# Thursday 8th

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<tr>
<th>Time</th>
<th>Session 1</th>
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<tr>
<td>9:00</td>
<td>Opening words</td>
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<td>Marjo Saastamoinen, Helsinki Institute of Life Science, University of Helsinki</td>
<td>Maria Santos, Department of Geography, University of Zurich</td>
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**Session 1**
- Coping with human-induced environmental change – butterflies as model system
- Unravelling the sources of variation in mitochondrial function and their fitness consequences in wild bird populations
- Are you ready for the heat? Plasticity vs adaptation of heat tolerance in three-spined stickleback
- Endophyte-promoted seed pathogen increases host grass resistance against insect herbivore
- Invasive mud crab Rhithropanopeus harrisii alters invertebrate community composition in the northern Baltic Sea
- Parental investment under predation threat in a long-lived sea duck: a study of corticosterone and prolactin levels in the eider Somateria mollissima
- The role of predator plumage colouration on mobbing behavior by passerines: a case study of the color polymorphic tawny owl
- Discovering new species of tropical ferns

**Session 2**
- Understanding social-ecological co-evolution in the context of global change
- Emerging conservation crisis? The risks for migratory bats with increasing wind turbine construction in Finland
- How Human-Animal relationship affects the behavioral response in a working context: The Asian elephant as a study case
- The long-term success of mandatory vaccination laws at implementing world’s first vaccination campaign in rural Finland
- Does local water quality affect people’s life quality? A case study in a coastal community
- What is the place of research in producing better futures?
- Predicting spatio-temporal distributions of migratory populations by combining citizen science data and Gaussian Process modelling
- Tree cavity abundance and beyond: habitat choice of the pygmy owl in the managed boreal forest
- Long-term spatial and temporal variation in eider nest predation and fecundity: a comparison between two subpopulations
**Friday 9th**

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<td>Jussi Heinonen, Department of Geosciences and Geography, University of Helsinki</td>
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<td>10:10-10:30</td>
<td>A computer in a volcano – The Magma Chamber Simulator</td>
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<td>Agnes Karlsson, Department of Ecology, Environment and Plant Sciences, University of Stockholm</td>
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<td><strong>Final words and Award Ceremony</strong></td>
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Keynote speaker:
**Marjo Saastamoinen**
Helsinki Institute of Life Science, University of Helsinki

**Biography**
Marjo Saastamoinen is an Associate professor in Evolutionary Ecology at the Helsinki Life Science Institute, University of Helsinki, where she leads the Life-history evolution research group. She is also a PI at the Research Centre for Ecological Change and Centre for Ecological Genetics. Her research focuses on the responses and underlying mechanisms of natural populations to environmental change. She is particularly interested in how individual-level responses or strategies impact population dynamics, abundances or trends. In her research she combines long-term monitoring data with experimental, genomic and modelling approaches. Most of her work involves using the Glanville fritillary butterfly and its metapopulation in the Åland islands as a model system. More recently her work also extends to other Lepidoptera, insects and even birds, and assessments at more community level responses.

**Coping with human-induced environmental change – butterflies as model system**

Organisms in natural populations are increasingly challenged by environmental variation and stress. However, as environmental variation is common in nature, species often harbour adaptive strategies that may mitigate negative impacts. Whether existing strategies also benefit individuals and populations under more novel stressors remains unknown. To address these questions, we are utilizing the Glanville fritillary butterfly as a study organism and effectively couple laboratory and field based studies with long-term demographic and environmental data and analyses. In my talk I will present some recent work assessing the impact of extensive summer drought on individual and population level responses, and discuss whether behavioural modifications in habitat use and thus spatial habitat heterogeneity mitigates negative impacts. I will finish my talk with analyses assessing temporal shifts in phenology and spatial shifts in northern range boundaries by using long-term data for 289 Lepidoptera species sampled over two decades. We show that even though a combination of phenology and range shifts is the most viable strategy under a changing climate only a minority of species are able to use it. This may have large consequences on future community composition of Boreal Lepidoptera.

**Unravelling the sources of variation in mitochondrial function and their fitness consequences in wild bird populations**

**Nina Cossin-Sevrin**
Department of Biology, University of Turku

The aim of my PhD project is to investigate how mitochondrial function shapes animal phenotype (e.g. size, growth rate), ageing rate and survival, but also to understand where inter-individual differences in mitochondrial function originate. To answer these questions, I am using wild birds as animal models, specifically great tits in Finland and king penguins in French Southern Territories (Crozet archipelago). Birds are ideal models for my project owing to the ease of obtaining both phenotypic and survival data in the wild, as well as to the possibility to collect information on mitochondrial function and telomere length (i.e. one biomarker of ageing) in a minimally-invasive way using their nucleated red blood cells. Mitochondria are the powerhouse of eukaryotic cells, converting nutrients into cellular energy, but they also generate harmful by-products (i.e. reactive oxygen species: ROS) accelerating ageing. Hence, variation in mitochondrial function is expected to explain differences in how organisms grow, reproduce and senesce. Mitochondrial function has also been proposed to respond to environmental stressors, especially early in life. Since very little information on mitochondrial responses to environmental constraints is available in free living animals, such an innovative and comprehensive PhD project will provide crucial pre-requisite regarding the determinants and consequences of variation in mitochondrial function, which will help to predict how animals might respond to environmental changes. Notably, it is presently unknown in natural populations (i) how variable are mitochondrial traits and whether this variation is under selection; (ii) whether mitochondrial traits are heritable and therefore can respond to selection, and (iii) whether environmental factors encountered early in life or at adulthood alter mitochondrial traits. I will address these outstanding questions in my PhD thesis. Since evolutionary adaptive potential is a
key mechanism to respond to rapid global changes linked to anthropogenic activities, we are convinced that this project is crucial to better understand the effects of human activities on birds.

Are you ready for the heat? Plasticity vs adaptation of heat tolerance in three-spined stickleback
Giovanna Mottola
Department of Biology, University of Turku

Climate change has been shown to increase the frequency of extreme thermal events like heat waves. Heat waves constitute a challenge for fish leading sometimes to mass mortality events. Fish can, nevertheless, try to counteract such heat wave episodes e.g. via local adaptation and phenotypic plasticity. The magnitude in the plasticity of fish to face heat waves might, however, be influenced by the thermal history of the fish and possible local adaptation to warm habitat. Such change in plasticity via possible local adaptation could lead to different capacities of fish to respond phenotypically to heat waves. We tested this hypothesis by comparing the individual capacities of sticklebacks from six populations to respond to heat waves with different thermal histories. Two of the populations originated from unique warm environment of the nuclear power plants, simulating the climate change environment, while the other populations belonged to cooler control areas along the Finnish coastline of the Baltic Sea. We measured the individual upper thermal tolerance in common garden conditions before and after a laboratory mimicked heat wave (increase of water temperature by 10°C) and the responses at molecular level. We found that 1-week long heat wave increased fish upper thermal tolerance by 3.3 ± 0.2°C. Importantly, neither the thermal tolerance nor the plastic responses at physiological or molecular level differed between nuclear power plant and control areas showing that thermal history have not modified the capacity to respond to heat waves even though the populations differed from each other genetically. We also found out that the individual plasticity was negatively correlated to thermal tolerance of the fish and together these results suggest that living (and adapting) in warm habitat might not enhance the phenotypic plasticity to respond heat waves and thermal tolerance has its upper boundary limits.

