

# **Vistís 2023 / EcoIce 2023**



**24.-25. mars 2023**

**Laugarbakki**

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# Dagskrá / Program

\*indicates presenting author

## Friday 24<sup>th</sup> March 2023

13.00 SETNING OG OPNUNARORÐ FRÁ FORSETA VISTFRÆÐIFÉLAGSINS /  
CONFERENCE OPENING AND WELCOME WORDS FROM VISTFRÆÐIFÉLAG  
CHAIR – Freydís Vigfúsdóttir

13.15 WELCOME WORDS FROM HEAD OF LOCAL ORGANISING COMMITTEE –  
Sandra Granquist

13.30 Keynote speaker/ Frummælandi: Ecological restoration to conserve biodiversity,  
mitigate climate change and reverse desertification  
*Ása L. Aradóttir*

MÁLSTOFA I / SESSION I – LÍFFRÆÐILEG FJÖLBREYTNÍ/BIODIVERSITY; Chair:  
Teresa Henke

14.00 Species is not a good unit for ecological conservation - a process perspective  
*Ole Martin Sandberg\**, *Anthony Schultz*, *Skúli Skúlason*

14.15 Within-Species Diversity: Summary and Findings of a Workshop  
*Anthony James Schultz\**, *Bjarni Kristófer Kristjánsson*, *Skúli Skúlason*, *Ole Martin Sandberg*, *Ragnildur Guðmundsdóttir*, *Áki Jarl Láruson*, *Filipa Samarra*, *Christophe Pampoulie*, *Hanna-Kaisa Lakka*

14.30 Af hverju getur skilningur á líffræðilegri fjölbreytni Íslands verið gott dæmi fyrir heiminn?  
*Skúli Skúlason\**, *Christophe Pampoulie*, *Ingibjörg Svala Jónsdóttir*, *Kristinn Pétur Magnússon*, *Snæbjörn Pálsson*, *Starri Heiðmarsson*, *Sæmundur Sveinsson*, *Tómas Grétar Gunnarsson*, *samstarfsvettvangurinn BIODICE*

14.45 Notkun spjaldtölva og annarra snjalltækja í felti  
*Rán Finnsdóttir\**, *Björk Sigurjónsdóttir*, *Bryndís Marteinsdóttir*

15.00 KAFFIHLÉ / COFFEE BREAK (15 MIN)

15.15 MÁLSTOFA II / SESSION II – BIRKI VISTKERFI/BIRCH ECOSYSTEMS; Chair:  
Guðbjörg Ósk Jónsdóttir

15:15 Skilgreining viðmiðunarvistkerfa fyrir endurheimt birkivistkerfa á Íslandi  
*Katrín Valsdóttir\**, *Kristín Svavarsdóttir*

15.30 Fjölbreytileiki jarðvegsbaktería í framvindustigum birkiskóga á Íslandi.  
*Hilmar Njáll Þórðarson\**, *Ása L. Aradóttir*, *Kristín Svavarsdóttir*, *Þóra Ellen Þórhallsdóttir*, *Jóhann Þórsson*, *Edda Sigurdís Oddsdóttir*, *Snæbjörn Pálsson*

15.45 Soil properties in Icelandic birch woodland ecosystems  
*Sólveig Sanchez\**, *Jóhann Þórsson*, *Ólafur Arnalds*

16.00 Natural colonization of birch in Iceland from discrete seed sources: implications for large-scale restoration of birch woodlands  
*Anna Mariager Behrend\**, *Ása L. Aradóttir*, *Kristín Svavarsdóttir*, *Þóra Ellen Þórhallsdóttir*, *Arne Pommerening*

16.15 Flash talk: Mosaic Patterns in Forested and Adjacent Non-forested Lands Around Iceland  
*Cassandra Ruiz*

16.20 KAFFIHLÉ OG VEGGSPJÖLD / COFFEE BREAK AND POSTERS (10 MIN)

16.30 MÁLSTOFA III / SESSION III – VISTFRÆÐI PLANTNA/PLANT ECOLOGY;  
Chair: Sólveig Sanchez

16:30 Subarctic ecosystem engineering by a deciduous shrub: Influences on microclimate, soil carbon and biodiversity

*Vigdís Freyja Helmutsdóttir, Kristín Svavarsdóttir, Þóra Ellen Þórhallsdóttir*

16.45 Icelandic *Empetrum nigrum* might retard ecosystem recovery

*Ingvild Ryde\*, Elizabeth H. J. Neilson, Eliza Cwalina, Augustin Baussay, Delphine Pottier, Kari Anne Bråthen, Ingibjörg S. Jónsdóttir*

17.00 The Effects of Grazing Exclusions on Flowering and Reproductive Success.

*Hrafnhildur Vala Friðriksdóttir\*, Bryndís Marteinsdóttir, Ingibjörg Svala Jónsdóttir*

17.15 Lífsögbreytur og aldursmat klettafrúr á Íslandi

*Álfur Birkir Bjarnason*

17.30 *Peltigera* lichens in Iceland: yet another reservoir of the plant pathogen *Pseudomonas syringae*?

*Natalia Ramirez*

17:45 Flash talk: Æxlunarhættir ljósbera (*Viscaria alpina* L.) og hugsanlegir drifkraftar fyrir þróun sérþýlis

*Benedikt Traustason\*, Þóra Ellen Þórhallsdóttir*

17.50-19.00 VEGGSPJÖLD / POSTER SESSION

## Saturday 25<sup>th</sup> March 2023

09.00 Keynote speaker/Frummælandi: Using tracking, modelling, and international collaboration to improve the conservation outlook for seabirds

*April Hedd*

09.30 MÁLSTOFA IV / SESSION IV – VISTKERFI HAFSINS/MARINE ECOSYSTEMS;  
Chair: Jóhanna Sigurðardóttir

09:30 GPS Tracks Reveal Foraging of Iceland's Nocturnal Seabirds

*Stephen Hurling\*, Erpur Snær Hansen, April Hedd, Katharine Studholme*

09.45 Centennial population control dynamics

*Erpur Snær Hansen*

10.00 Blue whiting stock structure in the Northeast Atlantic: one or many stocks?

*Haseeb Randhawa*

10.15 Otolith-fish size relationships of 5 mesopelagic fishes

*Charlotte Sarah Matthews*

10.30 Defining an alien species with uncertain arrival pathway

*Theresa Henke\*, Jakob Hemmer-Hansen, Snæbjörn Pálsson, Hlynur Bárðarson, Magnús Thorlacius, Guðbjörg Ásta Ólafsdóttir*

10.45 KAFFIHLÉ OG VEGGSPJÖLD / COFFEE BREAK AND POSTERS (15 MIN)

11.00 MÁLSTOFA V / SESSION V – ÞURRLENDISVISTFRÆÐI/TERRESTRIAL ECOLOGY; Chair: Anna Mariager Behrend

11.00 Long-term changes in herbivore community composition and vegetation impact in Iceland

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

11.15 The “mouse race” of Vestmannaeyjar: what will be the faith of the prevailing house mouse, following a recent introduction of another small mammal species?

*Ester Rut Unnsteinsdóttir\**, *Friða Jóhannesdóttir*

11.30 What are the effects of herbivore diversity on tundra ecosystems?

*Laura Barbero Palacios\**, *Isabel C. Barrio*, *Jan C. Axmacher*, *Laura Bartra*, *Katrín Björnsdóttir*, *Ragnhild Björkås*, *Mathilde Defourneaux*, *Mariana García Criado*, *Olivier Gilg*, *Michael den Herder*, *David S. Hik*, *Bernice C. Hwang*, *Ilona Kater*, *Elina Kaarlejärvi*, *Tiina H.M. Kolari*, *Jeppe A. Kristensen*, *Mari Kuoppamaa*, *Thomas K. Lameris*, *A. Joshua Leffler*, *Isla Myers-Smith*, *Emmanuel P. Pagneux*, *Matteo Petit Bon*, *Emmanuel Serrano*, *Eeva M. Soininen*, *Jennifer S. Ramsay*, *Anna Skarin*, *Natalya Sokolova*, *James D. M. Speed*, *Maria Tuomi*, *Helen Wheeler*, *Torben Windirsch*

12.00 HÁDEGISHLÉ / LUNCH BREAK (1 HR)

13.00 MÁLSTOFA VI / SESSION VI – ATFERLI OG VISTFRÆÐI  
FERSKVATNSFISKA/BEHAVIOUR AND ECOLOGY OF FRESHWATER FISH;  
Chair: Charlotte Matthews

13.00 Personality and temporal plasticity in fish populations along a gradient of evolutionary divergence

*David Benhaïm\**, *Louise Vernier*, *Camille Leblanc*

13.15 Influence of habitat complexity on stream-dwelling Arctic charr space use - does personality matter?

*Gabrielle Marie Valérie Ladurée\**, *David R. Benhaïm*, *Laura K. Weir*, *Stefán Ó. Steingrímsson*

13.30 Monitoring spawners of planktivorous Arctic charr in Lake Þingvallavatn, Iceland 1983-2022

*Finnur Ingimarsson\**, *Fia Elisabet Finn*, *Haraldur Rafn Ingvason*, *Stefán Már Stefánsson*, *Sigurður Sveinn Snorrason*

13.45 ÖR-HLÉ / LEG STRETCHER (15 MIN)

14.00 Shoaling in Mývatn Stickleback: Temperature and Origin Variation

*Spencer Edwards\**, *Kasha Strickland*, *Bjarni Kristófer Kristjánsson*

14.15 Foraging niche and diet variation in threespine stickleback (*Gasterosteus aculeatus*) in Lake Mývatn, Iceland

*Ragna Guðrún Snorradóttir\**, *Bjarni K. Kristjánsson*, *Katja Räsänen*, *Kasha Strickland*, *Joseph Phillips*

14.30 Juvenile feeding ecology in threespine stickleback

*Alessandra Schnider\**, *Etienne de la Burgade*, *Franka Hemme*, *Bjarni K. Kristjánsson*

14.45 Flash talk: Environment, life history, and demography in cave charr

*Grant Haines\**, *Bjarni K. Kristjánsson*, *Camille A. Leblanc*

14.50 LOKAORÐ /CLOSING REMARKS

15.10 KAFFIHLÉ / COFFEE BREAK (20 MIN)

15.30 AÐALFUNDUR / ANNUAL GENERAL MEETING

16.30-17.30 VEGGSPJÖLD/POSTER SESSION (1 HR)

18.15 RÚTA Í HEIMSÓKN Á SELASETUR ÍSLANDS/BUS PICKUP FOR VISIT TO SEAL CENTER

20:00 RÁÐSTEFNU KVÖLDVERÐUR/CONFERENCE DINNER

### VEGGSPJÖLD / POSTERS

Mold ert þú – jarðvegur og íslensk náttúra

*Ólafur Arnalds*

A Comparison of the Saddle Patches, Rake Marks and Catalogues of the Icelandic and Norwegian Killer Whale (*Orcinus orca*) Populations

*Alice Crighton\*, Filipa Samarra, Eve Jourdain*

Temporal changes in feeding ecology and life histories of fishes in Faroese lakes

