

CEES

Centre for Ecological and Evolutionary Synthesis

ANNUAL REPORT

2008



Norwegian
Centre of
Excellence



UNIVERSITY
OF OSLO



CEES IN BRIEF

The Centre for Ecological and Evolutionary Synthesis, CEES, is chaired by Professor Nils Chr. Stenseth. As of 31 December 2008 CEES consists of 148 members including students, researchers, technical and administrative personnel. The centre has a core group of 18 employees of which 11 are full-time, one is a part-time employee of the Department of Biology, two are employed by the Department of Mathematics, one by the Department of Economy, one by the Institute of Marine Research, and one being a visiting scientist at University of Alberta in Edmonton. The CEES staff represents 20 nationalities.

In 2008, 3 books, 10 book chapters and 99 articles in peer reviewed journals were produced by members of the CEES. Most of these publications lie within the core scope of the CEES. 89 invited talks and presentations at conferences were given by CEES members at various international fora. The CEES hosted 35 guest speakers, primarily from abroad. CEES had 57 international and national visitors (staying at least one week) in 2008.

About 60 MNOK of the total 2008 budget of 110 MNOK came from the 57 externally funded research projects that the CEES entertained in 2008. Most of these were funded through the Research Council of Norway, among them several projects under the Functional Genomics Programme (FUGE). We are also involved in various EU funded projects, and have a Marie Curie Early Stage Training site. Finally, we had 3 projects funded through StatoilHydro. 14 new projects were started in 2008, a major one being the 'Cod Genome Project', in which the CEES endeavours to sequence the entire cod genome by Spring 2009.

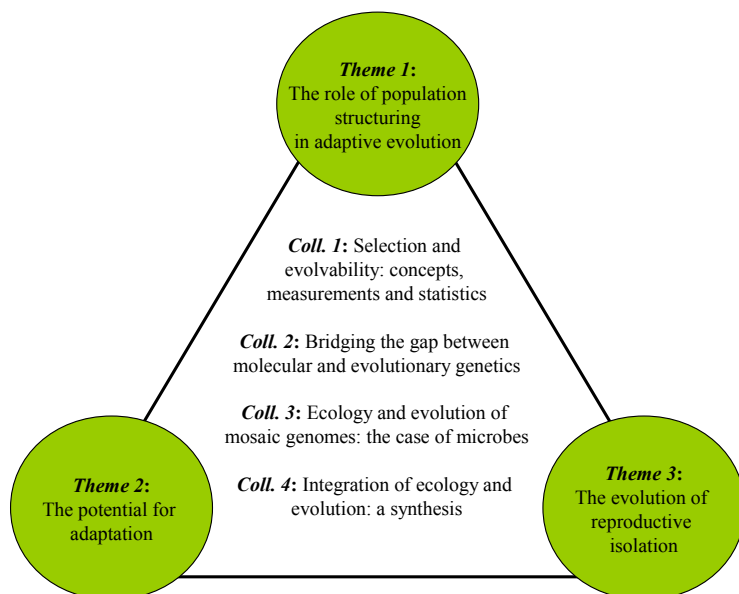
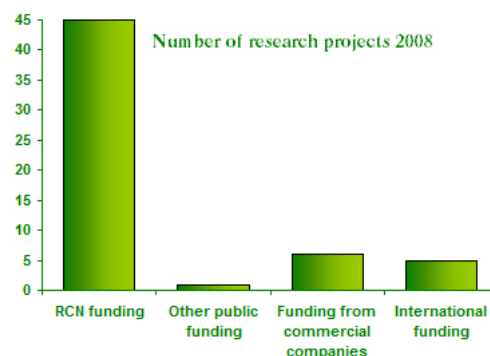
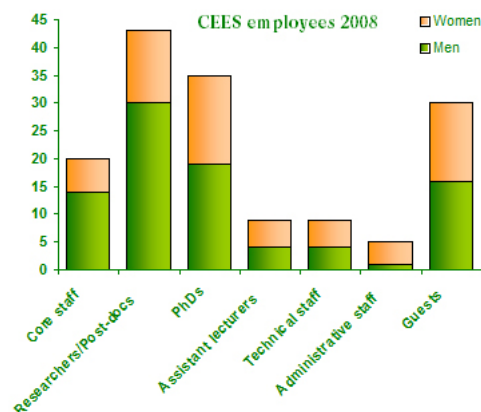
The CEES maintained a high level of visibility in 2008 both in scientific journals and in the media: our activities were covered by more than 350 national and international media items. Our paper on lemming cycles and climate, published in *Nature* towards the end of 2008, received much media coverage. This study shows that snow hardness plays a key role in determining the population dynamics of lemmings. Climate change has resulted in more wet snow in the mountains, leading to icy conditions in the tier between the ground and the snow layer. This has a negative influence on the reproduction and survival of lemmings causing the density cycles to disappear.

Our work is, as originally planned, structured into *Colloquia* and *Themes*, the former being focused projects each lasting for three years, and the latter consisting of ongoing, long-term work being accommodated within the centre. Our first colloquium (*Colloquium 1*), focusing on the application of measurement theory to ecology and evolution, started with a kick-off meeting at the Norwegian Academy of Science and Letters (2-3 October 2008), in which a number of internationally leading researchers participated. The first Kristine Bonnevie visiting professor, David Houle, arrived in the middle of the year and is linked to this colloquium. The theme work has been facilitated by separate funding for 6 projects, each of which involves more than one staff-member of the centre.

Our recently acquired 454-sequencing machine (part of the FUGE Ultra-high Throughput Sequencing Platform, UTSP) is now operative and more than 2.0 gigabases have been sequenced. The procurement of such a unit has resulted in us being given, as part of a national team, the responsibility for sequencing the cod genome. This work will be closely coordinated with our research on the ecology and population genetics of the cod. The coupling of genomics with more classical approaches will place us in the forefront of the field. This work will constitute a major part of *Colloquium 2*.

We have gained access to new and valuable Russian data on plankton in the Barents Sea and surrounding waters. Analysing these unique data shows that recruitment of cod, haddock and herring, but not capelin, can be expected to be higher if the Barents Sea becomes warmer due to climate changes. These results will be utilised to predict the vulnerability of the Norwegian-Arctic cod population to indirect effects of oil spill, through the occurrence of increased zooplankton mortality. Preliminary results indicate that such indirect effects are potentially just as important as direct effects.

CEES members supervised 36 Master- and 36 PhD-students in 2008, and were also involved in the teaching of 14 PhD/Master courses and 9 bachelor courses. A total of 9 new PhD students were employed by the CEES in 2008, 4 of whom are funded by the University of Oslo and 5 by external parties. During the spring term of 2008, CEES held an intensive course in 'Adaptive Dynamics' (course code BIO9910). Eva Kisdi, researcher at the University of Helsinki, was the main teacher. The course provided an in-depth introduction to adaptive dynamics, a theoretical framework for studying frequency- and density-dependent evolution with a high degree of ecological realism. All of the CEES 'Friday seminars' during this period focused on related topics.



The structure of the scientific work within CEES.

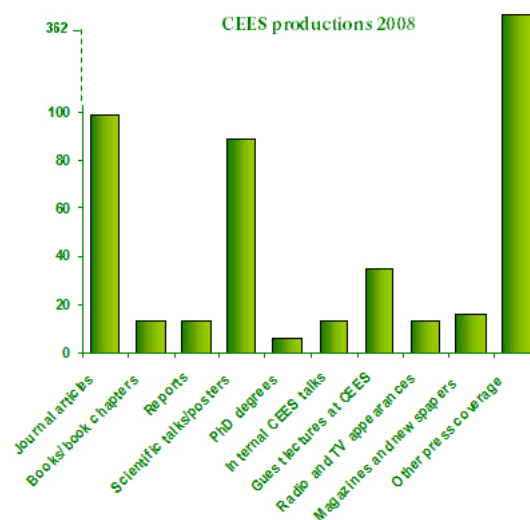


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1. THE CHAIR'S COMMENTS

The year 2008 is our first full year as a Centre of Excellence (CoE). We have filled the first set of PhD and postdoc/researcher positions and have been given national responsibility for sequencing of the cod genome. We have started work on *Colloquium 1*, and have allocated internal funds to some of our prioritized areas. Additional funding has been secured (including CoE-allocated funds to be used for gender balance efforts), and we are becoming a unified research centre.

CEES continues to grow: by the end of 2008 we were a total of 148 persons (including 36 PhD- and 36 Master students). Our overall annual budget amounts to 110 MNOK, of which 10 MNOK comes from the CoE core funding by the Research Council of Norway (RCN) and approximately 5 MNOK from the University of Oslo. The core funding is strategically allocated to activities for which we expect to obtain additional funds. Camilla Nesbø's *Young Outstanding Investigators* grant started this year; she is currently at the University of Alberta, but will be joining CEES next year. The following persons have been appointed to receive funding through the CEES: Researchers Øistein Haugsten Holen, Antonieta Labra, Lee Hsiang Liow and Stein Are Sæther, and PhD students Jan Husek, Inger Maren Rivrud Godvik, Annette Taugbøl and Kjetil Lysne Voje. We have employed three new lab engineers: Morten Skage, Junita Gaup and Monica Solbakken, and one field engineer, Anders Herland. Kari Beate Rygg is employed as a research administration advisor. It is my great pleasure to welcome them all to the CEES.

Our recently acquired 454-sequencing machine is expected to be very important to our future activities. The strategic decision of obtaining funding for installing such equipment has already resulted in us being given, as part of a national team, the responsibility for sequencing the cod genome. We believe that the coupling of genomics with more classical approaches will place us in the forefront of the field. To my great pleasure the Ministry of Fisheries and Coastal Affairs finds our marine work, particularly that on cod, sufficiently interesting to support these activities economically. The cod genome project will play a key role in *Colloquium 2* (starting in 2011) of which Kjetill S. Jakobsen has been appointed leader. (See 2.2.11 and 6.4.2.)

Among our prioritized research areas are (1) genetic and phenotypic variation in passerine birds across Europe, (2) genotypic and phenotypic variation in stickleback fish, (3) evolutionary responses to anthropogenic changes in a broad spectrum of terrestrial, freshwater and marine species, (4) polyploidy evolution, and (5) evolution under the influence of biotic and abiotic variation across time scales. These and other research foci are described in more detail later in this report, hence just some brief comments here:

(1) Several members of the CEES have, over a long period, used passerine birds as their research system. We are using internal funding to support these activities. In addition, two new researchers (Antonieta Labra and Stein Are Sæther) and one new PhD student (Jan Husek) will strengthen our focus on passerine birds. This work is closely linked to theoretically oriented studies, including statistical modelling efforts, carried out by our newly appointed researcher Øistein Haugsten Holen, and others. We aim at further strengthening these activities by obtaining more targeted funding from the RCN. (See 2.2.2, 2.2.3 and 2.2.4.)

(2) One of our new PhD students (Annette Taugbøl) will work on the stickleback project. This project is of considerable importance to the centre, both because of the great scientific potential of the system, and because it brings together a broad spectrum of scientists and students at the CEES. During the coming year our aim is to further develop the project by appointing one more researcher/postdoc, preferably through separate funding from the RCN. (See 2.2.7.)

(3) Evolutionary responses to harvesting and other anthropogenic environmental changes is a topic within which we have a broad spectrum of activities. During 2008 several members of the CEES have joined forces in an effort to critically review the existing literature. One new PhD student (Inger Maren Rivrud Godvik) has been allocated to this project. Our work on the Windermere system has resulted in several papers appearing in top journals. A workshop with project members together with other scientists was organised by the CEES at the Royal Society, held 2-3 June 2008. (See 2.2.12.)



Photo © Terje Heiestad

(4) One of our foci is the evolution and maintenance of polyploidy. We have allocated internal funding to a project in which our 454-sequencing facilities will be used to study polyploidy in *Arabidopsis* species. (See 2.2.13.)

