

Ocean biodiversity: Hidden depths



Our best writing from 2019 on
deep seabed mining, marine
protected areas and progress
towards a high seas treaty

**DEDICATED TO
ILLUMINATING,
ANALYSING AND
HELPING TO RESOLVE
OUR OCEAN CRISIS.**



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China needs its rich coastal wetlands

By **Ling Cao**

In July this year, UNESCO brought a bird sanctuary on the coast of the Bohai Bay into its prestigious list of world heritage sites. It is both China's first coastal wetland heritage site and the world's second intertidal wetland heritage site.

Coastal wetlands, which include coral reefs, mangrove forests and shallow seabeds, are some of the world's most biodiverse ecosystems. They provide breeding grounds and habitats for a multitude of marine organisms. This biodiversity and the ecological services wetlands provide makes them of huge natural and economic value.

Millions of birds of over 250 species are thought to inhabit China's coastal wetlands every year, accounting for 80% of the country's aquatic birds and including endangered species such as the red-crowned crane, the black-faced spoonbill and the oriental stork. They supply food for the birds as they breed, migrate, rest and overwinter.

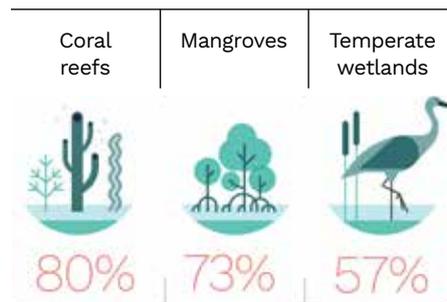
Coastal wetlands also help regulate the environment, by retaining and absorbing nutrients, purifying water, preventing soil erosion and protecting the coastline. For example, mangrove forests shield the land from typhoons and storm tides, while kelp beds clean water by absorbing nitrogen and phosphorus.

China's coastal regions are home to 40% of its population, 50% of its major cities and generate 60% of its GDP. But development of the coast is heavily dependent on the biodiversity found there. We used one set of data to carry out an in-depth analysis of the relationship between China's 32,000km of coastline and 22,000 marine species (10% of the global total). Of the world's seabird species, 23% are found in China, along with 14% of fish species. There are 2,500 commercial fish species, 800



Dr **CAO LING** is an Associate Professor at Shanghai Jiao Tong University's School of Oceanography. She completed her PhD in Resource Ecology and Management at the University of Michigan and worked at Stanford University for several years before returning to China.

Marine habitat lost in China since the 1950s:



commercial shrimp and crabs, and 100 commercial aquatic plants. Species such as the Chinese sturgeon, the Indo-Pacific humpback dolphin, five species of sea turtle, the horseshoe crab and dugong are either unique to China, or endangered worldwide.

Meanwhile, China catches 13 million tonnes of seafood every year, worth 200 billion yuan (US\$28 billion) and accounting for 20% of national seafood production. Marine species are also sources of important drugs for the medical industry – 1,000 have been identified as of medical use, with 250 containing substances that can help to treat cancer.

But coastal wetland areas are among the most affected and damaged by human activity, and suffer the largest drops in biodiversity. Disorderly and excessive development, pollution and illegal fishing have seen China lose more than 50% of its temperate coastal wetlands, 73% of its mangrove forests and 80% of its coral reefs. Large expanses of inshore habitats have been lost or degraded and ecosystem connectivity has fallen significantly, leading to sharp and sustained drops in the number of marine species, with increasing numbers of species becoming endangered.

As part of building an ecological civilization, China has taken a number of measures to improve the situation. Strong attempts have been made to bolster management and protection of marine biodiversity in line with a principle of “conserving while developing and developing while conserving”, with a revision of the Marine Environment Protection Law, establishment of priority marine conservation zones, better ocean zoning and a lifetime responsibility approach to marine environment damage, all of which have produced results.

For example, in 2016 and 2017 three documents were issued to ensure the conservation, management and appropriate use of coastal wetlands, including a program for wetland restoration, guidance on conservation and management of wetlands, and an overall wetlands conservation program for the 13th Five Year Plan period. A 2018 crackdown on land reclamation has also helped.

To date, China has established over 250 marine protected areas, covering 123,000 km², or 4.1% of China's total marine area. This includes 37,000 km² of inshore waters, 9.7% of the total. Species protected include the Indo-Pacific humpback dolphin, a rare species of lancelet, the Chinese horseshoe crab, and several coral, along with ecosystems such as mangrove forests, coral reefs, river mouth wetlands and islands. Since 2011, 42 national marine parks have been set up, and China aims to have 5% of its waters protected by 2020.

But currently only 24% of China's coastal wetlands are protected, far less than the nationwide proportion of 43%.

For genuinely effective management and conservation, much more needs to be done. There is no specific law covering coastal wetlands and the laws and regulations that touch on their protection are incomplete. There are numerous conflicts between various management systems, rather than a single coordinated system. Coastal wetland management involves multiple government departments and agencies, including

forestry, marine, fishery, homeland and environmental protection. Conflicts between various management systems often compromise the effectiveness of coastal wetland conservation efforts in China. Hopefully the recent government reshuffle can help solve this problem.

Most conservation work in coastal wetlands focuses on aquatic birds, particularly those which are endangered, with less attention paid to fish. Protected

areas are small, focused on only a few species, and not necessarily in the places where conservation is most needed. A lack of funding and poor understanding of what resources existing reserves contain and how to monitor these is severely limiting the protection and restoration of China's coastal wetlands. I hope ongoing management and conservation work will take the above issues seriously. 🍷

OVERVIEW

Alex Rogers: 'We are accelerating biodiversity loss in the ocean'

By **Jessica Aldred**

Professor Alex Rogers is science director of the REV Ocean foundation and a visiting professor and senior research fellow at Oxford University. He talks to China Dialogue about his book published this year, *The Deep*, and how we can turn the tide on the loss of sea life.

Jessica: A key UN report this year showed that human actions have "severely altered" the biodiversity in nearly 66% of marine environments. What are the biggest drivers of loss?

Alex: Overfishing and bycatch – it is still going on rampantly throughout the oceans. And it is still being done in a way which is highly damaging to the broader ecosystem.

How will daily life be impacted if we don't protect marine biodiversity?

One obvious way is that we will lose out in terms of food that we can harvest from the ocean. That may not directly affect us in developed countries... but certainly in developing countries, that will translate to impacts on food security and damaged livelihoods. It also affects tourism, and coastal protection – loss of ecosystems like mangrove forests, seagrass beds, kelp beds and coral reefs



ALEX ROGERS

has advised the UN, Greenpeace, WWF, G7, the BBC's Blue Planet II. He has three marine species named after him, including the zombie snout worm (*Osedax rogersi*).

exposes coastal zones to the increasingly severe effects of storms and sea-level rise which we are seeing from climate change.

There is a growing climate emergency movement. Are we at the same tipping point with the oceans? How bad is it?

At the moment, we are facing two crises that are interdependent. Firstly, the climate change crisis, and frankly that should have been treated as a global emergency 20 years ago. The only reason that the public is finally waking up to the problem is that the changes in climate are becoming so extreme.

The other crisis is the biodiversity crisis. Essentially we are in a situation of accelerating biodiversity loss in the ocean ... and there may be far more extinction going on than we actually realise. Despite so many

international conventions and agreements calling for monitoring of the marine environment and of biodiversity, it's just not happened. And that really needs to change.

How important are mechanisms like marine protected areas (MPAs)?

MPAs are extremely effective at maintaining biodiversity, increasing the abundance of animals within them and increasing resilience of the ecosystem to overfishing and climate impacts. The problem is that there are not enough of them – and not enough are well-enforced.

In your book, there is a fantastic chapter on discovering the deep-sea hydrothermal vents in the Southern Ocean. How do you feel about the prospect that such vents are being explored for mining?

A lot of the attention has been on the Clarion Clipperton Fracture Zone, an area in the equatorial Pacific where there are large deposits of polymetallic nodules on the seabed ... And although there has been a recent spurt of scientific research in that region, all that has really told us is how little we actually know. It hasn't given us the level of knowledge we actually need to manage mining. So scientists are deeply concerned about that.

But there are other mineral deposits as well: cobalt crusts on seamounts, and seabed massive sulphides on vents. And those are even more concerning in some ways, because hydrothermal vents have a very high level of endemism [species found nowhere else], they are rich in terms of biotechnological potential ... And also vents are actually quite

small and therefore very vulnerable to disturbance.

What's your view on a moratorium?

This is a decision that should be made by society. I am a conservation-minded scientist so obviously I don't want to see another large-scale activity impacting our ocean, which is already under severe stress. But if society has to make a decision ... it has to have a full understanding of what the impacts of this activity are going to be and how to best manage that so it has minimal damage. And at the moment we are not even in the ballpark of having that level of knowledge. So there should be at least a 10-year moratorium on any mining in the deep ocean.

Less than 10% of two million marine species have been described. Why is it so important to know more? How will greater knowledge help conservation?

It's important we know more about what's in the ocean. Not just the deep ocean, but all of it. One of the problems is just lack of information. Loss of biodiversity is a symptom that things are going wrong, that the way we are interacting with our ecosystems is not right. And if we don't have that information, then we don't understand what impacts we're actually having.

In your book, you say we have lost sight of what lies beneath the ocean and why it matters. What can

individuals do to help?

Number one – educate yourself about the ocean. Understand what's in there, why it's important. But also, educate yourself about what your government is doing on your behalf in terms of managing activities that are impinging on the oceans.

You have some lovely descriptions in your book of biodiverse places. Which area for you showcases the greatest biodiversity?

Coral reefs are just incredible. But good, healthy coral reefs are getting increasingly difficult to find ... but you can see really amazing stuff just by going down to a rocky shore. You can find really remarkable biodiversity on your doorstep. 

THE HIGH SEAS

High seas treaty: race for rights to ocean's genetic resources

As negotiations enter the final phase, countries are split over principles to govern exploitation; China is at the centre of the debate



By **Li Jing** | August 7, 2019

The ocean is home to millions of species, many of which are still unknown to humans. It supplies us with oxygen and each year absorbs nearly 25% of the greenhouse gases we produce by burning fossil fuels. However, vast areas of the high seas, which cover nearly half of the Earth's surface, remain unregulated.

Countries are currently negotiating a landmark global deal known as the

BBNJ (biodiversity beyond national jurisdiction), which for the first time would plug this significant gap while tackling the increasing pressures of activities such as fishing and mining, and marine pollution.

But the 48-page draft text for negotiation released by the United Nations in June indicates the wide-ranging differences that remain between nations.

"The negotiation is entering [its] technical phase, yet obviously the draft is

still heavily bracketed [open for debate], and many of the differences [that] remain [are] political, not likely to be resolved at [the] technical level," said Chen Jiliang, researcher at Greenovation Hub, a non-governmental organisation in Beijing.

Ahead of negotiations in New York later this month, some observers are worried about whether a legally binding deal can be reached in 2020 as scheduled. There is only one more round of talks planned next year.



“Marine genetic resources”

The 1992 Convention on Biological Diversity’s definition is “genetic material of actual or potential value”. The 2014 Nagoya protocol prevents any one nation or company from monopolising the world’s genetic resources, but until the high seas treaty is agreed, no such mechanism exists for biodiversity beyond national jurisdiction.



*Sea stars clinging to a pinnacle at the bottom of the Gulf of Mexico
(Image: NOAA, CC BY SA)*

‘Paris of the high seas’

Hailed by some conservationists as the “Paris Agreement for the high seas”, the challenges for diplomats, conservationists and scientists are equally, if not more, grave than the landmark climate deal reached in France in 2015. The high seas treaty must not only protect marine biodiversity, but accommodate existing legal treaties, and bridge a deep north–south divide in the development statuses, technological capacities and conservation beliefs of the countries involved.

Along with other contentious issues, such as creating marine protected areas and adopting environmental impact assessments for activities like mining, a core element of the debates is how countries will access and share the benefit derived from the ocean’s marine genetic resources in a fair and equitable manner.

New biological findings and technological developments have made marine organisms the object of commercial interest. From the biggest whale to the tiniest microbe, corporations and researchers are looking for genetic sequences that have immense potential value for the pharmaceutical, biofuel and chemical industries. Some of these sequences are associated with patents, allowing corporations and research institutions the sole right to conduct research on them and produce products related to them. An example is the US

chemical company Dow successfully isolating the genes that produce Omega 3 – a beneficial fatty acid mostly derived from fish – and splicing it into canola, a crop widely grown to produce cooking oil.

The global market for marine biotechnology is projected to reach \$6.4 billion by 2026. There are currently 12,998 patents involving 862 marine species. German-based chemical giant BASF has so far registered 47% of all marine sequences included in gene patents.

Yet there are two conflicting principles – both endorsed in the 1982 United Nations Convention on the Law of the Sea (UNCLOS) – which govern their exploration and exploitation. These have been hotly contested since the very beginning.

‘Freedom of high seas’ versus ‘common heritage’

The freedom of high seas principle gives countries the right to navigate, fly over, fish and carry out scientific research on the ocean that lies beyond exclusive economic zones and so belongs to no country.

In 1967, it was proposed that the sea would be open to all countries, but subject to international regulation for the common good of all humanity.

UNCLOS eventually declared “the Area” – seabed and subsoil beyond national jurisdiction – as the common heritage of mankind. The International Seabed Authority (ISA) was later founded

Top 10 countries claiming patents involving marine genetic sequences

	by 2009		by 2017
Germany	199	US	6,278
US	149	Germany	1,450
Japan	128	Japan	1,431
Israel	34	France	848
UK	33	UK	669
Norway	24	Denmark	632
France	17	Belgium	366
Denmark	13	Netherlands	105
Canada	11	Switzerland	103
Netherlands	9	Norway	66
...
China	1	China	1

Source: “Marine biodiversity and gene patents” (Science, 2011) and “Corporate control and global governance of marine genetic resources” (Science Advances, 2018)

Genetic sequences associated with patents, by 2017

Type	Species	Sequences
Microbes	634	9468
Fish	88	2055
Crustaceans	26	187
Corals	25	185
Molluscs	24	334
Anemones	16	89
Jellyfish	10	162
Plants	9	175
Worms	9	54
Sea urchins	7	103
Sea squirts	6	135
Lancelets	4	18
Sea pineapples	1	2
Sponges	1	26
Starfish	1	1
Whales	1	4

Source: Corporate control and global governance of marine genetic resources (Science, 2018)

to oversee exploration and subsequent mining of deep-sea resources, aiming to ensure benefits are shared equitably.

These seemingly contradictory ideals pose daunting challenges for negotiating the new deal, which covers not only the high seas, where the freedom principle prevails for human activities, but also the Area, where the common heritage of mankind principle applies.

If the freedom principle applies, whoever acquires the genetic material in the deep sea could enjoy exclusive rights over whatever products they develop. But if the organisms are recognised as the common heritage of mankind, developing countries will also be entitled to share in the benefits.

Governance gaps

In negotiation rooms, the situation is further complicated by yawning gaps between the economic and technological strength of countries in the global north and south.

In the draft text, almost all of Part II, which is dedicated to marine genetic resources, remains bracketed. Countries disagree on everything from what counts as genetic resources, where and how they're accessed and collected, to the objectives of the treaty and how countries will share the benefits.

Hu Xuedong, deputy head of the China Ocean Mineral Resources Research

and Development Association, said countries are largely grouped into three.

There are the industrialised countries with sophisticated technology to exploit the resources who would like as little restriction as possible (the United States, Japan and Russia). On the other side are the developing countries who are demanding a fair and equitable share of benefits. Somewhere in the middle is the European Union, which has a strong foothold in marine technology but is hoping to prioritise conservation. Hu points out that the EU adopts a rather pragmatic view to push forward the negotiations. And according to Hu, there are already signs that the “resource exploiting” group and the “pragmatically moving forward” group are gaining an upper hand in preparatory discussions.

China: between north and south

In the latest talks, China joined the G77 group of developing countries in demanding that “the principle of common heritage of mankind must underpin the new regime”, adding that the principle “should be at the core of the new instrument”.

Professor Xue Guifang, of the Centre for Polar and Deep Ocean Development at Shanghai Jiaotong University, explained that this common heritage principle was “a hard-fought victory” for developing countries in negotiating

seabed mining. “As a result, this is a position that China, as a developing country, is unlikely to give up.”

But as China is making rapid progress in deep-sea bioprospecting technologies, the country seems to be more willing to stay in the middle of the north–south divide, according to both Xue and Chen.

