

## ISMAR Geographic Sections

### Genova

Via De Marini, 6 - 16149 Genova  
Telephone: 010 6475432

### Trieste

Viale Gessi, 2 - 34123 Trieste  
Telephone: 040 305312

### Pozzuolo di Lerici

Forte Santa Teresa  
19032 Pozzuolo di Lerici SP  
Telephone: 0187 978305

### Bologna

Via Gobetti, 101 - 40129 Bologna  
Telephone: 051 6398891

### Ancona

Largo Fiera della Pesca, 1 - 60125 Ancona  
Telephone: 071 207881

### Lesina

Via Pola, 4 - 71010 Lesina FG  
Telephone: 0882 992702



Consiglio Nazionale delle Ricerche  
Istituto di Scienze Marine  
[www.ismar.cnr.it](http://www.ismar.cnr.it)



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**Istituto di Scienze Marine**

Director: Dr. FABIO TRINCARDI

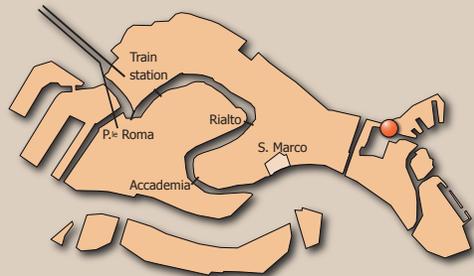
Arsenale di Venezia

Tese della Novissima 101-104

Castello 2737/F

30122 Venezia

Telephone: +39 041 2407927



## Research themes

**ISMAR conducts research in polar, oceanic and Mediterranean regions, focusing on the following themes :**

- **the evolution of oceans and their continental margins, studying submarine volcanoes, faults and landslides and their potential impacts onshore**
- **the influence of climate change on oceanic circulation, acidification, bio-geochemical cycles and marine productivity**
- **submarine habitats and ecology, and the increasing pollution of coastal and deep-sea environments**
- **the evolution of fish stocks with a view to keeping commercial fishing within sustainable limits and improving mariculture and aquaculture practices**
- **natural and anthropogenic factors producing economic and social impacts on coastal systems from pre-history to the industrial epoch**

### Fisheries and aquaculture

Fisheries science is one of ISMAR's main institutional interests, and is aimed at managing and understanding fishery-related problems. This is a multidisciplinary science involving oceanography, marine biology and conservation, ecology, population dynamics, economics and marine management, which seeks to provide an integrated picture of fisheries.

Aquaculture and mariculture represent another important topic for ISMAR. Designed to supplement the increasing exploitation of wild fisheries, they involve cultivating freshwater and saltwater organisms such as finfish, molluscs and crustaceans under controlled conditions.



### Physical and chemical oceanography

ISMAR investigates the structure and dynamics of the ocean and how it interacts with biological and chemical processes leading to eutrophication and hypoxia/anoxia. A key goal is understanding the interaction of the ocean with the atmosphere and the seafloor, i.e. across its upper and lower boundaries. The research is carried out by combining observational and model-based approaches.

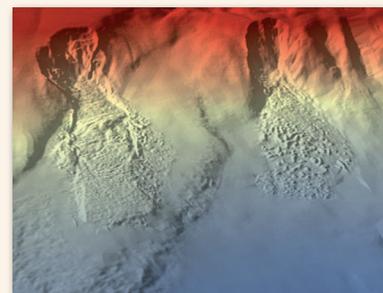
Ocean observations are obtained by research cruises, fixed stations and remote sensing. Modelling involves adopting analytical and numerical approaches to the study of ocean processes including the forecasting of waves and currents at coastal, regional and basin scales. Continuously recorded measurements of the state of the oceans, in the Mediterranean Sea and key regions such as Antarctica and the Arctic provide long-term data series that shed light on the ocean's role in climate change, including changing rates of deep water formation, evaporation, salt concentration and acidification.



### Geology and geophysics

ISMAR studies the evolution of rift basins, mid-ocean ridges and transform faults in the Mediterranean, Red Sea, Equatorial Atlantic and peri-Antarctic seas. The team also studies active tectonic structures and related geo-hazards in the Mediterranean region as well as submarine volcanoes and hydrothermal processes.

The sedimentology team investigates coastal and abyssal environments to determine the role of longshore drift, cascading and contour currents, as well as storms, turbidity currents and sediment failure, in shaping the architecture of continental margins. The studies range from the integrated basin scale to elementary depositional bodies and erosion /depositional events that can be observed today. Another field of interest is the interaction between sea-floor shaping processes and marine ecosystems.



### Climate and paleoclimate

ISMAR contributes to the study of the Earth's climate and the impact of human activities that are stressing the climate system. Changes in the Earth's climate are governed by complex interactions involving the atmosphere, the oceans, planetary volcanism, the cryosphere, the biosphere and external forces such as the variability of solar radiation. ISMAR maintains long-term time series of coupled oceanological and meteorological data in the Mediterranean and Antarctica that enable quantitative description of climate change. On longer time scales, ISMAR studies natural archives from a number of contexts containing data on a variety of geochemical and other proxies (sedimentological, biological, geochemical, and magnetic properties) to reconstruct the succession of Quaternary glacial cycles and the natural and anthropogenic impacts on the climate system since the onset of the Holocene.



### Ecosystems and bio-geochemistry

ISMAR has a long tradition of focusing on the comprehensive study of biodiversity of marine systems from transitional to deep-sea habitats, including extreme ecosystems in polar and chemosynthetic environments. Particular attention is devoted to the study of phenology and the structure and functioning of plankton and benthic communities in relation to environmental variables, climate and human impact.

ISMAR research activities include the evaluation of primary production in the ocean and the examination of plankton and microbial dynamics. Special emphasis is laid on the bio-geochemical cycling of key elements in the water column, especially those associated with global warming and climate change (e.g. carbon storage). ISMAR is also concerned with climate- and human-driven ecosystem variability, with attention paid to the issue of alien species and the presence and spread of potentially toxic algal species in the Mediterranean.



### Coastal systems: natural processes and human impacts

The coastal zone has been pervasively modified by humans over several millennia and especially since the industrial revolution. The Mediterranean provides some of the most extensive and diverse varieties of coastal environment in the world; ISMAR studies the response of these systems to climate change in order to improve environmental planning strategies.

The evolution of the coastal zone is analysed by integrating geophysical studies, sedimentology and habitat mapping with reconstructions from georeferenced historical maps. Human impacts during industrial and pre-industrial times are defined with respect to pollution, coastal erosion and risk assessment. The quality of transitional environments is assessed by studying hydrological, ecological and ecotoxicological processes.



### Technology

Technological studies are carried out to enhance the performance and efficiency of fishing equipment, in order to reduce the quantity of protected species in the bycatch and develop fuel-saving fishing practices. ISMAR has long been involved in studying the behaviour of innovative metallic materials in the marine environment and developing new pre-treatments and coatings designed to protect materials from corrosion and biofouling, thus minimizing environmental pollution. ISMAR develops tools for innovative sampling of extended sedimentary sections for the study of past environmental change. ISMAR is developing innovative tools for the 3D measurement of waves in order to enhance our understanding of the dynamics at the ocean-atmosphere interface and validate models of extreme waves.