(5) Co-evolution within multi-species communities, inhabiting abiotically varying environments represents a major scientific challenge and is among our prioritized activities. We refer to this as the Red Queen co-evolutionary project. One of our newly appointed researchers (Lee Hsiang Liow) will be spearheading this venture, collaborating with other CEES members including one of our new PhD students, Kjetil Lysne Voje. An international workshop was organised on this topic by the CEES in the Norwegian Academy of Science and Letters (18-19 August 2008). We tried, unsuccessfully, to obtain an Advanced European Research Council grant. We were, however, short-listed with the option of reapplying. The referee report was generally positive and will be useful in improving the proposal prior to resubmission. The short listed status also provided additional funding from the UiO that will be used strategically for further developing the proposal.

Colloquium 1, focusing on the application of measurement theory to ecology and evolution, started with a kick-off meeting at the Norwegian Academy of Science and Letters

(2-3 October 2008). I am sure that this work will contribute profoundly to ecological and evolutionary methodology. It certainly has made me think differently on how we approach research topics and in particular how we link theory and observations. The colloquium part of our activity has certainly proven to be a good construction. (See 2.2.1.)

The Themes are also developing fairly close to the original plans. In particular, discussion sessions broadly covering the themes' various topics have resulted in promising developments. Several CEES members have, for instance, joined forces on the topic of harvesting-induced evolution within a broad spectrum of biological systems. Similarly, the issue of how bird migration (and the timing thereof) is affected by climate change has attracted much interest across the CEES, as has the work on cod, stickleback and polyploidy evolution (many of these larger projects range across themes). The establishment of a new journal club on speciation has further gathered members with experience on a variety of species systems, an advancement that has also provided a positive step toward our integrative development (see part 2). The CoE funding is strategically used to strengthen the themes by allocating funding to projects concerned with fundamental issues within each theme.



1. THE CHAIR'S COMMENTS

Statistical modelling of observational data has historically been a strong platform of ours. In 2008 this platform was further developed by applying statistical modelling of ecological data (traditionally used for studying population dynamics of animals such as lynx and lemmings) to the analysis of the dynamics of gut bacteria communities. At the end of the year we forwarded a proposal to the Department of Biology and the Department of Mathematics to collaborate on statistical modelling of ecological and evolutionary data. The CEES is currently the research environment where the most advanced statistical methodology is being used and developed within an ecological and evolutionary context, within the Faculty of Mathematics and Natural Science.

We have for a long time aimed at developing a data-bank concept, resembling classical museums with curators maintaining the collections, for the long term monitoring of data. During 2008 the French presidency of the European Union helped us turn this idea to reality. I hope to be able to report considerable progress in this venture next year.

Improving the gender balance is of prime concern to us. The annual Kristine Bonnevie lecture on evolutionary biology (delivered on the anniversary of the UiO on 2 September) is intended to promote female scientists. This year's lecture was delivered by our Scientific Advisory Board (SAB) Chair, Professor Rita Colwell. Her lecture was well attended and

received. The Minister of Science, Tora Aasland, gave an introductory speech. We have also launched shorter career development stipends for female candidates and have obtained gender equalising funding from RCN for a female researcher, whom we aim to use as a role model for future tenure track positions for female scientists. (See section 5)

Internationalization is also of great importance to the CEES, which is currently comprised of 20 nationalities. I am pleased to observe that our foreign guests are generally very happy with the way we help them find their way into the Norwegian system and society. It is also worth noticing that the Minister of Science, Tora Aasland, visited the CEES in order to learn more about how we integrate our international members. She deemed CEES a success story, consistent with our high ranking by the CHE (www.cheranking.org/). During the latter part of 2008 we have benefited from hosting two Fulbright scholars (Lillian L. Wolfenbarger and John Paul McCarty).

Students are essential to the CEES: We are recognized as a Research School by the University of Oslo, the funding for which we primarily use on organizing an annual conference where students present their work, just as they are to do at international conferences. In 2008

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NEWS & VIEWS



POPULATION BIOLOGY

Case of the absent lemmings

Tim Coulson and Aurelio Malo

Changing weather patterns, producing the wrong kind of snow, have transformed the population dynamics of lemmings in northern Scandinavia. The knock-on effects have been felt throughout the ecosystem.

A colleague from Oslo once told me that when the Bible was translated into Norwegian, mention of plagues of locusts was replaced with plagues of lemmings. The logic behind this change was that most Norwegians knew nothing of locusts, but were all too familiar with periodic explosions in lemming numbers. The story is apocryphal, with references to lemmings only scrawled by the translator in the margin. Yet these scribbles suggest that lemming outbreaks have been a feature of northern ecosystems for the past millennium. But now the outbreaks, at least in some areas, have stopped. On page 93 of this issue, Kausrud *et al.*¹ explore the underlying reasons.

Norway lemmings (*Lemmus lemmus*) are remarkable animals. These rodents can live for three or four years, spending their winters beneath the snow and feeding mostly on moss. A female can produce up to three litters a year, with as many as 12 young per litter. Lemmings occasionally become super-abundant when large numbers of young survive². In northern Norway in 1970, lemmings were so common that snowploughs were used to clear the vast numbers of squashed animals from roads. Outbreaks don't last long: food becomes scarce, and lemmings will then often disperse en masse in search of greener pastures. On occasion, desperate to find food, they jump into water and start swimming. This behaviour led to the myth that lemmings commit suicide.

In northern Scandinavia, lemming outbreaks typically occur once every three to five years. Or they used to. In the past 15 years, localized outbreaks have either stopped or occur less frequently³. The cause of this change is the subject of debate, partly because the reason that rodent populations often show periodic outbreaks is itself controversial^{4–6}. Fluctuating predation, food availability or quality, and climate variability have all been proposed as plausible mechanisms generating these population cycles. Whatever the cause, it is clear that in parts of northern Europe something is now preventing these rodents from periodically producing large numbers of surviving young⁷.

Kausrud *et al.*¹ analyse a 27-year time series of lemming numbers from one site in Norway. They first demonstrate statistically that climate change means that Norway now gets a lot of the wrong sort of snow. Lemmings do well when warmth from the ground melts a small layer of snow above it, leaving a gap between ground and snow. This subnivean space provides warmth and allows lemmings to feed in relative safety from many of the animals that eat them. Climate change now means that the subnivean space does not exist for as much of each year as it used to. Worse still, the space itself is less likely to form: warmer temperatures mean that snow melts and refreezes, producing a sheet of ice that prevents lemmings from feeding on the moss.

The wrong sort of snow therefore means that food is hard to come by, keeping warm is challenging, and being eaten is more likely. Kausrud *et al.* use their statistical associations to construct a predictive model of lemming dynamics. This model, fitted to data from before the outbreaks stopped, predicts the observed cessation, providing compelling evidence that changing snow conditions are a major factor in the change in lemming population dynamics.

The researchers then go on to show that the reduction in the frequency of lemming outbreaks has knock-on consequences for the wider ecosystem. They argue that the scarcity of lemmings means that predators such as foxes turn their attention to other species, including willow grouse and ptarmigan, adversely affecting their populations. Evidence for changes in the numbers of species other than lemmings in these northern ecosystems is convincing. But although the mechanism that Kausrud *et al.*¹ propose — a shift in predation patterns — is plausible, it is speculative.

The critical reader will complain that the story is based on correlations. Although this is true, it is often the only way to study populations and the consequences of changing climate for ecosystems⁸. The collection of detailed long-term data on the dynamics of free-living populations of animals and plants rarely attracts the same excitement as

the conference was held at Hankø outside Oslo and coincided with this year's meeting with the Scientific Advisory Board (SAB), giving the board members an opportunity to learn more about the CEES.

Students are essential to the CEES: We are recognized as a Research School by the University of Oslo, the funding for which we primarily use on organizing an annual conference where students present their work, just as they are to do at international conferences. In 2008 the conference was held at Hankø outside Oslo and coincided with this year's meeting with the SAB, giving the board members an opportunity to learn more about the CEES.

Communicating science to a broader audience is a primary concern. It was a great pleasure to observe the tremendous media interest given to our work: altogether there were almost 400 media coverages worldwide. In addition to the previously mentioned Kristine Bonnevie lecture on evolutionary biology, the CEES organises a Darwin Day each year in an effort to communicate evolutionary biology to a broad spectrum of both academics and non-academics (See 4.2). 2008 marks the year of preparation for the double Darwin jubilee in 2009, which sees both the bicentenary of Darwin's birth and the 150th anniversary of the publication of *'On the Origin of Species'*. Three of our students, Jens Ådne Rekkedal Haga, Tore Oldeide Elgvin and Kjetil Lysne Voje, embarked on the 'Darwin Expedition 2009' in September, with the aim of following part of the same route Darwin travelled on *HMS Beagle* more than 150 years earlier. An overall goal of this project is to provide material for communicating science to a young and broader audience. (See 4.1.)

Both the Board and the Scientific Advisory Board (SAB) continue to aid us in the further development of the CEES. This is partly done through meetings, particularly with the two chairs, Reidun Sirevåg (Chair of the Board) and Rita Colwell (Chair of the SAB). I am grateful for the time and effort they devote to help us improve our performances. (See 6.3.)

Integrating the CoE in the university structure: I briefly mentioned in the previous year's annual report the many challenges in integrating our CoE within the university structure (both the Department of Biology and the Faculty of Mathematics and Natural Sciences). I conveyed some optimism. I am pleased, and in fact relieved, to say that our relation with the Department and the Faculty has developed very positively. I have been made part of the leader team of

the Department of Biology which has facilitated much better communication.

Together with other CoE Chairs at the University of Oslo, I have been involved in entertaining discussions on how the centres are integrated within the university system. It appears that the CEES lives in closer harmony with our host institute than some of the other centres; it is my hope that the CEES's experience can be used to benefit the entire university in its effort in integrating the centres.

The Chair as an active scientist: As mentioned in the previous year's annual report, my aim is to continue as an active scientist alongside being the Chair of the CEES. I am relieved to report that I have managed to live up to this. It is my intention to continue as a scientifically active staff member, even with my new duties as Vice-President/President (in alternating years) of the Norwegian Academy of Science and Letters. To achieve this I have resigned from several of my previous commitments.

Thanks: It is my great pleasure to thank all of our scientists (at all levels) for their hard and very dedicated work. Without you, there would be no CoE. I am also grateful for the outstanding work done by our technical and administrative staff; you make it much easier to accomplish our science at the CEES.

Congratulations: Finally, I would like to congratulate Tore Slagsvold who in 2008 was awarded the University of Oslo's Annual Research Prize, and Dag O. Hessen who was awarded the University of Oslo's Research Dissemination Award. It is also a great pleasure to congratulate our SAB-Chair, Rita Colwell, in being made Honorary Doctor of the University of Oslo; we are extremely pleased and honoured to benefit from your guidance in our efforts to steadily improve the CEES.

Nils Chr. Stenseth



2. SCIENTIFIC ACTIVITY

2.1 Introduction: Focusing on the synthesis of ecology and evolution

Ecological and evolutionary processes are inescapably intertwined; research in ecology and evolutionary biology, however, follows different traditions. As a team we strive to synthesize ecology and evolution, and to become a leading institution in this field. If successful we will, within 10 years, vitalise biology at the UiO and thereby considerably strengthen interdisciplinary science in Norway. Altogether we aim at becoming an important player in the international scientific arena, not least within the European science funding system. The CEES comprises a broad spectrum of expertise in ecology, evolutionary biology, molecular biology, bioinformatics, methodological and computational statistics, and are working on a wide range of well-established biological research systems covering the terrestrial, limnic and marine world. Within the time frame of the CoE, we endeavour to contribute significantly to the integration of biological sciences **and thus to an improved understanding of how the living world responds and adapts to environmental changes.**



Tore Slagsvold, the recipient of the University of Oslo's Annual Research Prize 2008

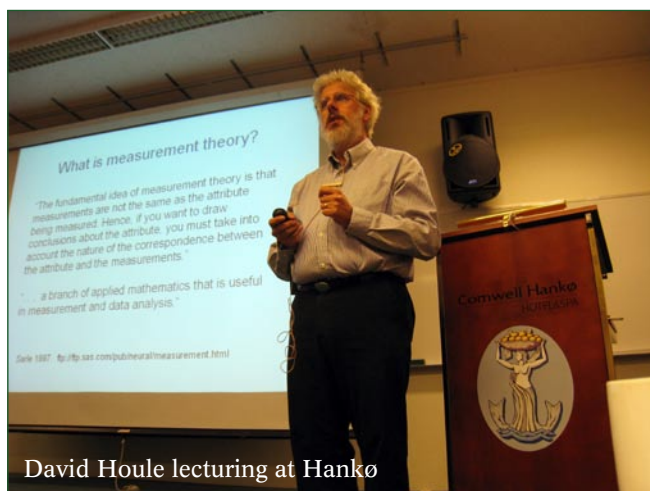
We continue to:

- Take advantage of our strong foundation in ecology and statistical methodology to extend our research into the interface between ecology and evolutionary biology.
- Take advantage of the broad spectra of biological systems available to the group as a basis for developing and testing general hypotheses at the interface between ecology and evolution.
- Further develop our research structure organised into *Themes* and *Colloquia*.
- Extend our collaborative network with current and new partners.
- Provide a basis for new interdisciplinary work at the UiO, not least within the University-wide Life Science initiative at our university.
- Contribute to a more equalized gender balance in high rank academic positions at the UiO.
- Provide international, interdisciplinary training for a new generation of students and postdocs.