Endophyte-promoted seed pathogen increases host grass resistance against insect herbivore
Miika Laihonen
Biodiversity Unit, University of Turku

Plant-microbe interactions depend on their biotic and abiotic environments. Despite the increased number of studies on plant microbiomes, ecological studies on plant-microbe interactions still rarely address the role of co-occurring plant-associated microbes. Here we contend that plant-associated microbes interact with each other and can have ramifications to higher trophic levels. In this study, we monitored natural occurrences of the pathogenic fungus (Claviceps purpurea) and aphids (Sitobion sp.) on Epichloë festucae symbiotic (E+) and non-symbiotic (E-) red fescue (Festuca rubra). Epichloë festucae is a systemic and vertically via seed transmitted endophytic fungus, and Claviceps purpurea, commonly called as ergot, is a seed pathogen of graminoids. Both fungi are well known for their production of animal-toxic alkaloids. The study was conducted in a semi-natural subarctic setting where E+ and E- plants from different origins (Spain and Northern Finland) were planted in a randomized design in a fenced common garden at Kevo Subarctic Research Station in Utsjoki, Finland. Our study revealed that seed-transmitted plant mutualistic fungal endophyte promoted the natural infection frequency of the seed pathogenic fungus in a shared grass host. Furthermore, the infection by the seed pathogen negatively affected aphid occurrence and numbers on plant inflorescences, irrespective of endophyte symbiosis. We assume that aphid occurrence was driven by ergot-derived alkaloids (we are currently analyzing the mycotoxin contents in the plant inflorescences). These results show that plant mutualistic fungi can increase the infection probability of a pathogenic fungus, which then becomes beneficial to the plant by controlling herbivorous insect. Our study highlights the complexity and context dependency of species-species and multi-trophic interactions, thus challenging labeling of species as plant mutualists or pathogens.

Invasive mud crab Rhithropanopeus harrisi alters invertebrate community composition in the northern Baltic Sea
Katariina Riipinen
Department of Biology, University of Turku
Non-indigenous species can alter the communities and ecosystems they are introduced to in many ways. In the species-poor Baltic Sea, the impact of non-indigenous species on biodiversity may be especially large. Rhithropanopeus harrisi is a novel invasive mud crab species in the northern Baltic Sea, where no native crab species exist. To determine the effects of R. harrisi presence and invasion stage on community composition, we sampled six sites in the Finnish Archipelago Sea, based on previous records of R. harrisi presence and abundance, on three sampling occasions in 2013. Invertebrate communities where R. harrisi was established differed from those with no R. harrisi, although the communities were also different from each other within sites of low crab density and no crabs. Species contributing the most to community differences were gastropods Hydrobia spp. and Theodoxus fluviatilis, bivalves Macoma balthica, Mytilus trossulus, and Cerastoderma/Parvicardium, polychaete Hediste diversicolor, Corophium volutator and other gammarid species, and chironomid larvae. Most of these species tended to be less abundant in the presence of R. harrisi, and many of them significantly so. Although community differences may in part be due to abiotic differences, such as different bottom sediments, occurrence and abundance of Fucus vesiculosus, and wave exposure, our study shows a clear shift in the invertebrate community composition following R. harrisi invasion.

Parental investment under predation threat in a long-lived sea duck: a study of corticosterone and prolactin levels in the eider Somateria mollissima
Bertille Mohring
Environmental and Marine Biology, Åbo Akademi University

Prey are exposed to higher predation risk during reproduction leading to a modification of the costs and benefits of reproduction. Predation threat may increase the survival cost of breeding, but may also lead to reduced parental investment. The impact of predation risk on avian parental investment may be hormonally mediated by prolactin and corticosterone, making them ideal tools for studying the trade-offs involved. Prolactin is associated with increased parental care and commitment in birds. In contrast, elevated corticosterone levels may reflect environmental or energetic constraints, and therefore reduce parental investment (the corticosterone-fitness hypothesis). We used these two hormonal proxies of parental investment to examine the effect of predation risk on common eider (Somateria mollissima) reproduction. We expected individuals breeding in riskier islands to reduce their parental investment, reflected in lower baseline prolactin levels and higher baseline corticosterone levels. We also investigated the associations between our hormonal parental investment proxies and individual quality and hatching success. Contrary to our expectations, prolactin levels were positively correlated with nest predation risk. This result could be explained by a selective disappearance of low-quality females (with low prolactin levels) from risky sites. Supporting this notion, hatching success and female body condition were positively correlated with predation risk on females, and baseline prolactin levels were positively associated with duckling body condition, a proxy of maternal quality. Regarding corticosterone, we found that corticosterone levels were negatively correlated with nest predation risk. This result could be explained by lower reproductive investment under increased threat (the corticosterone-adaptation hypothesis). Accordingly, hatching success was lower on islands characterised by higher nest predation risk. I suggest that long-term individual-based studies should now be done to disentangle the roles of individual plasticity and phenotypic selection in mediating parental investment under fluctuating predation threat.

The role of predator plumage colouration on mobbing behaviour by passerines: a case study of the colour polymorphic tawny owl
Charlotte Perrault
Department of Biology, University of Turku

In some species, individuals may exhibit different colouration which could provide different benefits. For instance, camouflage through colouration allows individuals to be less visible by the potential prey and thus, have a higher hunting success. Moreover, the rarest colouration may benefit from it since the potential prey would not encounter it often in the wild. In tawny owls, Strix aluco, two colour morphs exist: the brown one and the grey one. Knowing that the grey morph is more cryptic in a snowy landscape; is there a colour-morph specific benefit of crypsis against mobbing? Are the birds more threatened by the more common morph? In order to answer those questions, I studied passerines’ mobbing behaviour using
stuffed owls in a Finnish forest. I found that the two morphs are detected at the same time by the mobbing birds, but that the grey one seems to trigger a stronger response, i.e. faster alarm latency for the first bird that approaches the owl mount and longer-lasting mobbing; meaning that the most common morph is perceived as a higher threat than the rarest. Thus, colour polymorphism in predators could be maintained in natural populations in response to different hunting success in different environmental conditions.

