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A Systems Architecture for Blue Economy Competitiveness: Data, Standards, Analytics and Deployment in the Black Sea

EfxINNOs Black Sea Blue Growth Workshop Series

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AG Marine Solutions

AGMS AG Marine
Solutions

17 April 2026
Tbilisi, Georgia



**Big fish eat small fish,
what do the smallest fish eat?**

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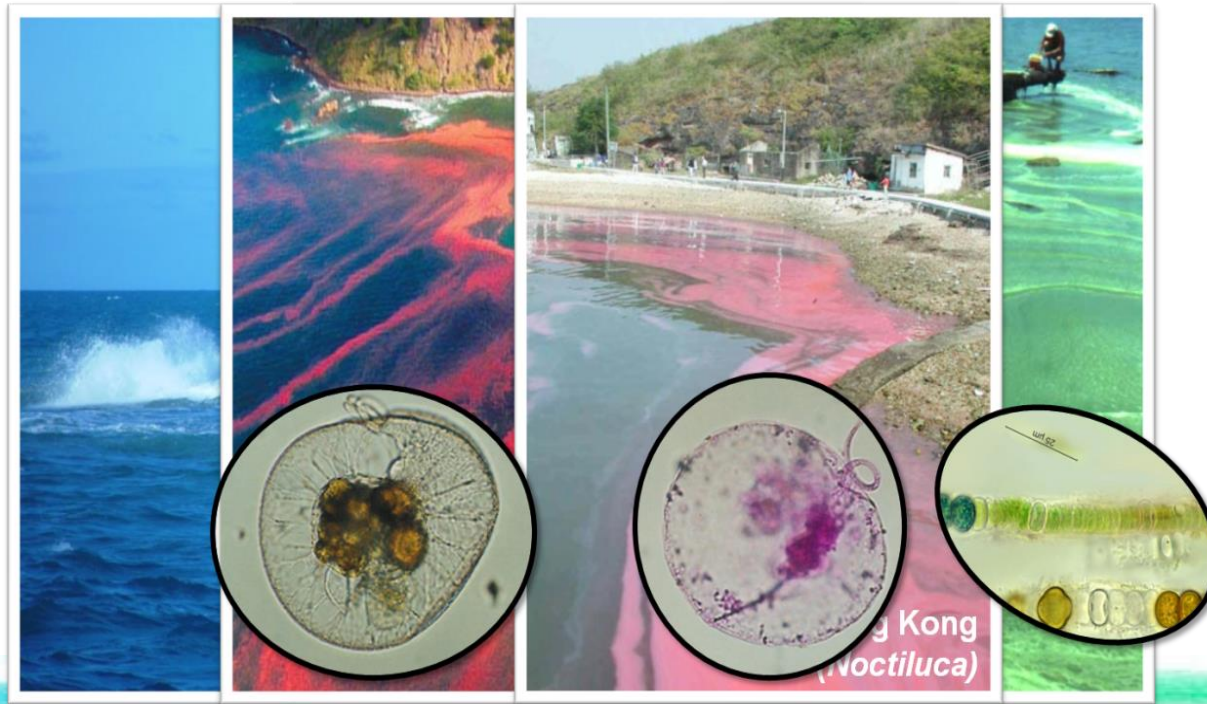


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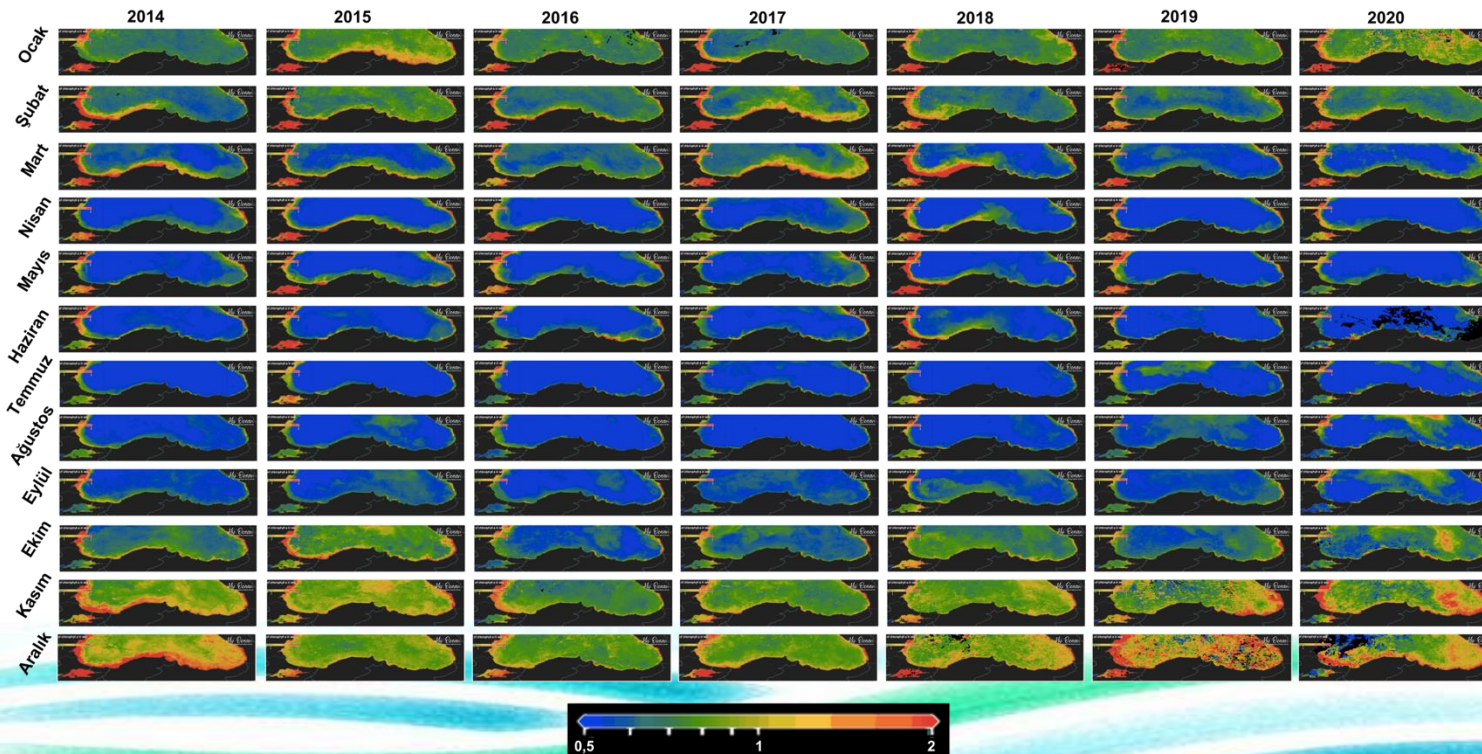