*Camille A. Leblanc, Krista M. Veijonen\*, Bjarni K. Kristjánsson, Janus Hansen, Ragnhildur Guðmundsdóttir, Kári H. Arnason, Hilmar Malmquist, Kirsten S. Christoffersen, Agnes-Katharina Kreiling*

Whales of Vestmannaeyjar: A citizen science initiative to monitor year-round presence of cetaceans around the Vestmannaeyjar archipelago

*Rodrigo A. Martinez Catalan\*, Filipa Samarra, Paul Wensveen*

Fjölbreytni svifkrabbadýra í ferskvatni á Íslandi í tíma og rúmi

*Þóra Atladóttir\*, Agnes-Katharina Kreiling, Haraldur R. Ingvarsson, Jón S. Ólafsson, Ragnhildur Guðmundsdóttir, Skúli Skúlason*

Monitoring CO<sub>2</sub> and CH<sub>4</sub> fluxes at a wetland and grassland site in West Iceland

*Ölvir Styrmisson\*, Sunna Áskelsdóttir*

The YAN App - Youth Nature Monitoring in the Arctic

*Cécile Chauvat*

Ecosystems trapped in a degraded state – the TRAPP project

*Ingibjörg Svala Jónsdóttir\*, Isabel C. Barrio, Bryndís Marteinsdóttir, Noémie Boulanger-Lapointe, Ian Klupar, Ingvild Ryde, Kari-Anne Bråthen, David S. Hik, Elizabeth Heather Jacobsen Neilson, Alejandro Salazar, Ólafur S. Andrésson, Hrafnhildur Vala Friðriksdóttir, Jón Guðmundsson, Martin A. Mörsdorf, Arna Björt Ólafsdóttir, Bastien Papinot*

Wetland restoration in Iceland – how to speed up the establishment of wetland vegetation in disturbed margins that follows restoration?

*Ágústa Helgadóttir\*, Sunna Áskelsdóttir, Ölvir Styrmisson.*

Energy budget of a wintering humpback whale (*Megaptera novangeliae*) in Eyjafjörður, Iceland

*Jóhanna Sigurðardóttir, Edda Elisabet Magnúsdóttir*

Diversity in the internal functional feeding elements of sympatric morphs of Arctic charr (*Salvelinus alpinus*)

*Guðbjörg Ósk Jónsdóttir\*, Laura-Marie von Elm, Finnur Ingimarsson, Samuel Tersigni, Sigurður Sveinn Snorrason, Arnar Pálsson, Sarah Elizabeth Steele*

How can we assess the impacts of multiple stressors in marine habitats?

*Einar Pétur Jónsson\*, Tómas Arnason, Hrönn Egilsdóttir*

# Ágrip erinda / Presentation abstracts

## Keynote speaker/ Frummælandi

### **Ecological restoration to conserve biodiversity, mitigate climate change and reverse desertification**

Ása L. Aradóttir\*

*Faculty of Environmental and Forest Sciences, Agricultural University of Iceland*

There is a growing emphasis on the restoration of degraded ecosystems world-wide because of its co-benefits for biodiversity conservation, climate change mitigation and reversal of desertification. Hence, the United Nations declared 2021-2030 as the UN Decade of Ecosystem Restoration, aiming to prevent, halt and reverse ecosystem degradation. Ecological restoration is the process of assisting recovery of ecosystems that have been degraded, damaged, or destroyed. It is underpinned by the scientific discipline of Restoration Ecology that seeks to understand processes of ecosystem recovery, ways to facilitate them where needed, and elucidate the consequences for biodiversity, ecosystem functioning and ecosystem services. Restoration Ecology is thus rooted in ecological theory, offering ecologists new challenges and insights into key ecological processes.

Iceland's ecosystems have undergone severe degradation and in some cases collapse, due to massive deforestation, unsustainable land use, soil erosion, draining of wetlands and other land conversion. Soil conservation and restoration efforts spanning more than a century show that ecosystem restoration is possible, but the outcome depends on both restoration interventions and their environmental and socio-economic context. The Icelandic government has emphasised restoration, protection, and sustainable use of ecosystems in recent policies—both for biodiversity and soil conservation and as a part of Iceland's climate change mitigation measures. This entails plans for increased wetland and heathland restoration and nearly tripling the extent of native birch woodlands.

Tackling large-scale restoration requires diverse research and well-educated professionals. Restoration research in Iceland spans decades—focusing mainly on methodology to begin with, while the current emphasis is more on ecological and trans-disciplinary research. BirkiVist is an example of a research project that addresses ecological and societal challenges and opportunities to birch woodland restoration and its impact on biodiversity, soils, hydrology, landscape, and aesthetics. Educational opportunities include courses and programs on ecological restoration at AUI and a new international MS program in Restoration Ecology is planned to start this fall. The GRÓ-Land Restoration Training Program, a capacity development training programme under the auspices of UNESCO, is also co-hosted by AUI and SCSU.

## **MÁLSTOFA I / SESSION I – LÍFFRÆÐILEG FJÖLBREYTNÍ/BIODIVERSITY**

### **Species is not a good unit for ecological conservation - a process perspective**

Ole Martin Sandberg<sup>1\*</sup>, Anthony Schultz<sup>1</sup>, Skúli Skúlason<sup>1,2</sup>

<sup>1</sup>*The Icelandic Museum of Natural History; <sup>2</sup>Hólar University*

The great biologist and conservationist E.O. Wilson claimed that “the species concept is crucial to the study of biodiversity”. Yet, there is no agreed-upon definition of the concept “species” and more recent developments within ecological research and conservation are



moving away from the species-focused model, which has not helped in slowing the rate of biodiversity loss. If species are not the proper unit of conservation the question, then, is: what is? Newer ecological models tend to focus on the diversity of processes taking place in an ecosystem – the relations and interactions between the different organisms as well as the abiotic factors. These cannot be modelled by focusing on species alone. In fact, members of the same species might have different roles and interactions within the same ecosystem, or the same roles might be performed by members of different species. This is the case in Iceland where a small number of species have diversified to fulfil multiple ecological roles in various niches. This calls for new ecological models that focus not on the beings performing the roles but on the overall process. Process philosophy can be a guide in developing these models as it focuses on difference itself, rather than the things that are different, as the key to generation of processes. Things, whether they are organisms, species or ecosystems, emerge out of dynamic interactions. Rather than conserving species, the goal of biodiversity research and protection must be to understand and protect these interactions.

### **Within-Species Diversity: Summary and Findings of a Workshop**

Anthony Schultz<sup>1\*</sup>, Bjarni Kristófer Kristjánsson<sup>2</sup>, Skúli Skúlason<sup>1,2</sup>, Ole Martin Sandberg<sup>1</sup>, Ragnhildur Guðmundsdóttir<sup>1</sup>, Áki Jarl Láruson<sup>3</sup>, Filipa Samarra<sup>4</sup>, Christophe Pampoulie<sup>5</sup>, Hanna-Kaisa Lakka<sup>6</sup>

<sup>1</sup>*The Icelandic Museum of Natural History*; <sup>2</sup>*Hólar University*; <sup>3</sup>*University of Iceland*;  
<sup>4</sup>*University of Iceland Research Centres*; <sup>5</sup>*Icelandic Marine & Freshwater Research Institute*; <sup>6</sup>*University of Jyväskylä*

In January 2023, Hólar University, NMSÍ, and BIODICE, with funding from the International Arctic Science Committee, co-hosted a workshop on the importance of within-species diversity. This presentation will summarise the workshop and present the key findings. The workshop brought together 25 international and Icelandic researchers to discuss an often-overlooked aspect of biodiversity: within-species variation. This diversity is crucial for evolutionary processes, as individual variation is the currency of evolution. Further, in Arctic and sub-Arctic systems that are often low in species diversity, within-species diversity can play an important role in shaping ecosystem function and resilience. Through a programme of presentations and discussion groups, workshop participants covered a range of topics. The first half of the workshop included topics such as how we think about biodiversity concepts, the importance of within-species diversity in different taxa and systems, and how we might identify and measure this diversity. The second half of the programme focussed on conservation applications, with participants discussing how to introduce the concept of within-species diversity to the public and policymakers, and how to include this diversity in conservation management and policy. Important findings included the crucial need to include local communities in all stages of research, policymaking, and conservation decision-making. Further, we need increased researcher involvement in communicating and promoting biodiversity research. Thus, researchers need more training in education and communication to different stakeholder groups, while institutions must invest in full-time science communication posts.

### **Af hverju getur skilningur á líffræðilegri fjölbreytni Íslands verið gott dæmi fyrir heiminn?**

Skúli Skúlason<sup>1,2\*</sup>, Christophe Pampoulie<sup>3</sup>, Ingibjörg Svala Jónsdóttir<sup>4</sup>, Kristinn Pétur Magnússon<sup>5,6</sup>, Snæbjörn Pálsson<sup>4</sup>, Starri Heiðmarsson<sup>7</sup>, Sæmundur Sveinsson<sup>8</sup>, Tómas Grétar Gunnarsson<sup>9</sup>, samstarfsvettvangurinn BIODICE

<sup>1</sup>Háskólinn á Hólum; <sup>2</sup>Náttúruminjasafn Íslands; <sup>3</sup>Hafrannsóknastofnun; <sup>4</sup>Háskóli Íslands; <sup>5</sup>Háskólinn á Akureyri; <sup>6</sup>Náttúrufræðistofnun Íslands; <sup>7</sup>Náttúrustofa Norðurlands vestra; <sup>8</sup>MATÍS; <sup>9</sup>Rannsóknasetur Háskóla Íslands á Suðurlandi

Hérlendis eru fáar tegundir vegna einangrunar landsins og skamms tíma sem lífverur hafa haft til að nema landið frá því að síðasta jökulskeiði lauk fyrir um 10,000 árum. Lítil samkeppni milli tegunda og æxlunarleg einangrun hefur leitt til aðlögunar að sérstæðum og oft óstöðugum búsvæðum sem jarðfræði landsins skapar í samspili við aðra umhverfisþætti. Þetta birtist meðal annars í þróun afbrigða ýmissa tegunda, t.d. fugla, breytilegri aðlögun laxastofna í mismunandi ám og hraðri þróun fjölbreytni innan stofna ýmissa tegunda svo sem bleikju í stöðuvötnum. Þá leiðir nýting fjölbreyttra búsvæða oft til stærri stofna lífvera. Vistkerfi lands, ferskvatns og sjávar eru þannig fjölbreytt og kvik. Þótt ósjálfbær nýting hafi orsakað hnignun vistkerfa, eru hér mörg vistkerfi, t.d. í ferskvatni, sem hafa fengið að þróast mikið til á eigin forsendum. Einnig er áætlað að hér séu 43% víðerna Evrópu. Þekking á slíkum vistkerfum samhliða skilningi á hraðri þróun og sérstökum aðlögunum lífvera veitir ómetanlega innsýn í eðli þess flókna hugtaks sem líffræðileg fjölbreytni er. Vandinn við árangursríka stefnumótun um líffræðilega fjölbreytni og sjálfbæra auðlindanýtingu er gjarnan hvernig fjölbreyntin er skilin og verðmæti hennar metin. Við stöndum á tímamótum og krafan um markvissa verndun og sjálfbæra nýtingu er hávær. Þetta sést á metnaðarfullum markmiðum um líffræðilega fjölbreytni sem alþjóðasamfélagið samþykkti á nýlegri COP-15 ráðstefnu Sameinuðu þjóðanna. Sömuleiðis hafa íslensk stjórnvöld sett sér framsækin markmið um sjálfbæra auðlindanýtingu. Vegna sérstöðu íslenskrar náttúru og tækifæra sem liggja í samfélagsgerð okkar getum við lagt mikið af mörkum hér heima og til alþjóðasamfélagsins á þessum vettvangi.

