

## Tillaga að verkefni á nýjan vegvísi um rannsóknarinnviði 2025

**Titill verkefnis: TerraMareIceland –Testing, analysing and mitigating the impacts of anthropogenic pollutants on aquatic low-trophic organisms in the cryosphere**

**Heiti stofnunar: BioPol ehf**

### Vinsamlegast hafið eftirfarandi atriði í huga við gerð tillögunnar

Umsækjandi þarf að svara öllum liðum hér að neðan. Þar sem stendur „Texti“ er hægt að skrifa texta, setja inn myndir eða töflur.

**Tillögum að innviðum á vegvísi um rannsóknarinnviði skal skilað á þar til gerðu eyðublaði. Ekki er leyfilegt að eiga við uppsetningu eyðublaðsins.**

Skjalið „Tillaga að innviðum á vegvísi um rannsóknarinnviði“ skal að hámarki vera þrjár blaðsíður, auk forsíðu, eða samtals fjórar blaðsíður. Nota skal leturgerð og leturstærð eins og stillt er í eyðublaðinu, þ.e. 11 punkta Calibri (body). Ekki er leyfilegt að breyta breidd spássú eða beyta fyrirsögnum í eyðublaðinu. Umsókn skal senda inn sem PDF-skjal.

Festur til að skila inn tillögum er til 12. september 2024, kl. 15.00.

Nánari upplýsingar er að finna á [heimasíðu Innviðasjóðs](#) og hjá sérfræðingum Innviðasjóðs hjá Rannís í gegnum tölvupóstfangið [innvidasjodur@rannis.is](mailto:innvidasjodur@rannis.is)

## Lýsing á tillögu til birtingar á heimasíðu Innviðasjóðs

### 1. Samantekt: Stutt lýsing innviðum

Despite the awakening global attention towards anthropogenic pollution, new synthetic compounds are being created and released every day while the impact of persistent ones is still being felt due to their bioaccumulation/biomagnification potentials and severe long-term consequences in apex predators. Moreover, only a comparatively small number of these new compounds have ever been tested for their impact on low-trophic species at the physiological or molecular level in ecosystem relevant concentrations and mixtures. Their effects differ greatly between species reflecting differences in the nature of the compound and in the pattern of exposure, routes of uptake, metabolism, rates of accumulation and sensitivity. In addition, responses may be exacerbated by interactions between the effects of different pollutants and environmental stressors (e.g., osmotic stress). Alterations of such variables associated with for instance climatic changes may exacerbate physiological responses to pollutant burdens of individual species with potentially destructive ripple-effects on ecosystems. **The current biodiversity crisis and ecosystem degradation which hamper fundamental requirements such as clean air, water and food are major important ecological challenges which need to be faced by humanity. To develop sustainable solutions (e.g., bioremediation) and to ensure a leading role for the Icelandic research community and businesses in this rapidly developing emerging field, the establishment of a the TerraMareIceland is proposed here.** The building chosen for the centre is a former prawn

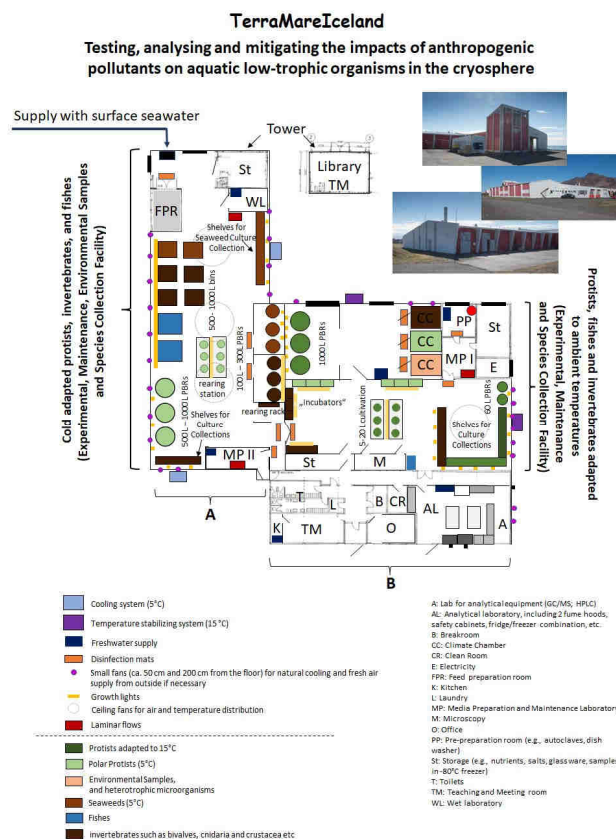


Figure 1. Overview of the proposed infrastructure.