Discovering new species of tropical ferns
Janina Keskiniva
Department of Biology, University of Turku

Many groups of organisms have been poorly sampled across their distribution, and field trips keep uncovering new species. At the same time genetics can help us discover cryptic diversity in already established species and shake taxonomic paradigms. In the Neotropical fern genus Danaea alone, 33 new species have been described since 2000. We described six additional species, raising the diversity to around 66 species. Finding new species is detective work, considering field and herbarium characteristics, genetics and biogeography. Field trips are the most optimal way to discover species as it allows examination of field characteristics and population level variation. Usually, however, one has to make do with herbarium samples augmented by pictures and field notes. Sequence data is also a great tool in the taxonomists toolbox. Many new species have first been found to be genetically distinct from existing species, and subsequently separated on the basis of morphology. There are at least 13 of such undescribed species in Danaea, seven of which we plan on describing. With rare or poorly sampled species the problem is having enough material to make a species description. However, without a taxonomic description these rare species can’t be protected.

SESSION 2

Keynote speaker:
Maria Santos
Department of Geography, University of Zurich

Biography:
Maria J. Santos holds the professorship in Earth System Science in the Department of Geography at the University of Zurich in Switzerland. Her group's research interests are in social-ecological systems, global change effects in species and ecosystems, Earth observation for biodiversity, and GIS and statistical modeling. She received her PhD from University of California Davis in 2010 and conducted postdoctoral research at the University of California Berkeley and Stanford University. In her research, she aims to address key societal and political issues related to Earth System sustainability in the Anthropocene.

Understanding social-ecological co-evolution in the context of global change

Global change has resulted in significant losses, degradation, and sorting of biodiversity with major implications for ecosystem functioning and human well-being. Scientific advances on how to monitor biodiversity from space have demonstrated feasibility and integration of observations with modeling of ecological and earth system processes. However, we are yet to be able to integrate these measurements in the coupled dynamic system that links biodiversity and ecological processes to social processes that determine rate of appropriation and demand for ecosystem services. To enable this integration towards an understanding of the processes that drive the dynamics between social and ecological systems (i.e. SES) across scales of space and time it is important to: (i) monitor the components of SES, i.e., ecosystem services, water, people, etc., (ii) quantify the connections between components of SES, and (iii) determine the scalability of SES outputs and outcomes and the process of their co-evolution. I will present a conceptual framework and illustrate it with case studies examined these three aspects of the interconnectedness in SES processes that are biodiversity-dependent. Understanding these relationships and feedbacks of SES is fundamental to answering questions regarding the performance of sustainable development goals (SDGs), and biodiversity and climate policies.

Emerging conservation crisis? The risks for migratory bats with increasing wind turbine construction in Finland
Simon Gaultier
Department of Biology, University of Turku

The presentation summarises the current state of knowledge on interactions between wind farms and
bats in the countries of the European boreal biogeographic region. We analysed data from articles in scientific journals, focusing on studies conducted throughout Europe, and found disparities between the two studied regions. There is a lack of data on their influence on ecology and distribution of bats in this region. Moreover, the volume of research on impacts of wind power on bats is low and is probably due to less wind farms in the area, despite the extreme importance of the European boreal region and the Baltic Sea in its centre for European bat migration. We also present preliminary results from a study about the avoidance effect. In the recent years, studies have shown that wind farms could affect bat use of habitats by repelling them in large areas around turbines. The objective of this study is to investigate the existence of this “avoidance effect” in a different context than the ones mentioned in the literature: forests in the European boreal biogeographic region. We monitored bat acoustic activity at several wind farms located in forests in Finland, to see whether bats are avoiding the area around wind turbines, and to what extent they are affected. We used 84 AudioMoth acoustic detectors positioned on forest edges in seven wind farms. Data were collected during the summer 2020 and have been analysed since November 2020. Results should be available in the Spring 2021; we are expecting to see low activity when close to the wind turbines, and increasing activity when getting away from the machines, meaning bats are repelled by wind turbines. We also expect to see every species or guild being affected.

How Human-Animal relationship affects the behavioural response in a working context: The Asian elephant as a study case.

Océane Liehrmann
Departement of Biology, University of Turku

The nature of relationships between people and animals has been of interest for many centuries. However, the experimental study of these interactions is a relatively recent development, despite the suggestion that Human-Animal interactions may have consequences for animal welfare. Intriguingly, although the Human-Animal relationship is an important factor to take into account in animal management, researchers have to date overlooked some animals: the working animals for hard labor known as draught animals. To investigate the human-Draught Animal relationship, 87 Myanmar timber elephants were asked to respond to the call of their own mahout (elephant caretaker) or the call of another mahout, and 52 of them were asked to walk on a novel surface. These tests aimed to assess if a long-lasting relationship between handlers and animals affects the quality of the response to work orders in a usual context or a disturbed context (confronted with novelty). The analysis revealed that most of the elephants responded only to their own mahout and elephants responding were less disturbed by the novel surface when they had a long-lasting relationship with the mahout calling. The success rate was also driven by the age of the elephant in interaction with the mahout’s identity, indicating the importance of training and for the animal and handlers to know and understand each other. On the contrary, when novelty was involved, the older elephants tend to fail more following the common theory of young individuals being less neophobic than older ones. This study is the first to experimentally assess the relationship between handlers and draught animals, highlighting its importance in improving work quality and performance. Further research is needed to investigate the role of the Human-Draught Animal relationship in terms of animal welfare and handlers’ security.

The long-term success of mandatory vaccination laws at implementing world’s first vaccination campaign in rural Finland

Susanna Ukonaho
Department of Biology, University of Turku

Infectious diseases are a major public health concern and socio-economic burden at all ages, but children are by far the most vulnerable to infections. In high income countries, infectious diseases are on the rise, a phenomenon in part attributed to the recent surge of vaccination hesitancy. To combat vaccination hesitancy, several countries recently made vaccinating children mandatory, but the effectiveness of such vaccination laws in increasing the vaccination coverage remains debated and the long-term consequences are unknown. Here we quantified the long-term consequences of vaccination laws on the vaccination coverage. We monitored for a period of 63 years the vaccination coverage during world’s first vaccination campaign against the highly lethal childhood infection smallpox in rural 19th century Finland before and after the introduction of the vaccination law in 1883. We found that annual vaccination campaigns were focussed on children
up to 1 year old, but that their vaccination coverage was low and declined with time until the start of the vaccination law, which stopped the declining trend and was associated with an abrupt coverage increase of 20 % to cover >80 % of all children. Our results indicate that vaccination laws had a long-term beneficial effect at increasing the vaccination coverage and will help public health practitioners to make informed decisions on how to act against vaccine hesitancy and optimize the impact of vaccination programmes.