In a 2017 press conference, the State Oceanic Administration announced it had been rapidly expanding its collections of deep-sea microbes since 2002 and had completed the DNA sequencing of 300 so far.

In an interview with National Oceanic News, the official newspaper of the administration, Shao Zongze, director of State Key Laboratory of Marine Biogenetic Resource, emphasised a sense of urgency to collect, research and patent the microbes, and eventually commercialise the findings.

As such, China seems to be keen to create some space for itself to manoeuvre. In its official submission to the UN, China stated the new international instrument should advance the “common wellbeing of humankind”, a slight language tweak that might suggest a deviation from the common heritage principle.

“The vagueness could be a deliberate move,” said Xue.

China seems to prefer unrestricted access to the living resources in the deep sea, which would be supported by a freedom of high seas principle. Yet on exploiting the resources, it prefers the benefit-sharing common heritage of mankind principle, according to Xue.

Every country will need to make some concessions towards a final deal, though time is running out.

“It seems not every country is in a hurry to hammer out a final deal,” said Chen, “but if there is limited progress at the upcoming talks in New York, we will need a higher level of political will before we can reach a substantial deal next year.”

Li Jing is a freelance writer covering environmental and climate issues. She was a visiting journalist fellow at the Reuters Institute for the Study of Journalism at the University of Oxford, and senior reporter at the South China Morning Post and China Daily.



(Image: Sean McRory)

THE HIGH SEAS

Governments thrash out treaty to save the high seas

Talks must overcome a web of vested interests before a biodiversity charter can be agreed

By **Chen Jiliang** | October 9, 2018

The first round of talks to establish a new treaty to protect marine life and biodiversity in the high seas took place at the United Nations in New York in September, with the goal of finalising a treaty in 2020.

The intergovernmental talks to protect biodiversity beyond national jurisdictions (BBNJ) lasted two weeks and covered four key topics, with the aim of ensuring all nations can share equally and sustainably in the benefits and resources – biological and mineral – of the high seas, which cover 45% of the planet's surface and are home to 90% of marine life.

The over-arching question of what powers a new treaty will have, and who will wield them, was among the most complex the delegates discussed. Resolving it will be crucial to the outcome. But we do know that establishing reserves to protect marine genetic resources touches on two of the core goals set for the talks.

Multiple stakeholders

There are multiple intergovernmental organisations and regional agreements

that have vested interests in how the deep sea is run. An effective treaty must put in place governance arrangements that end the fragmentation of the deep sea. Yet success will depend upon the consent of these organisations, and many governments, in order to put mechanisms in place for conservation and utilisation of marine biodiversity.

Conference president Rena Lee of Singapore referred to this dilemma in her closing remarks.

“It will not always be smooth sailing. We will not always paddle in the same direction. But, if we continue in co-operative, flexible and committed mode, we will reach our destination one day,” she said.

Upsetting the status quo

At least 16 regional and sectoral organisations are already involved in marine reserves. They include the International Seabed Authority (ISA), which oversees mineral extraction from the seabed; the Food and Agricultural Organisation (FAO); the International Maritime Organisation (IMO), which promotes maritime safety; the Convention on Biological Diversity; and UNESCO, which deals with natural

and cultural heritage.

However, marine reserves do not provide a uniform level of protection. For example, the Convention on Biological Diversity's Ecologically or Biologically Significant Marine Areas offer no conservation whatsoever; it merely recognises an area's importance. Regional fishery management organisations impose temporary fishing bans in certain areas, while the IMO designates emissions control areas – in both cases identifying boundaries and putting appropriate measures in place.

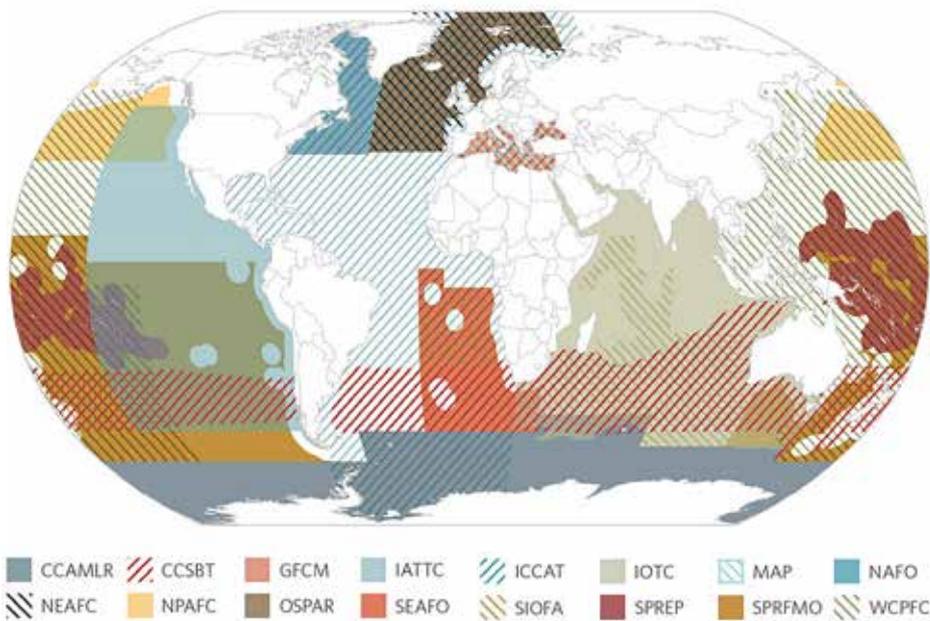
There was consensus at the BBNJ talks that such mechanisms should not be undermined by a new high seas treaty. So the question remains: how will new BBNJ marine reserves coexist and interact with systems that are up and running within their jurisdictions?

Implementation risks

In fact, there are already examples of co-ordination problems between international treaties and regional and sectoral organisations.

For instance, a 2010 conference on the OSPAR Convention, which protects the North-East Atlantic, agreed to set up a network of marine reserves, with seven

International governance on the high seas



Source: Pew

There are many examples of multiple organizations managing the same region, few mechanisms exist to facilitate communication or coordinate activities among them.

already in place in international waters. But OSPAR does not have the right to manage activity in those reserves, and relies on the convention's signatories to encourage the regional bodies they are members of to do so.

The results are uneven and undermine conservation. The North East Atlantic Fisheries Commission has banned fishing in the areas suggested by the OSPAR Convention. But the ISA and IMO have not done the same. This shows how regional and sectoral bodies can resist external pressure. Such resistance is likely to be a major hurdle facing the BBNJ talks.

A key question is whether a new BBNJ deal should go beyond the existing model and provide oversight and guidance for regional and sectoral bodies. However, this could undermine existing mechanisms. It also raises questions on how the powers of countries within regional bodies are balanced with those that are not.

Do countries outside the region have the right to decide how those within the region use international waters? Should countries in the region

have a veto? The talks will have to address these questions.

Three options

Three possible models for BBNJ nature reserves are under discussion:

- a global model, with a single body to manage these reserves worldwide
- a regional model, relying on existing regional organisations and their expertise
- a combined model emphasising regional conservation mechanisms, but adding an international body for oversight and guidance.

In the September talks, the global model emerged as the most popular with environmental groups and developing nations, which believe that a higher-ranking international body would exert pressure on regional and sectoral organisations to create reserves.

It was viewed as the best chance of counteracting the tendency of regional and sectoral bodies to put their members' interests first, as a BBNJ treaty would in principle require them to respond to the needs of "humanity as a whole".

The regional model had fewer

supporters and is being pushed by Russia, which has consistently opposed talks on a BBNJ treaty, arguing that existing mechanisms are adequate.

The combined model gained most support among developed nations, including some traditional seagoing powers. They want to maintain their existing membership benefits within regional bodies and use the additional powers of a BBNJ treaty to address key interests and concerns.

For example, as a major fishing nation New Zealand is concerned about conservation of fish stocks, so sees a treaty providing support for its calls to ban fishing in regional fishery management organisations (RFMOs).

China's negotiators did not express a preference during the talks, though the country has previously stressed its support for existing regional bodies.

On September 7 Mr Ma Xinmin, head of the Chinese delegation to the BBNJ negotiation, said: "The new international instrument in most cases will not overlap with the MPA measures under existing instrument or bodies." However, unlike Russia, China supports a treaty with the power to set up BBNJ marine reserves.

Mr Xinmin also stressed that agreements should be reached by consensus, as majority voting can produce decisions that lack sufficient support.

Two years to make it work

Three further rounds of negotiations are due to take place, with the next one tentatively scheduled for 25 March 2019. Success will depend not just on how the treaty balances organisational and national interests, but also the value the various parties place on the potential BBNJ reserves.

As an editorial in August's *Science Advances* magazine rightly concluded: "The high seas, like everything on Earth, are a limited resource. How we choose to protect and use its precious resources will test our humanity, our cooperation, and our collective vision for the future." 🌍

Chen Jiliang is a researcher at Greenovation Hub, a non-governmental organisation based in Beijing.

The future of deep seabed mining

Can the International Seabed Authority agree a way to develop mining whilst protecting biodiversity?

By **Jessica Aldred** | February 25, 2019

It's one of the coldest, darkest places on earth, full of marine life – much of which is yet to be discovered – with a seabed rich in mineral deposits.

In the last decade, the floor of the deep ocean that lies outside the jurisdiction of any one country has been increasingly explored. A number of parties are assessing the size and extent of mineral deposits that could provide raw materials for everything from batteries and jet engines to wind turbines and mobile phones.

Some deep seabed mining has already taken place within countries' waters: Japan in 2017, and in Papua New Guinea

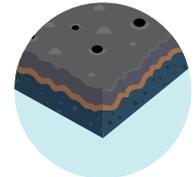
Deep-sea mineral deposits and the metals they contain



Polymetallic nodules
Source of nickel, cobalt, copper and manganese



Polymetallic sulfides
Copper, lead, zinc, gold and silver

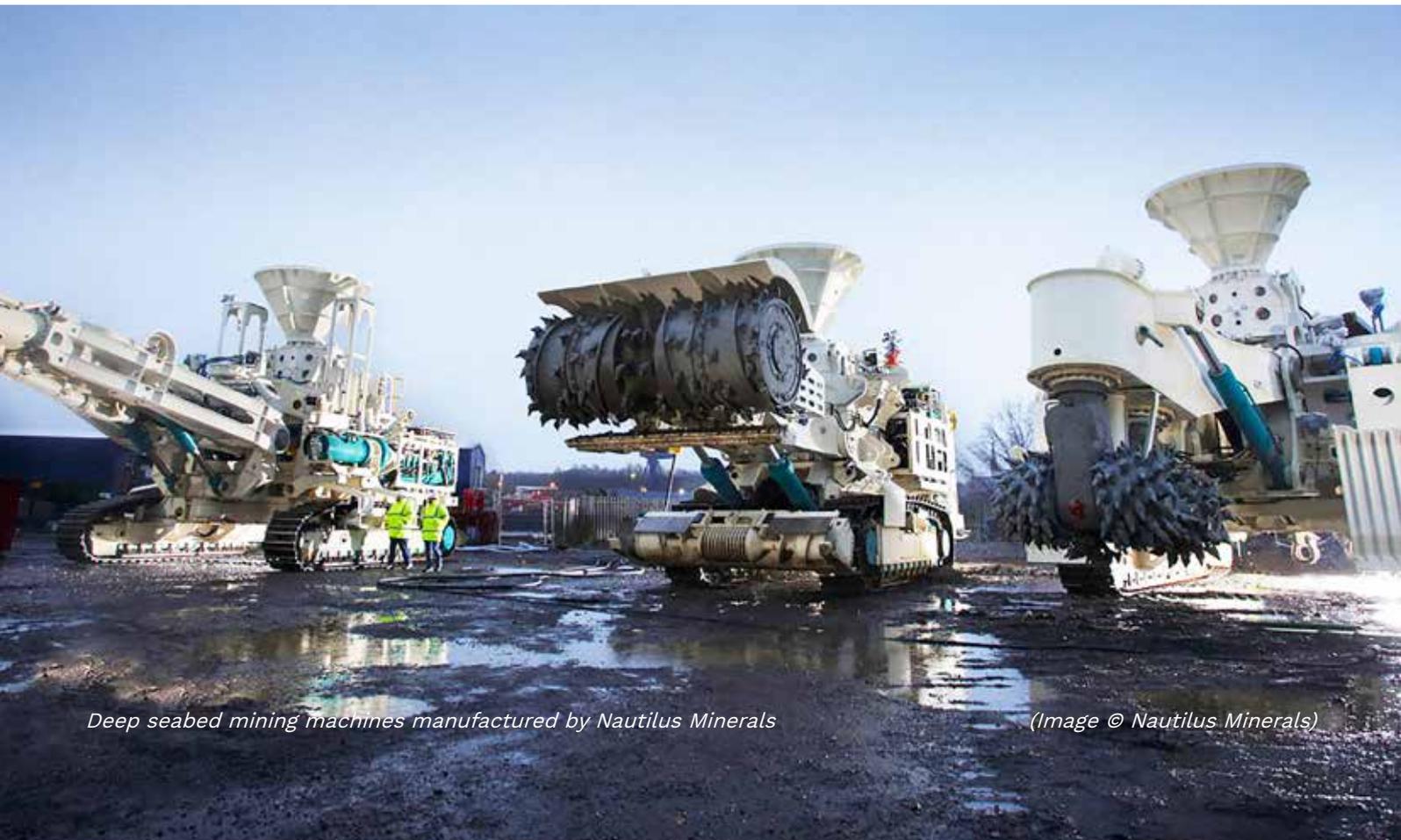


Cobalt-rich crust
Cobalt, vanadium, molybdenum, platinum and tellurium

where the controversial Solwara 1 mining project has ground to a halt. But this year will see a critical global debate on how to manage the resources that lie in “the area” – international waters of more than 200

metres deep that cover nearly two-thirds of the earth.

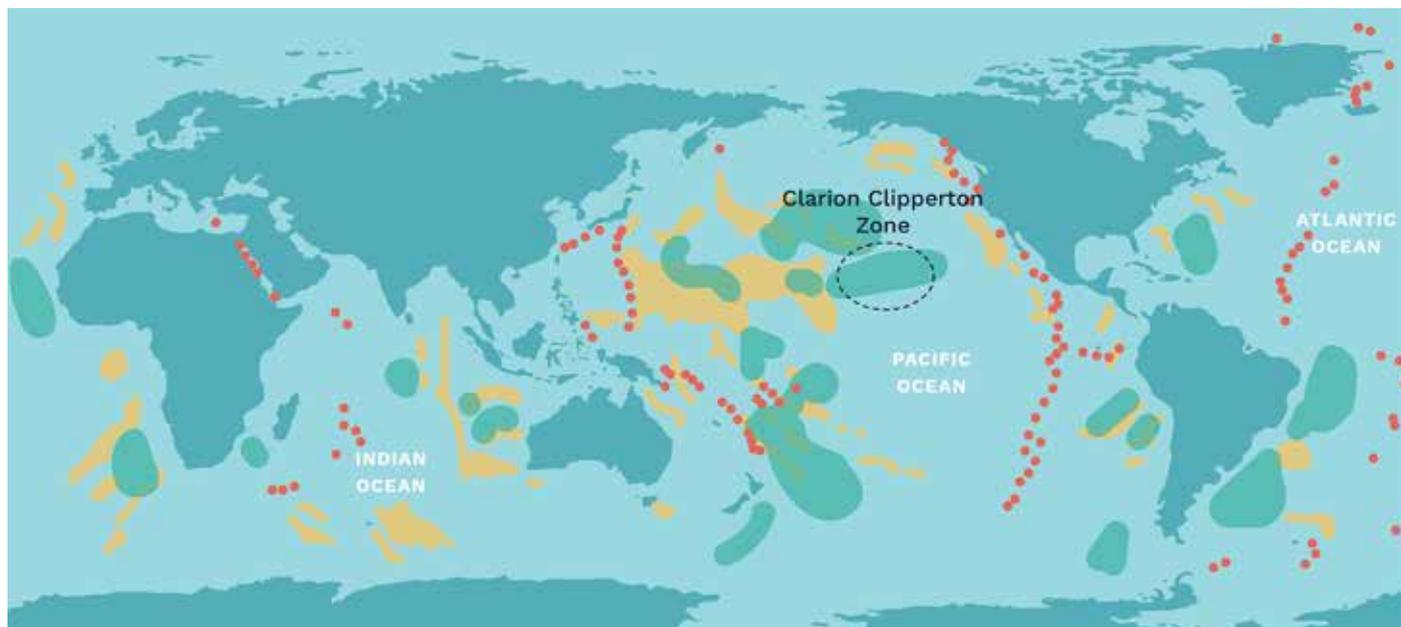
The question of who mines these – and how – is due to be formalised in a “code” being drawn up by the International



Deep seabed mining machines manufactured by Nautilus Minerals

(Image © Nautilus Minerals)

A map showing what could be mined and where



● Polymetallic nodules ● Cobalt-rich crusts ● Polymetallic sulphides / vents

Seabed Authority (ISA), the UN-appointed body responsible for managing the riches of the deep seabed for the “common heritage of mankind”.

