



Acrocnida brachiata (Montagu, 1804)

GEANS: GENETIC TOOLS FOR ECOSYSTEM HEALTH ASSESSMENT IN THE NORTH SEA REGION

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Introduction

Several EU directives and OSPAR guidelines require transitional sustainable management of marine resources. Benthic organisms are key components in environmental impact assessments and the Marine Strategy Framework Directive (MSFD). GEANS (Genetic Tools for Ecosystem Health Assessment in the North Sea Region) is a transitional co-operational project among nine institutions (ILVO, SGN, VLIZ, CEFAS, Naturalis, University Nord, Aarhus University, Wageningen University, SE Analytics) aiming to implement mainstream accurate, fast, cost-effective DNA-based tools in routine monitoring enabling national authorities to adapt management measures in a transitional coherent

way resulting in improved management of human activities and protection of the marine environment across the North Sea Region. Within GEANS an open DNA reference library is developed serving as the backbone of all the molecular protocols. Furthermore, real time pilot studies, in close cooperation with managers, policymakers and involved stakeholders are implemented and will deliver proof of concept on the added value of genetic approaches in environmental health management. GEANS will provide a decision support framework including a fit for purpose choice of genetic tools and protocols, helping to translate genetic results into simple indicators.



Caprella mutica (Schurin, 1935)

Materials & Methods

GEANS' Reference Library

Checklists of taxa used for biodiversity assessments in the North Sea region were obtained from all GEANS' partners. The lists were then sorted by taxon and merged to one key list together with accompanied information for each species (e.g. distribution, taxonomy). A barcoding workflow (Fig. 1) was then followed aiming to genetically barcode all the species in the key list and thus establish a COI barcode reference library for the North Sea.

