Scientist in Residence Report by Nigel Welford

Throughout two voyages over summer 2022, I conducted citizen and personal science projects with the sail trainees and professional crew aboard the TS Pelican of London. With a background in Marine Biology this experience became of particular interest to me, as I long wanted to put my skills to use in the field, and what better place to do it than aboard a tall ship! Furthermore, being able to introduce the trainees and professional crew to the world of marine science and share my passion for our blue planet with such young minds was an added bonus.

SAIL TRAINING IRELAND

Voyage 1 June 27th - July 3rd

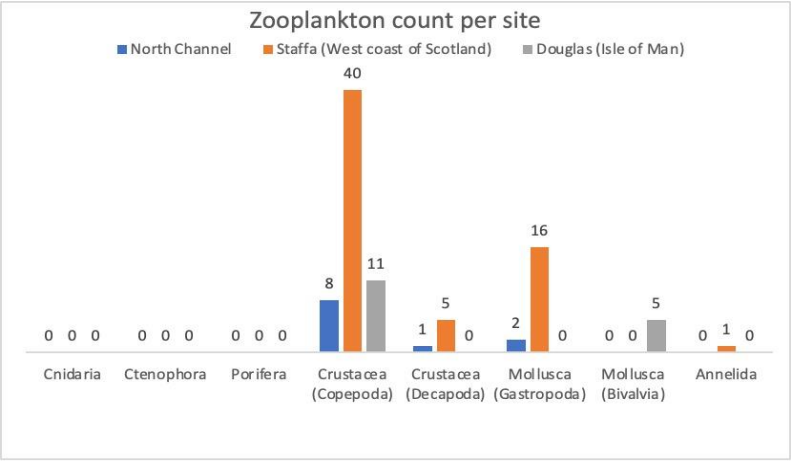
This was my first ever voyage aboard a tall ship, so there was a lot to get used to before I could conduct any science! On this journey, trainees from Sail Training Ireland and I, sailed across the Irish Sea from Dublin to Cork with a quick stop at "Cwm-yr-Eglwys", a hamlet South of Newport in Wales. During our voyage, we performed a variety of citizen science projects, including dedicated surveys. These are vessel-based searches for certain animal groups (usually seabirds or marine mammals) to track their populations and gain better understanding of their associated habitats and habitat distribution.

Seabirds, for example, usually nest on hard-to-reach cliffs and islands so that they can rear their chicks with minimal disturbance from predators and people. This means that many nesting sites will be impossible to spot unless you're doing so from a vessel offshore.

In the brief time we had onshore, we were lucky enough to find a sheltered beach packed with several different seaweed species and after collecting several species, I delivered a hands-on "in situ" introductory lesson to the trainees about the marvels and diversity of macroalgae on our shores.

Voyage 2: August 17th – August 22nd

During the second voyage, I focused more on my personal research project: I obtained plankton samples from different sites we visited, taking us from Dublin, up the North Channel into Staffa off the West coast of Scotland, then down again into Douglas in the Isle of Man and returning to Dublin. I watched for changes in abundance and diversity of zooplankton communities, and took the chance of introducing the trainee voyage crew from The Malahide Sea Scouts to the diverse microscopic animals (zooplankton) that drift in our seas. However, due to the unfavorable weather conditions, it became very difficult to take plankton samples while underway, and I could only take them the few times the ship was anchored. If anything, this is a testament to the challenges of performing science offshore and an interesting learning curve for the me!



SEAS YOUR FUTURE

Scientific Report:

From June 27th - July 3rd
During this first voyage, we conducted some **citizen science** projects including some dedicated seabird surveys, the data of which will be used by the British Trust for Ornithology (BTO) and the Royal Society for the Protection of Birds (RSPB) to monitor and analyse the distribution of some of the British Isles' iconic seabirds.

What's so important about birds? Seabirds are key health indicators for seas and coastal environments with many globally important species of seabirds found around the British Isles. Most of them have suffered a population decline of 30% since 2001, mainly from human disturbance and climate change[1]. Examples of disturbance include the introduction of non-native species in their breeding and nesting sites[2], increasing sea temperatures, changing populations of sand-eels and other fish they eat[3], and increased deaths from impact with windfarms and getting caught in nets[4]. Thus, the purpose of dedicated seabird watches is to better monitor the health and abundance of these seabird populations from areas which are harder to reach by land.

Whilst **onshore**, we found a sheltered beach covered with dozens of seaweed macroalgal (large) species. **Seaweeds** in the British Isles serve a very important purpose, fulfilling vital services that benefit both us and the animals which live and depend on seaweed (so-called ecosystem services). One example of this is their potential to absorb carbon dioxide from the atmosphere. It is estimated that one square kilometre of seaweed can absorb almost 3 tons of CO_2 per day[5]!

August 17th – August 22nd
My personal **research** project during the second voyage observed and compared abundances and distributions of selected groups of **zooplankton**, as a quick indicator of **water quality**.

All zooplankton are heterotrophic organisms, meaning they eat others for nourishment. Many are the first consumers in all **marine trophic food systems**, feeding on autotrophic organisms, those that produce their own nourishment, such as microscopic algae (phytoplankton). Zooplankton serve as intermediary species in many food webs[6,7], are food for many fish species, which are a vital source of food for many larger species in the Irish Sea, including the resident fauna of seals, dolphins and porpoises, and fauna which migrate seasonally (e.g. whales, orcas, seabirds).

Samples were collected with a conical plankton net of 100 µm mesh size dragged through surface waters for a reproducible distance. Numbers of species in 8 key groups of zooplankton were counted under the microscope.

