



FUTURE PLANET | OCEAN

Can we fix our ocean noise problem?



(Image credit: M Malleson/Getty)



Ally Hirschlag 13th July 2022

searchers are uncovering just how large the impact of in-made noise is on ocean life. But there are some prisingly simple ways we could tackle this overlooked lution problem.

n the aftermath of the terrorist attacks on 11 September 2001, a great lull fell over North America, above and below the water.

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Understandably, fewer people were traveling by air. But ship traffic was also significantly reduced, even as far north as the Bay of Fundy in Canada. As a result, underwater noise in the bay dropped by an incredible **six decibels** to below 150 Hz – equivalent to a soft rain or

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area is frequented by North Atlantic right whales, so scientists at Duke versity decided to see if the quieter waters had any impact on the giant nmals. Sure enough, after analysing their **feacal matter for stress hormones**, r found the lower human-caused ocean noise was leading to lower stress ls.

ine animals like whales use sound to do everything from communicate and el to look for food and find safe environments. "Sound travels faster and further ater than in air, and marine animals take advantage of it," says Lucille Chapuis, nsory ecologist at the University of Exeter.

Over the past 50 years, increased shipping has contributed To a 30-fold increase in the low-frequency noise present Jong major shipping routes – Lucille Chapuis

this also means that when there's a near-constant hum of underwater noise ution from things like boat traffic, it can severely impact their way of life. "Over past 50 years, increased shipping has contributed to a 30-fold increase in the frequency noise present along major shipping routes," says Chapuis.

gine your upstairs neighbour was having work done on their apartment and you an important work presentation to give over a video call. You'd find it quite cult to hear and communicate with your colleagues and do a proper job. That's t marine animals who live or migrate near anthropogenic noise endure most of time.

decades now, scientists around the world have been studying just how actful this noise can be on marine animals. Now, they are beginning to identify measures that, if widely adopted, could save many species from the impacts of overlooked form of pollution.

sonant problem

ar and aircraft landings, to the construction of offshore wind farms and seismic 'eys used to explore for oil and gas. But the most common source is boats, cifically from their propellers.

en propellers, especially older ones, turn at high speeds, they can create a drop ressure on the reverse side on the backside of the propeller that results in a lot ubbles, and low-frequency noise – an effect called **cavitation**. Cavitation also res boats less efficient because the propeller is expending a lot of energy, some hich isn't helping to push the boat forward.

low-frequency sound has a long range, so it can disrupt marine animal



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munication across a wide area. Bottlenose dolphins, for example, use all sorts bunds to communicate with each other, some detectable by other dolphins over **m (12 miles) away**, and are often impacted.



searcher deploys a hydrophone on a coral reef in Sulawesi, Indonesia (Credit: Lamont/University of Exeter)

[have] found that dolphins adjust their calls when it is noisy underwater, most y so they can be heard better by other dolphins," explains Helen Bailey, earch professor at the University of Maryland's Center for Environmental ence. "This is similar to when we shout louder when we are talking in a noisier

adjust" she means simplify, as anyone might do to try to relay a message when e's a lot of ambient noise. In a **2018 study** on the subject led by Bailey, the earchers recorded underwater noise caused mainly by boat traffic in the tern North Atlantic up to 130 decibels, on par with a busy highway. If dolphins regularly trying to communicate with such interference, it's safe to assume a lot lost in translation.

think sound is as important to whales as all of our senses out together. [T]hey can feel it vibrating throughout their whole body – Rob Williams

onic, low-frequency sound also impacts the ability of young fish to find home. enile fish use sound to suss out their ideal marine ecosystem. They listen for a **rse soundscape**, which indicates that there's abundant resources for lots of rent life. When anthropogenic sounds block these natural soundscapes, they end up in **inhospitable environments**. (Sadly, at the same time, **mass iching events** are killing off fragile coral reef systems, leaving less life to make nds there and attract the juvenile fish – a negative feedback loop which elerates the die-off of the reefs.) se pollution is an especially big problem for whales, who regularly use sound to the base with each other. One 2012 **study** of blue whales found the mid-range nd from ships' sonar overlaps with their calls to each other, forcing them to sat themselves as if they were losing connection on a mobile phone.

literally shrinks the whales' world," says Rob Williams, marine biologist and ider of **Oceans Initiative**, a non-profit working to protect marine life. Williams eves anthropogenic ocean noise is just as much a threat to whales as irrestation is to grizzly bears – it fundamentally impacts every aspect of their of life. "I think sound is as important to whales as all of our senses put :ther," he says. "[T]hey can feel it vibrating throughout their whole body."

