Chapter 9 - Under the Sea

Julie Smith, www.whatwouldjuliedo.blog

Used And Abused, Overkill, Toxic Stew, Is It Too Warm In Here? Please Make it Stop! The Aliens Are Here, Reef Greef, References

Used And Abused

The oceans on planet earth are even scarier than the land, if you ask me. Why would I say that? Well, it might have something to do with the fact that oceans cover more than 70% of the planet, yet we know very little about them. Or maybe that 50 – 80% of all life on earth is found underwater and we know very little about it. The National Ocean and Atmospheric Administration estimates that we understand less than 20% of the world beneath the sea.[1] We're just beginning to touch on the conditions at depths of more than a mile in the oceanic trenches, where continents spread and collide. We barely understand the currents that control the planet's weather and climate, and we're constantly discovering previously unknown and unsettling realities of oceanic chemistry and its impact on sea life and on terrestrial life. By one estimate, more than 90% of the ocean's species are still unclassified. Only 25% of the world's seabed is mapped in high resolution.[2]

And our relative lack of knowledge would be one thing, but at the same time we've pretty much trashed the ocean's surface waters, where most oceanic life lives, as far as we know, and we have little to no idea what the impact of our unrelenting destruction is or will continue to be. So we continue on our merry and oblivious path of destruction. Those of us who actually pay attention just know it's bad. But not how bad. Most people on earth have never actually seen the ocean, though it's probably safe to say that pretty much all of us are responsible for its destruction.

The ocean has historically been the global dumping ground for everything from our trash to our pollution to our shit, and in the meantime we've been overfishing the tar out of it to feed our endlessly growing population. There's this misguided perception that the ocean can take it, that the ocean is endless, that anything that's dumped into the ocean will disappear forever, and that aquatic life is endless. But it's not. Maybe at one time it was, sort of, but not anymore. We've managed to decimate the endless ocean, vast as it is. And the death of life on our planet, at the end of the day, may well be driven by an oceanic rebellion, if you will. And that's why I'm saying the ocean is scarier than the land.

For one thing, global warming is jacking up the temperature and the chemistry. Some parts are heating faster than others, and that temperature difference is what drives currents and weather. And, what's just as bad, or even worse, the CO_2 that we're spewing that's causing global warming is actually changing the chemistry of ocean water. The most obvious change is the acidity, which is increasing because a portion of CO_2 in the air dissolves in the ocean, and when CO_2 dissolves in water, it forms carbonic acid, which reduces the pH. So what? Well, a lower pH begins to dissolve the shells of shellfish. Do you happen to consume shrimp or clams on occasion? Don't get used to it. Their shells are their bodily protection, so without their shells, they're not long for it. By the way, higher marine life forms, like whales and penguins and several kinds of fish, also depend on

shellfish for food, so when, not if, we lose the shellfish, we'll lose those, too. So, if you happen to like tuna and grouper, don't get used to those either.

Scientists say that we must protect 30 to 50 percent of earth's oceans to have any chance at all of mitigating climate change.[3] Organizations such as the Global Ocean Alliance (GOA)[3] and the International Union for Conservation of Nature (IUCN)[4] have committed to protecting at least 30 percent of our oceans by 2030. This is necessary not only for biodiversity, but also for replenishing fish stocks and for storing carbon as plants and animals. I am not arm-waving here. We literally need intact marine biodiversity to survive. The oceans provide more than half the oxygen in the air that we breathe, provides half the carbon sink, and drives weather, for better or worse. The oceans also make up a huge portion of global economy.

> "Our shared ocean is facing unprecedented pressures, and together we are making a powerful case for increased protection," Zac Goldsmith, Minister of State, UK.

Currently, only about 3 – 7 percent of the oceans are protected at any level.[6,7,8] Think about that. It doesn't seem like we have much time here. If our goal is 30% by 2030, that's only 4 years away. Just saying. The main barriers to ocean protection are, in addition to the obvious fishing industry, the petroleum and mining industries. The fishing industry tries to argue that they can't feed the continuously growing population in only 50% of the ocean, which is ridiculous, when you think about it. I mean, what's everybody going to eat after we've completely run what little fish stocks are left down to nothing? Same argument for oil and mining, are we really going to suck every last resource from the deepest depths of the ocean, which arguably costs more in energy to produce these more difficult to reach resources, while spewing yet more of the resulting additional CO_2 into the atmosphere, making the problem worse?