Does local water quality affect people’s life quality? A case study in a coastal community
Ruslan Gunko
Department of Biology, University of Turku

Worldwide people pursue happiness and life satisfaction. In the 21st century, life quality assessment became a vital representative score in evaluating human life and started to play an important role on social and political agenda in the EU. The life quality measure requires a multidisciplinary approach dealing with both objective and subjective assessments of societal and economic matters, and the environment. Most of the studies of life quality are concentrated on a country level scale and local differences within a country or area are often less studied. Thus, the effect of the environment on life quality on a local scale is not known. In my project, I investigated the effect of objectively measured environmental factor and its subjective reflection (assessment of the visual conditions) on life quality. The study aims to understand if there is an effect of environment on local scale wellbeing and is it driven by actual state or psychological factor (perception of environment from locals). The study area is a coastal community Raseborg located in the Baltic Sea archipelago. For coastal communities, the state of water quality plays a more important role in comparison with other reflections of the environment. The objective measurements consist of high-resolution water quality data, including nutrient concentrations causing eutrophication, and were collected throughout the archipelago during an ice-free season in the Raseborg archipelago. The subjective data collected by surveying inhabitants' environmental and socio-demographic parameters in Raseborg in 2018-19. Additionally, respondents evaluated their life satisfaction. Analysis indicated a significant role of environment on life quality on a local level. However, this effect is significantly stronger for the perception of the environment, while the objectively measured state of the environment has a small effect on people’s life satisfaction on this scale. Thus, the psychological factor should be accounted for measuring life quality in coastal communities together with socio-demographic parameters.

What is the place of research in producing better futures?
Camilla Marucco
Department of Geography and Geology, University of Turku

In his article titled “Critical geography: anger and hope” (2007), Nicholas Blomley reminds us that, without ‘the vitality to animate social change’, feminist theory is a ‘limited resource’. As a fresh doctoral student and ‘geographer-to-be’, I was deeply inspired by Blomley’s article when I first read it in 2016. After few years researching the everyday lives of people of refugee background and, since 2017, attending to them also through so-called activism and personal life, I have come to believe that Blomley’s reminder is valid for research at large. To me, his words resonate with the imperative of refugee studies, i.e. the importance of contributing to both research and practice, to help improve the lives of people going through refugeeness (Harrell-Bond 1986, in Lytten 2019). In my case, research, activism and everyday life have interwoven tightly, constantly pushing me to explore ethical and methodological questions. In this presentation, I would like to reflect together with other students on what the place of research in producing better futures is (Blomley 2007, 62), inviting us all to imagine otherwise and remake the world (Sharpe 2016). Exchanging with others has been a core practice in my research: I see PhD as a sometimes lonely, always independent, but also deeply collective practice. Through my presentation and the hopefully ongoing dialogue, I aim to expanding (my, our) understandings of what research is and what it can actually do in the realm of asylum and immigration politics especially: a realm characterized by emergent horizons, loaded with racism and contested interpretations of the law, and strongly dependent on public attitudes and voting tendencies.
Predicting spatio-temporal distributions of migratory populations by combining citizen science data and Gaussian Process modelling
Antti Piironen
Department of Biology, University of Turku

Knowledge concerning spatio-temporal distributions of populations is a prerequisite for successful conservation and management of migratory animals. Achieving cost-effective monitoring of large-scale movements is often difficult due to lack of effective and inexpensive methods. Citizen science offers underutilized possibilities for researchers, but drawing reliable conclusions from these heterogeneous data often poses analytical challenges. We show how modern statistical tools can be used with heterogeneous citizen science data to distinguish distributions of migratory populations in difficult management situations. Gaussian Process models are widely adopted in the field of statistics and machine learning, but have seldom been applied in ecology so far. We introduce an R package gplite for Gaussian Process modelling and use it in our case study together with birdwatcher observation data to study spatio-temporal differences between bean goose (Anser fabalis) subspecies during migration in Finland in 2011–2019. Taiga bean goose (A. f. fabalis) and tundra bean goose (A. f. rossicus) offer an excellent example of a challenging management situation with harvested migratory populations. The subspecies have different conservation status and population trends. However, their distribution overlaps during migration to an unknown extent, which together with their similar appearance has created a conservation-management dilemma. We found that Gaussian Process modelling offers a flexible and effective tool for analysing heterogeneous data collected by citizens. There were spatial and temporal differences in distributions between the two bean goose subspecies in Finland. Taiga bean goose migrates through the entire country, whereas tundra bean goose occurs only in a small area in southeastern Finland and migrates later than taiga bean goose. In general, our approach combining citizen science data with Gaussian Process (GP) modelling can be applied to study spatio-temporal distributions of various populations and thus help in solving challenging management situations with migratory animals.

Tree cavity abundance and beyond: habitat choice of the pygmy owl in the managed boreal forest
Daniele Baroni
Department of Biology, University of Turku

Natural cavities are a critical resource for non-excavating hole-nesting birds, many of which are declining in northern Europe. We studied the abundance of suitable cavities for a forest-dwelling predator, the Eurasian Pygmy Owl Glaucidium passerinum, which requires tree cavities for both nesting and food hoarding. We found that natural cavities were scarce in the landscape (6.5/km2). However, natural cavity abundance per se does not seem to limit the breeding density of this predator, as suggested by a low occupancy rate in natural cavities and nest boxes. While the number of cavities per se may not limit the nesting of the owls, they may be limited by lack of cavities in suitable habitats. We found that pygmy owls are more demanding in their requirements for breeding than for food-hoarding habitat, as the habitat surrounding the nesting sites had a higher proportion and biomass of coniferous forests, especially spruce, and nesting sites were farther from houses than food-hoarding sites. Effective conservation strategies for this forest specialist should therefore include the maintenance of high-quality habitat that contains suitable cavities, supporting the need for protection of mature and old-growth forests as a whole, and not just of cavity bearing trees alone. The pygmy owl is furthermore a strong competitor and potential predator for other secondary cavity nesters, and may thus add to nest site limitation experienced by these species. Finally, we therefore carried out a passive acoustic survey, and using automated sound detection to estimate the abundance of this predator.