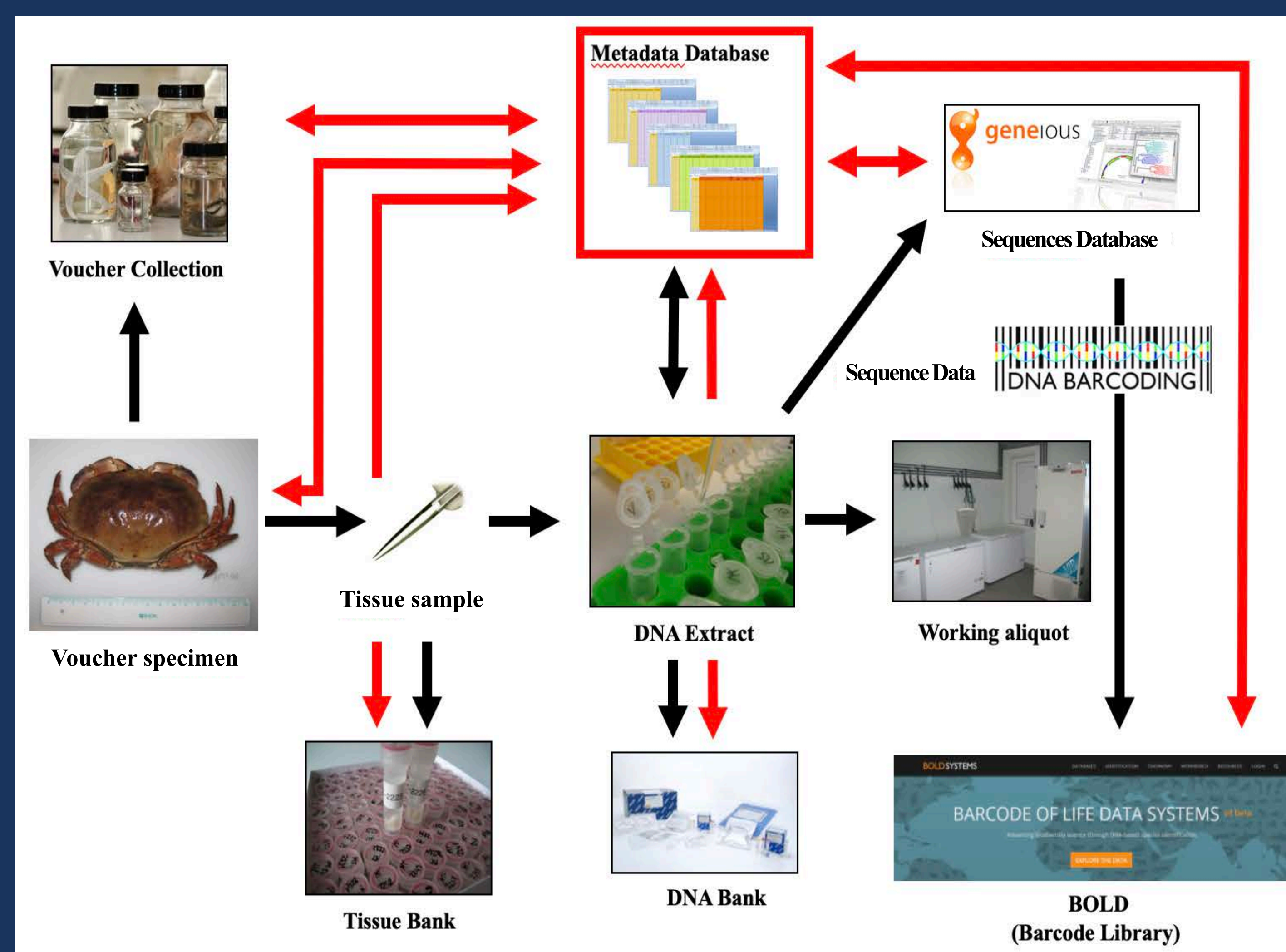


Figure 1: Schematic representation of the work flow followed for the production of the DNA barcodes and the compilation of the GEANS Reference Library.

Pilot studies

A set of pilot studies (Fig. 2) in hard and soft substratums were designed for introducing genetic (metabarcoding) protocols in addition to traditional techniques in existing monitoring programs in order to provide proof on the added value of genetic approaches in environmental health assessment. These pilots cover two broad areas, i.e. Environmental Impact Assessment (EIA) and Monitoring in relation to EU directives, such as the MSFD.