### **Notkun spjaldtölva og annarra snjalltækja í felti**

Rán Finnsdóttir\*, Björk Sigurjónsdóttir, Bryndís Marteinsdóttir  
*Landgræðslan, Gunnarsholt, 851 Hella*

Feltvinna á Íslandi er fjölbreytt en hefur það sameiginlegt að verið er að skrá mælingar og gögn úti í allskonar veðri. Blað og blýantur er oft staðalbúnaður og gjarnan fjölbreyttar leiðir farnar til að tryggja að hægt sé að skrá gögn í roki og/eða rigningu. Plöstuð blöð og mjúkir blýantar, plastpokar nýttir sem tjald, símtal úr mælireit yfir í bíl þar sem skrásetjari situr í skjóli, upptökur á síma þegar blaðið er fokið í veður og vind eða það hefur grotnað niður í bleytunni. Þegar heim er komið fyllast svo allir ofnar af feltblöðum í þurrki og á veturna tekur við löng vinna við innslátt og samlestur á gögnunum.

Árið 2019 hófst GróLindarverkefni Landgræðslunnar, vöktunástands gróður- og jarðvegsauðlinda Íslands. Á hverju sumri er gríðarlegu magni gagna safnað, hartnær 200 reitir eru mældir og vel yfir 500 mælingar skráðar í hverjum reit. Frá upphafi hafa öll gögn í GróLind verið skráð í spjaldtölvu. Meirihluti mælinga og allar ljósmyndir eru vistaðar í snjallforritinu Survey123 og gögnin send beint í gagnagrunn stofnunarinnar og tengd við staðsetningu vöktunarreits. Eyðublaðið í Survey123 (ESRI) er sett þannig upp að komið sé í veg fyrir flestar villur í skráningu. Örfáir dagar hvert haust fara í úrvinnslu gagna í stað nokkurra mánaða vinnu við gagnainnslátt og yfirferð. Næstu skref eru að tengja sjálfvirka grunnagnaúrvinnslu við gögnin og kortavefsjá, svo að um leið og mælingum er skilað birtist mælireiturinn með ljósmyndir og helstu meðaltalsupplýsingar á kortasjá verkefnisins.

## MÁLSTOFA II / SESSION II – BIRKI SKÓGAR/BIRCH FORESTS

### Skilgreining viðmiðunarvistkerfa fyrir endurheimt birkivistkerfa á Íslandi

Katrín Valsdóttir, Kristín Svavarsdóttir

*Landgræðslunni, 841 Hella*

Árangursrík endurheimt vistkerfa byggir á skýrri sýn um hvers konar vistkerfi stefnt er að því að endurheimta. Hér á landi hafa markmið vistheimtar oft verið óljós og þá einkum beinst að virkni eða þjónustu vistkerfis. Skilgreining á viðmiðunarvistkerfi er lykilskref við skipulagningu vistheimtarverkefna sem stuðlar að því að innleiðing þeirra verði markvissari með skýrum tilgangi og markmiðum. Það er nauðsynlegt fyrir bæði val á aðgerðum og mat á árangri. Við skilgreiningu á viðmiðunarvistkerfi er hugað að eiginleikum vistkerfis sem ekki er í hnignuðu ástandi og byggir á upplýsingum um fyrri og núverandi aðstæður og hvernig það gæti hugsanlega þróast í framtíðinni með tilliti til mögulegra umhverfisbreytinga, s.s. breytinga á loftslagi. Stuðst er við staðla alþjóðlegu vistheimtarsamtakanna (SER staðlana) við skilgreiningu á viðmiðunarvistkerfum. Endurheimt birkivistkerfa á 21. öld - áskoranir, leiðir og ávinningur (BirkiVist) er rannsóknaverkefni sem ætlað er að tryggja að endurheimtin sé byggð á bestu fánlegu þekkingu og að auka skilvirkni við endurheimt birkivistkerfa á Íslandi með áherslu á sjálfræðslu birkis. Hluti þess verkefnis er að skilgreina viðmiðunarvistkerfi fyrir birkivistkerfi. Til að skilgreina viðmiðunarvistkerfi var þekking á óhnignuðu birkikjarri og skógum tekin saman. Vinnufundur var haldinn með sérfræðingum og rýnt var í fyrirliggjandi gögn, ásamt því að gögnum var safnað í 10 gömlum birkilundum. Rannsóknin er ekki einungis mikilvæg fyrir endurheimt birkivistkerfa á Íslandi, heldur þjónar hún einnig því hlutverki að vera mikilvæg ráðgjöf fyrir önnur endurheimtarverkefni. Notkun viðmiðunarvistkerfa sem hluti þess að fylgja SER stöðlunum mun auka fagleg vinnubrögð og skila árangursríkari endurheimt.

### Fjölbreytileiki jarðvegsbaktería í framvindustigum birkiskóga á Íslandi.

Hilmar Njáll Þórðarson<sup>1\*</sup>, Ása L. Aradóttir<sup>3</sup>, Kristín Svavarsdóttir<sup>4</sup>, Þóra Ellen Þórhallsdóttir<sup>1</sup>, Edda Sigurdís Oddsdóttir<sup>2</sup>, Snæbjörn Pálsson<sup>1</sup>, Jóhann Þórsson<sup>4</sup>

<sup>1</sup>*Lif og Umhverfisvísindadeild. Háskóli Íslands;* <sup>2</sup>*Skógrækt Ríkisins;* <sup>3</sup>*Landbúnaðarháskóli Íslands;* <sup>4</sup>*Landgræðslan*

Verkefnið sprettur úr BirkiVist, þverfræðileg rannsókn sem miðar að þróun skilvirka leiða við endurheimt birkiskóga á landsvísu. Þessi hluti snýr að mati á líffræðilegum fjölbreytileika í birkiskógum. Jarðvegssýni voru tekin með 3,5 cm breiðum jarðvegsbor úr mismunandi framvindustigum 10 birkiskóga víðsvegar á Íslandi sumarið 2022.

Framvindu var skipt í þrjú stig 1) einungis smáplöntur af birki, 2) ungur skógur og 3) gamall skógur. Til samanburðar voru tekin sýni á stað þar sem ekkert birki var að finna. Á hverju stigi voru tekin 4 sýni og háplöntur flokkaðar og taldar í 1m<sup>2</sup> reit.

DNA var einangrað úr jarðvegssýnunum, bútar úr 16S RNA geni baktería fjölfaldað, merktir með upplýsingum og sýnastað og raðgreindir 417-420 basar per röð (e. metabarcoding) hjá Novogene, Englandi. Með samanburði við upplýsingar í genabanka voru flokkunareiningar raðanna ákvarðaðar. Alls voru 133 sýni greind með 39273 ólíkum DNA röðum, sem skiptust í 1294 ættkvíslir, 667 ættir, 418 ættbálka, 164 flokka og 61 fylkingar.

Fimm algengustu bakteríufylkingarnar eru að meðaltali per sýni Proteobakteríur (31,6%) (þar á meðal *Rhizobialis* 10%), Acidobakteríur (18%), Actinobakteríur (14,2%), Chloroflexi (9%) og Verrucomicrobiota (5,4%), allt þekktar jarðvegsbakteríur. Aðrar bakteríur voru í minna en 5% tíðni. Samkvæmt fyrstu niðurstöðum er marktækur mismunur milli skóga á fjölbreytileika

fjölda fylkinga og breytileika (shannon og simpson inv.) Línuleg módel gefa til kynna að munurinn sé eftir lengdargráðum en ekki munur milli framvindustiga. Breytileiki í bakteríum innan og milli skóglenda og framvindustiga verður borinn saman við breytileika í ITS röðum sveppa, í 18S RNA geni heilkjörnunga og við tegundabreytileika háplantna á sömu stöðum.

## **Soil properties in Icelandic birch woodland ecosystems**

Sólveig Sanchez\*, Jóhann Þórsson, Ólafur Arnalds

Mountain birch (*Betula pubescens*) woodlands were the key natural ecosystems of Iceland prior to the settlement about 1200 years ago. Massive land degradation has taken place over the past Millennium, including destruction of most of the birch woodlands, down to <1% cover, forming extensive barren lands in some areas. The woodlands provide important services such as being key system for preserving biodiversity, maintaining high carbon and fertility levels, and favorable hydrological properties.

Iceland has set national goals to restore the birch woodlands. EcoBirch - Restoration of birch woodlands in the 21st century ([www.birkivist.is](http://www.birkivist.is)) is a multi-disciplinary research project carried out by six institutions and universities. The project has multiple aims, including characterization of ecosystem changes that accompany the restoration of the birch ecosystems.

This PhD project aims to characterize soil properties of birch woodland ecosystems, among other factors. Ten birch woodlands scattered around the country were sampled. The soils are being analyzed to assess properties in old and young birch woodlands and to compare the results with the adjacent treeless land. The amount of carbon and nitrogen, pH and water retention have been measured; followed by clay content and bulk density. The first results show that old birch stands can store large quantities of carbon in the volcanic Andosols with higher carbon and nitrogen contents in the old birch woodlands compared to the other ecosystems.

## **Natural colonization of birch in Iceland from discrete seed sources: implications for large-scale restoration of birch woodlands**

Anna M. Behrend<sup>1\*</sup>, Ása L. Aradóttir<sup>1</sup>, Kristín Svarvarsdóttir<sup>2</sup>, Þóra Ellen Þorhallsdóttir<sup>3</sup>, Arne Pommerening<sup>4</sup>

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Mountain birch (*Betula pubescens* ssp. *tortuosa*) is the only species forming native woodlands in Iceland. The birch woodlands of Iceland have declined from a land cover estimated to be in excess of 25% before settlement to about 1.5% today. The Icelandic government has set an ambitious goal for the restoration of native birch woodlands, aiming to restore a total of 350.000 ha by the year 2030. To successfully obtain this goal it is necessary to harness the natural regeneration from existing birch woodlands, regardless of whether they were planted or seeded naturally. Mountain birch is an efficient colonizer in early succession, but studies have shown that this process may be restrained by multiple factors, such as climate, lack of safe sites for seedling establishment and disturbances such as grazing. The aim of our study was to examine the natural colonization patterns of Mountain birch from existing woodlands, and to disentangle drivers of seedling establishment. We present results from field studies of 10 birch woodlands in Iceland, where colonization was surveyed along line transects from the woodland edge. We derived general statistical models explaining the colonization patterns of birch seedlings from discrete seed sources. Our results show that

colonization patterns are highly site specific, with successful establishment being mainly limited by the availability of safe sites and distance to seed source, whereas the patterns for saplings display greater stochasticity. The results of this study contribute to filling a knowledge gap on how we can scale up birch woodland restoration in Iceland.