2.2 Scientific highlights in 2008

During 2008 we have further developed as a centre. Here we provide some highlights spanning across the broad spectrum of topics covered by the three *Themes* of the CEES. Most of the results in 2008 can be reported under *Theme 2*, however, ongoing activities within *Themes 1* and *3* are expected to be rewarding and will be presented in next years report. *Colloquium 1* has been active during 2008 and *Colloquium 2* will commence in 2010.

2.2.1 Colloquium 1: Selection and Evolvability: Concepts, measurements and statistical modelling



David Houle lecturing at Hanko

(Leaders: Thomas F. Hansen & Tore Schweder)

This colloquium is focused on conceptual, statistical, and theoretical issues concerned with quantification in biology, with special emphasis on evolutionary biology. It involves the collaboration of David Houle (Florida State University), Günter Wagner (Yale University) and Hirohisa Kishino (Tokyo University).

Formal measurement theory is a mathematical discipline to study the relationship between data and reality. Whilst many areas of biology have achieved a high level of statistical sophistication, biology is lagging far behind fields such as physics, psychometry, and economics in its attention to

problems of measurement. Our overall goal is to analyse the quantification of central concepts in evolutionary biology, ecology, and genetics. Concepts such as constraint, fitness, rate of evolution, dispersal and competition are crucial to theory in these fields, but still little attention has been given to how to gather and utilise data in order to make them measurable quantities. For each concept, we examine the theoretical context and models that provide it with meaning. Furthermore, we examine how the concept is quantified and look at the statistical methods and problems involved.

We discuss problems regarding scaling, transformations, and difficulties that may occur in meta-analyses and comparative studies across traits and species. Particularly, we will focus on situations where there is a conflict between the theoretical process models that motivated the research, and the statistical methods that are used to analyse the data. While statistical quantification of data is common, the exact link of the statistics to theoretical parameters is often tenuous, and the theoretical relevance may be further obscured by transformations of the data, significance testing, etc.

The colloquium hosted a seminar in September and a kick-off meeting titled 'Measuring Evolution' in October. In the latter we heard presentations from a number of internationally leading researchers within evolutionary biology, population genetics, quantitative genetics, morphometrics, paleobiology, ecology, and statistics. The main question asked by the participants was "How do we ensure that our theories and quantifications are meaningful?"

So far, the colloquium has spurred numerous activities including a weekly discussion group, and a number of specific projects related to the venture are developing.

2.2.2 Population biology of passerine birds (Theme 2)

(Endre Knudsen, Anna Nilsson, Jan Hušek, Tore Slagsvold, Helene Lampe & Nils Chr. Stenseth)

The spectacular phenomenon of bird migration has nourished a vigorous field of research for more than a century, and shifts in the timing (phenology) of migration has attracted much recent attention in light of climate change.

2. SCIENTIFIC ACTIVITY



Anna Nilsson doing fieldwork

Population declines have been observed for migratory birds both in Europe and in North America, and there are indications that species and populations showing little change in migration phenology are more severely affected. This could partly be due to a temporal mismatch between the timing of arrival and the timing of peak food abundance in the breeding area. At a population level, the ability to respond properly to climate change will, however, also depend on local weather conditions and habitat-specific factors, determining cues that are used for initiating breeding and food availability throughout the breeding phase.

At CEES, we study climate effects on migration and breeding phenology, population fluctuations and demographic factors such as chick production. In addition to using our own study populations of pied flycatchers, great tits and blue tits near Oslo, we work closely with collaborators possessing long-term data on populations of Eurasian dippers in southern Norway and white storks and red-backed shrikes in the Czech Republic. Large-scale data on migration phenology is obtained through collaboration with bird observatories in Norway, Sweden and Finland. This work started within the EcoClim Nordic Centre of Excellence, and has been important for a recent Italian initiative to establish a European data bank for bird phenology data, as well as ideas regarding a French-Norwegian phenology data bank.

A special issue of the journal *Climate Research*, edited by EcoClim researchers and focusing on bird migration and climate, is now followed up by a review paper evaluating claims regarding bird migration and climate in the recent research literature. Additional ongoing research investigates climate and local weather effects on population fluctuations in a partial short-distance migrant, the Eurasian dipper. Local climate change has already been shown to affect important components of population dynamics in red-backed shrikes, and further work at CEES is focusing on the role of climate in different components of the annual cycle on the breeding phenology of this species, as well as spatiotemporal variability in nest survival. The importance of match/mismatch with food resources along habitat gradients is addressed using

long-term data on Czech-breeding white storks and from our study populations of passerines near Oslo.

Further reading:

Jonzén N, Lindén A, Ergon T, **Knudsen E**, **Vik JO**, Rubolini D, Piacentini D, **Brinch C**, Spina F, Karlsson L, Stervander M, Andersson A, Waldenström J, Lehikoinen A, Edvardsen E, Solvang R, **Stenseth NC** (2008) Rapid Advance of Spring Arrival Dates in Long-Distance Migratory Birds. *State of The Planet* 2008-2009 pp. 88-92.

Hušek J, Adamík P (2008) Long-term trends in the timing of breeding and brood size in the Red-Backed Shrike *Lanius collurio* in the Czech Republic, 1964–2004. *Journal of Ornithology* 149:97–103.

Jonzén N, Ergon T, Lindén A, **Stenseth NC** (eds.) (2007) Bird Migration and Climate. CR Special 17. *Climate Research* 35:1–180.

2.2.3 Effects of social environment on behaviour in birds (Theme 2)

(Rosa M. de Ayala, Ane Eriksen, Bo Terning Hansen, Lars Erik Johannessen, Helene Lampe & Tore Slagsvold)

Learning and plasticity have been seen both as drivers of and constraints on evolution. Most studies of learning have focused on animals in captivity. We have developed a method of experimental cross-fostering of birds in the wild in which chicks are reared by heterospecific foster parents. This gives the opportunity to study effects of early learning on different aspects of the behaviour of free-living passerine birds. Cross-fostering of great tit nestlings to blue tit foster parents and vice versa has proven early learning to be of importance for a number of adult traits, such as species recognition and sexual preferences. We have discovered that such sexual imprinting lasts for life in this scenario. The cross-fostered birds become mixed singers, producing a combination of great tit and blue tit songs, both in terms of song type repertoire, and temporal and frequency parameters of the song. This is also the case when pied flycatcher males are raised by blue tit or great tit foster parents, although the pied flycatchers do not become sexually imprinted on their heterospecific host. Hence, song used in mate choice may be more responsive to environmental change than mate choice itself. Changes in song by learning may therefore serve as an essential first step in hybridisation and speciation processes.

Pied flycatchers change their song on a short-term basis. We therefore performed playback experiments on control birds

(not cross-fostered) to see if they could learn song from new 'neighbours', as adults. In addition we presented males with live conspecific birds to investigate how male intruders and prospecting females may change aspects of their song.

Sex allocation theory states that parents should adjust their offspring sex ratio according to the expected fitness returns from sons and daughters. Recent studies indicate that such adaptive manipulation is achievable, and that it may be significant in other physical features of the organism (e.g. morphological characters). Less is known, however, about the significance of this type of manipulation in *behavioural* traits. The cross-fostering of tits resulted in some apparently aberrant adult behaviour, such as reduced social dominance rank in winter, abnormal song in spring, and reduced mate guarding by males in the fertile period of females. Over a nine year period, we blood-sampled one hundred broods in which one of the parents had been cross-fostered, and a similar number in which none of the parents had been cross-fostered. Contrary to expectations, we found that broods with at least one cross-fostered parent contained significantly more sons than did control broods. We are currently analysing levels of extra-pair paternity for the same broods, and for broods sampled in 2008. Breeding success was very high in this year, with more than a thousand nestlings sampled of the two tit species. For this cohort, we also recorded nestling

growth and plumage colour (using a spectrophotometer), the latter variable reflecting richness of carotenoids in the diet. In the coming years, we determine to investigate how nutrition and social rearing conditions may affect behaviour, rate of local recruitment, survival and lifetime reproductive success of cross-fostered versus control birds.

Further reading:

Amrhein V, **Johannessen** LE, Kristiansen L, **Slagsvold** T (2008) Reproductive strategy and singing activity: blue tit and great tit compared. *Behavioral Ecology and Sociobiology* 62:1633-1641.

Hansen BT, **Johannessen** LE, **Slagsvold** T (2008) Imprinted species recognition lasts for life in free-living great tits and blue tits. *Animal Behaviour* 75:921-927.

2.2.4 Genetic and phenotypic variation in passerine birds across Europe and North Africa (Theme 3)

(Stein Are Sæther & Glenn-Peter Sætre)

An evolutionary biologist from a galaxy far, far away would probably comment on two things in his first paper on life on Earth: the remarkable fit between organisms and their environment (adaptation) and secondly, the huge number of discrete forms of life (species). He might also report that Earthlings (at least some of them) have discovered the correct explanation of this first phenomenon (natural selection), but that they are still struggling to explain the second. Because, contrary to popular belief and the title of his 1859 book, Darwin did not solve the question of how one species can give rise to new species. Darwin cracked the origin of adaptation, but the origin of biological diversity – speciation – is still not fully understood.

We study passerine birds to learn about fundamental processes of speciation. A major focus is hybridisation between closely related bird populations that have come into contact again after a period of isolation. Pied and collared flycatchers occasionally hybridise in contact zones, though female hybrids are sterile. We find less hybridisation than expected from random mating, suggesting that natural selection (against hybridisation) may play a direct role in explaining speciation. We have shown that genes on the sex chromosomes are important for this assortative mating in flycatchers, suggesting that such genes may also have a significant role in speciation in general. Consequently, we are investigating the role of sex-linked genes in reproductive isolation in other hybrid zones (nightingales, sparrows).



Blue tit | Photo © Maria Aasen

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Furthermore, we are comparing genetic divergence of sex-linked versus autosomal genes in several pairs of closely related birds that live in geographically separated regions, and do not have contact zones (passerines in Europe vs. North Africa). Some of these birds have diverged phenotypically, whereas others have not. We explore the relationship between time since isolation and degree of divergence in traits involved in reproductive isolation. Finally, we investigate theoretically how sex-linkage of traits such as mate preferences and male plumage influences speciation.

Further reading:

Sæther SA, Sætre GP, Borge T, Wiley C, Svedin N, Andersson G, Veen T, Haavie J, Servedio MR, Bureš S, Král M, Hjernquist M, Gustafsson L, Träff J, Qvarnström A (2007) Sex chromosome-linked species recognition and evolution of reproductive isolation in flycatchers. *Science* 318:95-97.

Servedio MR, **Sæther SA, Sætre GP (2009)** Reinforcement and learning. *Evolutionary Ecology* 23:109-123.