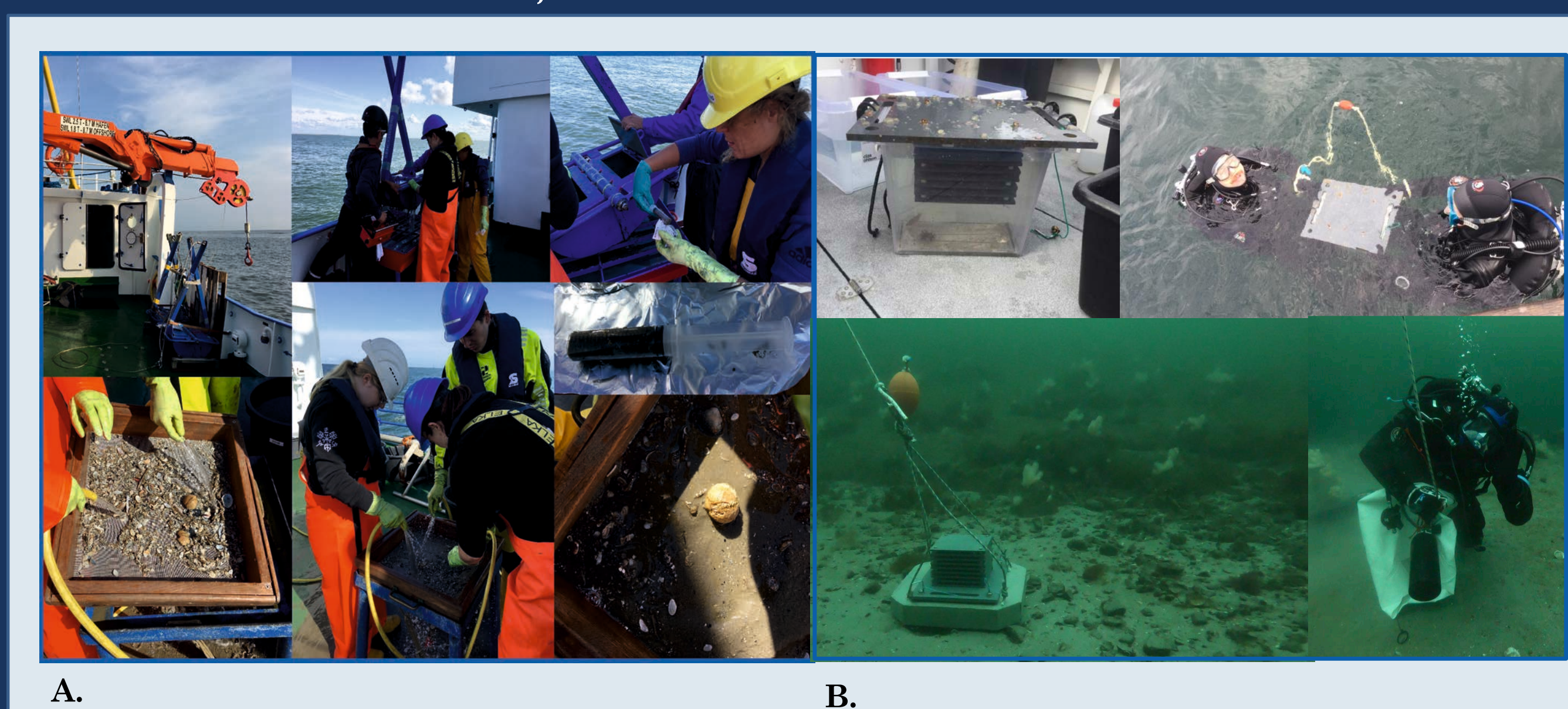


Figure 2: A, Soft bottom sampling in the long-term monitoring station of Senckenberg am Meer in Norderney Island, North Sea; B, Deployment of Autonomous Reef Monitoring Structures (ARMS)

Project Progress

GEANS' Reference Library

A total of 800 marine species were compiled in the key species list of which 118 were non-indigenous species (NIS). Among the 14 different animal groups included in the key species list Arthropoda displayed the highest proportion of species (32%, 256 species), out of which 4% (34 species) are NIS for the North Sea (Fig. 3). From the total number of species included in the list 43% (343 species) have already at least one representative DNA barcode sequence in GEANS reference library (Fig. 4), and species pages in BOLD have already been created (Fig. 5). The best represented groups are the Arthropoda and Echinodermata, which have DNA barcodes for 55% of the 256 species and 54% of the 33 species respectively.

