

Saving the Whale: How Much do you Value your Next Breath?¹

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April 2019

As more people and nations have become convinced that global warming is taking place, and we accept that the consequences of further warming are detrimental to economic growth and our survival, support for policies to combat global warming and mitigate its negative effects has also grown. Scientific research now indicates more clearly than ever that our carbon footprint has become a threat to our ecosystems and to our way of life as we now know it. Many proposed solutions to global warming are high-tech, such as finding ways to capture carbon directly from the air and bury it deep in the earth. But what if a low-tech solution to this problem could be found that is not only effective and more economically practical, but sustainable and ethical as well?

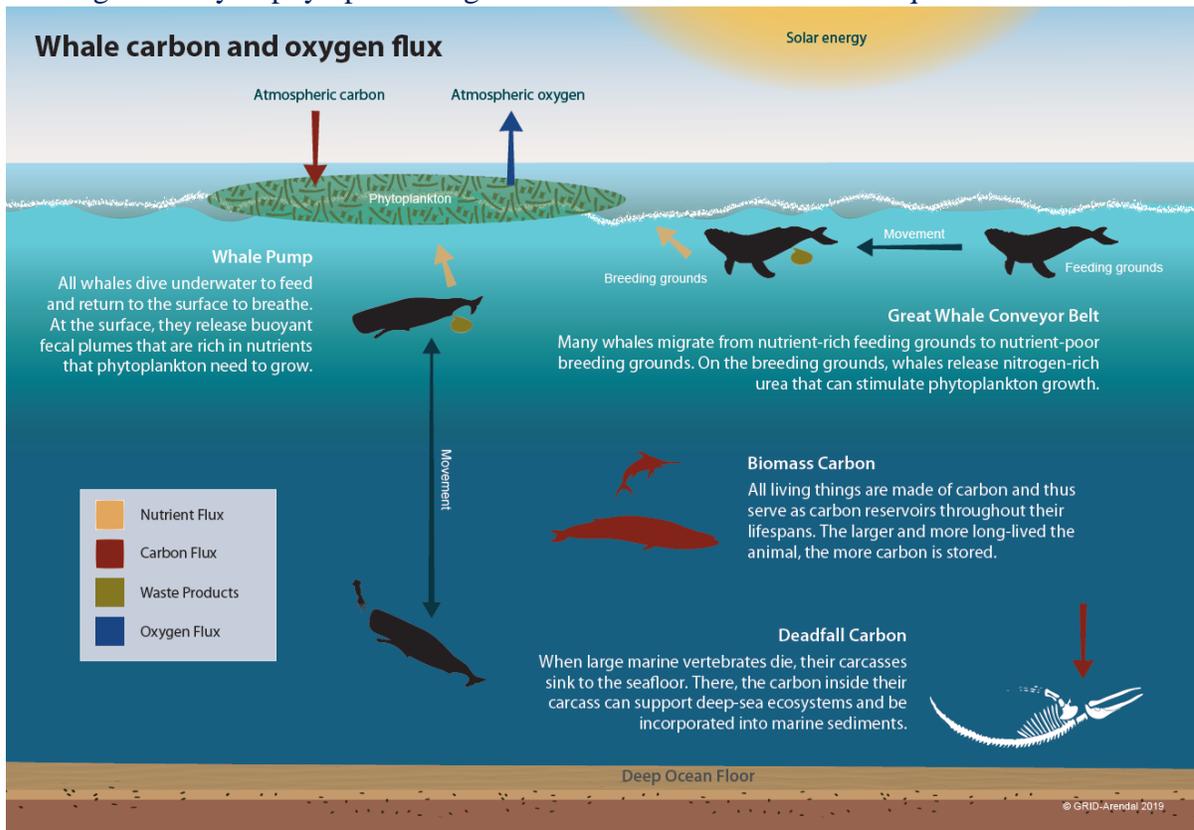
An example of such an opportunity comes from a surprisingly simple and essentially “no-tech” strategy to increase carbon capture from the atmosphere: increase global whale populations. Marine biologists have recently discovered that whales—especially the great whales—play a significant role in capturing carbon from the atmosphere. Imagine millions of whales, swimming throughout the global oceans capturing carbon in their large bodies. When whales die, they sink to the bottom of the ocean, each one sequestering 33 tons of CO₂ on average, taking that carbon out of the atmosphere for centuries. In contrast, a tree absorbs up to 48 pounds of CO₂ per year. But this is only the beginning of the story.