Wiley C, Fogelberg N, **Sæther SA, Veen T, Svedin N, Kehlenbeck JV, Qvarnström A (2007)** Direct benefits and costs for hybridizing *Ficedula* flycatchers. *Journal of Evolutionary Biology* 20:854-864.



Fieldwork on Flycatchers | Photo © Glenn-Peter Sætre

2.2.5 Herbivore grazing, plant evolution and feedback mechanisms in alpine ecosystems (Theme 2)

(Atle Mysterud & Dag O. Hessen)



Sheeps | Photo © Atle Mysterud

Large herbivores remove plant biomass by grazing and simultaneously stimulate productivity by nutrient recycling. The feedback mechanisms between large herbivores, plants responses and the ecosystem feedbacks are poorly understood.

Herbivores graze or browse selectively preferring forages with a high content of nutrients and a low level of structural and chemical defences. Grazed plants have therefore evolved different morphological and physiological traits to either avoid being selected (plant resistance) or compensate for loss of plant tissue (plant tolerance). Traits associated with high resistance are either low nutritional value, low digestibility or active defences that may be structural (e.g. cellulose), mechanical (e.g. spines) or toxic (e.g. phenolics). Traits associated with high tolerance may involve protection of or low placement of growth tissue (such as basal meristem in many grasses), high root to shoot ratio, ability to shuffle nutrients from root to shoot, high photosynthetic activity, and a tufted or mat-like growth form. Whether grazing promotes tolerant or resistant plant species has important feedback effects on the ecosystem structure and productivity. Plants preferred by herbivores are typically nutrient rich, fast-growing and are quickly decomposed in the ground. On the other hand, unpalatable chemically defended plants typically are nutrient low with slow growth and decomposition rates. Even slight changes in plant quality (caused by induced defences or through changes in the plant community) can markedly affect individual body growth, and thus the performance of northern herbivores.

This project forms part of a long-term replicated grazing experiment in alpine ecosystems which began in 2002. The aim is to further integrate the related fields of stoichiometry

(flow of energy and nutrients), herbivore foraging ecology/ population ecology and plant evolution/ecology (tolerance vs. resistance). The experiment consists of three replicates: no, low and high sheep density. Our goal is to quantify the responses to grazing in plants with different functional traits (and evolutionary strategies to cope with grazing) in terms of nutritional quality. We compared two highly selected herbs (low resistance to grazing), two grasses (tolerant) and two browse species (low selectivity, highly resistant species) at three stages of the grazing season. As indicators of quality, we used the content of Carbon (C), Nitrogen (N) and Phosphorous (P). C:N, C:P and N:P reflects relative protein content, and high C:P or C:N is indicative of low nutritional quality. High P-content also typically reflects high growth rates. The hypothesis to be tested is that the nutritional content reaches an optimum at intermediate disturbance levels due to increased mineralization in the soil ('grazing optimization hypothesis'), but that this most likely only applies to grazing tolerant species (grasses and sedges).

We successfully gathered data during the field season of 2008. The plant material has been prepared for analysis of quality, which is currently running. Final results are expected towards the end of 2009.

2.2.6 The lemming cycle gone with the climate (Theme 2)

(Kyrre L. Kausrud, Atle Mysterud, Jon Olav Vik, Anne Marie Eikeset & Nils Chr. Stenseth)

People in Scandinavia have for centuries been curious about lemmings and other rodents seemingly being absent for years but then suddenly becoming very abundant – and then abruptly disappearing again. The earliest written source of this phenomenon is the first Norse bible (Stjorn) from the early 1300s, where lemming 'swarms' are compared to Egypt's locust plagues. In the 1500s Scandinavian clergy recorded a Sami legend stating that the lemmings live on mountains in the sky, from where they are occasionally washed down by rainstorms. Some also noted the three-year cycle, even arguing the importance of weasels and stoats in this respect. Nevertheless, over the last century everything from sunspots to the lost continent of Atlantis has been offered by way of explanation for the population cycles and migrations of these northern rodents.

To obtain a better understanding, rodent populations have been monitored at the alpine research station at Finse in the Hardangervidda massif since 1970. Looking at the recorded number of rodents, three patterns are immediately striking:



Lemming | Photo © Erika Leslie

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1) between 1970 and 1994 there is a clear periodicity, with rodent peak years every third or fourth year, 2) the rate at which different rodent species are trapped is highly correlated in this period, despite their ecological differences, and 3) between 1994 and 2007 there are no rodent peak years, and the correlation between species also disappears.

Since 1970, students at the Finse winter ecology course have measured the snow pack hardness at intervals by digging through meters of snow. Their reports have fortunately been archived, and from these we found that the change in rodent population size (i.e. catch rate) over winter was clearly influenced negatively by the hardness of the snow layer closest to the ground. Since the rodents (as any digging student can confirm) would have to spend tremendous amounts of energy to reach the ground every time they attempted to graze or access cached food, they depend instead on the open pockets that form between the snow and the ground where they can feed, hide from predators and find shelter against bitter cold and wind during the winter. In mild and moist winters, however, these subnival spaces are often filled with ice and water, making life difficult for the rodents.

Using the available data on lemmings and other rodents, as well as that on other alpine species together with the snow and climate data, we made a set of statistical models that linked weather, snow conditions, rodent populations and bird populations. Snow hardness was the most important abiotic factor in predicting the dynamics of the rodent population. When including spring humidity and snow depth we could predict the rodent population density very well, given winter conditions and the previous year's rodent density (which seems very likely to be connected with predation pressure). Even when we did not include any of the data from after the cycles ceased in the 1990's, the absence of rodent years 1995-2007 was predicted by the model. Thus, the effect of climate on the population dynamics seems to be consistent, and it may be predicted that the trend towards milder, moister winters should have the observed effect of destroying the rodent cycles.

However, rodent years still occur sporadically in Scandinavia, as climate, topography and other factors vary over space. Therefore, we analysed the reported success of hunters of grouse and willow ptarmigan all across the counties surrounding the Hardanger massif, 1970-2007. We were able to demonstrate that the between-year variation shows the same pattern as expected from rodent-fed predators, fluctuating in accordance with the rodents and climate at Finse.

On the basis of our analysis, we conclude that if global warming continues to cause milder and moister winters in Scandinavia, the rodent cycles are likely to cease with a move towards a continental pattern. Rodent dynamics

are important on many levels from nutrient recycling to the survival of specialized predator species such as the arctic fox and snowy owl, and while difficult to predict in detail it seems very likely that the alpine ecosystem as we know it is heading for some fundamental changes.

Further reading:

Kausrud KL, Mysterud A, Steen H, Vik JO, Østbye E, Cazelles B, Framstad E, Eikeset AM, Mysterud I, Solhøy T, Stenseth NC (2008) Linking climate change to lemming cycles. *Nature* 456. 93-97.

2.2.7 The threespine stickleback (Theme 1)

(Kjartan Østbye & Asbjørn Vøllestad)

The threespine stickleback (*Gasterosteus aculeatus*) is a pet model system for many biologists. One reason is the large morphological variability among and within populations, for instance with respect to the number of armor plates (lateral plates) and pelvic structures (that together constitute an anti-predator defense apparatus). Sticklebacks are primary marine fishes that are fully plated, but plateless morphs or morphs with reduced number of plates are found in fresh water. This reduction in plate number is common all over the world, and is caused by a single mutation at one locus with major effect.



Threespine Stickleback | Photo © Kjartan Østbye

We have studied the morphology of sticklebacks from 200 coastal lakes and compared 32 marine and estuarine populations. The traits we focused on are the number of lateral plates and the development of the pelvic apparatus. In Lake Engervann, a small brackish water lake where three different morphs coexist, the variation in plate numbers is clearly driven by variation at one locus with two alleles. Homozygotes either have few or many plates, whereas heterozygotes have an intermediate number of plates.

Also the pelvic apparatus may be reduced and sometimes the pelvic girdle is completely missing. We observed reduction in 4 of the 200 freshwater populations investigated, whereas in the 32 marine populations one single fish with pelvic reduction was found. This finding firmly suggests strong selection against this mutation in the ocean.

Further work with these study systems will focus on early diversification – and the mechanisms (types of selection, genetic regulation) driving this diversification.

Further reading:

Klepaker T, Østbye K (2008) Pelvic anti-predator armor reduction in Norwegian populations of the threespine stickleback: a rare phenomenon with adaptive implications? *Journal of Zoology* 276, 81-88.



2.2.8 Multiple selective pressures shape the natural world (Theme 2)

(Eric Edeline, Nils Chr. Stenseth & Asbjørn Vøllestad)

Using time-series data from the Windermere pike (*Esox lucius*, the predator) and perch (*Perca fluviatilis*, the prey), we have shown that a consideration of the relative strengths and directions of multiple selective pressures is needed to fully understand ecological dynamics. In Windermere, selective harvesting of large pike with gillnets generates directional selection towards smaller body size, while natural selection (chiefly cannibalism) favours larger pike. Individual lifetime somatic growth decreased at the start of the time series because the harvest selection was stronger than the natural selection. However, natural selection favouring fast somatic growth strengthened across the time series, along with increased pike abundance. The harvest selection was overridden by natural selection when the fishing effort dwindled, triggering a rapid increase in pike somatic growth.

The Windermere perch is also under size-selective mortality. While the pike select against small perch, a perch-specific pathogen selects against large perch. Before 1976, the strength of pike-induced selection overrode the strength of pathogen-induced selection and drove a change to larger, faster growing perch. Predation-driven increases in the proportion of large, infection-vulnerable perch presumably favoured the pathogen, since a peak in predation pressure in 1976 coincided with a pathogen outburst and massive perch mortality. After 1976, the strength of pathogen-induced selection overrode the strength of predator-induced selection and drove a rapid change to smaller, slower growing perch. These changes made perch easier prey for adult pike and weaker competitors against juvenile pike, ultimately increasing the survival of juvenile pike and hence the number of pike. In summary, although predators and pathogens exploited the same prey in Windermere, they worked synergistically by driving rapid prey trait change in opposite directions. Our work on the Windermere system demonstrates



Pike | Photo © Eric Edeline

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that ecological and evolutionary processes operate on similar time scales, and that Darwinian theory is thus highly relevant to the management and conservation of natural systems.

Further reading:

Edeline E, Carlson SM, Stige LC, Winfield IJ, Fletcher JM, James JB, Haugen TO, Vøllestad LA, Stenseth NC (2007) Trait changes in a harvested population are driven by a dynamic tug-of-war between natural and harvest selection. *Proceedings of the National Academy of Sciences* 104: 15799-15804.

Edeline E, Ben Ari T, Vøllestad LA, Winfield IJ, Fletcher JM, James JB, Stenseth NC (2008) Antagonistic selection from predators and pathogens alters food-web structure. *Proceedings of the National Academy of Sciences* 105: 19792-19796.

2.2.9 Marine research: joint effort in digitizing historical Russian plankton data (Theme 1)

(Leif Chr. Stige, Dag Ø. Hjermann & Nils Chr. Stenseth)

It might come as a surprise to many that the Soviet Union collected some of the most interesting data series on marine life on the Norwegian coast. Starting in 1959, the Soviet carried out scientific cruises in the Barents and Norwegian Seas each spring and summer. The cruises lasted two months, starting in Murmansk, following the Murman and Norwegian coasts south-westwards to Røst and then back along fixed, off-shore transects. The scientific objective of the cruises was to collect data on fish eggs and larvae and other zooplanktonic organisms. The cruises covered the drift routes of the eggs and larvae of northeast Arctic cod (the largest remaining cod stock), as well as of other commercially important fishes, such as Norwegian spring-spawning herring. These data are unique, as very little comparable Norwegian monitoring data from this period exist. They are also of considerable scientific interest, as unravelling the causes of the large year-to-year variability in the early survival of marine fishes has been the number one issue in fisheries science for more than a century. During the political turmoil in the early 1990s, financial conditions for Russian scientists became difficult; in 1993 the cruises stopped and the bulk of the data still only exist as hand-written report sheets. In a Norwegian-Russian research collaboration financed by StatoilHydro, these data are now being digitized. Digitization started in 2008 and is scheduled to be finished in 2011 and the data will be analysed collaboratively by the Norwegian and Russian partners, resulting in joint publications. The partners are the CEES in Oslo, Institute of Marine

Research (IMR) in Bergen, Akvaplan-NIVA in Tromsø and Knipovich Polar Research Institute of Marine Fisheries and Oceanography (PINRO) in Murmansk. Similar schemes, in which Norwegian marine monitoring data have been analysed from new perspectives at the CEES, have previously resulted in a series of joint IMR-CEES publications. Hopefully, the marrying of the profound biological, ecological and statistical expertise found at the different Norwegian and Russian institutions will be similarly fruitful.

