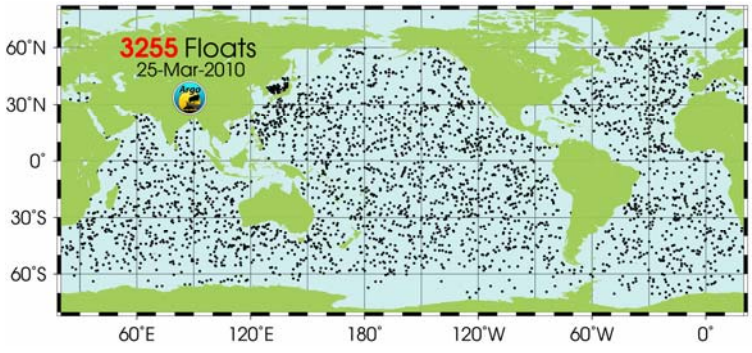
For the full pdf of the information kit on IOC visit
http://www.unesco.org/science/doc/ioc/Kit.pdf

More information can also be found at:
http://www.ioc-unesco.org/IOC50docs

Observing the Global Ocean

For 15 years, UNESCO-IOC has been overseeing a **Global Ocean Observing System** (GOOS) to observe, model and analyse marine and ocean variables. The data the system yields are used to provide accurate descriptions of the present state of the oceans, including living resources; continuous forecasts of the future conditions of the sea for as far ahead as possible, and the basis for climate forecasts.

According to Keith Alverson, Director of GOOS at the IOC, and James Baker, former administrator of NOAA and consultant to IOC, writing in the journal *Science* in 2006, "*…the real requirement for integrated Earth system science is a systematic, sustained record of observations, starting from as early as we can get quantitative information and extending reliably into the future. In particular, the ocean is critically under-sampled both in space and time, and national and intergovernmental observational commitments are essential for progress.*"



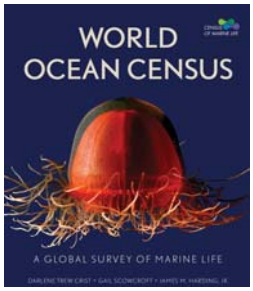
Argo is a global array of over 3200 free-drifting profiling floats that for the first time, allows continuous monitoring of the temperature, salinity, and velocity of the upper 2000 m of the ocean. All data are relayed and made publicly available within hours after collection. Until these buoys were deployed, ships of opportunity – where merchant mariners take measurements at 100-km intervals, for example – still provided the bulk of measurements, on a voluntary basis. Even now some areas, such as the Southern Ocean, are poorly represented. And Argo batteries need to be replaced every four years, so it is a challenge just to maintain the existing observation system.

Sea level rise

With about 200 million people living within coastal floodplains, and with two million square kilometers of land and one trillion dollars' worth of assets lying less than 1 metre above current sea level, sea level rise is one of the major socio-economic hazards associated with global warming. And with coastal development continuing and the population living in the coastal zone increasing rapidly, society is becoming more vulnerable to sea level rise and storm surges – as, for instance, Hurricane Katrina demonstrated in New Orleans (2005) and Cyclone Nargis demonstrated in Myanmar (2008).

"A major impact of global warming in coastal areas will be sea level rise," says Thorkild Aarup, a Programme specialist at IOC. "Rising sea levels will be felt most acutely through sea-level extreme events and a change in frequency of such events (storm surges and associated flooding, erosion and damage of coastal property and infrastructure). In other words the present day 'one in 100 years' flood could become a 'one in 10 years' risk at some locations before the end of the 21st century."

Protecting marine biodiversity



Given how important ecosystem biodiversity is for human welfare, national and international policies need to make sure it stays high on the agenda, in order to safeguard the health of the oceans. The International Year of Biodiversity, 2010, is one effort to raise pubic awareness of this serious issue. In October 2010, the 10-year Census of Marine Life (www.coml.org/) will culminate by publishing an Internet database – the Ocean Biogeographic Information System (OBIS) – with over 16 million records. At the same time, the Encyclopaedia of Life

(www.eol.org) will record photographs and details of some 250,000 marine species. The Census involved 2000 scientists from 82 countries and cost over $750m. UNESCO-IOC has been cooperating with Census researchers through a Memorandum of Understanding and the OBIS database will be an essential part of the IOC-IODE programme (International Oceanographic Data and Information Exchange).

Yet, as we discover the full scale of the diversity of life in the oceans, we also know that human activities are threatening the sustainability not just of individual marine species, but of entire ecosystems. Even a 1°C increase in temperature can kill the tiny, pigmented organisms that live in symbiosis with coral-building polyps. And their death ultimately kills the coral host that depends on them for nutrients synthesized by sunlight. Also, as the oceans absorb ever more excess atmospheric CO_2 produced by human activities, they are becoming more acidic (i.e. are lowering the pH), threatening a range of groups, including coral, mollusc, echinoderms and some species of zooplankton and phytoplankton. Most immediate impacts may be local, such as damage to coral reefs, but decisions have to be global, as collapsed ecosystems ultimately affect humanity as a whole.

The designation of Marine Protected Areas (MPAs) is one measure that may protect the resilience of marine ecosystems, preserve biodiversity and ensure sustainable use of resources. But, although some progress has been made with MPAs in coastal (territorial) waters, there is a vast and largely unknown area of deep ocean and high seas, beyond the jurisdiction of coastal states, yet with abundant and rare biodiversity that needs international regulation and protection.

