasts, and researchers. Also, there is the shipwreck site of Thistlegorm, sunk by German forces during World War II, near Ras Mohamed, Egypt. The site is among the world's best diving spots, and hosts a wide variety of marine creatures, such as the bat fish, barracuda fish, and grouper.

As interest in preserving the marine environment has grown, many researchers and artists have conducted studies on the use of environmentally-friendly materials for constructing more of these hard surfaces under water for coral reefs to grow on. Now, let us review some of the Museums established under the sea around the world.



Half Moon Beach Museum (Kingdom of Saudi Arabia)

A team of divers in the Eastern Province of Saudi Arabia established the first museum for the landmarks of Arab Gulf States, under the water of the Half Moon Beach, in Dammam. During their dive, visitors can see replicas of Al Faisaliyah Center and Kingdom Centre in Riyadh, the capital of KSA; as well as the Kuwaiti Towers, the Bahraini World Trade Center, and Burj Khalifa of the United Arab Emirates. In addition to serving as a tourist attraction, the Museum also contains fish-attracting pieces, aiming to revive marine life deteriorated due to the scarcity of coral reefs.



Cancún Underwater Museum (Mexico)

On Isla Mujeres, near the coast of the Mexican city of Cancún on the Caribbean Sea, British sculptor Jason deCaires Taylor, in collaboration with five other sculptors from Mexico, built an underwater museum, to be the first of its kind in the world. The Museum manifests a special interaction between art and the natural sciences. Known as Cancún Underwater Museum, it was established over the course of around four years, 2009–2013. The Museum comprises three blocks, two of which are submerged and contain 500 statues.

The idea of establishing this Museum originated with Jaime González Cano, Director of the Cancun National Marine Park, when he noticed the deterioration of the Manchones Reef—the largest in Cancún, Mexico—due to the high demand for tourists and divers to visit it. The main purpose of establishing the Museum was promoting the growth of coral reefs. The statues were sculpted from a special type of cement with a pH degree that encourages the growth of corals and attracts algae and various marine species over time.



Museo Atlántico (Spain)

Museo Atlántico is the first underwater museum in Europe, located at Lanzarote Island in Spain, off the coast of Bahía de Las Colorados. The Museum, inaugurated in 2017 after three years of construction, comprises more than 300 life-size statues. Museo Atlántico consists of twelve big blocks under water, also designed by the British sculptor Jason deCaires, representing his biggest project.

Divers can tour the underwater museum and admire the sculptures placed at a depth of around ten meters at the bottom of the sea. The statues were sculpted from pH-neutral materials to withstand for hundreds of years as artificial reefs where marine life thrives. In addition to the role Museo Atlántico plays in raising environmental awareness and placing marine life issues under the spotlight, some of its sculptures also shed light on the crisis of refugees and the displaced in Europe, with scenes of children rowing on fishing boats in search of hope. It is expected for the Museum to serve as a park and a living station for octopuses, sea urchins, and fish.

Human civilization and artistic creations cast their good shadows under the sea. They carry glimpses of the human history and culture, reflect the scientist's and artist's sense of responsibility towards the environment, and give hope to various forms of marine life and to the future of the planet.



A JOURNEY ACROSS THE SEAS AT THE PLANETARIUM

The Planetarium Science Center (PSC) displays weekly shows, two of which explore the secrets of seas and oceans in a super fun and exciting way.



The first, *Kaluoka'hina, The Enchanted Reef*, is suitable for children aged 4 years old and above. It narrates the amusing and interesting story of the glamorous and serene Kaluoka'hina tropical reef, the inhabitants of which live in peace. The depth of the ocean has guarded the charms of the reef until a volcanic eruption breaks the spell. As the story unfolds, a young saw-fish called "Jake" and his friend, the coral reef fish "Shorty", go on a mission to restore the magic that protects their home, the Kaluoka'hina reef. The show provides the target age group with much useful information about marine life, through the amusing narrative of an adventure



that appeals to all ages. It is also an educational show that raises children's awareness about the importance of conserving the marine environment.