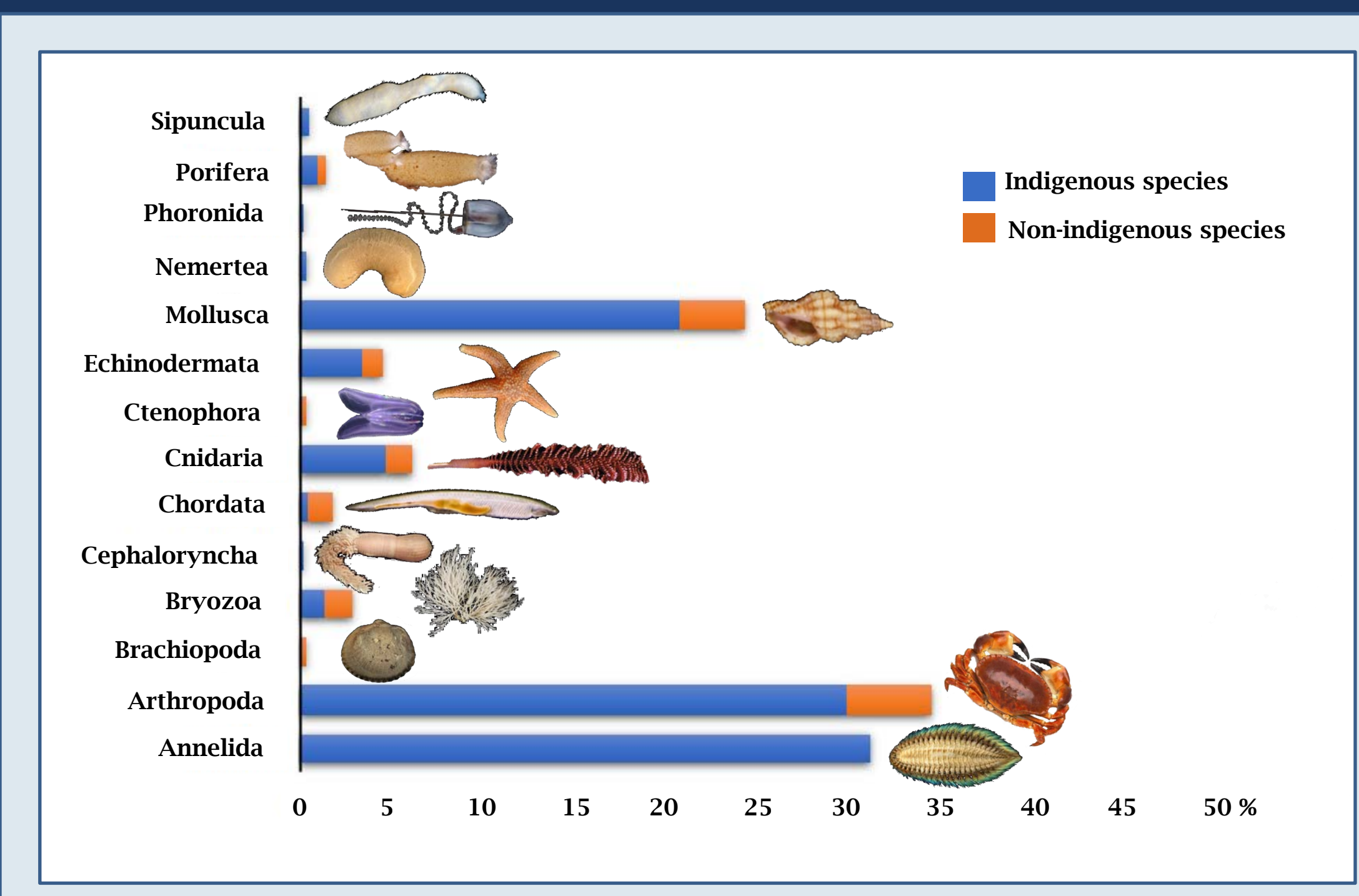