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The answer is hidden in the colour of the seas..



The answer is hidden in the colour of the seas..



What does PHYTOPLANKTON mean?

PHYTO
(Plant)

+

PLANKTON

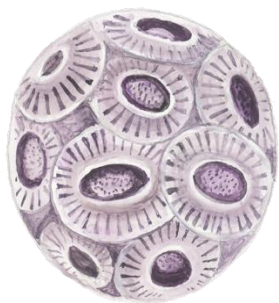
(Organisms that cannot move actively and can only be
displaced by the movement of water)

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Phytoplankton (Plant Plankton)

- ✓ They make up the vast majority of plants in seas and oceans.
- ✓ They are distributed throughout all seas and oceans, from the equator to the poles.
- ✓ They feed all animals in the sea.
- ✓ Through photosynthesis, they take in carbon dioxide from the environment and release oxygen.

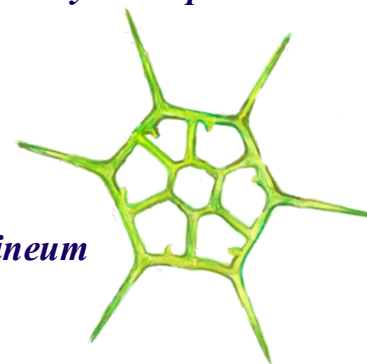
Emiliana huxleyi



Closterium navicula



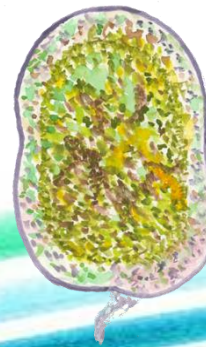
Dictyocha speculum



Chaetoceros peruvianus



Gymnodinium sanguineum



What does ZOOPLANKTON mean?

ZOO
(Animal)
+

PLANKTON

(Organisms that cannot move actively and can only be
displaced by the movement of water)

Zooplankton

- ✓ They do not produce their own food; instead, they feed on phytoplankton and other organisms smaller than themselves.
- ✓ They can be single-celled or several metres long.
- ✓ They play an important role in transferring the organic matter produced by phytoplankton to higher levels of the food pyramid.

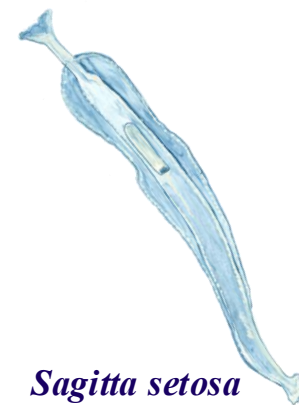
Aurelia aurita



Acartia clausi



Oikopleura dioica



Sagitta setosa

Anchovy egg



Engraulis encrasicolus

Penilia avirostris



Planktivorous fish (Feeding on plankton)

- ✓ These are species that feed on plankton composed of phytoplankton and zooplankton.
- ✓ They generally feed by filtering.
- ✓ Their growth depends on the density of plankton in their environment.
- ✓ Overfishing and the deterioration of water quality caused by the discharge of untreated wastewater into the seas are among the main pressures on this group.

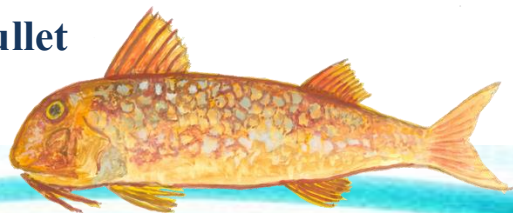
Anchovy



Whiting



Red mullet



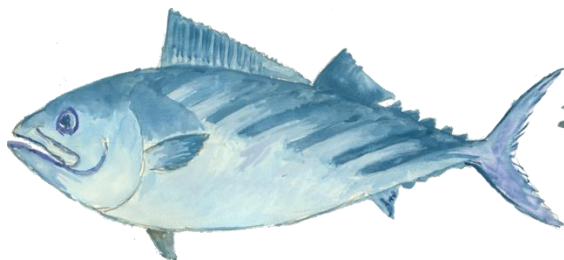
Whale shark



Carnivorous fish

- ✓ Carnivorous fish actively hunt and feed on zooplankton and planktivorous fish.
- ✓ Their growth depends on the amount of fish in the environment.
- ✓ Water quality is important for the survival of their eggs and young.
- ✓ Overfishing threatens their survival by causing declines in carnivorous fish stocks and in the other organisms they feed on.