Whales singing recorded off the coast of California (Cre		
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Bulk carrier cargo ship noise recorded off the coast of C		
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Boat noise recorded on the Great Barrier Reef, Australia		
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t noise recorded on the Great Barrier Reef, Australia (Credit: Lucille Ch...

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ams has studied killer whales for decades, including the **southern resident er whale** in the northeast Pacific Ocean, which is **among the world's most ically endangered animals** due to a dwindling food supply, pollution and ocean e.

ording to a **2017 study Williams co-authored**, anthropogenic ocean noise can b these whales from feeding as much as they normally would if the noise was present.

're showing that when boats are too close, and the boats are making noise, the r whales are spending 18-25% less time feeding than if there were no boats ind," he explains. Williams says the team also found that the whales' calls only the about 62% of the distance they would in a marine environment not ulated by boats and ships.

an noise also impedes killer whales' ability to catch chinook salmon and

ing, their primary food sources. A **recent study** that evaluated the behavior of the two prey fish found that they often react to boat noise as if it were a predator eeing or changing migration patterns, making it harder for the killer whales to h them.



lenose dolphins, who can make sounds detectable by other dolphins over 20km miles) away, are affected by ocean noise pollution (Credit: A Rosenfeld/Getty)

propogenic noise affects other prey fish in different ways. A **2016 study** found iselfish don't hear their predators approaching as well when motorboat noise is sent – making them more susceptible to being eaten. In fact, more than twice as iy fish were eaten when motorboats were passing than when they weren't, th suggests anthropogenic sound is directly linked to an increase in fish tality.

Jifficult to assess exactly how detrimental anthropogenic noise is to all ocean life since it appears to impact some species more than others. Most studies on subject, however, suggest that the auditory interference inhibits marine animals' ties to hear and react to biological sounds, which in turn decreases their ability urvive. And, in the case of critically endangered species, like the southern dent killer whale, experts like Williams believe such an impediment could nately put the species on a fast track to extinction.

easy win?

flip side of the ocean noise problem is that it is one of the few human-fuelled ution sources that has several relatively straightforward solutions.

nd emanating from ships is by far the most common culprit, so conservationists eve it should be addressed first. One of the easiest ways to do that is to simply ship and boat traffic to slow down when moving through areas rich in marine - a strategy which could also **help to cut carbon emissions from ships**. Major s in the US **Pacific Northwest** and **Vancouver** have already enacted slown programs, and a **recent study** found that the effort is making a significant rence.

nething as simple as slowing down a few knots makes a major drop in the e level. And we've just shown that it not only drops the noise level, but when s slow down, the killer whales are feeding more," says Williams.

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ke other conservation efforts, which can require years of development, noiseiction programs like these are relatively low-lift. And their impact can be felt t away. "We don't have to wait decades to fix this," says Williams. "What's utiful about working on ocean noise is that if we reduce the source, [the efits] take effect immediately."

ing ship lanes away from areas populated by sensitive species like killer les could also be beneficial, Williams adds. But in order for noise abatement eavours to have a widespread effect on marine life, they will have to be backed weeping public policy.

while slowing ships down is a good start, scientists agree ships ultimately d to be built and retrofitted with noise abatement in mind. A first step in that ction could be changing ship building requirements so the parts that make the t noise, like the engine and propeller, are designed to be quieter.

Navy and others have learned how to do this, but it has not [yet] been uired for commercial vessels," says Hildebrand.



lies have shown damselfish are more susceptible to being eaten when orboat noise is present, as they don't hear predators (Credit: E R ginger/Alamy)

International Maritime Organization has also **made building quieter ships** t **of its mission**, and in 2014 outlined **simple guidelines** for engineers and iufacturers to follow. That said, NGOs such as the World Wide Fund for Nature VF) **have noted the voluntary guidelines put out by the IMO have been ely ineffective at curbing anthropogenic ocean noise**, and are **calling for idatory limitations**. Natasha Brown, an IMO spokesperson, says the IMO's lelines are currently under review, providing an opportunity for member states NGOs to submit proposals for further work and action on underwater noise. ' mandatory measures, this would need to come from a proposal from an [IMO] nber state or states," she adds.

ofitting ships would also help to reduce ocean noise. This tends to be more ensive than adjusting designs and parts for new ships, but it could be worth it if the most problematic ships are targeted. **One of Williams' studies** on noise nating from a fleet of 1,500 ships found 50% of the noise was coming from 15% of the vessels. So retrofitting just those ships with new, noise-reducing vellers would make a significant difference in the fleet's overall sound impact.