2.2.10 Reaction norms in trout and cod (Theme 1 & 2)

(Asbjørn Vøllestad, Esben Moland Olsen & Nils Chr. Stenseth)



Trout | Esben Moland fishing

Harvesting of biological resources such as fish raises concerns about how to identify and preserve adaptive diversity in, for instance, growth rates and maturation patterns. In order to fully accomplish this, there is a need to elucidate the underlying causes of the variation that can be observed by us. Both evolutionary (genetic) and non-evolutionary (plastic) responses to environmental change could play important roles in shaping such diversity. Reaction norms are helpful tools for distinguishing between these two types of

responses. For instance, maturation reaction norms describe the underlying genetic maturation tendency across a range of environmental conditions. This way, plasticity is also accounted for. Specifically, plastic responses to different environmental conditions are expected to shift the phenotype along the reaction-norm, while an evolutionary response is expected to shift the reaction-norm itself. Probabilistic maturation reaction norms have been described from survey data for several Atlantic cod populations. In Skagerrak there is evidence for local geographic variation in maturation reaction norms on a scale that matches the population structure deduced from population genetics, indicating that the cod could be adapted to its local coastal environment.

We want to test the assumptions of the reaction norm approach by using data from a large mark-recapture experiment with brown trout. Using this dataset we can actually observe the transition from the immature to the mature state directly (by recapturing individual fish over several years), and compare the estimated reaction norms using these observations with those estimated using the probabilistic reaction norm method.

Further reading:

Carlson SM, Olsen EM, Vøllestad LA (2008) Seasonal mortality and the effect of body size: A review and an empirical test using individual data on brown trout. *Functional Ecology* 22: 663-673.

Olsen EM, Knutsen H, Gjøsæter J, Jorde PE, Knutsen JA, Stenseth NC (2008) Small-scale biocomplexity in coastal Atlantic cod supporting a Darwinian perspective on fisheries management. *Evolutionary Applications* 1: 524-533.

2.2.11 Genome sequencing of Atlantic cod (across all Themes)

(CEES-participants: Trine B. Rounge, Martin Malmstrøm, Lex Nederbragt, Ave Tooming-Klunderud, Monica H Solbakken, Bastiaan Star, Unni Grimholt, Nils Chr. Stenseth, Kjetill S. Jakobsen; the GenoFisk consortium (UMB, Nofima, UIB, HI, NTNU, UiTø); International partners: 454 Life Sciences USA, Sanger/EBI, Cambridge UK, Max Planck Institute, Germany)

Atlantic cod (*Gadus morhua*) is one of the most economically important fish species and an emerging aquaculture species. At the CEES, there has been ongoing cod research for quite some time, particularly related to population biology and genetics.



Cod | Photo © Bastiaan Star

We received 10 million NOK for a 2 year project from the GenoFisk programme in the fall of 2008, and immediately embarked on the task of sequencing the 930 Mb cod genome. Within 2009 we will have sequenced every stretch of DNA in the cod genome, on average at least 25 times, using the 454 technology. Sophisticated bioinformatic tools will be utilised in the completion of the assembly of the cod genome. These findings will comprise the sequencing of the first large genome based exclusively on 454-pyrosequencing reads. In addition to the genomic (DNA) sequencing, we also aim to sequence the transcriptome (mRNA) as well as the metagenome (bacteria, fungi, parasites, etc.) associated with cod. A major goal is to determine as many polymorphic sites as possible in the genome (and genes) of cod. A single nucleotide polymorphism (SNP) chip will be constructed on the basis of the mutations we encounter (many of these will be mutations detected in mRNA, and thus represent protein variants).

As soon as we have assembled the cod genome and designed a SNP chip, the most exciting part of the project will begin, and the cod genome project will enter a new phase of population genomics. With access to the annotated genome, we can then compare complete individual cod genomes (a complete cod genome will enable fast access to other cod genomes), selected parts of the genome such as the MHC genes, developmental genes, stress genes, etc., or specific genes that we expect to be associated with a particular phenotype. Such studies can be carried out on various populations of cod (showing different phenotypes), both by sequencing or by screening with the SNP chip. We will also obtain gene expression data from the various populations and phenotypes. These activities will be coupled with the CEES *Colloquium 2* which is under development; in this colloquium we will gather a multidisciplinary group of scientists such as ecologists, population geneticists, theoretical biologists and molecular biologists, with the overall aim of improving our understanding of the relationship between the genotype and phenotype of cod.

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2.2.12 Ecological and evolutionary effects of harvesting (Theme 2)

(Anne Maria Eikeset, Atle Mysterud, Geir Ottersen, Asbjørn Vøllestad, Tore Slagsvold & Nils Chr. Stenseth)



Photo © Atle Mysterud

Commercial harvesting of animals in the wild is of substantial economical importance, providing income and jobs. Harvesting is also an important component of many societies' cultures and traditions. The impact of harvesting on the exploited population's ecology has been studied for many decades. However, more recently the scientific community has become aware that harvesting can cause the evolution of life-history traits faster than was earlier believed. Selective removal of particular age or size groups (for instance big fish or game with large antlers) may change the genetic structure of a population. Since this selection pressure may be strong, traits may change, and such evolutionary changes have now been documented repeatedly; examples are earlier maturation in fish and smaller horns in ungulates due to size selective harvesting.

The studies of harvest selectivity and potential evolutionary effects of harvesting conducted at CEES span several species in marine, freshwater and terrestrial ecosystems. We focus on how different harvesting regimes are expected to differ in evolutionary consequences due to variation in both biological and cultural factors among these different species and systems. In some species, trait variation may be small and therefore unlikely to be targeted by hunters. For example, brown bears of different sex and age classes differ only slightly in size, and individual hunters rarely get the chance of shooting more than one bear over a given management period. Analysis of brown bear survival in two subpopulations in Sweden, monitored over a 23-year period, indeed documented that vulnerability to hunting among age and

sex groups was similar. A focus of further work is how behavioural and morphological traits of the animals as well as active hunter selection determine selection regimes.

Harvest selection works together with all other types of selection pressures. If there are opposing selection pressures, the outcome may be difficult to predict. Analysis of maturation trends in female red deer from Norway over a 39 year period showed no evidence for earlier maturation despite heavy harvesting. Harvesting in Scandinavia mainly aims for meat, targeting calves and yearlings, i.e. before age of first reproduction, which is less likely to yield an evolutionary response in maturation. Indeed, in one population the maturation trend was in the opposite direction of what would be predicted from harvesting-induced selection, suggesting other selection pressures are operating. Clear evidence for opposing selection pressures comes from a study of the top predator pike in Lake Windermere, UK. For this population, natural selection and harvest selection worked in opposition. Somatic growth decreased in periods when size selective harvest selection was strong, while natural selection due to cannibalism favoured fast somatic growth in periods with lowered harvest and increased pike abundance. To predict the effect of harvest selection we therefore also need to know the strength of natural selection on the traits under study. Unfortunately few estimates of the strength and direction of natural selection are available – even for important harvest species.

At CEES, we merge ecology, evolution, and economy by evaluating the potentially strong effects on economic yield of harvest-induced evolution. For example, the Northeast Arctic cod, being the largest stock of Atlantic cod, experienced an intensification of fishing pressure and change in fishing pattern towards all-year-round trawling after World War II. Since this increase in exploitation, mean age and size at maturation have decreased, a trend paralleled by observations in many other commercially harvested populations. Evidence suggests that these life-history changes have a genetic basis and may also lead to reduced productivity and potentially reduced yield. We demonstrate that, within a few decades, the evolution of life-history traits induced by fishing significantly reduces the economic returns generated by the feeding ground fishery in the Barents Sea. We show that ignoring evolutionary change can be economically costly over a relatively short time horizon. The insight obtained in our studies can advise management to become more enlightened in terms of evolution in the long-term.

Further reading:

Bischof R, Swenson JE, Yoccoz NG, **Mysterud A**, Gimenez O (2009) The magnitude and selectivity of natural and

multiple anthropogenic mortality causes in hunted brown bears. *Journal of Animal Ecology*: DOI: 10.1111/j.1365-2656.2009.01524.x

Mysterud A, Yoccoz NG, Langvatn R (2009) Maturation trends in red deer females over 39 years in heavily harvested populations. *Journal of Animal Ecology*: online early. DOI: 10.1111/j.1365-2656.2008.01514.x

Stenseth NC, Rouyer T (2008) Ecology - Destabilized fish stocks. *Nature* 452, 825-826.

Edeline E, Carlson SM, Stige LC, Winfield IJ, Fletcher JM, Ben James J, Haugen TO, Vøllestad LA, Stenseth NC (2007) Trait changes in a harvested population are driven by a dynamic tug-of-war between natural and harvest selection. *Proceedings of the National Academy of Sciences of the United States of America* 104:15799-15804

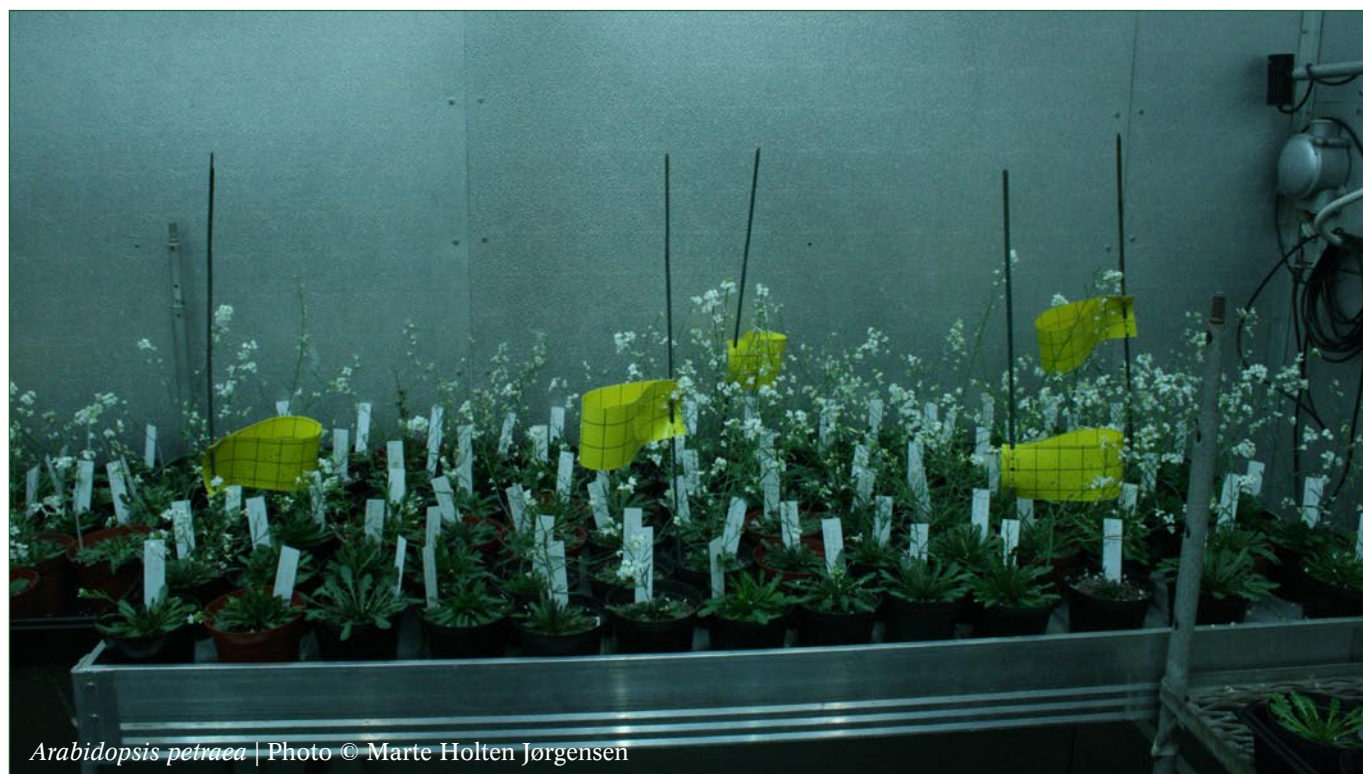
Carlson SM, Stenseth NC (2008) Fishery selection across the millennia. *Proceedings of the Royal Society B-Biological Sciences* 275:2657-2658.

