

DAGSKRÁ ÁGRIP ERINDA OG VEGGSPJALDA



Vistís/EcoIce
28. apríl 2022
Í fundarsal Hafrannsóknastofnunar
Fornubúðum 5, Hafnarfirði

Vistfræðifélag Íslands

Vistís 2022 / EcoIce 2022 Dagskrá / Program

08:15 HÚS OPNAR / HOUSE OPENS

08: 30 SETNING OG ÁVARP FORSETA VISTFRÆÐIFÉLAGS ÍSLANDS /
CONFERENCE OPENING AND WELCOME WORDS FROM THE
VISTFRÆÐIFÉLAG'S CHAIR – Freydís Vigfúsdóttir

08: 40 ÁVARP HAFRANNSÓKNARSTOFNUNAR / WELCOME WORDS FROM
HAFRANNSÓKNASTOFNUN – Þorsteinn Sigurðsson, Director of MRFI

08: 55 TILKYNNINGAR OG UPPHAF MÁLSTOFA / GENERAL HOUSEKEEPING AND
START OF SESSIONS - VISTÍS board

09:00 MÁLSTOFA I / SESSION I – ÞURRLendis VISTFRÆÐI / TERRESTRIAL
ECOLOGY

Chair: Sandra Granquist

09:00 [Winter distribution of Iceland breeding Oystercatchers - The Icelandic Oystercatcher's guide to the winter](#)

Sölvi Rúnar Vignisson, Böðvar Þórisson, Veronica Mendez, José Alves, Jörundur Svavarsson, Jenny Gill, Tómas Grétar Gunnarsson

09:13 [Effects of land conversion in sub-arctic landscapes on densities of ground-nesting birds](#) *Aldís Erna Pálsdóttir, Jennifer A. Gill, José A. Alves, Snæbjörn Pálsson, Verónica Méndez, Tómas G. Gunnarsson*

09:26 [The effects of demography, habitat quality and behaviour on shaping the population dynamics of Icelandic whimbrels](#)

Maite Cerezo-Araujo, José A. Alves, Camilo A. Carneiro, Gunnar Þór Hallgrímsson, Tómas G. Gunnarsson

09:39 [Do whimbrel chicks find enough food in Iceland?](#)

Camilo Carneiro, Tómas G. Gunnarsson, José A. Alves

09:52 [Estimation of population dynamics in white-tailed eagles in Iceland and Greenland based on analysis of whole genome data](#)

Áki Jarl Lárusson, Charles C. R. Hansen, Snæbjörn Pálsson

10:05 KAFFIHLÉ OG VEGGSPJÖLD / COFFEE BREAK AND POSTER SESSION (15
MIN)

10:20 MÁLSTOFA II / SESSION II – LÍFFRÆÐILEG FJÖLBREYTNÍ OG
VERNDARLÍFFRÆÐI / BIODIVERSITY AND CONSERVATION

Chair: Hrönn Egilsdóttir

10:20 [Managing problematic plants in Reykjavík](#)

Mervi Orvokki Luoma, Mariana Lucia Tamayo

10:33 [Pseudomonas syringae on Plants in Iceland Has Likely Evolved for Several Million Years Outside the Reach of Processes That Mix This Bacterial Complex across Earth's Temperate Zones](#)

Natalia Ramírez, Cindy Morris, Oddur Vilhelmsson, Margrét Auður Sigurbjörnsdóttir

10:46 [Faecal nutrient contribution of different herbivore species on an alpine ecosystem](#)

Laura Barbero-Palacios, Emmanuel Serrano, Isabel C. Barrio, José Antonio Carreira, Jennifer Adams Krumins

10:59 [Iceland: A Hotspot for Intraspecific Diversity?](#)

Anthony James Schultz, BIODICE network

11:12 [Restoring wetlands, streams and lakes for fishes](#)

Jóhannes Guðbrandsson, Ásgerður Elín Magnúsdóttir, Ingólfur Pétursson, Iðunn Hauksdóttir, Hlynur Óskarsson

11:25 KAFFIHLÉ OG VEGGSPJÖLD / COFFEE BREAK AND POSTER SESSION (25 MIN)

11:50 MÁLSTOFA III / SESSION III – VISTFRÆÐI HAFS OG VATNA / AQUATIC ECOLOGY I

Chair: Guðmundur J. Óskarsson

11:50 [A new laboratory to investigate the impact of multiple drivers on ocean life](#)

Einar Pétur Jónsson, Agnar Steinarrson, Hrönn Egilsdóttir, Ragnar Jóhannsson, Tómas Árnason

12:03 [Ecology of digenean infections in the common whelk *Buccinum undatum* – a case study from Breiðafjörður, Iceland](#)

Hildur Magnúsdóttir, Árni Kristmundsson, Snæbjörn Pálsson, Zophonías O. Jónsson, Erla Björk Örnólfsdóttir

12:16 [There's no place like home: How host physiology shapes symbiont microniches in a marine symbiosis](#)

Marta Sudo, Vesna Micic Batka, Jay Osvatic, Benedict Yuen, Thorsten Hueffer, Jillian Petersen

12:29 [The social aspects of biological invasions – involving stakeholders in the research on the establishment of the European flounder \(*Platichthys flesus*\) in Iceland](#)

Theresa Henke, Guðbjörg Ásta Ólafsdóttir

12:42 HÁDEGISHLÉ / LUNCH BREAK (50 MIN)

13:25 MÁLSTOFA IV / SESSION IV – VISTFRÆÐI HAFS OG VATNA / AQUATIC ECOLOGY II

Chair: Hlynur Bárðason

13:25 [How is spatial cognition shaped in sympatric morphs of Arctic charr from Vatnshlíðarvatn?](#)

Sabine Lobligeois, Marion Dellinger, Margaux Van Hussel, David Benhaïm

13:38 [Are environment and personality impacting the learning abilities of a wild anadromous Arctic charr population \(*Salvelinus alpinus*\)?](#)

Margaux Vanhussel, Marion Dellinger, Gabrielle Ladurée, David Benhaim

13:51 [Spatial Ecology of Sympatric Juvenile Atlantic Cod and Saithe at Nursery Grounds](#)

Anja Katrin Nickel, Guðbjörg Ásta Ólafsdóttir

14:04 [Inter and intraspecific variation in how anthropogenic impact correlates with near-shore fish movement](#)

Michelle L. Valliant, Guðbjörg Ásta Ólafsdóttir

14:17 KAFFIHLÉ OG VEGGSPJÖLD / COFFEE BREAK AND POSTER SESSION (40 MIN)

15:00 PALLBORÐSUMRÆÐA UM HLUTVERK STOFNANA Í ÞJÁLFUN FRAMHALDSNEMA / PANEL DISCUSSION ON THE ROLE OF RESEARCH INSTITUTES IN GRADUATE STUDENT DEVELOPEMENT

17:00 AÐALFUNDUR / ANNUAL GENERAL MEETING

17:30 VEGGSPJÖLD OG VEITINGAR / POSTERS AND REFRESHMENTS

POSTERS

[Cool biocrust: A long-term warming experiment with subarctic biological soil crust](#)