ating a financial incentive for private companies to build, buy and operate ter ships could be another useful approach. Design adjustments already on the ket, such as propellers which reduce cavitation, can also make ships more ient and reduce carbon emissions, says Williams. For companies looking to go ener, that added benefit may be what tips the scales.

etening a noisy landscape

le boat noise is the most common form of anthropogenic ocean noise, other ces also create problems.

construction and operation of offshore wind farms is among them. Many major ctures offshore are built using pile drivers, which can cause sudden bursts or es of loud underwater sound.

der or higher frequency sounds like these may do more immediate damage to rby marine life than the more chronic, lower-frequency sounds, says John ebrand, a professor of oceanography at the University of California. "At high nsities it may be that the noise creates physiological damage," he says.

way to reduce this noise is to create a **bubble curtain** around the sites. It's as it sounds, "a series of bubbles that form almost a wall and block some of the nd being emitted from a source," explains Bailey.

rever, Chapuis notes that the operation of the wind farms also produces "a stant, low frequency sound, which can represent a chronic source of noise, n if the levels are not that high". Some researchers argue this noise should be ressed in the planning of where wind turbines are placed, as well as in the ronmental impact assessments of individual projects.

:raft can also produce significant underwater noise, especially when they ilarly take off and land at airports near bodies of water. Moving runways further y from areas that are home to sensitive marine life could help curb the olem.

As long as humans are around, the noises they bring with hem will likely remain a part of ocean soundscapes

ary sonar is another source of anthropogenic ocean noise that can sound so lar to whale calls that it confuses them, leading them to lose their sense of ction – thought to be one reason why whales end up stranded on beaches. One initial solution is for the military to reduce the need for sonar by instead esdropping on natural sounds from marine animals as a way of detecting erwater threats.

lerwater mining for fuels like oil and gas can also produce bursts of ocean e. Sometimes, excavation teams set off large explosions, or use seismic air s in sharp bursts from a ship above to push through the ocean floor.

ebrand argues that restrictions are needed for such noise exposure of marine nals, "in much the same way that **OSHA** [the US Occupational Safety and Ith Administration] limits human exposure to high levels of noise". Restrictions d include decibel limitations at certain points in bodies of water where erable marine habitats exist, regulated by environmental government agencies the Environmental Protection Agency (EPA) in the US.

se agencies could also provide guides for different industries to reduce their nd emissions. Seismic survey noise, for example, can be tempered by asing the air in more continuous, lower frequency pushes over longer periods me – a process called **marine vibroseis.**



drophone listens for clicking sounds made by sperm whales near Pico Island, ugal (Credit: wildestanimal/Getty)

using on one source of ocean sound pollution or one impacted species at a won't make much of a difference on a global scale. But considering the arching environmental impact, followed by the creation of a multipronged plan ction, might. In order to best assess what progress is being made and where < still needs to be done, monitoring soundscapes around the world must be part lat plan.

	This concerns a long-term, grobat occan
ΝΤ	noise monitoring system that's accessible to anyone
	anywhere. Not only would researchers be able to better
	track changes this way, activists or politicians looking to
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	field, but scientists within it are always looking for ways
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	technology. "We've developed this acoustic prospecting
	toolkit where we can just give someone a \$1,000 (£815)

Hildebrand has called for a long-term **alobal ocean**

Pelican case [a durable, waterproof case for sensitive

s] and they can go and do spot recordings in some remote parts of the world," 3 Williams.

puis says scientists are also actively encouraging the development of low-cost, erwater recorders so that more research can be done, and more people can over "the fascinating sounds which can be heard underwater".

ong as humans are around, the noises they bring with them will likely remain a of ocean soundscapes. But like any other type of harmful pollution, ocean e needs to be regulated in a meaningful way if we are to keep marine animals' nd-driven worlds from shrinking away.

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FUTURE PLANET | ARCHITECTURE

The sustainable cities made from mud



(Image credit: Alamy)



By Isabelle Gerretsen 6th July 2022

Mud buildings are remarkably good at keeping us cool in summer and warm in winter, and withstanding extreme weather. In the search for more sustainable buildings, architects are returning to this overlooked, age-old construction material.

n Yemen's ancient walled city of **Sana'a mud skyscrapers soar high** into the sky. The towering structures are built entirely out of rammed earth and decorated with striking geometric patterns. The earthen buildings blend into the nearby ochre-coloured

mountains.

Sana'a's mud architecture is so unique that the city has been recognised as a **Unesco World Heritage site**.

"As an outstanding example of a homogeneous architectural ensemble reflecting the spatial characteristics of the early years of Islam, the city in its

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