ANTARCTIC CLIMATE EXPEDITION 2023

aurora expeditions

BLUE CARBON

CHANGING COURSE OF CLIMATE CRISIS

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NEWSLETTER CONTRIBUTION BY THE PRINCIPAL EXPEDITION TEAM

THE ANTARCTIC CLIMATE EXPEDTITION 2023 (ACE 2023)

Aims to bring about public and government awareness of the importance and the splendor of the Antarctic, to address the warming climate and loss of ice in the southern polar region as a direct threat to the future of human life on this planet.
The purpose of this Expedition is to confront the consequences and develop creative strategies for everyone to radically reduce carbon emissions, with the goal that each one of us will take more active ownership of our carbon footprint, then find ways to reduce and offset their emissions.
Hence the primary mission is for the ACE 2023 Team to propose and champion 23 Resolutions to reduce and offset emissions within our lives, communities, and countries to pace up in reaching Net Zero.
The principal expedition team for this important climate summit will comprise conservationists, celebrities, and ocean luminaries. 100 people will be selected to be part of ACE 2023. You can be one of them. Find out more here.

#ACE2023, #AntarcticClimateEpic, #AntarcticClimate, #OceanGeographic, #ACETEAM

Images by MICHAEL AW

As the passage of catastrophic effects from climate crisis becomes increasingly likely, our search is on for innovative ways to mitigate the risks. One potentially powerful and low-cost strategy is to recognize and protect natural carbon sinks – places and processes that store carbon, keeping it out of Earth's atmosphere. Forests and wetlands can capture and store large quantities of carbon. These ecosystems are included in climate change adaptation and mitigation strategies that 28 countries have pledged to adopt to fulfil the 2015 Paris Climate Agreement. So far, we have ignored our ocean. There is no policy created to protect carbon storage in the ocean, which is our planet's largest carbon sink and a central element of our planet's climate cycle.

Our world ocean is essentially a giant, global carbon sink responsible for absorbing and accumulating 25 to 35% of atmospheric carbon emissions. "Some 93% of Earth's carbon dioxide is stored and cycled through the oceans" (Nellemann et al. 2009). About 1.5 billion tonnes of carbon are captured and sequestered annually by high seas ecosystems, an amount that if calculated in monetary terms of social benefit would equate to around $150 billion USD each year. Terrestrial forests and coastal marine ecosystems such as saltwater marshes, mangroves, kelp forests, and seagrass beds are all recognized for their ability to store and sequester atmospheric carbon, but high seas ecosystems are just now starting to be credited for their "blue carbon" economy.

Until recently, phytoplankton and zooplankton have been the primary focus of scientific studies detailing the oceanic carbon cycle, but the role of marine vertebrates is now being explored to determine their importance in powering the biological carbon pump. It seems as though the impact of large marine vertebrates on carbon uptake has been grossly underestimated, and they may be as critical in the carbon cycle as the microscopic creatures we know more about. A recent report released by the non-profit Blue Climate Solutions in collaboration with the Norwegian environmental foundation, GRID-Arendal, refers to this form of blue carbon as "Fish Carbon" even though fish, mammals, and even turtles are included in the group.

"In healthy marine ecosystems, marine vertebrates facilitate uptake of atmospheric carbon into the ocean and transport carbon from the ocean surface to deep waters and sediment, thus providing a vital link in the process of long-term carbon sequestration." As outlined by this report, the sequestration of atmospheric carbon by marine vertebrates can be broken down into eight main biological mechanisms.

Marine Vertebrae Carbon.

Marine animals can sequester carbon through a range of natural processes that include storing carbon in their bodies, excreting carbon-rich waste products that sink into the deep sea, and fertilizing or protecting marine plants. In particular, scientists are beginning to recognize that vertebrates, such as fish, seabirds and marine mammals, have the potential to help lock away carbon from the atmosphere.

Image by MICHAEL AW

Trophic Cascade Carbon.

Trophic cascades occur when change at the top of a food chain causes downstream changes to the rest of the chain. As an example, sea otters are top predators in the North Pacific, feeding on sea urchins. In turn, sea urchins eat kelp, a brown seaweed that grows on rocky reefs near shore. Importantly, kelp stores carbon. Increasing the number of sea otters reduces sea urchin populations, which allows kelp forests to grow and trap more carbon.

Image by JOANNE SMART

Biomass Carbon.

Carbon stored in living organisms is called Biomass Carbon, and is found in all marine vertebrates. Large animals such as whales, which may weigh up to 50 tons and live for over 200 years, can store large quantities of carbon for long periods of time.

QUANTIFYING MARINE VERTEBRATE CARBON

To treat "blue carbon" associated with marine vertebrates as a carbon sink, scientists need to measure it. One of the first studies in this field, published in 2010, described the Whale Pump in the Southern Ocean, estimating that a historic pre-whaling population of 120,000 sperm whales could have trapped 2.2 million tons of carbon yearly through whale poo.

