

FORSKNINGS- OCH UTVECKLINGSINSTITUTET

# Aronia Research

2008 – 2011

ARONIA

VID ÅBO AKADEMI OCH YRKESHÖGSKOLAN NOVIA

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Editing & layout: Mari Pihlajaniemi  
Publisher: AB Yrkeshögskolan vid Åbo Akademi  
ISBN 978-952-5839-32-6  
Cover photo: Aleksi Lehikoinen

# Preface

In 2010, Aronia celebrated its first ten years of operation. The jubilee seminar was called “Managing the environment for the future”. This title sets focus on the urgent need for the scientific community to unite with the rest of society around the challenging future of mankind, or as one of the key-note speakers, professor Anthony Fox, succinctly expressed this sentiment in the title of his presentation, “Urbanisation, climate change and why we need applied ecology institutes now more than ever”.

From the start, Aronia’s activity has been based on a joint structure, with Åbo Akademi University and Novia University of Applied Sciences as maintainers. Our name, Aronia Research and Development Institute, indicates the merging of a strong academic unit for basic research with a dynamic portfolio of applied projects. Today our activity is mainly dedicated towards coastal ecology and natural resource management, with the Aronia Coastal Zone Research Team (ACZRT) leading the scientific research.

“The economic invisibility of nature is the main reason for why we are losing nature”(Pavan Sukhdev, study leader of TEEB, The Economics of Ecosystems and Biodiversity). This citation eloquently summarizes the need to acknowledge that the value of most of the natural resources we depend on for our future well-being lie outside the current economic mechanisms of our society. In Aronia, we have responded to the need to address this problem in two ways. We have developed a research initiative focusing on the concepts of evidence-based conservation and ecosystem services and by building on a local Knowledge Cluster at Campus Raseborg. The Knowledge Cluster unites R&D, education, governmental and private sectors around a sustainable use of natural resources.

We are a local unit aiming at a local impact with broad potential application. True integration of the management of natural resources with local economics inevitably includes the question of resource allocation. Currently, funding for the planning and realization of sustainable resource use is in general ineffectively used. This is true at global, regional and local scales and is due mainly to lack of data and application in both the natural and social sciences. We are undertaking assessments to identify needs both for more effective management tools and practices and also to meet the requirements of primarily municipal-level practitioners. Our GIS expertise is currently heading towards the broader concept of GeoDesign with the particular goal of integrating municipal planning with R&D in practice.

In the coming years, we will continue our research in ecology and evolutionary biology and apply results to development projects on integrated natural resource management. The pertinence to implement state of the art planning technology and other innovative tools to local community development is globally identified. We aim at sharing this responsibility both by conducting research to improve the quality of background data and by hands-on applications for real-world sustainable community development.

Photo Mikael Kilpi



# Cyanobacteria and Zooplankton Interactions with Eutrophication and Climate Change

Jonna Engström-Öst, Andreas Brutemark, Maiju Salonen, Anna-Karin Sandbacka & Anu Vehmaa

This project focuses on toxic cyanobacteria bloom ecology and how cyanobacteria interact with zooplankton, other algae and fish larvae. We work with field and lab-based experimental data, as well as long-term monitoring data. Our main interests are multiple stress, i.e., pH, temperature and toxic effects on oxidative status and reproductive success of zooplankton, as well as allelopathy (chemical warfare), and algal toxin production.

## Highlights

Increased temperatures are almost synonymous with climate change; there is, however, also the other CO<sub>2</sub> problem, which means that CO<sub>2</sub> dissolves in ocean water and thereby lowers the pH. We used a 40-year monitoring dataset to show that the Gulf of Finland, in fact, is no exception (Brutemark et al. 2011). But what are the consequences of climate change for aquatic biota? Our studies on one of the most common nuisances in the Baltic Sea,



Back row: Hedvig Hogfors, Anu Vehmaa (PhD student), Towe Holmborn and Elena Gorokhova; front row: Andreas Brutemark (post-doc) and Jonna Engström-Öst (project leader). Photo Celia Hillo

Hunting zooplankton off Tvärminne Zoological Station. Photo Jonna Engström-Öst



the bloom-forming cyanobacteria *Anabaena*, suggest that cyanobacteria like it hot, but can at the same time be negatively affected by a low pH.

The environment is changing and this will influence the cyanobacteria ecology, but does it have any other environmental impacts? In 2010 we studied this together with our collaborators from Systems Ecology at Stockholm University. We show that a low pH, high temperature and toxic cyanobacteria increase stress levels in copepods, reduce their reproduction and quality of eggs, and delay juvenile development.

This multiple stress study will be part of Anu Vehmaa's PhD thesis. To verify all these results we conducted a whole-summer field study investigating copepod sex ratio, mortality, reproduction and condition.

In addition to increased temperatures and acidification, salinity is also predicted to decrease due to increased precipitation and less frequent salt water inflow through the Danish Straits. We show that the toxic cyanobacterium *Anabaena* grows better and becomes twice as toxic in freshwater as in brackish water (Engström-Öst et al. 2011a). This means that we can expect changes in the cyanobacteria community composition in the future. The species that thrive in freshwater will gain benefits compared with brackish water species. It can further result in more toxic blooms in coming years.

Cyanobacteria do not only respond to the environment, but respond also sensitively to competing algae and grazers by changing their toxin production. Grazers can indirectly lower the toxin levels in cyanobacteria by grazing upon competitors. Our study shows that cyanobacterial toxin production responds rapidly to other animals and plants in the sea (Engström-Öst et al. 2011b).

The spring bloom and its future changes due to climate factors are also close to our hearts. In springs 2008 and 2009, we studied the effects of changing bloom composition on reproduction of the grazers, calanoid copepods. We found that the dominating species in the bloom is important, but the food quality effects are species-specific, instead of there being food species groups of good and bad quality (Vehmaa et al. 2011 in press).

### Key publications

Andreas Brutemark, Jonna Engström-Öst & Anu Vehmaa 2011: Long-term monitoring data reveal pH dynamics, trends and variability in the western Gulf of Finland. — *Oceanological and Hydrobiological Studies* 40: 91-94

Jonna Engström-Öst, Hedvig Hogfors, Rehab El-Shehawy, Bart De Stasio, Anu Vehmaa & Elena Gorokhova 2011: Toxin producing cyanobacterium *Nodularia spumigena*, potential competitors and grazers: testing mechanisms of reciprocal interactions. — *Aquatic Microbial Ecology* 62: 39-48

Jonna Engström-Öst, Sari Repka & Mirva Mikkonen 2011: Interactions between plankton and cyanobacterium *Anabaena* with focus on growth and toxin concentration. — *Harmful Algae* 10: 530-535

Maiju Salonen & Jonna Engström-Öst 2010: Prey capture of pike larvae *Esox lucius* in turbid water. — *Journal of Fish Biology* 76: 2591-2596.

Anu Vehmaa, Anke Kremp, Timo Tamminen, Hedvig Hogfors, Kristian Spilling & Jonna Engström-Öst (in press) Copepod reproductive success in spring bloom communities with modified diatom and dinoflagellate dominance. — *ICES Journal of Marine Science* doi: 10.1093/icesjms/fsr138



The research vessel Aranda (Finnish Environment Institute) is perfect for sampling in spatial studies in hydrology and plankton ecology. Photo Janne Bruun, Finnish Environment Institute

### Collaboration

- Dr. Wanderson F. Carvalho, Instituto de Estudos do Mar Almirante Paulo Moreira, Brazil (harmful algae)
- Prof. Bart De Stasio, Lawrence University, USA (biogeography)
- Prof. Elena Gorokhova & Lic. Hedvig Hogfors, Stockholm University, Sweden (oxidative stress)
- Prof. Edna Granéli, Linnaeus University, Sweden (harmful algae)
- MSc. Lorena Grubisic, Uppsala University, Sweden (microbiology)
- Dr. Elin Lindehoff, Umeå University, Sweden (algal blooms)
- Dr. Sari Repka, University of Turku, Finland (toxic cyanobacteria)
- Dr. Sanna Suikkanen, Finnish Environment Institute, Finland (allelopathy)
- Prof. Kaarina Sivonen, University of Helsinki (cyanobacteria)

Cyanobacteria bloom at Jussarö 15 July 2010. Photo Anu Vehmaa



# Ecology, Conservation Biology and Sustainable Management of Coastal Marine Benthic Ecosystems

Johan Erlandsson, Elicer Diaz & Lina Mtwana Nordlund

We carry out research in different marine benthic systems (temperate to tropical), i.e. intertidal as well as subtidal rocky shore and soft-bottom environments, mainly mussel beds and seagrass meadows. Our research can be divided into the following projects: 1. Effects of habitat loss and fragmentation on biodiversity and abundance of macrofauna in mussel beds in Sweden and Finland 2. Connectivity between Marine Protected Areas (MPAs) and exploited areas through settlement/recruitment processes in mussel beds in South Africa, and the role of mussel bed rehabilitation 3. Ecology and social-ecology in shallow tropical marine ecosystems, especially human disturbance in seagrass meadows in East Africa (Lina Mtwana Nordlund, PhD project) 4. Effects of cormorants on the benthic ecosystem with analyses of biodiversity, community metabolism, and spatial patterns of invertebrates.



Elicer Diaz & Johan Erlandsson. Photo Kajsa Mellbrand

## Highlights

### Effects of habitat loss and fragmentation on biodiversity

This project estimates the effects of habitat loss/fragmentation on biodiversity and abundance of macrofauna using mussel beds (on the Swedish west coast and Gulf of Finland) as a model system. The specific objectives are to i) Estimate whether there is a critical amount of mussel habitat needed (test threshold theory) to sustain a high species diversity and abundance; ii) Experimentally estimate effects of habitat loss/fragmentation of mussel beds

Lina Mtwana Nordlund at the seagrass meadow



on species richness, composition, density, and migration; iii) Estimate changes in spatial structure of biodiversity across small spatial scales in relation to mussel habitat cover. Instead of a positive linear/non-linear relationship we found mainly negative relationships between mussel habitat amount and biodiversity.

### Resource use, Marine Protected Areas and mussel bed rehabilitation

The brown mussel is a vital protein source for poor communities in South Africa. Today mussel populations are depleted/declining quickly due to over-exploitation. Natural recovery is very slow, leading to the loss of an important resource and high biodiversity habitat, towards an algal dominated ecosystem. This project provides knowledge about the connectivity between Marine Protected Areas (MPAs) and exploited areas through settlement/recruitment processes, i.e. the export of larvae from MPAs and recolonisation of exploited populations. The project also studies small-scale effects of rehabilitated mussel beds on settlement/recruitment. It also determines if a critical amount of mussels is needed to sustain high biodiversity. Some results so far are that MPAs do not export larvae to exploited shores, but that rehabilitated mussel beds have positive effects on mussel settlement.

### Ecology and social-ecology in tropical marine systems

This project deals with human disturbance in shallow marine tropical ecosystems, mainly seagrass meadows in East Africa, from ecological and social-ecological viewpoints, investigating implications of different management strategies.

The effects of invertebrate harvesting by local people on biodiversity in seagrass ecosystems (study 1, 2), and how this influences local livelihood (study 2) have been estimated (negative effects on diversity and social-ecology found). Whether remote sensing of the coast could be a good management tool (study 3) has been investigated. Experimental effects of invertebrate harvesting/disturbance intensity on ecosystem function and structure (study 4) are being analysed. Finally, the intention is to gather expert opinions about intertidal management in the Western Indian Ocean region and propose potential management methods (study 5).

### Effects of cormorants on the benthic ecosystem

The density of cormorants in the Gulf of Finland has increased exponentially since 1996. This project determines the influence of nesting cormorants on benthic aquatic organisms. The release of faeces/guano of cormorants into the sea might function as a nutrient source with a positive effect on biodiversity of invertebrates and algae. Three research lines to assess the subtidal effects of cormorants were designed: 1. Analysis of biodiversity, 2. Community metabolism, 3. Spatial patterns of invertebrates. The analyses are carried out contrasting these three variables at nesting islands versus non-nesting islands. Analysis of diversity comprised the sampling at different depths and during two seasons. Increased benthic biodiversity close to cormorant islands has been found.