Whale Carbon

In recent years, scientists have also discovered that whales have a “multiplier effect” of increasing phytoplankton production wherever they go. Marine biologists have learned that whales’ waste products contain exactly the minerals needed for the growth of phytoplankton. Whales bring minerals up to the ocean surface through their vertical movement, called the “whale pump,” and also through their migration across oceans, called the “whale conveyor belt.” Preliminary modeling and estimates indicate that this “fertilizing” activity of whales

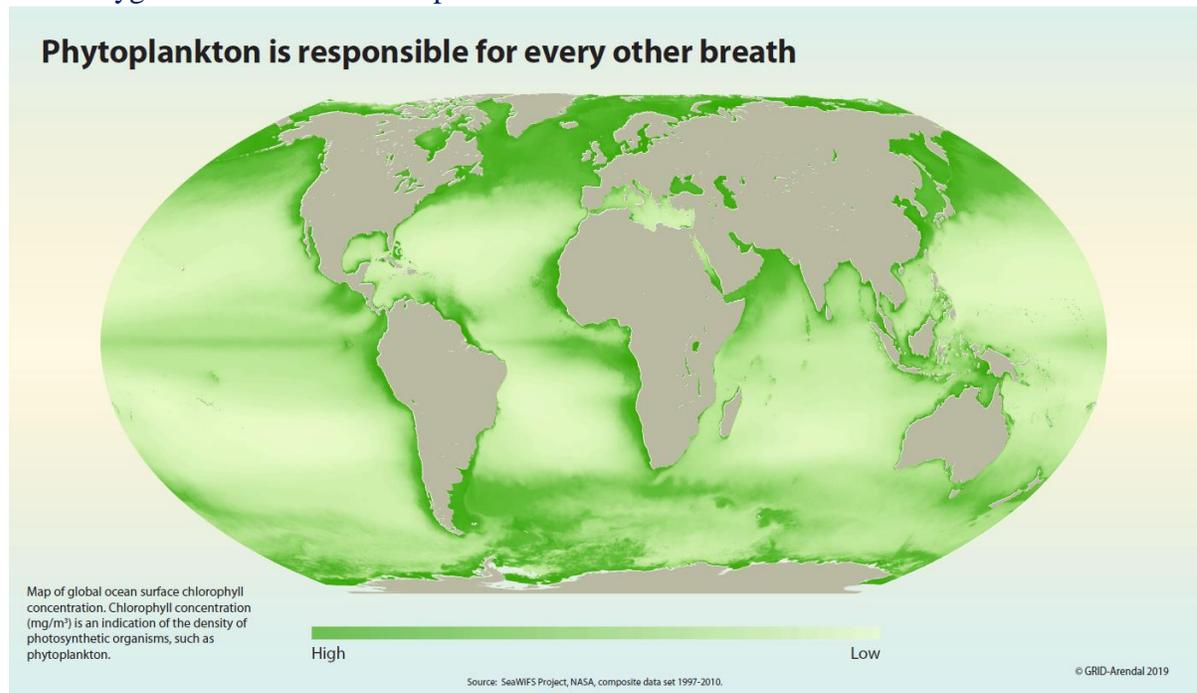
¹ The authors are grateful to Rayyan Chami, Michael Fishbach, Tiina Kurvits, Steven Lutz, Lennard Milich, Dinah Nieburg, Roger Proudfoot, Joe Roman, Rima Saliba, and Heather Watrous for informative discussions. Graphics provided by GRID-Arendal with support from the UN Environment/Global Environment Facility Blue Forests Project.

adds significantly to phytoplankton growth in the areas that whales frequent.



So, how large is their potential impact? Phytoplankton is responsible for approximately 50% of all oxygen produced—that is, every other breath we take—and for the capture of about 40% of all CO₂ produced. To put things in perspective, that is equivalent to the CO₂ captured by 1.70 trillion trees—4 Amazon forests' worth—or 70 times the amount of CO₂ absorbed by all the trees in the Redwood National and State Parks, per year! More phytoplankton means

more oxygen and more carbon capture.



