

Molecular technologies in the marine environment: Assessing the status of marine ecosystems with just four letters ACTG

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Marine ecosystems are facing tremendous global and local anthropogenic and natural threats. Yet, these ecosystems are vital to many ecosystem services and human health in general. Therefore, there is a need to urgently improve our understanding of the resilience of marine ecosystems. Here, we focus on developing molecular tools to support this approach.

First, we need to assess the current resilience and status of our marine ecosystems through field research in an efficient and informative manner. We use new molecular DNA based methods to gain insight in the distribution of species in the Belgian Part of the North Sea across time and space. We sampled water seasonally across different sampling stations in the Belgian Part of the North Sea. We extracted the DNA from these water samples to identify different species that were present in those water samples (e.g. fish, jellyfish, copepods...).

Second, we need to assess the resilience of our marine ecosystems to future impacts through experimental research. Here, we collected organisms of the copepod species *Temora longicornis* in the Belgian Part of the North Sea for experimental research in the laboratory. In these experiments, we studied the effects of increased temperature, both sudden increases in temperature and gradual increase in temperature. We then sequenced the RNA of the exposed organisms to understand which genes, molecular pathways and mechanisms were involved.

Similarly, we also studied the effects of algal biogenic compounds on human long cell lines using RNA sequencing to again identify which genes, molecular pathways and mechanisms were involved.

The use of molecular technologies to obtain insight on mechanisms and molecular pathways will allow us to better understand how organisms in the marine environment respond to environmental stress and how biogenic compounds from the marine environment affect other organisms including ourselves. Overall, molecular technologies offer unique opportunities to study marine ecosystems at a currently unexplored level.

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