### Collaboration

#### South Africa project:

- Prof. C. D. McQuaid, Dr. F. Porri & Dr. V. Cole, Rhodes University, South Africa
- Dr. V. Nakin & Dr. G. Calvo-Ugarteburu, Walter Sisulu University, South Africa
- Dr. Christina Halling, Stockholm University, Sweden

#### Habitat fragmentation project:

- Dr. Mats Westerborn, Park and Forest Services, Finland
- Prof. Nils Kautsky, Stockholm University, Sweden
- Doc. Patrik Kraufvelin, Aronia, Åbo Akademi University / Novia, Finland

#### Lina's PhD project:

- Dr. Martin Gullström, Göteborg & Stockholm University
- Dr. Maricela de la Torre-Castro, Stockholm University
- Dr. Narriman Jiddawi, University of Dar Es Salaam, Tanzania

#### Cormorant project:

- Prof. Martin Wahl, Leibniz-Institut für Meereswissenschaften, Benthic Ecology, Germany
  - Prof. Peter Hambäck & Dr. Gundula Kolb, Stockholm University, Sweden
  - Dr. Mats Westerborn, Park and Forest Services, Finland
- Inter-disciplinary collaborations and/or partnerships:
- "Eco-efficient water management: mussels as Baltic Sea treatment workers and servants for regional growth" Project collaboration between different partners in Sweden, Finland (e.g. ARONIA), Latvia, Lithuania and possibly Åland.
  - Participation in the planning of city/University partnership (in Finland & South Africa). Involved in the planning of the partnership between Raseborg, Finland and Grahamstown, South Africa, and especially the subsequent cooperation between Novia/Aronia and Rhodes University on joint courses and student projects in coastal ecology and sustainable management.



Invertebrate harvester. Photo Lina Nordlund

### Key Publications

Díaz, E. R., Erlandsson, J. & McQuaid, C. D. 2011: Detecting spatial heterogeneity in intertidal algal functional groups, grazers and their co-variation among shore levels and sites. — *Journal of Experimental Marine Biology & Ecology*. In Press.

Erlandsson, J., McQuaid, C. D. & Sköld, M. 2011: Patchiness and Co-existence of Indigenous and Invasive Mussels at Small Spatial Scales: the Interaction of Facilitation and Competition. — *PLoS ONE*. In Press.

Erlandsson, J., McQuaid, C. D. & Stanczak, S. 2011: Recruit/algal interaction prevents recovery of overexploited mussel beds: indirect evidence that post-settlement mortality structures mussel populations. — *Estuarine Coastal and Shelf Science* 92: 132-139

Díaz, E.R. & McQuaid C.D. 2011: A spatially explicit approach to trophic interactions and landscape formation: patchiness in small-scale variability of grazing effects along an intertidal stress gradient. — *Journal of Ecology* 99: 416 – 430

Nordlund, L., Erlandsson, J., De la Torre-Castro, M. & Jiddawi, N. 2010: Changes in an East African social-ecological seagrass system: invertebrate harvesting affecting species composition and local livelihood. — *Aquatic Living Resources* 23 (4): 399-416

Cormorants. Photo Eliecer Diaz



# Ecosystem Services for Evidence-based Conservation ESEC

Traci Birge, Pieter Deleu, Marianne Fred, Tuomas Leinonen, Kajsa Mellbrand, Mari Pihlajaniemi (coordinator COAST-MAN)

The Ecosystem Services Research Group was officially formed in autumn 2011 when critical mass was reached in the number of researchers involved at ARONIA. Our research focuses on improving sustainability, species and habitat conservation, management of cultural landscapes, and comparing ecosystem services in local food networks throughout Europe. The topics taken up by the group are diverse and each project involves community outreach, research, and teaching at Åbo Akademi University and Novia. The common theme for all of the projects is that they explore ecosystem services as a tool for reaching conservation goals. We have adopted the evidence-based conservation paradigm, with the aim of providing the community with evidence-based information to aid in decision making at all levels of organisation.

## Highlights

Community involvement, research and outreach have grown with the formation of the Ecosystem Services Research Group. Pieter Deleu was chosen in 2011 as project researcher for a three-year position funded by the ELY Centre for the Aronia local foods project “Bra Mat”. Kajsa Mellbrand has joined us as project researcher focusing on ecosystem services of islands in the Aronia-led Green Islands project. Green Islands has strongly incorporated the ecosystem services framework to address Baltic Archipelago questions.

Larvae of the Apollo butterfly (*Parnassius apollo*) on its host plant Stonecrop (*Sedum telephium*). Photo Aleksí Lehtikoinen



Mari Pihlajaniemi, Traci Birge, Marianne Fred & Kajsa Mellbrand. Photo Malin Kurkisuo

COAST-MAN SGA, which is Finland’s first UNEP-endorsed ecosystem assessment using the Millennium Ecosystem Assessment framework, started in 2008. To date, COAST-MAN has organised three community meetings related to conservation and livelihoods in rural areas. Traci Birge presented the results of her research on cultural landscapes to local farmers in 2010. Mari Pihlajaniemi coordinates outreach through the COAST-MAN web page she developed and manages.

Evidence-based conservation was introduced to teaching at Novia in the Aronia-led Coastal Zone Ecology, Conservation and Management course in 2009. This motivated us to initiate a one year Systematic Review project on the perceived problem of increasing cormorant populations in the Baltic region. Using the Systematic Review methodology, Tuomas Leinonen identified knowledge gaps in management and understanding of cormorant populations.

In summer 2010, butterflies and bees in the urban environment were mapped as a part of a “Pollinators in the city” project. The project was lead by Marianne Fred and carried out with the aid of a team of surveyors. The local community was supportive of the project and opened their gardens to the surveyors. Findings showed that private gardens were more favourable to pollinators than green city areas, even in a small “green” town like Tammissaari. Adding features of private gardens, such as increasing nectaring flowers, would attract more pollinators to urban parks. The endangered Apollo butterfly was successfully reintroduced to the Ekenäs Archipelago Na-



tional Park. The introduction was part of a larger project studying the habitat requirements of the Apollo. One of the two mainland Apollo populations in Finland is located in Inkoo. The extent of the population was mapped over a three-year period. Given the close proximity of Inkoo to Helsinki, this knowledge is important for decisions on future land development.

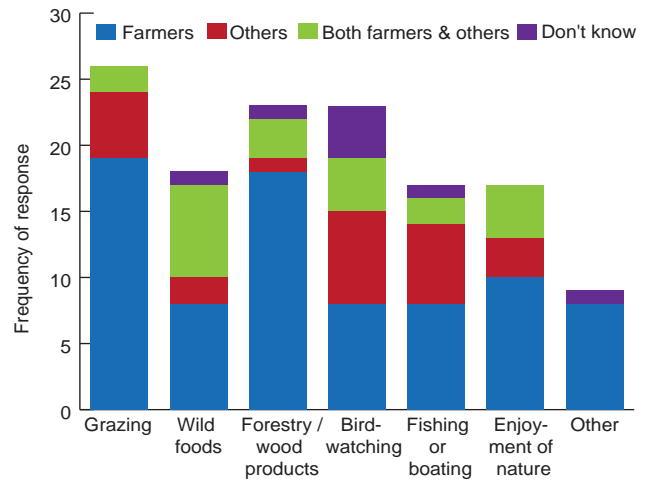
Farmers in Raseborg were surveyed and interviewed as part of ongoing research on endangered cultural landscapes. All farms in Raasepori were sent a postal questionnaire inquiring about the presence and use of grazed woodlands and meadows. The return rate for the questionnaire was a very positive 40%. Farmers who own or manage these landscapes were interviewed in 2010. Results show that these landscapes provide many ecosystem services in addition to fodder production. This and other findings were presented in 2011 at the 4th annual Ecosystem Services Partnership conference, titled "Ecosystem Services: Integrating Science & Practice", in Wageningen, The Netherlands.

In December 2011, COAST-MAN Sub-Global Assessment (SGA) will be represented at the International Ecosystem Assessment meeting in Bilbao, Spain. The meeting brings together SGAs from around the world for sharing information on process and methods for conducting ecosystem assessments. Traci Birge and Mari Pihlajaniemi will present COAST-MAN and participate in training. The meeting is important to us because COAST-MAN is an umbrella for all of our projects with a strong community component. The meeting provides us with the opportunity to bring the results of multiple projects together and communicate them to a wide audience working in the field of ecosystem services.

#### Collaboration

- Bra Mat
- Green Islands
- iCCB (integrated climate change biology programme IUBS)
- SGA Network
- UNEP-WCMC (World Conservation Monitoring Centre)

Multi-functional landscapes: Grazing cows produce local food while maintaining natural and cultural values. Photo Traci Birge



Ecosystem services of traditional rural biotopes. Based on interviews with Raasepori farmers. N= 27. Colours indicate users of ecosystem services.

#### Recent Publications

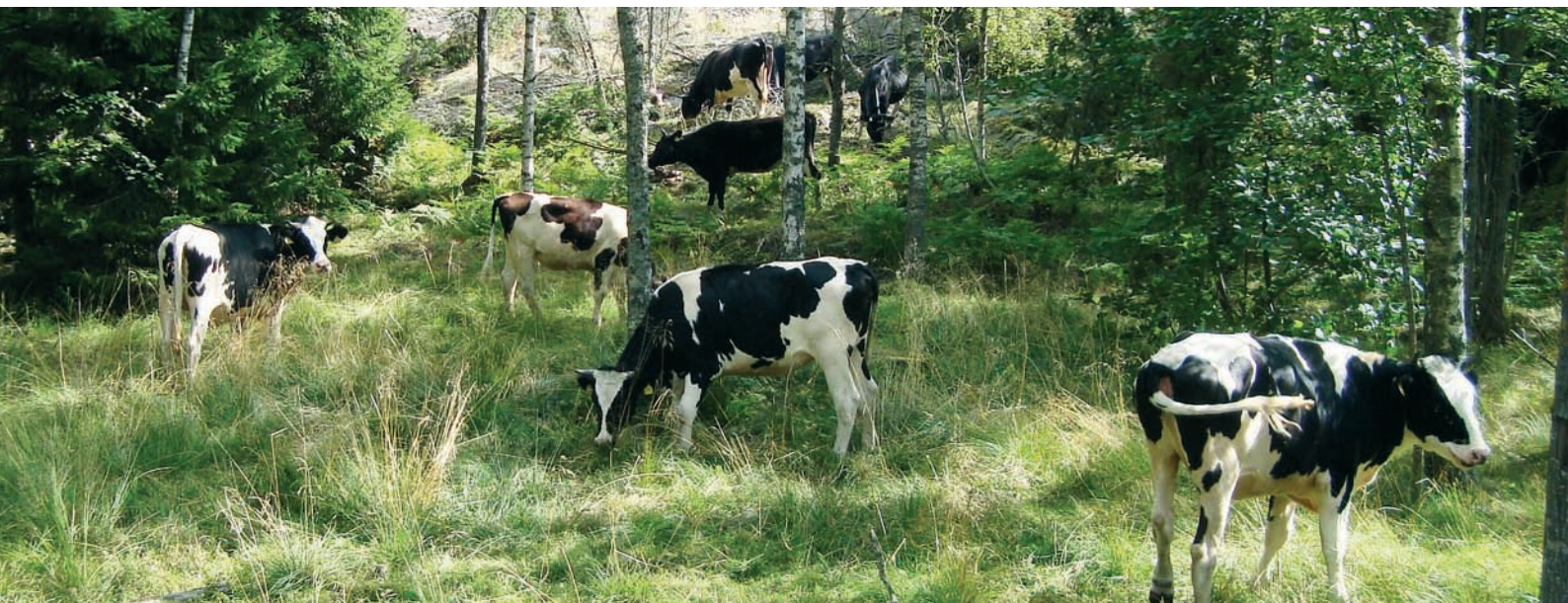
Birge, T. & Fred, M.S. 2011: New ideas for old landscapes: using a social-ecological approach for conservation of traditional rural biotopes – a case study from Finland. – *European Countryside* vol 3. In press

Polly, P.D., Eronen, J.T., Fred, M., Dietl, G.P., Mosbrugger, V., Scheidegger, C., Frank, D.C., Damuth, J., Stenseth, N-C. & Fortelius, M. 2011: History matters: ecometrics and integrative climate change biology. – *Proc. R. Soc. B* published online January 12 2011 doi: 10.1098/rspb.2010.2233.

