

# Coastal and Marine Ecosystems

Coastal zone ecosystems are complex, dynamic environments, where land and ocean meet:

- interaction of human activities and nature's rhythms;
- fragile environment, characterised by slow and rapid erosion and prone to catastrophic disasters (hurricanes, tidal waves);
- very diverse ecosystem of plants animals and birds both in the water and on the shore area;
- many sea animals and birds utilize the coastal zone for food and nurseries for their young;
- many land-based animals, birds and humans use coastal zones as prime habitat and feeding ground;
- Globally, increasing numbers of humans live and work in the coastal zones
- Humans add nutrient and toxic waste into coastal waters affecting all coastal zone quality of life including their own;
- Humans try to disrupt and control the normal fluctuating state to achieve a stable, predictable physical environment for human habitation and utilization;
- Canada needs to monitor and manage large marine areas under its Exclusive Economic Zone in 3 oceans (Atlantic, Arctic and Pacific).



*This MERIS image shows the complex river system inside Casamance with its heavy discharge into the sea. Courtesy of: ESA*

The open ocean marine ecosystem covers 70% of the Earth's surface, and ranges from Arctic to tropical waters and from coral reef and surface systems to deep water ecosystems kilometres beneath the ocean surface. The marine ecosystem is being affected by climate change:

- Sea level rise due to ocean warming affects marine ecosystem adaptation
- More severe marine storms occurring more often affects coastal habitats
- Pacific Ocean El Nino warming affects Canadian economics in fisheries, aquaculture, coastal recreation
- The Arctic marine ecosystem has unique challenges due to the harsh northern climate including marine mammal habitat, changing ice cover
- "Diverse and productive, coral reefs are a vital source of food and employment for millions of people, protect coastlines from storms and erosion, and are important storehouses for potential pharmaceuticals. The threat to their survival from human activities and increasing ocean temperatures is of global concern."<sup>1</sup>
- "The Government will place increased emphasis on opportunities [...] to maximize the potential of our vast coastal and offshore areas through a new Oceans Action Plan."<sup>2</sup>

## ***"Hot" Issues:***

- Coastal surveillance in support of Canadian security and sovereignty claims;
- Canadian ratification of United Nations Convention on the Law of the Sea (UNCLOS) in late 2003 requires mapping of our sea bed claim in next ten years; a number of recent initiatives target oceans: Oceans Act 1997, National Oceans Strategy 2002, Oceans Action Plan 2004;
- Integrated, sustainable coastal management (how to best do it);
- Marine fish and mammal stock levels affected by human activities (fishing, waste disposal, hydrocarbon extraction, transportation) and changing environmental conditions;
- Climate change, making the coastal zone an increasingly dangerous place for humans (storms, water levels); increased occupation of coastal areas places lives and property at high risk;
- More frequent toxic algal blooms in nutrient-rich and pollution-laden freshwater and sea water mixtures;
- Marine transportation through the Northwest Passage to significantly increase with global warming and oil and gas development, bringing environmental risk (oil pollution, invasive species).

<sup>1</sup> World Resource Institute, [wri.igc.org/marine](http://wri.igc.org/marine)

<sup>2</sup> Speech from the Throne 2004, p. 17

### **Key players:**

- Fisheries and Oceans Canada (DFO) is responsible for overall management of Canada's oceans and coastal zones (ocean science, fisheries conservation and protection), as well as for the Canadian Coast Guard (security, enforcement, oil spill monitoring, marine traffic); the Marine Environmental Data Service manages the marine science data in Canada and provide data quality assurance for global drifting buoy program <http://www.meds-sdmm.dfo-mpo.gc.ca>
- Environment Canada plays a critical role through weather prediction and ice forecasting (Meteorological Service) and through the Canadian Wildlife Service (oil spill cleanup)
- Department of National Defence is responsible for the Canadian Navy; <http://www.forces.gc.ca>
- The Royal Canadian Mounted Police (Public Safety and Emergency Preparedness Canada) are responsible for security and enforcement on Canada's coasts and in remote communities, particularly along Canada's three ocean coastlines. <http://www.rcmp-grc.gc.ca>
- Natural Resources Canada is responsible for the Canadian Geospatial Data Infrastructure within GeoConnections initiative <http://www.geoconnections.org/CGDI.cfm>
- Atlantic Coastal Zone Information Steering Committee (ACZISC) established by the Council of Maritime Premiers in 1992 to help organize the rich and varied coastal zone knowledge base in Atlantic <http://www.dal.ca/~mbutler/aczisc.htm>
- National Research Council manages the Oceans Advance national technology cluster, facilitating community integration [www.oceansadvance.net](http://www.oceansadvance.net)
- The Coastal Zone Canada Association (CZCA) formed in 1993 is a national association that focuses on the sustainable management and conservation of the coastal areas of Canada. [www.czca-azcc.org](http://www.czca-azcc.org)
- The International Ocean-Colour Coordinating Group (IOCCG) was established during 1996 under the auspices of the Intergovernmental Oceanographic Commission (IOC), following a resolution endorsed by the Committee on Earth Observation Satellites (CEOS), to act as a liaison and communication channel between users, managers and agencies in the Ocean Colour arena. [www.ioccg.org](http://www.ioccg.org)

