

B - Risk assessment of invasive alien species - changes in marine biodiversity.

This area will focus on risk assessment of the introduction and distribution of invasive alien species (IAS) in the North Atlantic Ocean and the Mediterranean Sea, and how these species affect the distribution and abundance of native species (i.e. flora and fauna) and their impact on marine biodiversity.

The introduction of IAS is considered to be one of the greatest environmental and economic threats and, along with habitat destruction, the leading cause of extinctions and resultant biodiversity decreases worldwide. In the marine environment, biological invasions are frequent in coastal communities, and the rate of inventoried invasions has significantly increased in the last two decades. By far the greatest proportion of marine invasions has been facilitated by the international commercial shipping industry through two major vectors: ballast water and fouling. As most commercial shipping ports are located within harbours, bays and estuaries, the ballast that is loaded in these waterways inadvertently uptakes and later discharges both adult and larval stages of local marine species. It is assumed that species from these habitats are adapted to natural fluctuations of various factors (i.e. salinity, temperature) and are thus pre-adapted for establishing in new regions of similar habitat. In addition, shipping is also a major vector of change for the introduction and spreading of IAS as some species stick to ship hulls and other artificial substrates in a process known as 'biofouling'. Algae, molluscs and other marine organisms settle and grow these on ship hulls where they can be transported to other regions in the globe. Furthermore, IAS can be introduced through additional vectors such as aquaculture, live bait and aquaria.

In addition, recent studies have shown that the increase of seawater temperatures and related changes in ocean currents are also favouring the spread of species from tropical and subtropical regions towards temperate areas. A better understanding on the relationship between these two variables – climate change and invasive species – is crucial because they are among the most critical pressures to biodiversity.

Human activities are major responsible for the introduction and spreading of IAS, both directly, acting as vectors for the introduction of such IAS, or through climate change. In addition, environmental changes driven by climate change can favor the spread of species out of their distribution range. However it remains unknown the proportion of

introduced species accounted for by these two major factors. Thus, whether the growing spread of IAS can be explained only by climate change and human activities or if also involves evolutionary processes implying genetic adaptations of the IAS to new environmental conditions still remains relatively unexplored.

In order to assess and prevent the harmful impact of IAS on autochthonous flora and fauna and the biodiversity of marine ecosystems it is necessary to map the current abundance and distribution, conduct a risk assessment of species already introduced, and increase the knowledge about how these species affect the marine ecosystems, specifically the autochthonous fauna and flora, as well as their impact on the biodiversity in North Atlantic Ocean and the Mediterranean Sea. In order to prevent further introduction and spread of IAS it is necessary first to identify the main vectors responsible for the introduction of these species (ballast waters, hull fouling, aquaculture activities, etc.) and formulate effective measures to prevent its introduction. Moreover, it is recommendable to analyse up to what point environmental changes induced by anthropogenic climate change can favour these processes, as well as the expansion of tropical or subtropical species to northern latitudes. Timely identification of vectors of change and detection of new introduced species will facilitate the initiation of countermeasures to hinder its spread and limit its damaging effects.