Alejandro Salazar, Ólafur Andrésson

[A Whale Trail for Iceland: How to realize Iceland's potential for land-based marine mammal observation](#)

Barbara K. Neubarth, Verónica Méndez Aragón, Paul J. Wensveen

[Acoustic behaviour of the northern bottlenose whale \(*Hyperoodon ampullatus*\) within the North Atlantic soundscape](#)

Caroline E. Haas, Patrick J. O. Miller, Sascha K. Hooker, Jörundur Svavarsson, Paul J. Wensveen

[Using parasites for stock discrimination of Icelandic cod](#)

Francesco Golin, Haseeb Randhawa

[Assessment of diversity of macroinvertebrates in freshwater springs using eDNA](#)

Hafrún Gunnarsdóttir, Agnes-Katharina Kreiling, Bjarni K. Kristjánsson, Snæbjörn Pálsson

[TUNDRAsalad: evaluating the role of herbivore diversity on tundra ecosystems](#)

Isabel C. Barrio, Laura Barbero-Palacios, Noémie Boulanger-Lapointe, Mathilde Defourneaux, David S. Hik, Elina Kaarlejärvi, Eeva M. Soininen, James D. M. Speed, and the TUNDRA salad team

[The Puffling Patrol: A citizen-science initiative to monitor the number and state of Atlantic Puffin fledglings during the fledging season in Heimaey Island, Vestmannaeyjar](#)

Margrét Lilja Magnúsdóttir, Gígja Óskarsdóttir, Erpur Snaer Hansen, Rodrigo A. Martinez Catalan

[Assessing long-term changes in vertebrate herbivore communities and herbivory pressure across Iceland over seven decades](#)

Mathilde Defourneaux, Noémie Boulanger-Lapointe, James D. M. Speed, Isabel C. Barrio

[Relationship between plant palatability and ecosystem conditions in the Icelandic grazing commons](#)

Noémie Boulanger-Lapointe, Ian Klupar, Bryndís Marteinsdóttir, Rán Finnsdóttir, Ingibjörg Svala Jónsdóttir

[Biodiversity as preservation of difference](#)

Ole Martin Sandberg, Skúli Skúlason, Anthony Schultz

[Urban bird diversity: does abundance and richness vary unexpectedly with green space attributes?](#)

Rebecca Thompson, Mariana Tamayo, Snorri Sigurðsson

[The status of the Icelandic harbour seal \(*Phoca vitulina*\) population: 40 years of monitoring trends \(1980-2020\) and the current threats to the population](#)

Sandra M. Granquist

[Effect of physical enrichment on the brain shape of Arctic charr Large Benthic morph from Lake Þingvallavatn](#)

Ylva Poirier, Alannah Gourlaouen, Marion Dellinger, Leslie Lafouasse, David Benhaïm

ÁGRIP ERINDA / PRESENTATION ABSTRACTS

MÁLSTOFA I / SESSION I – ÞURRLENDIS VISTFRÆÐI / TERRESTRIAL ECOLOGY

Winter distribution of Iceland breeding Oystercatchers - The Icelandic Oystercatcher's guide to the winter

Sölvi Rúnar Vignisson^{1,2}, Böðvar Þórisson², Veronica Mendez², José Alves^{2,3}, Jörundur Svavarsson⁴, Jenny Gill⁵, Tómas Grétar Gunnarsson²

1. Þekkingarsetur Suðurnesja
2. Rannsóknarsetur Háskóla Íslands á Suðurlandi
3. University of Aveiro
4. Háskóli Íslands
5. University of East Anglia

From the initiation of bird ringing in Iceland in 1921 to 2019, a total of 11 408 Oystercatchers have been metal-ringed, mostly as unfledged chicks (9 513). A colour ringing project started in 2013 by the Research Centre in South Iceland. Since then 743 adult oystercatchers, two juveniles and 448 unfledged chicks have been colour ringed. Additionally 16 Oystercatchers were equipped with Druid GSM/GPS tags. We used these recoveries, sightings and tracks to infer the migration routes and winter distribution of Icelandic Oystercatchers. The distribution of ring recoveries suggests that most Icelandic-breeding Oystercatchers migrate to Ireland and the British Isles while the non-migrating part winters in western Iceland (Faxaflói and Breiðafjörður). We provide the first formal account of ring recoveries of Icelandic Oystercatchers.

Effects of land conversion in sub-arctic landscapes on densities of ground-nesting birds

Aldís Erna Pálsdóttir^{1,2}, Jennifer A. Gill³, José A. Alves^{1,3,4}, Snæbjörn Pálsson², Verónica Méndez^{1,5}, Tómas G. Gunnarsson¹

1. South Iceland Research Centre, University of Iceland
2. Department of Biology, University of Iceland
3. School of Biological Sciences, University of East Anglia
4. Department of Biology & CESAM, University of Aveiro
5. University Centre of the Westfjords

Habitat loss and degradation are major drivers of biodiversity declines on a global scale. Habitat loss often occurs through fragmentation of natural areas by anthropogenic features and infrastructure. Although highly fragmented habitats have been studied intensively, less is known about the initial effects of habitat fragmentation, when single structures are introduced into large areas of natural habitat. The introduction of anthropogenic features can affect ground-nesting birds by reducing the amount and/or quality of available habitat, which could result in local declines in breeding abundance. In Iceland, one of the most important areas for breeding waders in Europe, anthropogenic developments outside urban areas are in their infancy. The Icelandic lowlands still contain large areas of semi-natural wetlands, grasslands and heathlands, which hold large breeding populations of a range of ground-nesting waders (e.g. Golden Plover (*Pluvialis apricaria*), Whimbrel (*Numenius phaeopus*), Redshank (*Tringa totanus*), Dunlin (*Calidris alpina*) and Black-tailed Godwit (*Limosa limosa*)). These habitats are being increasingly fragmented by roads, summer houses, power lines and forest plantations. Here we quantify how wader density and distribution vary in relation to anthropogenic features, and use these findings to estimate the potential scale of impact of these features in lowland Iceland and provide guidelines for future measures to reduce impacts and maintain the species and their habitats.

The effects of demography, habitat quality and behaviour on shaping the population dynamics of Icelandic whimbrels

*Maite Cerezo-Araujo*¹, *José A. Alves*^{1,2}, *Camilo A. Carneiro*¹, *Gunnar Þór Hallgrímsson*³, *Tómas G. Gunnarsson*¹

1. South Iceland Research Centre, University of Iceland, Laugarvatn, Iceland
2. Department of Biology, CESAM, University of Aveiro, Aveiro, Portugal
3. Institute of Biology, University of Iceland

Investigating drivers of population dynamics is essential to understand population trends and persistence and to develop appropriate conservation and management strategies. Population dynamics are driven by both density dependent and density independent factors. In a natural system where species are competing for resources, the order of resource use can be determined by the individual's ability to outcompete conspecifics at suboptimal conditions of high population density. The outcome of these interactions will be reflected in differences in demographic rates and ultimately in population size.

