Using Marine Technology to protect oceans and influence decision-making

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Reading time 8 mins

Key Points

- The health of marine ecosystems is rapidly declining
- Threats include overfishing, climate change, pollution, shipping, and mining
- Scientific observation and data collection are needed to inform improved decision-making and planning
- Technologies such as gliders, remotely operated vehicles, and geographic information systems are key
- Provides data regarding ocean acidity, species migration, plankton production etc

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It’s no secret that our oceans are in grave danger. Factors such as climate change and pollution are damaging the health of marine ecosystems and causing them to decline at an alarming rate. But it’s not all doom & gloom: According to the WWF’s Living Planet Report, “ much of the activity threatening the ocean is avoidable, and solutions do exist to turn the tide.” [1] Reliable and impartial data collection are crucial to implementing solutions, and this is where marine technology – such as underwater drones – has a central role to play.

What are the threats our oceans are facing?

The Living Planet Report estimates that only 13% of the world's ocean remains unaffected by human impact. Negative consequences threaten global food security, employment, and climate regulation. They also lead to international disputes over maritime boundaries – especially concerning a country's Exclusive Economic Zone. Some of these threats include overfishing, climate change, ocean-based pollution (e.g. oil spills, plastic, waste disposal), shipping, and deep-sea mining.

The 2022 United Nations Ocean Conference in Lisbon 1 July highlighted the vital role of science, technology and innovation in overcoming sustainable development hurdles [2]. Strengthening scientific observation and data collection is needed to improve decision-making and planning. In doing so, it is hoped that the cycle of marine pollution, acidification, biodiversity decline, and ocean warming can be broken.

Top data collection technologies used in Oceanography

Oceanography studies all aspects of the ocean, covering everything from marine life and ecosystems; to currents, the movement of sediments, and seafloor geology [3]. It's an interdisciplinary study that helps to provide answers to essential questions regarding the health of marine ecosystems: How are species adapting to environmental changes? How long does it take for an ecosystem to recover after an oil spill? What are the consequences of increasing levels of ocean acidification?

Before answers and potential solutions can be found, data needs to be collected reliably, efficiently, and comprehensively. Some of the leading marine technologies used to study oceans [4] include:

- Sea gliders: Underwater gliders that cover thousands of miles over long periods and dive down to depths of 1000 metres. GPS determines its position, and it's fitted with internal and external sensors to scan the ocean and collect data
- Buoy systems: Floating instrumentation platforms that gather information about the sea and environmental conditions
- Drifters: Flotation devices fitted with a transmitters that collects information about currents and ocean circulation patterns in real time
- Geographic information systems: Computer systems used to capture, store, check, and display geographical data
- Remotely operated underwater vehicles (ROVs): Robotic vehicles fitted with sensors and sampling tools to collect various types of data from the ocean

What kind of eco-saving information

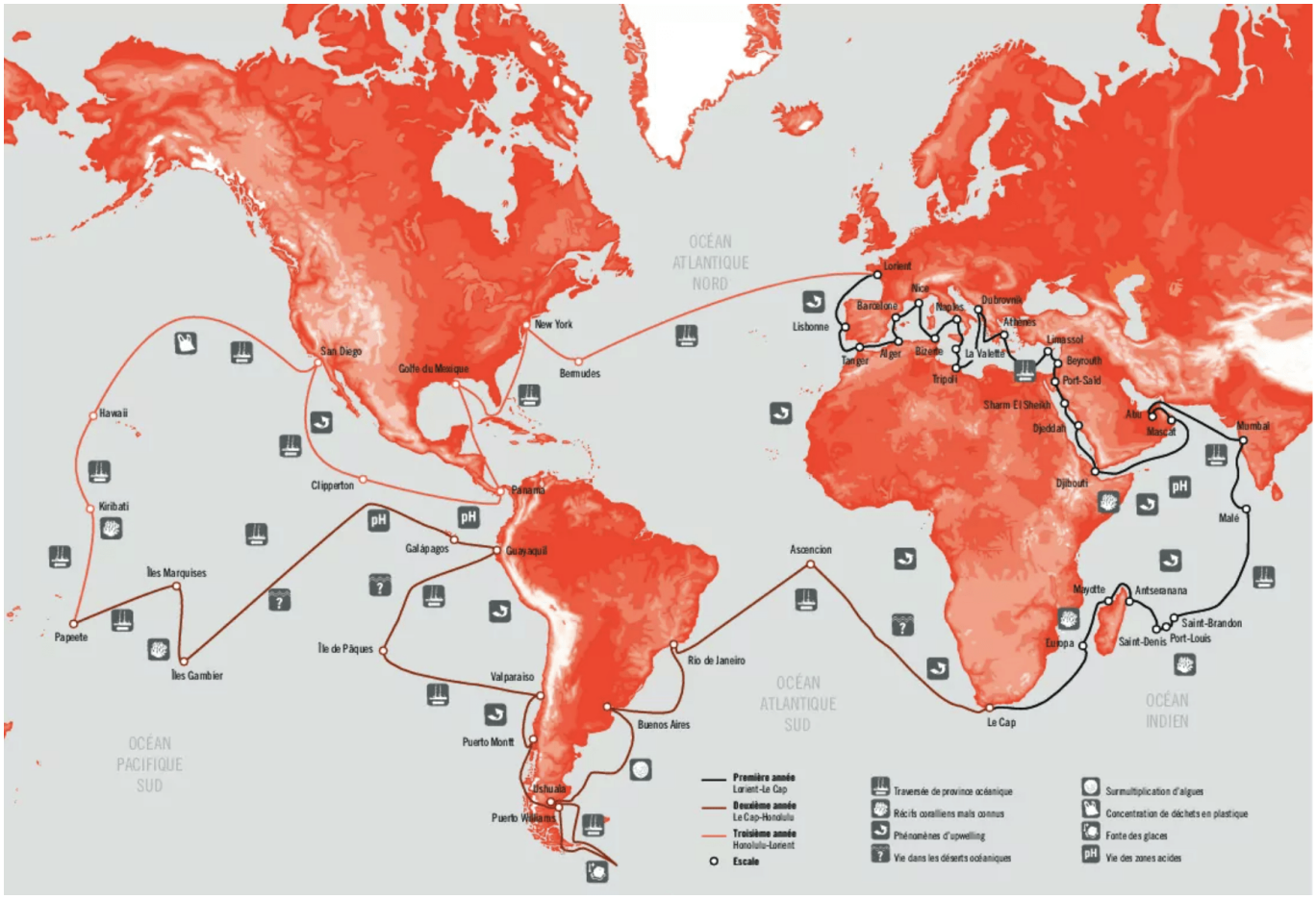
can marine technology provide?