Long-term spatial and temporal variation in eider nest predation and fecundity: a comparison between two subpopulations
Ida Hermansson
Environmental and Marine Biology, Åbo Akademi University

The most common reason for breeding failure in birds is nest predation. Nest predation not only depresses current reproduction, but may have largely neglected long-term effects on breeding propensity, dispersal and, ultimately, population dynamics. As a ground-nesting bird maintaining high incubation constancy, female eiders
(Somateria mollissima) experience an elevated risk of predation during breeding. The Baltic Sea eider population has declined rapidly during the last decades and is now classified as endangered. The reasons for this decline are considered subpopulation-specific, with predation of particularly adult females as one main driver. However, overlooked in this regard is that rapidly increased adult predation also facilitates primary and secondary nest predation events. In this study, we compare the determinants of nest predation and clutch size in two geographically distinct subpopulations in 1990-2020, Tvärminne (western Gulf of Finland) and Velkua (Archipelago Sea). We assessed among-population covariation in nest predation rates and clutch size, and compared their temporal and habitat-specific dynamics between sites. Long-lived species should prioritize their own survival at the expense of current reproduction in more dangerous habitats, reflected in a reduced clutch size. My preliminary results suggest that nest predation rates, but not clutch sizes, were weakly correlated between sites, that nest predation risk showed an increasing trend only in Tvärminne, and that habitat-specific trends in both variables differed between sites. The results of this study will aid in identifying factors improving the prerequisites for successful breeding not only in eiders, but also in other waterfowl species with similar ecologies in the Baltic Sea

A computer in a volcano – The Magma Chamber Simulator

Magmatism is largely responsible for the transport of energy and matter within the Earth’s crust. Magmas are relatively hot and readily react with their surroundings, which may be other magmas or solid rocks (wallrock). Such reactions are important, for example, in inducing volcanic eruptions and in the formation of economically valuable ore deposits. Yet, magma chambers, where most of the aforementioned reactions take place, are inaccessible to scientists. For decades, we were forced to rely mainly on compositions of rocks and experiments on natural and synthetic materials at high pressures and temperatures to understand these processes. Accumulation of such experimental data, however, has enabled the development of thermodynamic and geochemical models for a rather wide range of magma and rock compositions. Such models have recently been integrated into computational tools which simulate the thermodynamic and geochemical consequences of, e.g., crystallization of a magma chamber or melting of a rock. The recently developed Magma Chamber Simulator software relies on such approach and models the effects of crystallization and assimilation (entrainment of wallrock materials in the magma) on phase equilibria and chemistry in an evolving magma + wallrock system. Tabular and graphical output makes the results of multistep scenarios easy to visualize and synthesize. There are myriad applications of the MCS: placing constraints on volcanic and plutonic suites and forward modeling provide quantitative insight into processes that shape, and have shaped, our planet. Finally, I hope that the story of how I got funding and involved in developing the software provides guidelines for young students and scientists in planning their future careers. Share your ideas, be pro-active, and go where your research leads you.

Geochemical characteristics of mafic and ultramafic rocks from the Mawat ophiolite, NE Iraq

Heider Al Humadi
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The Mawat ophiolite is a remnant of the Neotethyan oceanic crust, preserved in the Zagros suture zone in NE Iraq. The mantle section is composed of serpentinized peridotite including harzburgite, dunite, pyroxenites and chromitites. The crustal section consists of gabbros, as well as
basalts and siliceous carbonates. The ophiolite is intruded by felsic dykes. The mafic and ultramafic rocks are divided into four geochemical groups. Three of the groups are highly depleted in the LILs and some HFSEs and plot below the N-MORB reference line suggesting that these elements have been mobile. The immobile element-based diagram shows that the basaltic and ultramafic rocks resemble the boninitic lavas related to the subduction initiation. Also, in the Ti/V diagram, these rocks fall in the boninite field. This suggests that the magmatic rocks were formed in a forearc region at the initial stage of subduction. The fourth group plots in the MORB field in the Ti/V diagram. This can interpret as indication of rifting during to the extensional setting above a subduction zone. In the Th/Yb vs. Nb/Yb diagram, the mafic rocks of this study and the reference data from other parts of the Mawat ophiolite are classified into three groups. They plot in the oceanic arc, continental arc and MORB fields. In the Ti/V diagrams, they fall in the MORB, IAT and boninite fields. These geochemical data are consistent with the suprasubduction zone tectonic setting.

Evolution of the ancient crust in SW Fennoscandia, Baltic Sea region
Evgenia Salin
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The continental crust is a collage of orogenic belts, generated as island arcs and microcontinents welded and amalgamated together. These processes are governed by a plate tectonic scenario. Understanding of plate tectonics is a major key to understanding of our planet from formation of mountains, earthquakes and mineral resources to appearance of life in the long timescale. The Fennoscandian Shield is an exposed part of the ancient continent Fennoscandia in northern Europe, which southern and eastern margins are covered by a thick layer of the sedimentary rocks. The Precambrian (less than 500 Ma) basement beneath the Baltic Sea comprises a continuation of the Fennoscandian Shield covered by the sedimentary rocks and remains the least studied area relative to the exposed parts of the shield north and west of the Baltic Sea and extensively drilled sediment-covered areas east and south of the Baltic Sea. The evolution of the Fennoscandian Shield involves a significant growth of the continental crust with a marked zonation from the older rocks in the northeast (northern Finland) to younger rocks in the southwest (e.g. southern Sweden). Based on petrological, geochemical and geochronological data, it is shown that the evolution of the Precambrian crust in the Baltic Sea region follows the same trend as in the whole Fennoscandian Shield. It can be presented as a sequence of belts, which progressively become younger from the central part of the Baltic Sea (northern Gotland) towards northern Poland.

U-Pb xenotime geochronology of cordierite-anthophyllite rocks in Orijärvi, southern Finland
Teemu Vehkamäki
Department of Geography and Geology, University of Turku

Xenotime [Y(HREE)PO4] is an yttrium and REE bearing phosphate mineral with typical uranium content around 100 ppm. It is very resilient to Pb-loss in later metamorphism under 600 °C. Xenotime forms in wide variety of rock types and P-T ranges. These features make it an ideal geochronological tool. The Orijärvi mining camp in southern Finland hosts a VMS-type Cu-Zn-Pb ore within cordierite anthophyllite rocks (CARs) formed by metamorphic recrystallization of hydrothermally altered rocks. The hydrothermal alteration is thought to have taken place during volcanism prior to the regional metamorphism. We sampled two CARs from the Orijärvi area for xenotime U-Pb dating. The first sample was collected from the vicinity of the Orijärvi mine and another from the Iilijärvi mineralised zone 600 m to the north. The xenotimes from the Orijärvi CAR are all rounded in shape and yield a concordia age of ~1.82 Ga. The Iilijärvi CAR contains similarly rounded xenotime grains but they yield distinctly younger concordia age of ~1.78 Ga. Previous monazite age determinations from the Orijärvi and Iilijärvi CARs yielded concordia ages of ~1.80 Ga and ~1.82 Ga, respectively. This is concluded to have resulted from two regional metamorphic events. Both the xenotimes of the Orijärvi mine CAR and the monazites of the Iilijärvi CAR yield the same ~1.82 Ga age. The ~1.78 Ga xenotime age of the Iilijärvi CAR is dissimilar to all previous age groups and might indicate the presence of third metamorphic event in the area. The age of the hydrothermal alteration remains elusive.