Mellbrand, K., Lavery, P., Hyndes, G. & Hambäck, P. A. 2011: Linking land and sea – different pathways for marine subsidies. – *Ecosystems* 14 (5): 732-744

UNEP-WCMC. main authors: Walpole, M.; Brown, C.; Tierney, M.; Mapendembe, A. Contributing authors: Viglizzo, E., Goethals, P.; Birge, T. et al. 2011: Developing ecosystem service indicators: experiences and lessons learned from sub-global assessments and other initiatives. – Secretariat of the Convention on Biological Diversity, Montréal, Canada. Technical Series no. 58. <http://www.cbd.int/doc/publications/cbd-ts-58-en.pdf>

Fred, M.S. & Brommer, J.E. 2010: Olfaction and vision in host plant location by *Parnassius apollo* larvae; consequences for survival and dynamics. – *Animal Behaviour* 79, 313-320



# Experimental Rocky Shore Ecology

Patrik Kraufvelin & Jörg Sareyka

We are investigating the effects of human-induced pressures on marine benthic communities by coupling field observations/experiments with controlled studies in mesocosms and/or aquaria. The locally and regionally conducted research is often joined together at European and even global level through effective international networking (GAME, MARBEF). Current research topics include: 1) Hard bottom studies on foundation species such as the bladder-wrack and the blue mussel including their associated communities (since 1989), 2) Optimal practice in sampling methodology, experimental design and statistical analysis for investigating benthic communities (since 1995), 3) Eutrophication-related experiments in rocky littoral mesocosms at Solbergstrand, Norway (since 1996), 4) Experimental work on introduced species and their impact (since 2004), 5) Biodiversity and ecosystem functioning (since 2005), and 6) Combating eutrophication through “nutrient” harvesting of algae and mussels (since 2010). The studies encompass areas from strictly theoretical basic research to applied science – mostly with an evident coupling to management issues.

## Highlights

We carry out marine research in the Baltic Sea (Tvärminne – the Åland Islands), in Norway, at European (MARBEF) and even global scale (GAME – Global Approach by Modular Experiments, South-Africa). The highlights are presented separately for each sub-project listed above.

1. Foundation species: We are studying the performance of bladder-wrack (e.g. competition, reproduction, lower growth limit, adaptation to light fluctuations) and blue mussels (regional, wave exposure, site-to-site and depth differences) and possible consequences for associated macrofauna under escalating threats from human activities. Most recently, we have seen that bladder-wrack receptacles mature 3-4 weeks earlier during early springs (mild winters) than during cold springs (Ruuskanen et al., submitted). This climate-change induced mismatch



GAME 2006 - Re-union 2010: Julia Nyström, Björn Stockhausen and Patrik Kraufvelin

between the timing of bladder-wrack settlement and maximum occurrence of competing filamentous algae might cause a missed “window of opportunity” and reduced bladder-wrack distribution.

2. Sampling methodology: We have examined scale-dependent distributional patterns in soft sediment macrofaunal communities in three areas representing different environmental regimes and intra-site variability (Kraufvelin et al. 2011). The systems showed clear species distribution patterns driven by local environmental conditions, but with a substantial biotic component seen as the proportion and role of rare species and the high spatial variability observed at the smallest scale (i.e. 10 m). The results are valuable for the refinement of sampling design, for interpretation of monitoring programs and for incorporating scaling issues into questions of marine biodiversity and conservation.

3. Solbergstrand’s mesocosms: We have studied macroalgal biomass, diversity and production as well as their relationships under long-term influence of nutrient enrichment and wave action (Kraufvelin et al. 2010). Total biomass of macroalgae was higher at low nutrient and high wave levels, the diversity was lower and there were significant negative correlations between macroalgal diversity and primary productivity. These partly surprising results highlight the importance of species identities and context dependency when examining BEF-relationships.

4. Introduced species: As part of the international GAME-network, we have examined the new-comer *Gammarus tigrinus* and if it affects native amphipods negatively and may change littoral communities of the northern Baltic Sea. We have shown that introduced *G. tigrinus* is more

Tvärminne field sampling, Chitose Yamazaki and Benjamin Weigel.  
Photo Patrik Kraufvelin



tolerant to environmental changes due to eutrophication and a warming climate than native *G. zaddachi* (Sareyka et al. 2011). We have also found a wider tolerance range for four other pairs of introduced and native marine species around the globe (Lenz et al. 2011). Thus, stress tolerance seems to be a property of successful invaders which could be applied for screening profiles and risk assessment protocols.

5. Biodiversity and ecosystem functioning: In a series of GAME-experiments replicated globally, we translocated >500 hard bottom communities to new environments simulating a rapid but moderate change (Wahl et al. 2011). We show that availability of free substratum relates negatively, while taxon richness relates positively to structural persistence. Thus, when facing environmental change, taxon-rich communities retain their original composition longer than taxon-poor communities. We also found an interaction between taxonomic and functional diversity which may help understand some of the seemingly contrasting findings of past research regarding the behaviour of communities exposed to environmental stress.

6. Combating eutrophication through “nutrient” harvesting: We estimate net environmental effects from harvesting nutrients present in blue mussels (Upcoming EU-project 2012-13: BalticEcoMussels), macroalgae (Kraufvelin, in preparation) and their associated algal/animal communities to get background data about the relevancy of different nutrient mitigation measures.

### Collaboration

- BIOFUSE (MARBEF). Effects of biodiversity on the functioning and stability of marine ecosystems: European scale comparisons
- The global GAME-network
- Erik Bonsdorff, Jennifer Jungerstam, Ann Lindholm, Annica Långnabba, Johanna Mattila, Tessa Mäki, Jens Perus, Sonja Salovius & Jörg Sareyka, Åbo Akademi University
- Hartvig Christie, Lars Andreas Kirkerud, Frithjof Moy & Kjell Magnus Norderhaug, NIVA, Oslo, Norway
- Eliecer Diaz & Johan Erlandsson, Aronia
- Stein Fredriksen, University of Oslo, Norway
- Mark Lenz, Martin Wahl, Benjamin Weigel & Chitose Yamazaki, IFM-GEOMAR, Kiel, Germany
- Magnus Lindström & Ari Ruuskanen, Tvärminne Zoological Station
- Julia Nyström & Mats Westerborn, Park and Forest Services
- Morten Foldager Pedersen, Roskilde University, Denmark

Landscape of the bladder-wrack. Photo Patrik Kraufvelin



Solbergstrand mesocosm. Photo Patrik Kraufvelin

### Key publikations

Kraufvelin, P., Lindholm, A., Pedersen, M. F., Kirkerud, L. A. & Bonsdorff, E. 2010 Biomass, diversity and production of rocky shore macroalgae at two nutrient enrichment and wave action levels. – *Marine Biology* 157:29–47

Kraufvelin, P., Perus, J. & Bonsdorff, E. 2011: Scale-dependent distribution of soft-bottom infauna and possible structuring forces in low diversity systems. – *Marine Ecology Progress Series* 426:13–28

Wahl, M., Link, H., Alexandridis, N., Thomason, J., Cifuentes, M., Costello, M. J., da Gama, B. A. P., Hillock, K., Hobday, A. J., Kaufmann, M. J., Keller, S., Kraufvelin, P., Krüger, I., Lauterbach, L., Antunes, B. L., Molis, M., Nakaoka, M., Nyström, J., bin Radzi, Z., Stockhausen, B., Thiel, M., Vance, T., Weseloh, A., Whittle, M., Wiesmann, L., Wunderer, L., Yamakita, T. & Lenz, M. 2011: Re-structuring of marine communities exposed to environmental change: a global study on the interactive effects of species and functional richness. – *PLOS One* 6 (5):e19514

Sareyka, J., Kraufvelin, P., Lenz, M., Lindström, M., Tollrian, R. & Wahl, M. 2011: Differences in stress tolerance and brood size between a non-indigenous and an indigenous gammarid in the northern Baltic Sea. – *Marine Biology* 158:2001–2008

Lenz, M., da Gama, B. A. P., Gerner, N. V., Gobin, J., Gröner, F., Harry, A., Jenkins, S. R., Kraufvelin, P., Mummelthei, C., Sareyka, J., Xavier, E. & Wahl, M. 2011: Non-native marine invertebrates are more tolerant towards environmental stress than taxonomically related native species: Results from a globally replicated study. – *Environmental Research* 111:943–952

# Decomposition of Organic Material Through the Photochemical Processes in the Aquatic Ecosystems

Anssi Vähätalo, Sanna Vaalgamaa, Yihua Xiao, Hanna Aarnos, Susann Müller, Miika Kuivikko, Kalle Meller, Jari Uusikivi, Karina Moslova & Ville Kasurinen

The main research theme of the group is solar radiation-induced photochemistry in the aquatic systems, but some of the research is related to birds also. The group is developing and applying photochemical models to provide perspectives into biogeochemistry of natural and anthropogenic substances. Vähätalo's research group aims to build a critical mass around the research theme with collaborative links to other groups carrying out environmental research. The group has close and active research links with several laboratories in Finland and abroad. At the moment the core research group consists of the group leader, two post doc researchers and four PhD students. The main research themes of Vähätalo are: 1) The role of dissolved organic matter for the functioning of aquatic ecosystems 2) The photochemical transformation of natural organic matter in surface waters 3) The solar photolysis of harmful anthropogenic organic chemicals in the environment 4) The optical properties of surface waters and sea ice and 5) The impact of climatic warming on (aquatic) birds.

## Highlights

Some exciting findings of the themes above are:

1) Dissolved organic matter (DOM) absorbs hydrophobic harmful chemicals, such as brominated fire retardants and polyaromatic hydrocarbons, and controls their fate in aquatic systems.

2) In the Baltic Sea, solar radiation-induced photochemical reactions are primarily responsible for the mineralization of dissolved organic carbon (DOC) transported by rivers to the Baltic Sea. The photochemical reactions

Dr. Sanna Vaalgamaa examines the photochemical decomposition of synthetic hormone used in birth-control pill in the coastal Baltic Sea in summer 2011. Photo Anssi Vähätalo



Anssi Vähätalo. Photo Kajsa Mellbrand

transform organic carbon into easily available form at a rate, which exceeds tenfold the total catch of fish, and cascades through the trophic levels from bacteria to zooplankton (see the schematic figure).

3) Solar radiation-induced photolysis is solely responsible for the decomposition of many harmful organic chemicals, such as brominated fire retardants, which cannot be biologically decomposed in surface waters. However, fluorinated pollutants, such as perfluoro-octanoic acid, resists environmental photolysis as their photolytic half lives are > 25 000 years in the Baltic Sea.

4) Chromophoric DOM (CDOM) is the most important absorber of solar ultraviolet radiation in numerous aquatic environments ranging from streams to lakes through estuaries to coastal waters and sea ice. CDOM forms the most important natural UV-screen for the organisms in the Baltic Sea ice.

5) Climatic warming acts e.g., through North-Atlantic oscillation resulting in advance in ice breakup and early arrival of (aquatic) birds, which respond by phenotypic plasticity to the climatic oscillations.

One of the most exciting projects is the Big River-project. The on-going project assesses the linkage between the continents and the ocean through rivers. Rivers provide a remarkable source of organic matter, nutrients and metals for the coastal ocean. Although rivers export about 0.25 Gt C yr<sup>-1</sup> to the ocean, apparently little dissolved organic matter (DOM) in the open ocean originates from

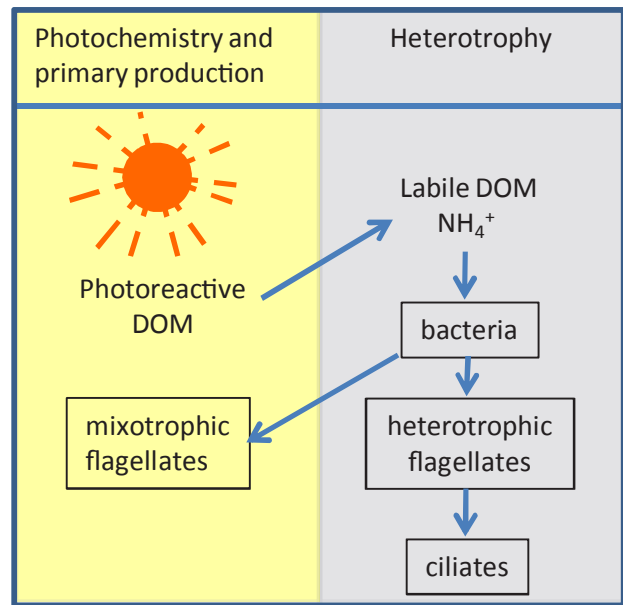
the continents. We hypothesize that microbial, photochemical decomposition (separately and in cooperation) are responsible for the disappearance of DOM, re-mineralize dissolved organic nutrients and link the continental DOM to the heterotrophic food webs of coastal oceans.