> It is no exaggeration to say that what happens in the next five years will determine the future of life on Earth.
>
> We have five years to place the world on a sustainable trajectory before negative feedbacks of combined nature degradation and climate change place us on the downhill slope of runaway tipping points. The risk of failure is real – and the consequences almost unthinkable.[9]

It turns out, ironically, that when an area is protected with fishing bans, the areas that are outside the protected areas do significantly better. This is because when the fish are allowed to reproduce and spawn unimpeded in a balanced ecosystem, their offspring spill out into the unprotected waters, providing plenty of fish to catch. This reality has been likened to an investment account with an untouched principal – the protected areas provide annual returns in the form of fish that continuously replenish the stock for fishermen. This has been found to be true for species from tuna to lobsters to clams.[5] This is a total no-brainer win-win. So, if there is absolutely no economic impact to the fishing industry, and fish stocks will improve, there's absolutely no reason to further delay protecting our oceans. And it needs to be 50% and not a measly 30%. For crike sake. What are we waiting for?

Some awesome examples of this reality in practice include the Papahanaumokuakea Marine National Monument and the Pacific Remote Islands Marine National Monument, which are among the largest Marine Protected Areas (MPAs) on Earth. Combined they're about four times the

size of Texas, or equivalent to a quarter of the U.S.. These provide protected areas for a huge biodiverse array of corals, fish, birds, sharks, and whales.

Yet another example is Northbrook Island in Franz Josef Land, which was added to the Russian Arctic National Park in 2016 to protect polar bears, bowhead whales, ivory gulls, and Atlantic walruses. The walruses were nearly extinct in the early1900's because of overhunting and now there are more than 10,000. I mean, how sweet is that??

Currently, about 60% of the ocean is under stress because of commercial fishing, shipping, pollution and climate change, and it's getting worse.[8] Shark and ray populations have dropped by 70%[6], and local fishermen across the globe can no longer survive on the fish they are able to catch, sometimes only catching one fish in an entire day, when they used to catch large numbers.[10] According to National Oceanographic and Atmospheric Administration (NOAA) estimates, the Florida reef's healthy coral cover has fallen 90% in the past 50 years, due to a combination of factors, including disease, heat stress, sediment and nutrient pollution, development, hurricanes, and damage from boats.[11] This is too bad, because Florida's coral reef is the largest reef ecosystem in the U.S., at 385 miles long, and reefs generally are where most aquatic life exists. Basically, so go the reefs, so go the fish.

Overkill

Have you ever heard of krill? They're similar to shrimp, about 2 inches long, and they are central to the web of life in Antarctic oceans. Whales, seals, penguins, squid and fish are examples of sea life that depend on krill for their food source. Now, humans are depleting the population of krill, forcing the wildlife that depends on the krill to find something else to eat, which is needed by other wildlife, and so on, upsetting the balance and pushing yet more species to extinction. Billions of krill are netted annually for use in dietary supplements, mainly omega-3 pills, food for farmed salmon and food for aquarium fish. In some countries, it's even canned like sardines for human consumption. We've already driven another important food source to extinction in Antarctic waters, the Antarctic silverfish, which was consumed by Adelie penguins. The penguins are now forced to eat more krill, which accelerates the depletion of the krill.[12]

Our decimation of krill is an example of squeezing out the base of the food chain with our sheer numbers and demands, forcing higher animals to make do, to a point. Of course, when we run out of krill we'll move to the next food source, squeezing out those options for the wildlife, and we'll eventually crash all the populations if we don't knock it off. After all, the wildlife does need to eat in order to survive, just like us. Pretty much duh. We can reduce our impact on krill fairly simply, by using chia seeds or algae oil for omega 3, and feeding farmed and aquarium fish sustainable foods. For my own home aquariums, I've gone to brine shrimp, *Cerio daphnia*, tubifex and dried flies, which are easily cultivated, and the fish do just fine.

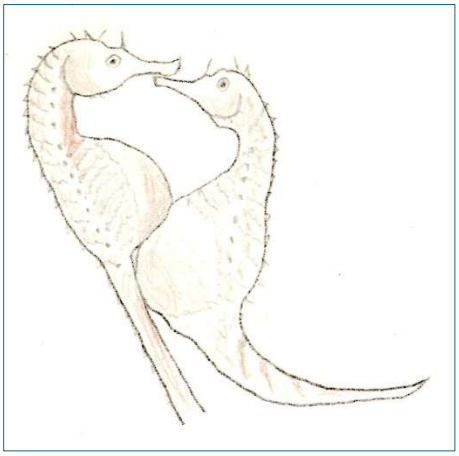
Moving to the top of the food chain, sharks get no respect. While they are certainly dangerous predators, they have lived in the oceans for 400 million years, and we're taking them out in just 100 years. As top predators, they are key to keeping the marine ecosystems in balance. And, while they have a reputation for killing people, the actual truth is that they only kill an average of 12

people per year.[13] And, when you think about it, the people are, after all, in their space. Meanwhile, we kill more than 300 million sharks per year, and are driving them to extinction. We also kill about 40,000 humans, basically ourselves, per year in the U.S. in car accidents. So, I ask, which is more dangerous? The sharks or us? I vote "us".