## **Mosaic Patterns in Forested and Adjacent Non-forested Lands Around Iceland**

Cassandra Ruiz

*University of Iceland*

BirkiVist is a research project aimed to restore the only native forests of Iceland, those of birch (*Betula pubescens*), on a national level, while analyzing the main obstacles of natural colonization and the changes to the landscape. The 2010 Icelandic Landscape Project (ILP) established a checklist of 23 variables along with a quantitative scoring of 37 colors to classify landscapes based on visual characteristics. Ten old birch forest sites around Iceland were studied with their adjacent non-forested comparison sites to determine their landscape classification via multivariate statistical analysis, i.e., Cluster Analysis and Principal Component Analysis. But what new variable is more important in determining classification groups between the additional data of color, patch, and drone grading? Drone grading has 19 of the 23-variables in the checklist and stitched 2x2 photographs using a 1:1,164 map scale, making this additional variable the most dominant in deciding groups. Whereas color grading, where a total of 11 of the 37 colors established in ILP were identified, does not change the groups, only the cluster analysis height and two subgroups. Patch grading, however, recognizes patterns in the drone images and then quantifies the number of patch switches following 4x4 lines, resulting in the comparison sites having a higher number in this variable, making this the second most prominent new variable. Therefore, old birch forests score lower in terms of patch diversity, vegetation diversity, and color range but score higher in terms of patch size when compared to their adjacent non-forested sites.

## **MÁLSTOFA III / SESSION III – VISTRÆÐI PLANTNA/PLANT ECOLOGY**

### **Subarctic ecosystem engineering by a deciduous shrub: Influences on microclimate, soil carbon and biodiversity**

Vigdís Freyja Helmutsdóttir<sup>1\*</sup>, Kristín Svavarsdóttir<sup>2</sup>, Þóra Ellen Þórhallsdóttir<sup>1</sup>

<sup>1</sup>*Faculty of Life- and Environmental Sciences, University of Iceland;* <sup>2</sup>*Soil Conservation Service of Iceland*

Woody plant species may act as ecosystem engineers by physically changing their biotic or abiotic environment, resulting in facilitating or inhibiting effects on plant establishment and growth. We examined ways in which woolly willow (*Salix lanata* L.) modifies its local environment on a glacial outwash plain and nearby willow heath in Iceland, where transects were established with origin at individual shrubs. Snow cover, relative air humidity, decomposition rate and stabilisation of soil organic matter declined with increasing distance from shrubs, while ground surface temperature, vascular plant species and functional group richness increased. Vascular plant biomass was not significantly affected. Ground surface temperature was positively associated with decomposition rate, suggesting that lower temperature due to canopy shading may partly offset increased decomposition rates under shrubs. Overall negative effects on local plant biodiversity indicate that potential facilitation by *S. lanata* is mostly outweighed by interspecific competition. On the outwash plain

however, deciduous dwarf shrubs and woody species saplings were most frequently recorded close to *S. lanata*. Facilitation may thus be restricted to functionally related species and be more pronounced in early successional ecosystems.

### **Icelandic *Empetrum nigrum* might retard ecosystem recovery**

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Grazing-cessation in degraded rangelands in the Icelandic highlands does not improve aboveground plant productivity and diversity. This indicates that the ecosystems are trapped in degraded states by internal feedbacks. Understanding the trapping mechanisms is important to fully comprehend the consequences of land degradation and how this will change in a future warming world. One important mechanism might be the release of chemicals (allelochemicals) from un-palatable plant species, such as the evergreen dwarf shrub *Empetrum nigrum*, to its surroundings, inhibiting seed germination and growth of other plants (referred to as allelopathy). We aim to assess the role of allelopathic effects of *E. nigrum* in retarding ecosystem recovery in degraded dwarf shrub heaths in the subarctic highlands of Iceland. Our objectives are to assess (I) the allelopathic effects of Icelandic *E. nigrum* populations and associated soils on more palatable species, (II) the chemical profile of *E. nigrum* plants, and (III) how the profile is affected by grazing-cessation and climate warming. Samples were collected from different *E. nigrum* tissues, subspecies, and populations along with associated soils. Furthermore, *E. nigrum* leaves were collected from an International Tundra Experiment (ITEX) site including long-term (27 years) experimental warming plots (open-top-chambers) and grazing-cessation plots (fence). Chemical analysis was performed using liquid chromatography–mass spectrometry. Preliminary results suggest that (I) Icelandic *E. nigrum* is allelopathic (bioassays), (II) key allelochemicals are identified in both green and senescent *E. nigrum* leaves indicating long-lasting allelopathic legacy, and (III) long-term grazing-cessation and warming do not affect the leaf concentration of key allelochemicals.

### **The Effects of Grazing Exclusions on Flowering and Reproductive Success.**

Hrafnhildur Vala Friðriksdóttir<sup>1\*</sup>, Bryndís Marteinsdóttir<sup>2</sup>, Ingibjörg Svala Jónsdóttir<sup>1</sup>

<sup>1</sup>Háskóli Íslands; <sup>2</sup>Landgræðslan

Only about half of Iceland is covered by vegetation and only about 10 percent of the vegetated area is considered in good condition. The rest is degraded, some areas more severely than others. Heavy sheep grazing is one of the main drives of degradation through impacts on vegetation structure and plant community composition. Sheep grazing may reduce flowering and seed set, which in turn has consequences for plant recruitment. The degradation state of ecosystems could also influence the flowering success of plants as conditions in severely degraded areas where ecosystems have collapsed can be much harsher for plants than in better vegetated areas. The aim of this study was to determine the effects of sheep grazing on flowering and reproductive success in two different habitats in the Icelandic highlands. Data was gathered during the summer of 2021 and 2022 in a 6 – 7 year old fence experiment in two different habitats at Auðkúluheiði, a vegetated dwarf-shrub heath and an

eroded gravelly desert habitat. Results showed that there were differences in flowering and seed production between the habitats. Grazing exclusion seemed to effect flowering but the effects were different between habitats. Grazing exclusions did not effect seed production, which was generally low.

## Lífsögbreytur og aldursmat klettafrúr á Íslandi

Álfur Birkir Bjarnason<sup>1,2</sup>

<sup>1</sup>Náttúrustofu Suðausturlands; <sup>2</sup>Háskóli Íslands

Lífsaga (e. life history) lýsir lífsferli og fórnarskiptum (e. tradeoff) lífveru með tilliti til vaxtar, lifunar og æxlunar. Hjá plöntum tekur hún m.a. til fræstærðar, lágmarksstærðar fyrir æxlun, vaxtarhraða, æxlunarátaks, dánarhraða og ævilengdar. Til að mynda geta plöntur verið fjölærar en einæxla. Þær leggja þá miklar auðlindir í upphafi lífsferils síns í vöxt en fresta blómgun og deyja að henni lokinni. Til að vege upp á móti færri æxlunar-atburðum yfir lífsleiðina þurfa fræin sem einæxla fjölærar plöntur mynda annaðhvort að vera fleiri eða lífvænlegri. Slík lífsaga er fágæt í íslenskri flóru þar sem < 2% æðplöntutegunda eru fjölærar og einæxla. Klettafrú (*Saxifraga cotyledon*) er ein þeirra.

Sumarið 2021 voru merktar 214 plöntur á 4 klettaveggjum í Fljótshverfi og eftirfarandi breytur skráðar: þéttleiki plantna, þvermál blaðhvírfingar, fjöldi blaða og blaðhvírfinga, blómgunartíðni og fjöldi aldina í blómskipuninni. Fræi var safnað í ágúst. Niðurstöður sýna að einungis um 5,6% stofnsins blómgaðist sumarið 2021 sem gæti bent til um 20 ára kynslóðatíma. Einnig var mikil umsetning á laufblöðum sem var óvænt þar sem blöðin eru dýrmæt ljóstíllífunar- og forðalíffæri. Þá var línulegt samband milli blaðfjölda og stærðar blaðhvírfinga, auk þess sem greinilegur stærðarþröskuldur fyrir blómgun var í stofninum. Hér mun ég kynna þessar niðurstöður um stærðardreifingu, lágmarksstærð fyrir blómgun og vaxtarhraða klettafrúr á Íslandi. Auk þess mun ég kynna næstu skref og hvernig við hyggjumst fá skýrari mynd á kynslóðalengd klettafrúr með hliðsjón af vaxtarhraða, sambandi blaðfjölda og stærðar, og stærðarþröskuldi fyrir blómgun.

## Peltigera lichens in Iceland: yet another reservoir of the plant pathogen

### *Pseudomonas syringae*?

Natalia Ramirez

University of Akureyri, Iceland

The study of *Pseudomonas syringae* has recently shifted from an agrocentric context to an ecological perspective. The discovery of new niches inhabited by *P. syringae* improves our knowledge of the adaptive skills of this bacterial group and helps us realize the extent of its dispersion. The objective of my doctoral research project is to determine if lichens in Iceland harbor *P. syringae* with pathogenic potential for crops. Of the 16 different types of lichen analyzed, species of only one genera were consistently found to harbor *P. syringae*: *Peltigera* spp. I will present the results of two questions addressed in my work. Firstly, I have tried to determine if *P. syringae* from lichens are unique to lichens or if lichens simply harbor strains from the surrounding environment. For this question, the genetic diversity of the strains collected from lichens was compared to strains sampled from moss and vascular plants at each sampling. Secondly, I have determined if the fitness and pathogenic potential on crop species of *P. syringae* strains from lichens is similar to that of strains with well-known epidemiological importance. For this question, I have compared population dynamics and virulence of lichen strains and reference epidemic strains by inoculating species of crop plants that are grown in Iceland (barley, cucumber, kale...). Overall, the results of this work

offer a unique opportunity to mark the starting point of observations on potential disease emergence as temperature, prevailing weather and land use change in Iceland as consequences of climate and global change.

## **Æxlunarhættir ljósbera (*Viscaria alpina* L.) og hugsanlegir drifkraftar fyrir þróun sérbylis**

Benedikt Traustason<sup>1</sup>, Þóra Ellen Þórhallsdóttir<sup>2</sup>,  
<sup>1</sup>Náttúruminjasafn Íslands; <sup>2</sup>Háskóli Íslands

Blómplöntur hafa einstaklega fjölbreytt æxlunarkerfi en meginþorri tegunda er þó með tvíkynja blóm. Hins vegar hafa tvær gerðir sérbylis þróast í mörgum ættum; sérbyli (dioecy, með aðskildum karl- og kvenblómum) og kvensérbyli (gynodioecy, með tvíkynja og kvenblómum). Þegar tvíkynja lífvera verður einkynja, fækka möguleikar hennar á að koma erfðum áfram. Því verður eitthvað að koma til og vega upp það tap.

Æxlunarkerfi ljósbera (*Viscaria alpina*) hefur hlotið litla eftirtekt en hann er almennt talinn hafa tvíkynja blóm. Þó eru til gamlar rannsóknir á sérbyli í grænlandskum og skandinavískum ljósberastofnum. Hér verður greint frá fyrstu niðurstöðum rannsóknar á æxlunarkerfi ljósbera í tveimur stofnum, í Þúfuveri á miðhálandi Íslands og á Skeiðarársandi. Markmið rannsóknarinnar var að: 1) greina hvort kvenplöntur ljósbera mynduast í stofnunum tveimur og ef þær mynduast 2) hver æxlunarárangur þeirra og frægæði væru samanborið við tvíkynja plöntur. Gagnasöfnun fór fram sumarið 2018 og verður framhaldið 2023.