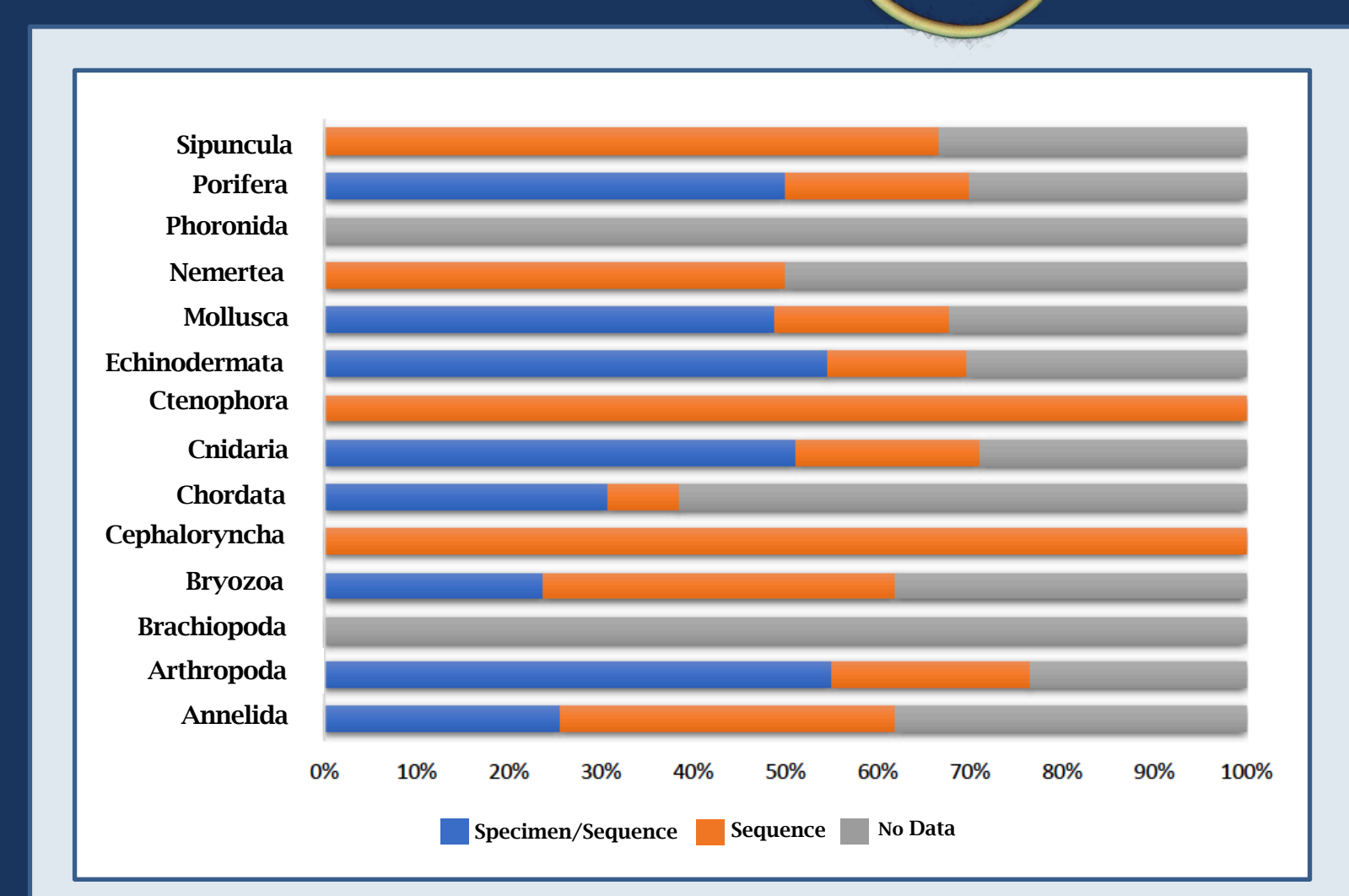