factory. It offers 1614 m<sup>2</sup> for the selected purpose and contains two parts (Fig.1). The main part (965 m<sup>2</sup>), which will contain the low-trophic level (LTL) species adapted to ambient temperatures, including micro-algae and cyanobacteria in small and up-scale cultivations for feeding purposes, laboratories, offices, teaching facilities, climate chambers for eco-toxicological and bioremediation experiments, was built in 1974 (Fig. 1B). The smaller part of the building (648.4 m<sup>2</sup>), which will include the cold adapted LTL culture collections, was built in 1997 (Fig. 1A). The building will comprise facilities for harbouring the existent culture collections of polar and sub-Arctic protists (153 strains), invertebrates such as Crustacea (e.g., copepods), amphipods, bivalves, etc. (37 species),

supporting the isolation of new species from environmental samples, microscopical taxa analysis, small- and large-scale ecotoxicological test-cultivation for different purposes, rearing facilities, experimental set ups for ecological projects, and laboratory facilities for media and sample preparations as well analysis (e.g., nutrients, biochemical gross compositions, stress related compounds such as enzymes, proline, etc, but also metabolites, infochemicals, and accumulation potentials of pesticides, pharmaceuticals, flame retardants, organometallics, UV-filters, PAHs, PFASs, PCBs in biomasses). For teaching purposes, covering ecotoxicology, protist taxonomy, parasitology, ecology, biochemistry, and physiology, two rooms will be available for up to 20 students each. For practical teaching of, for instance, taxonomy and parasitology on selected species of the culture collection, one of these rooms will be equipped with Olympus education microscopes. For guest scientists, company staff, master's and PhD students, workspaces in the analytical laboratory as well offices will be available in the roof spaces.

## 2. Meginmarkmið með uppbyggingu innviða?

TerraMareIceland aims to conduct and host projects as well provide services facilitating the development of new technologies and know-how in Iceland and beyond, simultaneously supporting the education and training of next generation scientists and company staff. **Specifically, TerraMareIceland will focus on ecotoxicological and molecular effects of anthropogenic pollutants on species in sub-Arctic and polar habitats, with special consideration of associated organisms of the lower trophic levels (e.g., bacteria, fungi, protists, including parasitic forms and algae, as well as eggs and larval stages from invertebrates and forage fish) and their interactions in aquatic food webs.** Thereby know-how in biotechnology (e.g., bioremediation) and aquaculture (e.g., LTL aquaculture) will be used to generate monitoring tools and sustainable solutions to mitigate and eradicate future effects of man-made pollutants on environmental and human health. Furthermore, TerraMareIceland aims to

- build up competences among experts, students and company staff in Iceland in the field and raise the awareness of the public.
- compensate lack of such well-equipped highly specialised facilities in Iceland.

## 3. Hvernig mun innviðauppbyggingin stuðla að nýliðun og leiða til aukins samstarfs og betri nýtingar innviða?

The enhancement of domestic and international collaboration within the broad field described above will be facilitated by offering top-quality cultivation facilities, analytical methods and know-how regarding LTL systematics, physiology, biochemistry, and parasitology as well as insights into physiological effects of anthropogenic chemical pollutants on low-trophic organisms, interactions (chemical ecology) and potential negative ripple effects in the food-web. Current existing ITN's in which BioPol participates such as the **COST Action "ParAqua - Applications for Zoospore Parasites in Aquatic Systems"** <https://paraqua-cost.eu/> and the **MSC-ITN "PHABB – Pathogens of Algae for Biocontrol and Biosecurity"** <https://mcam.mnhn.fr/en/about-phabb-pathogens-algae-biocontrol-and-biosecurity-6679> are already uniting a high number of international experts, stake holders and institutions and most of the colleagues have expressed their desire to conduct research at the TerraMareIceland either in person or/and in form of students to conduct internships and theses. In this context, the proposed infrastructure would facilitate increased cooperation,

development of joint future projects and continuous utilization of the TerraMareIceland. Furthermore, it is planned to conduct summer courses at the Center in which for instance taxonomy and applied aspects of LTL biotechnology and aquaculture will be taught. In this context, UnAk had already pointed out in the past the possibility to take part by including appropriate courses in their curriculum. Adding a practical aspect into LTL taxonomy as well as biotechnological and aquacultural applications will lead to higher interest of students into these topics, thereby facilitating the recruitment rate in science and innovation in this field in Iceland.