Bonito



Pike



Gilthead seabream



Grouper

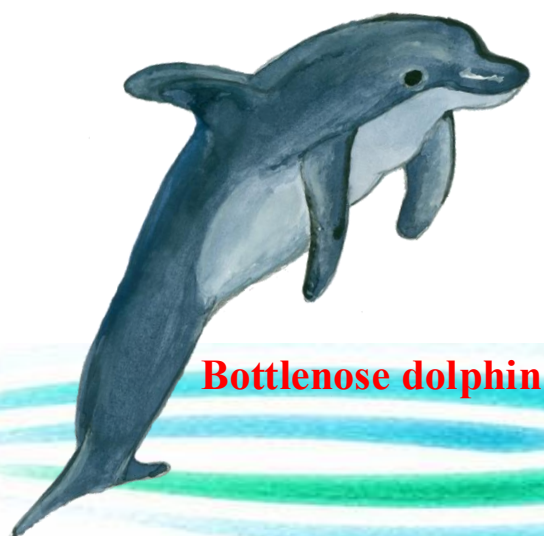


Shark



Marine mammals

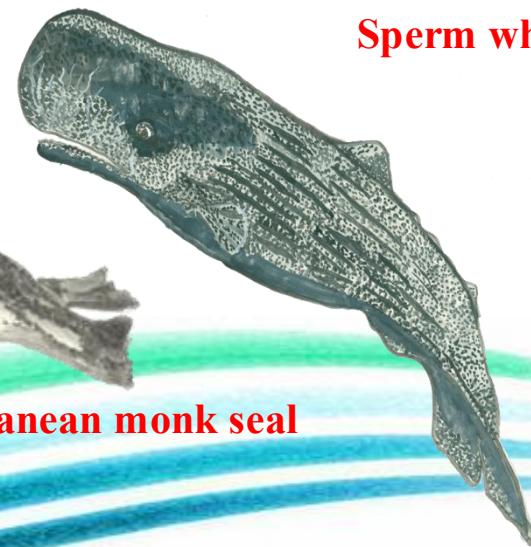
- ✓ They are warm-blooded, care for their young, and need to breathe.
- ✓ Although there are planktivorous whales, they are generally carnivorous.
- ✓ As a result of overfishing, both their numbers and the abundance of the organisms they feed on have decreased.
- ✓ They are affected by the concretisation of coastlines, intense human activities along the coasts, and declining water quality.
- ✓ Some mammal species are protected under international conventions and hunting them is prohibited.