In this 3-year study, we investigated mechanisms driving Icelandic whimbrel (*Numenius phaeopus islandicus*) population dynamics in south Iceland, one of the most important breeding grounds for waders in Europe. To do so, we explored the relationships between breeding density, breeding success, breeding behaviour and different parameters of habitat quality along a continuous gradient of whimbrel density, ranging between 3 to 40 pairs per km², and across three habitat types that vary in quality: river plains, heathland, and moss-heath. We found highest breeding densities and strongest anti-predator behaviour at river plains, where more potential food resources are present. Interestingly, breeding success did not follow this trend and was stable across habitats, at different adult densities and at different levels of food resources, suggesting that density dependent mechanisms may regulate breeding output of whimbrels in South Iceland.

Do whimbrel chicks find enough food in Iceland?

Camilo Carneiro^{1,2}, *Tómas G. Gunnarsson*¹, *José A. Alves*^{1,2}

1. South Iceland Research Centre, University of Iceland, Lindarbraut 4, IS-840 Laugarvatn, Iceland
2. Dep. Biology & CESAM, University of Aveiro, Campus de Santiago, 3810-193 Aveiro, Portugal

Trophic mismatches are among the multiple effects of global warming. Typically, they occur when consumers fail to alter their phenology at the same pace as their resources, resulting in asynchrony between resource availability and demand, often with negative consequences, such as lower productivity or lower growth rates of the progeny. Between breeding birds and their food resources, mismatches are often assessed by comparing the peak of demand (e.g., hatching date) and peak of resource availability (e.g., arthropod biomass). However, synchronisation of demand and availability should be considered in the light of the minimum food threshold required for growth, since it is below that level where fluctuation in resources is relevant.

To investigate how Icelandic whimbrel *Numenius phaeopus islandicus* may respond to warming temperatures, we begin by assessing whether the chicks can be limited by food resources during growth. To accomplish that, we collected data on crowberry and invertebrate abundance, and measured the chicks at 3-day intervals; additionally, we collected their droppings to identify prey selection. With this information we are now able to

describe chicks' diet and investigate potential effects of resources' abundance on chick development.

Estimation of population dynamics in white-tailed eagles in Iceland and Greenland based on analysis of whole genome data

Áki Jarl Lárusson¹, Charles C. R. Hansen¹, Snæbjörn Pálsson¹

1. University of Iceland, Institute of Life and Environmental Sciences

Historically, populations of white-tailed eagles (*Haliaeetus albicilla*) have dispersed broadly across the Eurasian continent, with populations identified on the islands of Greenland and Iceland as the westernmost points of their range. These populations have anecdotally undergone significant demographic shifts in parallel with major events in human population expansion and development over the last 1,000 years. In a recent PhD thesis, Charles Hansen, using both contemporary and historic genomic samples from eagle populations across Iceland, Greenland, and northwest Europe, reported a strong signature of population structure across this range, and signatures of shifting genetic variation over time within the island populations. Here we assess further the demographic processes behind the differentiation of the island populations from the mainland by modelling geneflow and fluctuations in populations size over time, using coalescent simulations. In addition, we extend the previous analyses by reducing the data set to independently segregating nucleotide variants throughout the genome. Model comparisons support that geneflow has been unidirectional in the settlement of the islands and supports previous signatures of the possible impact of human activities on these eagle populations over time.

MÁLSTOFA II / SESSION II – LÍFFRÆÐILEG FJÖLBREYTNÍ OG
VERNDARLÍFFRÆÐI / BIODIVERSITY AND CONSERVATION

Managing problematic plants in Reykjavík

Mervi Orvokki Luoma¹, Mariana Lucia Tamayo¹

1. Environment and Natural Resources, Faculty of Life and Natural Sciences, University of Iceland

Invasive and alien species, such as Nootka lupine (Lúpina = *Lupinus Nootkatensis*), cow parsley (Skógarkerfill = *Anthriscus sylvestris*), and sweet cicely (Spánarkerfill = *Myrrhis odorata*), can threaten urban biodiversity and negatively impact the functioning and health of urban ecosystems. Developing management strategies to monitor and control the spread of these species is essential. These strategies can include mapping distribution, public outreach and awareness, and actively controlling these problematic plants. Several management actions were implemented during the summer of 2021, which included mapping the distribution of Nootka lupine in protected areas and launching an outreach campaign about sweet cicely and cow parsley in Reykjavík. Our management efforts, public events and social media presence were a collaboration with the City of Reykjavík, Reykjavík Botanical Garden, and Flóran Garden Bistro. We generated updated and detailed distribution data of Nootka lupine for Fossvogsbakkar and Laugarás protected areas. Our events reached nearly 14,000 people via social media with nearly 100 people responding and 30 attending. The events were focused on learning how to recognize and manage cow parsley and sweet cicely, as well as how to use them for cooking, helping to increase public awareness in a fun and interactive way. The knowledge gained and lessons learned from these management efforts will be used to further develop and implement local and Nordic management strategies for invasive species in urban areas. We will continue this collaboration project in 2022.

***Pseudomonas syringae* on Plants in Iceland Has Likely Evolved for Several Million Years Outside the Reach of Processes That Mix This Bacterial Complex across Earth's Temperate Zones**

Natalia Ramírez¹, Cindy Morris¹, Oddur Vilhelmsson¹, Margrét Auður Sigurbjörnsdóttir¹
Háskólinn á Akureyri

Cultivated plants have been the major focus of phyllosphere microbiology, and for plant pathogens in particular. Even when weed and wild plant microflora are surveyed and plant pathogens detected, the hypothesis of spillover from cropped plants cannot always be eliminated. In a setting with low potential for spillover from crops, we assessed the abundance and diversity of *Pseudomonas syringae* on mosses, ferns and angiosperms from prairies and grasslands, moors, and wetlands, in lowlands, alpine and arctic regions in Iceland where agriculture accounts for only 1% of this remote island's land surface. *P. syringae* was detected on all plant types (moss, fern, angiosperms) at 1000 – 6 x 10⁷ cells/g of leaves at 31 sites on the west, north and east coasts of Iceland that were sampled from 2018 - 2020. Nearly all known *P. syringae* phylogroups (PG) were detected, with PG10 dominating and PG02 found only on cultivated pasture grass.