But the growth of phytoplankton is limited by the nutrients available in seawater. Despite the fact that nutrients are carried into the ocean through dust storms, river sediments flowing into the ocean, and upwelling due to wind and waves, nitrogen and phosphorus remain scarce and limit the amount of phytoplankton that can bloom in warmer parts of the oceans. In colder regions, such as in the Southern Ocean, the limiting mineral tends to be iron. If more of these missing minerals became available in parts of the ocean where they are scarce, more phytoplankton could grow, potentially absorbing much more carbon than otherwise possible.

Earth-tech and not only High-tech

This is where protecting the whales comes in. If whale numbers were allowed to grow back to their 4-5 million strong pre-whaling stock, this has the potential to add significantly to the amount of phytoplankton in the oceans and to the amount of carbon they capture per year. At a minimum, even a 1 percent increase in phytoplankton productivity due to whale activity would capture hundreds of millions of tons of additional CO_2 per year, equivalent to having 2 billion mature trees suddenly appear every year. Keeping in mind that whales, on average, live over 60 years, this is truly a gift of life that keeps on giving!

A big reason why protecting whales could add significantly to carbon capture is that the current population of the largest great whales is only a small fraction of what it once was. Sadly, due to decades of industrialized whaling, biologists estimate that overall whale populations have been reduced to less than one fourth of their numbers and for some species, like the blue whales, to only three percent of their previous abundance. Despite the end of commercial whaling, whales still face significant life-threatening hazards including ship

strikes, entanglement in fishing nets, waterborne plastic waste and noise pollution. While some species of whales are recovering—slowly—many are not.

Thus, because their surviving populations are small, the benefits from the whales' ecosystem services to us and to our survival are much less than they could be. And beyond the loss of carbon sequestration, low whale populations also have a depressive effect on ecotourism and fisheries, two industries estimated to generate hundreds of billions of dollars of economic activity. Given that in many cases the beneficiaries of whale-related industries would be low-income states such as Gabon and El-Salvador, this represents an especially costly missed opportunity for economic development.

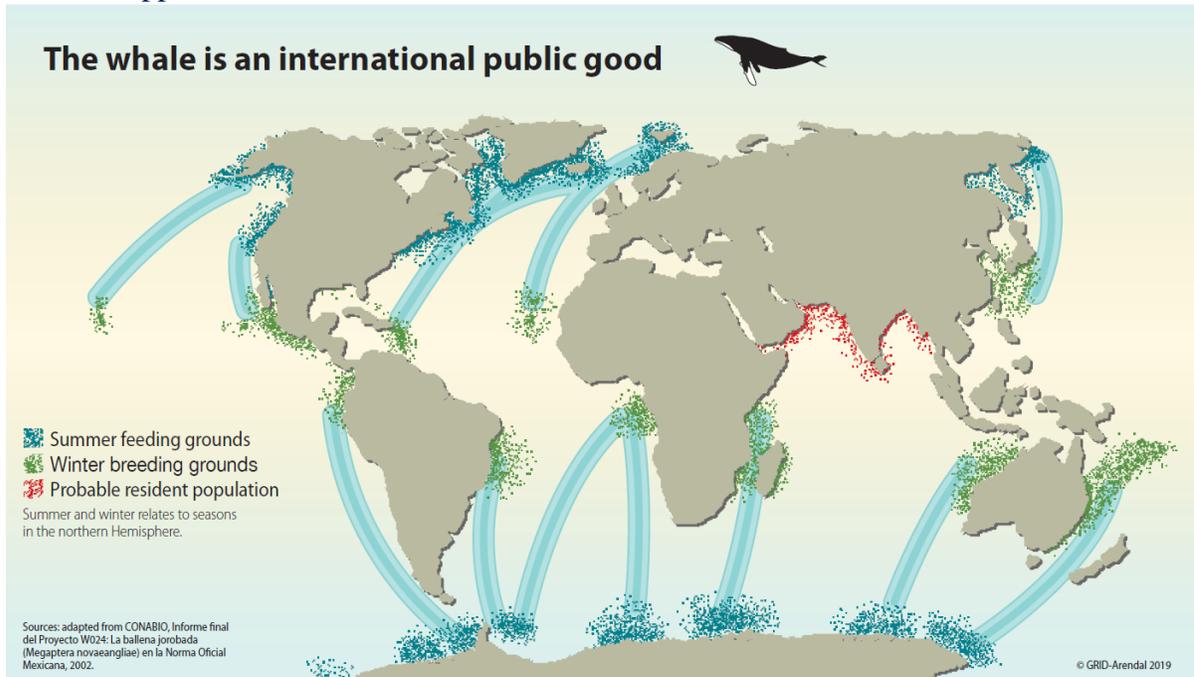
In short, enhancing our protection of whales from man-made dangers delivers benefits to ourselves, the planet, and of course, the whales themselves. This “earth-tech” approach to carbon sequestration can also avoid the risk of unanticipated negative effects from untested high-tech fixes. Nature has had millions of years to perfect her whale-based carbon sink technology. All we need to do is let them live.