Bottlenose dolphin

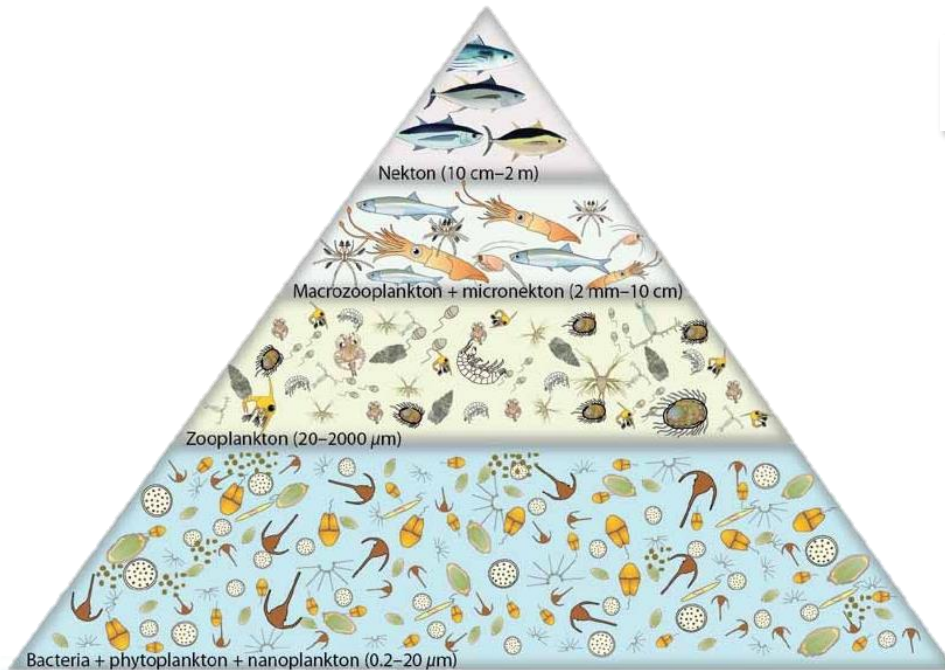


Mediterranean monk seal

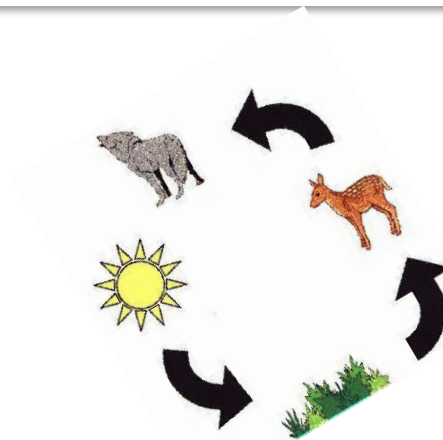


Sperm whale

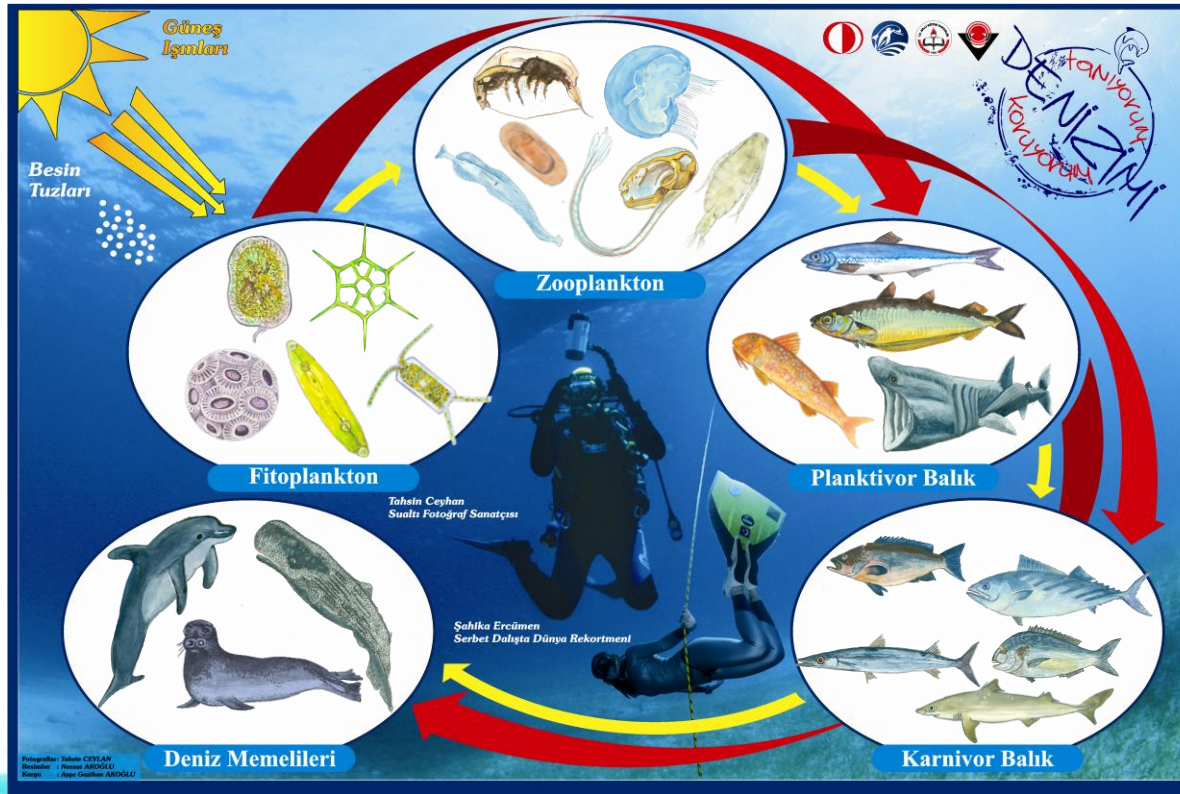
Food Chain in the Seas



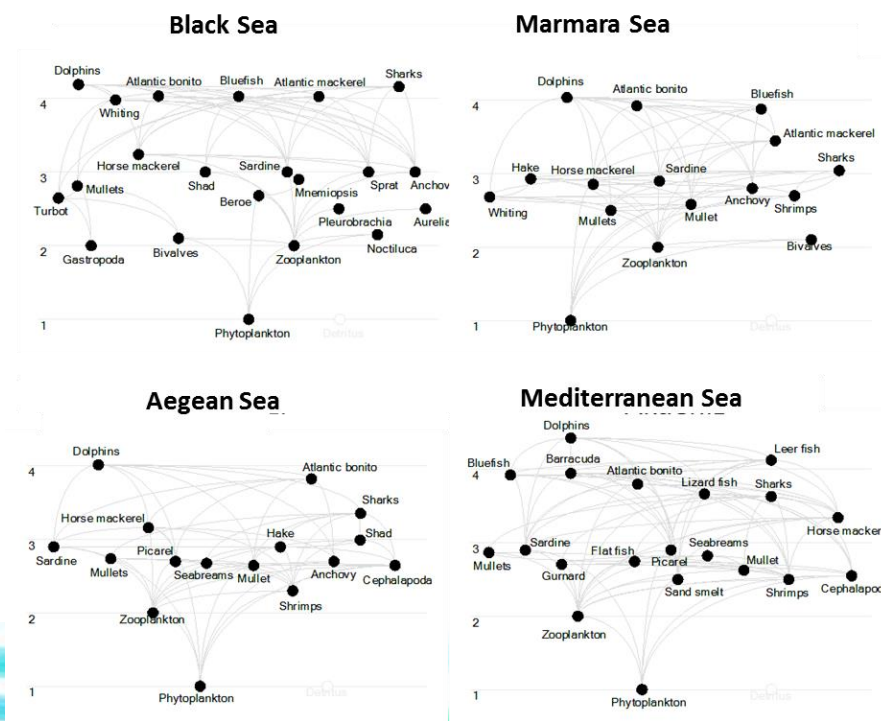
Food Chain on Land



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Modelling and Scenario Testing in the Regional Marine Ecosystems of Türkiye



