The rapid loss of some of the ocean’s most productive and species-rich habitats like coral reefs, mangroves and seagrasses threatens the wellbeing of hundreds of millions of people. Plastic pollution is also a growing global problem. Plastic debris has been detected in all major marine environments worldwide, from shorelines and surface waters down to the deepest parts of the ocean, even at the bottom of the Mariana Trench. Almost 6 billion tonnes of fish and invertebrates have been taken from the world’s oceans since 1950. Now, big data and a new wave of technologies are helping to improve our understanding of what is happening in our oceans by tracking where large vessels are travelling. Layering this information together with data from a range of sources is helping us to build up a more comprehensive picture of our ocean footprint.

OCEAN HABITATS VITAL TO HUMANITY IN STEEP DECLINE

Billions of people worldwide - especially the world’s poorest - rely on healthy oceans to provide livelihoods, jobs and food and the range of goods and services that flow from coastal and marine environments. The FAO estimates that fisheries and aquaculture alone assure the livelihoods of 10-12% of the world’s population, and 4.3 billion people are reliant on fish (including freshwater) for 15% of their animal protein intake. Nearly 200 million people depend on coral reefs to protect them from storm surges and waves.

However, some of the key habitats that underpin ocean health and productivity are in steep decline. Coral reefs support more than a quarter of marine life but the world has already lost about half of its shallow water corals in only 30 years. If current trends continue, up to 90% of the world’s coral reefs might be gone by mid-century. The implications of this for the planet and all of humanity are vast.

What is widely recognized as a crisis for biodiversity also risks becoming a major humanitarian challenge, particularly for coastal areas in South East Asia, Melanesia, Coastal East Africa and the Caribbean where there is strong dependence of communities on marine resources for food and livelihoods.

John Tanzer, Paul Gamblin and Linwood Pendleton, WWF

Nearly 200 million people depend on coral reefs to protect them from storm surges and waves.

Tropical seas overheated by climate change have bleached, damaged and killed coral at unprecedented levels. Mass bleaching was first documented in the 1980s and satellite imagery has connected the distribution of bleaching events on Australia’s Great Barrier Reef in 1998, 2002 and 2016 with increased sea surface temperatures. In the aftermath of the bleaching event in 2016, extreme, prolonged heat led to catastrophic die-off of fast-growing coral species – which have complex shapes that provide important habitats – and these were replaced by slower-growing groups that shelter fewer sea creatures. This drastically changed the species composition of 29% of the 3,863 reefs that make up the Great Barrier Reef. Other threats to coral reefs include overfishing, selective fishing and destructive fishing practices, and pollution from runoff which sullies reef waters, compromising coral health.

Mangroves are a key natural asset for many tropical and subtropical coastlines, providing livelihoods to many millions of coastal families and protecting them from violent storms and coastal erosion. They sequester nearly five times more carbon than tropical forests and provide nurseries to innumerable juvenile fish species that grow to join wider ocean ecosystems. Clearing for development as well as over-exploitation and aquaculture have contributed to a decline in the extent of mangroves by 30% to 50% over the past 50 years.

Seagrasses, marine flowering plants that include the widely distributed genera Zostera, Thalassia, and Posidonia, also represent important coastal ecosystems that provide critical human benefits including habitat that supports commercial and subsistence fisheries, nutrient cycling, sediment stabilization, and globally significant sequestration of carbon (reviewed in Waycott, 2009). They are threatened directly by destructive fishing practices, boat propellers, coastal engineering, cyclones, tsunamis and climate change, and indirectly by changes in water quality due to land run-off. In their global assessment, Waycott et al. 2009 found that seagrasses have been disappearing at a rate of 110 km² per year since 1980 and that 29% of the known areal extent has disappeared since seagrass areas were initially recorded in 1879. These rates of decline are comparable to those reported for mangroves, coral reefs and tropical rainforests, and place seagrass meadows among the most threatened ecosystems on Earth.
Global Fishing Watch is harnessing vessel tracking systems, satellite data, artificial intelligence and Google’s computing power to generate a clearer view of global industrial fishing activity by larger vessels, weighing 300 tonnes or more.

TRACKING THE GLOBAL FOOTPRINT OF FISHERIES

Millions of square kilometres of ocean and hundreds of thousands of fishing vessels – the fishing industry has long been hard to monitor, and its global footprint is difficult even to visualize. A lot of industrial fishing takes place unobserved, far from land; once the boats move on, they leave behind few visible traces of their activity. In this environment, illegal fishing activity flourishes and is thought to be worth between US$10 billion and US$23 billion per year. Now, a wave of new technologies is creating an information revolution that has the power to transform our understanding of what’s happening on our blue planet.

Global Fishing Watch is an international non-profit organization committed to advancing the sustainability of our oceans through increased transparency. It processes data from Automatic Identification System (AIS) transponders used by large vessels to publicly broadcast their position in order to avoid collisions at sea. Vessels using AIS continuously send out signals showing their identity, position, course and speed, and this information is picked up by satellites. According to the International Convention for the Safety of Life at Sea, while on international voyages, large fishing vessels (over 300 tonnes), cargo ships over a certain weight, and all passenger ships are required to use AIS.

By analysing the identity, speed and direction of broadcasting vessels, we can derive new intelligence on vessel behaviour and activity. Global Fishing Watch uses machine learning algorithms to determine which vessels are fishing boats, and where, when and how they are fishing. Global Fishing Watch has so far analysed 22 billion messages publicly broadcast from vessels’ AIS positions between 2012 and 2016.

NEW TECHNOLOGIES ARE CREATING AN INFORMATION REVOLUTION TO TRANSFORM OUR UNDERSTANDING OF ILLEGAL FISHING

Figure 11: Global Fishing Activity, 2016

Industrial-scale fishing activity by vessels broadcasting AIS. Fishing hotspots were seen in the North East Atlantic and Mediterranean, Northwest Pacific, and in upwelling regions of South America and West Africa. Boundaries or ‘holes’ in effort show where regulations apply, e.g. the exclusive economic zones of island states. All the data is available for download.

This data is made publicly available through an online platform, where it can be used by researchers and others. They recorded data on more than 40 million hours of fishing in 2016 alone, tracking vessels over more than 460 million kilometres – a distance equivalent to the moon and back 600 times. The researchers found that when dividing the ocean into a grid of about 50 kilometres on a side (about 160,000 cells), fishing activity was observed in over half the ocean. This represents a huge area, over 200 million square kilometres. Moreover, in almost another 20% of the ocean, few vessels carry AIS or AIS reception is poor, meaning that the actual area of the ocean affected by industrial fishing is likely higher.

For a paper published in Science, the Global Fishing Watch research team produced ‘heat maps’ – see figure 11 – that illustrate where industrial fishing by large vessels is most intense. These ‘hot spots’ include the northeast Atlantic and northwest Pacific, as well as in nutrient-rich regions off South America and West Africa. The team examined the origin of the fishing vessels as well, finding that just five countries and territories – including China, Spain and Japan – account for more than 85% of the fishing effort they observed on the high seas.

These groundbreaking new datasets, and the high-definition view they give of global industrial fishing activity, are increasingly being used by governments and management bodies to inform policy decisions and enforcement, and to strengthen transparent governance of marine resources in support of sustainability goals.