Chapter

# Introductory Chapter: Marine Monitoring Pollution

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## 1. Introduction

Monitoring the quality of the marine and coastal environment combines activities of various kinds and is defined as a type of activity that can be exercised on a regulatory basis (this is a control) or to evaluate levels or trends for a scientific study. This definition made it possible to clarify later, after a good number of debates, the definition of the monitoring objectives. It was at the origin of the extensive definition produced by the Oslo and Paris Conventions (the OSPAR Convention), which constitutes the most current reference: "continuous monitoring is the repeated measure of the quality of the marine environment and of each of its compartments, namely, water, sediment and living environment; natural or anthropogenic activities or inputs that may affect the quality of the marine environment; and the effects of its activities and contributions" [1].

Monitoring of the coastal and marine environment in particular requires the study of water (physical chemistry, temperature, salinity, oxygen, bacteriology, etc.), the sediment (grain size, micro, etc.), and living (benthos, plants, magnoliophytes, algae, fish, coral, biomonitoring, bioindicators). The methods and means of analysis and monitoring features of the marine and coastal environment (physical and chemical parameters, pollutants, nutrients, etc.) are numerous. Measurements are essential for understanding and interpreting data to accomplish the goals of surveillance [2].

The study of environmental pollution implies as a precise knowledge as possible of the distribution of pollutants in ecosystems and their effects on living organisms. Sometimes, it is customary to distinguish between a chemical monitoring whose purpose is to determine the level of contamination by a particular pollutant biotope and biomass and other biological monitoring which aims to assess the impact at a given moment or time of environmental pollution on exposed populations and communities. Since the critical level of ecotoxicological concentration-response relationship to a given pollutant is known, it will subsequently be possible to establish environmental protection standards for the pollutant under consideration.

## 2. Monitoring of general quality parameters

### 2.1 Enrichment and eutrophication parameters

This monitoring only covers water bodies. The basic parameters are temperature, salinity, nutrients (nitrate, nitrite, ammonium, phosphate), chlorophyll a, and pheopigments. On some sites, dissolved oxygen and silicate are also measured.

Analysis and determination of concentrations of pollutants environment can track their transfer to coastal waters.

The enrichment of water by nutrients, especially nitrogen and/or phosphorus, causes an accelerated growth of algae and higher forms of plant life to produce an undesirable disturbance to the balance of organisms present in the water and to the quality of water concerned. Thus, due to massive chemical inputs (agriculture, detergents, etc.), enrichment can lead to eutrophication. Therefore, it is important to follow the control parameters of this evolution (COD, BOD5, chlorophyll, organic matter, turbidity, etc.) [3].

Also, the optical properties (wavelengths of absorption and diffusion) of suspended particles are similar to those of chlorophyll pigments. The turbidity causes a loss of the luminous flux (by absorption or diffusion) in the water mass, which makes its quantification by modulation of its spectral signal a very important point for a better estimation of the Chl-a by satellite.

### 2.2 Chemical contaminants

#### *2.2.1 Heavy metals*

This contamination due to the presence of heavy metals and elements contaminating the biosphere, lead, as well as cadmium, arsenic and mercury, which is the most worrying of these pollutants. The contribution of the chemical species results in a more or less important contamination, that is to say a level of concentration above the normal, or a level at least detectable.

Contaminants are most often measured in living matter (shellfish and fish), in sediment, but sometimes also in water or suspended matter. The toxicity of a metal depends on its concentration in relation to the need and the tolerance of the organisms. At excessive concentrations, even trace elements can become toxic [4].

#### *2.2.2 Hydrocarbons and PCB*

The behavior of hydrocarbons at sea is complex: it obeys many physical and chemical processes. The oil is spreads on the surface of the sea (voluntarily or accidentally), and floats under the influence of its own weight, and the forces exerted on it are the current and the wind. These forces will also combine to move the tablecloth.