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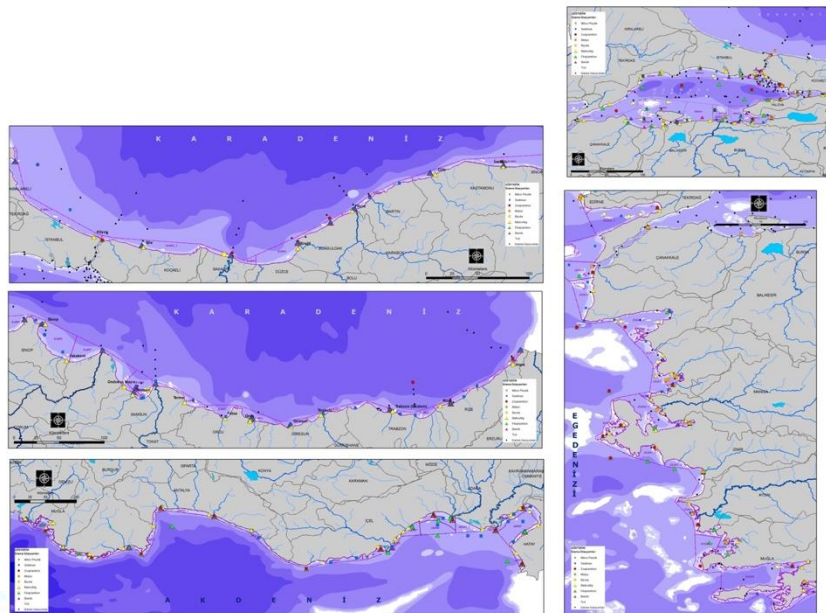


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Modelling and Scenario Testing in the Regional Marine Ecosystems of Turkiye



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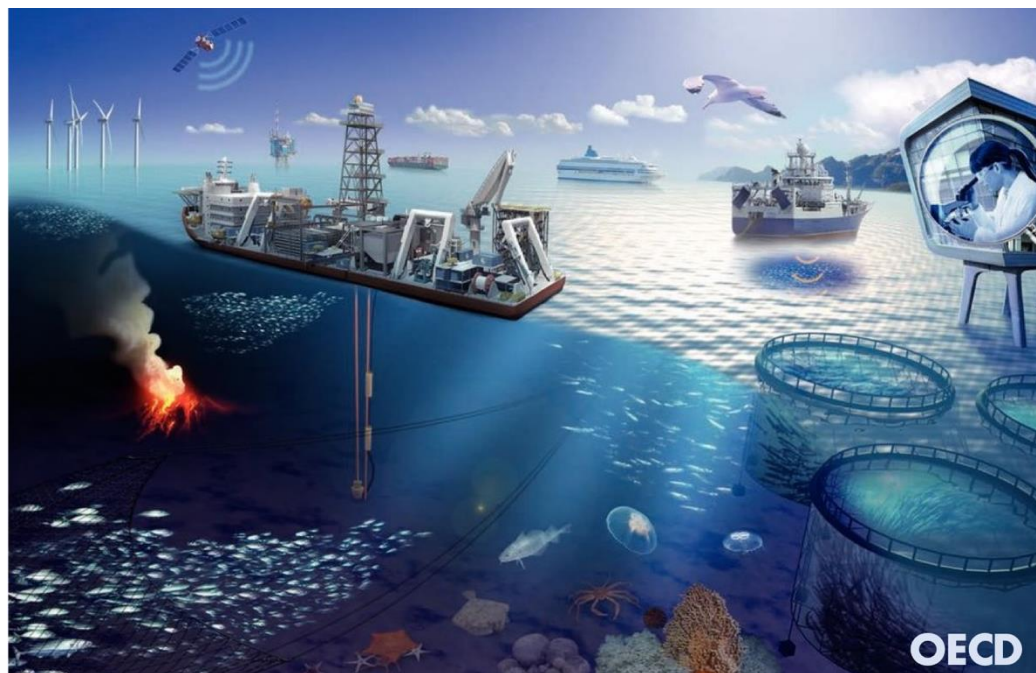