The other show, entitled *The Great Barrier Reef*, is suitable for audiences aging 12 years old and above. The show is an epic adventure that documents the efforts exerted to conserve coral reefs. It helps us understand and preserve the wondrous vibrant marine world, through the large planetarium projection. Book a show ticket to go on your own virtual diving experience, to enjoy an adventure to remember at the Great Barrier Reef, where you can explore the natural, breathtaking, exquisite beauty

By: Nadine Elsarrag
Marketing Specialist,
BA Planetarium Science Center

of the world's most wondrous creatures. A native resident in the reef will take you on an expedition to many amazing natural wonders, swimming along with giant manta rays, sea turtles, sharks, and minke whales.

The PSC is an ideal place to enjoy a full day of edutainment. It believes in its pioneering role as a non-for-profit educational institution that aims to raise awareness, understanding, and public interest in science and technology through fun activities. It is worth mentioning that the PSC, affiliated to the BA Cultural Outreach Sector, is a member of the International Planetarium Society. The Planetarium theater is a cutting-edge facility featuring state-of-the-art projection technology to display a kaleidoscope of fascinating scientific shows that cover a diverse variety of scientific fields and are suitable for a wide range of groups. These shows bring the universe so close to the public they feel as if they are flying through space and time.



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Available Planetarium Shows

- Seven Wonders; 30 min.
- Kaluoka'hina: The Enchanted Reef*; 33 min.
- The Mission; 25 min.
- Great Barrier Reef; 42 min.
- To Space and Back; 25 min.
- Stars of the Pharaohs; 35 min.
- Oasis in Space; 25 min.
- Alexandria the Cradle of Astronomy; 22 min
- The Secrets of Gravity; 45 min.
- The Future by Airbus; 27 min.
- Phantom of the Universe; 25 min.
- Space Flight (Live Show); 45 min.

ALEXploratorium

Discovery Zone

Opening Hours and Guided Tours Schedule

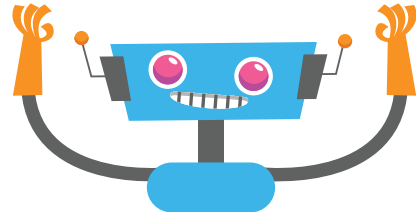
From Sunday to Thursday (except Tuesday):
10:30, 12:30, and 14:30

Tuesday: 10:00 and 11:30.

Entry fees: EGP 10.- (EGP 5.- for students)

Listen and Discover

12D Shows Fees: EGP 20.-



The Planetarium operates Sunday to Thursday, and offers four shows per day; except on Saturday and Tuesday, it offers three shows only. For schedule and fees, please visit the PSC website.

The Bibliotheca Alexandrina Planetarium Science Center (PSC) invites its visitors to spend a day of fun learning, where they can enjoy amazing scientific shows that cover a diverse variety of scientific fields and are suitable for a wide range of groups at the **Planetarium Theater**.

Visitors can also enjoy tours of the **History of Science Museum**, which highlights scientific discoveries throughout three eras: Pharaonic Egypt, Hellenistic Alexandria, and the Golden Age of Islam.

Moreover, visitors can enjoy a collection of interactive exhibits that targets children and adults, workshops, **DVD** and **3D** shows at the **ALEXploratorium**, as well as shows at the **12D Theater**.