Over time, the lighter components of the oil will evaporate, and some will dissolve in the water. The waves, by their agitation, will cause a dispersion of tiny droplets in the water column or cause the formation of an emulsion of water and oil, which will stay on the surface.

The rate at which these different physicochemical phenomena occur is a function of the nature of the oil, wind speed, wave height, and temperature. When pollution occurs, it is very useful for surveillance teams to know how it will evolve. To do this, prediction models are used based on available information on pollution. These models also use weather and hydrodynamic forecasts. In marine ecosystems, PAHs and PCBs are bioavailable to fish and invertebrates (especially mollusks) not only from water and suspended matter in water but also from sediment [5].

## 3. Monitoring of biological effects

Monitoring biological effects aims to assess the health status of marine flora and fauna by measuring the response of these organisms to disturbances in the quality of the environment.

The microbiology of seawater concerns all microscopic living organisms (bacteria, viruses, fungi, etc.). The search for microorganisms can be done in water or shellfish as needed. Oysters and mussels are the most used ones (filtering organisms).

Fecal coliforms are used as indicators of fecal contamination of the water environment (freshwater and marine waters) and also indicative of a probable presence of pathogenic microorganisms. They are most often taken into account in surveillance. Bacteriological analysis is a means of determining the quality of seawater.



## 4. Environmental monitoring: satellite observation

Satellite remote sensing is considered a promising technique for studying some phytoplanktonic algae because of its advantages of large-scale, real-time, and long-term monitoring; the application of statistical models in the field of remote sensing is an indispensable tool. The main objective of this study was to quantify the spatial distribution, and develop empirical models, and detect phytoplankton algal bloom phenomena (diatoms and dinoflagellate), transparency of water, turbidity of sea, coastal pollution, chlorophyll, suspended matter, and hydrocarbons with remote sensor satellites.

Detection of changes in transparency of the water column is essential for understanding the responses of marine organisms to the availability of light. Water transparency models determine long-term geographic and depth distributions, while acute reductions cause short-term stress, potentially mortality, and may increase the vulnerability of organisms to other environmental factors. Several studies have shown that monitoring water clarity, which is well correlated with water quality, is a good way to manage water quality; however, it is impossible to monitor the clarity of water in a large area for long periods.

Also, thermal pollution of marine water adversely affects the local environment and ecosystems due to consequent rise in water temperature [5].

## 5. Aims of this book



Surveillance provides some of the scientific basis for standard development and application. The methodology of marine pollution control is governed by algorithms and models.

A monitoring strategy should be put in place, coupled with an environmental assessment concept, through targeted research activities in areas identified at the local and regional level. This concept will make it possible to diagnose the state of "health" of these zones and consequently to correct the anomalies.

## 6. The main objectives are:

### 6.1 Task I: ecological monitoring

Analysis and determination of environmental concentrations of pollutants and their transfer to coastal waters involves the developing ecological parameters to detect changes in ecosystem health. This includes new research on the field ecological status of species in addition to conventional monitoring and assessment of the ecological status of coastal waters.

### 6.2 Task II: risk assessment

The application of risk assessment techniques will make it possible to evaluate the impact of substances on the marine ecosystem.

Using bioaccumulation and biomagnification measurements, the potential effects of pollutants detected on humans and local populations of common terns will be assessed.

### 6.3 Task III: development of marine environmental management and monitoring tools

In this phase, integrated risk assessment procedures are developed for the assessment of the impact of pollutants on human health and the environment. Other tools for monitoring and mapping marine pollution are integrated into a marine information system that manages pollutant databases and simulations obtained by high-resolution temporal and spatial satellite imagery (maps, satellite images, pollutant concentration, hydrodynamic parameters, physicochemical parameters, phytoplankton, sea color, chlorophyll, temperature, turbidity, suspended matter, coastal bathymetry, salinity, etc.). The result of monitoring is a computerized decision support tool that meets the objectives of managers [6].

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