Hér er í fyrsta sinn greint frá fundi kvenplantna ljósbera síðan 1920 en þær voru ríflega fjórðungur stofnsins í Þúfuveri (28,5%). Engin kvenplanta fannst á Skeiðarársandi. Ekki var munur á fjölda blóma eða spírunarhlutfalli fræja milli kynja í Þúfuveri og skýrir það tvennt ekki viðgang kvenplantna. Hins vegar var blómgunarferli kvenljósbera í Þúfuveri frábrugðið tvíkynja einstaklingum. Þroskun frævu kvenblóma var marktækt fljótari sem eykur líkur á víxlfrjóvgun og gæti hjálpað við að viðhalda kvenblómum í stofninum. Í rannsóknum næsta sumar er fyrirhugað að greina mögulegan mun á hæfni tvíkynja- og kvenplantna t.a.m. með samanburði á: fjölda fræja, kynslóðatíma, lifun kímplantna ásamt gæðum frjókorna.

## **Keynote speaker/Frummælandi**

### **Using tracking, modeling, and international collaboration to improve the conservation outlook for seabirds**

April Hedd\*

*Wildlife Research Division, Wildlife and Landscape Science Directorate, Environment and Climate Change Canada, Mount Pearl, Newfoundland.*

Seabirds are the most threatened group of birds, facing a multitude of pressures at terrestrial breeding colonies and within their foraging zones at sea. The highly pelagic lifestyle of tubenosed seabirds (albatrosses, shearwaters, and storm-petrels) makes them particularly vulnerable, as they are exposed to these pressures in the waters of several nations and on the high seas, throughout the annual cycle. My research interests are at the interface of ecology and conservation, and as a government scientist, I'm increasingly asked to provide science advice to managers and policy makers in areas of impact assessment (e.g., offshore energy development), Marine Spatial Planning/Protected Area development, and protection for species at risk. I will present on several projects employing advancements in tracking technologies and statistical techniques, as well as international collaborations, to address



conservation challenges of seabirds. These projects include: 1) studying albatross foraging ecology in the Southern Ocean to improve understanding of bycatch risk and inform mitigation techniques; 2) contributing tracking data and, critically, developing standardized methods for using these data to identify important bird and biodiversity areas at sea (e.g. the OSPAR NACES MPA); and 3) working with partners, regionally and internationally, to understand drivers of decline for the globally Vulnerable Leach's Storm-Petrel throughout the Atlantic. Working at the international level (e.g., through data sharing, partnering with research consortiums like Seatrack, and developing common goals among range states) is key to improving the conservation outlook for highly migratory species.

## **MÁLSTOFA IV / SESSION IV – VISTKERFI HAFSINS/MARINE ECOSYSTEMS**

### **GPS Tracking Reveals First Insights into Foraging Movements of Iceland's Nocturnal Seabirds**

Stephen Hurling<sup>1\*</sup>, Erpur Snær Hansen, April Hedd, Katharine Studholme  
<sup>1</sup>*Agricultural University of Iceland*

Globally, one third of all seabird species is threatened with extinction, among which petrels are considered most at risk. This study focuses on the three nocturnal species of petrel breeding in Iceland: Leach's storm-petrel (*Hydrobates leucorhous*), European Storm-petrel (*Hydrobates pelagicus*) and Manx Shearwater (*Puffinus puffinus*). While all three are locally red-listed, Leach's Storm-petrel is globally red-listed and found to have declined by an estimated 40-49% between 1991 and 2018 at Elliðaey, the largest Icelandic breeding colony. With an apparent lack of pressures at breeding sites, there is urgent need to better understand the foraging distribution of Icelandic petrels and threats they face at sea. To address this critical information gap, miniaturised Global Positioning System (GPS) trackers (<1g for storm-petrels; <7g for Manx shearwater) were deployed for the first time on individuals of all three species during incubation on Elliðaey, in summer 2022. With devices deployed for approximately 10 days, data were obtained for 14 Leach's Storm-petrels, 13 European Storm-petrels and 5 Manx Shearwaters. The first maps outlining at-sea foraging movements will be presented for each species; in addition to trip duration and distance, Hidden Markov Models will be used to characterise behavioural states along foraging trips (e.g. to identify transit vs foraging behaviour). This represents the first findings of a two-year study into diet and distribution for all three species to help conserve breeding populations of Iceland's nocturnal seabirds, both here and throughout their Atlantic range.

### **Centennial population control dynamics**

Erpur Snær Hansen  
*South Iceland Nature Research Centre*

Recruitment failure has been prevalent for many Icelandic middle and upper trophic level marine taxa since 2003-2005, ranging from sandeels to puffins and including a number of commercially harvested spp. Here the role of two environmental variables, Sea Surface Temperature (SST) and Silicate concentration (Si) are examined over a century of Atlantic Puffin's and other apex species population changes. SST is found to be the main „bottom up“ population control mechanism. The effects are spatially widespread, both regional neritic suppression of sandeel prey, and thus chick production, and also a recently discovered SST regime shift within the Sub Polar gyre (SPG), the wintering area of the Icelandic puffin

population and millions of other seabirds. The SPG rapid warming in 1995 led to a 50% reduction in northern krill, an important winter prey. Simultaneously the Icelandic puffin population capacity was reduced by half in only 5 years (for the second time in a century), supposedly due to overwinter mortality of newly fledged birds! In 2003-2019 an extreme and unprecedented but regional delay in puffin breeding phenology was observed ( $>1.5$  SD, 60 year time series) along a sandeel stock collapse. The hypothesized mechanism for this is a Silicate induced trophic mismatch. That recently observed and unprecedented Si reduction largely diminishes the diatom bloom, which constitute the beginning of the phytoplankton bloom. This causes a mismatch by many taxa's larval stage (hatching in spring) with their zooplankton prey (including the sandeel) cascading up the foodweb. It will remain to be seen if we manage to extend the Si record by 70 years in due time for the conference.

### **Blue whiting stock structure in the Northeast Atlantic: one or many stocks?**

Haseeb S Randhawa

*Faculty of Life and Environmental Sciences, University of Iceland*

Blue whiting, *Micromesistius poutassou*, is one of the most important pelagic fisheries in the Northeast Atlantic and represents a key component of this marine ecosystem. Reported catches ranged between 0.1 million ton (2011) and 2.4 million ton (2004) during the past two decades and the stock collapsed between 2008 to 2011, taking several years to recover. Currently, blue whiting is managed as one stock, despite scientific evidence suggesting the presence of at least two stocks which overlap in distribution. When multiple stocks are managed as a single entity, there is risk of overexploiting one stock, thus reducing its genetic diversity, and hampering its potential for recovery. In recent years, the International Council for the Exploration of the Seas (ICES), which assesses the blue whiting stock size and advises on the total allowable catch to fishing nations, has identified blue whiting stock structure as a research priority. A new project funded by the Nordic Atlantic Cooperation (NORA) is introduced here and aims to assess blue whiting stock structure in the Northeast Atlantic using an integrative approach (otolith shape, otolith microchemistry, genetics/genomics, parasites) to improve stock assessment and provide a new tool for fisheries managers. To achieve this, fishing nations will collaborate to collect blue whiting from across its range in the Northeast Atlantic at all stages of its life cycle, from new recruits on nursery grounds, juveniles/adults on the feeding grounds, and adults on the spawning grounds. This project brings together scientists from five fishing nations exploiting blue whiting.

### **Otolith-fish size relationships of 5 mesopelagic fishes**

Charlotte Matthews

*University Centre of the Westfjords*

The mesopelagic zone of the ocean is an important habitat for many fish species, yet little is known about the biology and ecology of these species. In this thesis, I analyzed specimens of five species of mesopelagic fish from the southern coast of Iceland: *Gaidropsarus argentatus*, *Benthosema glaciale*, *Notoscopelus kroyeri*, *Arctozenus risso* and *Paralepis coregonoides*. For each species, we took multiple size measurements and extracted sagittal otoliths. Various otolith characteristics were then measured. The distribution of each species was investigated alongside variables such as region, temperature, and trawl depth. Comparisons were also made during the analysis between sampling years (2020 and 2021). Length-weight relationships were determined for each species, and growth parameters such as the slope (b) and the coefficient of determination ( $r^2$ ) were calculated for three out of five species. Two

myctophid species showed positive allometric growth ( $b > 3$ ), and the juvenile *G. argentatus* showed negative allometric growth ( $b < 3$ ). The relationship between otolith size and fish length was analyzed for each species, and regression models were used to assess the strength of the relationship. For each species, different otolith characteristics had different correlation strengths for predicting weight and length. Myctophid species were primarily caught during deep trawls (between 3.8 and 8.1 °C), and Lotidae and Paralepididae species during surface trawls (between 8.7 and 11.9 °C). These findings provide valuable insights into the biology and ecology of mesopelagic fish around Iceland and contribute to our understanding of these species' role in the global ocean ecosystem.

### **Defining an alien species with uncertain arrival pathway**

Theresa Henke<sup>1\*</sup>, Jakob Hemmer-Hansen<sup>2</sup>, Snæbjörn Pálsson<sup>1</sup>, Hlynur Bárðarson<sup>3</sup>, Magnús Thorlacius<sup>3</sup>, Guðbjörg Ásta Ólafsdóttir<sup>1</sup>

<sup>1</sup>University of Iceland, Iceland; <sup>2</sup>DTU aqua, Denmark; <sup>3</sup>Marine and Freshwater Research Institute, Iceland

Defining alien species is often based on introduction pathways. But how should we define a species where uncertainties remain on its introduction? And how does this uncertainty affect stakeholders' perceptions? This is explored within the case study on the origin of European flounder (*Platichthys flesus*) in Iceland. Flounder has been observed in Iceland since 1999, where two hypotheses on its introduction have been raised, 1) that it arrived via ballast water from central Europe and 2) that it came from the Faroe Islands. A previous microsatellite-based study indicated Faroese flounder to be genetically different to other European populations. Using the same genetic markers, Icelandic flounder were compared to reference populations, indicating the Faroe Islands as the most likely origin. Knowing the origin raises the question whether flounder has been accidentally introduced or spread naturally. Using three anonymous online surveys it has been explored how invasion scientists would classify flounder going forward and whether the possibility of natural dispersal would change the documented negative perception of stakeholders. Results highlight the difficulties of defining the status of an understudied species in invasion science. They also showcase that to stakeholders perceived negative impacts of a species are more important than how it arrived.