Faecal nutrient contribution of different herbivore species on an alpine ecosystem

Laura Barbero-Palacios¹, Emmanuel Serrano², Isabel C. Barrio¹, José Antonio Carreira³, Jennifer Adams Krumins⁴

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2. Wildlife Ecology & Health group (WE&H) and Servei d'Ecopatologia de Fauna Salvatge (SEFaS), Departament de Medicina i Cirurgia Animals, Facultat de Veterinària, Universitat Autònoma de Barcelona (UAB), Bellaterra, Barcelona, Spain
3. Departamento de Biología Animal, Vegetal y Ecología, Universidad de Jaén, Jaén, Spain
4. Department of Biology and Molecular Biology, Montclair State University, Montclair, NJ, USA

One pathway through which herbivores contribute to nutrient cycling and ultimately affect ecosystem functioning is dung and urine deposition. This mechanism is particularly relevant in nutrient-limited northern and alpine ecosystems. However, the contribution of different herbivores to soil nutrient cycling will differ between herbivore species because of their varied diet choices and energy requirements. In this study, we analyse for the first time the monthly contribution of faecal carbon, potassium, phosphorous, and nitrogen of an alpine herbivore assemblage consisting of a wild herbivore (chamois) and three free-roaming livestock species (sheep, horse, and cow) in the Spanish Pyrenees over the summer months (June to October). We found variation in nutrient concentration over time and between the species for the four nutrients. Nutrient concentration largely followed plant phenology, with higher levels of potassium, phosphorous and nitrogen earlier in the summer but declining thereafter, while carbon increased towards the end of the growing season. Horse faeces were in general richer in potassium, whereas sheep faeces were richer in carbon, phosphorous, and nitrogen. Our results show that the composition of herbivore assemblages can have a large influence of the amount and seasonal distribution of nutrient deposition by herbivores that should be accounted for when modelling nutrient cycling in northern and alpine ecosystems. These results are also very relevant to Iceland where different herbivores, both domestic and wild, coexist in the summer tundra rangelands.

Iceland: A Hotspot for Intraspecific Diversity?

Anthony James Schultz¹, BIODICE network

1. Icelandic Museum of Natural History/NMSÍ

There is a consensus within the scientific community of the importance of biological diversity for sustaining ecosystem function, buffering against environmental pressures, and supporting evolutionary change. At the same time, the loss of biodiversity worldwide has been more pronounced in the last 100 years than previously documented.

Critically, the application of biodiversity concepts across research, policy, and education, often treat species-level diversity as the primary organisational level of biodiversity. Such approaches typically ignore the full spectrum of biodiversity, from individuals to ecosystems, along with the ongoing processes and relationships within and between organisational levels of biodiversity. This is an important oversight, as increasing evidence shows that different scales of biodiversity can have significant functional impacts on ecosystem processes – e.g. intraspecific variation.

Iceland's geographical isolation, climatic history, recent deglaciation, and young geology have resulted in low species numbers – although the same processes have produced highly heterogeneous environments, driving high levels of intraspecific variation. Iceland is therefore an excellent case study for biodiversity research.

There are well documented examples of this (e.g. resource polymorphism in Arctic charr), but there exist many more novel examples of intraspecific variation in Iceland. Here we will highlight Iceland's unique biodiversity by presenting diverse examples across taxa, suggesting that Iceland may be a biodiversity hotspot for intraspecific variation. Further, we propose that Iceland is a key global case study for understanding the processes which generate, shape and maintain different levels of biodiversity, as well as reassessing how we conceptualise and work with biodiversity concepts.

Restoring wetlands, streams and lakes for fishes

Jóhannes Guðbrandsson¹, Ásgerður Elín Magnúsdóttir¹, Ingólfur Pétursson^{1,2}, Iðunn Hauksdóttir², Hlynur Óskarsson¹

1. Landbúnaðarháskóli Íslands
2. Landgræðslan

Wetland restoration is one of the main pillars of Iceland's fight against climate changes due to carbon emission from drained wetlands. Wetlands are also an important habitat for various organism. In Iceland lakes and streams in wetlands form an important habitat for the European eel (*Anguilla anguilla*) and salmonids, especially brown trout (*Salmo trutta*). Eel spawns at sea but spends most of its live growing in freshwater whereas brown trout spawns in streams but migrates to sea or lakes for feeding. Clear migration routes are therefore important for these species.

Draining of wetlands in the last century most likely had a negative effect on these species by destroying or degrading habitats and cutting off migration routes. It is therefore essential to consider the life history of freshwater fishes when wetlands are being restored.

We initiated a project to look at the ecological benefits of restoring wetlands, streams and lakes in a small watershed, referred to as Kálfalækur watershed, in Mýrar West Iceland. Barriers to migration and fish habitat were mapped in natural streams and streams affected by drainage. We looked at juvenile density and fish species composition at multiple sites. We are working on estimating changes in watershed area, wetness, lake size and channel length before and after restoration from an elevation model and other geographic information.

We assume restoration of this area will yield better habitat for the endangered eel and recreational fishing of bigger brown trout population could provide financial gain for landowners.

MÁLSTOFA III / SESSION III – VISTFRÆÐI HAFS OG VATNA / AQUATIC ECOLOGY I

A new laboratory to investigate the impact of multiple drivers on ocean life

Einar Pétur Jónsson¹, Agnar Steinarsson¹, Hrönn Egilsdóttir¹, Ragnar Jóhannsson¹, Tómas Árnason¹

1. Hafrannsóknastofnun, rannsókn- og ráðgjafastofnun hafs og vatna / Marine and Freshwater Research Institute

It's important to understand and predict the impact that both large- and small-scale environmental changes have on marine organisms and ecosystems. From physiological to ecosystemic effects, there is a need to understand life's response to future environments. There has been limited potential for experimentation to study the impact of environmental variability on organisms in Iceland due to a lack of infrastructure.

Work is now underway to set up a new state-of-the-art experimental laboratory well equipped to test hypotheses on the effects of different drivers on marine organisms. The laboratory is situated in the Marine and Freshwater Research Institute's aquaculture research station on the Reykjanes peninsula, Iceland. The station makes use of fresh groundwater, geothermally heated water (60°C) and borehole seawater that has been naturally filtered through the basalt bedrock.

The laboratory will allow for temperature and carbon chemistry manipulation (to study ocean acidification) for each of its 45 tanks and provides 5 different temperatures simultaneously (9 tanks per temperature). It will also be possible to study the effects of various other environmental parameters. Each tank has a 60 cm diameter and offers the possibility to experiment on organisms such as invertebrates, fish and algae. Initial experiments include testing the effect of pH and temperature levels on fish larvae and evaluating the calcification and dissolution rates of calcifying algae.

Ecology of digenean infections in the common whelk *Buccinum undatum* – a case study from Breiðafjörður, Iceland

Hildur Magnúsdóttir¹, Árni Kristmundsson¹, Snæbjörn Pálsson², Zophonías O. Jónsson², Erla Björk Örnólfsdóttir³

1. Institute of Experimental Pathology, University of Iceland, Keldur, Reykjavík, Iceland
2. Faculty of Life and Environmental Sciences, University of Iceland, Reykjavík, Iceland
3. Department of Aquaculture and Fish Biology at Hólar University, Hólar, Iceland

Host-parasite interactions are important drivers of biodiversity and ecosystem dynamics. The most ubiquitous and numerous parasitic helminths, the digeneans, depend on gastropods as intermediate hosts in marine systems; among them the large, long-lived whelk from the Buccinoidea superfamily (order Neogastropoda). Digeneans are very dependent on their hosts and are affected among other things by the host species' population connectivity and predator-prey relations.