Tasked with what some say is an impossible mandate of promoting the development of deep seabed mining while ensuring the practice does not harm the marine environment, the ISA’s 168 members must agree on how

these fragile and unique ecosystems will be protected, how the potentially multibillion dollar industry will be regulated, how any profits will be shared equitably, and how it can demonstrate accountability and transparency.

The clock is ticking. So far, the ISA has granted 29 exploration contracts of 15 years for three types of deposits across more than 1.3 million square kilometres

of seabed in the Pacific, Indian and Atlantic oceans. Several of these contracts are due to expire in 2021, so the ISA has two key meetings in February and July in Kingston, Jamaica, to finalise the code and meet its deadline of 2020.

Those advising on the code say that for perhaps the first time in history, a governing body and its members have the chance to establish rules for an extractive industry before it begins. But civil society groups and scientists argue that the world’s ocean is already severely stressed from climate impacts and overfishing, and that regulations are being developed without a full understanding of the risks.

Deep sea mineral formations contain a number of highly prized metals, including copper, zinc, manganese, cobalt and rare earth elements.

Polymetallic nodules, consisting mainly of manganese, are bumpy, usually potato-sized balls suspended in mud on the floors of the deep abyss. They’re found in an exploration zone of the eastern Pacific known as Clarion-Clipperton. This is the area of greatest commercial interest, estimated to hold more nickel, cobalt and manganese than all known terrestrial deposits combined. A recent MIT cost-benefit analysis found that mining these nodules would be

Seabed mining sponsoring state	Contractor
China	China Minmetals Corporation
Cook Islands	Cook Islands Investment Corporation
UK and Northern Ireland	UK Seabed Resources Ltd.
Singapore	Ocean Mineral Singapore Pte Ltd.
Belgium	Global Sea Mineral Resources NV
Kiribati	Marawa Research and Exploration Ltd.
Tonga	Tonga Offshore Mining Limited
Nauru	Nauru Ocean Resources Inc.
Germany	Federal Institute for Geosciences and Natural Resources of Germany
India	Government of India
France	Institut français de recherche pour l'exploitation de la mer
Japan	Deep Ocean Resources Development Co. Ltd.

profitable, with annual revenues of up to US\$2.2 billion a year.

Polymetallic sulphides are formed through hydrothermal activity when hot water, discharged from the earth's crust, hits the cold water and deposits a "heap" of minerals including iron, silver and gold. These vents look like smokestacks, and are mostly located on the top of steep, semi-active volcanoes deep in the Pacific and Atlantic.

Cobalt crusts are found on underwater mountains, mostly in the Pacific, at depths of 400 to 7,000 metres, and contain rare earths.

The 29 exploration contracts have been granted to a mix of private entities sponsored by national governments, including China, France, Germany, India, Japan, the Republic of Korea, the Russian Federation and the InterOceanmetal Joint Organisation (a consortium of Bulgaria, Cuba, the Czech Republic, Poland, the Russian Federation and Slovakia), as well as small island states such as the Cook Islands, Kiribati, Nauru, Singapore and Tonga.

China, the world's largest consumer and importer of minerals and metals, is a very influential party, with the most contracts, according to Conn Nugent, director of the Pew Charitable Trusts Seabed Mining Project, which is pressing for a "precautionary" mining code. "National prestige is at stake here. Xi [Jinping] has the 'three deeps' – deep space, deep earth, deep ocean. And that tells me that they are going to be throwing a lot of resources into this."

Once the code is agreed, seabed mining would not necessarily start immediately. Under ISA draft rules, contractors will have to carry out an environmental impact assessment and demonstrate financial and technological capacity. The Belgian firm Global Sea Mineral Resources has said it is ready to start as early as 2023. Observers forecast anything from 2025-27, while others question whether the "geologists' fantasy" will get off the ground at all.

Michael Lodge, the secretary-general of the ISA, says commercial deep seabed mining depends on three things: "Firstly, the regulations, which we expect to finalise in 2020. Second the technology developments, where we have seen an increase in investment in recent years.

Thirdly, the commercial aspect – the market price of metals."

Meeting demand

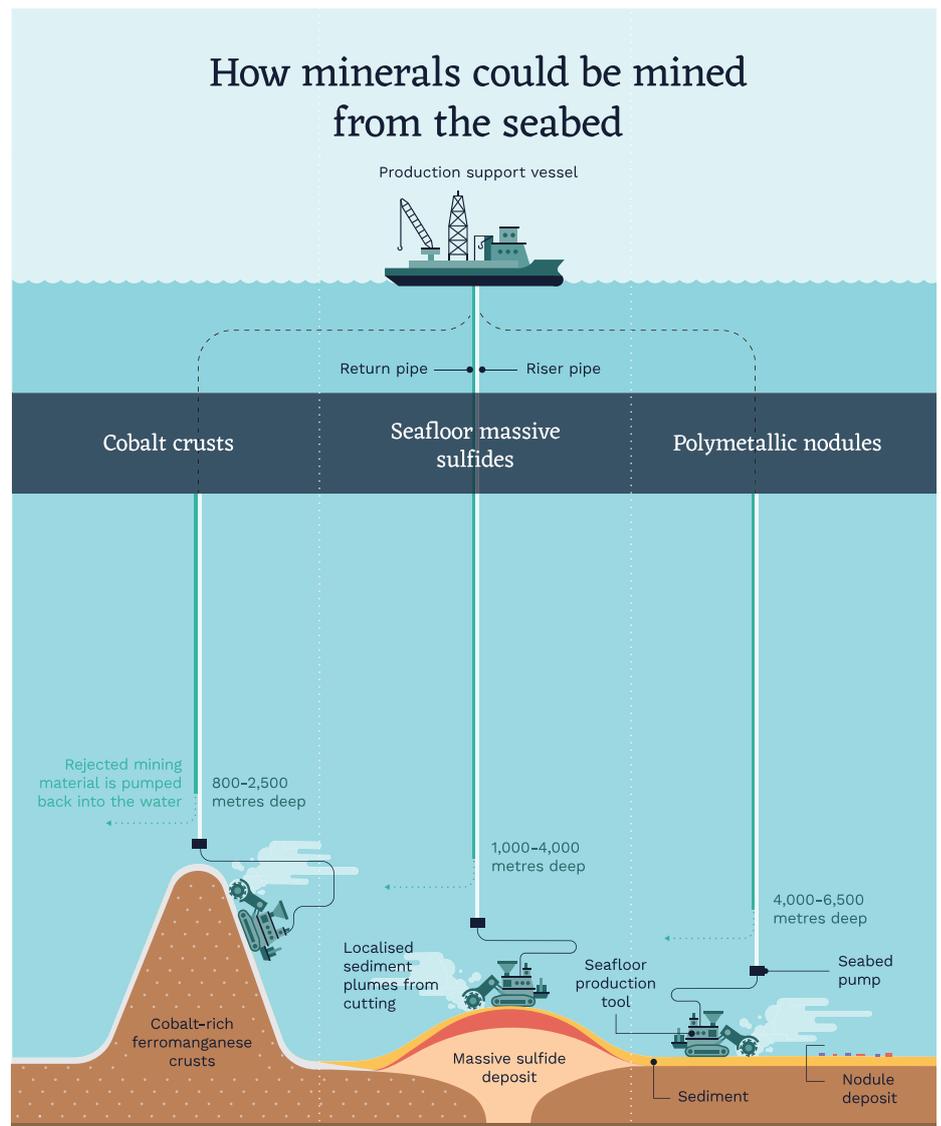
While there have been a number of failed attempts to exploit these minerals, there are reasons why the latest phase of exploration could succeed. John Parianos, chief geologist of Nautilus Minerals, says it comes down to demand from a growing, resource-hungry population. "What we are facing today is a much bigger market thanks to more widespread industrialisation which is directly linked to a reduction in world poverty."

Estimates vary, but if mineral demand were to increase at the predicted 1% annual rate, it would be about 60% higher by 2050. For specific commodities such as copper, there could be up to a 341%

increase in demand. The ISA says that up to 15% of global demand for copper and nickel could be met from the deep seabed.

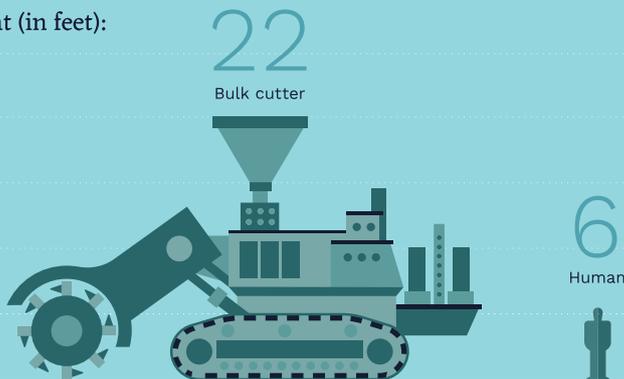
At the same time, land-based deposits of metals have become more difficult and less profitable to extract. Cobalt is mined almost exclusively in the Democratic Republic of Congo, one of the poorest, most violent and corrupt nations in the world. Advocates of deep sea mining argue that it could offer – in far richer concentrations than are found on land – a reliable, clean and ethical source of the raw materials that are critical to high-tech and renewable energy technologies.

However, a 2016 supply and demand review concluded that even under the most ambitious scenario – 100% renewable energy by 2050 – projected



Deep-sea mining machine

 Total height (in feet):



 Total weight (in tonnes)



Small car

1



Blue whale

170



Seafloor tool

310

demand could be met by existing terrestrial mining, improved metals recycling, and more. “Deep sea mining promotes the belief that you can continue unparalleled growth, but in different ways,” says Andy Whitmore, of the Deep Sea Mining Campaign (DSMC), a coalition of NGOs and local people from the Pacific, Americas and Canada opposed to mining.

Unseen devastation

While the debate over demand continues to divide, the mining industry has made huge advances in the technology needed to extract and process these minerals in the harsh conditions of the high seas. In April, a Belgian firm will lower a world-first 25-tonne robotic tractor 4,500 metres to the Pacific seabed.

Based on existing designs, deposits will be pumped up to a surface ship through a tube several kilometres long. Nodules will be harvested by a giant caterpillar that will roll over the ocean floor, injecting water into the mud to disturb the deposits, sucking them out and ejecting the mud behind. The sulphides will require a huge robotic machine to roll over the seabed and use mechanical teeth to grind up the

top few metres. These giant machines, which weigh nearly twice as much as a blue whale, will leave heavy, long-lasting footprints.

These processes will affect the seabed, the water column above it and surrounding areas. The scraping of the ocean floor to extract the nodules could destroy deep sea habitats of octopus, sponges and other species. Mining of the vents, which harbour massive animal communities at densities that make them one of the most productive ecosystems on earth, is likely to stir up sediment that could smother some animals. Other species that are uniquely adapted to the lack of sunlight and high pressure of deep water, could be affected by the noise and pollution.

“The areas these mines will cover will be massive: up to 10,000 square kilometres,” says Matthew Gianni, co-founder of the Deep Sea Conservation Coalition. “Sediment plumes could go tens of kilometres off the site itself. Even if they only travelled a few kilometres, there could be an overall impact two to three times the size of the actual mining site itself that would degrade these ecosystems and eliminate species.

He adds that after 30-40 years of exploration and disturbance of the Clarion-

Clipperton zone there is very little recovery. “Any recovery will certainly not be seen on human timescales.”

Last year, an article in *Frontiers in Marine Science* concluded that the vulnerable nature of deep-sea environments, limited technology to minimise harm, significant gaps in ecological knowledge, and uncertainties of recovery meant the mining industry “cannot deliver an outcome where there is no loss of biodiversity”.

While the mining areas look like vast expanses of mud and rock, a 2016 survey of life in the Clarion-Clipperton zone found a surprising diversity of life. Of the 12 animal species collected in an area roughly the size of one mine, seven were new to science.

Carl Gustaf Lundin, the director of International Union for Conservation of Nature’s global marine and polar programme, says: “Our current knowledge of the deep sea is not sufficient to protect the unique species that live there from mining operations. It is alarming to see contracts being granted for these still largely unexplored and vulnerable areas. We need a 10-year moratorium on seabed mining exploitation.”

“Probably the most important constraint on mining is the fact that we don’t know enough about the deep sea. We will be trashing areas before we even know what’s down there,” says Gianni.



But Parianos believes that deep seabed mining can have fewer environmental and social impacts than terrestrial operations. “If you accept that you need to get your metals from somewhere, there are all sorts of benefits with deep sea compared to land. No vegetation is harmed, it’s self-contained, there is no freshwater pollution. I think it’s good for the environment – if we can get it right.”

Some argue that decades of regulation governing terrestrial mining have failed to prevent ecological disaster. “If you have deep-sea mining, you will still have terrestrial mining, one will not simply replace the other,” says Whitmore. “There are deep concerns that even if you have sets of regulations, can companies protect this environment – which is so unseen and away from human eyes?”

The draft regulations of the ISA cite protection of the marine environment as a “fundamental principle,” but there has been no agreement so far on how that protection will be ensured. The code needs to define what would constitute an acceptable level of harm to the environment, develop guidelines for the mining companies to conduct environmental assessments and agree on a regime or body to monitor that.

Among the proposals for protection are no-mining zones in ecologically important areas, known as “regional environmental management plans”, or REMPs. These could cover up to 32% of

“the area” and while they may work for the fields of manganese nodules, experts question whether they would be of benefit for the hydrothermal vent zones.

“For many people there is an instinctive reaction that mining is destructive and dangerous (based on people’s perception of land-based mining). But it is important to consider the issue of deep seabed mining in a broader context. Deep-sea mining is one of the most tightly regulated uses of the ocean. It is the only part of the global commons that is administered under an international regime,” says Lodge.

“No state or entity can explore or exploit the seabed except under contract to the ISA, agreed to by all 168 members. We have spent many years preparing for deep seabed mining, and we know exactly what to do to regulate it and ensure minimum environmental impact. Interest in deep-sea minerals has also led to a massive increase in funding for deep-sea science, most of which is specifically aimed at better understanding the marine environment.”

Conflict of interest

Any money made from eventual mining will be subject to a benefit-sharing regime and distributed among member states, taking into account the needs of developing nations. The payment regime is still being considered, and the ISA has contracted MIT to compare a number of economic models.

“Countries are starting to realise that

even a dozen or more mining operations aren’t going to pay a lot in royalties if it’s divided by the 167 nations plus the EU. But they can make potentially good money by being a so-called sponsor state where they tax the mining company directly,” says Gianni.

This conflict of interest concerns critics. “It’s deeply worrying that the ISA is creating the rules at the same time as making money out of the rules it creates,” says Whitmore. “The tie between the companies and the countries sets up unhealthy situations in terms of transparency and accountability.”

“Even with the best regulations in place, if the economics are sufficiently strong to drive this industry forward, it’s going to be extremely difficult to say no to a country who wants a contract,” says Gianni. “Once you open the door you have the potential to have runaway development for mining of the deep ocean over hundreds of thousands of kilometres and the ISA will have very few tools in its chest to constrain that industry.”

Jessica Aldred is special projects editor for China Dialogue, focusing on globally important environment themes including the ocean and biodiversity. She spent 10 years as deputy environment editor at the Guardian, and has nearly 20 years’ experience working in the newsrooms of major media organisations in London, Sydney and Melbourne. @j_alred



A sea star 2,500 meters beneath the central Pacific turns its stomach inside out to feed on Victorgorgia coral (Image: NOAA, CC BY SA)

Is China ready to mine the deep sea?