## **MÁLSTOFA V / SESSION V – ÞURRLENDISVISTFRÆÐI/TERRRESTRIAL ECOLOGY**

### **Long-term changes in herbivore community composition and vegetation impact in Iceland**

Mathilde Defourneaux<sup>1\*</sup>, Isabel C. Barrio<sup>1</sup>, Noémie Boulanger-Lapointe<sup>2</sup>, James D.M. Speed<sup>3</sup>

<sup>1</sup>Agricultural University of Iceland; <sup>2</sup>University of Victoria; <sup>3</sup>NTNU University Museum, Norwegian University of Science and Technology

Herbivores can have large impacts on ecosystems, but the magnitude of their impacts is determined their density and community composition. Recent changes in the relative abundance of wild and domestic herbivores likely influence the ecological functionality of many extensive grazing systems worldwide. Consequences of such changes might be more important in low productive sub-arctic ecosystems like Iceland, where agricultural practices are often based on extensive grazing of rangelands and to a lesser extent, on highly

productive improved grasslands, and where recent increases in numbers of wild herbivores like geese pose management conflicts.

We estimated changes in densities of wild and domestic herbivores from 1986 to 2020 in Iceland. We computed changes over time in herbivore pressure by calculating the metabolic biomass of wild and domestic herbivores and estimated the amount of plant material consumed by these groups of herbivores in improved and unimproved lands.

We found a shift from a livestock to a wildlife-dominated herbivore community. However, wild species only accounted for 9% of the total herbivore pressure in 2020 and their overall intake still represents a small proportion of what is consumed by livestock in improved lands and rangeland (4-6%). Overall, total herbivore density increased (9%), but total herbivore biomass decreased by 15%. Our findings provide insights into the environmental conflicts that Iceland is facing in a rapidly changing environment. Currently wild herbivores only represent a small fraction of the herbivore pressure, and a little proportion of biomass consumption in either improved lands or in rangelands at national scale.

### **The “mouse race” of Vestmannaeyjar: what will be the faith of the prevailing house mouse, following a recent introduction of another small mammal species?**

Ester Rut Unnsteinsdóttir\*, Fríða Jóhannesdóttir

Only one mammalian species arrived in Iceland on its own, the Arctic fox (*Vulpes lagopus*). As humans settled in Iceland in late 9th century, two rodent species were accidentally introduced: house mice (*Mus musculus*) and wood mice (*Apodemus sylvaticus*) and both have lived there since. House mice are extremely successful in travelling with humans and thrive well in vicinity of inhabited areas. In these conditions, house mice become extremely dense and over compete other, even larger, rodent species. Wood mice cannot compete with house mice in such conditions and are less likely to travel with humans. The wood mouse, however, thrives well in outback areas and natural habitats, without any reliance on humans. Heimaey is the largest and the only inhabited island of Vestmannaeyjar (a cluster of islands 12km south off the mainland of Iceland). The house mouse was the only mouse species in Heimaey for over 1100 years, until 2019 when the first capture of “a strange mouse” took place in a pest control trap by an industry building in Heimaey. This turned out to be a wood mouse, found in Vestmannaeyjar for the first time in history. Now, the wood mouse is spread all over the island Heimaey and its effect on the prevailing house mouse is unknown. In a well-documented example from the island of St. Kilda in Scotland, the native house mice lost in competition with wood mice, and later became extinct shortly after humans had abandoned the island. As there will still be people living in the village of Heimaey, it is predicted that the house mice will not become extinct, but it is likely that the species will be restricted to the inhabited region while the wood mice will only occupy the surrounding vegetated areas. But in fact, no one can tell so we just have to observe and see what will become the result of the “mouse race” of Vestmanneyjar.

### **What are the effects of herbivore diversity on tundra ecosystems?**

Laura Barbero Palacios<sup>1\*</sup>, Isabel C. Barrio, Jan C. Axmacher, Laura Bartra, Katrín Björnsdóttir, Ragnhild Björkås, Mathilde Defourneaux, Mariana García Criado, Olivier Gilg, Michael den Herder, David S. Hik, Bernice C. Hwang, Ilona Kater, Elina Kaarlejärvi, Tiina H.M. Kolari, Jeppe A. Kristensen, Mari Kuoppamaa, Thomas K. Lameris, A. Joshua Leffler, Isla Myers-Smith, Emmanuel P. Pagneux, Matteo Petit Bon, Emmanuel Serrano, Eeva M. Soininen, Jennifer S. Ramsay, Anna Skarin, Natalya Sokolova, James D. M. Speed, Maria Tuomi, Helen Wheeler, Torben Windirsch

Northern ecosystems are strongly influenced by herbivores, but differences in diet composition, behaviour and energy requirements among herbivore species lead to contrasting impacts on ecosystem functioning. Arctic herbivore communities are changing rapidly in response to ongoing environmental and land use changes, and for these reasons, a better understanding of the consequences of changes in the diversity of herbivore assemblages in ecosystem functioning is needed. We used a systematic review to synthesize the available evidence on the effects of herbivore diversity on different processes, functions, and properties of Arctic tundra ecosystems. We searched primary field studies in databases, search engines and specialist websites and retrieved 5891 articles. After screening titles, abstracts, and full texts, 201 articles including 3955 studies were considered relevant for the systematic review. There was a geographical bias in the distribution of studies across the tundra biome, with most studies concentrated around well-established research locations. Most studies focused on the effects of a single herbivore species, while only a few studies specifically addressed the separate and combined effects of different herbivore species. The majority of studies focused on impacts of vertebrate herbivores on different aspects of arctic tundra vegetation, while other ecosystem processes, functions and properties have received less attention. Our results indicate that the available knowledge on the effects of herbivore diversity is relatively limited, so the consequences of ongoing changes in herbivore communities may be difficult to forecast. Future studies should explicitly address the role of herbivore diversity to understand the responses of tundra ecosystems to ongoing environmental changes.

## **MÁLSTOFA VI / SESSION VI – ATFERLI OG VISTFRÆÐI FERSKVATNSFISKA/BEHAVIOUR AND ECOLOGY OF FRESHWATER FISH**

### **Personality and temporal plasticity in fish populations along a gradient of evolutionary divergence**

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Personality is now recognized as an ecologically and evolutionarily significant phenomenon because it can affect fitness directly. However, empirical studies specifically tackling the importance of personality in the processes of adaptive divergence and speciation are scarce. Whether selection favours plasticity or canalisation of personality traits in specific contexts and how ecological conditions affect the presence and the structure of personalities remains to be elucidated. We used five populations of Arctic charr (*Salvelinus alpinus*) chosen along a gradient of genetic and phenotypic divergence i.e. an anadromous population supposedly close to the ancestral population and two pairs of sympatric lake morphs. Fish were raised individually from egg stage in a common garden experiment to specifically assess the genetic bases of boldness trait in those populations. Thirty-two individuals per morph were repeatedly tested at 11 months old in an open field test with a shelter to assess boldness. The repeatability of boldness trait i.e. personality, within and among-individual variation, and temporal variation were assessed within each population. Then, the temporal plasticity in boldness and boldness mean score were assessed among populations. The results show differences among populations for the three variables, with the highest repeatability in the most diverged population, an increase of boldness over time and lower mean value in the anadromous population. This suggests that boldness and temporal plasticity differ between

the anadromous population and the more diverged lake populations under a controlled embryonic/juvenile environment.

### **Influence of habitat complexity on stream-dwelling Arctic charr space use - does personality matter?**

Gabrielle M.V. Ladurée<sup>1\*</sup>, David R. Benhaïm<sup>1</sup>, Laura K. Weir<sup>2</sup>, Stefán Ó. Steingrímsson<sup>1</sup>  
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<sup>2</sup>*Department of Biology, Saint Mary's University, Halifax, Nova Scotia, Canada*

Habitat complexity is a key component of animal population ecology that can affect foraging behaviour, activity levels and spatial patterns in a wide range of animals. In stream salmonids, numerous studies report the effect of increasing spatial complexity on individual space use and social organisation. However, little is known about the repeatability of these behaviours over time and across habitats, nor do we understand their possible link with standard measures of animal personality. Juvenile wild Arctic charr (*Salvelinus alpinus*) were captured and assessed for personality traits in the laboratory. They were then placed into 12 semi-natural stream enclosures (n=8 fish per enclosure) with different habitat complexity conditions (five shelters or one shelter) for 42 days. Repeated estimates of space use, activity and social behaviour were collected in the field. We expected fish to exhibit distinct spatial organisation and activity levels corresponding to habitat complexity, i.e., lower shelter availability should result in fish aggregating and being more active. In contrast, fish with high shelter availability should exhibit more sheltering behaviour and lower activity levels. Regardless of the treatment, we expected bolder fish to be more aggressive towards conspecifics, more active and exhibit higher growth than shyer ones. Here we present preliminary results from this study with an overview of the oncoming steps of the project.

### **Monitoring spawners of planktivorous Arctic charr in Lake Þingvallavatn, Iceland 1983-2022**

Finnur Ingimarsson<sup>1</sup>, Fia Elisabet Finn<sup>1</sup>, Haraldur Rafn Ingvason<sup>1</sup>, Stefán Már Stefánsson<sup>1</sup> og Sigurður Sveinn Snorrason<sup>2</sup>  
<sup>1</sup>*Natural History Museum of Kópavogur;* <sup>2</sup>*Líf- og umhverfisvísindastofnun Háskóla Íslands*

Global warming poses serious threats to lake ecosystems. Amongst effects already documented are changes in fish communities in northern and temperate lakes. Here we present data from monitoring of spawners of planktivorous Arctic charr (*Salvelinus alpinus*) in Lake Þingvallavatn focusing on changes in life history characteristics, - size and age at sexual maturation-, and population density. These data will be analysed with respect to surface layer temperatures (1962- 2022) and vertical profiles of temperature and zooplankton from 2007 and a recent, sharp increase in the population of brown trout (*Salmo trutta*) in the lake.

### **Shoaling in Mývatn Stickleback: Temperature and Origin Variation**

Spencer Edwards\*, Kasha Strickland, Bjarni Kristófer Kristjánsson  
*Hólar University, Háeyri 1, Sauðárkrókur*

Behavioral variation within populations has the potential to lead to novel adaptations and population divergence. The threespine stickleback (*Gasterosteus aculeatus*) in Lake Mývatn is an ideal candidate to study such local adaptations. Threespine stickleback diverge in their morphology and physiology across the lake, partly in relation to habitat diversity, e.g. in temperature. However, we have yet to investigate many behavioral differences within the population. In the present study, we investigated whether variation in habitat of origin, which

vary widely in temperature, predator densities, and geological features have an impact on the shoaling behavior of stickleback of lake Mývatn. Fish were reared at contrasting temperatures (22 °C and 13°C) and raised for about 3000 degree-days. Shoaling was tested by placing a single fish in an arena with a shoal (10 individuals) and distractor (2 individuals) on either side. Fish were then recorded for 15 minutes, and their time spent near the shoal was examined. We studied if the tendency to shoal is related to habitat of origin and rearing conditions. We found that all fish show a strong tendency to shoal, but that time spent shoaling (versus interacting with distractors/exploring) is greater among fish raised in the cold treatment, regardless of cross type. This research will help us to better understand patterns of diversification across lake Mývatn and could be replicated for other ecologically significant populations. Furthermore, understanding how behavior, morphology, and environment interact may increase our ability to predict how populations will respond to environmental change.