مركز القبة السماوية العلمي
Planetarium Science Center

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BAPSC

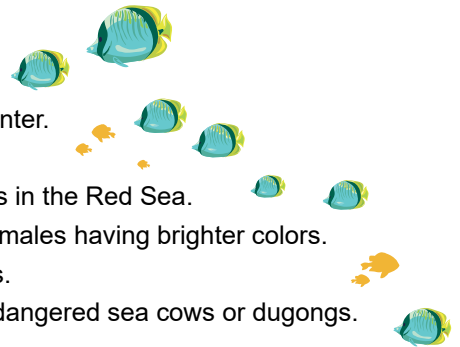


Treasure Hunt

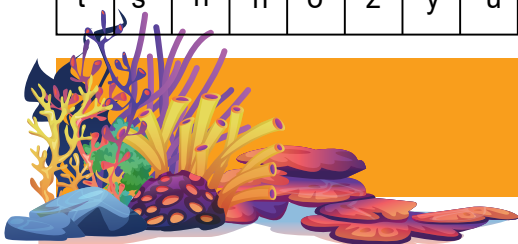


Excited to explore more of sea hiding wonders? Let us search together for the treasures of the Red Sea hiding among the letters. Use the QR Code to find the answers of the riddles below in “The Treasures of the Red Sea” article series, published in SCiPlanet Online magazine under the theme “Oceans and Marine Life”.

1. A bright yellow fish that lives in coral rich areas.
2. A popular site known as a home for spinner dolphins in Marsa Alam.
3. A super-fast fish, jet black in color with a dotted back (reversed).
4. An illusive fish that is difficult to photograph, named after a famous painter.
5. How many turtle species exist on Earth (reversed)?
6. A very small fish named after a European country, although it only lives in the Red Sea.
7. A fish with striking blue lines that runs horizontally along its body, with males having brighter colors.
8. The main material that forms coral reefs, produced by tiny coral polyps.
9. An area at the southern Red Sea famously known as home for the endangered sea cows or dugongs.



m	a	s	k	e	d	b	u	t	t	e	r	f	l	y	f	i	s	h	g	a	i
f	l	a	s	h	e	r	w	r	a	s	s	e	a	z	o	y	r	e	u	i	r
a	i	t	r	o	p	y	u	o	k	i	a	g	e	b	c	p	m	v	y	x	e
i	c	a	l	c	i	u	m	c	a	r	b	o	n	a	t	e	n	t	x	a	g
n	s	y	e	l	c	y	o	a	m	s	r	d	t	j	u	q	e	p	k	i	n
d	y	a	t	v	a	i	c	b	j	u	d	n	v	k	d	a	v	m	e	o	i
u	x	r	e	o	s	p	a	n	i	s	h	t	r	i	p	l	e	f	i	n	r
y	t	e	u	m	s	r	q	e	k	z	a	p	o	g	l	b	s	i	y	a	p
g	b	e	k	i	o	p	d	y	x	l	g	t	u	c	e	l	n	a	s	z	s
o	n	f	y	u	m	c	a	s	v	i	e	j	l	d	y	q	t	p	r	k	e
t	s	h	n	o	z	y	u	m	a	r	s	a	a	b	u	d	a	b	b	a	b



Answers:
1. Masked Butterflyfish
2. Sataya Reef
3. Springer!

4. Picasso
5. Seven
6. Spanish Triplefin

7. Flasher Wrasse
8. Calcium carbonate
9. Marsa Abu Dabbab

Guess the Shark!

Everyone knows the notorious white shark, but there are milliard species of sharks swimming around the world. Read the descriptions of the five shark species below and match with the right photo and common name.



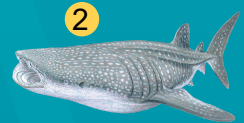
Thresher shark

Tiger shark

Hammerhead shark

Whale shark

Goblin Shark



It has a distinctive head structure, which is flattened and extended to resemble a hand tool shape.

A rare deep-sea shark, sometimes referred to as a living fossil. It has pinkish skin and a long snout.