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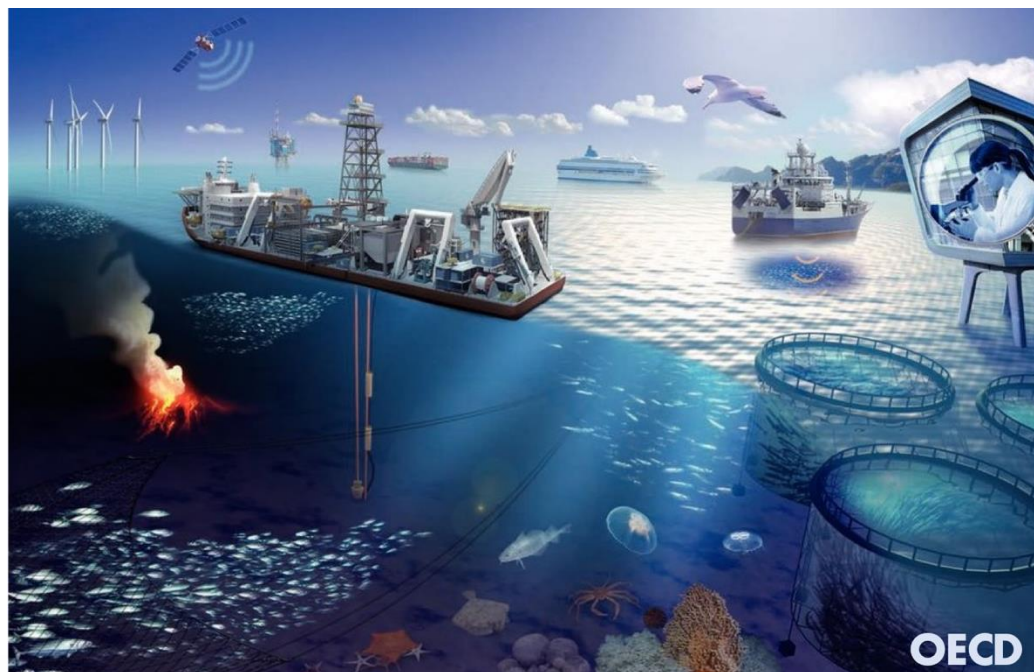
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What is Blue Growth?



Blue Growth is the sustainable growth of marine and maritime sectors to meet society's increasing demands for food, energy, raw materials, employment, and economic prosperity.

What is Blue Growth?



The EU policies, initiatives, and programs

- The European Green Deal
- Horizon Europe Program
- Mission Ocean, Seas and Waters
- Blue Growth/Economy Strategy
- Environmental Impact Assessment Framework
- Marine Pollution Control
- Climate-Neutral and Smart Cities

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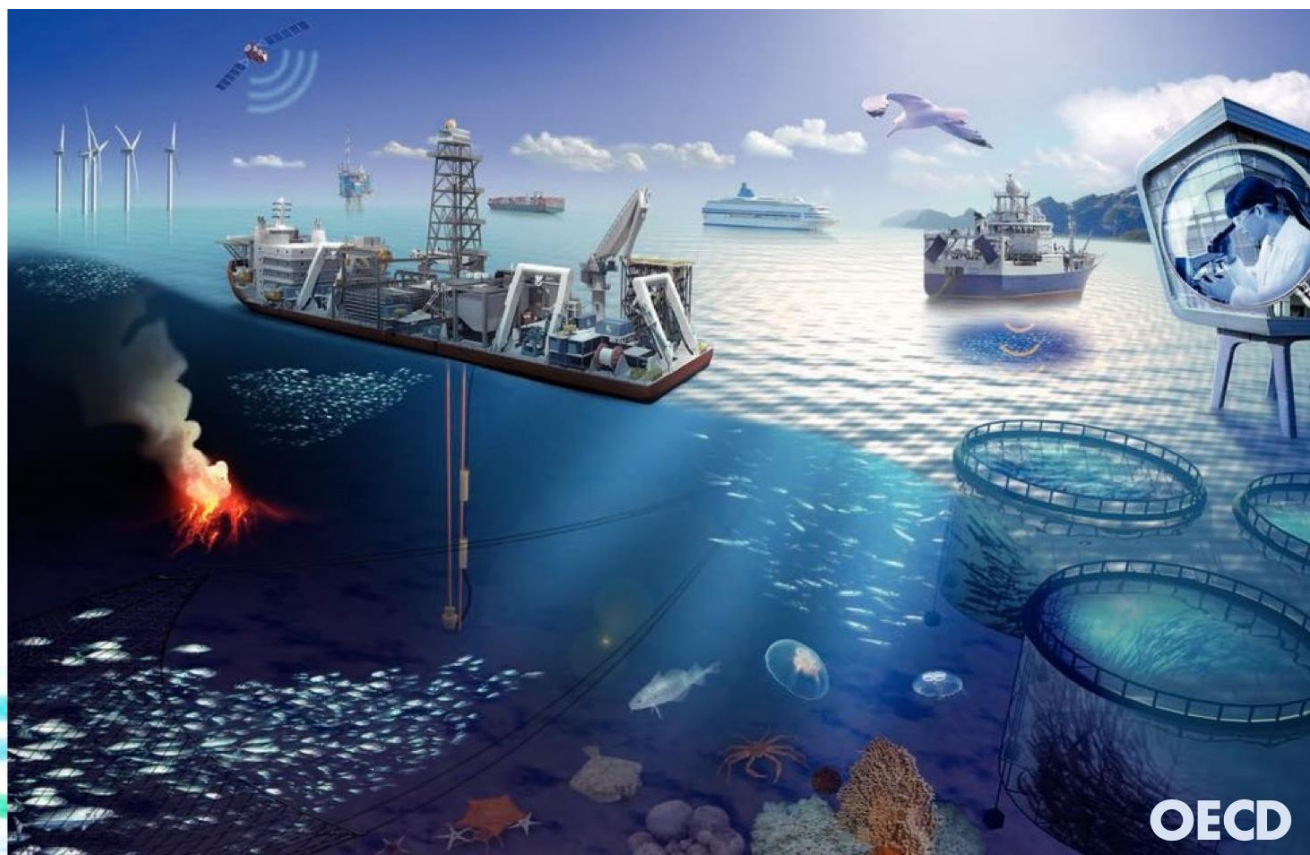


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What is Blue Growth?