Now we turn to the economic side of the solution. Protecting whales has a cost. Mitigating the many threats to whales involves compensating those entities causing the threats, a group that includes countries, businesses and individuals. In order to ensure that this approach is practical, we must determine the monetary value of whales.

Whales are an International Public Good

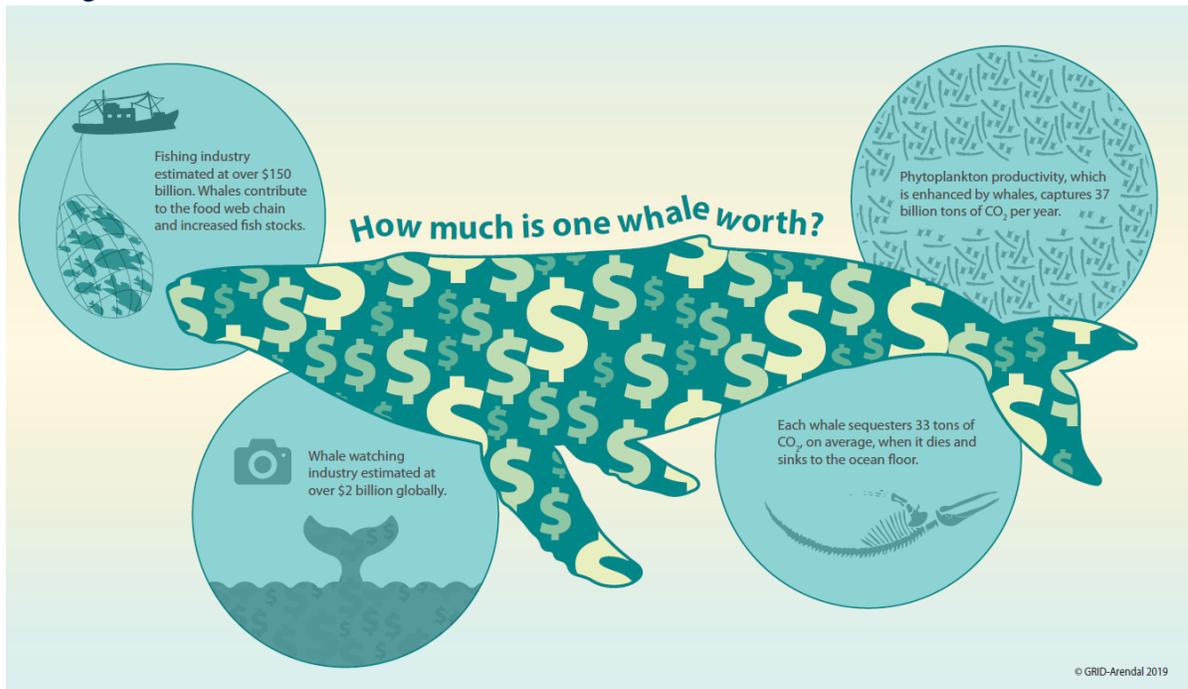
Whales migrate thousands of miles each year between seasonal feeding areas in the high latitudes and their calving areas in the low latitudes. Thus, no one country can claim ownership or responsibility for any specific groups of whales. Indeed, because whales produce climate benefits that are dispersed literally all over the globe, they produce a positive externality for all societies. And because each person benefits from the existence of whales without diminishing the benefits that other people receive from them, they are a classic public good. In fact, they are truly an “international public good” because they visit many countries each year. This means that whales are affected by the classic problem of the “tragedy of the commons” that afflicts public goods and the producers of positive externalities: no individual who benefits from them has enough incentive to pay their fair