### **Foraging niche and diet variation in threespine stickleback (*Gasterosteus aculeatus*) in Lake Mývatn, Iceland**

Ragna Guðrún Snorradóttir<sup>1\*</sup>, Bjarni K. Kristjánsson<sup>1</sup>, Katja Räsänen<sup>2</sup>, Kasha Strickland<sup>1,3</sup>, Joseph Phillips<sup>1,4</sup>

<sup>1</sup>Hólar University, Iceland; <sup>2</sup>University of Jyväskylä, Finland; <sup>3</sup>University of Edinburgh, Scotland; <sup>4</sup>Creighton University, United States

Resource availability is a major driver of ecological and evolutionary processes, where studies of diet specialization can link these processes. The foraging abilities of individuals are shaped by morphological and behavioural traits which themselves are the results of genetic and environmental interactions, through evolution. A well-suited study system for a better understanding of the relationship between an organism's environment, the niche it selects, and the expression of its phenotype is threespine stickleback (*Gasterosteus aculeatus*) from Lake Mývatn.

Mývatn shows considerable ecological variation, with two main basins encompassing a range of habitat types, physiochemical conditions, and invertebrate species that differ throughout the lake. Moreover, the stickleback population in Mývatn differs in densities throughout the lake, shows phenotypic variation in feeding morphology, and fluctuates in size across years. Here we assessed variation in stickleback diet (i.e. stomach content) from fish caught in June 2021 from different sites within the lake to investigate whether there is evidence for individual specialization, where some individual uses a particular subset of resources. We then linked diet variation and morphology (gill raker structure and head morphology). Such individual specialization in relation to morphology and environments may indicate divergent selection and/or reflects prey differences among sites. This study provides insight into the continuum of specialization - generalization of the Mývatn stickleback population and provides a baseline for future studies examining temporal changes in divergent selection.

### **Juvenile feeding ecology in threespine stickleback**

Alessandra B. Schnider\*, Etienne de la Burgade, Franka Hemme, Bjarni K. Kristjánsson

Interactions between organisms and their environment shape the phenotype and are usually studied in adults. However, the organismal phenotype is largely moulded during the juvenile phase and natural selection during this stage is often strong. Studying juvenile threespine stickleback (*Gasterosteus aculeatus*) from lake Mývatn offers a unique opportunity to assess organism-environment relationships. The lake is highly heterogenous and the adult

stickleback population is divergent in feeding morphology among contrasting habitats. We tested whether diet and trophic morphology already diverges at a juvenile stage. To do so we analyzed stomach contents of juveniles from distinct habitats within the lake, as well as performing geometric morphometric analyses of the head on the same individuals. We saw clear differences in juvenile diet composition and head morphology between contrasting habitats. An especially clear contrast was found between the proportion of small Cladocera and Chironomidae larvae in an individual's diet, which is in line with reports for adults from the same habitats. We also found a change in diet and morphology based on size, where smaller individuals fed more on small Cladocera and bigger individuals consumed more Chironomidae larvae. This size dependent shift in diet and morphology is indicative of ontological changes in diet and morphology. Thus, the here presented study delivers insight into the development of trophic morphology, as well as diet mediated diversification.

### **Environment, life history, and demography in cave charr**

Grant E. Haines\*, Bjarni K. Kristjánsson, Camille A. Leblanc

*Háskólinn á Hólum*

Due to the ease with which individuals may be repeatedly observed and have the same data taken through time, small populations in confined areas offer unusual opportunities for studying the influence of environmental changes on population demographics and evolution of life history. To the north and west of Mývatn, numerous small populations of arctic charr are present in lava caves that are not connected to the lake itself. The ecology of Mývatn and the surrounding area is heavily influenced by yearly chironomid midge swarms, and the midges are assumed to provide nutrient subsidies to the caves, but numbers of midges vary considerable between years. Twenty of the cave populations have been observed twice yearly since 2012, with individuals tagged upon capture, and their lengths recorded. These observations will be used to calculate approximate population sizes and demographic variables in each of the caves. Using the charr dataset, as well as data on abiotic environmental variables, and midge abundances, I will determine whether fluctuations in the midge population have demonstrable effects on charr growth rates, population size, and body size structure of the cave populations.



## VEGGSPJÖLD / POSTERS

### **Mold ert þú – jarðvegur og íslensk náttúra**

Ólafur Arnalds

*Landbúnaðarháskóla Íslands*

Kynnt er ný bók um jarðveg, íslenska náttúru og stöðu íslenskra vistkerfa: „Mold ert þú – Jarðvegur og íslensk náttúra“.

Moldin fæðir og klæðir jarðarbúa og hún miðlar jafnframt ferskvatni um vistkerfi. Skilningur á vistkerfum og hvernig þau bregðast við álagi vegna athafna mannsins á jörðinni krefst þekkingar á jarðvegi.

Jarðvegur á Íslandi er sérstæður á heimsvísu, frjór en viðkvæmur, því aðstæður fyrir þróun hans hérlendis eru afar sérstakar. Á þessari mold þróast einstök vistkerfi. Grunnur að jarðvegsfræði er lagður í upphafi bókarinnar og síðan er íslenskum jarðvegi gerð sérstök skil. Í bókinni er varpað ljósi á hversu miðlæg moldin er í kolefnishringrás jarðar, enda er þar að finna meira kolefni en í gróðri og andrúmslofti samanlagt. Hún getur bæði bundið og losað CO<sub>2</sub> og hefur afgerandi áhrif á styrk gróðurhúsalofttegunda í andrúmsloftinu og loftslag jarðar.

Í „Mold ert þú“ er útskýrt af hverju áhrif frosts á náttúruna eru meiri hérlendis en þekkt annars staðar. Hinum einstöku sandauðnum og áhrifum þeirra á öll vistkerfi landsins er einnig gefinn sérstakur gaumur.

Leitast er við að opna augu lesandans fyrir eðli og ástandi vistkerfa – þar sem moldin gegnir lykilhlutverki ásamt gróðurþáttum. Ferli hnignunar eru skýrð sem og þeir þættir sem skilgreina ástand lands. Í bókinni er dregin upp skýr mynd af stöðu íslenskra vistkerfa sem víða eru hrúnin eða í afar hnignuðu ástandi.

Fjallað er um rætur landhnignunar og rangrar landnýtingar hérlendis sem annars staðar, en þeirra er m.a. að leita í lögum og reglum, styrkjakerfi, „samdaunasýki“ (e. shifting baseline syndrome) o.fl. þáttum – allt þættir sem lögð vaxandi áhersla á í tengslum við umhverfissamninga Sameinuðu þjóðanna og stöð vistkerfa jarðar.

Að lokum er vikið að vistheimt – endurheimt vistkerfa – sem er e.t.v. mikilvægasta viðfangsefni mannkynsins nú á dögum.

Bókin er gefin út af IÐNÚ-útgáfu í samstarfi við Landgræðsluna, Landbúnaðarháskóla Íslands og Vísindasjóð Orkuveitu Reykjavíkur. Hún verður gerð aðgengileg á netinu án endurgjalds ([moldin.is](http://moldin.is)).

### **A Comparison of the Saddle Patches, Rake Marks and Catalogues of the Icelandic and Norwegian Killer Whale (*Orcinus orca*) Populations**

Alice Crighton\*, Filipa Samarra, Eve Jourdain

*Icelandic Orca Project and The Norwegian Orca Survey*

This project aims to provide a comprehensive view of the spatial overlaps, phenotypic differences, and social structures of the two largest North Atlantic killer whale (*Orcinus orca*) populations, the Icelandic, and the Norwegian, considering the changing abundance and distribution of prey resources. Following the restoration of the pre-collapse Norwegian Spring Spawning Herring migration route, which now brings them annually into Icelandic waters, we presume that traceable spatial overlap between the Icelandic and Norwegian Killer whales may now exist as they migrate to follow the herring. The photo ID catalogues of Iceland and Norway are being compared manually to discover whether they have any individuals in common. This photo ID data is also being analysed for differences in the

frequency of saddle patch type, to examine for the phenotypic variability or similarity between the populations and to act as an indicator of the levels of transiency seen in each location. Rake marks on killer whales are scars or lesions on the epidermis left by the teeth of conspecifics. To assess the differences in social structure, the percentage rake mark coverage of each whale photo ID will be measured and compared based on sex, age, location, and frequency of occurrence. By gathering this data, we hope to provide a clearer understanding of the similarities in phenotype and social organisation, but also whether there is intermingling of the populations which will help to inform conservation efforts for this species in the North Atlantic moving forward.

### **Temporal changes in feeding ecology and life histories of fishes in Faroese lakes**

Camille A. Leblanc<sup>1</sup>, Krista M. Veijonen\*<sup>1</sup>, Bjarni K. Kristjánsson<sup>1</sup>, Janus Hansen<sup>2</sup>, Ragnhildur Guðmundsdóttir<sup>3</sup>, Kári H. Árnason<sup>1</sup>, Hilmar Malmquist<sup>3</sup>, Kirsten S. Christoffersen<sup>4</sup>, Agnes-Katharina Kreiling<sup>2</sup>

<sup>1</sup>Hólar University, Iceland; <sup>2</sup>Tjósvanið, Faroes Islands; <sup>3</sup>Icelandic Museum of Natural History; <sup>4</sup>University of Copenhagen

The FishFAR project aims to identify the effects of climate change on community structure and trophic ecology of fishes in subarctic Faroese lakes. We selected three lakes representing contrasting combination of fish species and compared available resources, fish diet and fish morphology. By studying what fishes eat, where they are found, and how/if they compete, we can identify their overall influence on the lake ecosystem. We aim to compare the data we collected in this project to data obtained in summer 2000 (NORLAKE project), allowing an estimation of changes in salmonid species, Brown trout (*Salmo trutta*) and Arctic charr (*Salvelinus alpinus*), in the context of warming.

In summer 2022, we sampled the lakes Leynavatn, Saksunarvatn and Toftavatn, as well as placed temperature loggers at various depths in each of the lakes. We sampled fishes in various areas of throughout the lakes and collected benthic macroinvertebrates and plankton at deep water (> 12 m) and in the littoral zone (0-1 m) stations. A similar campaign will be repeated in the summer 2023, capturing both annual variation (2022 vs. 2023) and long-term changes (2000 vs. 2022/2023).

This project will increase our understanding of spatial and temporal changes in biodiversity of freshwater fishes in small subarctic lakes. This is of critical importance for successful conservation of biodiversity under the current climate and biodiversity crises.

### **Whales of Vestmannaeyjar: A citizen science initiative to monitor year-round presence of cetaceans around the Vestmannaeyjar archipelago.**

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<sup>1</sup>Náttúrustofa Suðurlands; <sup>2</sup>Háskóli Íslands

Cetaceans draw significant public attention but are sparsely distributed. Citizen science can be a powerful tool to monitor their occurrence. We explored the possibility of collecting information on cetacean presence year-round via opportunistic sightings reported by citizen scientists in Vestmannaeyjar (South Iceland).

The citizen science initiative WhaVe (Whales of Vestmannaeyjar) was established in October 2020. A Facebook page “Hvalir við Vestmannaeyjar / Whales of Vestmannaeyjar” and a Messenger chat were created for sharing the location of sightings. Most sightings were made from land, although the ferry, fishing vessels or cruise-ships were used as platforms as well.