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MARITIME TRANSPORT



The EU policies, initiatives, and programs

- FuelEU Maritime
- EU Emissions Trading System for Shipping
- Digitalization of Transport
- European Maritime Single Window
- Clean Ports
- Waste Management and Pollution Control
- Sulphur Emission Control Areas
- MARPOL
- Ballast Water Management Convention
- European Sustainable Shipping Forum
- Clean Shipping Alliance

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MARINE AND COASTAL TOURISM



The EU policies, initiatives, and programs

- European Tourism Strategy
- European Coastal and Maritime Tourism Quality Label
- Smart and Sustainable Tourism
- EU Digitalization Initiatives for Tourism
- Sustainable Destination Management
- European Tourism Indicator System
- European Charter for Sustainable Tourism in Protected Areas
- Promoting Safe and Clean Beaches
- Sustainable Coastal Accommodation
- Climate Adaptation in Coastal Tourism
- Blue Flag Program for Beaches and Marinas

MARINE CAPTURE FISHERIES



The EU policies, initiatives, and programs

- Marine Strategy Framework Directive
- Common Fisheries Policy
- Sustainable Fisheries Management Plans
- Maximum Sustainable Yield (MSY) Targets
- Discard Ban and Landing Obligation
- Regional Advisory Councils
- Selectivity and Bycatch Reduction Measures
- IUU (Illegal, Unreported, and Unregulated) Fishing
- Sustainable Fishing Gear Development
- Monitoring, Control, and Surveillance
- Sustainable Fishing Certification Schemes
- Fishing Quota Allocation Mechanisms
- Integrated Fisheries Management

MARINE AQUACULTURE



The EU policies, initiatives, and programs

- Common Fisheries Policy Aquaculture Provisions
- Sustainable Aquaculture Practices
- Integrated Multi-Trophic Aquaculture
- Responsible Aquaculture Labeling
- Aquaculture Feed Sustainability
- Aquaculture Best Management Practices
- Marine Recirculating Aquaculture Systems
- Sustainable Aquaculture Certification Programs
- Aquaculture and Climate Change Adaptation

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MARINE BIOTECHNOLOGY



The EU policies, initiatives, and programs

- Bioeconomy Strategy
- Marine Biotechnology Research and Innovation Agenda
- Sustainable Marine Biotechnology Practices
- Marine Biotechnology Regulatory Framework
- Sustainable Marine Biotechnology Feedstock
- Carbon Footprint Reduction
- Carbon Capture

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MARINE ENERGY



The EU policies, initiatives, and programs

- Energy Directive
- Marine Renewable Energy Directive & Action Plan
- Offshore Renewable Energy Strategy
- Ocean Energy Forum
- Clean Energy for All Europeans Package
- European Marine Energy Centre
- Marine Renewable Energy Roadmaps
- European Battery Alliance

MARINE MINING/DRILLING



The EU policies, initiatives, and programs

- Offshore Safety Directive
- Seabed Mining Regulation
- International Seabed Authority (ISA) Cooperation
- Carbon Capture and Storage (CCS)
- Offshore Oil and Gas Regulation
- Oil Pollution Response and Preparedness
- Energy Policy

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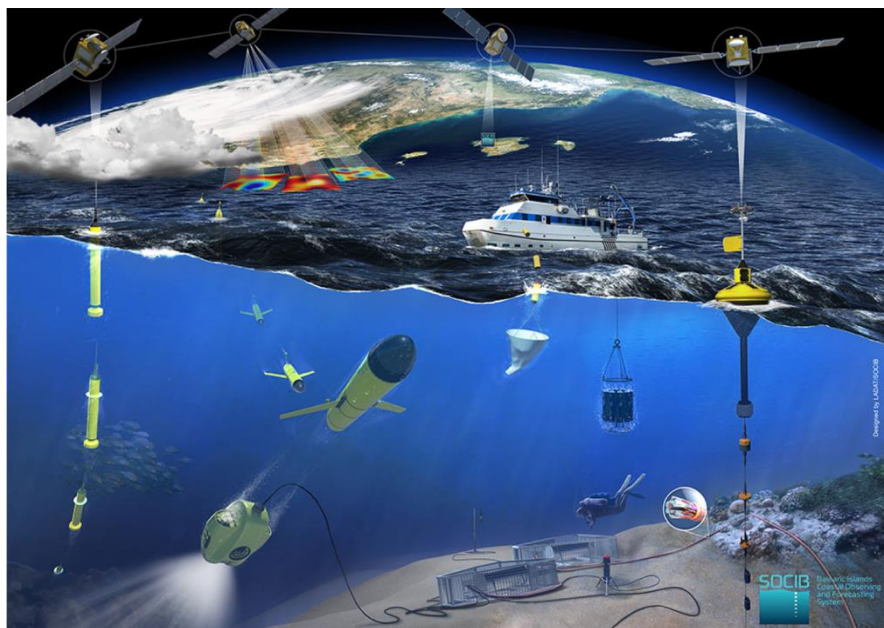


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MARINE RESEARCH



The EU policies, initiatives, and programs

- Marine Strategy Framework Directive
- Copernicus Marine Environment Monitoring Service
- European Marine Observation and Data Network (EMODnet)
- European Ocean Observing System (EOOS)
- Joint Programming Initiative Healthy and Productive Seas and Oceans (JPI Oceans)
- European Marine Board (EMB)