These hypotheses are tested with a series of experiments, which provide key parameters for the description of the photochemical and microbial decomposition of riverine DOM in the coastal ocean in particular when coupled to the appropriate environmental conditions in front of selected big rivers (e.g., solar radiation dose, hydrology, etc.). The rivers selected for this project are Parana (Argentina), Mississippi (USA), St Lawrence (Canada), Congo (Zaire), Ganges-Brahmaputra (Bangladesh), Mekong (Cambodia), Yang Tse (China), Lena (Russia), Amazon (Brazil), and Danube (Romania). These rivers export 1/4 DOM to the ocean, and therefore many analyses related to the collected water sample can be converted into global dimensions.

### Some collaborators

- Long term ecological research network (Tvärminne Zoological Station, Lammi Biological Station, Hanko Bird Observatory)
- Analytics by mass spectrometry (Tapio Kotiaho, University of Helsinki, Chemistry/Pharmacy)
- Transformation of pharmaceuticals (Raimo Ketola, University of Helsinki, Pharmacy; Leif Kronberg, Åbo Akademi and his Nordic networks)
- Ecotoxicology and partition chemicals in environment (Jussi Kukkonen, Jarkko Akkanen, University of Eastern Finland)
- Optical measurements (Stefan Sims, Jukka Seppälä, Pasi Ylöstalo, Finnish Environmental Institute)
- Hydrological models with decomposition modules (Kai Rasmus, Timo Huttula, Finnish Environmental Institute; Jyväskylä and their Danish colleagues).
- Environmental photochemistry (Richard Zepp, Environmental Protection Agency, Georgia USA.; G. Christopher Shank, University of Texas, Port Aransas)
- Through our Big River-project we collaborate with ca. 20 foreign researchers (e.g., Lars Tranvik, University of Uppsala, Rob Spencer, Woods Hole Research Center, Massachusetts, USA).
- Nuclear magnetic resonance spectroscopy of riverine dissolved organic matter (André Simpson, University of Toronto, Canada)
- Fourier-transformed ion-cyclotron resonance mass spectroscopy (Torsten Dittmar, University of Oldenburg, Germany)
- Natural abundance of C-14 in DOM (Leigh McCallister, Virginia Commonwealth University, USA)
- C-13 in chromophoric DOM (Yves Gelin, Concordia University, Montreal, Canada)
- Iron-ligands of dissolved organic matter (Jiri Kopáček, Hydrobiological Institute Academy of Sciences, Czech Republic; Timo Sara-aho, Finnish Environmental Institute, Stan van den Berg, University of Liverpool, United Kingdom)
- Carbon cycling in a sub-catchment of Baltic Sea (Lammi Biological Station, University of Helsinki, Anna-Maria Rajala, Samu Mäntyniemi, Lauri Arvola, University of Helsinki; Martin Forsius, Finnish Environmental Institute; Martyn Futter, Swedish Lantbruk University; Aino Smolander, Outi Kiikkilä, Veijo Kitunen, Finnish Forest Research Institute).
- The fate of organic harmful chemicals such as brominated fire retardants, synthetic estrogens, pharmaceuticals in surface waters (Sami Huhtala, Noora Perkola, Kari Lehtonen, Finnish Environmental Institute; Jaana Koistinen, Tvärminne; the FIX-ME consortium with ca. 25 Finnish members)
- Sea ice studies (Sönke Maus, University of Bergen; David Thomas, Finnish Environmental Institute; Colin Stedmon, Technical University of Denmark; Mats Granskog, Norsk Polar Institute, Tromsø; the Sea Ice Ecology-consortium with ca. 12 members in University of Helsinki and Finnish Environmental Institute)
- Climatic change and birds (Aleksi Lehikoinen, Finnish Natural History Museum; Esa Lehikoinen, University of Turku; the Hanko Bird Observatory team with ca. 10 members)

Sampling sea ice in Svalbard in March 2009. From left to right: Eivind Borge, Susann Müller and Anssi Vähätalo, who can easily be identified by his binoculars. Photo Sönke Maus



Solar radiation-induced flux of photoreactive DOM through a heterotrophic food chain with a linkage to autotrophic plankton (mixotrophic flagellates).

### Recent Publications

Vaalgamaa, S., Vähätalo, A. V., Perkola, N. & Huhtala, S. 2011: Direct and indirect photochemical reactivity of perfluorooctanoic acid (PFOA) in conditions representing surface water. – *Science of Total Environment* 409: 3043-3048.

Müller, S., Vähätalo, A. V., Granskog, M. A., Autio, R. & Kaartokallio, H. 2011: Behaviour of dissolved organic matter during formation of natural and artificially grown Baltic Sea ice. – *Annals of Glaciology* 52: 233-241.

Maus, S., Haase, S., Büttner, J., Brüttsch, S., Huthwelker, T., Schwikowski, M. & Vähätalo, A. 2011: Ion fractionation in young sea ice from Kongsfjorden, Svalbard. – *Annals of Glaciology* 52: 301-310.

Vähätalo A. V., Aarnos H., Hoikkala L. & Lignell R. 2011: Microbial link through the photochemical transformation of terrestrial dissolved organic matter supports hetero- and autotrophic production in coastal waters. – *Marine Ecology Progress Series* 423: 1-14.

Kuivikko, M., Sorsa, K., Kukkonen, J. V. K., Akkanen, J., Kotiaho, T. & Vähätalo, A. V. 2010: Partitioning of tetra- and pentabromo diphenyl ether and benzo(a)pyrene among water, dissolved and particulate organic carbon along a salinity gradient in coastal waters. – *Environmental Toxicology and Chemistry* 29(11): 2443-2449.



# Parental Care Strategies, Reproductive Success and Environmental Stress in Eiders

Markus Öst, Johan Ekroos, Kim Jaatinen, Mikael Kilpi, Kristina Noreikienė & Martin Seltmann

Our research lies at the interface between fundamental research in evolutionary and behavioural ecology and more applied investigations into population dynamics and conservation biology. Despite different objectives, each subproject benefits from the others and from a unique twenty-year data set on eider ducks, our main study species, from Tvärminne, SW Finland. There are four main themes: 1) understanding why, how, and under what conditions eider females share brood-rearing duties with each other, forming crèches, i.e. eider 'kindergartens', 2) determining whether eider females have stable 'personalities', and whether these personalities affect sociality, reproductive success, or the adaptation to a changing environment, 3) assessing female breeding habitat selection in relation to internal state and external conditions, 4) clarifying the population dynamics and demography of eiders, a keystone species in the Baltic, particularly in relation to a shifting predation regime. The methods include statistical analysis of observational and experimental data, laboratory analyses and theoretical modelling.

## Highlights

We have examined how predation risk affects the extent of reproductive sharing allowing cooperation to emerge, based on a theoretical model in which we determined the evolutionary stable effort of partners given their quality. Our model (Jaatinen et al. 2011a) correctly predicted that increased predation risk on female eiders at Tvärminne led to an increase in the relative proportion of cooperative, as opposed to solitary, parental care modes, and also female group sizes increased (Fig. 1). Eider parental care strategies therefore respond rapidly to changes in predation risk, associated with the recovery of the white-tailed sea eagle, a major predator of nesting eider females. Such flexibility seems, however, not to exist for breeding habitat selection. In a study by Öst et al. (2011), in which we analyzed breeding dispersal between subsequent years, we found that although failed nesters moved farther than successful ones, breeding dispersal almost exclusively takes place within islands. One factor limiting dispersal is that moving to unfamiliar sites delays breeding (Öst et al. 2011).

Nerves of steel are rewarded at eider capture. Kim Jaatinen (right) can only stand and watch while the female is heading towards Petteri Lehtikoinen (left), having fired his hand net prematurely. Also Johan Ekroos (middle) is out of the running. Photo Marjo Aikko



Helping hands from near and far are needed during the short but hectic eider field season. The field crew of 2010: (upper row, from left): Colby Chase, Marjo Aikko, Andrea Maier, Martin Seltmann, Petteri Lehtikoinen, Johan Ekroos and Kim Jaatinen. Benjamin Steele (left) and Markus Öst are sun-bathing sitting down. Photo Benjamin Steele

Unfortunately, however, site fidelity carries a substantial survival cost under rapidly changing predation risk targeted at nesting adults rather than eggs. The overall survival rate of eider females at Tvärminne is the lowest ever recorded for this species (Ekroos et al., submitted) and predation disproportionately affects islands without vegetative cover, where female survival is significantly lower than on forested islands. Despite this disadvantage, females do not change nesting locations from open to forested islands. To conclude, increased adult predation risk is a main driver of population change in our study population. The breeding population in the Baltic Sea has decreased with 40% (Ekroos et al. 2011) and the effect of increased white-tailed sea eagles may explain a substantial part of this decrease.

Our work has also given valuable insights into ecological genetics. While preliminary work suggested that eiders form non-kin brood-rearing coalitions (Öst et al. 2005), a re-analysis based on a larger sample revealed a complex relationship between relatedness and sociality (Noreikienė 2011, MSc thesis, Univ. of Aarhus). Small

brood-rearing coalitions have more relatives than larger ones, but this may be driven by individual quality differences: females that are older and in better condition prefer small groups and have more relatives around due to the progressive disappearance of low-quality individuals. Accordingly, our survival analysis demonstrated a positive link between female body condition and subsequent survival (Ekroos et al., submitted). The importance of individual quality is also highlighted in our recent paper (Jaatinen & Öst 2011) showing that old and experienced females attract young good-condition females as coalition partners.

We have recently linked behavioural attributes of female personality with stress physiology and endocrinology. Several behavioural and physiological traits are consistent and correlated with each other. Intriguingly, the results challenge the universality of a positive correlation between boldness and aggression (Seltmann et al., in prep.).

Finally, we have investigated conspecific brood parasitism, in which a female lays her eggs in the nest of a conspecific host, using the Barrow's goldeneye as a model. This work has been successful both theoretically (Jaatinen et al. 2011b) and empirically (Jaatinen et al. 2009a, 2011c), shedding light on the intricate dynamics between parasite nesting status, host-parasite relatedness and spatial proximity.

### Key publications

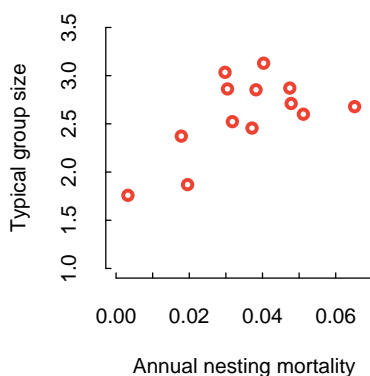
Jaatinen, K. & Öst, M. 2011: Experience attracts: the role of age in the formation of cooperative brood-rearing coalitions in eiders. — *Animal Behaviour* 81: 1289–1294.

Jaatinen, K., Öst, M. & Lehikoinen, A. 2011: Adult predation risk drives shifts in parental care strategies: a long-term study. — *Journal of Animal Ecology* 80: 49–56.

Jaatinen, K., Öst, M., Gienapp, P. & Merilä, J. 2011: Differential responses to related hosts by nesting and non-nesting parasites in a brood-parasitic duck. — *Molecular Ecology*, in press.

Öst, M., Lehikoinen, A., Jaatinen, K. & Kilpi, M. 2011: Causes and consequences of fine-scale breeding dispersal in a female-philopatric species. — *Oecologia* 166: 327–336.