The biggest reason sharks are killed is for their fins, for shark fin soup, mainly in eastern countries, even though there is almost no nutritional value in the fins, making it just a fad. Evidently, it's about the mouth feel. I'll never understand. And, even worse, the fishers don't even bother to kill them, they cut off their fins and throw them back into the sea to die a horrible torturous death. People don't pity them and don't care, because they have a bad reputation that they don't deserve, driven by horror films like "Jaws". Commercial fishermen also see sharks as competition, so they don't care if they get killed as bycatch. Sharks are also hunted for their meat in some places, as well as gill plates, leather and liver oil.

Sharks and rays have slow reproduction rates, which makes it hard for them to withstand overfishing. Globally, sharks have decreased by 71% in the past 50 years, according to the Living Planet Index, which has been tracking wildlife populations since 1970. Catch rates are constantly increasing to meet demands of increasing human populations, and annual deaths have literally tripled since 1970.[14]

Some of the most prolific marine life habitats are also the most abused, including seagrass beds, coral reefs, mangroves and estuaries. These house the highest diversity of marine life, and are being trashed by commercial bottom trawling, which snatches up pretty much everything on the sea floor, plants and animals alike. Bottom trawling is illegal in many places because it's so incredibly destructive, but is still going on illegally.



Seahorses are one of my favorite sea creatures. They're just so cute! Sadly, they're an example of the many species that are being driven to extinction because of the practice of bottom trawling and nets. The bycatch from commercial fishing operations are killing at least 76 million seahorses every year, mainly for traditional Chinese medicine and trinkets. Hong Kong, mainland China and Taiwan are the biggest importers of dried ground-up seahorses, and the population is down by 90% in less than 20 years. Some live seahorses are sold for aquariums, including to the U.S. Every single species of sea horse is on the IUCN Red List of Threatened Species.[15] So much for sea horses.

One of the world's worst fishery collapses is in the South China Seas, where the fishery has almost disappeared, and is estimated to be down by more than 90% compared to 1970. Before it was overfished by humans, it was one of the richest marine ecosystems on the planet. This sea covers 1.4 million square miles and supplies food for millions of people in ten countries. Now that there's barely any fish left, the countries are fighting over fishing rights, nitpicking over the scraps that are left, which is useless band aide behavior that only leads to corruption, piracy and illegal

fishing, when the real solution is to set aside at least half the sea for conservation and subsist on vegetables for a while. In five years they could literally have their fishery back.

About 300,000 whales and dolphins are killed in nets each year as bycatch, and a smaller portion, about 100,000, are hunted legally. Dolphins swim with yellowfin tuna, so avoiding consumption of yellowfin tuna caught in nets will help. Both dolphin and whale populations had been decimated as of the late 19th century, but severe restrictions on hunting have allowed the populations to begin on a gradual path of recovery. This is encouraging and shows what can be done, though there are some specific species that are on the IUCN Red List, like the vaquita dolphin, which is actually a porpoise in the Gulf of California. This species was down to just 19 individuals by 2018. They were driven to extinction by gill nets, where they were bycatch, because they swam with totoaba, a commercial food fish. A last-minute moratorium on net fishing for totoaba came too late to save the species.[16]

Otter populations in the seas around Prince Edward Island and California were nearly extinct by the late 19th century due to overhunting for the fur trade, and strict otter protection rules were implemented. Now the populations are beginning to grow. The otters in turn are helping to protect coastal marshes in California by consuming striped shore crabs that damage banks and leave them vulnerable to erosion. These kinds of rare success stories give me a small glimmer of hope.

> "For the most part, if you stop killing marine mammals and turtles, they can recover and do quite well", Andrew Trites, director of the marine mammal research unit at the University of British Columbia

Toxic Stew

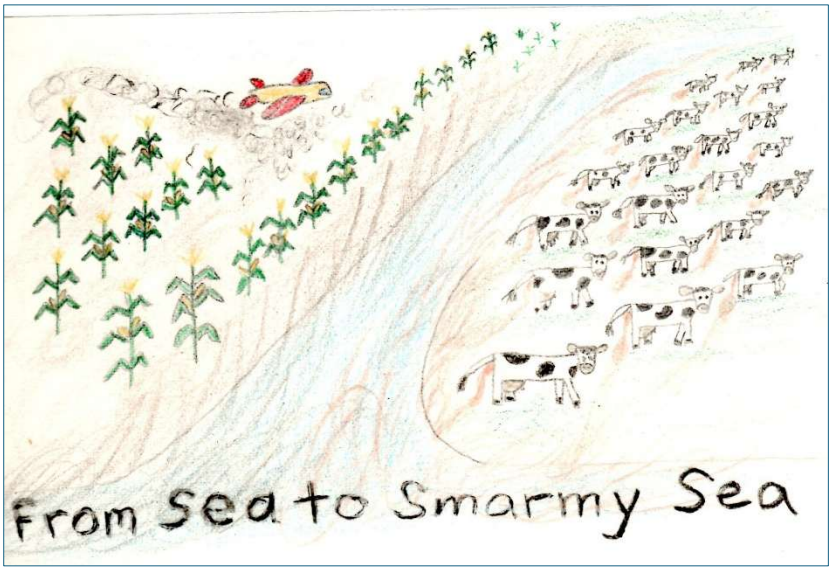
With our agricultural pesticides and nutrient runoff, we have turned the ocean into a toxic stew that is killing marine wildlife, one species at a time. And our dreadful practices of applying nasty petrochemicals at every turn are completely unnecessary, the result of big corporations like Monsanto, Bayer, Syngenta Ag and Corteva convincing farmers and big industrial operations that these chemicals are absolutely necessary. And, with the backwards way we produce monocrops and overextend our precious soil, they're probably right. But it doesn't need to be this way, and if we have to choose between killing our entire ocean or knocking it off with the poisons, which would you choose?