Ecosystem functioning

Ocean acidification

The ocean plays an essential role in the storage and exchange of CO_2 with the atmosphere, absorbing about 25% of excess atmospheric CO_2 due to human activities, and acting as a buffer to slow climate change. But the continual uptake of CO_2 and heat is changing the ocean in ways that could have dangerous consequences for marine ecology and biodiversity. Dissolved CO_2 makes the seawater more acidic (lowers the pH) which increases the solubility of calcium carbonate, the stuff of seashells and many invertebrate skeletons, decreasing the health and abundance of the microscopic animals at the base of the ocean's food web, and thus disrupting entire ecosystems. UNESCO-IOC is a joint sponsor of the International Ocean Carbon Coordination Project, together with the Scientific Committee on Oceanographic Research (SCOR), coordinating observations and research, as well as developing policy and international agreements.
http://unesdoc.unesco.org/images/0018/001873/187319e.pdf

Land-based marine pollution

According to the UN Environment Program (UNEP), the global economic impact of marine contamination, in terms of human disease and ill health, may be running at nearly US$13 billion. Meanwhile, sewage discharges, combined with run off of fertilizers from the land and emissions from cars, trucks and other vehicles, are enriching the oceans and seas with nitrogen nutrients. These, in turn can trigger invasions of harmful algal blooms (HABs). UNESCO-IOC has been running a Harmful Algal Bloom research and education programme since 1993. http://www.ioc-unesco.org/hab/

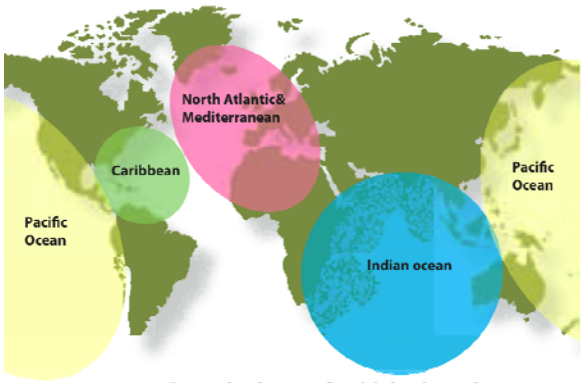
Protecting people and property from tsunamis

http://www.ioc-tsunami.org/

In 1965, following devastating tsunamis generated from earthquakes in Chile (1960) and Alaska (1964), the newly-created IOC was requested to establish an International Tsunami Warning System in the Pacific, with the Pacific Tsunami Warning Centre (PTWC) and the International Tsunami Information Centre (ITIC) in Honolulu, Hawaii Islands (USA). Since 1965 the IOC has continuously tried to extend cover for the Indian Ocean and the Caribbean region, similar to the Pacific Tsunami Warning System PTWS for the Pacific Ocean. But the dangers of a tsunami were ignored because they have been so rare in these areas.

On 24 December, 2004 a massive (magnitude 9.1) earthquake off the coast of Banda Aceh, in Western Sumatra (Indonesia), generated a tsunami that caused over 230,000 deaths and billions of dollars of damage in 11 countries. Although Banda Aceh, itself, bore the brunt of the catastrophe, coasts and their populations in Sri Lanka, India and nine other Indian Ocean countries as far as 5000 km away, were also severely hit by the tsunami. It was the first basin-wide tsunami on record in the Indian Ocean. As there was no early warning system in the region, local people and tourists were neither warned, nor prepared to face the disaster. Following this catastrophe the IOC was mandated to establish a global warning system. It became imperative that a tsunami should never again create such avoidable loss of life.

In 2005, UNESCO-IOC was mandated to coordinate intergovernmental efforts to set up an **Indian Ocean Tsunami Warning System (IOTWS)**, building on over 40 years of experience gained with the Pacific Warning System. Five years later, after a tremendous effort involving 28 Member States, the system is planned to be operational by 2011. The Pacific Tsunami Warning Centre (PTWC) in Hawaii, USA and the Japanese Meteorological Agency (JMA) in Tokyo, Japan have, since April 2005, been providing an interim tsunami advisory service to the Indian Ocean. Similar tsunami warning systems are reaching completion for the **Mediterranean and the North East Atlantic (NEAMTWS)** and the **Caribbean (CARIBE-EWS)**, thus covering all the earthquake (and therefore tsunami) prone ocean basins in the world. PTWC provides an interim tsunami warning service to the Caribbean Sea.



Four regional systems for global early warning

Protecting our coasts

UNESCO-IOC is involved in a number of initiatives, particularly in Africa, focusing on developing measures that enable coastal communities to adapt to climate change. The IOC approach focuses on restoring natural coastal ecosystems that are threatened by the impacts of climate change (e.g. sea level rise, coastal erosion). These coastal ecosystems include mangroves, sea grasses, wetlands and sand dunes that have been depleted or destroyed, often through unsustainable development initiatives for housing, aquaculture, tourism, etc. Restoring these ecosystems brings several simultaneous benefits, including natural protection against sea level rise, storm surges and erosion, protected biodiversity – mangroves are spawning grounds for fish – and even absorption of atmospheric CO_2, as well as sustainable local livelihoods, such as fishing, or eco-tourism.

IOC also promotes risk and vulnerability assessments and works with local communities to integrate these into the planning cycle. In addition to the adaptation measures, IOC is involved in developing community zoning plans for coasts.

The need for a global and continuing review of the state of the ocean

Assessment of Assessments

This is why, at the World Summit on Sustainable Development, in Johannesburg in 2002, World leaders agreed to "establish by 2004 a *Regular Process under the United Nations for global reporting and assessment of the state of the marine environment, including socioeconomic aspects*, both current and foreseeable, building on existing regional assessments." The initial phase of this Regular Process, started in 2006, came to be known as the Assessment of Assessments and has been carried out under the joint leadership of UNESCO-IOC and the United Nations Environment Programme (UNEP). Using the results of the Assessment, the first cycle of the 'regular process' started in 2010 and is due to end in 2014.