The country's prospecting contracts cover more of the international seabed than any other

By **Tang Damin** | March 25, 2019

China's most famous manned deep-sea submersible, recently upgraded at great expense, is named after the legendary aquatic dragon Jiaolong. Another mythical dragon, the Dragon King, also frequents the seabed, in a palace filled with unimaginable treasures. While the palace may be legendary, the Jiaolong could soon be set to find real treasures, 7,000 metres deep.

In 2020, it will commence its first round-the-world voyage and one of its key tasks will be to investigate seabed minerals.

China is the world's largest manufacturer of electronics, solar panels and wind turbines. That means a huge demand for metals essential to these products, such as copper, nickel, manganese and cobalt. They also require rare earths, which China is the largest producer of, as it is of gold and aluminium.

But with land reserves of key minerals dwindling, extraction is becoming harder and more expensive. So, many nations including China are keen to prospect for deep-sea minerals. The exploration and extraction of these minerals in international waters is governed by the International Seabed Authority, which is based in



A robot collecting a copper-rich chimney on the deep seabed (Image © Nautilus Minerals)

Kingston, Jamaica. China currently holds the largest number of exploration contracts from the authority. Does this mean it will be first to start commercially mining the deep?

The lure of the deep

The question of how long mineral reserves on land will last is already pressing. Land supplies of nickel, which is widely used in solar panels, can only meet another 40 years of demand. But the deep-sea reserves of nickel so far identified could extend that by another 40.

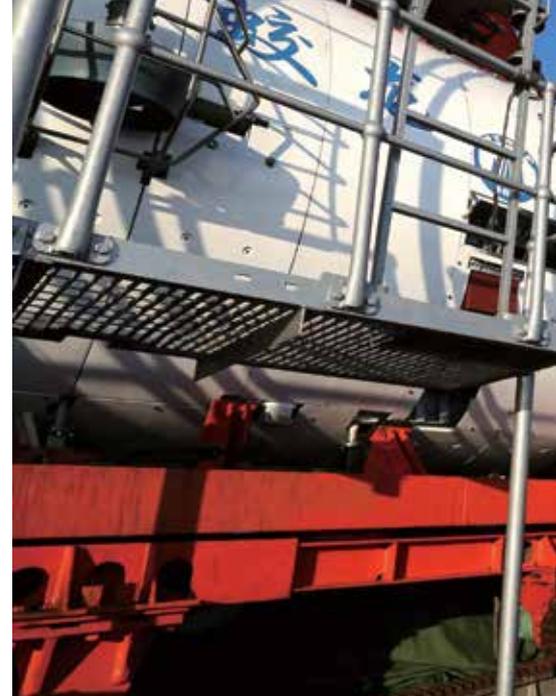
Some also believe that deep-sea mining will work out better value than mining on land, as it will be free of the costs of disputes.

"There's huge potential for it, because the reserves are massive," said Xue Guifang, of the Centre for Polar and Deep Ocean Development at Shanghai Jiaotong University, adding that there is international consensus on this point.

Xue said there are two reasons mining hasn't started yet. Reserves on land are still commercially viable, and the legal preparations aren't yet complete. However, "everyone views deep sea resources as usable."

Globally, deep-sea mining technology is shifting from a period of experimentation towards commercial operations.

In September 2017, a Japanese mining vessel carried out a "large-scale" extraction of minerals from 1,600 metres beneath Japan's exclusive economic zone off Okinawa. The amount of ore collected and the profitability of the operation are not yet known. However, in February this year a deep-sea mining venture run by Canada's Nautilus Minerals for the last eight years was halted due to lack of investment.



Jiaolong preparing to dive, South China Sea



Nautilus Minerals' "Bulk Cutter" for fragmenting the seabed before another machine collects it (Image © Nautilus Minerals)

Nautilus was hoping to be the world's first legal and commercial deep-sea mining operator.

Technological constraints

So how are China's preparations for deep-sea mining going? It's a bit complicated.

China has obtained four of the 29 contracts issued by the International Seabed Authority. These include all three available types of contract and cover a wider area than is held by any other nation.

Considering the enormous sums put into the Jialong it is clear that China is taking deep-sea prospecting very seriously and ranks among the most advanced nations in terms of prospecting technology.

But in mining technology, China still lags behind Japan, Korea and Western nations. Japan invented a deep-sea mining system in 1967, which was later tested at a depth of 4,500 metres. Since



(Image: Xinhua/Alamy)

then researchers in France and the US have come up with a range of other systems. Today, the leading deep-sea mining tech firms are Nautilus Minerals and Australia's Neptune Minerals.

In comparison, sea trials of China's system to pump minerals up from the seabed reached a depth of only 304 metres. The Kunlong, a mining vessel built as part of the same project as the Jiaolong, cannot mine deeper than 500 metres.

But Liu Shaojun, a professor at Central South University who works on design and control of deep-sea equipment, thinks that a nation's deep-sea mining capabilities can't be judged solely on depths achieved. Research completed and industry capabilities are relevant too.

"Overall, I think China's deep-sea mining technologies and capabilities rank above average, internationally," Liu said.

Observers point out that while speeding up domestic research, China is also looking for resources overseas. For example, China's CRRC Group has acquired the UK's SMD, a manufacturer of deep-sea submersibles. While Fujian Mawei Shipbuilding, which is building Nautilus Minerals' production support vessel, is actively working with foreign firms.

Policy support

China's latest two Five-Year Plans for the marine economy show it intends to be actively involved in deep-sea development. Will strong policy support



In 2020, we will see what fate awaits the seabed."

lead to breakthroughs?

The 12th (2011-2015) and 13th (2016-2020) Five-Year Plans put the date of China's application for deep-sea exploration contracts and research prospecting equipment at between 2011 and 2015. Two of the three exploration contracts held by the China Ocean Mineral Resources R&D Association were obtained during that period.

But neither of the two plans were clear on exactly how the aim of "promoting commercialisation of deep-sea mining, manufacturing of deep-sea equipment and utilisation of deep-sea bioresources" would be achieved, or when.

According to Xue Guifang, China

started research into deep-sea mining in the 1980s, and has had 40 years of reliable funding and outcomes since then. Therefore Xue Guifang doesn't rule out the possibility of "leaps" forward in the near future.

Duncan Currie is a consultant with the High Seas Alliance, which monitors deep-sea mining issues. He thinks China does not seem to be in a hurry to start deep-sea mining, both because it still has ample mineral reserves, and because as demand for metals fluctuates with industrial demand it is not yet certain that deep-sea mining will be necessary.

China's strategic thinking on deep-sea mining may become clearer once the Jiaolong has completed its 2020 round-the-world voyage and China has an understanding of what resources are available.

Ecological risks

One cause of the intense international interest in deep-sea mining, alongside the geopolitical impact of the allocation of mining rights, is the environmental risk to the seabed.

The collection of metallic nodules from the seabed will affect habitats of creatures such as octopuses and sea sponges, and the waters in which metallic sulphides are created are often also biodiversity hotspots. According to Currie, there is still much to be done before deep-sea mining can really get started: a legal system needs to be put in place, and more research and better technology for biodiversity protection are needed.

As an emerging economy facing various environmental challenges at home, China's environmental regulation of deep-sea mining is drawing global attention.



(Image: NOAA, CC BY SA)

China has started to put legislation and mechanisms in place. It passed a Deep Sea Mining Law in 2016, followed by regulations for the licensing of deep-sea mining in 2017, ruling on how organisations can obtain permission to mine the deep, and how they should do it. The two laws take account of the commitment made by China to the International Seabed Authority (ISA) that Chinese operators will operate within a legal framework when deep-sea mining permits are issued.

But despite the Deep Sea Mining Law being in place in China, it will take some time for a complete legal and regulatory system to take shape, as the law will need to be followed up by complementary regulations, such as those on licensing mentioned above. There are also temporary regulations on data and samples collected during deep-sea prospecting. Rules on environmental protection are still being drafted.

Of course, China is a signatory to the UN Convention on the Law of the Sea, and so its activities in international waters will be constrained by international law. Currently the ISA is working on a code that will govern deep-sea mining, which is due to be finalised at its two meetings this year. These will be the basic standards China and other nations must abide by.

China has always played an important role at the ISA. It joined in 1996, only two years after the authority was formed, and was one of its biggest funders. Now it is one of its biggest member states, a member of Group A, which has a more powerful vote on the council. Shanghai Jiaotong University's Centre for Polar and Deep Ocean Development, a Chinese research body, also has observer status. But it remains to be seen whether China having a relatively large say in deep-sea mining affairs will mean it does more to protect the environment.

And in 2020, the deadline the ISA has set for finalising its regulations, we will see what fate awaits the seabed. 🍷

Tang Damin is a freelance environmental writer and former Beijing senior editor for China Dialogue.

DEEP SEABED MINING

Can a 'mining code' make deep seabed extraction sustainable?

Consultation is key to regulating an essential industry, argues the secretary-general of the International Seabed Authority

By **Michael Lodge** | March 11, 2019

Mining and metals are essential to achieving the UN's 2030 sustainable development goals. As the world's population continues to grow, the demand for critical metals will continue to increase. The European commission estimates, for example, that demand for copper – one of the key minerals of interest for deep seabed mining – could rise by up to 341% by 2050 compared to 2010.

Deep seabed mining has the potential to provide us with long-term socio-economic benefits. The question is, how can we use this resource in a way that is sustainable and minimises the impact on the marine environment?

The good news is, we know how.

Law of the deep sea

For 25 years, the International Seabed Authority (ISA) has carried out its mandate to implement the legal regime established by the 1982 United Nations Convention on the Law of the Sea (UNCLOS), to achieve the sustainable use of marine mineral resources for the benefit of humankind as a whole.

ISA is the only forum where all 168 Parties to UNCLOS, including 167 member states and the European Union, cooperate to administer the mineral resources in areas beyond national jurisdictions. It is the only organisation mandated to ensure equity in access to the deep seabed, along



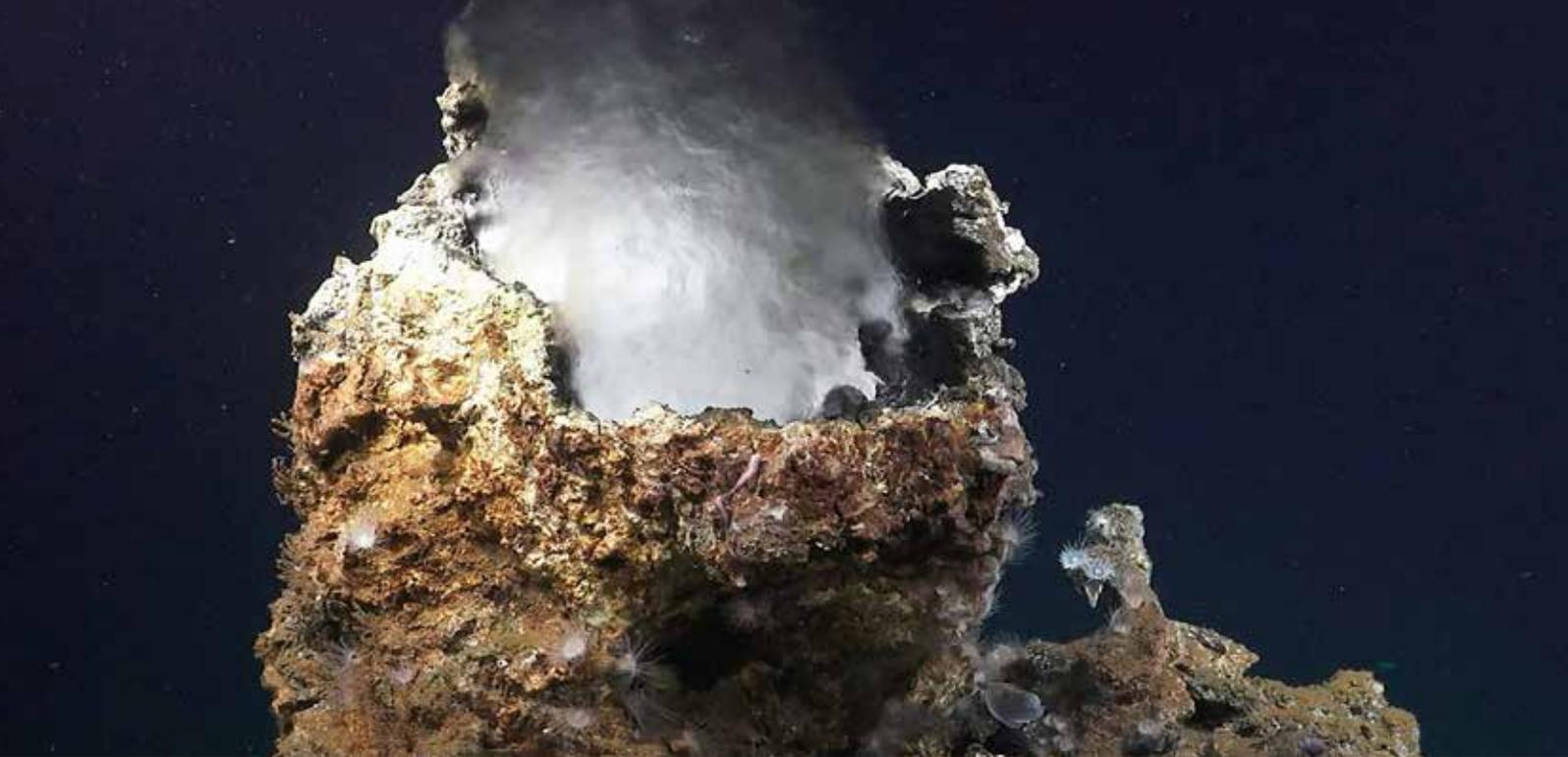
I encourage everyone to participate fully in this consultation process”

with equitable sharing of benefits and scientific knowledge, and long-term sustainability in protection of the marine environment.

Fundamentally, environmental protection is at the forefront of ISA's responsibilities. To be approved, even exploration activities must be accompanied by an assessment of their potential impact, along with a description of a programme for oceanographic and baseline environmental studies. These requirements must be abided by in accordance with the rules, regulations and procedures adopted under consensus, by all 168 members of ISA.

I encourage everyone to participate fully in this consultation process

Since 2012, ISA has established nine marine protected areas on the seabed of the Pacific Ocean, as part of the regional environmental management plan adopted for an area known as the Clarion-Clipperton Fracture Zone. Collectively, these protected areas cover 1.6 million square kilometres. Compare this to the total area covered by the



Hydrothermal vents are rich sources of life, copper and other valuable metals

(Image: Schmidt Ocean Institute)

exploration contracts in the same region of 1.3 million square kilometres.

These areas represent one of the largest applications of marine protected areas on Earth. ISA is also in the process of extending regional management plans for the north Atlantic, the Indian Ocean and the north-west Pacific.

In light of this, any commercial exploitation or deep seabed mining activities will not be permitted to proceed unless the 168 members of ISA are satisfied that rigorous environmental safeguards are in place, through globally applicable regulations.

As of today, ISA has approved 29 contracts for exploration of the international deep seabed area, involving 22 different countries, covering 0.7% of the world's seabed.

Consultation and consensus

The research undertaken as part of these contracts is the main source of data and knowledge helping us to better understand the deep seabed environment and ecosystems. It is also through this research, that we will be able to identify the best measures required to protect the marine environment.

Over the last 25 years, ISA has developed a highly comprehensive set of rules, regulations and procedures dealing with prospecting and exploration for mineral resources in the international deep seabed area. Building on this, and as seabed activities progress, a major effort is currently underway to develop exploitation regulations, known as the mining code, which includes a broad stakeholder consultation process.

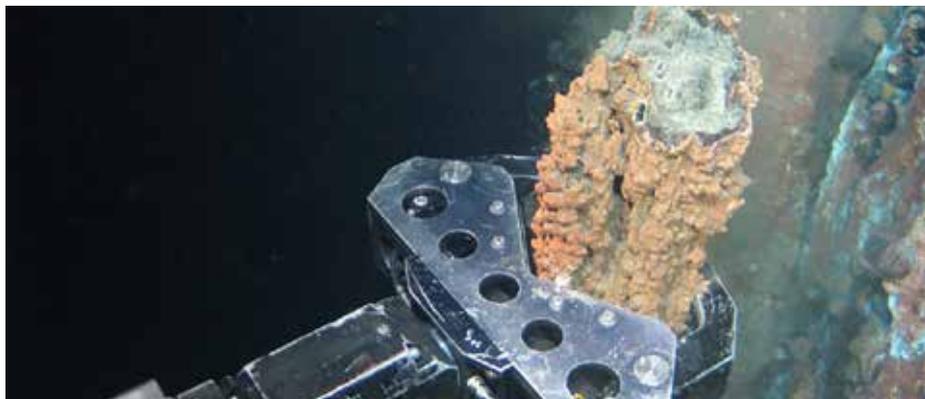
I can think of no other activity in the ocean where we have had the luxury to put the rules into place before the activity has occurred, and I encourage everyone to participate fully in this process.