Short-term meander change - A field approach
Previous studies have shown that meander bends follow certain developmental phases from a straight reach towards a neck cut-off. The meander planform types are classified into simple symmetric, simple asymmetric, compound symmetric and compound asymmetric. The curved channel shape and the transverse bed slope induce a distinctive three-dimensional flow field and an unevenly distributed sediment transport pattern, intensifying the sinuosity by time. The spatial patterns of the fluvial and geomorphological processes, however, vary according to the planform type. Thus far, the newest technology has not been used to investigate the meandering river processes over various planform types to a large extent. In this study, we collect orthoimages over a clear watered, highly dynamic river reach containing 14 meander bends, which all differ from each other by shape and size, at two occasions using a remotely controlled drone. Based on the images, we form topographical models over the area using Structure-from-Motion, and bathymetric models using optical-empirical methods, for both occasions. We combine the models to seamless river geometries. We map the morphological changes occurring between the drone-flights by subtracting the two geometries from each other. We measure the flow field cross-sectionally using Acoustic Doppler Current Profiler during different discharges, concurrently with the photogrammetric surveys. We also collect data on sediment characteristics, and water level changes and slopes. We analyse the effects of planform type and bend geometry on the flow characteristics and morphological development of meander bends.

Severe acidity, a problem for stream invertebrate populations in coastal acid sulfate soil-affected streams
Mats Willner
Geology and mineralogy, Åbo Akademi University

Many coastal streams in Finland show heightened levels of metals and periods with severe acidity. The deteriorating water quality is caused by iron sulfide sediments that have formed in the Baltic sea since the former Litorina sea stage (approximately 7500-4000 BP). These sediments can be found especially around the Gulf of Bothnia, which is experiencing a relatively fast post-glacial land up-lift (1 mm/year). Hence, these sediments may occur at altitudes of approximately 100 m above the current sea level in some parts of the area. Drainage of these sulfide containing sediments for agriculture and forestry was intense during the late 20th century. Drainage lowers the groundwater level, which enables oxygen to penetrate deeper into the sediment. As a result, the iron sulfide sediments are exposed to an oxidizing environment, which give rise to an acid sulfate soil horizon. The formed acidity and the oxidation products are flushed from the soil to recipient streams during high flow occasions. Acidic drainage water rich in metals cause severe problems for sensitive species. Acid sulfate soils alter stream invertebrate communities by causing a drop in EPT -species richness and species abundancies. Chronically acidic streams that experience severe acidity completely lack species from the orders Ephemeroptera and Trichoptera. Periods with sublethal water quality is also harmful for stream invertebrate individuals and cause e.g., gill- and anal papillae abnormalities and heightened levels of bioaccumulated metals in individuals of the mayfly genus Hydropsyche (Trichoptera). Climate change is estimated to cause dry summers and warm and rainy winters. This would increase the metal and acidity load to our streams and cause deteriorating conditions for stream invertebrate populations. Many species already exist near their tolerance level and an increase in acidity or metal concentration might cause a further collapse of species richness.

River plume and sediment transport seasonality in a non-tidal semi-enclosed brackish water estuary of the Baltic Sea
Jouni Salmela
Department of Geography and Geology, University of Turku

Our study aims to determine the development of sediment rich freshwater plume in an non-tidal brackish water dominated estuary under different environmental conditions in the Northern Baltic Sea. We studied three different seasons, two open water periods with low and high river discharges, and one ice-cover period with a high river discharge. To conduct our analyses, measurements of salinity, temperature, suspended sediment concentration, turbidity and current were performed. As far as authors know, the development of sediment rich freshwater plume has not been studied in a brackish water, non-tidal
estuary prior study at hand. The results indicated that river plume has different seasonal behaviour and it is controlled by different factors. During low river discharge at open water river plume did not exist and the estuary head became vertically mixed. In addition, wind driven inverse estuarine circulation developed, causing surface layer inflow and bottom layer outflow. During high river discharge periods, both at open channel and ice-cover conditions, buoyant plume developed indicating highly stratified estuary conditions. We also found positive estuarine circulation pattern, with surface layer outflow and bottom layer inflow during ice-cover, while the whole water column flowed offshore during open water. Buoyant river plume was found to be consistent with highly stratified conditions, where the salinity difference of four practical salinity unit, was strong enough to prevent vertical mixing between fresh surface and saline bottom layers. Sediment was transported much further during highly stratified than vertically mixed conditions.

Cyanobacterial biomolecules in the paleoenvironmental reconstruction of loess sediments

Tamara Dulic
Biochemistry, Åbo Akademi Univesity

Loess, the sediment that forms in semi-arid regions, is a product of past dust deposition events and is arguably thought to be of aeolian origin. The process of loess formation involves two phases - accumulation of dust particles by trapping, stabilization, and sedimentation, and post-depositional alterations. While the latter merely involves geochemical processes, the former phase is an active mechanism and requires a mediator. According to the BLOCDUST hypothesis, cyanobacteria of Biological Loess Crusts (BLCs) play a significant role in the first phase, as the utilization of accumulated dust represents their survival strategy in arid and semi-arid environments. To test the BLOCDUST hypothesis and ascertain the biological origin of loess, we performed biochemical, mineralogical, and geochemical analyses on cyanobacterial strains isolated from BLCs, cyanobacteria-dominated BLCs, and a loess-paleosol sequence. The SEM/EDS analyses of cyanobacteria-dominated BLCs revealed the crucial role of extracellular polymeric substances (EPSs) in the trapping, cementation, and accumulation of dust particles and contributed to the understanding of the porous structure of loess. Geochemical analysis of a loess sequence revealed the prevalence of short-chain (C-15-C19) over long-chain (C27-C31) n-alkanes, indicating a significant microbial contribution to the biomarker signal. The dominance of C16-n-alkanes observed in the loess sequence, cyanobacterial strains, and BLCs indicates the cyanobacterial origin of this biosignature. The calculated biomarker proxies for 3-cyclic terpenes and hopanes indicate the presence of cyanobacterial/algal communities during the formation of the loess sediment. The observed abundance of cyanobacterial biosignatures in the loess-paleosol sequence and the calculated biomarker proxies strongly support the BLOCDUST hypothesis and the biogenic origin of the loess. The results fill a critical gap in the paleoenvironmental interpretation of loess-paleosol sequences and urge further development of the sedimentary biosignatures and biomarker proxies used in this field.