Overall, marine systems suffer from a paucity of knowledge on geographical patterns, population connectivity and biodiversity. Furthermore, ecological studies of marine host-

parasite interactions are relatively few, and particularly so in benthic environments. Resolving the ecology of digenean infections in buccinid gastropods is an important step towards advancing our knowledge of the complex spatial and species associated biodiversity of marine systems.

In the current project, *Buccinum undatum* L., 1758, the type species of the *Buccinum* genus, in Breiðafjörður, Iceland, was used as a model system for the relationship of ecological variables, life-history traits, and shell morphology to prevalence and intensity of digenetic infections in buccinid gastropods. Whelks were sampled with baited traps in five areas in the inner part of Breiðafjörður, W-Iceland, monthly between June 2007 to the end of 2008. Gross clinical signs were used to determine presence/absence of digenean infections. Environmental variables studied included latitude and longitude, depth, and substrate type. Host life-history traits taken into account were: sex, sexual maturity, shell height and age. Shell morphology was based on traditional morphometrics of shell and aperture.

There's no place like home: How host physiology shapes symbiont microniches in a marine symbiosis

Marta Sudo, Vesna Micic Batka, Jay Osvatic, Benedict Yuen, Thorsten Hueffer, Jillian Petersen

1. Department of Microbiology and Ecosystem Science, Centre for Microbiology and Environmental Systems Science, University of Vienna, Austria
2. Department of Environmental Geosciences, Centre for Microbiology and Environmental Systems Science, University of Vienna, Austria

Symbiotic associations with microbes have allowed many animal species to acquire new biological functions and expand their niche, increasing their fitness. This is also true of lucinidae, the most species-rich family of symbiotic bivalves. All lucinids associate with sulphur-oxidizing bacteria, their own intracellular primary producers that provide them with nutrition. Due to their intracellular localization, symbionts depend entirely on the host to supply sulphide and thiosulphate, their energy sources. Although numerous symbiont genotypes are known, all encode highly conserved sulphur oxidation pathways. Since multiple lucinid host species often co-occur in the same habitat, with symbionts that seem to have identical requirements, the question arises how these co-occurring host and symbiont pairs avoid competition. We aimed to investigate the physiology of two co-occurring host-symbiont pairs by HPLC quantification of sulphide and thiosulfate in the animal tissues, and with CHNS elemental analysis of total sulphur content. Thiosulfate concentrations in both species were up to 300 times higher than the surrounding environment, thus, both shape the microhabitat of their symbionts by accumulating energy sources from the environment. In addition, one species had significantly higher sulphide and thiosulphate concentrations creating a unique symbiotic niche. Meanwhile, the second pair had strikingly high sulphur content, up to 15% of dry weight of the animal, consistent with storage of elemental sulphur granules by the symbionts as a metabolic intermediate. This shows that despite remarkable genetic similarity, these animals and their symbionts show distinct physiological adaptations that may explain the basis of niche partitioning and their stable coexistence.

The social aspects of biological invasions – involving stakeholders in the research on the establishment of the European flounder (*Platichthys flesus*) in Iceland

Theresa Henke, Guðbjörg Ásta Ólafsdóttir

1. University of Iceland Research Center of the Westfjords

Biological invasions and their impacts have attracted scientific attention since the 1960s'. Most often, invasion science has focused solely on biological and ecological perspectives, vastly ignoring anthropogenic factors. Considerations of human and social perspectives have increasingly gained attention. Involving these components enables scientists to understand inflicted changes beyond ecological levels and offers opportunities to gather data from people directly impacted. As a case study, stakeholders were involved in research on European flounder (*Platichthys flesus*) in Iceland. The objective was to understand their perception of this species and to collect further data on its distribution. *P. flesus* has been reported in Iceland since 1999 and can currently be found in most parts of Iceland. Considering that *P. flesus* co-occurs with valuable salmonids in freshwater habitats, recreational fishermen and managing parties were identified as important stakeholders. Using anonymous online surveys, stakeholders were asked to answer questions about their knowledge and previous experiences with *P. flesus*. To investigate their perception, participants were asked to rank their agreement on statements concerning *P. flesus*. Additionally, semi-structured interviews were held to gain a better understanding of what drives people's perception. Over 100 locations have been collected on *P. flesus* encounters, strongly improving previous distribution maps. Furthermore, the results indicate not only a highly negative perception among the recreational fishing sector but also outline specific concerns regarding *P. flesus*' impacts on native species. For international comparison, a similar survey was conducted in countries throughout *P. flesus*' native range, revealing a strong difference between Iceland and native countries.

MÁLSTOFA IV / SESSION IV – VISTFRÆÐI HAFS OG VATNA / AQUATIC ECOLOGY II

How is spatial cognition shaped in sympatric morphs of Arctic charr from Vatnshlíðarvatn?

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Spatial cognitive abilities enable animals to navigate in their environment and perform their vital functions. Thus, spatial cognitive abilities are part of fitness determination and submitted to selection. Like other traits, cognition has a genetic basis and is plastic, i.e. influenced by the environment to some extent. Here, we compared the spatial cognitive abilities of the two sympatric morphs of Arctic charr (*Salvelinus alpinus*) from Vatnshlíðarvatn Lake (Iceland), reared from egg stage in common garden either in plain or enriched treatments to investigate genetic basis and plasticity of these traits. In a T-maze, we firstly focused on the learning performance to achieve a task (choosing the side signaled by a landmark 9 times out of 10 consecutive training trials). In a second step, we assessed the navigation strategy used by the fish to orient (motor response versus beaconing) by placing the landmark on the opposite side of the training configuration). In a first step, we recorded the learning performance, given by the number of trials needed to reach a criterion, and in a second step, we placed the landmark on the opposite side of the previous configuration to assess the strategy (motor response *versus* beaconing) used by the fish, in a conflict test. We

expected (1) the physical enrichment regardless of the morph type to promote higher learning rate and use of a beaconing strategy, (2) the Silver morph to show higher learning rate and use of a beaconing strategy because of the higher variability of its environment and life style. Unlike our predictions, preliminary results seem to show no effect of the rearing environment on the learning performance, higher learning performance in the Brown morph, and no difference regarding the cognitive strategy between treatments and morphs i.e., the motor response is observed in any case. We discuss the preliminary results of this study in the context of ecological differences between both morphs and treatments.

Are environment and personality impacting the learning abilities of a wild anadromous Arctic charr population (*Salvelinus alpinus*)?

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Environmental complexity and enrichment were shown to impact mental processes for orientation in space, i.e. spatial cognition, in various fishes. Nevertheless, no study has been led on the Arctic charr to our knowledge. Moreover, studies also seem to connect personality and individual learning e.g., bolder and shyer individuals express different behaviours when placed in a new environment. Therefore, we investigated whether personality could influence spatial learning performance. With its evolutionary gradient of morphological and genetic divergence within populations, this species makes a good model for studying evolutionary processes such as cognition. An exploratory approach was used to investigate whether spatial learning abilities of juvenile anadromous morphs of Arctic charr are influenced by the rearing environment (enriched vs plain), and/or personality. Fish (N=19) were individually placed in a T-maze designed to assess spatial learning performance. They had, each day, two sessions of three training trials to learn to choose a particular side until reaching the learning criterion (i.e., choose the correct side nine times out of ten trials in a row). All the training sessions were video recorded, and variables potentially related to the learning performance were extracted. We predicted that (1) individuals raised in an enriched environment would show a higher learning rate than individuals from a plain environment; (2) Shyer individuals would learn more efficiently than bolder ones. Here we discuss the preliminary results of this study.