There is this process called "organic farming", which uses natural techniques to grow food, without the use of noxious chemicals. It can be done. Yes, it's more labor-intensive, which is why organic food is more expensive than chemically farmed food, but in the U.S. we waste so much food that the additional cost of organic food is a wash if we also avoid wasting food. And, it's not hard. I know because that's what we do at home, and have been for more than 20 years.

I'm talking about using a little more labor to grow our food, to save all wildlife, because all wildlife depends on water to survive. In fresh water, fish have to swim in it and land animals and birds have to drink it. Then, when all the surface water eventually reaches the ocean, the marine life has to live in it. So it can't be too much of a shock to think they're sickening, weakening and

dying faster, and reproducing less efficiently, if they can reproduce at all. Imagine living your entire life in a toxic stew of pesticides? Would you expect to feel great or feel like death all the time? I mean, seriously.

In the U.S., we have this law called the National Pollutant Discharge Elimination System (NPDES), a mouthful of a title, which makes it illegal for industries to release toxic or nutrient-laden water into U.S. surface waters, like creeks, rivers and lakes. All water that is discharged from towns, cities and industries is required to be treated so that excessive nutrients are removed, and the water is safe for fish and wildlife. However, agricultural operations don't have to meet these standards, because big corp lobbyists somehow convinced legislators that it would make it too difficult and expensive to grow our food if they had to mess with treating their discharge. This agricultural effluent is basically what runs downhill off the fields until it eventually reaches a water body, and is known in the wastewater industry as "non-point" discharge.



Non-point discharge contains everything that had been applied to upstream industrial crops, including fertilizers, insecticides and herbicides. As this toxic stew runs downhill through the waterways, from high streams and creeks to lower rivers, it continues to accumulate, until it reaches the ocean. The fertilizers load the ocean with incredibly high levels of nutrients that cause algae to run wild, like a cancer, and turn into runaway uncontrolled toxic algae blooms, while the insecticides and herbicides, mainly petrochemicals, poison the wildlife outright. The algae is called toxic because it grows so fast that it consumes oxygen at extremely high rates until the oxygen is depleted in the water locally, and then it dies due to lack of oxygen and biodegrades, releasing yet more nasty toxic chemicals like domoic acid, anatoxin and saxitoxin, some of the most potent neurotoxins on earth, in the process. Other toxic byproducts of algae blooms off the coast of Florida include hepatoxins that can lead to liver disease in all life, including humans, and cylindrospermopsin, which can damage the liver or the kidneys.[17]

Sharks are swimming up Florida canals off the gulf coast to escape the oxygen-depleted red tide algal bloom in the gulf, which is killing sharks, fish, turtles, dolphins and manatees. In addition to agricultural runoff, the dead zone is exacerbated by warming waters.

South American rivers are flowing agricultural chemicals and untreated sewage into the Caribbean Sea, causing uncontrolled spread of Sargassum algae. The swarms of brown algae are forming a 5,000 mile long mass between the Caribbean and the western coast of Africa.[18] In the

U.S., nutrients from agricultural regions in the Midwest and the south are flowing into the gulf of Mexico, loading it with nitrogen and phosphorous that have created an ever-growing dead zone.

Algal blooms off the Atlantic Florida coast are killing off seagrass that manatees need, resulting in the deaths of nearly 1,000 manatees per year. The algae makes the water turbid and blocks the sun, so the grass can't grow. Seagrass also sequesters huge amounts of carbon, so as we kill the seagrass with massive agricultural toxins, we're also losing a huge carbon sink that could be helping to mitigate global warming.

The Florida Fish and Wildlife Conservation Commission is trying to replenish the seagrass and increase mollusk populations that filter the water, but it could take many decades to recover. They were even trying to feed the manatees lettuce until the seagrass recovered, 200,000 LBS of it in a year. That's when you know it's bad. That's a lot of lettuce. And, I have to wonder if the lettuce was grown organically or if its production contributed yet more pesticide and nutrient runoff to the ocean. And, of course, if the manatee are impacted, so are all the other wildlife in these waters.