Figure 3: Percentage contribution of 800 species included in the GEANS Reference Library grouped by phylum.



Sabellaria alveolata (Linnaeus, 1767)

Figure 3: Percentage contribution of species in GEANS key species list grouped by phylum, with at least a DNA barcode in GEANS partner's databases (blue), at least one specimen in the collections (orange), and without specimen or DNA barcode in Partner's databases or collections (grey).



Peringia ulvae (Pennant, 1777)

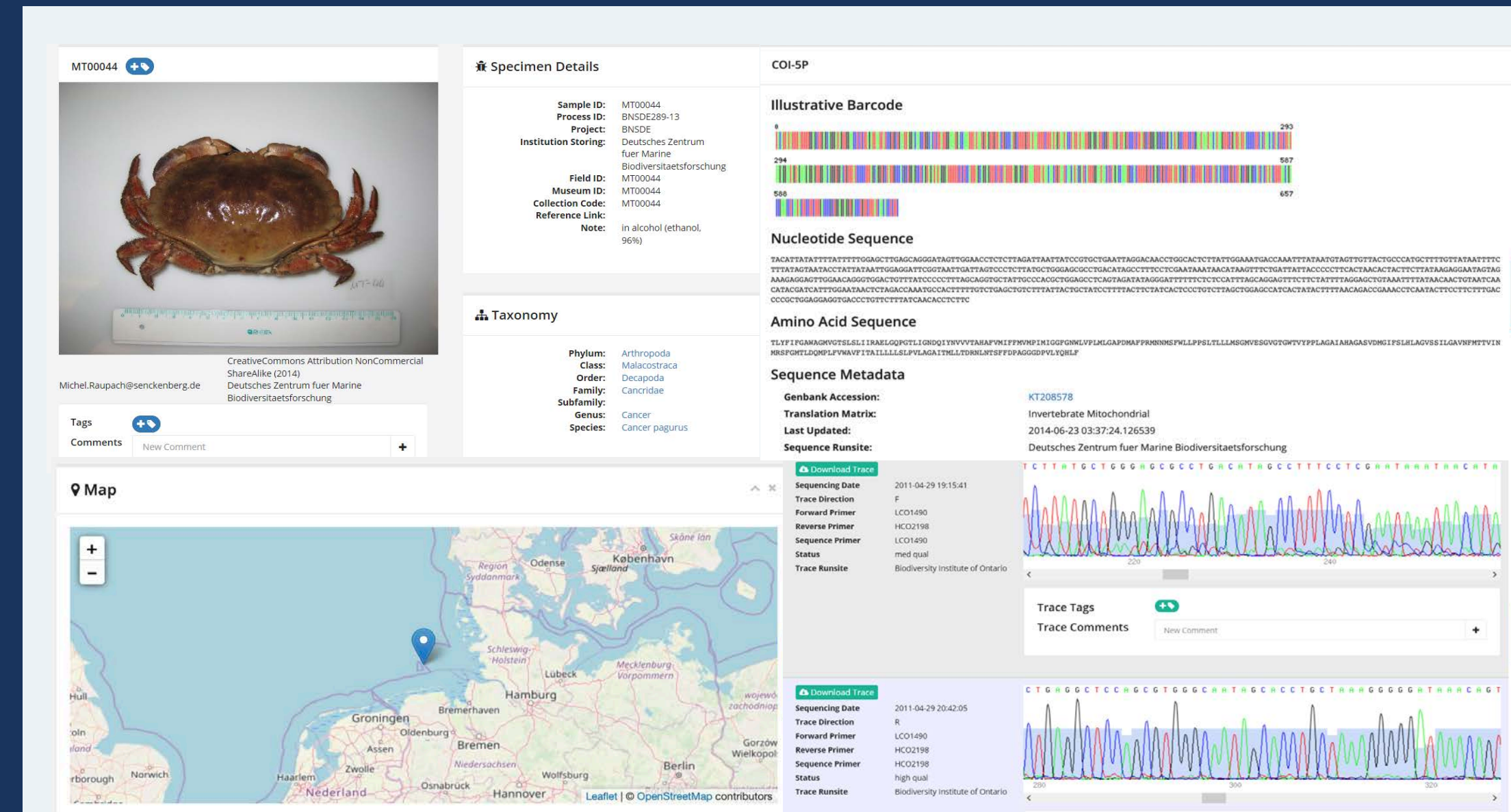


Figure 4: Example of a species page [*Cancer pagurus* (Linnaeus, 1758)], within GEANS' Reference Library, created in BOLD.



Acanthocardia echinata Linnaeus, 1758

GEANS final outcomes will be the improved transitional environmental health assessment, increased time-efficiency by up to 60% and the reduction of the costs by 40%.