POLICY-PRIORITY DATA NEEDS

- **Ministry of Environment, Urbanization and Climate Change**
 - Pollution, marine litter, noise monitoring, coastal status, GES indicators
- **Ministry of Transport and Infrastructure**
 - Port air/sea emissions dashboards
 - Rapid ballast water test/inspection workflows, discharge
 - Safety/environment with AIS/VTs compliance data
- **Ministry of Agriculture and Forestry**
 - Stock status, eutrophication, sediment quality
 - HAB early warning in aquaculture
- **Ministry of Health**
 - Bathing water classification, food safety, seafood toxins/residues
- **Ministry of Energy and Natural Resources**
 - Environmental footprints of coastal/offshore energy infrastructure
 - Hydrographic change and construction/operations monitoring
- **Ministry of Interior, Coast Guard, Municipalities**
 - Inspection, emergency response
 - Municipal wastewater/stormwater
- **Culture and Tourism**
 - Bathing water quality / pollution at tourist beaches
 - Marine protected areas and tourism interactions

DATA NEEDS BY USE CASE

• Ports and Ship Operations

- Fuel compliance and port-related emissions
- Ballast water testing; discharge water monitoring
- Quay/oceanographic measurements

• Municipalities / Coastal Management

- Rain-flood early warning; bathing water classification
- Coastal litter and microplastic density

• Fisheries & Aquaculture

- Stock indicators (CPUE, length-frequency), bycatch/capacity
- HAB early warning (chlorophyll anomaly, toxin), sediment indicators

• Tourism & Public Health

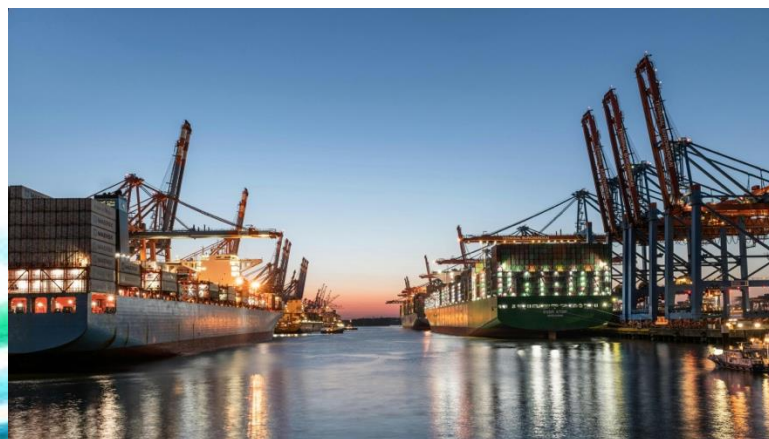
- Beach quality classification, pathogen indicators, visibility

• Energy & Infrastructure

- Hydrographic change, noise, seabed integrity
- Comparable monitoring before and after construction/operation

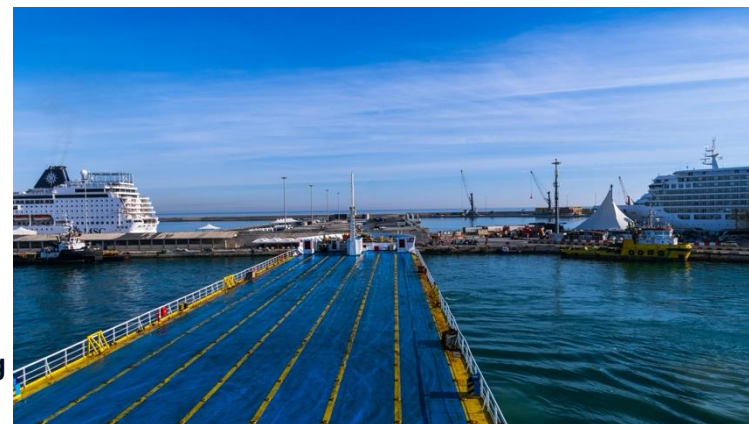
• Nature Conservation & Biodiversity

- Habitat integrity, invasive species early warning
- Remote sensing + validation for seagrass / protected areas



TECHNOLOGY BASKET (BY DATA NEED)

- **In Situ Measurement**
 - Multi-parameter measurements (CTD, DO, pH, turbidity)
 - ADCP/HF radar, automatic nutrient/pigment analyzers
- **Platforms**
 - Fixed stations/buoys, gliders/AUVs/ROVs, sampling vessels
 - Coastal stations and port sensor networks
- **Remote Sensing**
 - Optical (Sentinel-2/3), SAR (Sentinel-1), thermal; drone-based imaging
 - Image analytics for marine litter / macroalgae detection



- **Biological/Genetic**
 - Biodiversity, biomass, eDNA/qPCR; biological indicators
- **Acoustic**
 - Passive acoustic buoys, noise mapping
- **Sampling & Laboratory**
 - Water/sediment/organism; microplastics; bioaccumulation
- **Data/Model Fusion**
 - Nowcast + forecast (wave/current/quality); anomaly detection



Decision Support Architecture

- **Data Life Cycle**
 - Collection → Quality Assurance/Quality Control → standard dictionary/schema → API/access → archive
- **Open Dictionary & Identifiers**
 - Parameter codes, station/sensor IDs, versions
- **Real-Time Dashboards**
 - Institutional and public dashboards; early warnings/alerts; transparent reporting
- **Analytics & Forecasting**
 - ML-based anomaly detection, HAB/Flood/Overflow early warning; realtime + forecast maps
- **Governance & Security**
 - Authorized data domains, access layers, logging, and service level agreements

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