Öst, M., Clark, C. W., Kilpi, M. & Ydenberg, R. C. 2007: Parental effort and reproductive skew in coalitions of brood-rearing female common eiders. — *American Naturalist* 169: 73–86.



(Fig. 1) Increasing predation mortality of incubating eider females increases the typical female group size in brood-rearing coalitions formed at sea. Annual mortality is measured as the number of killed females related to total nest numbers on islands. Shown are data from 13 years (1997–2009) from Tvärminne. From Jaatinen et al. (2011a).

### Current collaborators

- Hanna Kokko & Jussi Lehtonen, Australian National University
- Barry D. Smith, Canadian Wildlife Service
- Keith Hobson, University of Saskatchewan
- Ronald C. Ydenberg, Simon Fraser University
- Anthony D. Fox & Karsten Laursen, National Environmental Research Institute
- Alekski Lehikoinen, Finnish Museum of Natural History
- Hannu Pöysä, Finnish Game and Fisheries Research Institute
- Juha Merilä, University of Helsinki
- Martti Hario, Finnish Game and Fisheries Research Institute
- Patrik Karell, Aronia
- Phillip Gienapp, University of Helsinki
- Romi Rancken, Novia University of Applied Sciences
- Anette Fenstad, University of Trondheim
- Børge Moe, Jan Ove Bustnes & Sveinn Are Hanssen, Norsk institutt for naturforskning
- Kjell Larsson & Peter Waldeck, Gotland University
- David Costantini & Pat Monaghan, University of Glasgow
- Benjamin B. Steele, Colby-Sawyer College
- Eldar Rakhimberdiev, Cornell University
- Kendall Mashburn & Shannon Atkinson, University of Alaska Fairbanks, Fisheries Division
- Tuula Hollmén, Alaska SeaLife Center, University of Alaska

PhD student Martin Seltmann can't hide his joy after collecting an extraordinary stress hormone sample. The concentration of glucocorticoids in faeces indicates a female eider's stress coping ability, an important component of her personality. Photo Kristin Gabrielsen



# Evolutionary Dynamics of Colour Polymorphism and Mechanisms of Selection

Patrik Karell

I study evolutionary and population dynamics in relation to environmental change using the tawny owl as a model species. The project aims at understanding proximate mechanisms of natural selection, life-history trade-offs and genotype-environment interactions. I am currently focusing on parasite-mediated selection and thermoregulatory adaptations to harsh winter conditions. I also collaborate with ornithologists nationally and internationally in order to combine data on tawny owls and study dispersal and variation in evolutionary dynamics on a larger scale. Because tawny owls display large variation in genetically determined plumage colouration it is an excellent species to study such evolutionary processes in natural populations. Colour polymorphism is thought to be maintained and evolve due to morph-specific sensitivity to the environment. Therefore, differently coloured tawny owls are expected to be adapted to given environments.

## Highlights

In this project I am mainly studying a population of tawny owls in Southern Finland. The population has been monitored by ornithologists in the Kimpari Bird Project since 1978 and more recently I have joined the team in order to continue the collection of data and use the valuable long-term data for scientific purposes.

Recently, we published our results of survival analyses on the long-term individual based data on tawny owl colour morphs (Karell et al 2011a). The colour polymorphism of tawny owls ranges from pale grey to reddish brown individuals. We found that the tawny owls have become increasingly brown as winter climate in Finland has become warmer. Our results show that survival of the brown morph is markedly lower than that of the grey morph in cold and snow-rich winters (selection against the brown morph). As winters have become milder with less snow the survival of the brown morph has improved and reached the level of the grey morph (Fig. 1). This has led to a rapid increase in the frequency of the brown morph in the population. As this was one of the first empirical studies to document an evolutionary response to climate change in a natural population, this finding



Patrik Karell. Photo Petri Valo

caught the attention of both national and international media. The result also raised the question of what mechanisms leads to differential survival of the colour morphs in cold and snow-rich winters. Other empirical studies suggest that there are intrinsic differences (immunological, physiological) between colour morphs which affect their energetic demands and susceptibility to parasites and pathogens.

In another recent study, we found that the cost of being infected by blood parasites are colour morph-specific in the tawny owl (Karell et al. 2011b). Here, we used an experimental approach where we medicated tawny owl females against the parasites. We found that the energetic costs of defence against parasites and pathogens differ between the colour morphs. I am currently looking into the long-term effects of medication, and parasites in general, on survival and breeding performance. The findings may help explain whether a difference in parasite defence between colour morphs is related to differential survival under harsh winter conditions. On a more general level the results will shed new light on the role of parasites as agents of natural selection and their impact on the evolutionary dynamics of the host.



In autumn 2011 I will collaborate with and work at Lund University in Sweden to develop new genetic tools to study blood parasites from blood samples of tawny owl adults and offspring collected in the past six years. I will also begin to look at metabolic and thermoregulatory differences between colour morphs as possible mechanisms for morph-specific adaptations to harsh winter conditions.

#### Current collaborators

- Prof. Jan-Åke Nilsson & prof. Staffan Bensch, Lund university
- Academy researcher Dr. Jon E. Brommer & Dr. Jari Valkama, University of Helsinki
- Academy researcher Dr. Heli Siitari, University of Jyväskylä
- Prof. Xavier Lambin, University of Aberdeen
- Prof. Anders P. Møller & Dr. Ismael Galván, Université Paris-Sud

#### Key Publications

Karell, P., Ahola, K., Karstinen, T., Valkama, J. & Brommer, J.E. 2011a: Climate change drives microevolution in a wild bird. — *Nature Communications*, 2: 208 / ncomms1213.

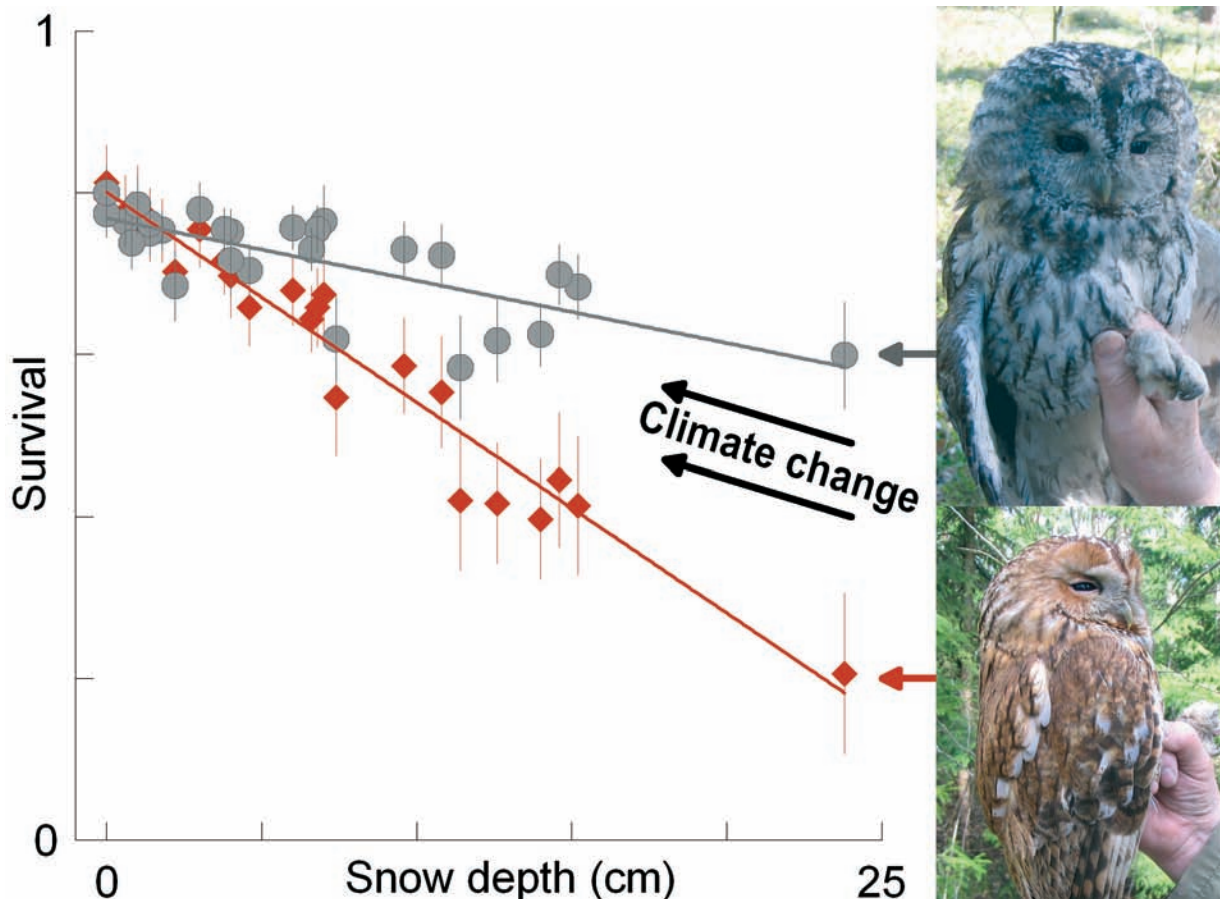
Karell, P., Ahola, K., Karstinen, T., Kolunen, H., Siitari, H. & Brommer, J.E. 2011b: Blood parasites mediate morph-specific maintenance costs in a colour polymorphic wild bird. — *Journal of Evolutionary Biology*, 24: 1783-92.

Karell, P., Ahola, K., Karstinen, T., Zolei, A. & Brommer, J.E. 2009: Population dynamics in a cyclic environment: Consequences of cyclic food abundance on tawny owl reproduction and survival. — *Journal of Animal Ecology*, 78: 150-162

Karell, P., Kontiainen, P., Pietiäinen, H., Siitari, H. & Brommer, J.E. 2008: Maternal effects on offspring Igs and eggsize in relation to natural and experimentally improved food conditions. — *Functional Ecology* 22: 682-690.

Karell, P., Pietiäinen, H., Siitari, H. & Brommer, J. E. 2007: A possible link between parasite defence and residual reproduction. — *Journal of Evolutionary Biology* 20: 2248-2252.

Survival of the brown tawny owl morph (red symbols) is much lower than that of the grey morph (grey symbols) in winters with deep snow. The general direction of ongoing climate change is towards milder winters, which reduces the survival selection against the brown morph and leads to an increase of brown tawny owls in the population. Photos Patrik Karell



# Bra Mat i Västnyland

Ann-Louise Erlund (project leader), Jenny Öhman (project assistant), Pieter Deleu (project researcher), Marianne Fred (research advisor, member of steering group).

In recent years the focus on locally produced foods has increased. This can be seen in the increased awareness of different consumer groups. The issues at hand are often connected to health, environment and sustainability. Locally produced food is considered healthier, having less environmental impact, and being a more sustainable alternative when compared to food produced via conventional farming practices with long transport distances. Bra Mat i Västnyland's aim is to create networks to facilitate a more effective production of local foods, stimulate product development of local foods and improve the distribution of local foods in the region. The network consists of local stakeholders, from the primary food producers to the consumers of locally produced food.

Bra Mat i Västnyland studies the environmental impacts of locally produced foods via ecosystem services connected to landscapes where local food networks (slow-food networks) are situated. Ecosystem services are material and non-material services that functioning ecosystems offer for free. These include circulation of nutrients, and water purification, but also wild foods, climate control, and the cultural identity connected to a landscape. The project researcher Pieter Deleu will compare ecosystem services within the agricultural landscape connected to slow-food networks both in Raseborg and in other European countries.

Photo Eva Tordera Nuño



Jenny Öhman, Marianne Fred & Ann-Louise Erlund, Pieter Deleu missing. Photo Kajsa Mellbrand

## Highlights

The project started in September 2011 and will continue until the end of June 2014. Although the project is new, there are already several highlights worth mentioning. The recruitment process revealed that there is very much professional knowledge of all aspects of food in the region. This is worth mentioning since food is one of the major tourism-promoting subjects of the region today. Horticulturist Jenny Öhman has been recruited as the project assistant and M.Sc. Pieter Deleu as the project researcher.