In California, sea lions are dying in massive numbers because of a mysterious cancer that researchers are finding is caused by toxic chemicals DDT and PCB's, in addition to a previously unknown herpes virus.[19] Southern California beaches have been littered with hundreds of dead sea lions and dolphins from consumption of shellfish contaminated with domoic acid, a potent neurotoxin that they get from a toxic algae called *Pseudo-nitzschia*, which is spreading faster and further offshore in recent years.[20] And, as always, we know about the dolphins and sea lions because they're washing up on the beaches; there is probably many times as much marine life dying the same way that we don't see.

In Alaska, marine mammals including sea otters, whales, and seals are dying from a combination of factors, including toxic algae blooms, and ingesting trash, including plastic. Even jellyfish, at the bottom of food chain, are washing up by the millions from British Columbia to California. Otters, sea lions, sea stars, sea birds, crabs, and krill are dying of poisoning from toxic algae, from eating creatures that are poisoned with toxic algae or from starvation because their food supply was wiped out.

Off the coast of Turkey, they're dealing with a new thing with a working moniker of "sea snot", a gooey mucus that is connected to high levels of algae. This muck is likely due to warmer waters caused by climate change, and may contain dangerous microbes such as *E. coli*. That can't be good for marine life. Just imagine "breathing" in *E. coli* all day long. Yuck.

Since the ocean is downhill from everything, it follows that anything that gets dumped in surface waters on land will end up in the ocean eventually. Because of the way the currents flow in the Pacific Ocean, trash has accumulated into a dense mass of plastic, known as the Pacific Garbage Patch, between California and Hawaii. This mass is mainly made up of plastic single-use food and drink packages and containers, that are light enough to float, and break down over time into extremely small microplastics. There are more than 5 trillion pieces of microplastic in the oceans – more than there are fish. This might be why the whales of the world keep beaching themselves and expiring with wads of plastic in their guts, a kind of gruesome global protest. And why bugs in the Mariana Trench, 36,000 feet below the surface of the ocean, are full of plastic.[21] These microplastics form mats that attract baby fish fry, who hang out among them and try to eat

the tiny pieces, mistaking them for food. The plastic chokes their tiny digestive systems, and they die. In this way, we are decimating marine populations with our trash. And it's all of us, not just people in boats on the open sea throwing their trash overboard.

Plastic also kills sea birds, to the tune of more than a million every year. And we thought cats were bad. Plastic bags look so much like jellyfish that turtles try to eat them and choke themselves. And now many organizations are trying to figure out how to clean it up without killing the marine life too. Wouldn't it be a whole lot easier to not use plastic? I mean, hello? It's challenging, with big corp throwing plastic at us at every turn, but with determination and thought, it can be done. We have a zero waste household, and have for at least 10 years, and we do it by buying bulk as much as possible, which is actually most of our food, and if the food must be in a container, making sure it's recyclable, and then recycling it. Some stores are offering returnable containers. If that's available where you live, do it! Once you start down that path, it's so satisfying that you'll never go back. Let's see, plastic or the ocean. I vote for the ocean.

Is it Too Warm in Here?

Warming oceans caused by climate change are creating endless havoc for marine life, most of which was not anticipated, further illustrating how clueless we humans really are. The ocean stores more than 90% of the excess heat on the planet, so the actual warming isn't really a huge surprise, nor is the additional dissolution of CO_2 in warmer water. As a chemical engineer, I know that CO_2 solubility increases in water that is in contact with higher concentrations in a gas (air in this case) that's in contact with the water. It turns out that the ocean absorbs nearly 25% of the annual emissions of anthropogenic CO_2.[22]

To make things worse, CO_2 turns into carbonic acid in water, which increases the acidity of water. In the sea, the shells of shellfish like lobsters, clams, shrimp, krill, oysters and miniscule copepods are dissolving and thinning because of this. Even microscopic pteropods at the absolute rock bottom of the food chain are not spared, as seen through a scanning electron microscope.[23] And, what's really scary is these critters are cleaner species that consume detritus and nutrients that accumulate on the sea floor to keep the ocean clean, while providing a key food source for upper life forms from fish to whales to sea birds. So, our excessive CO_2 emissions are literally taking out the bottom of the marine food chain. Personally, that freaks me out. How about you?

Also, the increasing acidity may also endanger the ability to smell, making it harder to find food, detect predators, or sense each other's pheromones during mating season. Yet another problem with warming water is that warmer water holds less oxygen, which fish need to breathe.

We even have a flesh-eating bacteria called *Vibrio vulnificus* that seems to be increasing in the Gulf of Mexico and the East Coast. The Centers for Disease Control has advised the public to be careful about exposure to coastal waters.[24] That's when you know it's bad. And, we humans may be able to stay away, but the fish can't. So there you go.