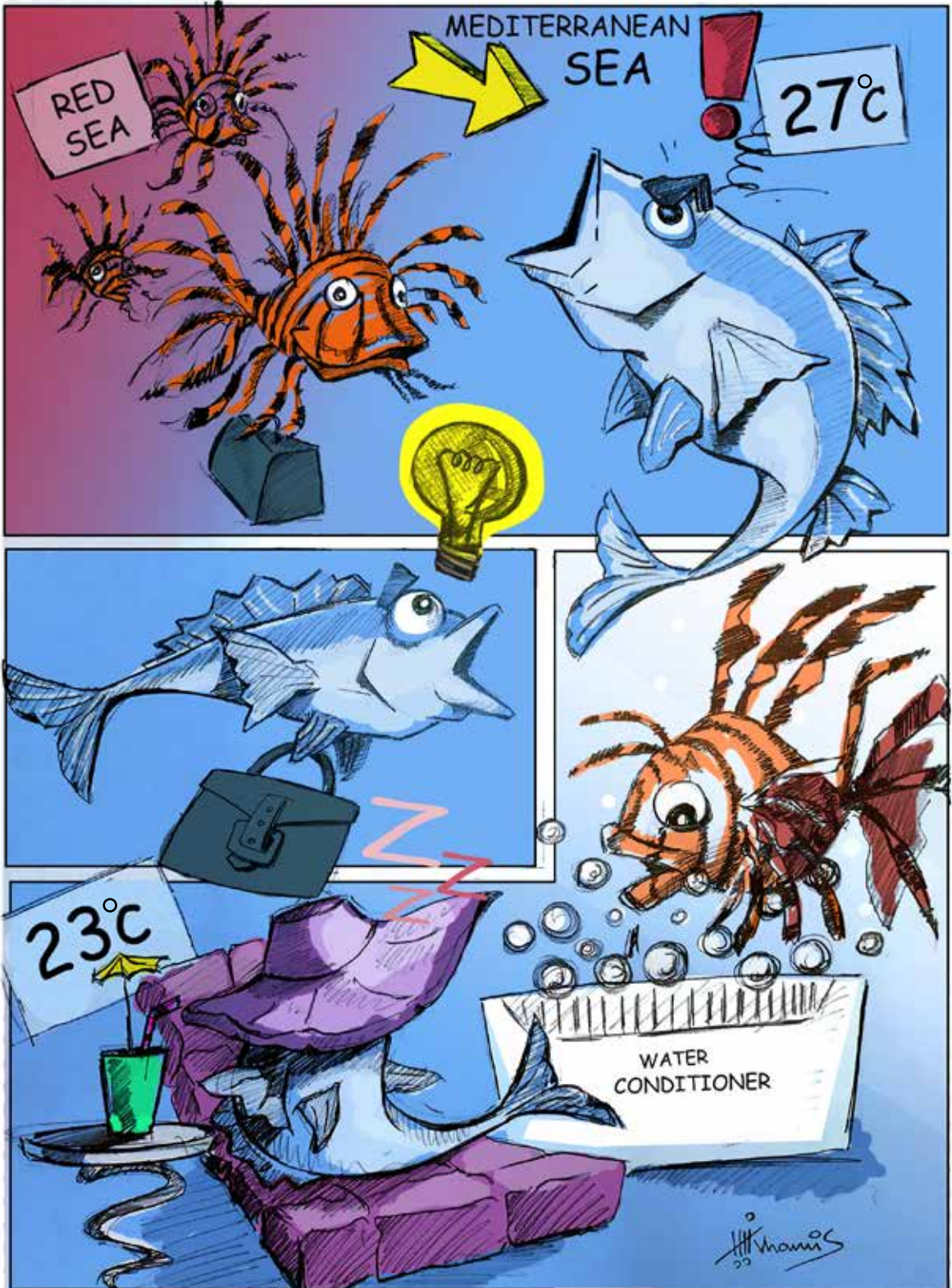
It has dark stripes down its body, which resemble the pattern of a big cat.

A filter feeder with very large mouth, it feeds almost exclusively on plankton and very small fish.

It has a very long upper tail fin, which it uses to swat its preys from schools.



LIONFISH ATTACK!



Check out the "In Depth: An Interview with Dr. Emad Khalil", page 6.
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