2.2.13 Polyploid evolution: The effect of genome duplication on s-allele diversity and gene expression (Theme 3)

(Marte H. Jørgensen, Kjetill S. Jakobsen, Barbara Mable, Marcus Koch & Anne K. Brysting)

Polyploidy (whole genome duplication) may be the single most important mode of sympatric speciation in the plant kingdom. Providing extra sets of genetic material for phenotypic variation and adaptation, and with consequences such as rapid genomic rearrangements, genomic downsizing, movement of genetic elements across genomes, and movement of foreign genetic material into the genome, polyploidy is an evolutionary trigger. The fate of duplicated gene pairs gives insights to the evolution of polyploids. Silencing or loss of one of the copies is predicted by classical theory, and massive loss of redundant genes in polyploids has indeed been confirmed by empirical analyses. However, unexpectedly high levels of duplicate gene preservation have been observed, and various explanations suggested.

As part of a larger focus on the evolutionary effects of polyploidy in both plants and animals, we are among other things working with the genus *Arabidopsis*. This genus includes several polyploid lineages as well as the geneticists' favourite model plant, *A. thaliana*, and therefore makes an excellent group for studying the effects of genome duplications. We have investigated the origins of tetraploid populations of *A. kamchatica* from Beringia and *A. petraea* and *A. arenosa* from Central Europe. The first polyploid seems to stem from hybridisations between two diploid species (*A. lyrata* and *A. halleri* ssp. *gemmifera*) followed by genome duplication (allopolyploidization). The latter two may be of allo- or autopolyploid origin, and are currently being studied.



Arabidopsis petraea | Photo © Marte Holten Jørgensen

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Polyploidy is often coupled with loss of sexual reproduction or higher degree of self-fertilization than in diploids. Diploid *A. petraea* plants have a sporophytic self-incompatibility system (SSI) where outcrossing is ensured by a self-recognition phenotype of both pollen and stigma. We are studying the possible effect of polyploidy on this mechanism using controlled crosses within families of known genotypes and comparing genotypes among the offspring with the segregation of compatibility phenotypes based on fruit set.

Using the 454 high throughput sequencing platform, we are now at the initial stage of analysing gene expression differences resulting from genome duplication in *Arabidopsis* auto- and allopolyploids. We will investigate mRNA levels by constructing solid phase (454) cDNA libraries from floral buds and by in-depth sequencing of the transcriptome in polyploids and their diploid relatives. The approach should provide insight into the issue of dosage effects of gene copy numbers in polyploids and diploids and putative recombination events within the coding regions.

2.2.14 The evolutionary genomics of secondary metabolites – another type of immune system? (Theme 1 & 2)

(Ave Tøming-Klunderud, Trine B Rounge, Anke Stüken, Lex Nederbragt, Hanne Ballestad & Kjetill S Jakobsen)

Secondary metabolites are organic compounds that are not directly involved in the normal growth, development or reproduction of organisms. Secondary metabolites are known to have antibiotic, immunosuppressive and various toxic bioactivities, but little is known about their precise biological functions. The variety of secondary metabolites is particularly prominent in prokaryotes and eukaryotic microorganisms.

With 2 billion years of success, cyanobacteria have been essential for the evolution of life and are of great ecological significance, which make them a most fascinating group of organisms. A large proportion of the biosynthetic capacity of cyanobacteria is involved in synthesis of bioactive secondary metabolites; we are interested in the genes involved. The secondary metabolites are essentially synthesized by combinational chemistry (involving cyclic peptides and/or polyketides) catalyzed by multi-domain enzymes encoded by large gene clusters (to a large extent consisting of repetitive gene segments).

We have investigated many gene clusters in a large number of naturally occurring strains (both within and among water systems) in order to better understand the mechanisms creating the variety of the chemical classes and the variation within each class. As an example, we have shown that the

entire gene cluster for microcystin synthetase is a mosaic of various phylogenetic affinities and that there is positive selection for some of the recombinants (particularly those causing new variants of the peptide). It is therefore evident that Horizontal Gene Transfer (HGT) is causing variation and that there is selection for new peptide variants, probably as a response to different biotic or abiotic factors. We believe that having a certain set of secondary metabolites (a chemotype) enables a particular bacterium to adapt to a certain environment within a lake. Consequently, a particular chemotype defines a population or a sub-population. This is indeed what we have observed in Norwegian oligotrophic lakes such as Steinsfjorden and Kolbotnvannet as the chemotypes correspond to populations showing distinct bloom dynamics, seasonal occurrence and habitat distribution in these two lakes. This is a breakthrough for understanding the cyanobacterial population genetics and dynamics. In order to address how each gene (also the non-secondary metabolite genes) ‘behaves’ between populations and in totally different environments (for example in eutrophic lakes) we have started to sequence *Planktothrix* strains from Lake Steinsfjorden, Kolbotnvannet and from some German lakes (using 454 sequencing). In addition, we have sequenced an *Aphanizomenon* strain highly different from the *Planktothrix* strains. In the *Planktothrix* CYA 98 strain we see that as much as 5 % of the genes are peptide synthetases, and it produces peptides both through non-ribosomal and ribosomal pathways. When we have finished about five additional genomes our data for studying cyanobacterial population genomics will be superior.

Further reading:

Tøming-Klunderud A, Mikalsen B, Kristensen T, Jakobsen KS (2008) The mcyABC operon is a genetic mosaic in naturally occurring *Microcystis* strains. *Microbiology* 154: 1886-1899.

Rounge TB, Rohrlack T, Kristensen T, Jakobsen KS (2008) Highly similar cyanopeptolin NRPS operons from geographically remote *Planktothrix* strains; epimerase makes the difference. *BMC Microbiology* 8:141.

Tøming-Klunderud A, Fever D, Rohrlack T, Jokela J, Rouhiainen L, Sivonen K, Kristensen T, Jakobsen KS (2008) Evidence for positive selection acting on microcystin synthetase adenylation domains in three cyanobacterial genera. *BMC Evolutionary Biol* 8:56.

2.3 New staff

We hereby present the new CEES staff, who have been employed directly on funds to the CoE either as a contribution from the University of Oslo or through the CoE funding from the RCN.



Jan Husek (*Theme 2*) has been employed as a PhD since 1 October 2008. He has a Masters in Ecology and Environmental Protection from Palacky University Olomouc Czech Republic. The title of his PhD project is 'Evolutionary and ecological effects of climate change for passerine birds'.



Inger Maren Rivrud Godvik (*Theme 2*) has been employed as a PhD since 1 September 2008. She has a Masters from the University of Oslo, Department of Biology. The title of her PhD project is 'Harvesting selectivity and possible evolutionary trait changes in contemporary red deer populations'.



Annette Taugbøl (*Theme 1*) has been employed as a PhD since 1 October 2008. She has a Masters from the University of Oslo, Department of Biology. The title of her PhD project is 'Stickleback morph variation in populations: A study with genomic and ecological perspectives'.



Kjetil Lysne Voje (*Coll. 1, Theme 2*) was employed as a PhD from 1 August 2008. He has a Masters from the University of Oslo, Department of Biology. The title of his PhD project is 'Comparative methods investigating evolutionary processes and adaptive evolution'.



Lee Hsiang Liow (*Coll. 1*, will link up to *Coll. 4*) has been employed as a researcher since 1 January 2009 through gender equalising funds from RCN. She has a Masters from the Swedish Agricultural University and Uppsala University (joint degree), a PhD from the University of Chicago and thereafter a postdoc period at the CEES. Her current research focus is "to study macroevolutionary and macroecological patterns and processes as seen from the fossil record".



Stein Are Sæther (*Theme 1 & 3*) has been employed as a researcher since 1 January 2009. He has a Masters from the University of Trondheim, a PhD from the Norwegian University of Science and Technology (NTNU) and a previous postdoc position at Uppsala University and the Netherlands Institute of Ecology (NIOO-KNAW) and thereafter a period as a researcher at the CEES. His current focus is on 'Evolution of reproductive isolation in birds'.



Øistein Holen (*Theme 2*) will enter his research position at CEES during July 2009. He has a Masters, a PhD and a postdoc position from the University of Oslo, department of Biology. His research focus will be on 'Signal evolution - adaptation and constraint'.

2. SCIENTIFIC ACTIVITY



Antonieta Labra (*Theme 2*) has been employed as a researcher since 1 August 2008. She has a Masters, a PhD and a postdoc position from the Universidad de Chile (Santiago, Chile). In addition she has had a position as “Courtesy Research Assistant Professor” at Florida State University (USA). She is currently involved in three research projects: 1) Mate choice in Pied Flycatchers, 2) Chemical signals and reproductive isolation and 3) Morphological and physiological aspects of lizard thermoregulation.



Kjartan Østbye (*Theme 1*) has been employed as a researcher since 16th March 2009. He has a Masters from the University of Oslo, Department of Biology and a PhD from the Norwegian University of Science and Technology (NTNU) and Norwegian Institute for Nature Research (NINA) in Trondheim. His current research focus is “to study the adaptive radiation in the threespine stickleback following their postglacial colonization of freshwater habitats using a set of methods such as population genetics, morphology, behaviour, and in the future also functional genomics”.



Camilla Lothe Nesbø (*Theme 1 & 3*, will be responsible for *Coll. 3*) has been awarded the Research Council of Norway’s stipend as an Outstanding *Young Investigator (YFF)* for 5 years, starting 1 September 2008 at the University of Alberta in Edmonton. She will continue this work at CEES from 2010. Camilla has a Masters and a PhD from the University of Oslo, Department of Biology and thereafter a period as a postdoc and Senior Researcher at Dalhousie University, Canada. Her research focus is currently ‘Biogeographic and population analyses of Thermotogales bacteria from hydrocarbon-rich environments’.

3 EDUCATION AND RESEARCH TRAINING

3.1 Research training

Besides research the centre focuses primarily on graduate training. Our permanent scientific staff is involved with teaching at all levels, and we are interested in contributing to educating excellent candidates for future positions also at the basic level. Rather than building our own educational programme at bachelor and master level, we are involved in the basic education of our host Department, the Department of Biology (Bio), as well as other units of the university (e.g. Mathematics and Economics). In 2008 we contributed to the teaching of 9 Bachelor courses and 14 Master/PhD courses. 36 Master students were supervised by CEES members.

3.1.1 The graduate school and the student conference at Hanko

A main goal of the CEES is to offer a professional and interdisciplinary training programme, organised within a Graduate School (a status which CEES has been awarded by the UiO). We receive an annual funding (NOK 50 000) which partly finances the costs incurred by our annual conference for Master and PhD students. The broad spectrum of experience and skills at the CoE allows us to offer a unique interdisciplinary PhD training programme, where participants benefit from a stimulating international environment.

Students work in research teams, supervised by two core members, and follow an Individual Personal Career Development Plan.

During the spring term of 2008, CEES held an intensive course in 'Adaptive Dynamics' (course code BIO9910), a course with full credence. Eva Kisdi, researcher at the University of Helsinki, was the main teacher of the course, which provided an in-depth introduction to adaptive dynamics, a theoretical framework for studying frequency- and density-dependent evolution with a high degree of ecological realism.