And the unexpected ripple effects of our endless reckless consumption of fossil fuels go on and on. For one thing, marine species, similar to land species, are seeking out cooler waters and moving out of their original habitats. Life that has normally existed at the equator, for example, is

moving towards the poles as changing global climates are making tropical waters too warm for them. This is really bad. We're talking about major disturbances in the marine ecosystem that could ultimately trigger mass extinction of sea life.

99% of sea turtles from the northern part of the great barrier reef off Australia were born female in 2014 and 2015. A new study attributes this disproportion to climate change: Female turtles tend to hatch in warmer temperatures, while males are more likely to favor cooler temperatures.[25] A similar phenomena is happening with lobsters on the northern Atlantic sea coast.

Animals are now moving to places they've never been, and disrupting ecosystems. This is happening about seven times faster in ocean species than land species, and is causing increases in diseases, as animals that carry and are immune to different diseases come in contact with each other. Food chains are getting disrupted not only from moving species, but from changes in metabolism in the warmer water. Warming oceans are reducing fat in what little krill is left, making it even harder for whales to maintain healthy weights, causing them to die in large numbers. Seabird populations are dropping, because they need hake and herring, that are small enough that their chicks can swallow, but now larger butterfish are moving in, and the herring catch them instead, and the chicks can't swallow them. Then they don't get enough food and are too weak to migrate.

In addition to moving south or north to cooler waters, some species are actually moving down to deeper, cooler water. With less light, there's less color, which can make it difficult to tell prey, predator and potential mate apart.[26]

Did you happen to see the 2004 disaster film "The Day After Tomorrow?" It's yet another prescient Hollywood movie in which a passionate climate scientist, played by Dennis Quaid, does his best to alert the U.S. government and the U.N. about climate data that he's been collecting with his team, that shows the oceans are about to turn, and it won't be pretty. Our clueless Vice President dismisses him with a wave of his arms, and then we lose the entire planet north of 30 degrees latitude to deep freeze, and pretty much everybody in the U.S. dies. A great sci fi thriller that was accused at the time of everything from "propaganda" to "inaccurate" to "impossible". Whatever. At the end of the day it was just a movie.

However, I'm beginning to wonder if Hollywood may have actually gotten it least partly right, because now new research is showing an alarming shift in the ocean's deepest, coldest water.[27] With the acceleration of the melting of Antarctica's ice shelf, the ocean circulation is actually slowing down, which could have devastating impacts on earth's climate. This circulation has always regulated the

THE DAY AFTER TOMORROW

After climatologist Jack Hall is largely ignored by U.N. officials when presenting his environmental concerns, his research proves true when a superstorm develops, setting off catastrophic natural disasters throughout the world.

Day After Tomorrow Film Poster - 20th Century Fox

energy balance for the entire planet, and stabilized the climate. The slowing of this system of currents will most certainly collapse marine ecosystems, strengthen severe weather, like hurricanes, heat waves and accelerate sea level rise. So get ready. You're not going to have to live near the sea to deal with this disaster. For my part, I'm glad we're experienced mountaineers with the know-how and right equipment to survive in sub-zero temperatures!

In yet another terrifying cascade of events, let's look at kelp.[28] Have you even heard about kelp? I guess it would be understandable since it's been more of a benign presence than really a big deal, so to speak. Now, it's getting some attention, because we're losing it due to warming waters, and entire marine ecosystems are collapsing because of it. Kelp forests, basically coastal underwater forests, actually 20 times more efficient at sequestering carbon than land forests, are a keystone species in shallow coastal marine ecosystems. They provide food and shelter for coastal marine species.

In the middle of the Pacific Ocean is a gigantic hot spot, known as "The Blob" that is killing entire marine food chains. The warm water has spread further and deeper and is lasting longer than any similar event in recorded history. Marine heatwaves in the Pacific have stressed the kelp forests and caused sea-star wasting disease, which began in 2013 and has resulted in the largest marine extinction in modern history. Billions of starfish have disappeared from the entire Pacific coast, from Alaska to Mexico. Large sunflower sea stars were major predators of sea urchins, and the urchin population has exploded. Urchins are now consuming all the kelp, which was already weakened by global warming. Now 95% of the kelp forests are gone, and the sea floor is now covered with spiky urchins.[29]

A truly amazing and global phenomena that could help save our planet and our oceans is just being discovered and studied by scientists. It turns out that many forms of sea life move down to deeps depths, between 600 and 3,300 feet, dubbed the twilight zone, and then at dusk they move up under cover of darkness to hide from predators while they feed. It turns out that literally trillions of fish, shrimps, amphipods, jellyfish and squid do this. When they return to the deep before dawn, they are full of food from the phytoplankton they eat at the surface, basically moving sequestered carbon to the deep, where they release it in their feces and through their gills.[30]