SESSION 4

Keynote speaker:
Agnes Karlsson
Department of Ecology, Environment and Plant Sciences (DEEP), Stockholm University, Sweden

Biography:
Agnes Karlsson is an assistant professor and docent in Marine Ecotoxicology at Stockholm University. She received her PhD in Marine Ecology from Stockholm University in 2010 and conducted post-doctoral research at the University of Waikato and University of Otago, New Zealand, and finally at the Department of Environmental Science and Analytical Chemistry, Stockholm University (2011-2016). In her research, she aims to advance our understanding of how individuals, populations, communities and ecosystems react and adapt to natural and anthropogenic stress (e.g. eutrophication, over-fishing, contaminants, invasive species and climate change).  

Environmental change in the Baltic Sea: making the most of monitoring data

The Baltic Sea ecosystem has been impacted by human activities for decades and is now changing rapidly because of climate change; the maximum primary production has shifted from spring to summer and projected changes include higher temperatures and increased riverine input. It is also
one of the best studied coastal areas with long-term data sets, making it a model system for linking environmental variables to ecological effects, a necessity for adaptive ecosystem-based management. In this presentation I will focus on some of my recent experiences from co-analysing data from various monitoring programs to better understand causes behind altered health status and contaminant burden in Baltic biota (from plankton to seals), as well as changes in benthic biodiversity. I will specifically highlight the value of retrospective chemical analyses (stable isotopes) of archived samples from monitoring for various applications in food web ecology and contaminant science.

Resource-dependent sexual selection: spatial variation in mating success in a sand goby population
Johanna Yliportimo
Environmental and Marine Biology, Åbo Akademi University

Resource distribution is an evident factor generating intrasexual competition, but its role in shaping the spatiotemporal fluctuations in sexual selection is still poorly understood. Resource distribution affects temporal mate availability in the nest-building sand goby (Pomatoschistus minutus), through reproductive rates, and creates local variation in reproductive success. Shallow spawning habitats along the Finnish coastline are often adjoined by more productive, but patchy macrophyte-dominant habitats. Availability of food becomes crucial for females during the mating season since sand goby is a batch-spawning fish that needs to acquire resources for each successive spawn. Via female fecundity, the asynchrony of mate availability creates variation in male mating success. In a field experiment, we introduced artificial nest tiles at different distances from a macrophyte habitat, in a study area poor in natural nest substrates. Our main hypothesis was that the male mating success is highest in the proximity of the more productive environment, while variation in mating success increases with distance. Based on preliminary results, the distance from the macrophyte habitat in itself was not statistically significant, but there was two-dimensional variation in mating success. Variation in opportunity for selection also seems to have a spatial component. The peak in mating at the end of June concurred with observations from earlier research. The size of the nest-holding males had a positive relationship with their mating success. Our results show how even a small-scale study in sexual selection can be complex to interpret, but to unravel the link between sexual selection and resource distribution, more experiments in natural populations are needed.

The warming of Arctic marine environments and the implications to seafloor biodiversity and ecosystem functioning; an investigation of East Greenland's current ecological structure and mechanistic drivers.
Phoebe Armitage
Environmental and Marine Biology, Åbo Akademi University

Arctic marine environments are the most impacted by climate warming with temperatures increasing at rates of more than two times faster than any other ecosystem on Earth. As a result, ramifications to the physico-chemical structure of the water column are having impacts on endemic biodiversity and are altering important ecological functions and services, such as carbon sequestration, Arctic food web interactions, nutrient recycling, and commercial fish stocks. With limited knowledge of the functional structure of the East Greenland coast, this study uses the biological trait approach (BTA) to assess spatial changes of the faunal communities of the seafloor (epibenthos) relating to sea-ice communities (East Greenland Fjord systems) to open-water communities (continental slope) and aims to determine the key drivers in benthic community structure by assessing relationships between phylogenetics, species traits, and environmental variables using the Hierarchical Modelling of Species Communities (HMSC) analysis. Here we show clear spatial patterns in functional diversity and functional trait groups across the East Greenland shelf with the highest species and functional diversity across the continental shelf and the lowest on the slope. Additionally, we reveal the key drivers of species composition and their traits to be depth, oxygen, turbidity, and fluorescence. As melting glaciers will add terrestrial input into the water column and cause scouring to the seafloor, the later three key drivers are expected to increase in variability across time and space, and thus, alter biological communities and their ecological functional roles. Switching functional groups from biological community structure may mean a reduction in ecosystem services which could consequentially unbalance the Arctic carbon budget and
commercial fisheries. Therefore, further research into Arctic functional trait groups and their response to climate change are important when considering ecosystem effects, especially when focusing on future management and conservation strategies of Arctic ecosystems.

Identification of marine heatwaves in the Archipelago Sea and experimental testing of their impacts on the non-indigenous Harris mud crab
Lucinda Kraufvelin
Environmental and Marine Biology, Åbo Akademi University

In conjunction with climate change, marine heatwaves (MHWs) are expected to become more frequent and increase in intensity and duration. Despite the rapid warming of sea surface temperature (SST) observed in and projected for the Baltic Sea compared to other large waterbodies, not many experimental studies have examined the impact of MHWs in this area. This study consists of one modelling and one experimental section. In the modelling part, metrics of MHWs in the Archipelago Sea were identified and analysed by applying the software package “heatwaveR”, on two SST datasets from Seili. For the experimental part, impacts of simulated MHWs were tested on the non-indigenous mud crab, *Rhithropanopeus harrisii*. Measured response variables were feeding and growth. The treatments were designed based on metrics retrieved from the climatological SST data assessed in the modelling section. The three treatments represented a present average MHW (Present), an MHW of increased amplitude (Amplitude) and a future MHW scenario of a high amplitude (Intensified). *R. harrisii* recently entered the Archipelago Sea with an expanding distribution range, which may be driven by its relatively high tolerance to environmental stress in comparison to many native species. Thus, I hypothesized that *R. harrisii* would tolerate the benign heatwave treatment but may suffer from intense heat stress experienced in the applied future heatwave scenarios. The mean SST (both summer and annual) in the Archipelago Sea has increased over the last 52 years (0.4 and 0.5 °C per decade respectively), and so has the frequency of MHWs. The latter may mainly be driven by an increase in mean SST in the region. There was no significant difference between the treatments in feeding rates or growth over the 36-day long experimental period. Hence, *R. harrisii* tolerates extreme temperatures that are associated with both present and future MHWs in the Archipelago Sea. The effects of MHWs on species and communities and the modelling of MHWs should be examined more closely in the Baltic Sea, and so should the effects of invasive species.