Spatial Ecology of Sympatric Juvenile Atlantic Cod and Saithe at Nursery Grounds

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Knowledge on animal movement can greatly enhance our understanding of species' biological functions and interactions with their environment. Little is known about the movement and dispersal of juvenile marine fish in Iceland, although this knowledge would be very applicable to management and protection of nursery grounds. Iceland's coastal waters provide nursery grounds to juvenile Atlantic cod (*Gadus morhua*) and saithe (*Pollachius virens*), where juveniles spend the first 2 to 4 years of life. Environmental conditions such as temperature, as well as variation in diel pattern and habitat associations are likely to have strong effects on juvenile distribution and migration from nurseries. Furthermore, differences in the small scale movement between species, population and individuals can unveil adaptations which allow closely related species, such as the sympatric cod and saithe juveniles to coexist.

This study uses acoustic telemetry to directly measure inter- and intraspecific differences in fish movement and examine the effect of environmental factors on the juveniles' spatial

ecology. The juveniles' movement was studied in a network consisting of 33 receivers in 6 gates across Seyðisfjörður (Ísafjarðardjúp). A total of 53 juvenile cod and 33 juvenile saithe were tagged internally with acoustic transmitters (battery life of 3 months) and released in late summer 2020 and 2021. From the telemetry data mortality, winter migration, activity, directional movement, depth distribution, and diurnal variation in these traits, were compared between individuals and species and related to environmental data. Results reveal a strong impact of environmental factors as, well as inter- and intraspecific variation on juveniles' movement and migration.

Inter and intraspecific variation in how anthropogenic impact correlates with near-shore fish movement

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Fish movement distributes consumer nutrient energy within food webs. However, movement can be altered due to anthropogenic impact on abiotic (i.e. temperature) and biotic (i.e. non-native species) factors in the fish's environment with consequences for resource distribution and timing of life-history events (i.e. migration). Icelandic nearshore waters are nursery habitats for early life-stages of many marine fish and foraging habitats for anadromous fish. The current study focuses on Arctic charr (*Salvelinus alpinus*), brown trout (*Salmo trutta*), Atlantic cod (*Gadus morhua*), and saithe (*Pollachius virens*), and the possible different impacts by stressors, both individually and by species. Such small-scale differences may result in altered niche use, shifts in competitive interactions, and species life-history. The current study focuses on the behaviour leading up to the onset of deeper offshore water migration and will examine what environmental factors trigger early life decisions. Consequently, the following question is addressed: Do environmental or anthropogenic drivers (temperature, sea cages, etc.) shape the distribution, movement, and behaviour (activity) of these marine and anadromous fish species? An acoustic telemetry array is planned in Dýrafjörður to track the movement and migration of the species, determining their distribution, depth, environmental temperature and (from a subset of fish) swimming activity. The data will be related to environmental conditions in the fjord and other stressors (i.e. sea cages). Here I present preliminary data on the movement of all the species, including depth and temperature profiles across species and individuals, and discuss the findings in the context of niche segregation caused by temperature preferences/avoidance.

ÁGRIP VEGGSPJALDA / POSTER ABSTRACTS

Cool biocrust: A long-term warming experiment with subarctic biological soil crust

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Experimental research on biological soil crust (biocrust) has been key for understanding the effects of climate change on arid and semi-arid ecosystems. However, when it comes to biocrust from cool and mesic environments, almost all the available data comes from observational studies, e.g. chronosequences after a glacier retreat. This kind of biocrust covers vast areas in Iceland and other subarctic regions. In 2018, we established what to our understanding is the first long-term warming experiment on a cool and mesic subarctic

biocrust habitat. We followed protocols standardized by the International Tundra Experiment and the Tea Bag Index network, so our research contributes to large-scale, international initiatives. A warming of +1-2 °C, for 1-4 years, has clearly affected the composition and function of the biocrust-dominated ecosystem, including changes in the structure of the aboveground community and an acceleration of decomposition rates, at different depths and both of organic matter composed of labile and recalcitrant carbon. Some features of the ecosystems changed after only a few months of simulating warming, raising the question whether cool biocrust, and the ecosystem services that it provides, are particularly sensitive to climate change.

A Whale Trail for Iceland: How to realize Iceland's potential for land-based marine mammal observation

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Whale trails are marine mammal themed walks, routes or networks along coastlines that enjoy increasing popularity abroad. Most human interactions with whales in Iceland currently occur during boat-based whale watching, research, or fishing activities. Whale trails may provide the public the opportunity to observe marine mammals in an accessible and less invasive way than from a vessel. Themed trails or walks exist throughout the country focusing on terrestrial aspects such as birds, botany, or history. Not many marine-themed initiatives can be found. This project set out to conduct an assessment of Iceland's potential for a whale trail and, if found appropriate, suggest a preliminary plan for its implementation. First, different realizations of whale trails abroad and their associated challenges were examined through six semi-structured interviews and online research. Knowledge derived from the interviews advised the Icelandic whale trail format deemed the most suitable and informed criteria for whale spotting sites. A mix of desk- and field-based research helped to identify six initial shore-based whale watching locations and potential stakeholders. Finally, a vision and roadmap for an Icelandic whale trail as a loose network of spotting sites was created, allowing for regional variations. Based on experiences from similar initiatives abroad, it was concluded that such an Icelandic whale trail, if implemented carefully and with a long-term goal in mind, can be beneficial for cetacean research and conservation. It has also the potential to benefit human-nature relationships, environmental literacy as well as tourism marketing and management.

Acoustic behaviour of the northern bottlenose whale (*Hyperoodon ampullatus*) within the North Atlantic soundscape

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Northern bottlenose whales belong to the family of beaked whales and are sighted with some regularity in Iceland's offshore and coastal waters. Due to their elusive behaviour including short surface intervals, visual observations are difficult to collect, leaving much of this

species' ecology unknown. However, their active acoustic behaviour with frequent production of species-specific echolocation clicks make them suitable for bioacoustics research. Such clicks have been shown to function in orientation and foraging during deep-diving but may also play a role during socialising at the surface. By using various approaches for acoustic data collection, ranging from animal-attached tags to fixed hydrophones moored to the seafloor, different aspects regarding occurrence, habitat use, movement patterns and behaviour can be explored. In this PhD project, the animals' functional use of sound throughout the dive cycle will be investigated using data from animal-attached sound and movement recording tags deployed off Jan Mayen (Norway). This knowledge will be used to further explore differences in acoustic behaviour between offshore and coastal habitats around Iceland. Moreover, multi-year data from bottom-moored hydrophones deployed off Jan Mayen, Iceland and potentially other locations will be analysed for annual and seasonal patterns in occurrence and movement. Overall, findings will be linked to recorded noise, e.g. vessel noise and sonar, to investigate its impact on the animals' acoustic occurrence and behaviour. This question is of particular interest due to beaked whales' high sensitivity to noise and the increasing industrialisation of the arctic and subarctic waters where the study species is commonly found.