If we stop screwing up the environment now, we could actually have some hope with this twilight migration thing, because it's basically how fossil fuels formed in the first place. About 25% of CO_2 emissions from fossil fuel burning are absorbed by ocean life, in a process called the biological carbon pump. Some studies suggest that migrating twilight zone animals may move as much as 50% of the pump's carbon load into the deep, where it's stored away from the atmosphere, for hundreds or thousands of years. If it stays there and is buried by ocean sediment, it will be trapped and will eventually biodegrade into oil and natural gas. If we can leave this alone, it could seriously help get our planet back in balance. However, as always, greedy big corporations are investigating the establishment of fisheries in the twilight zone, since the surface fisheries are disappearing. Each and every one of us needs to do our part to prevent this at every level, from refusing to buy seafood to advocating for government restrictions to voting for leadership that says "no" to this potential insanity, since the global impact would be horrendous, obviously.

To make matters even worse, cruise ship tourism in Alaska and the far north is picking up, because people want to see the glaciers before they melt and the polar bears before they go extinct. You have to be kidding me. Cruise ships are some of the biggest contributors to global warming, burning a good 50,000 gallons of diesel fuels each day, and collectively about a ton of sulfur oxides daily. And, they dump wastewater directly into the ocean without bothering to treat it, making the toxic stew even worse. Let's show we care by travelling up north and making the problem worse. If we really give a rot about the glaciers and polar bears, the best thing we can do is leave them alone, and do what we should be doing to turn this around, which is cut our personal carbon footprints by stubbornly refusing to be a part of the greed, gluttony, waste and materialism that is ruining our planet. These are things that can head off the extinctions and melting, if done well.

Please Make it Stop!

If we're not killing, poisoning or warming the marine environment, our mere presence disrupts the lives of the marine wildlife. Unless we're swimming or out there on the water in a kayak or sailboat, we're likely in a motorboat or ship that, by definition, has engines that make noise. It would be like living next to an airport or a train track or major highway. Most of us would not choose that because of the noise. Obviously some of us do live in noisy areas, but it's not healthy for us or for marine wildlife. Lights are yet another problem that messes with our metabolism, as well as with most animals.

The ecology of sound is a relatively new area of study that began with land animals, and has extended to marine wildlife. It turns out that every fish has specific and distinct arrays of sounds that they make, so other fish know who's around, and to communicate. Even without ears, they perceive the sounds differently than animals with ears, using echolocation. Sea creatures are constantly disturbed by our relentless noise, which makes it hard for them to detect predators, prey and each other. We've filled the oceans with noise from our boats and ships, and the petroleum industry, that's producing the fossil fuel that's heating our planet has thousands of offshore oil platforms, and does seismic surveys. Underwater sonar is yet another disruptive source of noise.

Artificial light pollution can disrupt sleeping, feeding and reproductive cycles of all animals, including aquatic life and humans. It also interferes with coral reproduction, and is part of the reason coral is disappearing. Night lights are completely unnecessary and a waste of energy. Out of all the energy-wasting things we do to add to global warming, night lights should be the first to go. We have outdoor lights on motion sensors at our home, so they only come on when needed. Easy peasy.

An example of the impact of light can be seen with sea turtles that live in the ocean, and climb up onto sandy beaches to lay their eggs. When the eggs hatch, the babies are supposed to go back into the water, but lights on the shore disrupt their orientation and most of them never make it, which is playing a role in extinction of sea turtles. Some beach venues that are known to have sea turtles are turning off their lights during hatching season to help mitigate this.

The Aliens Are Here

When we think of aliens, if we do, we typically think of flying saucers with strange beings aboard that may look something like us, or like insects, or octopuses, or something else completely different. It turns out that we do have aliens among us, if you want to look at it that way. They live on earth, but in a completely different environment than we humans, and they look nothing like us. Yet, they're mammals, like we are, they have babies that they nurse and nurture for several years until they are old enough to fend for themselves. They have strong family relationships, culture and language that we don't understand, involving sounds that we can't make, that can travel undersea for miles and miles as they communicate from great distances. When one of their own dies, they grieve. They haven't figured out how to make language translators, produce fossil fuels or make plastic. This may be because they don't need them for a happy and fulfilling life. They can travel for thousands of miles beneath the sea, and go wherever they want. Except on land. But who wants to come up here, anyway, when it's so beautiful down there? Or was. Until we came along. Earth's special and unique aliens didn't really evolve to deal with masses of humanity, not only hunting them nearly to extinction, but also trashing and poisoning their world.

By now, have you figured out who I'm talking about? If not, I'm referring to whales and dolphins, truly amazing creatures who are turning out to be more like us that we ever would have dreamed. Researchers are constantly making new discoveries – that different groups have regional cultures, and they pass down dialects, routines and feeding habits to next generations. They work together to hunt using different techniques, like corralling fish, and they eat specific kinds of fish. Whales even have a more developed paralimbic portion of the brain than we humans have, and more recently wild orcas were seen literally wearing dead fish on their heads, like hats, something that we humans have long done.