The Irish Sea is affected by a number of **pollutants and contaminants**, with sources including urban sewage release, industry and agricultural waste runoff, shipping and offshore dumping, as well as spills/leaks from underwater oil sea pipes[7]. Many zooplanktonic organisms are susceptible to the pollutants found in the Irish sea and changes in aquatic systems[6,8] in general. Thus, zooplankton species presence/absence, abundance, and richness can be used as measures of biological condition of a region.

Results from my research project can be seen in the graph above. The data demonstrate differences in the **abundance of organisms and species richness** between sites sampled: Staffa on the west coast of Scotland had the largest abundance and species richness of organisms present. In contrast, the more urban sites in the North Channel (between N Ireland and Scotland) and the Harbour of Douglas on the Isle of Man showed much lower abundance and diversity. At all sites, copepods (crustaceans) were the most abundant grouping of organism, with the majority being *Calanus* species.

I also found **microplastic pollution**. Interestingly, the fewest microplastics were collected at Douglas, even though this site was closest to human settlements. In samples from Staffa and the North Channel, I counted nearly three times the number of microplastic filaments. This demonstrates the spreading potential for microplastics, which are now found in every habitat, food and drink, across the world.

To conclude:
Working as a resident scientist aboard a ship grants us access to areas otherwise very difficult to reach, either due to costs or the innate complexity of navigation. Having the opportunity to gather data from these areas helps us better understand environmental deterioration and changes and their causes, as well as to construct solutions to tackle them.
I am immensely grateful for the opportunity of being able to perform marine science here, where few people have had the chance to before, and know that the work we do is key for the organisations that benefit of it.

References:

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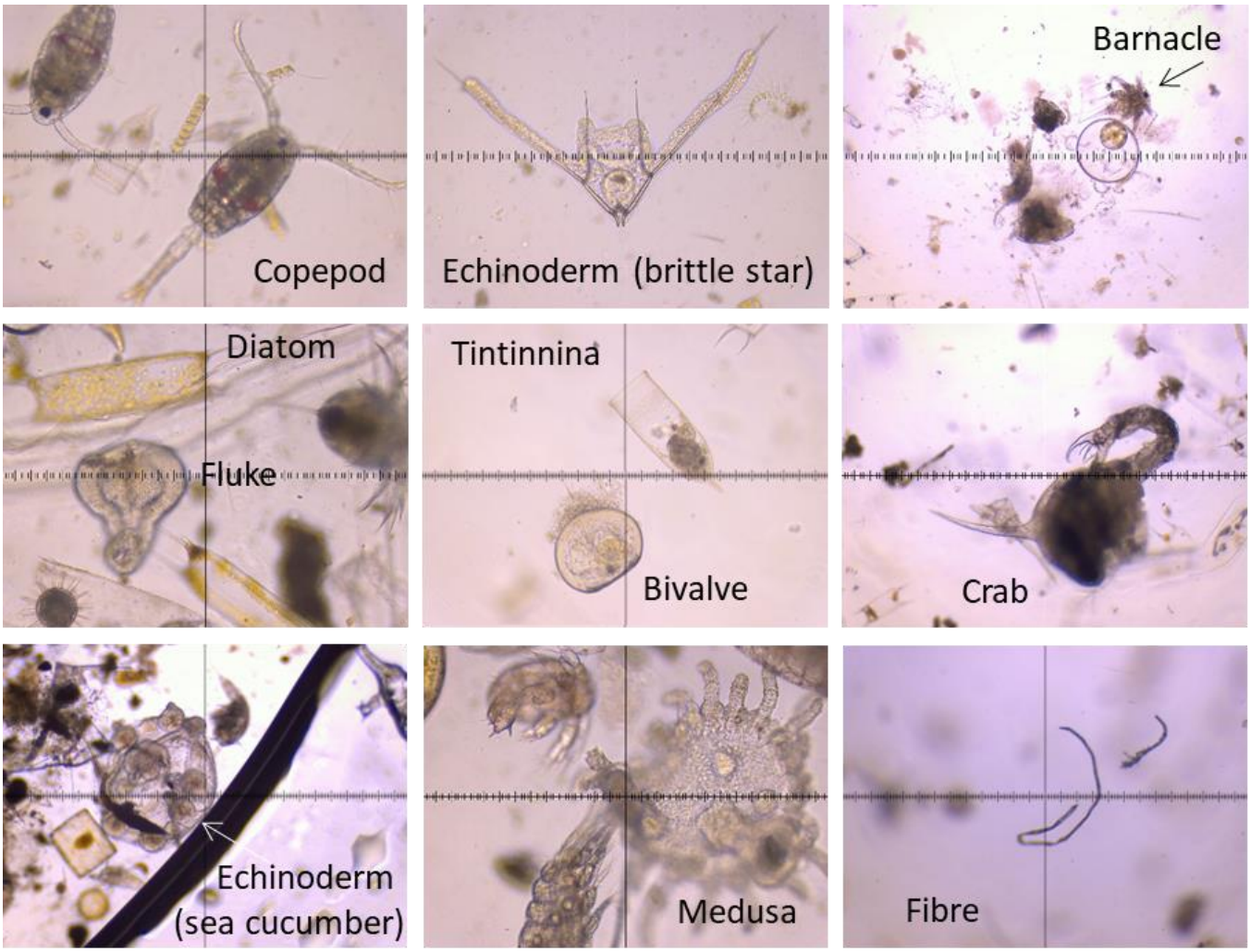

Selection of screenshots from the microscope for illustration purposes. This diverse range of organisms was collected by Charly Braungardt from the Liffy and Scotsman's Bay near Dublin in August 2022. Most of these organisms are larval stages, which have a very different appearance as adults. The exception are copepods, which are zooplankton as adults, too.