Once in place, these regulations will require any mining companies planning to undertake activities in the international seabed area to abide by stringent criteria and account for continuing compliance through oversight by independent entities.

The development of the regime under which mining of the deep seabed could take place occurs in a transparent, public forum of consensus-building by the international community under international law.

It is done so within a framework of reference of environmental protection, sustainability, impact assessment and oversight. Most importantly, it is anchored in the driving principle that the proceeds of any mining of the deep seabed will be transparent, and for the benefit of humankind as a whole. This presents a unique opportunity for us to work together to ensure a sustainable future for all. 🔄

Michael Lodge is a lawyer and secretary-general of the International Seabed Authority. His previous posts include Associate Fellow of Chatham House (2007) and member of the World Economic Forum's Global Agenda Council on Oceans (2011-2016).



Underwater copper-rich chimney sampling

(Image © Nautilus Minerals)



Anemone attached to a carbonate boulder at 1,500 meters depth

DEEP SEABED MINING

Deep seabed mining: key questions

This year a code governing the mining of the seabed in international waters is set to be finalised

By **Jessica Aldred** | February 26, 2019

What is deep sea mining?

It's the process of retrieving mineral deposits from the deep sea – the area of the ocean below 200 metres. This covers around 65% of the Earth's surface and harbours a rich diversity of species adapted to the harsh environment – many of which are still unknown to science. It also encompasses unique geological features, including mountain ranges, plateaus, volcanic peaks, canyons, vast abyssal plains and the Mariana Trench, which at almost 11,000 metres is the greatest depth registered in the ocean.

Is mining taking place now?

Shallow water mining for sand, tin and diamonds is already happening around the world, and some deep sea mining has taken place within the territorial waters of certain countries. But deep sea mining in international waters that belong to no one nation – known as The Area – is currently at the exploration stage.

To date, 29 contracts to explore for 15 years have been granted to assess the

size and extent of three different types of mineral deposits in areas totalling more than 1.3 million square kilometres.

Actual mining cannot begin in The Area until the agreement of the code. This is a detailed set of regulations being debated at two key meetings this year. It's expected to be adopted in 2020.

Who decides the code?

The International Seabed Authority (ISA), established under the UN Convention on the Law of the Sea, is an independent organisation based in Kingston, Jamaica. There are 167 member states plus the EU.

Who is exploring?

A mix of corporate enterprises, state-owned companies and several governments, including China, France, Germany, India, Japan, South Korea, Russia and the Interoceanmetal Joint Organisation (a consortium of Bulgaria, Cuba, the Czech Republic, Poland, the Russian Federation and Slovakia), as well as small island states such as the Cook Islands, Kiribati, Nauru, Singapore and Tonga.



Shallow water mining for sand, tin and diamonds is already happening around the world, and some deep sea mining has taken place within the territorial waters of certain countries. But deep sea mining in international waters that belong to no one nation – known as The Area – is currently at the exploration stage.



(Image: NOAA, CC BY SA)

What are they exploring for and where?

Nickel, copper, cobalt, manganese, zinc, silver, and gold are some of the targets of proposed mining activities. Current exploration is focused on three types of marine mineral deposits: polymetallic nodules found lying on the seafloor; polymetallic sulphides, or “seafloor massive sulphides”, which form around hydrothermal vents; and cobalt-rich ferromanganese crusts that cover seamounts. Exploration zones are mainly in the Pacific, mid-Atlantic and Indian oceans.

Why do we need these minerals?

They’re used in various electronic products and energy storage – from

smartphones, laptops, solar panels, wind turbines and electric vehicles. Terrestrial supplies are becoming harder and less profitable to extract while demand for minerals continues to grow. Advocates of deep seabed mining argue that it provides a source of reliable, clean and ethically sourced minerals.

How would they be extracted?

Seabed formations will be scooped, dredged, or severed by gigantic machines weighing more than a blue whale. The deposits would be piped up to a ship through several kilometres of tubing and processed at sea, where waste material would be pumped back into the water.

What possible effects could this have on the ocean?

These processes will affect the seabed, the water column above it, and the surrounding area. The scraping of the ocean floor to extract the nodules could destroy deep sea habitats of octopuses, sponges and other species. Mining of the vents, which harbour massive animal communities at densities that make them one of the most productive ecosystems on Earth, is likely to stir up sediment that could smother some animals. Other species that are uniquely adapted to the lack of sunlight and high pressure of deep water, could be affected by the noise and pollution. Scientists are concerned that not enough is known about these species or ecosystems to establish an adequate baseline from which to protect them or monitor the impact of mining.

Who will profit from deep sea mining?

The ISA’s draft regulations state that money received from the proposed royalties or other financial regimes will be subject to a benefit-sharing regime, and distributed among members states, taking into account the interests and needs of developing states, particularly the least developed and land-locked. The payment regime is still under consideration and several different economic models are being considered.

When would mining start?

Contractors would have to conduct an environmental impact assessment in line with the rules, regulations and procedures set out by the ISA for mining rights to be granted. They will also need to demonstrate financial and technological capacity. Some industry groups say they are ready to begin as early as 2023, but most observers say that 2025 is more likely. 🔄

Jessica Aldred is special projects editor for China Dialogue, focusing on globally important environment themes including the ocean and biodiversity. She spent 10 years as deputy environment editor at the Guardian, and has nearly 20 years’ experience working in the newsrooms of major media organisations in London, Sydney and Melbourne. @j_alred

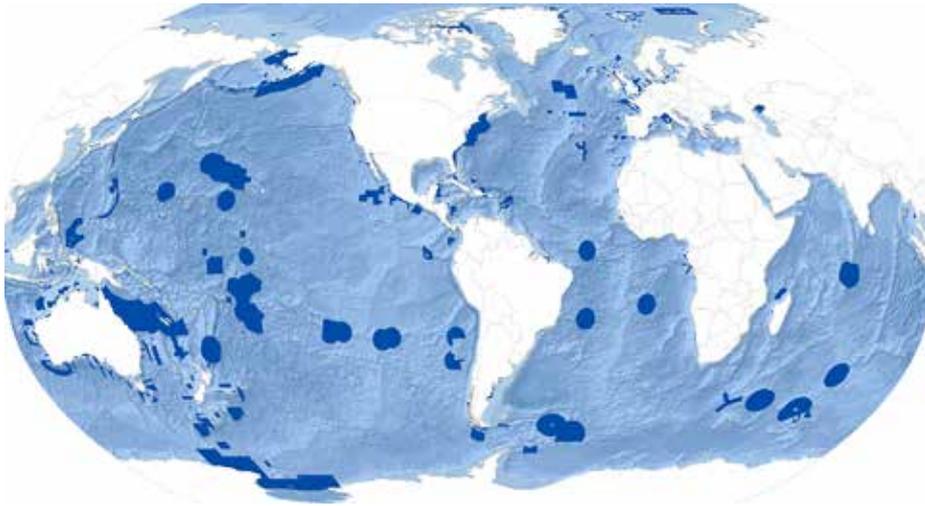


A polymetallic nodule

(Image © Nautilus Minerals)

Will large protected areas save the oceans or politicise them?

Are marine parks driven more by geopolitics than conservation?



Marine protected areas (dark blue) cover 7.59% of the ocean (Image: UNEP-WCMC/IUCN)

By **Fred Pearce** | April 25, 2019

How can we save the oceans? They cover two-thirds of the planet, but none are safe from fishing fleets, minerals prospectors or the insidious influences of global warming and ocean acidification.

In the past decade, there has been a push to create giant new Marine Protected Areas (MPAs). They now cover nearly 9.7 million square miles (25 million square kilometres), equivalent to more than the land area of North America. Cristiana Paşca Palmer, executive secretary of the United Nations Convention on Biological Diversity, says the world is on course to reach the convention's target of having a tenth of the oceans protected by next year.

But questions are being raised. The growth has been driven by the formation of giant MPAs bigger than many

countries, often in remote regions where the threat to biodiversity is lower. So, critics are asking, are countries creating big distant MPAs to distract attention from the harder task of protecting trashed coastal ecosystems closer to home? And is there a geopolitical game afoot, a stealth rush to control the oceans for political ends? And does that explain why half of the ocean waters covered by MPAs are in the hands of the United States and two former European colonial powers, Britain and France?

Most ocean scientists see the rush to create vast MPAs as a boon to marine conservation. They are cost effective, connect different marine ecosystems and encompass larger parts of the ranges of migrating species such as whales and tuna, protecting “corridors of connectivity among habitats in ways not afforded by smaller MPAs” says

Bethan O’Leary, a marine scientist at the University of York in the United Kingdom.

But the geography of the new large MPAs seems to reflect politics as well as ecology. The biggest American MPAs are in the 200 nautical mile (370 kilometre) internationally recognised exclusive economic zones (EEZs) off Alaska and around the Hawaiian archipelago. And France and Britain are busy asserting their control over wide stretches of oceans in EEZs around tiny islands that they hung onto at the close of the European colonial era.

Britain has fully protected less than only 2.9 square miles (7.5 square kilometres) of its domestic waters, but has promised 1.5 million square miles (3.88 million square kilometres) of “enhanced marine protection” around its territories in remote oceans by 2020.





A diver swims in French New Caledonia's Coral Sea Nature Park, a marine protected area in the South Pacific (Image: Simon K Ager/Flickr, CC BY ND)

That is more than 16 times the size of the UK itself. The waters earmarked include three of the 12 largest MPAs declared to date: around the Chagos Archipelago in the Indian Ocean, Pitcairn Island in the Pacific and South Georgia in the Southern Ocean, to be followed by Ascension Island, St. Helena and Tristan da Cunha, all in the South Atlantic.

France is not far behind, promising 850,000 square miles (2.2 million square kilometres) by 2020, including waters around New Caledonia and French Polynesia, as well as Reunion and Mayotte in the Indian Ocean.

These giant MPAs are a relatively new phenomenon. Most have been created since 2010, when the Convention on Biological Diversity adopted its 10% target. Until then most were small, and about half of the world's 15,000 MPAs still measure only a few square

kilometres.

But the case to go big has been growing. While small safe spaces for nature may protect particular habitats like coral reefs and sea grasses, their impact on wider marine ecosystems and migrating fish stocks is bound to be small, marine ecologists argue. Partly because of this, and partly through bad design and poor enforcement, a recent meta-analysis of the impacts of existing MPAs by Graham Edgar, a senior research scientist at the University of Tasmania, found that "most of the MPAs studied... were not ecologically distinguishable from fished sites".

Some scientists also say that with coastal MPAs, local fishers often lose out. Their livelihoods are disrupted as their fishing activities are declared illegal, while big commercial fishers just move on and damage somewhere else. There

have been calls for codes of conduct to protect such communities. Nathan Bennett, an ocean geographer at the University of British Columbia, said in a Yale Environment 360 interview two years ago that protecting the interests of coastal communities could "make the difference between the success and failure of marine conservation".

So will large MPAs do better? Most are in remote, near-pristine areas with lots of marine life to save. The US's Papahānaumokuākea Marine National Monument in the Hawaiian archipelago, for instance, is more than twice the size of Texas and supports 7,000 species, a quarter of them endemic. The 250,000 square mile (647,497 square kilometre) MPA declared by the British around the Chagos archipelago in the Indian Ocean is "the world's largest contiguous undamaged [coral] reef area", according to the former chief scientific advisor for the area, Charles Sheppard of Warwick University. It includes the largest atoll in the world, the Great Chagos Bank, and has 310 species of coral, 821 of fish (including 50 shark species) and 355 of molluscs. The MPA there has created the world's largest "no-take" zone, where all commercial fishing is banned.

But some say the progress on protecting the oceans this way has been hyped. Enric Sala, a marine ecologist at the National Geographic Society, recently called the claim to be close to achieving protection for 10% of the world's oceans "false and counterproductive". While 7% of the oceans have so far been earmarked for some protection, only 5% have actually had plans implemented and only 2% ban commercial fishing.

Among MPAs where commitments remain unimplemented, Sala notes, two of the biggest are New Zealand's Kermadec Ocean Sanctuary and French New Caledonia's Coral Sea Nature Park. And when the departing Bush administration in 2009 created the Marianas Trench National Marine Monument near the US territory of Guam in the western Pacific, it ceded to pressure from the Northern Mariana Islands to allow fishers to continue their activities there.

But O'Leary says most designated



NOAA scientists approaching a young North Atlantic right whale they disentangled off Cape Canaveral, Florida (Image: NOAA, CC BY)

large MPAs have management plans either in place or in preparation, and the development of drone, radar and satellite technology will make them easier to police than in the past.

A second concern of critics is that the massive coverage of MPAs may not be addressing the urgent task of protecting marine species and ecosystems from real and current threats.

Most large MPAs are in remote areas. The US, for instance, has instituted strong or full protections in less than 1% of seas in its waters around the continental US, compared with 43% in remote waters, according to a recent study that O’Leary co-authored.

Luiz Rocha of Hope for Reefs, a campaigning initiative of the California Academy of Sciences, says large remote MPAs “invariably exclude the only areas that would benefit from spatial protection, those close to the shore. They protect areas that nobody uses, and that changes nothing.” In fact, it is worse than nothing, he argues, because by allowing countries to hit UN targets, these remote MPAs reduce the pressure to provide real protection where it is needed.

2010

These giant MPAs are a new phenomenon, mostly created since 2010 when a goal of protecting a tenth of the oceans was adopted

Even bigness provides few benefits, Rocha contends. “The media and the public love announcement of reserves ‘the size of Belgium’, but for species like tuna, the size of Belgium is like the size of your backyard.”

But O’Leary and other advocates for large MPAs counter that big protected areas provide more protection for migrating species than small areas. And even if they don’t counter urgent current threats, O’Leary says, they do provide “proactive protection of ocean wilderness areas against future exploitation” in the same way as protected terrestrial wildernesses.

Some critics charge that many big MPAs are as much about geopolitics as conservation. This particularly applies to the post-colonial MPAs of Britain and France, in which tiny, sometimes unpopulated, mid-ocean islands once occupied as refuelling stops for naval vessels, become the twenty-first century basis for what some are calling “ocean grab”. Britain has declared an MPA around South Georgia, which is claimed by Argentina, and, just as controversially, has also done so around the Chagos archipelago in the mid-Indian Ocean.

In colonial times, the archipelago was administered by Britain from adjacent Mauritius. However, in 1965, three years before granting independence to Mauritius, the British separated it off and signed a deal with the US for a major American military base on the largest of its 60 islands, Diego Garcia. As part of the deal, the British subsequently forcibly removed some 1,500 Chagossians. Living in exile in Mauritius and the UK, they have been campaigning to be allowed to return and resume economic activities such as fishing.

That was made more difficult when in 2010, Britain created a giant “no-take” MPA around the archipelago, excluding only Diego Garcia. A message from the US Embassy unearthed and published by Wikileaks, said British officials had said that “establishing a marine park would, in effect, put paid to resettlement claims”. The British government has repeatedly denied any such motive.

Things came to a head last month when, after decades of legal dispute, the

International Court of Justice in The Hague, the UN's highest court, declared British control of the Chagos to be a "wrongful act". The islands, including the MPA, should be handed back to Mauritius "as rapidly as possible", the court ruled.

It is far from clear if the British government will accede to this demand. Mauritius' London embassy did not respond to requests to clarify its plans for the MPA. But in the past it has said that while it had no problem maintaining an MPA, a no-take zone would "not be compatible" with its plans for returning Chagossians and exploiting marine resources.

Whatever the future for such contested waters, the bigger prize of saving oceans remains. Scientists have argued that the world should aim to protect not 10%, but 30% of the oceans. That would require concerted international efforts to protect the two-thirds of the oceans that lie outside national EEZs.

Just 0.5% of these "high seas" are currently covered by MPAs. These are in areas covered by regional or international treaties. The largest is the Ross Sea MPA

off the coast of Antarctica, which covers an area almost the size of Alaska and is one of the world's most productive marine ecosystems, though concerns have mounted because of a krill fishery allowed there under the terms of the Antarctica Treaty. Others include the Charlie-Gibbs MPA, a biodiversity hotspot in the mid-north Atlantic where polar and tropical waters meet. It is managed by the Oskar Convention on the north-east Atlantic marine environment.