Photo Eva Tordera Nuño





Photo Eva Tordera Nuño



Photo Eva Tordera Nuño

Already this autumn, the project has had the opportunity to work together with local actors on organizing food-related events. The first weekend of October (Mickelsmäss) is traditionally the harvest festival time in the region. The food festival ‘Smaka på Västnyland’ (taste of western Uusimaa) was organized in Fiskars by Slowfood Västnyland rf on the first weekend of October 2011. The festival brought together about 70 local food producers and was visited by 12 000 -15 000 visitors. The next event, “Locally produced food and products from the wide forests”, was in focus on October 22 at Forest Festival (Skogens Fest) which was arranged at Novia UAS in Ekenäs. During this event Nordic Chefs demonstrated, among other activities, how to make your own sausages.

**Collaborators**  
Ecosystem Service Research group  
Slow Food



Photos from the food festival ‘Smaka på Västnyland’  
Eva Tordera Nuño  
([www.wix.com/evatordera/evatordera](http://www.wix.com/evatordera/evatordera))

Photo Eva Tordera Nuño



# Climate and Greenhouse Gases – the Local Point of View

Tiina Haaspuro & Malin Kurkisuo

This project entity covers two different ongoing subprojects concerning climate issues on a local level. Mitigation of climate change through taking measures to reduce greenhouse gas emissions has become everyday life even on a local level and this project aims to raise the level of knowledge on the phenomena, especially concerning its cause and effect locally. The subproject 1 concentrates on developing calculation methods for the effect of greenhouse gas sinks on a local level to evaluate how much carbon is sequestered in the carbon sinks and to create a calculation model for that purpose. The subproject 2 aims to develop an energy and climate programme for the municipality of Raasepori. The project is a continuation of a finished project where a survey of greenhouse gas emissions was carried out on a local level in southwestern Finland in 2009, approximately the same area where the present projects operate.

## Highlights

In the beginning of 2011 we began a new two-year project in cooperation with researchers from the Finnish Forest Research Institute and another one year project in cooperation with the municipality of Raasepori.

In the subproject that concentrates on developing calculation methods for greenhouse gas sinks we have managed to gather other cooperators from research groups doing

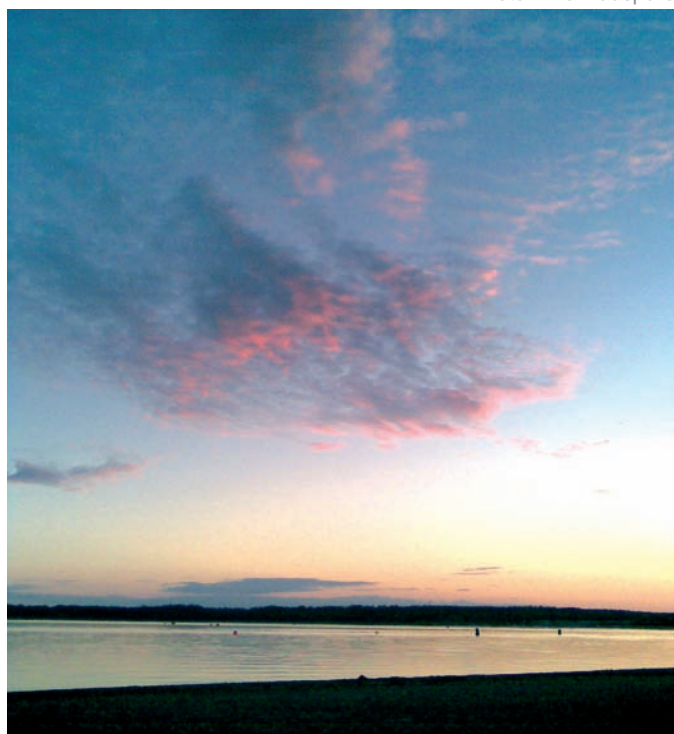


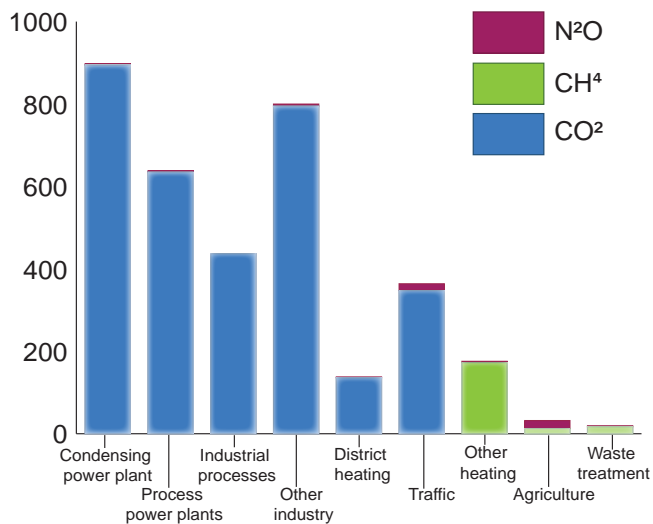
Tiina Haaspuro & Malin Kurkisuo. Photo Kajsa Mellbrand

their research in the field of greenhouse gases circulation dynamics in different natural environments, such as lakes and farmlands. The developing of a model for calculating the greenhouse gas sink's effects has proceeded well and a preliminary model already exists. The model is going to be a tool for municipalities to calculate how the greenhouse gas sinks function in their area, and it can even be used as an instrument in planning land use. The model structure will be of such a nature that all the coefficients and parameters are included in the model and the user only needs to fill in some basic data about the size and extent of the natural areas in the municipality in question. The model will calculate the amounts of carbon dioxide, methane and nitrous oxide produced. The work continues as we try to gather more calculation material and develop calculation methods for other natural environments, such as mires, sea shores, etc. We also strive to supply the model with a bioenergy application, where the climate effects of different forms of bioenergy can be calculated.

The development of an energy and climate programme for the municipality of Raasepori has been a success as we have managed to include staff from the municipality of Raasepori to a close cooperation, where the measures to reduce energy consumption were planned together with the staff to make sure the measures are practical and feasible. This project will produce a handbook for every different sector in the municipality, where field-specific measures to reduce energy use and emissions are presented. It will also include a handbook for inhabitants in Raasepori, which will include practical advice about mea-

Photo Tiina Haaspuro





Distribution of GHG-emissions on different emission sectors + share of CO<sub>2</sub>, CH<sub>4</sub> and N<sub>2</sub>O for the study area ( 8 municipalities in southwestern Finland).

sure everyone can take in their everyday life to cut down energy use. In order to get the citizens to think about their energy use, we carried out a survey, where people could give clues and ideas about how to cut down energy use. The survey was a success. The answers will be used in compiling the handbooks.

The calculation of greenhouse gases in southwestern Finland was successfully completed in 2009. The emissions were calculated for eight municipalities in southwestern Finland. The emission sectors that were calculated were energy (production and consumption in different forms), industrial processes, agriculture and waste management. The calculations included carbon dioxide, methane and nitrous oxide, but the main results were presented in CO<sub>2</sub> equivalents. We used an existing calculation model to perform the calculations. The emissions level was high for the entire area, though heavily influenced by a great number of industries.

Photo Esa Savolainen



Photo Tiina Haaspuro

#### Collaborators

- Prof. Rainer Backman, University of Umeå, Sweden
- Senior Researcher Tarja Tuomainen, Finnish Forest Research Institute
- The Municipality of Raseborg

#### Publication

Haaspuro, T. & Fortelius, W. 2010: Växthusgasutsläpp i Västra Nyland – Kartläggning över år 2007. – Novia publikation och produktion, serie R: rapporter, 3/2010, 58 pp.



# GREEN ISLANDS

Kaj Mattsson, Kajsa Mellbrand & Marianne Fred

The Green Islands –project’s (Central Baltic Interreg IV project, 2011-2013) main goal is to improve environmental conditions in the Baltic Sea region. The project aims at achieving “greener” islands by mapping, analyzing and evaluating the situation in terms of how solid waste is taken care of, energy and water consumption, wastewater management and ecosystem services on participating islands in Sweden, Finland and Estonia. The Finnish islands participating are Vänö, Iniö, Skåldö and Högsåra.

We want to work together with islanders towards sustainable solutions on the small and the large scale, and explore available solutions fitting the current situation on the islands. Workshops will be arranged on different topics (energy, wastewater management, ecosystem identification etc.) on each island with invited experts.

Ecosystem services are defined as the benefits people receive from nature. Ecosystem services will be mapped together with associated social components and user groups.



Marianne Fred, Kajsa Mellbrand & Kaj Mattsson. Photo Traci Birge

Old fishing harbor on Jumo (Iniö). Photo Kajsa Mellbrand





Early summer brings wild chives to the archipelago.  
Photo Janne Gröning

## Goals and Highlights

During the project we try to produce a complete analysis and quantification of the level of sustainability within water, energy, wastewater, waste management on the islands and ecosystem services, make management plans with stakeholder participation and high local ownership on the islands, do the mapping of ecosystem services and their users, and calculate the green house gas emission of each island (Ecological Footprint of the island).

All information gathered in the inventories will be publicly available via a GIS (Geographical Information System) portal. The portal will provide transparent analyses and suggestions for others interested in maintaining or making their island greener. The involved islands will be functioning as showcases.

Among the recent highlights of the project is the sustainable energy workshop on the island of Iniö, Finland and the energy seminar on the island of Utö, Sweden. Three new islands wanted to be involved in the project. These islands are Högsåra in Finland and Tynningö and Ramsö in Sweden. Green Islands has also been active in media, with several radio broadcasts and articles in the local press.

## Project Partners

- The Archipelago Foundation in the county of Stockholm, Sweden
- Association of Estonian Islands (AEI)
- Novia University of Applied Sciences, Finland
- Sustainable Saaremaa, Estonia



Solar panels in the Kullen energy park in Katrineholm, Sweden.  
Photo Lennart Andersson



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# NANNUT – Nature and Nurture of the Northern Baltic Sea

Sonja Jaari, Mikael Kilpi & Jill Karell

The archipelago of Finland, Åland and Sweden is highly productive with a diverse flora and fauna. As the area is under strong land-use pressure, sustainable planning of the area is important and more information of the underwater nature is acutely needed. Today there is a complete lack of basic tools which can be used by municipalities in the planning process and cooperation between experts and stakeholders with regard to the marine environment is lacking.

The NANNUT project (Central Baltic Interreg IVA) integrates the usage of underwater information in the planning of human activities in marine shallow areas. The project duration is three years (Oct 2009 - Aug 2012). The project is mainly funded by the EU and has a total budget of 1.3 million €.

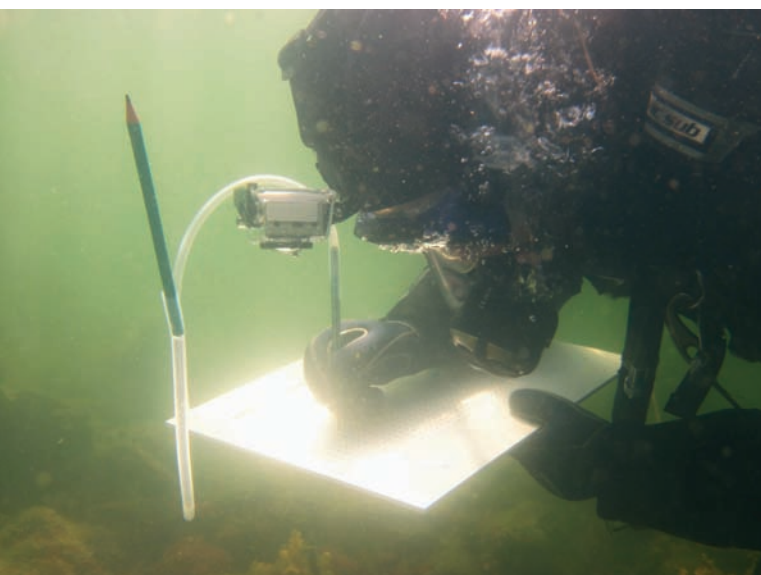
By carrying out pilot actions, the project develops best practices. Another aim is to establish a network between people working with different issues regarding the Baltic Sea.