share to support them.



In order to solve this international public goods problem, we must first ask, what is the monetary value of a whale? With every externality, proper valuation is warranted if we are to galvanize businesses and other stakeholders to save the whales. Our conservative estimates put the value of a single whale, based on its various contributions, at over 2 million US dollars, and easily over 1 trillion US dollars for the current stock of whales. The 2013 market price of a whale's meat was about 24 thousand dollars, in countries where it is part of the national diet. Clearly, this market price does not factor in the positive externality that whales provide to our own survival. If it did, the price would be prohibitively expensive, likely

driving demand for whale meat in those countries to zero.



But how to tackle the myriad of other dangers to whales, such as ship strikes, entanglements, noise pollution, and plastics in the oceans? Luckily, economists know how these types of problems can be solved. First, incentives in the form of subsidies or other compensation can be given to those who would incur significant costs from making considerations for whales. For example, shipping companies can be compensated for the cost of altered shipping routes or transit times needed to reduce the risk of collisions. Just as the Reducing Emissions from Deforestation and Forest Degradation program (REDD) is designed to promote forest carbon storage in developing countries through financing mechanisms, a financial facility for protecting whales and other “blue carbon” natural assets could also be developed.

How much do we Value Our Next Breath?

These general solutions, however, raise specific questions that are especially tricky to answer. Exactly how much should we be willing to spend on protecting the whales? We estimate that, if whales were allowed to grow back to their pre-whaling numbers, it would cost less than \$13 dollars per person per year to subsidize these whales’ CO₂ sequestration efforts. But how should this cost be allocated across countries, individuals, and businesses? On the other side, how much should each individual, company, and country that must bear some of the cost of protecting whales be compensated? And who will oversee the compensation, and monitor compliance with the new rules?

Another important issue is the time frame needed to mobilize our response. With the consequences of climate change here and now, there is no time to lose in identifying and implementing new methods to prevent or reverse harm to the global ecosystem. But this strategy depends on improving the protection of whales so that their populations may grow

more quickly. Unfortunately, unless new steps are taken to do this, we estimate it would take over 30 years just to double the number of current whales, and several generations to return them to their pre-whaling numbers. Society and our own survival can't afford to wait this long.

A new mindset—

What is needed is a new mindset—an approach that recognizes and implements a holistic attitude towards our own survival, living within the bounds of the natural world. While whales are not “our” solution, having inherent value of their own and the right to live, a new mindset recognizes and values their integral place in a sustainable ocean and planet. Healthy whale populations imply healthy marine life including fishes, seabirds, and an overall vibrant system that recycles nutrients between oceans and land, improving life in both places. The “earth-tech” strategy of enabling whales to return to their previous abundance in the oceans could lead to significant benefits not only to life in the oceans but also to life on land, including our own.

Coordinating the economics of whale protection must rise to the top of the global community's climate agenda. Since whales play an irreplaceable role in mitigating and building resilience to climate change, their survival should be integrated into the objectives of the 190 countries that signed the Paris Accord in 2015 for combating climate risk. The IFIs, in partnership with other U.N. and multilateral organizations, are ideally suited to advise, monitor, and coordinate the actions of countries in protecting whales. The IMF and the World Bank are well placed to help governments integrate the macroeconomic benefit that whales provide in mitigating climate change, as well as the cost of measures to protect the whales, into their macro-fiscal frameworks. As to how soon this enhanced program to save the whales should begin, the following poignant reminder by the Reverend Martin Luther King, Jr. looms large: “The Time is always Right to do what is Right.”

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