But many more may be established if the UN finalises a new High Sea Treaty on schedule in 2020. Talks on the treaty were scheduled to resume in New York in March. Its provisions will almost certainly include creating MPAs in international waters. Candidates include the Sargasso Sea, a zone of sluggish waters in the north Atlantic off the British territory of Bermuda that is full of floating seaweed among which both American and European eels breed.

The question then becomes who will fund and manage MPAs on the high seas. The moving forces behind them will likely be the same as those that helped trigger the recent spurt of large national MPAs: American and other conservation

groups backed by private philanthropists.

Conservation International helped mastermind the French MPA around New Caledonia. The Switzerland based Bertarelli Foundation helped establish those around French Polynesia and Chile's Easter Island. In the Seychelles, The Nature Conservancy raised money from US philanthropists, including actor Leonardo DiCaprio, to buy up national debt in return for the creation of two large marine reserves. The Louis Bacon Foundation, established by a US hedge fund manager, is to pay for policing a British MPA around Ascension Island.

Biggest of all is the Pew Charitable Trusts, which says it has already "helped safeguard 5.2 million square kilometres – an area 10 times the size of Central America". Pew first proposed and helped fund British MPAs at Chagos and Pitcairn, as well as pushing for US initiatives such as the Marianas Trench Marine National Monument. In a joint initiative with the Bertarelli Foundation, Pew recently appointed former US Secretary of State John Kerry and former British Prime Minister David Cameron as "ocean ambassadors".

Elizabeth Karan, a senior manager at Pew, said in an email interview that her organisation is helping "identify important areas for biodiversity on the high seas, and work[ing] with governments [to] develop proposals". Policing of these non-national MPAs would be done by treaty signatories regulating their industries.

Some see such philanthropists as planetary saviours; others as agents of a creeping privatisation of one of the last great global commons. Either way, it is a big task. 🍷

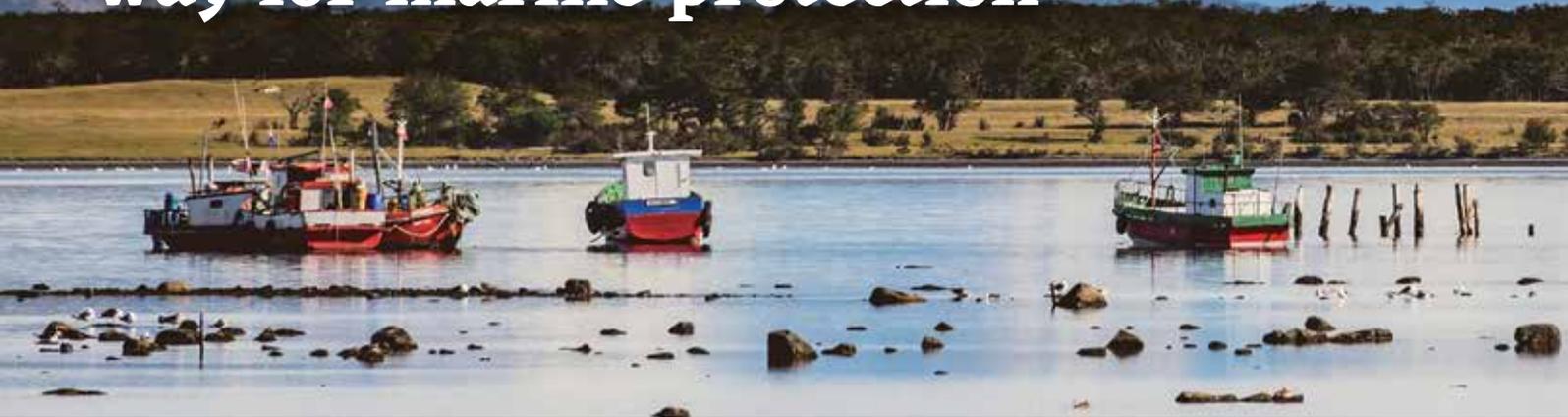
This article was first published in Yale E360

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Reef assessment and monitoring in Papahānaumokuākea Marine National Monument (Image: Scott Godwin/NOAA, CC BY NC)

How Latin America's 'Southern Cone' is leading the way for marine protection



The move will benefit biodiversity, fisheries resilience and carbon sequestration

By **Fermin Koop** | April 5, 2019

Home to some of the world's most biodiverse areas, Chile, Argentina and Uruguay are stepping up the protection of millions of square kilometres of ocean.

The move is part of a global target to safeguard at least 10% of the world's marine and coastal areas by 2020.

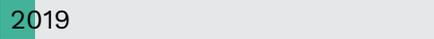
Marine protected areas (MPAs) – stretches of water managed for conservation – are rising and now cover 8.4% of Latin America's oceanic territory. Argentina, Chile, Uruguay, which along with Paraguay comprise the Southern Cone, are largely responsible for the increase.

Ocean health is critical to all life on the planet. Phytoplankton, the microscopic plants found in the sunlit area of almost all oceans, generates about half of the Earth's oxygen. But the oceans are in decline, largely because of human activity. MPAs are seen as a key tool to safeguarding the health of the oceans and tackling the impacts of overfishing, pollution and acidification. They can bring both ecological benefits and economic gains.

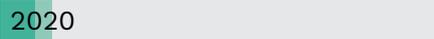


Protecting our oceans

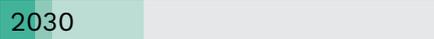
Just **over 7%** of the oceans are for mally protected



The UN aims to protect **at least 10%** of coastal and marine areas by 2020



Scientists and conservation groups want a more ambitious goal of **30%** by 2030



“Development, population expansion and climate change, among other factors, affect biodiversity and the systems on which biodiversity relies. Part of the impact is solved with MPAs, which help to restock the affected areas,” said Claudio Campagna, head of the Forum for the Conservation of the Patagonian Sea.

Marine reserves – the strictest form of MPA – in which all mining, dredging

and fishing is prohibited, can restore ocean health by protecting biodiversity, enhancing ecosystem resilience, supporting fisheries productivity and safeguarding cultural traditions tied to the seas.

Effectively placed MPAs have been shown to increase fish biomass and offer a path to recovery for predatory species such as sharks. A study in Ecuador's Galapagos Islands, for example, found that waters surrounding an MPA supported higher catches.

MPAs can lead to economic growth through tourism. In Chile, the government created a plan in 2014 to promote sustainable tourism in them. Partly thanks to these efforts, the number of visitors nationwide reached three million, an 88% increase compared to 2007.

MPAs also help improve biodiversity, genetic diversity, carbon sequestration and even enhance the absorption of carbon dioxide. They can lead to more resilient ecosystems and in turn help secure the wellbeing of societies that depend on healthy oceans.

“As was the case with forests decades



(Image: Andrew Coleman/Alamy)

ago, people have realised that the oceans aren't a never-ending source of resources and that the pressure put on them are starting to show its effects," said Germán Pale, coordinator of the MPAs programme at Vida Silvestre NGO. "MPAs expanded as a way to conserve resources for future generations."

Chile, the poster child

One of the world leaders in MPAs, 44% of Chile's territorial waters is covered

by 25 protection sites. Since 2010, the country has moved from having 463,000 square kilometres of protected marine territory to more than 1.3 million.

At that time, Chile was starting to feel the pressure of overfishing, with diminished resources following decades of unregulated activity. The government saw MPAs as a way to recover fish stocks and started working with scientists, communities and NGOs to quickly expand the protected territories.

"This isn't something that was done from a specific organisation or from the state. Without the involvement of the communities, the marine protected areas would have failed," said Liesbeth van der Meer, executive director of Oceana.

The country has various types of MPAs, most of which ban all activities except scientific research. Only one allows sustainable forms of tourism and fishing. All are managed by the environment ministry and protected by Chile's navy.

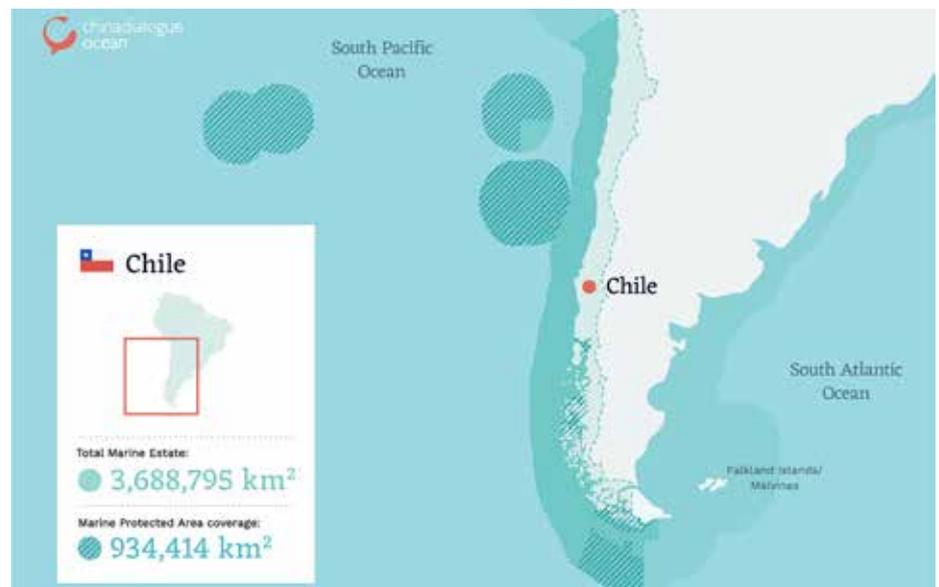
A significant event occurred last year when former president Michelle Bachelet signed laws to protect three main regions.

The largest, of more than 720,000 square kilometres, is the Rapa Nui MPA, around Easter Island, where industrial fishing and mining is prohibited but traditional fishing continues. It is one of the few MPAs in the world in which indigenous people voted to establish the boundaries and level of protection.

The Juan Fernández Islands rank second, at 261,598 square kilometres, and with complete protection from all activities.

The Diego Ramírez Island reserve, home to some of the last intact ecosystems outside the Antarctic region, follows in third place, with an area of 55,600 square kilometres at Chile's southernmost point.

"A few years back, Chileans considered the sea just a synonym for the beach. Nobody looked beyond that. This has now changed, and people relate





differently with the marine resources,” said Alex Muñoz, head of National Geographic’s Pristine Seas initiative.

Nevertheless, challenges remain. Most of the MPAs are offshore, with only 1-2% located near the coast. Experts agree the upcoming task will be to identify valuable areas and to work with communities, while seeking not to affect artisanal fishermen.

Argentina, catching up

Argentina has recently taken significant steps to expand its network of MPAs, now representing 9.5% of its marine territory and on the verge of fulfilling the UN’s 2020 goal.

Until last year, less than 3% of the country’s marine territory was protected. These MPAs were small and coastal. The only protected oceanic area was Namuncurá/Banco Burdwood, created in 2013.

In December 2018, the Senate passed a bill to triple the safeguarded marine territory by creating two new MPAs: Namuncurá/Banco Burdwood II and Yaganes, both located in Argentina’s exclusive waters.

“The protected areas came after long-term work with many actors of society. We identified nine large zones that should be protected to guarantee the functioning of the ecosystems. The new MPAs are part of that area,” said Pale.



Yaganes covers almost 69,000 square kilometres and will be divided into three zones, prohibiting all activities except scientific research on the seabed and allowing fishing only in the area closer to the land.

Namuncurá covers over 32,000 square kilometres and will be divided into two zones. In the west, sustainable fishing will be allowed, while in the east, all activities will be banned except scientific research.

The law that created the new MPAs also put them under the authority of the National Parks Administration, where previously they had not been managed by a dedicated body. The move gave the state more control and sovereignty over the MPAs, with enforcement carried out by the navy.

“The fact that we now have a body in charge of managing MPAs ensures that proper controls will be done to avoid illegal fishing and extractive activities, while opening the door to creating new protected areas,” Milko Schwartzman, a marine conservation expert, said.

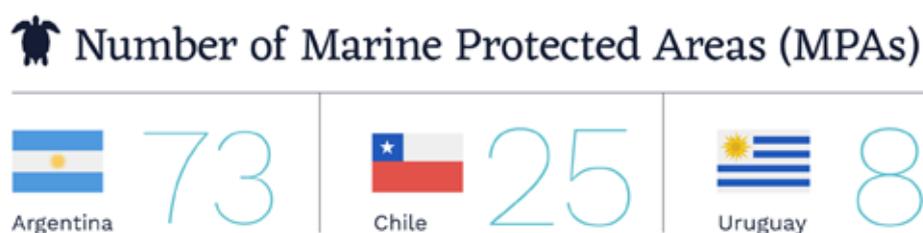
Uruguay, pushing for more protection just across the Río de la Plata, Uruguay could soon follow Argentina in expanding its network of MPAs after a campaign by local environmental organisations.

The country now has eight marine protected territories, representing less than 1% of its waters. They are managed by a National System of Protected Areas, which is part of the housing, territory and environment ministry.

All its MPAs are either coastal or inland. NGOs argue that they are not representative of the country’s marine ecosystem and are proposing the creation of a set of offshore marine reserves.

“The current areas don’t even have a consolidated work plan, with no involvement from communities,” said Rodrigo García Pingaro, founder of the NGO Oceansanos. “If we move forward with the new offshore MPAs, we would be covering 18% of Uruguay’s exclusive economic zone.”

Fermín Koop is an Argentine journalist, specialising in the environment with experience across diverse publications such as the Buenos Aires Herald, Clarín, Ámbito Financiero, Buena Salud and Notio Noticias.





White cranes fly over the Melneg Wetland in northeast China's Jilin Province (Image: Xinhua/Alamy Stock Photo)

MPA AND BIODIVERSITY TARGETS

How 'viper island' started a wave of coastal conservation

Environmental reforms promise stronger safeguards for China's coastline

By **Zhang Chun** | October 24, 2018

Shedao island is only small but it's home to thousands of pit vipers, a snake that wraps itself around tree branches so that it can ambush small migrating birds.

The island, which lies about 10 kilometres south-west of China's Liaoning peninsular is less than one square kilometre in size. It became China's first marine reserve in 1963 to protect the vipers.

The State Council then expanded it in 1980 to include Laotieshan, a forested mountain area on the nearby mainland that supports egrets, cranes and Mandarin ducks, thereby covering the pit vipers' entire known habitat. In doing so, the government created a national nature reserve – just the first of several that were approved in the early 1980s.

But the successful protection of the pit viper is not typical. Despite the creation of reserves, conservation in China's coastal areas has mostly lost out to development. This has resulted in the rapid and severe degradation of ecosystems, even in areas that have some protections in place.

This may be about to change. The new



Ministry of Natural Resources, which emerged from the government restructuring in March, has taken on and unified some of the powers from other government bodies. This should address the problem of weak and competing oversight that has hampered conservation.

Pollute first, conserve later

By 2017, China had designated marine reserves of 124,000 square kilometres – 4.1%

of all coastal waters along the country's 18,000-kilometre coastline. The area is equivalent to half the total land area of the United Kingdom.

Nonetheless, 4.1% is low by international standards. The average for countries that have placed national waters under protection is 14.4%. China is also far from the target set by signatories to the Convention on Biological Diversity in 2010. This called for 10% of national waters to be protected by 2020.

And marine reserves do not guarantee complete protection. Within China's reserve boundaries, economic development and human activity is restricted and controlled but land reclamation and coastal development have limited the effectiveness of reserves even as they were being created. By 2000, China had lost 53% of its temperate coastal wetlands, 73% of its mangrove forests and 80% of the coral reefs it had in 1950.

Amongst other causes, such losses have resulted from run-off of agricultural fertilisers and seepage of heavy metals that have fouled many river mouths, bays and wetlands.

The future of China's fishing and aquaculture industries and the direction of its coastal development rests with the new

ministry and its ability to deploy effective oversight. In particular, this means using the system of “ecological red lines” that set strict limits on pollution, and which fall under the concept of “ecological civilization”.

Legal changes

As China has adopted wider and more stringent environmental policies, it has protected more areas.

Three years after Shedao was made a national nature reserve in 1980, environmental protection became a basic national policy. A national environmental protection conference marked the turning point.

The 1982 Marine Environmental Protection Law provided a legal basis for establishing marine reserves and spurred a wave of new ones over the following 20 years.