Using parasites for stock discrimination of Icelandic cod

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Atlantic cod (*Gadus morhua*) is an important commercially exploited fish species for the Icelandic economy. It is currently managed as a single stock, but there is increasing evidence that possibly two (or more) stocks exist in Icelandic waters. For the sustainable exploitation of this species, it is vital to know its stock structure, to minimize the risk of overexploiting an ecologically distinct sub-population of cod in Icelandic waters.

Together with other techniques, parasites can be used to infer the existence of separate fish stocks. Our ongoing survey consists in thoroughly examining cod individuals from several inshore and offshore sites from the north and southwest of Iceland and describe their respective parasite (micro- and macro-parasites; ecto- and endo-parasites) faunas. Differences in prevalence and intensity of infection can indicate the existence of separate stocks. Furthermore, one or more parasite species might be considered suitable biological tags for stock discrimination purposes.

An overview of the parasite taxa infecting cod will be given, together with an overview of the methodology employed. The latter will cover the steps taken during sampling, the molecular techniques that will be used for molecular identification of parasites, and the statistical techniques that will be used to detect differences in parasite community composition of the different sampling sites.

Assessment of diversity of macroinvertebrates in freshwater springs using eDNA

Hafrún Gunnarsdóttir, Agnes-Katharina Kreiling, Bjarni K. Kristjánsson, Snæbjörn Pálsson

Freshwater springs are known for rich biodiversity and stable ecosystems as temporal fluctuation in environmental variables are considered low. A recent study by Kreiling et al. (in press) summarized the invertebrate diversity in freshwater spring ecosystems in Iceland, based on morphological classification. Here we present an application of eDNA metabarcoding to assess species diversity in the same freshwater springs, and from two caves in Lake Mývatn. Two liters of water were sampled from 17 sites, filtered through 0.22 µm

Sterivex filters and the DNA extracted. A fragment of the mitochondrial cytochrome c oxidase (COI) gene with specific primers proven to be good to target freshwater invertebrates, and sequenced at Novogene, UK. DNA reads were compared to COI records of in genebank and BOLD databases, using the RDP-classifier. The analyses gave 210 different taxa with 97 different genera and 119 species that reduced to 123 taxa with 69 genera and 73 species after rarefaction, considerably larger than by the traditional method (54). Alpha diversity (Shannon index, taxa richness and evenness) differed significantly among sites and was greater at the surface of the spring than in the spring source. Dissimilarities in alpha diversity between the two methods were partly due to reads not assigned to lower taxa (genera or species level), because of absence of records in the reference database. Comparison of the beta diversity obtained with the two different sampling methods revealed strong correlation between the results. Species compositions were shaped by environmental variables, water temperature being the most significant input.

TUNDRAsalad: evaluating the role of herbivore diversity on tundra ecosystems

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Herbivores play key roles in terrestrial ecosystems and influence multiple ecosystem functions. However, different herbivores can have different impacts because of differences in their body size or energy requirements. The effects of herbivores may combine in different ways, with unknown consequences to ecosystem function. The TUNDRAsalad project synthesizes and advances current knowledge on the role of herbivory and herbivore diversity in tundra ecosystems. Specifically, TUNDRAsalad aims at incorporating herbivore diversity, a relevant but overlooked dimension of the influence of herbivory on ecosystems, into predictions of ecosystem function in tundra by critically examining several interrelated ecosystem functions. So far, the results of this 3-year project started in 2021 have shown that we have an incomplete knowledge on herbivory across the Arctic that precludes generalizations on the impacts of herbivores on tundra vegetation. Ongoing TUNDRAsalad work includes: 1) synthesizing knowledge on the effects of herbivore diversity on processes, functions and properties of tundra ecosystems through a systematic review; 2) mapping areas of high herbivore diversity with potential conservation value; 3) implementing a coordinated field experiment across the tundra biome to study the effects of herbivore diversity on the multifunctionality of tundra ecosystems; and 4) accounting for herbivore diversity to improve grazing management at a regional scale, using Iceland as a case study. By providing a better understanding of how herbivore diversity influences ecosystem functioning in tundra, our results will help to guide appropriate adaptive strategies to preserve natural values of tundra ecosystems and related ecosystem services.

The Puffling Patrol: A citizen-science initiative to monitor the number and state of Atlantic Puffin fledglings during the fledging season in Heimaey Island, Vestmannaeyjar.

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3. Háskoli Íslands, Ægisgata 2, 900 Vestmannaeyjar

Long term monitoring is an essential tool to detect changes in ecosystems and identify key factors underlying population fluctuations. Citizen-science initiatives can provide a baseline to monitor such trends. In Vestmannaeyjar, a fraction of Atlantic puffin fledglings (pufflings) fly towards town when heading to the ocean during the fledging season (August-October). During the early 2000s, a decline in pufflings was detected, leading to the creation of “Pysjueftirlitið–The Puffling Patrol” in 2003, a programme to monitor pufflings landing in town.

Trained volunteers recorded number of pufflings found during the fledging season, measured body mass (BM), wing length (WL) and ringed a subsample. In addition, due to covid-19 pandemic, an online form was made available in 2020 to upload data by citizen-scientists. Biometrics, body condition index (BCI: BM/WL) and fledging season timing (1st and last date, peak and duration) were analysed with one-way Anova and *ad-hoc* Tukey HSD test and correlated with Pearson correlation method with key environmental variables: sea-surface temperature SST; wNAO climate index; and oceanic Sub-Polar Gyre index.

Over 44,000 pufflings were registered between 2003-2021. BM and WL varied within years. BCI was negatively correlated to the 1st date ($r=-0.65$, $P<0.015$) and the peak of the season ($r=-0.66$; $P<0.01$). Season duration was negatively correlated to SST ($r=-0.62$, $P<0.05$).

The annual fledging season’s beginning and duration varied, possibly suggesting a phenological adaptation of puffins to environmental variations. Puffin chick production is known to be strongly correlated to SST, but it appears that factors delaying the season also retard chick growth.

Assessing long-term changes in vertebrate herbivore communities and herbivory pressure across Iceland over seven decades

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Herbivores have an important impact on ecosystem functions and dynamics. Rapid environmental changes and human management are changing herbivore communities worldwide, both in terms of species composition and abundance. Often, these changes involve shifts in the relative abundance of domestic and wild herbivores. For instance, populations of wild herbivores like migratory geese are increasing across the North, while extensive grazing by domestic herbivores is declining. However, we know little about the consequences that such changes in the herbivore community have on ecosystems, especially in sub-arctic environments, where plant productivity is low due to the harsh climate.

