Student Research Projects

NIOZ Marine Masters Summer Course 'Exploring the Wadden Sea'
NIOZ – Royal Netherlands Institute for Sea Research, Texel, 30 June - 12 July 2019

Project 1: Tidal dynamics and their influence on plankton dynamics

The Wadden Sea is a complex tidal ecosystem, changing continuously in terms of currents, waves, sea level, temperature, salinity, sediment concentration and hence light conditions and availability of nutrients. This dynamic environment will have its effect on the biodiversity and productivity of the lower parts of the food chain (phytoplankton and zooplankton). To obtain an impression of these interactions, a variety of physicochemical and biological parameters will be studied along a salinity gradient in the Dutch Wadden Sea and during one tidal cycle.

Project 2: Tidal dynamics and their effect on sediment transport

Every day, tidal currents move tons of suspended sediment from the North Sea into the Wadden Sea and back again, through the tidal inlets that breach the Wadden Sea island chain. In the Wadden Sea, sheltered by the barrier islands against the force of incoming waves from the North Sea, sediment particles suspended in the seawater settle out on the seabed. With time, sediments accumulate into vast tidal flats emerging during low tide, which are the typical landscape element of the Wadden Sea and an important habitat for marine life. Whether this landscape will remain during future sea level rise and local seabed subsidence depends on the balance of sediment import and export through the tidal inlets. In this project, we will quantify suspended sediment transport in the Texelstroom in relation to the dynamics of the tide.

Project 3: The Prins Hendrikpolder coastal protection

The Wadden Sea dike of Texel has been subjected to a large-scale reinforcement, necessary for protecting the island population against risks associated with the rising sea level and changing climate. At the Prins Hendrikpolder Dike, the section of dike extending between NIOZ and Oudeschild, natural landscape elements have been included to strengthen the dike and, at the same time, to enhance habitat diversity. The aim is to collect physical and biological data from the subtidal foreland area of the dike to assess how the dike reinforcement has changed the conditions and to evaluate the possible gains in terms of habitat diversification.

Project 4: Using stable isotopes to unravel the Wadden Sea foodweb

The Wadden Sea is the major feeding ground for migratory birds resting in Northwestern Europe, but it also plays an important role for other species like seals, fish and invertebrates, to name a few. In this project, carbon and nitrogen isotope signatures of various Wadden Sea species, reflecting their

past diet, will be used to establish the predominant food sources and therewith a basic food web of the Wadden Sea. Samples of phytoplankton and zooplankton in the water column, benthic algae, macro- and megafauna will be collected from tidal flats and on board the research vessel Navicula between Texel and Den Oever.

Project 5: Release and uptake of essential elements from contrasting sediments in the Wadden Sea area

Sediments and the (micro)organisms inhabiting them play a crucial role in controlling the availability and cycling of essential elements such as phosphorus (P), nitrogen (N), sulfur (S) and carbon (C) in aquatic ecosystems. The exchange between sediment and water depends on the type of sediment (fine-grained, coarse-grained) and organisms (microbial populations, burrowing species). Detailed analysis of the dissolved components in sediments and their release to the overlying water, as well as identification of contributing micro- and macrofauna, is essential to understand this exchange. In this project, we will use traditional and novel, high-resolution methods to either directly measure or calculate the exchange of selected crucial biogeochemical species (N, P, O, S) between sediment and water. These geochemical data are supplemented by visual identification of micro- and macrofauna. This will be done for two contrasting sediment types – muds rich in organic matter from tidal flats and coarse sediments from the dynamic Waddenzee – to help appreciate how different sedimentary environments function on a biogeochemical level and help to exacerbate or alleviate problems with excess nutrient inputs into coastal systems.

Project 6: The role of chemical structure and UV exposure on the degradation of plastic in the marine environment

Large quantities of plastics comprising a diverse set of hydrocarbon or hydrocarbon-like polymers are constantly released to the oceans. The impacts of plastics in marine environments are poorly understood, though we know they can be persistent in the environment and harmful to marine life. The severity of this problem is gaining momentum because the untamed demand for plastics has led to an ever-increasing release of plastic to the sea. However, despite its seemingly persistent properties, plastic litter does not accumulate as expected, indicating a substantial sink for plastics in the ocean. Several potential sinks for floating plastic litter ranging from enhanced sinking as a result of biofouling, microbial degradation and photo degradation are currently discussed in the scientific community. It seems likely that the chemical structure of the polymer plays an important role in its degradability. In this project, we will identify the chemical structure of marine plastic debris using Raman spectroscopy. Furthermore, we will measure polymer degradation products by chromatographic assays to determine plastic degradation as a function of the polymer structure and UV exposure.