In 1990 the State Oceanic Administration (SOA), which is responsible for defining rules on marine conservation, established the first five national marine nature reserves. In 1995 the State Council introduced regulations on the management of marine nature reserves.

China’s largest marine reserve protects spotted seals in the Bohai Sea. It was established in 1992 and given national marine reserve status in 1997.

Between 2012 and 2017 the percentage of China’s waters covered by reserves grew from 1.2% to 4.1%.

Balancing economic growth and conservation

Since 2000, the SOA has focused on creating marine special reserves (MSR). These permit limited economic development and are broadly defined to include areas of natural, historical or cultural importance.

Liao Guoxiang, deputy head of the Wetlands Centre at the SOA’s National Marine Environmental Monitoring Centre said marine special reserves permit some economic development in an attempt to balance protection and reasonable use. They can be used in areas earmarked for development.

The first MSR to be set up by a local government was in south-west China’s Fujian province in 2000. SOA, which approves marine special reserves released management regulations in 2010. In contrast, State Council approval is needed for national marine nature reserves, which tend to be larger, more ecologically valuable and have more robust protection.

By 2016, there were around 80 marine special reserves, including marine parks, islands, and oil and gas exploration sites, and 35 national marine nature reserves.



Saunders's Gull, at Liaoning Shuangtai estuary national reserve

Weak, competitive, divided

According to research published in *Nature* in 2014, the most effective marine reserves ban fishing, strictly enforce rules, occupy a minimum of 100 square kilometres, have been in existence for at least a decade, and have natural barriers to human activity. At least three of these factors need to be in place for protection to work.

But only a few of China’s national marine reserves meet that standard. China has focused on creating marine special reserves since 2000 but these are less likely to provide sufficient protections because they permit development.

The International Union for Conservation of Nature has six protected area categories based on different management objectives. China’s marine special reserves generally rank in the lower categories, according to Zhang Yan, the IUCN’s representative in China. Many are Category V, defined as “seascape areas with both tourism and protection functions”. Category VI includes reserves where oil, gas or mineral extraction is permitted.

National marine nature reserves tend to be better managed and protected than MSRs, with more robust rules and a dedicated

management body. This is because they are approved by the State Council, a higher authority than the SOA.

However, the weak protection for China’s marine reserves is also partly due to divided management and oversight because they are split across different government departments.

There are lower categories of reserves approved and overseen by many other agencies, such as the Ministry of Agriculture’s “marine product genetic resource reserves”; the forestry authorities wetland reserves; and those run by the Ministry of Ecology and Environment.

This makes it harder for a single department to establish a large reserve and leads to competition between departments and a proliferation of managers. For example, the Yancheng Red-crowned Crane Nature Reserve in Jiangsu province is managed by the environmental authorities but overlaps with a deer reserve managed by the forestry authorities.

Some marine special reserves hold special scenic area status and are overseen and funded by both the marine and tourism authorities.

“Management of reserves in China is a bit confused,” Liao explained, listing the departments involved in running marine reserves prior to the March 2018 reforms as



(Image: daviddvd-fudan/Flickr, CC BY-NC-SA)

the State Oceanic Administration; the State Forestry Administration; the Ministry of Agriculture; the Ministry of Ecology and Environment; and the Ministry of Land and Resources.

The IUCN favours having one government body to manage all activity within a single reserve and conduct consultations with local stakeholders when a reserve is planned.

Economic challenges

Economic development in China over the past four decades has brought huge changes that have wreaked havoc on coastal environments, while weak management of marine reserves exacerbated their impact.

Since 1949, there have been three waves of land reclamation: to build large salt evaporation ponds in the early years of the People's Republic; to create farmland in the 60s and 70s; and to expand aquaculture and in the '80s and '90s.

Coastal fisheries expanded from the 1980s: commercial fishing was widely permitted and demand increased. Annual catches reached 10 million tonnes or more in

1995, outstripping the eight or nine million tonnes that experts viewed as sustainable.

Economic growth moved even faster from 2000, driven by foreign investment in export industries; more coastal lands were reclaimed for ports and industrial and economic zones.

Development and protection were in competition. From 2005 to 2012 nine coastal or marine reserves shrunk by a total of 5,756.77 square kilometres – including the Shedao and Laotieshan national reserve and Yancheng national reserve.

To rein in excessive coastal development, the State Council published a notice on July 25, 2018 on stricter management of reserves and controls on land reclamation.

“The rapid loss of large stretches of natural coastline and shallows and intense fishing in shallow waters have reduced coastal biodiversity,” said Zeng Jiangning, a researcher with the SOA's No.2 Ocean Institute.

Seeing red

A new approach based on “red lining” sensitive areas promises to improve environmental protection. Marine ecological red lines have been trialled since 2012 under State Council supervision in Liaoning, Shandong, Hebei and Tianjin, which all border the Bohai Sea.

In 2016, the SOA built on those trials with a document on the full implementation of the red line system that will roll them out nationwide.

Ecological red lines were first proposed in 2011 but it was not until February 2017 that the Central Committee and State Council published enforcement guidelines. By making local party committees and government responsible for observing the red lines, it finally became a policy with binding force.

National red lines brought the chaos of marine development under control by making larger marine reserves possible. One red line mandated each coastal province to classify at least 30% of its coastline a marine ecological red line area.

Creating marine red lines rescued certain ecosystems, according to Wang Yamin, a professor at the Marine College at Shandong University's Weihai campus. “It takes 10 years to get a national marine reserve set up,” he said. “That would be too late.”

Red line areas can ban or limit development. Marine reserves will ban development; areas which are not yet protected but are worth protecting will see development limited – for example key fishing grounds, coastal wetlands, or areas supporting rare animals.

Marine reserves and marine ecological red lines in Liaoning

Produced using 2017 data from the government of Liaoning

Liao Guoxiang said “the area of China's protected waters is set to increase significantly”, if all the red line areas are taken into account.

However, there is still no legislative basis for how red lines should be set. And vague language such as “limiting development” may not provide effective protection.

Unified management at last

Unified management is on the way. Reforms to China's ministerial structure published in March 2018 will see the National Forestry and Grasslands Bureau within the new Ministry of Natural Resources take over running nature reserves, scenic areas, natural heritage sites and geoparks that are currently divided between the SOA, Ministry of Land and Resources, Ministry of Water Resources and the Ministry of Agriculture.

It will solve a major long-running problem as part of the drive for “ecological civilisation.”

But ministerial reforms are only the beginning. Some tasks will have to wait until sub-ministerial functions and structures have been finalised, and those follow-up changes will also impact on how effective China's nature reserves are.

For example, prior to the reforms the Ministry of Environmental Protection would carry out annual checks on all nature reserves nationwide and publish a report on its findings. Now, all reserves are managed by the Ministry of Natural Resources – and it is not yet known if it will continue this practice.

Future challenges

The rapid increase in the number of marine reserves also presents challenges, as does consolidating different local rules on management of reserves into a single system.

“Some types of marine reserves, such as fishery reserves, have been in place for decades and a lot of experience has been accumulated. Are the fishery authorities going to pass all that accumulated experience onto a body that previously only managed reserves on land?” asked Xue Guifang, a professor to the University of Shanghai's Koguan School of Law and an expert on marine law.

Xue believes conflicts will arise as ministerial powers shift during the transition period, but the trend toward tougher marine protection is clear. 🍷

Our thanks to the Crossborder Environment Concern Association for their assistance with this article.

Can blue finance save the oceans?

Blue bonds and other novel financial devices may fund conservation projects that have until now been off-limits

By **Fred Pearce** | May 28, 2019

Conservation could be on the verge of a blue revolution. This year there is growing talk about using entrepreneurial finance to capture atmospheric carbon in revived marine and coastal ecosystems such as coral reefs, mangroves, salt marshes and sea grasses. Conservationists call it “blue carbon”.

There is increasing scientific conviction that blue carbon is one of the cheapest options for carbon capture. And that capturing carbon in coastal ecosystems brings with it a host of other ecological, economic and social benefits, from improved fisheries and richer tourism experiences to protection against rising tides and lethal tropical cyclones.

No wonder Chile, the host of this year’s conference of parties (COP) for the UN climate negotiations in Santiago, says it wants the event to be remembered as the “blue COP”.

The ‘debt for nature’ swap

Blue finance is new territory for conservationists, says Emily Landis, coastal wetland strategy lead at The Nature Conservancy (TNC), a US-based NGO that has taken a lead in finding private funds for marine conservation. The science of counting tonnes of carbon in coastal ecosystems, and methodologies for making sure it stays put, are now both reaching maturity, she says, giving banks and investors the confidence to stake money on the virtues of blue carbon in return for tradable carbon credits or other benefits.

TNC’s showcase project is the Seychelles Sovereign Blue Bond, the world’s first blue bond, which was



Proving environmental benefits in the fluid waters of an ocean is harder than on terra firma.”

launched last October. The nation comprises 115 islands, many of them coral fringed, spread across an area of the Indian Ocean three times the size of California. Its economy depends almost entirely on tourism and fisheries. And its government is in debt.

So TNC offered a “debt for marine nature” swap. With help from investors, the World Bank and its Global Environment Facility, TNC bought up US\$22 million of Seychelles debt owed to Britain, France, Italy and Belgium. It then excused some of the debt, while lowering interest rates and lengthening the payback period on the rest. The money “saved” goes into a trust fund that pays for conserving marine protected areas and promoting fisheries and other parts of the nation’s blue economy. The World Bank called it “a model for other small island developing states and coastal countries”.

TNC sees itself as a packager of dozens of future deals on the same lines, bringing financiers and governments together, but also bringing their own ecological expertise. “The deals incentivise governments to create marine protected areas. But we also design plans for the countries’ ocean areas, and do work engaging with stakeholders such as local fishers,” says Robert Weary, deputy



La Digue Island, The Seychelles

managing director for blue bonds at TNC.

Proving environmental benefits in the fluid waters of an ocean is harder than on terra firma.

He stresses that to ensure the integrity of the project, host governments will always be in a minority on the public-private trust fund boards that manage the cash.

Investors get a secure return on their capital, often insured by the US government through its Overseas Private Investment Corporation. They can also bask in an environmental payback, which may bring self-congratulatory smiles round the boardroom and is also undeniably good PR.

“It’s a triple bottom line,” says Weary. “They get their money back, we get conservation on the ground and the host government gets to restructure its debt.”

Under the UN Climate Convention, blue carbon projects can also attract tradable carbon credits. Very few countries mentioned blue carbon



(Image: Robert Armitage/Alamy)

directly in their submissions to the Paris Agreement in 2015. But TNC nonetheless has big plans for cornering what it sees as a growing market. “We want to have 20 deals in place in 20 countries within five years,” says Weary. They could protect at least a third of marine sources in 4 million square kilometres of ocean. “To do that we need to raise US\$3 billion.”

It has a big initial focus in the Caribbean, with nine indebted island nations in line to swap that debt for marine conservation – and hopefully improve their tourism as well as their biodiversity. Grenada, St Lucia and Barbados head the queue. In Africa, the mangroves of Kenya and Tanzania may also soon benefit from attention.

Ecosystem insurance

Not all projects will focus only on blue carbon. Another version of blue finance, says Landis, is “ecosystem insurance”, in which beach hoteliers or others dependent on healthy coastal ecosystems pay to protect the coral

reefs and mangroves that provide coastal protection against storms. TNC has established a trust fund to protect reefs and beaches on the tourist coast of Mexico’s Yucatan peninsula, against hurricanes for instance. A tourist tax is channelled into the fund to pay for both routine reef maintenance, such as removing debris and replanting species, and bigger repairs after hurricanes.

More complex hybrid financial deals allow investors to combine carbon capture with meeting corporate social responsibility, such as by contributing to the UN sustainable development goals, which cover everything from biodiversity to food security and gender equality to the resilience of coasts.

And while most blue finance projects have been in the tropics, they could spread elsewhere. In January, the Norwegian asset management company Storebrand unveiled a Baltic Blue Bond to finance ecological recovery in the Baltic, Europe’s most polluted sea. It promises

to clean up sewage and industrial waste either by installing new treatment plants or protecting the marine ecosystems that also cleanse the waters.

An ocean of risk?

Some ecologists see the ambitions for expanding blue conservation finance as far-fetched. Proving environmental benefits in the fluid waters of an ocean is harder than on terra firma.

Take blue carbon. You must be able to demonstrate that projects such as restoring mangroves will store carbon for at least 100 years, the same as for a forest on land. But those mangroves face many essentially uncontrollable threats, from tides that wash away seedlings or bring in pollution, to tropical storms, and the constant rise in sea levels that can drown any coastal ecosystem.

A workshop in Australia two years ago concluded that such risks meant “blue carbon projects ... are likely to have a low return on investment and may not be cost-effective.” Landis says: “You have to be really careful with the choice of your sites, because of sea-level rise.”

Many past projects to plant mangroves have not been successful, says Wetlands International, an NGO that once promoted planting but now instead favours creating the right coastal conditions for natural reseeded and growth. Either the wrong species were planted, or they were planted in places where the seedlings washed away. Aftercare was often poor when communities were paid for planting but not for looking after the results.

In a global survey, Shing Yip Lee of the Chinese University of Hong Kong, with colleagues, reported in April that such projects “generally did not result in significant long-term mangrove area increase or tree survivorship”. And there could be downsides even when projects were successful. The same study found that the widespread planting of cordgrass, an exotic salt marsh grass, along the Chinese coastline, had choked tidal mudflats and reduced foraging areas for migrating wildfowl on their crucial East Asia flyway.

Blue aquaculture

TNC has another initiative up its

finance sleeve that may be more surprising than restoring coastal ecosystems. It wants a hand in the fast-growing global business of marine aquaculture.

Aquaculture is notoriously the destroyer of large areas of tropical mangroves for prawn ponds. But TNC's thinking is simple. With a still-rising population – and little sign of big declines in food waste – the world needs ever more food. And aquaculture is going to be a big part of that. “Oceans cover 70% of the planet, but provide only 2% of its food,” says Robert Jones, who leads aquaculture strategy for TNC.

Aquaculture is set to change that. “Over the next decade we estimate between US\$150 and US\$300 billion will be invested in building aquaculture infrastructure,” says Jones. Much of it will displace coastal ecosystems.

It has to be made less destructive of the environment, he says. “More sustainable aquaculture systems struggle for finance, so we want to build interest in them,” by using blue finance vehicles to showcase best practice and find ways for people to invest in it. TNC published a report in May looking at “responsible alternatives to overfished wild species.”

Jones sees three opportunities. One is called “recirculating aquaculture”, which means growing fish on land in tanks of recycled treated waste from sewage works. A second is moving coastal fish farms further offshore, as has started happening in China's Bohai Sea, where their impacts on coastal ecosystems and water quality will be less. A third is switching to cultivation of seaweed and shellfish that can restore coastal environments rather than destroying them.

Such technology could have particular benefits for the troubled coastal ecosystems of China, home to 60% of the world's aquaculture, he says.

In a world where aquaculture is of fast-growing importance along many coastlines, making it more sustainable could be the biggest benefit of all to be gained from blue finance. 🔄



A shark fin wholesaler in Hong Kong

(Image: Kike Calvo/Alamy)

UNDER THREAT

Tackling the trade in endangered species

Trade controls are crucial for conservation of ocean creatures, but face challenges

By **Zhang Chun** | April 26, 2019

Earlier this year in Rome, scientists from around the world debated the need to control trade in the endangered shortfin mako shark. The meeting of the United Nations Food and Agriculture Organisation (FAO) was to determine if this species, along with a handful of others, should be given protection under the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES).

The decision in the end was not a positive one for the shortfin mako, with the expert panel declaring insufficient evidence to list the species. But threats to its survival, and many other shark species, remain.

Shark fin is a traditional delicacy in Hong Kong. Half of all shark fins harvested are either consumed in this tiny territory or pass through it on the way to other markets. Most of them come from vulnerable or endangered populations.

Hong Kong is a hub for the trade in a wide range of endangered marine species.

In late March, China Dialogue Ocean held a seminar in the territory to discuss improved protections for these animals.

Experts at the seminar agreed that a CITES listing is only a first step. More cooperation on preventing illegal trading is also needed.

A hard list to get on

CITES is an international agreement controlling the trade in endangered species that came into effect in 1975. It has three appendices listing species at risk from international trade and in need of special protections. Cross-border commerce is banned for those species listed on Appendix I. The other two appendices offer lower levels of control.

