5 ways that climate change affects the ocean

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By Jessica Pink

For an ecosystem that covers 70 percent of the planet, oceans get no respect.

All they've done is feed us, provide most of the oxygen we breathe, and protect us from ourselves: Were it not for the oceans, climate change would have already made Earth uninhabitable.

How?

The oceans have gamely absorbed more than 90 percent of the warming created by humans since the 1970s, a 2016 report found. Had that heat gone into the atmosphere, global average temperatures would have jumped by almost 56 degrees Celsius (100 degrees Fahrenheit).

But as vast as the seas are, there is a limit to how much they can absorb, and they are beginning to show it. Today, on World Oceans Day, Human Nature examines some of the ways that climate change affects life in the oceans — and what that means for humanity.

1. Higher temperatures are bad for fish — and for us.

Persistently rising temperatures are having a cavalcade of effects on marine life. Consider:

- Warmer waters cause coral bleaching, which in turn impacts coral reef ecosystems that are home to most of the ocean's biodiversity — and provide crucial sources of food for people.
- Warmer waters threaten to cause mass migration of marine species in search of the right conditions for feeding and spawning.
- Change in water temperatures can directly affect the development and growth of most fish and cephalopods (such as octopus and squid).

For the 3 billion people worldwide who rely on fish as their chief source of protein, the prospect of fewer and smaller fish in the sea is bad news.

2. Polar ice is melting.

In what has become a dismal annual ritual, wintertime Arctic sea ice continues to dip to new lows as the oceans warm. Meanwhile, Antarctica is shrinking from underneath, as submerged ice is rapidly melting, according to recent studies.

The effects of this warming on iconic species such as polar bears are well-documented. Under the surface, though, the problem is no less urgent. Consider:

- The production of algae — the foundation of the Arctic food web — depends on the presence of sea ice. As sea ice diminishes, algae diminishes, which has ripple effects on species from Arctic cod to seals, whales and bears.

- Diminished sea ice results in the loss of vital habitat for seals, walruses, penguins, whales and other megafauna.
- Sea ice is a critical habitat for Antarctic krill, the food source for many seabirds and mammals in the Southern Ocean. In recent years, as sea ice has diminished, Antarctic krill populations have declined, resulting in declines in the species dependent on the krill.

What does this mean for us? Impacts to the Arctic cod fishery is having cascading effects, culminating in human-wildlife conflict, for one. A dramatic decrease in sea ice — and seafood — pushes polar bears toward coastal communities and hunting camps to find food, a nuisance and danger to people living there.

3. Rising sea levels represent a slow, seemingly unstoppable threat.

Climate change poses a dual threat for sea levels.

For one, when land-based polar ice melts, it finds its way to the sea. (Ice that forms in polar seas, on the other hand, doesn't affect sea levels when it melts.) Second, when water warms, it expands to take up more space — a major yet unheralded cause of sea-level rise.

With sea-level rise accelerating at a rate of about one-eighth of an inch per year, the effects on humanity are plain:

- Though only 2 percent of the world's land lies at or below 10 meters (32 feet) above sea level, these areas contain 10 percent of the world's human population, all directly threatened by sea-level rise.
- Small island nations such as those in the Pacific Ocean stand to be wiped off the map. The people of Kiribati, for example, are among the world's first refugees of sea-level rise, and two of the nation's islands have all but disappeared into the ocean.

The effects of sea-level rise on wildlife is less explored but no less important:

- The survival of coral reefs, mangroves, sea grasses and other critical habitat-forming species hinges on their ability to move into shallower waters. Slow-growing species are most unlikely to be able to keep pace with the rising sea level.
- Critical coastal habitats — for instance, sea turtle nesting beaches — are lost as the sea level rises. Natural and man-made barriers such as cliffs, sea walls, and coastal developments stand in the way of migrating further inland.

4. Warming oceans alter currents.

Climate change impacts ocean temperatures as well as wind patterns — taken together, these can alter oceanic currents.

How does this affect wildlife?

As mentioned earlier, many marine species' migratory patterns can change as the currents they follow are altered. And many species that depend on ocean currents for reproduction and nutrients will be affected. For example, many reef-building coral and reef fish species rely on dispersal of their larvae by currents.

The impacts of changes in ocean currents on humanity could be severe, as currents play a major role in maintaining Earth's climate. For example, Europe's relatively mild climate is maintained in part by the

large Atlantic current called the Gulf Stream, which is experiencing an “unprecedented slowdown.” Changing these currents will have major implications for the climate across the globe, including changes in rainfall — with more rain in some areas and much less in others — and to air temperatures. These changes have drastic implications for countless species, including humans.

5. Climate change is affecting the chemistry of seawater.

The same burning of fossil fuels that increases greenhouse gas levels in the atmosphere, is also altering the chemical composition of seawater, making it more acidic. The ocean absorbs 30 percent of the carbon dioxide in the atmosphere; when that carbon dissolves into the water, it forms carbonic acid.

How does this affect marine life? A lot.

Acidification directly ocean life that build shells of calcium carbonate such as corals, scallops, lobsters and crabs, and some microscopic plankton that are a foundation of the food web throughout the ocean. These shell-forming organisms provide critical habitats and food sources for other organisms. Increased acidification can also limit the ability of certain fish to detect predators, disrupting the food chain.

The disruption and destruction of coral reefs and shellfish will have profound effects on humanity, chiefly in the form of less food for people who rely on the ocean for it.

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