#### 4. Hverju munu innviðirnir breyta miðað við stöðuna í dag?

Some techniques that can be used to research the pollution effects and accumulation potentials are available in foreign institutions, others need to be developed or adapted in the future to target newly synthesized pollutants. BioPol has built up close collaborations with such foreign facilities and benefits via training of students, consultation etc., but specialized analyses of pollutants are highly expensive. By building up a safe well-equipped ecotoxicological laboratory, specialised on testing and analysing anthropogenic pollutants in Iceland, many opportunities will be opened. There are still vast knowledge gaps concerning pollution and in particular the negative effects of chemical hazards on the biota in Icelandic coastal areas as well as in other semi remote parts of the world such as the environments of the cryosphere. In addition, bioremediation schemes targeting for instance PFAS are not developed yet.

#### 5. Framtíðarsýn uppbyggingar og reksturs

Regarding the individual facilities of TerraMareIceland, first the build-up of the **cultivation facilities** (1. In Table 1) is planned, including laboratory for preparations and maintenance. In the next step, an **Analytical Laboratory and associated facilities** (2.) will be developed. After that, the **Microscopy and teaching facilities** (3.) as well as the **Experimental Units** (4.) will follow. Finally, the **Ecotoxicological analytical facility** (5.) will be equipped. It is planned to

Functional Part of the Center	Equipment	Estimated Costs
1. Cultivation and associated facilities	2 x Room Climate Control Units (one for A tract and one for B tract, <b>Rivascold</b> ); laminar flow ( <b>Labonics</b> Class II A2 biological safety cabinet Labo305BSC-II); autoclaves (e.g., one Astell AMB240, 63 liters benchtop and one Astell benchtop <b>Ecofil</b> 33 liters); fridge/freezer combination; laboratory probes for conductivity, pH and T measurements; Shelving units (metal frames with glass shelves; <b>Vittsjö</b> , Ikea); tables for rearing systems; 10 x Wine-Climatic-Cabinets (Liebherr) as incubators at 5 - 15°C; IQ 7005 Water Purification System (Milli-Q® Merck); balances (Isolab); bins for IMTA experiments, seaweed and fish husbandry (SÆPLAST); light equipment (LUMAX-LED Plant and Sun, including cables and controller); dish washer (Elko); seawater distribution system	30.295.950
2. Laboratories and associated facilities	Drying oven (Memmert UF75-SJS); Centrifuges, balances, pH and T probes, bathes etc. convoluted (Isolab); Laboratory furniture, including 2 fume hoods, safety cabinets etc. convoluted (Kebo); pipettes, consumables, etc. convoluted (Isolab); Rotary Evaporator ( <b>Heidolph</b> ); -80°C freezer RDE60040FV (Thermo); fridge/freezer combination; FURNACE 350CI 8SEG 240V (Thermo); freeze dryer (SPScientific); Hielscher UIP400MTP for ultrasonic sample preparation; dish washer (Elko); glass ware (Isolab); portable Yamato Compact glove box.	40.713.947
3. Experimental Units, Microscopy and teaching facilities	Walkable Climate Chambers (KOMEG); glass ware for upscales of feeding organisms (e.g., 5 L flasks; Isolab); ecotoxicological test benches (6 glass 16-litre exposure tanks placed on magnetic stirrers); plankton wheels; EVOS™ M5000 Imaging System; 10 Education Microscopes CX23 (Olympus); Tables, chairs etc. convolute (Ikea)	41.469.226
4. Ecotoxicological analytical facility	Agilent 1220 Infinity II LC system with DAD, FLD and LC/MSD for <b>OpenLAB CDS ChemStation</b> Edition (e.g., accumulation potentials of pesticides, halogenated organic contaminants, pharmaceuticals, flame retardants, organometallics, UV-filters, PAHs, PFASs, PCBs in biomasses); Thermo <b>Varioskan</b> LUX multimode plate reader (e.g., for high-throughput cytotoxicity screenings and further multiple applications); Microtox® FX Test System (Modern Water)	49.595.256
Σ		162.074.379

further extend the existing culture collection of sub-Arctic and polar clonal protist strains and invertebrates in the upcoming 5-10 years as basis for future projects, educating students and company personnel.

#### 6. Aætluð fjármögnunarförf næstu ár

The overall costs of the center are estimated with **162.074.379 kr**, including the equipment for all named facilities (1-5) in the paragraph above.

**Table 1.** Estimated financing needs of the TerraMareIceland