Another 2010 study calculated that the global pre-whaling population of approximately 2.5 million great whales would have exported nearly 210,000 tons of carbon per year to the deep sea through Deadfall Carbon. That's equivalent to taking roughly 150,000 cars off the road each year.

A 2012 study found that by eating sea urchins, sea otters could potentially help to trap 150,000 to 22 million tons of carbon per year in kelp forests.

Deadfall Carbon.

When living organisms die, their carcasses sink to the seafloor, bringing a lifetime of trapped carbon with them. This is called Deadfall Carbon. On the deep seafloor, it can be eventually buried in sediments and potentially locked away from the atmosphere for millions of years.

Greenland sharks, can live for over 400 years, storing large quantities of carbon for long periods of time.

Image by DOUG PERRINE

Whale Pump.

Whales can also help to trap carbon by stimulating production of tiny marine plants called phytoplankton, which use sunlight and carbon dioxide to make plant tissue just like plants on land. The whales feed at depth, then release buoyant, nutrient-rich faecal plumes while resting at the surface, which can fertilize phytoplankton in a process that marine scientists call the Whale Pump.

Image by MICHAEL AW

The Great Whale Conveyor Belt.

Whales redistribute nutrients geographically, in a sequence we refer to as the Great Whale Conveyor Belt. They take in nutrients while feeding at high latitudes then release these nutrients while fasting on low-latitude breeding grounds, which are typically nutrient-poor. Influxes of nutrients from whale waste products such as urea can help to stimulate phytoplankton growth.

Image by MATTHEW SMITH

Biomixing Carbon.

Whales can bring nutrients to phytoplankton simply by swimming throughout the water column and mixing nutrients towards the surface, an effect researchers' term Biomixing Carbon.

Twilight Zone Carbon.

Fish poo also plays a role in trapping carbon. Some fish migrate up and down through the water column each day, swimming toward the surface to feed at night and descending to deeper waters by day. Here they release carbon-rich fecal pellets that can sink rapidly. This is called Twilight Zone Carbon.

These fish may descend to depths of 1,000 feet or more, and their fecal pellets can sink even farther. Twilight Zone Carbon can potentially be locked away for tens to hundreds of years because it takes a long time for water at these depths to recirculate back towards the surface.

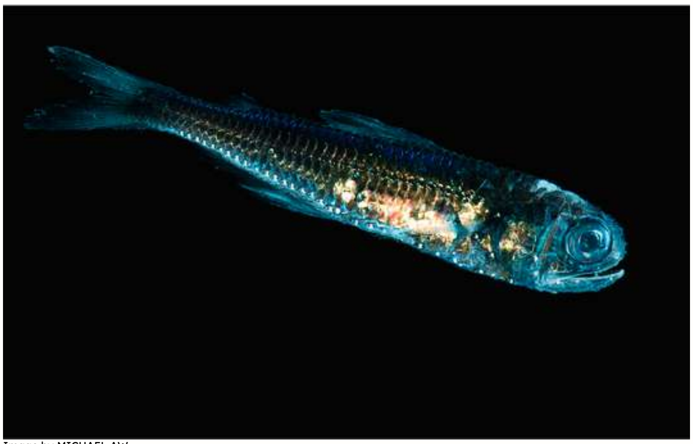

Image by MICHAEL AW

QUANTIFYING MARINE VERTEBRATE CARBON

Even more strikingly, a 2013 study described the potential for lanternfish and other Twilight Zone fish off the western U.S. coast to store over 30 million tons of carbon per year in their faecal pellets.

Scientific understanding of marine vertebrate carbon is still in its infancy. Most of the carbon-trapping mechanisms that we have identified are based on limited studies, and can be refined with further research. So far, researchers have examined the carbon-trapping abilities of less than 1% of all marine vertebrate species.

A NEW BASIS FOR MARINE CONSERVATION

Many governments and organizations around the world are working to rebuild global fish stocks, prevent bycatch and illegal fishing, reduce pollution and establish marine protected areas. If we can recognize the value of marine vertebrate carbon, many of these policies could qualify as climate change mitigation strategies.

“Fish Carbon” plays an important role in sequestering atmospheric carbon and transporting nutrients throughout the ocean, essentially fertilizing the water so that phytoplankton can flourish and absorb more carbon through photosynthesis. It also helps to buffer the ocean so it can more efficiently resist acidification. By recognizing and properly valuing the roles played by marine vertebrates in the oceanic carbon cycle, marine conservation policies and ecosystem management strategies will more accurately address the importance of “Fish Carbon” in mitigating climate change.

With this updated understanding of blue carbon, maybe we will start viewing schools of fish as mobile vertebrate forests of the ocean, giving us more reason than ever to protect what is left and work to replenish our world’s waters in an effort to implement solutions to our current climate challenge.

In the next issue, we will go into the role and contribution of Governments to Climate Action.