3.1.2 The Marie Curie Early Stage Training (EST)

The Marie Curie Early Stage Training on Ecological and Evolutionary Response to Climate Variation (CEES-MCO) is also an important part of our research education programme. In total 11 PhD students (7 short-term and 4 long-term) will stay at CEES during the 48 month project period from 2006 to 2010. In 2008 4 full-time PhD students and 4 short-term PhD students were engaged at CEES-MCO. The candidates have been very successful during their stay at the centre, and of the short-term students 4 have already completed their PhD degrees at their home institutions; Stepha-



3 EDUCATION AND RESEARCH TRAINING

nie Carlson (US) in 2006 and Thor Veen (France), Tristan Rouyer (France) and Anke Stüken (Germany) in 2008. The rest are planning to complete their degrees within the years 2009/2010. All 4 long-term students will defend their theses at the CEES. During 2008, our Marie Curie EST students co-authored a total of 11 papers. The programme has also promoted international cooperation among our scientists and the home institutions of our visiting PhD students.

3.1.3 Journal clubs

The CEES arranges four different Journal Clubs: (www.cees.uio.no/calendar/internal-events/journal-clubs/):

- Behavioural Ecology Forum: 19 sessions were held in 2008.
- Thursday Lunch Club: 28 sessions were held in 2008.
- Measurement Theory Forum: 17 sessions were held in 2008.
- Speciation Forum: 8 sessions were held in 2008.

The two latter discussion groups were established in the second half of 2008.

These Journal Clubs stimulate critical reading of scientific papers and provide an opportunity for students to keep updated with their own subject areas as well as related scientific fields. Participating students (including the MC-fellows) choose relevant papers that focus on general scientific challenges within the field of ecology and evolution.

In addition to the four Journal Clubs we also have a 'Discussion Group on Ecological Forecasting' (meetings to discuss papers and focused topics, with the goal of developing a concentrated review of the applications of ecological forecasting). This group organised 10 meetings during the fall term of 2008.

3.1.4 Late lunch talks

The Late Lunch Talk seminar series (www.cees.uio.no/calendar/internal-events/late-lunch-talks/), formerly the Friday Lunch Talks, is a forum where employees, visiting scientists and students at CEES present and discuss their work and ideas. The format is of rather informal facilitating discussions. 13 seminars were held in this series in 2008; 10 of them in the autumn term, when seminars were held approximately every second week.



4. SCIENTIFIC OUTREACH

The CEES works towards increased awareness of science in the general population. Communication of scientific findings, both our own (reported in the primary literature) and others, to a broad public audience, is prioritized. Annually, we organise two non-technical events: Darwin Day and the Kristine Bonnevie lectures on Evolutionary Biology, both drawing full houses of academics and laymen.



Dag O. Hessen

Several core members frequently appear in the mass media, Dag O. Hessen being the most prominent in this respect. In 1998 he received RCN's prize for Excellence in Communication of Science, and we are pleased to announce that in 2008 he won the Research Dissimination Award of the University of Oslo. Hessen is responsible for coordinating Public Relations for the CEES.

Two of our earlier papers were highlighted in 2008:

- Jonzén *et al.* (2006, *Science* 312: 1959-1961) identified in June 2008 by Thomson Reuters' ScienceWatch/Essential Science IndicatorsSM as a "Fast breaking paper" in the field of Environment/Ecology: <http://sciencewatch.com/dr/fbp/2008/08junfbp/08junfbpStenseth/>
- Stenseth *et al.* (2002, *Science* 297: 1292-1296) identified in August 2008 by Thomson Reuters' ScienceWatch/Essential Science Indicators^S to be one of the most cited papers in the research area of "Climate Fluctuations/Emerging Research Fronts": <http://sciencewatch.com/dr/erf/2008/08augerf/08augerfStenseth/>

4.1 The Darwin Expedition

As part of the Norwegian Charles Darwin celebration, three students affiliated with CEES, Kjetil Lysne Voje, Jens Ådne Rekkedal Haga and Tore Oldeide Elgvin, embarked on the science communication project *The Darwin Expedition* in 2008.

The expedition repeats parts of the journey Darwin made in South America some 170 years ago, one of his main sources of inspiration.

In collaboration with the Norwegian Broadcasting Company (NRK), the expedition was continuously documented on the web, TV and radio (<http://blogg.nrk.no/darwin>, *Schrödingers katt*, *Newton* and *Verdt å vite*). The media coverage currently counts about 100 stories in various formats, mainly on NRK.

The aim was, through the experiences gained in Darwin's footsteps, to draw broad public attention to the natural sciences in general, with special focus on biological research



Armadillo | Photo © Kjetil Lysne Voje

4. SCIENTIFIC OUTREACH

and Darwin's scientific contributions. Special emphasis was made on attracting a young audience.

With financial support from The Research Council of Norway, The Freedom of Expression Foundation, The University of Oslo, Toyota – and invaluable help from University of Oslo staff and students – the expedition set off in September.

During the last months of 2008 the expedition traced the Darwin route from Brazil to Chile. It continued until the bicentenary of Darwin's birth (12 February 2009), which was covered from the Galápagos.

4.2 Darwin Day

Darwin Day is an international recognition of science and humanity. It is celebrated annually on 12 February, the birthday of Charles Darwin. Darwin Day at the University of Oslo has been organised by CEES since 2006. The programme for 2008 included five invited international researchers who lectured on topics related to the evolution of language, communication and perception. Close to 200 people turned up for the event.

"En feiring av vitenskapen og menneskeheten"

Darwin Day 2008

"Communication"

Program 12. Februar

Auditorium 1, Vilhelm Bjerknes hus, Blindern

09:15-09:30 Prof. **Nils Chr. Stenseth**
Introduction: Darwin's influence on our understanding of communication in animals and man.

09:30-10:15 Prof. **Andrew Carstairs-McCarthy**
Flaws in language as clues to its prehistory.

10:15-11:00 Dr. **Simone Pika**
Our gesturing cousins: One approach to the evolution of language.

11:15-12:00 Dr. **Ulrike Aust**
Levels of categorization in animals and humans.

Lunch

13:15-14:00 Dr. **Juliane Bräuer**
I know what you see: Visual perspective taking in apes and dogs.

14:15-15:00 Prof. **Tecumseh Fitch**
Language Evolution: The Comparative Approach and Darwin's Contribution.

Arrangør:
CEES
Centre for Ecological and Evolutionary Synthesis

Kontakt: Nils Chr. Stenseth, n.c.stenseth@bio.uio.no, Eli K. Rueness, e.k.rueness@bio.uio.no.

4.3 The Kristine Bonnevie lecture on Evolutionary Biology



Rita R. Colwell

The Kristine Bonnevie lecture on Evolutionary Biology is delivered annually on 2 September, the anniversary of the University of Oslo. The lectures are held in memory of Kristine Bonnevie, the first female professor in Norway. In 2008 the Minister of Research and Higher Education, Tora Aasland, opened the event with a lecture on gender balance at the University. The main speaker was Professor Rita R. Colwell who gave a

lecture entitled 'Cholera, Climate, and Genomics: The Saga of *Vibrio cholerae*'. More than 200 people turned up for the event. Professor Colwell was awarded an honorary doctorate of the University of Oslo at the day of the lecture.

Kristine Bonnevie Lectures on Evolutionary Biology 2008


Programme Tuesday September 2
Auditorium 1 Georg Sverdrups Building


10.15 Opening remarks by Rector Geir Ellingrød

10.20 Minister of Research and Higher Education Tora Aasland:
"Gender Balance at the University -
Expectations to universities and authorities"

10.45 Professor Rita R. Colwell:
"Cholera, Climate, and Genomics: The Saga of *Vibrio cholerae*"

The main speaker, Professor Rita R. Colwell, will on Sept. 2 be awarded an honorary doctorate of the University of Oslo. She is a Distinguished Professor at University of Maryland, College Park, as well as at the Johns Hopkins University Bloomberg School of Public Health. She is the former Director of the United States National Science Foundation and presently serves as President of the American Institute of Biological Sciences.

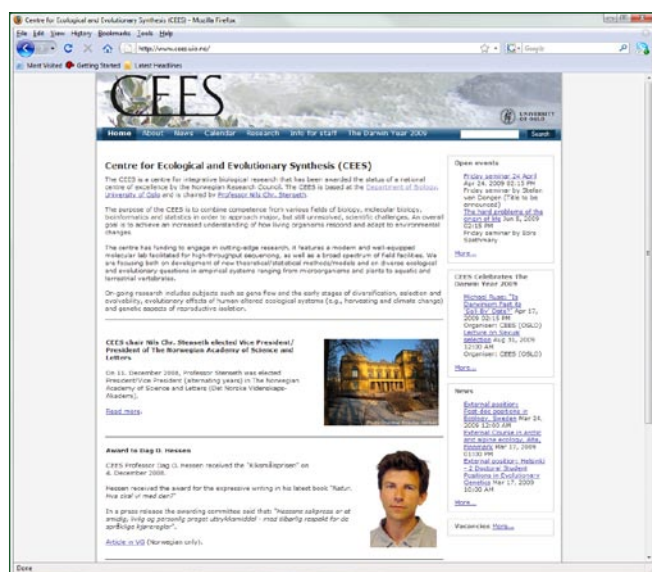
 **UNIVERSITY OF OSLO**

 **CEES**
Centre for Ecological and Evolutionary Synthesis

The Kristine Bonnevie Lectures on Evolutionary Biology are organized by the CEES as part of the University of Oslo anniversary. For more information please see: <http://www.cees.uio.no/kristine-bonnevie-2008>

4.4 The CEES web pages

During 2008 CEES established a fully working website (cees.uio.no) that is continually updated with information on upcoming events, vacancies (internal and external) and other news. A main feature of the website is a personal page for each CEES member, with information on background, publications and more. Similarly, each CEES project has a page with a project summary and list of persons involved.



4.4 CEES in the media

CEES experienced a high rate of media appearances in national and international media sources during 2008. Almost 400 media coverages were devoted to our work. Some of those works receiving the most media attention are:

Kausrud *et al.* (2008). 'Linking climate change to lemming cycles'. *Nature* 456: 93-97. This study shows that snow conditions determine population dynamics in this species; with climate change snow conditions change, and lemming cycles cease.

Several of our papers on plague (Stenseth *et al.* 2008, *PLoS Medicine*; Stenseth 2008 in a book published by Institute of Medicine; Ben Ari *et al.* 2008, *Biology Letters*) received much media attention. They document how climate is a major force in plague dynamics. The *PLoS Medicine* paper provides, in addition, a synthesis of available data pertaining to the eco-epidemiological plague system.

Rouyer *et al.* 2008, *Proceedings of the National Academy of Sciences of the United States of America*. This paper demonstrates how fishing and environmental forces jointly determine the observed dynamics.

Le Bohec *et al.* 2008, *Proceedings of the National Academy of Sciences of the United States of America*. This paper documents how climate change profoundly affects the survival of the King penguin.

Jonzén *et al.* 2008 *Science* has been included in *State of the Planet 2008-2009*.

In addition to the publications mentioned above, the Norwegian book by Dag O. Hessen, *Natur - hva skal vi med den?* (Gyldendal), received a lot of attention in the media. The book was also noted in connection with the author receiving the 'Riksmålsprisen' in 2008. Dag O. Hessen and Tore Slagsvold are among the CEES members most frequently appearing on various nature programmes on Norwegian radio and TV.

5 GENDER EQUALISING STRATEGY

Equalising the gender balance in high-rank academic positions is a priority of both the Research Council of Norway and the University of Oslo. CEES has implemented several guidelines to counter “the leaky pipeline” of women through the academic hierarchy, from Master level, through to PhD and postdoc level and to tenured scientific staff. At CEES, we use a dual approach to attract and keep female scientists, partly optimising the conditions for our female students and staff and partly emphasizing female role models.