Understanding the relative impact of both livestock and wild species is crucial to improve management policies and preserve the natural value of such regions. We combined the best available abundance time series data for each species of herbivore at Iceland scale; with data on body weight, energy requirements, and diet preferences, and computed the metabolic

biomass and the forage intake of the overall herbivore community as proxies of their impact. Although the abundance of wild species has increased in recent decades, the relative impact of wild herbivores is still negligible compared to that of domestic herbivores. Our study is the first to assess the overall changes of the herbivore community in Iceland over the past seven decades and to quantify the potential impact of these changes on vegetation. Our findings provide insights regarding the environmental conflicts Iceland is facing in a rapidly changing environment, where increasing herbivore populations may further limit primary production.

Relationship between plant palatability and ecosystem conditions in the Icelandic grazing commons

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1. Háskóli Íslands
2. Landgræðslan

Excessive livestock grazing can drive ecosystems towards a degraded state through both the loss of palatable plant species and the overall reduction of vegetation cover. Once an ecosystem has shifted to a degraded state, excluding grazers may not be sufficient for the system to return to the original or a healthier state. The processes that trap ecosystems in these degraded states are, however, not well understood. Grouping plant species into plant functional types (PFT) that reflect their role in ecosystem processes has proven a useful tool in predicting the function of species assemblages. Nutrient-rich, palatable species such as grasses, some dicotyledon herbs and deciduous shrubs can be classified as facilitating PFTs, while slow-growing, unpalatable species such as evergreen dwarf shrubs and rushes can be classified as retarding PFTs. In this poster, we present preliminary results evaluating the relationship between the relative abundance of retarding PFTs and ecosystem conditions in Iceland.

More specifically, we analysed data collected by the Landgræðslan monitoring program, Gróllind, in 2019-2021 at 389 sites randomly located across the grazing commons. At each site, vegetation and bare ground cover, as well as vegetation height, were evaluated along 2 perpendicular 50 m transects. From these measurements, we derived the percent cover of retarding vegetation for each site and evaluated their relationships to plant productivity and erosion. Results confirm the usefulness of the plant functional type approach to understanding ecosystem states in the Icelandic grazing commons and will serve as a basis to further investigate the mechanisms linking PFT and ecosystem functions.

Biodiversity as preservation of difference

Ole Martin Sandberg, Skúli Skúlason, Anthony Schultz

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Biodiversity is an important topic for ecology, but it is not settled what the concept means and why it is important. On the one hand, 'diversity' can simply refer to the existence of numerous different things (species, organisms, genes, etc.) each of which have their own independent existence and potential value. This is illustrated in the views that we owe it to future generations to preserve the diversity of nature because some day we might for example discover a beneficial use of a given gene. This is in line with the prevailing mechanical view of nature that the function and development of organisms and systems is caused by the inherent properties of individual substances.

Importantly, the concept of diversity can also refer to the existence of different things where the emphasis is on the relational quality of their difference. This view is closer to the field of ecology where studies consider relations and context essential for the properties of the things. This aligns itself with the views of process philosophy in which substances do not have independent existence but are the results of interaction and difference which create something new. This is relevant for the ecology in Iceland, where species are few, but there are dynamic processes within species related to great differences of habitats in close proximity (see biodice.is). This makes Iceland unique as a place where natural processes are rapidly evolving and creating new forms of life.

Urban bird diversity: does abundance and richness vary unexpectedly with green space attributes?

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Urban green spaces vary widely in size, location, age, and other attributes which may influence bird diversity. With urban bird diversity as a useful indicator of overall biodiversity within cities, we evaluated the relationship between bird diversity and green space attributes in the smaller green spaces of the City of Reykjavik, Iceland. Fifteen green spaces were selected, representing different size categories (small: <5 ha and large: 7-41 ha) and different locations within the urban sprawl (central and suburban). Bird abundance and species richness were monitored during thirteen transect surveys at each site from March to September 2020. Abundance, species richness, the Shannon diversity index, and evenness were compared across parks. Richness did not vary significantly with park size but was significantly higher in old- and intermediate-age parks that were centrally located ($p < 0.005$). Otherwise, bird diversity was significantly higher in large, intermediate-aged, polygon-shaped parks with residential urban contexts ($p < 0.05$). Bird diversity did not vary significantly over the survey season. These results indicate that abundance and richness respond differently to park attributes and both measures should be considered when monitoring urban bird diversity. It also provides useful insights for the value of smaller urban green spaces to urban planning decisions, specifically in high latitude cities and those undergoing densification.

The status of the Icelandic harbour seal (*Phoca vitulina*) population: 40 years of monitoring trends (1980-2020) and the current threats to the population

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Regular population censuses are crucial measures to detect fluctuations in pinniped population sizes and a foundation to inform seal management. In this presentation, the status of the Icelandic harbour seal (*Phoca vitulina*) population based on population trends over a 40-year period (1980-2020) is investigated and current threats to the population discussed. The most recent harbour seal population estimate from the summer of 2020 resulted in 10,319 (CI 95% = 6,733-13,906) animals, which indicate that the population is 69% smaller than when systematic monitoring of the population commenced in 1980 (33,327 seals). Due to this decrease, the Icelandic harbour seal population is defined as endangered on the Icelandic national list for threatened populations. Long term trend analysis reveals that the largest decline occurred between 1980 and 1990, when the population decreased about 50%.

After that, the population decline continued, although at a slower rate. Currently, the population is considered to fluctuate around a stable minimum level. Due to the sensitive conservation status of the population, it is important to assess and sustainably manage potential threats to the population, including human induced removals, anthropogenic disturbance, and various environmental factors such as contaminants, climate change and fluctuation in prey availability. Furthermore, increased monitoring of population demographic factors is urgent.

Effect of physical enrichment on the brain shape of Arctic charr Large Benthic morph from Lake Þingvallavatn

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The Arctic charr is the most northerly freshwater fish on Earth and has spread over several lakes and rivers, with differences in habitat such as temperature, food, predation and shelter. Due to these different circumstances, different morphs have arisen within the species, creating differences in morphology. The brain of the Arctic charr is plastic during its entire life, being able to modify itself functionally and structurally. This can be promoted by experiences with the environment, having a positive or negative effect on the development and neural plasticity of the brain. In this way, the environment can influence the shape and size of different parts of the brain. The goal of this study is to investigate the effect of physical enrichment on the brain shape of the Arctic charr. This was done by raising Large Benthic charr from Lake Þingvallavatn in plain vs enriched tanks. The fish brains were dissected, fixed in formalin and photographed on dorsal view. Then landmarks were placed to outline the brain shape so a comparison could be made between the two rearing conditions. Since structural complexity increases with enrichment, we predicted the development of larger brains to be promoted by enriched environments. More precisely, we expected larger brain areas involved in spatial cognitive processing, i.e. the cerebellum, telencephalon and the optic tectum, since an enriched environment requires more complex moment-to-moment representations. Here we present and discuss some preliminary results assessing the effect of physical enrichment on brain shape.