There are ten partners in the project from Kotka in Finland in the east to Stockholm in Sweden in the west. The leadpartner is Novia University of Applied Sciences, located in Raseborg. One student from NOVIA is completing her final thesis within the project and one student has been conducting her internship in the project.

## Highlights

The NANNUT project started in the beginning of October 2009. Since the beginning we have had ten project partners, financiers believing in the project and a wonderful

Photo Malin Ek



The NANNUT-team going for a fall excursion in the archipelago near Korpoström. Project co-ordinator Sonja Jaari (below right) and project leader Mikael Kilpi (on the left) are the representatives of Aronia. Photo Malin Ek

plan. We were aiming at developing the best and economically most feasible methods for planners and decision makers so they could take the underwater environment into consideration in the land-use planning process. We have had two very successful field seasons and become a tight-knit team with an expertise ranging from land-use planning to ecological knowledge of the flora of shallow bays, to specialists on harbor activities and experts modeling fish spawning areas. Currently, we are mainly processing the vast amount of information we have gathered during the project period, and will be presenting it to the stakeholders during the spring 2012.

One of the main problems we have encountered is the lack of easy, fast and cheap methodology for making inventories in the underwater environment. Today there is very little underwater data available and the existing data is mainly in forms difficult to access. In NANNUT we have been trying to establish the most optimal inventory methods for planning situations on different geographical scales. During the field season we have been trying diving, underwater video and snorkeling. By combining the field data and using mathematical modeling we are aiming to present the most effective and cost-efficient methods to use for various planning situations.

The main areas for field work are situated around the northern coasts of the Baltic Sea. Video inventories have been carried out in the Raseborg area. Diving inventories have been conducted in the Archipelago Sea and fish spawning sites have been studied both in the easternmost part of the Gulf of Finland and in the Archipelago Sea. On Åland the fieldwork has mainly been concentrated to shallow bays. In addition existing data has been gathered from different sources (databanks and reports) and been analyzed and processed into a form usable for decision



makers. This has mainly been done in the area around Stockholm and in the harbor areas around Kotka and Turku.

One problem hindering the use of underwater data in the planning process is the lack of communication between different authorities and scientists. A lot of the underwater data today remains unused as it is in a form difficult to grasp. To overcome this we have tried to arrange gatherings for people working with planning and underwater inventories to come together and share their needs and experiences. We have arranged several workshops and seminars aimed at different stakeholder groups. In the project we are now trying to present data in a form perceivable for all stakeholder groups.

To present the data to stakeholders and the general public we have set up a homepage and a data portal ([www.nannut.fi](http://www.nannut.fi)). Furthermore, we will be arranging a road show touring along the northern Baltic coast in the spring of 2012 where we present the final results of the project.

#### Project partners

- Aronia, Novia University of Applied Sciences
- Centre for Economic Development Transport and the Environment for Southwest Finland
- Metsähallitus, Natural Heritage Services
- Government of Åland
- Stockholm University
- Finnish Game and Research Institute
- Centre for Economic Development Transport and the Environment for Southeast Finland
- Lounaispaikka/Regional Council of Southwest Finland
- Centre for Economic Development Transport and the Environment for Uusimaa
- University of Turku/ Centre of Maritime Studies



Photo Malin Ek



CENTRAL BALTIC  
INTERREG IV A  
PROGRAMME  
2007-2013

Photo Eva Sandberg-Kilpi



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# BACES

Ann-Louise Erlund & Mikael Kilpi

## Baltic Archipelago and Islands Centres

**BACES – Baltic Archipelago and Island Centres is a three-year Central Baltic INTERREG IV A project running from May 2010 to April 2013. BACES is a cooperation project between 11 partners from Sweden, Finland and Estonia wanting to share ideas and strategies on how to develop their BACES as assets for regional development. Central Baltic INTERREG IV A Programme 2007-2013 is a European territorial co-operation programme funding cross-border projects in the central Baltic Sea area. The Programme focuses on environment, economic growth as well as attractive and dynamic societies.**

### Highlights

Seven centres for development are defined in the project. The seven BACES - Baltic Archipelago Island Centres are Arkösund (SE), Tyrislöt (SE), Fyrudden (SE), Söderhamn (SE), Hanko (FI), Raseborg (FI) and Hiiumaa (EE). These BACES are to be the drivers of development and growth in the archipelago area, and project activities are focused in these centres.

The main objective of the project is to accelerate regional economic growth through the development of seven BACES - Baltic Archipelago and Island Centres as drivers for sustainable development and growth. The objective is to develop strategies and solutions for the BACES area economy, find and test new models and methods for economic growth, and to improve pre-conditions for living, working and visiting in the archipelago and island area. Further the project aims at raising awareness of the natural environments around BACES and developing these as assets for sustainable tourism.

Photo Eva Sandberg-Kilpi

The project also aims to improve the availability of information on the archipelago and islands outside the region. This will be done by development and investments in Info centres located in the BACES.

The project focuses its activities within three main areas: **ACCESSIBILITY** – improved accessibility to and from the seven BACES and improved availability of information on the archipelago and islands

**ECONOMY** – improved economic viability of the BACES economy and products by developing the pre-conditions for making a living in the area and by and prolonging the tourist season

**ENVIRONMENT** – environmental networking, increased awareness of the natural environments around BACES, and develop these as assets for sustainable tourism

In Hanko and Raseborg the municipalities together with Novia University of Applied Sciences will improve accessibility to archipelago.

### Project Partners

- Ötsam Regional Development Council, Sweden
- Norrköping Municipality, Sweden
- Söderköping Municipality
- Valdemarsvik Municipality, Sweden
- County Administrative Board of Östergötland, Sweden
- Municipality of Söderhamn/Culture and development department, Sweden
- Eurohouse NGO, Estonia
- Foundation Tuuru, Estonia
- Aronia, Novia University of Applied Sciences, Finland
- Hanko Municipality, Finland
- Municipality of Raseborg, Finland



# GIS centre

Romi Rancken, Daniela Hellgren & Lasse Kurvinen

The dominant part of the information available in the world has a spatial dimension. Every object in the real world has a place or a path it follows and almost everything happens somewhere. GIS (geographic information system) is specialized in handling this dimension, together with other dimensions (like time) and formats (like tabular or multimedial data) of a unit of information. The main workflows in GIS aim either at data capture, analysis or visualization, for most projects a combination of all three.

Most disciplines and professions have been relatively slow in utilizing the developments of GIS during the 40 years the technology has been available and, until recently, a certain degree of expertise has been demanded to master even basic operations in GIS. The GIS centre was established to offer expertise but also to lower the threshold for students, researchers and others to take GIS into daily, non-expert use, the way people are using word-processing programs.

The basic funding has come through a foundation, Jordfonden, but substantial funding has also been provided through a range of mostly EU-funded projects with a GIS component, in many cases aimed at the tourism sector.

## Highlights

The GIS centre – which in practice consists of a GIS lab and 1-2 GIS experts - has been providing students, researchers and project personnel with a variety of services ranging from technical assistance in handling data and producing maps, to short courses and to guidance for thesis writers, project personnel and trainees. R&D activities have been more geared towards developing and

Photo Mikael Kilpi



Google Earth is a useful addition to traditional GIS tools for easy visualizing of spatial data in 3D.

testing techniques and workflows than towards academic research.

During its decade-long existence, the GIS centre has formed a strong and fruitful relationship with Lounaispaikka, the GIS centre of the Turku region and also participated in national and Scandinavian working groups within the field of GIS.

In the future the GIS centre will broaden its scope and put more emphasis on the use of GIS in natural resource and community planning. We will follow the development of the concept and practice of GeoDesign closely, and develop regional applications based on its philosophy and technology.



# Additional Networks and Close Collaborators

## Tvärminne Zoological Station (University of Helsinki)

Tvärminne Zoological Station belongs to the Faculty of Biological and Environmental Sciences, University of Helsinki. It serves as a centre for a large variety of high quality biological research, carries out environmental monitoring, and offers facilities for field courses, symposia and seminars. Through these activities it also contributes to the “third task” of the universities: interaction with the surrounding society.

Tvärminne Zoological Station was founded in 1902 by Johan Axel Palmén, the Professor of Zoology at the University of Helsinki, as a private endeavor. His aim was to establish a coastal field station in an area with great environmental diversity and thus good possibilities for research. Under the terms of Professor Palméns will, the Station passed on to the University of Helsinki in 1919.

## Raseborg Municipality, Environment Office

The environmental administration in Raseborg sorts under the environmental- and building committee. Operations are divided between two units, the Environment Office and the Building Inspection. The Environment Office has five employees and an associated water and food laboratory. The bulk of activity consists of monitoring and permit processes as well as statements of expertise. Important subareas are: nature conservation, water management, waste management, land use, industrial and other planning issues.

## Finnish Environment Institute (SYKE) (2010- )

Aronia and the Finnish Environment Institute signed a mutual agreement for cooperation in 2010. Both parties agreed upon a long-term cooperation, to promote the accessibility of research and expertise in environmental science. Thematic fields of cooperation include maintenance of biodiversity, promoting species level management and ecological, cultural and economic issues related to management of the environment.

## NOWAC Nordic Waterbirds and Climate – network (2010 - )

NOWAC was among the first projects in the Nordic Top-level Research Initiative, funded within the first call “Effect studies and adaptation to climate change”. The projects contribute to improving our knowledge about the effects of climate change, with a focus on possible solutions to how we best can adapt to these changes in the future. The NOWAC Network focuses on waterbirds in a



Tvärminne Zoological Station. Photo Anssi Vähätalo

changing world.

## Partners

The NOWAC steering committee is chaired by Tony Fox from NERI, Aarhus University, Denmark and comprises members from Sweden, Finland and Iceland. The Network currently involves scientific partners from University of Iceland and Vékis (Iceland), Kristiansstad University and University of Lund (Sweden), Åbo Akademi University & Novia University of Applied Sciences, University of Helsinki, and Finnish Game and Fisheries Research Institute (Finland) and NERI. The Norwegian Institute for Nature Research has recently been invited to join NOWAC. The Swedish Hunters Association and Dansk Jagtakademi are also associated partners.

## The WelFin LTER-site (2006 - )

The WelFin LTER-site is located at the Hanko peninsula, at the entrance to the Gulf of Finland. The activities, started in 2006, are largely focused to the coastal areas surrounding Tvärminne Zoological Station (University of Helsinki, coordinating partner); a marine station established in 1902. Most of the other partners of this site have a long history of scientific collaboration with Tvärminne. Although high-quality basic research continues to be at the heart of the site’s activities, many of the research questions nowadays include aspects of human induced long-term change.

The aim of the site is to maintain and strengthen the research facilities and activities related to the understanding of the coastal ecosystem, and to offer continued and improved capacities to make use of the background and monitoring data of the region. The need for the site’s services is emphasized by ongoing habitat changes in the Western Gulf of Finland driven by forces from local (e.g. physical disturbance) to global (e.g. climate change) scales.

## Partners

University of Helsinki, Aronia Research and Development Institute, Finnish Environment Institute (Marine Research Centre), Centre for Economic Development, Transport and the Environment for Uusimaa, Park and Forest Services, Finnish Game and Fisheries Research Institute, Finnish Forest Research Institute, Halias-the Hanko Bird Observatory, Association for Water and Environment of Western Uusimaa.

The WelFin site is part of the national Finnish Long-Term Socio-Ecological Research network FinLTSER.

## The international Research School in Applied Ecology (IRSAE)

Aronia is a partner in “The international Research School in Applied Ecology (IRSAE)”. The network is coordinated by Hedmark University, Norway and the other partners are Karlstad University, Grimsö Research Station, and Swedish University of Agricultural Sciences, the Department of Wildlife and Ecology at Århus University and NINA (The Norwegian Institute for Nature Research).



## The Hanko Bird Observatory Halias (2001- )

The Hanko Bird Observatory Halias lies at the southern tip of Finland near Hanko. The observatory is operated by Tringa r.y. (The Ornithological Society of Uusimaa) since 1979. Halias operates a year-round standardized observation and ringing scheme for migrant birds using the main migration corridor along the Hanko Peninsula. Halias is a vital partner in the LTER WelFin network. Very recently, the 100th contribution from Halias was published, manifesting the observatory as a nationally unique resource for monitoring and understanding bird population dynamics.