### **Provincial and Industry Associations**

- The Council of Atlantic Premiers (CAP) was formally established in May 2000 to provide Premiers with a stronger forum to give voice to the Atlantic Canadian perspective on matters of national and regional interest, and to facilitate greater regional cooperation among provinces. <http://www.cap-cpma.ca>
- Alliance for Marine Remote Sensing in Bedford, NS: AMRS is an international not-for-profit association which develops and promotes marine applications of remote sensing technologies. <http://www.waterobserver.org/amrs>

### **International Organizations:**

- Global Ocean Observing system (GOOS) is part of an Integrated Global Observing Strategy (IGOS) in which the UN agencies (UNESCO and its IOC; WMO, UNEP, and FAO) are working together and with ICSU and the satellite agencies (via the Committee on Earth Observation Satellites - CEOS). In that context, the GOOS forms the ocean component of GCOS (the Global Climate Observing System) and the marine coastal component of the GTOS (the Global Terrestrial Observing System). GOOS itself is sponsored by the IOC of UNESCO, WMO, UNEP and ICSU. [www.ioc.unesco.org/goos/](http://www.ioc.unesco.org/goos/)
- Committee on Earth Observation Satellites (CEOS) and its members. CEOS membership encompasses the world's government agencies responsible for civil Earth Observation (EO) satellite programs, along with agencies that receive and process data acquired remotely from space.

## **Space and Oceans: coastal and marine systems**

- Space-based EO is the only means by which to collect regular information on key climate change parameters such as sea surface temperature and ocean salinity.
- Space-based EO provides a unique overview critical to understanding and monitoring coastal ecosystems and implementing integrated coastal management.
- Space-based communications are the only means for ships to communicate at sea.

## **Issues for the CSA:**

- Enhanced/integrated Canadian satellite information services meeting operational marine surveillance with satellite observing systems
  - Integrating satellite data into marine forecast models
  - Monitoring pollution from vessel traffic
  - Monitoring vessel traffic (fisheries management & security)
  - Monitoring icebergs
  - Monitoring local marine weather conditions
- Satellite information for enhanced Canadian local coastal weather and marine forecasts
  - Satellite information to support accurate warnings to cities, fishermen, production platforms, marine transportation
  - tracking marine based storms
- Satellite information for Canadian marine border security information requirements
- Meeting the coastal zone and marine operations requirements for timely, reliable, long term, cost effective data from satellite marine observations through collaborative satellite information sharing
- Providing Arctic community cost effective access to satellite communications and data services
- Assuring access to a suite of optical/IR sensors with adequate dynamic range to capture data with adequate spectral and spatial resolution for cost effective ecosystem monitoring in the coastal zone meeting the unique limitations of coastal marine weather patterns
- Collaboration with CEOS in planning Canadian participation in the coordinated satellite sensor system deployment to meet operational users marine monitoring requirements – GOOS planning
- Monitoring the wetlands in Canada's coastal zone

**Related themes:**

Security and Surveillance  
Disasters  
Environmental Factors Affecting Health  
Climate Change & Variability  
International Development  
Sustainable Water Resources  
Weather  
North/Arctic  
Biodiversity & Ecosystem Conservation  
Industry and Industrial Policy  
Engaging EO Users  
Group on Earth Observations (GEO)  
Global Monitoring for Environment and Security (GMES)  
Committee on Earth Observation Satellites (CEOS)  
Coastal and Marine Ecosystems

**References:*****Basic Information:***

EC – Canadian Wildlife Service <http://www.ews-scf.ec.gc.ca>  
Canadian Coast Guard <http://www.ccg-gcc.gc.ca/>  
National Defence – The Navy <http://www.navy.forces.gc.ca>  
Royal Canadian Mounted Police <http://www.rcmp-grc.gc.ca>  
Atlantic Coastal Zone Information Steering Committee, A Guide to Coastal Information in Atlantic Canada <http://www.dal.ca/~mbutler/aczisc.htm>  
GeoConnections <http://www.geoconnections.org/CGDI.cfm>  
DFO – Marine Environmental Data Service <http://www.meds-sdmm.dfo-mpo.gc.ca>  
Oceans Advance <http://www.oceansadvance.net>  
Coastal Zone Canada Association <http://www.czca-azcc.org>  
International Ocean-Colour Coordinating Group (IOCCG) <http://www.ioccg.org>  
UNEP Vital Water Graphics <http://www.unep.org/vitalwater>  
UNEP <http://www.unep.org/themes/marine>  
The Council of Atlantic Premiers (CAP) <http://www.cap-cpma.ca>  
Alliance for Marine Remote Sensing in Bedford <http://www.waterobserver.org/amrs>  
The Global Ocean Observing System (GOOS) <http://ioc.unesco.org/goos/>  
Committee on Earth Observation Satellites (CEOS) <http://www.ceos.org>

***Latest update:***

Fisheries and Oceans <http://www.dfo-mpo.gc.ca>

***Closer look:***

BURKE Lauretta, KURA Yumiko, KASSEM Ken, REVENGA Carmen, SPALDING Mark, MCALLISTER Don, *Pilot analysis of global ecosystems (PAGE): Coastal ecosystems*, April 2000 ([http://wri.igc.org/wr2000/coast\\_page.html](http://wri.igc.org/wr2000/coast_page.html))

UN Convention on the Law of the Sea <http://www.un.org/Depts/los/index.htm>