Some marine species, such as the totoaba, have been listed on the CITES appendices since the beginning. But it wasn't until 2002, when all species of seahorse were given protection, that new marine animals began to be added.

Under CITES processes, if the country of origin of a species thinks it is

suitable for CITES protections and needs other nations to help prevent trade, it can propose its inclusion. Scientists first assess if trade does actually threaten the survival of the species in the wild, and then there is a vote on the proposed inclusion at a conference of parties to the treaty.

Yvonne Sadovy, professor of marine biology and ecology at the University of Hong Kong, says the trade restrictions that listing on CITES allows are crucial for conservation.

But even if a species is in decline, gaining agreement that it needs protection under CITES trade controls is no easy task, especially when it's regarded as a food source.

Sadovy explains one of the reasons for this is that the majority of the 183 parties to the convention need to agree before a proposal can be accepted.

An example is the bluefin tuna. A proposal to ban the trade in a sub-species, the Atlantic bluefin, was put forward in 2010, and rejected by 68 votes to 20, with 30 abstentions.

The bluefin is widely used in sushi, and as demand has increased with the spread in popularity of Japanese cuisine,

populations have fallen. The Atlantic bluefin is considered endangered, just one of the three sub-species on the International Union for Conservation of Nature's (IUCN) Red List. No bluefin tuna are currently listed in on any CITES appendices.

But things are changing. According to Sadovy, acceptance is growing that trade in a small number of threatened marine species needs to be controlled to within sustainable levels. "The need for more attention to manage fisheries is growing all the time. We have no choice, without management, one by one species will decline, the most vulnerable ones first," she said.

A hard trade to control

In theory, a CITES listing should put a species on the radar of law enforcement agencies, as the treaty calls for strict controls on imports and exports. But that doesn't stop smugglers.

Sophie Le Clue, director of environment at the ADM Capital Foundation, estimates that only 10% of smuggled species are confiscated or interdicted. The remainder is either not discovered or not identified, she said.

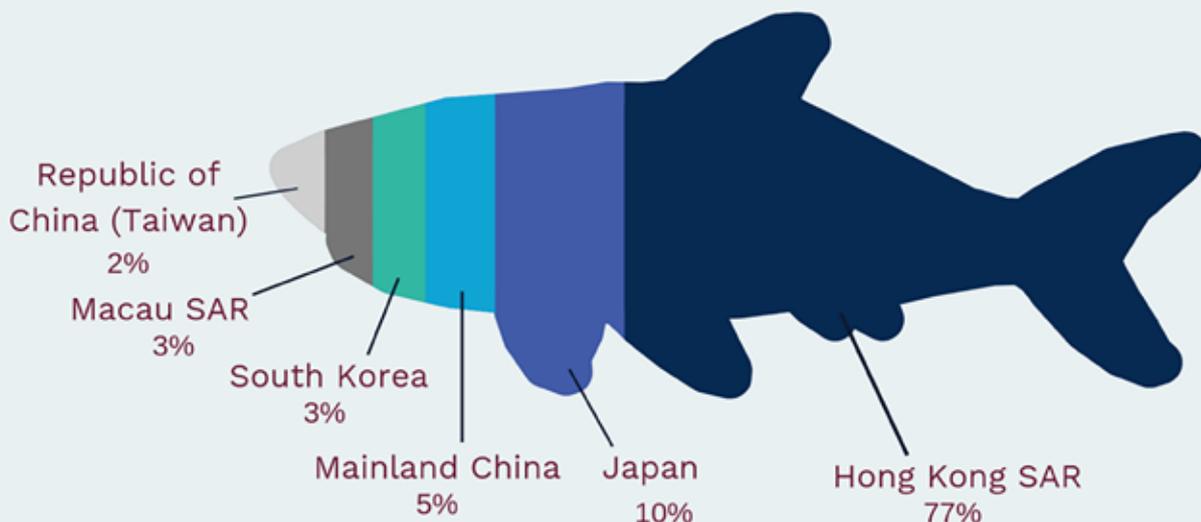
Smugglers have a range of methods, some very hard to tackle. The firms transporting the goods may not even be aware of what they are carrying, making them unable to help the authorities. Illegal goods may also be labelled as legitimate products, a method that is particularly common in containerised shipping. It is even harder to monitor small fishing vessels, which can land cargoes away from official ports.

For the authorities, identification is a major challenge. Some illegally smuggled species can be identified by eye, whether as live specimens or as products. But some, including shark fin, are harder to spot. According to Le Clue, you might be able to identify fins taken from adult sharks, but it's hard to determine the species of a fin taken from a juvenile.

For other smuggled animal products, such as the teeth of cetaceans, turtle shell products or dried fish swim bladders and gills, identification often requires special technology.

Manta ray gills have been a particular focus for staff at China's CITES Endangered Species Scientific Commission. Both species of this giant ocean creature were listed by CITES in

Where shark products end up in East Asia



2014, with China named as the centre of trade.

Dried manta ray gill is used as an ingredient in traditional medicines in parts of Asia, allegedly to treat measles and increase the production of breast milk. In China, it is not officially listed as a medicinal ingredient, which means that although it is used, it is not widely known. To help enforce the new trade restrictions, the commission's researchers purchased over 200 samples of medicines for analysis and DNA testing. They were then able to teach law enforcement officials how to identify products containing the organ.

Smugglers also choose their routes to avoid harsher punishments. Selling totoaba swim bladder worth two million yuan (US\$297,340) can incur an eight-year jail sentence on the Chinese mainland, but no more than two years in Hong Kong. This means Hong Kong is a less risky, and so more popular, destination for smugglers. For Amanda Whitfort, a professor at the University of Hong Kong's Faculty of Law, blocking that loophole would solve a major issue.

A hard problem to pin down

Although smuggling is a serious issue, failures to implement the CITES treaty are also central to the continued decline of many listed species. The totoaba of Mexico's Gulf of California has been on Appendix I since the 1970s, but populations are still falling. This has had a significant impact on a species of porpoise that shares its habitat with the totoaba – the vaquita is now facing extinction with fewer than 20 mature individuals left in the wild.

Zheng Ruiqiang of Shantou University's Marine Biology Institute helps customs officials identify smuggled species. But he says even effective enforcement at the border is not a lasting solution, as the situation is constantly changing. "Customs officials have reported that when ivory trading was banned, the number of cetacean teeth being smuggled increased," he said.

That isn't an isolated case. An investigation by Stan Shea, marine projects director for the Bloom Association's Hong Kong branch, found

that while shark fin consumption has started to fall in Hong Kong after years of campaigning, many diners think it is acceptable to replace it with swim bladder or sea cucumber. They are unaware that these choices again result in the trade in endangered species, or that the demand for fish swim bladder, for instance, is leading to overfishing of the Nile perch in East Africa's Lake Victoria.

Zeng Yan, assistant to the director of China's CITES commission, thinks it is normal for a banned product to be replaced with an alternative. She says that rather than spending time protecting species after species, it would be better to look at the underlying motivations driving trade and consumption, and ask what is reasonable and sustainable. "We need wider-ranging policies and frameworks to find a balance between the fishing industry and sustainable conservation and find a better solution," she said.

According to Michael Fabinyi, associate professor at the University of Technology Sydney's School of Communication, people often think that China's eating habits are centuries old and can't be changed. "I don't think that's necessarily the case," he said. He has found that food consumption can be affected by things like tariffs and marketing, as well as what might at first appear to be unrelated changes. Recent anti-corruption campaigning by the Chinese government, for instance, has led to a significant drop in the consumption of luxury seafoods in Beijing.

According to Stan Shea, culture determines what we eat, and also our future. For the Chinese, fish on the table symbolises a plentiful supply of food. "I don't want to be remembered as the generation that ate it all," he said. 🍷

Zhang Chun is a senior researcher at China Dialogue.



Fish maw for sale

(Image: Earnest Tse/Alamy)

Overfishing pushes rhino rays to brink of extinction

Giant guitarfish
(Image: ImageBROKER/Alamy)

Humans are driving the decline of species in the oceans, in freshwater and on land, finds IUCN's 'red list' of threatened species

By **Jessica Aldred** | July 18, 2019

Overfishing has pushed two families of stingray to the brink of extinction, according to the latest annual update to the “red list” of the world’s threatened species.

Wedgefishes and giant guitarfishes, known as rhino rays because of their elongated snouts, are now the most imperilled marine fish families in the world. All but one of the 16 species have been assessed as critically endangered by the list, which means they are one step from becoming extinct.

Increasingly intense and unregulated coastal fishing is driving their decline, with most snared accidentally as bycatch. Closely related to sharks, with some species growing up to three metres long, they live in shallow waters from the Indian and west Pacific oceans to the east Atlantic Ocean and Mediterranean Sea. Rhino ray meat is sold locally, while the fins are highly valued and internationally traded for shark fin soup.

“To prevent losing these ray families, it is critical that governments immediately establish and enforce species protections, bycatch mitigation programmes, marine protected areas, and international trade controls,” said Colin Simpfendorfer, co-chair of the IUCN species survival commission’s shark specialist group.

The annual list, compiled by the International Union for the Conservation of Nature (IUCN), based in Switzerland, is the most authoritative assessment of the status of the world’s plant and animal species. The latest list adds almost 9,000

new species, bringing the total assessed to 105,732 species – though this is thought to be a fraction of the number living on Earth. Some 28,338 species are threatened with extinction, and not a single one was recorded as having improved in status.

“This update clearly shows how much humans around the world are overexploiting wildlife,” said IUCN acting director-general, Dr Grethel Aguilar.

The report also warned that hunting for bushmeat and habitat loss had led to the decline of seven primate species, and comes months after a major report warned that nature loss would have grave impacts for human wellbeing.

“This update confirms the findings of the recent IPBES global biodiversity assessment: nature is declining at rates unprecedented in human history,” said Jane Smart, global director of the IUCN biodiversity conservation group. “Both national and international trade are driving the decline of species in the oceans, in freshwater and on land.”

She said decisive action was needed “at scale” to halt this decline, with the timing of this assessment seen as critical ahead of next year’s UN biodiversity convention summit in Kunming, China.

“Loss of species and climate change are the two great challenges facing humanity this century,” said Lee Hannah, senior scientist at Conservation International. “The red list addresses both, by letting us know the extinction risk faced by all species, including climate change, in that assessment. The results

are clear, we must act now.”

The update also revealed dramatic declines in numbers of the world’s 18,000 freshwater fish species. More than half of Japan’s endemic species and one-third of Mexico’s are threatened with extinction, driven mainly by the loss of free-flowing rivers, increased agricultural and urban pollution and invasive species.

William Darwall, head of the IUCN freshwater biodiversity unit, said: “The loss of these species would deprive billions of people of a critical source of food and income, and could have knock-on effects on entire ecosystems.”

Earlier this year, a global analysis published in the journal *Nature*, showed that only a third of the world’s great rivers remain free-flowing, with the impact of dams drastically reducing the benefits provided by healthy rivers to people and nature.

The red list also added 500 deep-sea bony fish species, such as bioluminescent lanternfishes, which are found at depths of more than 1,000 metres, and face potential threats from deep-sea fishing, oil and gas extraction, and sediment plumes created by deep seabed mining operations.

The International Seabed Authority has granted 29 licences for exploration and is currently drawing up a code to govern eventual mining operations, but many scientists, along with civil society and campaign groups, are calling for a moratorium, saying that not enough is known about deep-sea marine life to adequately assess the ecological threat.

The scaly-foot snail (*Chrysomallon squamiferum*), which lives at depths of 2900 metres in the Indian Ocean, is the first hydrothermal vent mollusc to be added to the list. There is concern that if mining is permitted, its habitat could be severely reduced or destroyed. 🐞

David Obura: ‘We are not doing enough to combat the decline of coral reefs’

Dealing with greenhouse gas emissions and overexploitation is key to sustainability

By **Jessica Aldred** | March 28, 2019

The Economist World Ocean Summit in Abu Dhabi in March 2019 brought together policymakers, business and tech leaders, scientists and civil society groups to discuss the threats to the world’s oceans, and how to create a sustainable ocean economy.

One of the experts we interviewed was David Obura, director of CORDIO East Africa (Coastal Oceans Research and Development – Indian Ocean), a non-profit research organisation based in Kenya. David is also chair of the coral specialist group at the International Union for the Conservation of Nature. We asked him about the outlook for coral reefs.

Why does coral matter in global conservation terms?

It matters because corals are the architects of coral reef ecosystems in shallow tropical waters. Because of their location and how they grow, they are one of the most biodiverse marine ecosystems. They also provide amongst the highest levels of benefit to people – in poor countries in particular, but in rich ones too – in terms of fisheries, tourism and coastal protection.

What is the current status of coral?

The latest science is that even with the Paris climate agreement [to hold global warming] to 1.5C, we will lose 70-90% of coral reefs, and at 2C we are likely to lose all coral reefs. That’s as a globally connected ecosystem – there may be coral reefs that survive in some pockets but they will be quite rare. And there will be some places with a few corals surviving, growing on rocky reefs and reef surfaces, but they won’t be constructing a reef ecosystem in the same way as we have been used to.



David Obura diving off the coast of Madagascar (Image: Keith Ellenbogen)



DAVID OBURA

What does this mean for our oceans?

Twenty five per cent of all marine species are supposed to spend part of their life cycle on a coral reef. What it means for that 25% of species we don’t entirely know. We won’t lose all of them of course, but many will lose a key part of their life cycle. And the productivity of tropical coastlines will go down significantly, so the benefits received to those countries will be much reduced.

What are we doing to combat decline?

We’re not doing enough. There are two main areas. One is global, and that’s carbon dioxide and greenhouse gas emissions. We’re still on the bad side of these scenarios if we want to save coral reefs. Second is all the local threats to reefs, basically based on population – the number of people and economic activity. Both of these are growing through the roof without any real policies

about bringing them under control. So we’re worsening the situation for reefs across the board. There is a lot of conservation action – marine protected areas, and things we are discussing here at this conference. But we’re not really dealing with the fundamentals.

Are there any emerging technology solutions?

There is a lot of research currently on restoration and improving the prospects for corals and coral reefs, and I’m a scientist so I certainly support research. But the truth is at the moment none of the actions really restore ecological function on a reef. You can grow individual corals, and you can grow 10,000 corals, but they don’t really restore the functions of the reef. So you can’t go in and claim to a fishing community, for example, that you can restore the fisheries that they used to have by restoring their coral reef, because we can’t do that.

Are there some coral reefs that are more important than others to save?

There is a project called the 50 reefs to identify the most in-need reef areas, and even [narrowing it down] created a lot of

controversy. The key reef regions really are the Coral Triangle in Southeast Asia, some of the main Pacific island areas, in the Indian Ocean we have identified the northern Mozambique channel as a key area for connectivity and diversity of coral reefs, and some areas in the Red Sea and South Asia as well.

What about the Great Barrier Reef?

The Great Barrier Reef is the poster child for coral reefs because it's the biggest one. But really the most diverse reefs are in the Indonesia and Philippine regions. For species diversity, and connectivity to other reef areas, that really is the most important reef area in the world.

There has been a lot of talk at this conference about the blue economy and making our seas more productive.

How do you see coral fitting into that?

Corals are a core part of what the blue economy should be about, and the blue economy should be about sustainable investments. A discussion has come up here on mangroves and blue carbon and paying for the ecosystem services that mangroves, sea grasses and coral reefs provide. If we do that, if we really invest the money to ensure those services are sustained then that's what the blue economy means to me. Coral reefs – because they support so much of national and local economies they are a central part of the blue economy – but we're not yet financing to make sure their productivity remains intact.

Tell us about your CORDIO East Africa project

CORDIO is a research organisation, we're a non-profit registered in Kenya. We work at the regional level in eastern Africa and the western Indian Ocean, so it's about 10 countries. It's a coral reef region that's quite well defined. And we are trying to support consistent monitoring across all countries. We are trying to do research to help understand the climate vulnerability of coral reefs and also what needs to be done for sustainable fisheries – local, small-scale fisheries that are “climate-smart” and can survive the pressures of climate change as well, and advise on the policy and management necessary to sustain reefs.

Is there a strong political will in this region for preserving reefs?

In our region we have political interests in coral reefs and the ocean because a lot of poor people depend on fishing and live by the sea. Also, with the reality of African development we are looking for growth so the ocean economy is really being looked at as a solution for the future. But we have to do it right. We don't yet have the political will to do it sustainably. 



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