Photo Aleksii Lehtikainen



Observation of migration in Hanko Bird Observatory.  
Photo Petteri Lehtikainen

## MA Sub-global Follow-up

In 2008, UNEP called for a follow-up programme, with new sub-global assessments, to the Millennium Ecosystem Assessment. In August 2009, Aronia's COAST-MAN project received status as an official SGA endorsed by the United Nations-lead Millennium Ecosystem Assessment Follow-up Programme. This assessment is the first SGA for Finland.

COAST-MAN stands for Coastal Management and is a sub-global assessment (SGA) of the coastal zone in the western Gulf of Finland. The assessment uses the UN Millennium Ecosystem Assessment framework to understand how the ecosystem provides ecosystem services that contribute to human wellbeing and prosperity in the region. The SGA works closely with the Wel-Fin Long Term Ecological Research -site (LTER) Programme at University of Helsinki's Tvarminne Zoological Research Station.



# Aronia Personnel

## Aronia board

Chairman -2010  
**Lars Hassel**  
Professor Åbo Akademi

Chairman  
**Birgitta Forsström**  
Vice President Novia

Vice Chairman  
**Kai Lindström**  
Professor Åbo Akademi

**Wilhelm Fortelius**  
Director of Aronia

**Mikael Kilpi**  
Research Manager  
Aronia

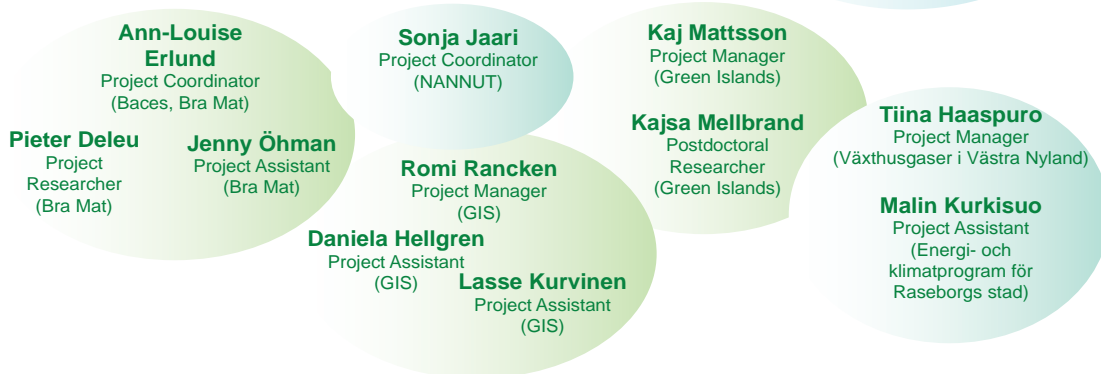
**Barbro Schaumann**  
Academy Lecturer  
Åbo Akademi

**Emma Vironmäki**  
Research Manager  
Novia

## Aronia Coastal Zone Research Team



## Project Personnel



## Supporting Personnel

**Mari Pihlajaniemi**  
Project Assistant  
(information officer, webmaster)

**Ulrica Isaksson**  
R&D Unit Secretary  
Novia & Aronia



# Aronia Funding

## Aronia Coastal Zone Research Team Basic Funding

### Raseborg Municipality Konstsamfundet Stiftelsen för Åbo Akademi

#### Research Group Funding

##### Cyanobacteria and Zooplankton Interactions with Eutrophication and Climate Change

Academy of Finland, Maj and Tor Nessling Foundation, Walter and Andrée de Nottbeck Foundation, Onni Talas Foundation, Stiftelsen för Åbo Akademi, Nordic Marine Academy

##### Ecology, Conservation Biology and Sustainable Management of Coastal Marine Benthic Ecosystems

Formas Sweden, the Swedish Research Council, Åbo Akademi University, Swedish Cultural Foundation in Finland, Academy of Finland & Nessling Foundation

##### Ecosystem Services for Evidence-based Conservation ESEC

Academy of Finland (Post-doctoral fellowship), Ehrnrooth foundation, Oskar Öflund Foundation, Nordenskiöld-Samfundet i Finland r.f., Stiftelsen för Åbo Akademi, Swedish Cultural Foundation in Finland

##### Experimental Rocky Shore Ecology

Swedish Cultural Foundation in Finland, Societas pro Fauna et Flora Fennica, Åbo Akademi, Walter and André de Nottbeck Foundation

##### Decomposition of Released Organic Material Through the Photochemical Processes in the Aquatic Ecosystems

Kone Foundation, Helsinki University Centre for Environment HENVI, Academy of Finland, Walter and Andrée de Nottbeck Foundation

##### Parental Care Strategies, Reproductive Success and Environmental Stress in Eiders

Academy of Finland, Finnish Cultural Foundation, Maj and Tor Nessling Foundation, Nordenskiöld-Samfundet i Finland r.f., Oskar Öflund Foundation, Societas pro Fauna et Flora Fennica, Sofie von Julin Foundation, Stiftelsen för Åbo Akademi, Swedish Cultural Foundation in Finland, Waldemar von Frenckell Foundation, Walter and Andrée de Nottbeck Foundation

##### Evolutionary Dynamics of Colour Polymorphism and Mechanisms of Selection

Academy of Finland



Photo Mikael Kilpi

#### Project Funding

##### Bra Mat i Västnyland

Centre for Economic Development, Transport and the Environment

##### Climate and Greenhouse Gases – the Local Point of View

Kone Foundation, Municipality of Raseborg & AKO Länsi-Uusimaa

##### GREEN ISLANDS

Central Baltic Interreg IV A Programme 2007-2013

##### NANNUT – Nature and Nurture of the Northern Baltic Sea

Central Baltic Interreg IV A Programme 2007-2013

##### BACES

Central Baltic Interreg IV A Programme 2007-2013

# Aronia Ten Years – the Event of the Year 2010

The two day anniversary event in Ekenäs, held at the culture centre Karelia, was a success. Starting with an international seminar with invited speakers from the research network of Aronia, the second day welcomed all to join in a lively debate about the future of the sea and the archipelago and was rounded off with a stunning show by artists with bonds to the islands. Truly a great way of commemorating the first 10 years of activity at Aronia!

Thursday 16.9	Friday 17 September
<b>Jubilee seminar "Managing the Environment for the Future"</b>	<b>Seminar Program in Swedish "Skärgården väntar inte"</b>
	<b>Konferencier: Erik Pöysti</b>
10.00 <b>Welcome</b>	
10.15-11.00 <i>Prof. Lars Hassel, Åbo Akademi University:</i> Sustainability and financial markets	10.00-12.00 <b>Urgent issues in the archipelago</b> <i>Klaus Berglund, Johan Åberg, Jonna Engström-Öst, Johan Erlandsson, Marianne Fred, Mikael Kilpi, Patrik Kraufvelin, Gustav Munsterhjelm, Markus Öst</i>
11.00-11.45 <i>Prof. Ronald Ydenberg, Simon Fraser University / Wageningen University:</i> Co operative Wildlife Management in the 21st Century	
11.45-12.30 <i>Dr Thorsten Blenckner, Stockholm Resilience Centre, Stockholm University:</i> Ecosystem responses to climate in the context of multiple drivers	12.00-13.00 <b>Archipelago buffet and entertainment</b>
12.30-14.00 <b>Lunch break</b>	13.00-15.00 <b>Open discussion on urgent issues to be continued</b> Questions, observations, provocations
14.00-14.45 <i>Prof. Sture Hansson, Dept. Systems Ecology, Stockholm University:</i> Transboundary trophic interactions – have changes in the marine off-shore Baltic sea food web caused reproduction problems for coastal freshwater fish?	
14.45-15.30 <i>Dr Jon Brommer, Bird Ecology Unit, University of Helsinki:</i> Large-scale changes in nature: diversity, dynamics and evolution	18.00-21.00 <b>Coastal Feast</b> Program including <i>Uffe Enberg, Sixten Lundberg, Lasse Mårtenson, Jan Nybom, Ecca Sjöblom, Benny Törnroos and Birgitta Ullsson</i>
15.30-15.45 <b>Coffee break</b>	A fish plate will be served during the break.
15.45-16.30 <i>Dr Megan Tierney, UNEP World Conservation Monitoring Centre:</i> The value of valuing nature: how ecosystem assessments can guide future policy and planning to enhance human well-being	
16.30-17.15 <i>Prof. Anthony Fox, National Environmental Research Institute, Aarhus University:</i> Urbanisation, climate change and why we need applied ecology institutes now more than ever	
17.15- 17.30      Concluding discussion	
19.00 <b>Conference dinner at Restaurant Knipan</b> Dinner 49€	

The Aronia anniversary seminar drew a crowd to the Karelia theatre in Ekenäs -closest to the camera prof. Ron Ydenberg and prof. Tony Fox paying attention. Photo Klaus Hansen

Some of the Aronia crew on stage in action during a panel discussion- from left to right: Gustav Munsterhjelm (City of Raseborg), Patrick Kraufvelin, Johan Erlandsson, Johan Åberg (MTK), Jonna Engström-Öst, Miki Pöysti (stage director), Marianne Fred, Mikael Kilpi and Markus Öst. Photo Klaus Hansen





# Publications 2008 – 2011

## 2011

Birge, T. & Fred, M.S. 2011: New ideas for old landscapes: using a social-ecological approach for conservation of traditional rural biotopes – a case study from Finland. – European Countryside vol 3. In Press.

Brutemark, A., Engström-Öst, J. & Vehmaa, A. 2011: Long-term monitoring data reveal pH dynamics, trends and variability in the western Gulf of Finland. – Oceanological and Hydrobiological Studies 40: 91-94

Brutemark, A. & Granéli, E. 2011: Role of mixotrophy and light for growth and survival of the toxic haptophyte *Prymnesium parvum*. – Harmful Algae 10: 388-394

Díaz, E. R., Erlandsson, J. & McQuaid, C. D. 2011: Detecting spatial heterogeneity in intertidal algal functional groups, grazers and their co-variation among shore levels and sites. – Journal of Experimental Marine Biology & Ecology. In Press.

Diaz, E.R. & McQuaid, C.D. 2011: A spatially explicit approach to trophic interactions and landscape formation: patchiness in small-scale variability of grazing effects along an intertidal stress gradient. – Journal of Ecology 99: 416 – 430

Ekroos, J., Fox, A. D., Christensen, T. K., Petersen, I. K., Kilpi, M., Jónsson, J. E., Green, M., Laursen, K., Cervencel, A., Boer, P., Nilsson, L., Meissner, W., Garthe, S. & Öst, M. 2011: Declines amongst breeding eider *Somateria mollissima* numbers in the Baltic/Wadden Sea flyway. – Ornithologia Fennica, in press.

Engström-Öst, J., Hogfors, H., El-Shehawy, R., De Stasio, B., Vehmaa, A. & Gorokhova, E. 2011: Toxin producing cyanobacterium *Nodularia spumigena*, potential competitors and grazers: testing mechanisms of reciprocal interactions. – Aquatic Microbial Ecology 62: 39-48

Engström-Öst, J., Repka, S. & Mikkonen, M. 2011: Interactions between plankton and cyanobacterium *Anabaena* with focus on growth and toxin concentration. – Harmful Algae 10: 530-535

Erlandsson, J., McQuaid, C. D. & Sköld, M. 2011: Patchiness and Co-existence of Indigenous and Invasive Mussels at Small Spatial Scales: the Interaction of Facilitation and Competition. – PLoS ONE. In Press.

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Ianora, A., Bentley, M. G., Caldwell, G. S., Casotti, R., Cembella, A. D., Engström-Öst, J., Halsband, C., Sonnenschein, E., Legrand, C., Llewellyn, C. A., Paldavičienė, A., Pilkaitė, R., Pohnert, G., Razinkovas, A., Romano, G., Tillmann, U. & Vaiciute, D. 2011: The relevance of marine chemical ecology to plankton and ecosystem function: an emerging field. – Marine Drugs 9: 1625-1648.

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Jaatinen, K., Öst, M., Gienapp, P. & Merilä, J. 2011c: Differential responses to related hosts by nesting and non-nesting parasites in a brood-parasitic duck. – Molecular Ecology, in press.

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