Spatial and dietary sources of elevated mercury exposure in white-tailed eagle nestlings in an Arctic freshwater environment
Camilla Ekblad
Department of Biology, University of Turku

Human-induced mercury (Hg) contamination is of global concern and its effects on wildlife remain of high concern, especially in environmental hotspots such as inland aquatic ecosystems. Hg biomagnifies through the food chain resulting in high exposure in apex predators, such as the white-tailed eagle (*Haliaeetus albicilla*), making them excellent sentinel species for environmental Hg contamination. An expanding population of white-tailed eagles is inhabiting a sparsely populated inland area in Lapland, northern Finland, mainly around two large reservoirs flooded 50 years ago. As there were indications of elevated Hg levels in this population, we measured Hg exposure along with dietary proxies (δ13C and δ15N) in body feathers collected from white-tailed eagle nestlings in this area between 2008 and 2018. The Hg concentrations were investigated in relation to territory characteristics and dietary ecology as potential exposure pathways. The Hg concentrations in the nestlings (4.97 – 31.02 μg g-1) were elevated, compared to earlier reported values, e.g. in nestlings from the Finnish Baltic coast, and exceeded normal background levels (≤ 5.00 μg g-1) while remaining below the tentative threshold of elevated risk for Hg exposure mediated health effect (> 40.00 μg g-1). The main contamination pathways were found to be controlled by the trophic position (proxied by δ15N), the dietary proportion of the predatory fish pike (*Esox lucius*), and the vicinity to the Porttipahta reservoir. Our results show that even though the Hg levels in the fish in the reservoirs are considered below safety threshold, the levels are still considerably elevated in their terrestrial avian predators, potentially causing risks in top predators as well as humans consuming high amounts of local fish. We also identified a potential evolutionary trap, as increased intake of the preferred prey, pike, increases exposure
Trophic dynamics of mercury in the Archipelago Sea

Riikka Vainio
Department of Biology, University of Turku

At present day, mercury (Hg) exceeds its natural environmental concentrations and has well-documented biomagnification and toxic properties. Food web fluxes of Hg are affected by the compositional and structural properties of the food chains, species characteristics and environmental conditions, all resulting in different potential health risk outcomes depending on the species and their position in these food webs. In the present study we analysed the biomagnification potential of Hg in benthic and pelagic food chains along the Finnish coast of the Archipelago Sea, a central part of the Baltic Sea. We analysed total Hg concentrations in 3 bird species (range: 0.2 to 6.3 µg g-1 dry weight [dw]), 17 fish species (range: 0.01 to 1.5 µg g-1 dw), 10 invertebrate species (range: 0.0 to 0.08 µg g-1 dw), and 4 primary producer species (range: 0.0 to 0.2 µg g-1 dw) and resolved individual trophic position using stable nitrogen isotopes. Food web Hg fluxes were based on trophic magnification (TMF) and biomagnification (BMF) factors. Our preliminary results show most BMFs >1 in both the pelagic (mean ± SD: 14.2 ± 30.0) and benthic food chain (mean ± SD: 7.5 ± 20.4), underlining the overall biomagnification potential of Hg. Based on the TMFs, higher biomagnification seems to occur in the pelagic food chain (TMF = 4.2) compared to the benthic one (TMF = 3.6), probably due to the interplay between differential bioaccumulation at the lowest trophic level, and the physio-ecological characteristics of the species.

Thank you mum for making me strong!
Maternal effects of exercise swimming on reproductive success in farmed fish
Luca Pettinau
Department of Biology, University of Turku

Salmonid reproductive migration is one of the most famous examples of migrations in the animal kingdom. Salmon and trout are also one of most used fish in aquaculture for food production but are also used for conservation efforts with stocking programs. However, the current rearing conditions in the farms does not allow adult spawners to develop their normal migration behavior and it is unknown whether it might lead to negative effect on their offspring. Previous studies have shown that swimming improves several aspects of fish physiology such as cardiac performance, growth, and immunity system. In the current study, the aim was to study the effects of simulated migration effort, i.e. induce swimming exercise training during natural migration period, on reproductive success of aquaculture female adult brown trout (Salmo trutta) and on their offspring. To do that we randomly divided the spawners in two groups with two difference water flow conditions, control group with normal water velocity used in aquaculture (0.2 bl/s) and exercise group with an intense water flow (0.7 bl/s) for 6h per day for 5 weeks. After 12 days of resting, the artificial reproduction was induced. To investigate the effect of swimming exercise on the reproductive success we analyzed the mass, length, condition factor, fecundity and eggs size of the spawners and hatching success, survival rate in different age classes and mass, length and condition factor of the offspring.

The elephant in the room: monitoring elephant calves for the first time during their traditional taming procedure
Jennie Crawley
Department of Biology, University of Turku

A quarter of endangered Asian elephants are captive, with >90% of these tamed (e.g. for work, tourism) and cared for by traditional handlers (mahouts) in Asia. Although traditional taming is a much-discussed welfare issue, it is often a taboo subject and no studies have empirically assessed its impact on the elephant calves. In this study we monitored five measures of physiological stress (FGM: Faecal Glucocorticoid Metabolites, SC: Serum Cortisol, Glu: Glucose, CK: Creatine Kinase, H:L: Heterophil:Lymphocyte) in 41 calves undergoing taming in Myanmar, both over the critical first 10 days of taming and over the following six months to assess the extent and duration of any adverse effects. Measures increased by 50-60% (FGM, SC, Glu), 170% (H:L) and 900% (CK) in calves over the first few days, not observed to the same extent in control adults. Some measures stabilised sooner (Glu, SC, 7-10 days) than others (CK, FGM H:L 1-2 months), with some indication of chronic stress. Monitoring calves undergoing different taming techniques is key to providing empirical evidence to management decisions and understanding how they impact calves, relevant to ~15,000 captive elephants in Asia. Future studies should compare short- and long-term health and fitness impacts of taming
across different populations and prioritise both calf and mahout welfare.

**Information depths of analytical methods assessing whitefish otolith chemistry**

*Viktor Finnäs*

*Environmental and Marine Biology, Åbo Akademi University*

The elemental composition of otoliths provides historical information on migration and provenance of fish. Due to the complex structure of the otoliths, the depth from which the elemental information originates has to be considered. Otoliths from whitefish captured in the Baltic Sea (n=30) were analysed using three analytical methods often used to assess otolith chemistry. The information depths were calculated for μ-XRF and PIXE and measured for LA-ICP-MS. The information depth in PIXE depends on the energy of the incident particles and on the element to be analysed, while in XRF it depends mostly on the element to be analysed as the energy of the incident X-rays usually is high enough to excite atoms at depths of several hundreds of micrometres. If we assume that the otolith is exposed to X-rays from a Rh-tube (20.16 keV) about 50% of the detectable Sr(Kα) X-rays will be emitted from a depth ranging from 0 to 114 μm. In the case of PIXE with 3 MeV protons the corresponding range is 0–15 μm. The information depths in LA-ICP-MS were determined by measuring the depth of the laser-ablated spots and trenches that remained on the otolith surface. The depths measured with a scanning white light interferometer (SWLI) were found to be about 40 μm for spots and 11 μm for trenches.