During the period October 2020 – December 2022 (695 days), a total of 306 sightings were reported, averaging 0.44 sightings / day. Out of 8 different species identified, the main species were humpback, killer and minke whale, together accounting for 78.3% of the sightings. The timing of sightings was skewed towards spring (March-May) and summer (June-August), representing 77.5% of the total. Species presence varied by season; humpback whales were mainly seen during winter and spring (December-May, 79.6% of their sightings), while killer and minke whales were mostly sighted during summer (June-August, 80.6% and 79.6% of their sightings, respectively).

This marked seasonality is likely linked to prey availability and migration patterns, namely of capelin and herring. This study helps us better understand the importance of South Iceland for cetaceans and shows that citizen science can provide useful long-term monitoring data.

### **Fjölbreytni svifkrabbadýra í ferskvatni á Íslandi í tíma og rúmi**

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Svifkrabbadýr, vatnaflær og árfætlur, skipa mikilvægan hlekk í fæðuvef stöðuvatna. Þau eru afar næm á umhverfi sitt og geta brugðist hratt við bæði lífrænum og ólífrænum breytingum í umhverfinu. Mikilvægt er að fylgst sé með lífveruhópum sem þessum í ljósi þeirra umhverfisbreytinga sem nú eiga sér stað vegna hlýnandi loftslags ásamt auknu álagi á náttúruna af manna völdum. Líffræðileg fjölbreytni krabbadýra í svifvist stöðuvatna á Íslandi hefur hingað til ekki fengið mikla athygli. Þær rannsóknir sem gerðar hafa verið hafa einkum beinst að tveimur mest rannsökuðu vötnum á Íslandi, Þingvallavatni og Mývatni.

Yfirlitskönnun á lífríki íslenskra vatna fór fram á árunum 1992–1998, þar voru m.a. tekin svifsýni úr yfir 80 vötnum og krabbadýr greind. Þetta gaf gott yfirlit yfir helstu hópa krabbadýra sem finnast á Íslandi. Skortur er aftur á móti á vöktunarverkefnum sem snúa að svifkröbbum í ferskvatni á landsvísi en slík verkefni eru nauðsynleg ef athuga á breytingar á samfélagsgerðum yfir tíma. Markmið þessa verkefnis er að kanna fjölbreytni svifkrabbasamfélaga í ferskvatni á Íslandi í tíma og rúmi og er efniviður rannsóknarinnar fenginn úr framangreindri yfirlitskönnun frá árunum 1992–1998 ásamt svifsýnum í eigu Náttúrufræðistofu Kópavogs sem tekin voru á árunum 2012–2013. Nítján vötn voru tekin fyrir í báðum þessum rannsóknum og verða þau sérstaklega borin saman með tilliti til breytinga yfir tíma.

### **Monitoring CO<sub>2</sub> and CH<sub>4</sub> fluxes at a wetland and grassland site in West Iceland**

Ölvir Styrmisson\*, Sunna Áskelsdóttir

*Landgræðslan / The Soil Conservation Service of Iceland*

Wetlands and grasslands have important roles, they f.e. act as habitats, regulate waterflow, store nutrients, stabilize soil and feed livestock. In recent years their roles in the carbon cycle and in carbon storage have been highlighted. At Reynivellir, Kjósarhreppur, Western Iceland, monitoring of CO<sub>2</sub> and CH<sub>4</sub> fluxes in a drained wetland, an undrained wetland and a naturally drained grassland began in the spring of 2022. The goal of the project is to create models of the carbon budget based on variables such as soil temperature, the water level, photosynthetically active radiation and vegetation variables with a high temporal resolution, which could be used to estimate the carbon budget of other areas with less data. Nine monitoring plots were set up in the three land types where chamber measurements were taken

for calculation of CO<sub>2</sub> respiration, uptake of carbon and CH<sub>4</sub> emissions, along with other variables. Measurements were taken weekly from May to October and less regularly after that. Continuous logging of some variables began in 2022 and continuous logging will have a greater role in 2023. Considerable variability in CO<sub>2</sub> respiration and CH<sub>4</sub> emissions were seen between land types but the differences in carbon uptake were smaller. Statistical models of CO<sub>2</sub> respiration and carbon uptake had high explained variability but CH<sub>4</sub> models were weaker and linear interpolation proved to be a more suitable gap filling method.

## **The YAN App - Youth Nature Monitoring in the Arctic**

Cécile Chauvat

Naturalist and Coordinator of Youth for Arctic Nature

*Náttúrustofa Norðurlands Vestra*

The Youth for Arctic Nature project (YAN, arcticnature.org) is a 3-year project funded by NORA which aims to connect Arctic youth to their local environment. The primary goals are to encourage youth to participate in the study of nature and climate change in the Arctic, to connect Arctic youth who are interested in their local nature with each other and with local scientists, and to empower youth in wildlife monitoring.

There are many challenges to implementing a community-based project like YAN. These include, for example, the continued involvement and motivation of youth and youth leaders, standardization of data collection, dissemination and archiving of results, and effective communication about the project. To address these obstacles, an app was created to link all stakeholders while making it simple for users to understand methods, to access our results, and to contribute to the project in a valuable way. In this poster, I will explain how the YAN app works and how it tackles common issues faced by youth-based monitoring initiatives. I will also present some pilot projects and future perspectives.

## **Ecosystems trapped in a degraded state – the TRAPP project**

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The TRAPP project aims to investigate ecosystem processes that slow down or prevent recovery of heavily grazed rangelands in the Icelandic highlands following grazing-cessation. A special emphasis is on understanding the role of different plant functional types and soil related processes in retarding or facilitating transitions to healthier ecosystem states. The project is organised into three work packages, each addressing specific research questions. WP1: What is the relationship between the relative abundance of palatable and unpalatable species (facilitating and retarding PFTs) and ecosystem functions (primary productivity, decomposition rates, soil fertility and soil carbon) in tundra rangelands? WP2: How is the relative abundance of PFTs and ecosystem functions affected by cessation of grazing in heavily grazed rangelands in a warming climate? WP3: Which mechanisms affect the rate of ecosystem processes and the establishment of more palatable species (facilitating PFTs, rate of recovery) in heavily grazed rangelands after grazing cessation and how are they affected

by climate warming? The poster will introduce the TRAPP project, how different student projects are linked within the overall project and present some preliminary results.

### **Wetland restoration in Iceland – how to speed up the establishment of wetland vegetation in disturbed margins that follows restoration?**

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When carrying out wetland restoration, considerable disturbance on the vegetation cover often follows when the soil is moved. How quickly and what combination of vegetation covers these wounds varies greatly. A comparative study was set up at drained wetlands in Sogn, Ölfus (S-Iceland) and at Ytri-Hraundalur, Mýrar (W-Iceland) to test three methods to speed up the establishment of wetland vegetation at the margins that were disturbed following restoration (implemented in 2019): (i) transporting turfs with wetland vegetation; (ii) spreading green hay from local wetland vegetation patches and (iii) sowing annual grass seeds to facilitate the establishment of local vegetation. The disturbance state of the margins was measured in 2019, the vegetation and surface measurements were then repeated in 2020 and 2021. Preliminary results indicate that good workmanship during restoration actions, successful raising of water table and slowing down surface water flow facilitates the establishment of wetland vegetation in the disturbed margins and there is a difference between the three methods how they speed up the establishment of wetland vegetation.

### **Energy budget of a wintering humpback whale (*Megaptera novangeliae*) in Eyjafjörður, Iceland**

Jóhanna Sigurðardóttir\*, Edda Elísabet Magnúsdóttir

*University of Iceland*

Humpback whales are large baleen whales, commonly sighted in Icelandic coastal waters during the summer while winters are generally spent on low latitude breeding grounds. Humpback sightings during the winter have, however, become more common in the last years. It has been suggested that such behavior represents a more opportunistic life history strategy than previously described. To investigate the energy budget of a wintering whale, a young-adult humpback observed feeding in Eyjafjörður, Iceland, during winter was tagged with an archival tag for ~24 hours. The dive profile indicated a diel pattern with deeper dives performed at higher light levels and resting during the evening and night. The breathing rate was examined in relation to deep dive behavior with the aim of investigating energy demands after diving events. Additionally, the breathing rate from the tag was compared with the observed breathing rate logged from a land station to test the feasibility of using land-based observations for assessing the underwater behavior based on breathing rate only. Results from the tag showed that the average breathing rate was higher with a higher lunge rate, but the variance was quite high. In addition, only 56% of the breaths were recorded from land with inconsistent time lags, varying from 5 to 29 sec. Thus, such a cost-efficient method needs improvement for better significance. Importantly, the results show for the first time, the foraging effort of a wintering whale in Icelandic waters and reflect on the feeding opportunities for an overwintering humpback in these sub-arctic waters.

## **Diversity in the internal functional feeding elements of sympatric morphs of Arctic charr (*Salvelinus alpinus*)**

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The diversity of functional feeding anatomy is particularly impressive in fishes and correlates with various interspecific ecological specializations. Intraspecific polymorphism can manifest in divergent feeding morphology and ecology, often along a benthic–pelagic axis. Arctic charr (*Salvelinus alpinus*) is a freshwater salmonid known for morphological variation and sympatric polymorphism. In Lake Þingvallavatn, Iceland, four morphs of arctic charr coexist that differ in preferred prey, behaviour, habitat use, and external feeding morphology. We studied variation in six upper and lower jaw bones in adults of the four morphs using geometric morphometrics and univariate statistics. We tested for allometric differences in bone size and shape among morphs, morph effects on bone size and shape, and divergence along the benthic–pelagic axis. We also examined the degree of integration between bone pairs. We found differences in bone size between pelagic and benthic morphs for two bones (dentary and premaxilla). We found clear bone shape divergence along a benthic–pelagic axis in four bones (dentary, articular-angular, premaxilla and maxilla), as well as allometric differences between morphs in the dentary. Most dramatic was the dentary, where morph explained more shape variation than bone size. Comparatively, benthic morphs possess a compact and taller dentary, with shorter dentary palate, consistent with visible (but less prominent) differences in external morphology. As these morphs emerged in the last 10,000 years, these results indicate rapid functional evolution of specific feeding structures in arctic charr. This sets the stage for studies of the genetics and development of rapid and parallel craniofacial evolution.

## **How can we assess the impacts of multiple stressors in marine habitats?**

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The anthropogenic changes in environmental factors, added to the natural variability of some of these, have understandably led to an increase in the studies on the biological consequences of these changes. Experimental studies on the biological effects of marine environmental factors such as temperature and pH have mostly been studied separately for each factor, although the changes in these are commonly occurring simultaneously. This has led to a call for more realistic studies including more than one factor at a time and the MFRI has responded to this call by building an experimental aquaculture facility that can house such experiments. Before tackling questions about the effects of multiple factors with a complicated experiment, questions regarding the factors' ranges, physiological modes of action on organisms and corresponding performance curves need to be answered. Such an experimental strategy including both single and multiple stressor studies is now being carried out at the MFRI facility and collaborating laboratories in Monaco. This presentation will give insight into the design and execution of marine multiple stressor studies, using examples of the recent and ongoing experiments, as well as introducing a meta-analysis approach.