IoT and marine technology are invaluable data collection resources and help us better understand both short and long-term consequences of human impact. A perfect example is a research team in Alaska: they're using a 59kg underwater drone fitted with sensors to measure carbon dioxide levels in the ocean, combat ocean acidification, and monitor global warming [5]. While still in its development phase, the benefits of this type of technology are numerous:

- Avoids the need to use ships, buoys, and moorings – which themselves can pollute oceans – to measure CO2 concentrations and pH levels
- Designed to dive down to approximately 1000 metres and can roam remote parts of the ocean autonomously – thus collecting a more comprehensive data set
- Its navigation system is programmed to know how deep down to dive, where to collect samples, and when to surface and send a locator signal for retrieval
- Although more development is needed, the glider sensors operate well even in harsh environments

Another example of how marine technology is helping to drive decision-making and influence policy comes from the Fondation Tara Océan [6]: The first foundation in France recognised for promoting public interest dedicated to the ocean. One of their most notable expeditions was the most significant genetic sequencing task ever undertaken. Nearly 35,000 samples of viruses, algae, and plankton were analysed, collected, and – among other things – used to create a cartographe. These activities enabled them to:

- Identify marine ecosystems that produce the highest quantities of plankton (the foundation of the aquatic food chain and a key producer of oxygen), such as Chile, California, Senegal, Namibia and Mauritania
- Analyse DNA samples and identify the ones that are responsible for photosynthesis
- Use a combination of marine, terrestrial, and satellite data to identify maritime regions that are crucial for specific types of plankton production
- Combine this with imaging technologies to see where and when phytoplankton is in bloom, together with its dispersal in relation to marine currents



Global Expedition conducted by the Fondation Tara Océan to study plankton and chart their findings on a world map

In an interview with Mathieu Ducrocq (environmental consultant), he highlighted an additional benefit of using marine technology, high-resolution imagery devices, and AI to drive decision-making. AI technology can examine the minute details of plankton imagery (taken from devices such as a plankoscan and planktoscope). When programmed with analysis criteria such as size and shape (of which there are roughly 60), it provides data on an even grander scale – and allows for a deeper understanding of how the global food chain works.

Will this be enough to turn the tide against marine decline?

The sceptic wants to conclude that governments have a disappointing track record of not honouring agreements regarding climate change and protecting ecosystems. Regardless of promises made and accords signed to reduce CO2 emissions, invest in renewable energies, and protect our oceans, the health of marine ecosystems is still declining. No amount of marine technology, data collection and analysis will change the tendency to prioritise short-term economic gains over long-term sustainability.

The realistic optimist draws a different conclusion: Because the ocean is such a vast and complex

territory to monitor, data collection has been equally challenging and costly to obtain. However, IoT and marine technology have made it much easier to collect and share data-based information globally. This information empowers citizens, businesses, and NGOs with the knowledge needed to make conscious decisions, hold governments responsible, and compel international organisations such as the UN to enforce consequences.

What side of the fence are you on regarding Marine Technology? Share your thoughts and let us know – we'd love to hear from you.

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