We've shown how much we appreciate our local alien life by poisoning their water so badly that toxic chemicals like PCB's have built up in their blubber, and toxic chemicals released from algae growing in warmer waters are poisoning whales, which are washing ashore in Alaska. They used to get 8 whales in a year, and now they're getting a dozen or so in a month. There are about 100,000 ships in the oceans transporting goods to satisfy our relentless consumerism, and the

noise they make disrupts the whales, and whales are constantly getting run over, because they feed near the ocean's surface.

We're also starving them to death. By killing off most of the Chinook salmon population that they depend on for food with overfishing, dam building and climate change, we're weakening them. Pregnant females are having miscarriages and calves are dying of starvation.

Does all this feel like a great way to treat aliens? It seems pretty nasty to me.

Reef Greef

Coral is so unique that most of us think it's rock. But it's not. Coral is actually an animal, and they reproduce by spawning, where individual coral polyps release sperm and eggs into water, which then fertilize and become free-swimming larvae until they eventually settle onto a hard surface, like rocks along coastlines, to form new coral. Once the polyps settle, they form a hard calcium carbonate exoskeleton around themselves. Coral reefs form in warm, shallow water with good sunlight, and grow at rates ranging from 0.3 to 2 cm/year for massive coral, and up to 10 cm/year for branch corals. It can take 10,000 years for an entire reef to form.

Corals provide a huge array of benefits, including protection of shorelines, and are hosts for thousands of species of sea life. They cover about 1% of the ocean's surface, but support about 25% of ocean life. In the past 20 years, 80% of coral has been lost. This is pretty scary, because coral reefs provide about half the planet's oxygen, which pretty much all animals, including us, require for life. The coral is dying from bleaching due to global warming, and from a new form of cyanobacterial disease, possibly driven by stress from the warming. Coral lives in a symbiotic relationship with algae that lives in the coral tissues and provides essential nutrients to the coral through photosynthesis. It's also the algae that gives the coral color, as the calcium carbonate coral skeleton is white.

> "What's happening to reefs is a crisis of governance – of water quality, of fisheries, and especially of greenhouse gases – and there's work to be done in all three realms." Terry Hughes, Marine Biologist.

High temperatures from global warming are causing the algae to turn toxic, and when that happens the algae will either die or be ejected by the coral, so the coral turns white in a process called bleaching. Without the algae, the coral will die of starvation or disease.

More than 50 areas globally have had mass coral bleaching since early 2023, resulting in the past decade's second-largest bleaching event.[31] Mass reef bleaching events are five times more common now than in the 1980's, which aligns with climate models that predict that bleaching events will increase with increasing temperatures. Coral bleaching, which has been a regular process in the months of August or September in the northern hemisphere, are now happening earlier, beginning in July because of high surface water temperatures. The Florida Keys' coral populations have declined by 80 to 90% over the past 50 years, which is damaging to Florida's natural ability to withstand storms, at a time when storms are getting worse for the same reason, global warming.

The Great Barrier Reef, the largest on the planet, is made up of some 3,000 separate reefs strung along 1,400 miles of Australia's northeast coastline. There are some 600 different species of coral in this reef. Water temperatures are now 3 – 7 ºF higher than normal, which is devastating the reef. Coral bleaching has killed 50% of the reef in the past 30 years.

And temperature isn't the only way we're killing the coral. We're also killing them with our trash. It turns out that coral also eats microplastics, and the microplastics contain microbes that are toxic to the coral. Also, as with the fish fry, the microplastics choke the coral's digestive systems and kills them. Researchers found that corals off the Great Barrier Reef consistently eat microplastics.[32] According to a study led by Florida Atlantic University's Harbor Branch Oceanographic Institute, warming waters isn't the only cause of dying coral and the horrific damage to the Florida Keys' marine ecosystems. It turns out that a huge culprit is nutrient runoff.[33] Higher rainfall levels, which are caused by climate change, are sending water full of fertilizer nutrients and toxic pesticides from Florida farm runoff into Florida Bay by way of the Everglades. Conventional sunscreen ingredients like oxybenzone is also killing coral, so if you swim in the ocean, at least use a responsible sunscreen.

Think about this. If all this devastation doesn't convince you and everybody else that we have a really serious problem to deal with, then we're going down along with our oceans and all the incredible life that still exists there. And we'll deserve it. Again, as horrid as all this is, we still have a slim chance of turning it around. Coral can recover quite quickly, along with associated sea life, if we cease and desist with our reckless use of fossil fuels, and provide sanctuaries for the sea life. They just need to be left alone. Really not so different from us, if you think about it.