To optimise conditions for female scientists who may temporarily be unable to perform their normal activities in the lab, UiO funding has been secured for appointing a lab technician assigned female scientist. Furthermore, in 2008 we have focused on scholarships for transitional engagements, enabling female candidates to qualify for further scientific careers. In 2008, 9 persons received such support from CEES. Transitional engagements varied from 2 to 6 months. We received 305 000 NOK in support from UiO, and used a total of 1.1 MNOK on these engagements in 2008. Three of the master students that obtained transitional engagements are now employed in PhD positions (Inger Maren R Godvik, Silje Hogner, and Annette Taugbøl). The other master students having received such stipends have written manuscripts that are currently under review. Two PhD students got short term prolongation in their positions, and are now employed as postdocs (Trine B. Rounge and Anke Stüken), and one of the postdocs who received funding (Hege Gundersen) will start in a new permanent position at the Norwegian Institute for Water Research (NIVA) in April 2009.

To provide role models for our female staff, both the CEES board and Scientific Advisory Board are run by female scientists. The deputy Chair is female, two of the three themes are co-chaired by female scientists and one of the four colloquia is chaired by a female scientist (Camilla L. Nesbø). Nesbø has received funding as an *Outstanding Young Investigator* (RCN), and we have secured funding for Lee Hsiang Liow on RCN gender equalising funds. We will use the position provided to Liow as a role model for future tenure track positions as a measure of recruitment strategy for female scientists.



Photo © Tore Oldeide Elgvin

6 MANAGEMENT AND ADMINISTRATION

The CEES is established as a Centre of Excellence (CoE) by The Research Council of Norway (RCN). It is hosted by the Department of Biology (Bio) under the Faculty of Mathematics and Natural Sciences at the University of Oslo (UiO). RCN and UiO are, regarding core funding, our main financial contributors and constitute the final reporting entities that define the guidelines under which we are to operate. Bio is responsible for our work and for most administrative support (with the exception of the Administrative Leader).

6.1 Administrative structure

The centre is run on a daily basis by the Chair, Professor Nils Chr. Stenseth, the Deputy Chair, Researcher Eli K. Rueness, and the CEES administrative team. At weekly meetings all running and strategic issues are dealt with. Regarding scientific progress within the centre, the Deputy Chair and the Chair liaise closely on a daily basis.

In order to facilitate the running of the CEES, and to provide a good cooperative relationship between our host, Bio, and CEES, delegations have been implemented from the Head of Department to the CEES Chair and from the Head of Administration at the Department to the Head of Administration at CEES (Katinka E. Grønli). The Chair and the Head of Administration at CEES are also part of the Leader team at the Department, participating in weekly meetings with the Department head and his team.

The CEES core, the fraction of our staff that has committed themselves to allocate most of their research time to the centre during the whole period of the CoE, meets 3 to 4 times a year. In 2008, the core group was the same as that defined in the annual report of 2007 with the addition of David Houle (Kristine Bonnevie professor on *Colloquium 1*).

Within the core group we find the *Theme* and *Colloquia* leaders. These leaders have responsibility for the daily scientific work and progress within their respective *Themes/Colloquia*. They rank applicants for funding, report on progress, and chair scientific meetings where their work is presented and discussed. One of the leaders from each *Theme/*

Colloquia meets with the Chair, the Deputy Chair and Head of Administration approximately every second month.

The Leader Group and the Core serve as advisors to the Chair, participating in important decisions related to scientific progress, recruitment of personnel, reporting and financial issues.

Professor Atle Mysterud has been appointed to be in charge of running administration of the fieldwork related resources, while the CEES lab board has been appointed to administrate the running of the CEES laboratories. In 2008 the lab board consisted of Anne K. Brysting, Kjetill S. Jakobsen, Eli K. Rueness, Nanna W. Steen and Ave Tooming-Klunderud. For full mandate, see: <http://www.cees.uio.no/research/facilities/mandate-for-the-cees-lab-board.html>

6.2 Administrative support

The CEES administration is lead by Katinka E. Grønli. The administration prepares general correspondence, budget, accounting figures and reports. It is in charge of the daily routines involved in handling the CEES personnel and assists in general communication, the development of proposals for external funding and in running the CEES website.

Bio has allocated two full-time Advisors in research administration to the centre. In 2008 Gry Gundersen and Kari Beate Rygg were holding these positions. They assist in conducting full budgets for new applications according to the UiO standard, making contracts between UiO and external partners for running projects, developing proposals and in the reporting of existing projects. They also assist the Head of Administration at Bio in reporting scientific activity, and Katinka E. Grønli in all matters related to the administrative support functions within the centre.

CEES has employed two Higher Executive Officers, Anne Margrete Holst and Tore Wallem, to deal with the development of our website, general scientific outreach and non-scientific matters related to guest researchers and students. Wallem has been in charge of developing new web pages for CEES and for the implementation of a project concerning ethics in science, developed by the UiO. Both Wallem and

Holst have assisted with travel arrangements and reimbursement procedures, housing and general bureaucracy matters for guests and new employees.

First line services are run primarily by Bio; these include telephone- mail-, reception- and accessory services and the purchase of normal running equipment.

All financial transactions are jointly authorised by Nils Chr. Stenseth and Katinka E. Grønli. The resolutions are executed by the economy section at Bio, which also provides help with budgets and accounting analysis, reports, etc. Mari E. Smith has been responsible for the accounting analysis of CEES in 2008.

General IT support is provided by the Department of Molecular Biosciences. Universitetets senter for informasjonsteknologi (USIT) has provided help and support in establishing CEES's new webpages (www.cees.uio.no/) and profile.

All administrative support required for the students (from Bachelor to PhD level) is provided by the department where the students are enrolled. For most of our students this is the Department of Biology. A notable exception is the running of our MC-EST, which is supported administratively by Gry Gundersen.

First-line personnel support is provided by Katinka E. Grønli, whilst professional handling of personnel matters (contracts, payment routines etc.) is provided by the Faculty of Mathematics and Natural Sciences administration. Bente Schjoldager is allocated as the responsible body for all CEES matters.

A secure archive system is provided by The Faculty, which from 2008 has been in an electronic format.

6.3 The Board and the Scientific Advisory Board

The CEES Board is an administrative body that meet approximately twice a year to focus on strategic and control functions as well as approving budgets, accounts and annual reports. In 2008 the CEES Board consisted of: Chair, Reidun Sirevåg (Microbiologist, University of Oslo, and General Secretary of the Norwegian Academy of Science and Letters), Sven-Axel Bengtson (Ecologist, Lund University, Sweden), Rolf A. Ims (Ecologist, University of Tromsø), Bernt Øksendal (Mathematician, Centre of Mathematics for Applications, a CoE at the University of Oslo), Trond Schumacher (Chair of Department of Biology, University

of Oslo) and Birger Kruse (Faculty Director of the Faculty of Mathematics and Natural Sciences, University of Oslo). For more details, including its mandate, see the CEES web pages and the CEES annual report of 2007.

Comments by the Board Chair, Reidun Sirevåg

The CEES board had two meetings in 2008, the first on 11 March and the second on 3 September. The latter was held at the venue of the annual CEES conference at Hankø and participants could thus observe several of these presentations. We were pleased with the professionalism that this conference conveyed. During this conference, the Board also had the opportunity to meet with members of the CEES Scientific Advisory Board.

At the meeting in March, a preliminary budget was approved, and at September's meeting the board was provided with an overview of the expenditures in relation to the preliminary budget and the corresponding adjustments. As expected, the expenditure in this first year of CEES's existence did not altogether fit the budget, since several scientific positions were not filled until later than originally planned. It is my impression that the resources are handled in a sound way, and that care is taken to use the resources in a way that benefits the goals of the centre.

The most important issue in 2008 has been to fill the announced positions of PhD students and postdocs with competent people who would fit into the programme and the idea of CEES, i.e. to allocate the right people to the right group, whilst at the same time maintaining a good balance between the groups and themes of the Centre. There has been some disagreement between the CEES and the Department of Biology regarding the assessment of the applications for vacant positions. This disagreement was rooted in the establishment of two different selection boards, one appointed by the CEES and one by the Department of Biology, which had different views on the qualifications and ranking of the candidates. This was unfortunate, and a more suitable procedure for appointments must be established for future assessments in connection with new openings. In order to ensure the goals of the Centre, care should be taken in future to ensure that the integration of the various groups connected to CEES is taken into consideration. It appears at the end of the year that the positions have been filled in such a way that there is also a good balance with regard to gender.



Blue tit | Photo © Maria Aasen

Another important issue that has been discussed is the mandate for the group responsible for the lab-related activities at CEES. This mandate helps to ensure efficient use of the lab facilities that have been developed.

The overall impression is that already the first year of existence of CEES has resulted in a large scientific production of high quality. There also exists impressive, well thought out plans for the year 2009.

Furthermore, it appears that the CEES and its host institution, the Department of Biology, have settled into a peaceful coexistence as also seems to be the case regarding the Faculty of Mathematics and Natural Science.

The CEES Scientific Advisory Board (SAB) has been appointed by the board of the CEES. The primary request to the SAB is to critically investigate and compare our research plan with our actual work and progress, and to guide and advise, should changes or additions be implemented in the plan. In 2008 the SAB held two meetings which took place during the annual CEES conference, 3 and 5 September. Here the SAB discussed the scientific focus of CEES, how to get started, and the processes involved in hiring the new PhD and Post docs. In 2008, the Scientific Advisory Board consisted of Chair, Rita R. Colwell (Microbiologist, University of Maryland, US), David R. Brillinger (Statistician, University of California, Berkeley, US), Edward J. Feil (Microbiol-

ogist, University of Bath, UK), Barbara Mable (Evolutionary Biologist, University of Glasgow, UK), Anne Magurran (Behavioural Ecologist, University of St. Andrews, UK) and Gordon H. Orians (Evolutionary Biologist, University of Washington, Seattle, US).

Comments by the Scientific Advisory Board Chair, Rita R. Colwell

The complex issues of environmental change occurring globally and fundamental aspects of evolution are addressed within the CEES by outstanding scientists working in a coordinated framework. CEES represents an excellent centre for collaboration in research, education, and public outreach. Designed to investigate effectively and productively those issues arising from the complexity of natural systems, CEES scientists have already made significant contributions to the scientific literature in peer-reviewed journals, providing communication of important findings to the general public. During the first year of its existence, the CEES has developed several structures and is now moving rapidly to complement research strengths with enhanced capability in interdisciplinary research and education. CEES is ideally positioned to address multidisciplinary issues in organismic and molecular biology, notably in application of statistical modelling. Many of its projects are expected to yield important and interesting results, notably work on

harvesting-induced evolution, as well as studies of plague. Highly promising is the research underway on sequencing the cod genome. The ecology and population genetics of cod provides an excellent position from which to integrate information within the classical biological setting.

At its second meeting outside Oslo in 2008, the SAB provided advice and guidance, with emphasis on those areas most likely to benefit from increased investment of resources, especially in closing gaps in its strategic plan. Clearly, the SAB was very pleased with the excellent progress made so soon after the establishment of CEES, especially in setting an agenda for research, education, and public communication. SAB believes the future of CEES, unquestionably, will continue to be exciting and highly productive.

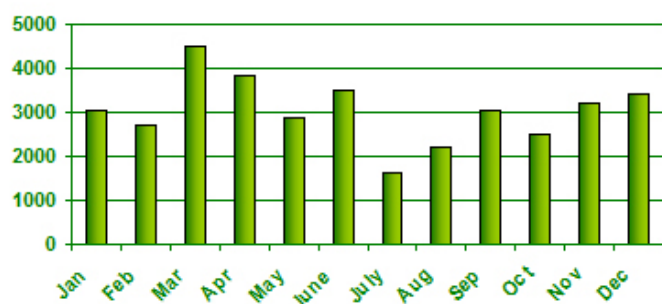
6.4 Experimental facilities

6.4.1 DNA and sequencing labs

www.cees.uio.no/research/facilities/dna-lab/

The CEES lab has an infrastructure consisting of pre-PCR labs, separate PCR facilities, post PCR and DNA sequencing labs. In addition there is a dedicated lab for class 2 security research. The lab is fully equipped for DNA and RNA extraction for all type of animal and plant tissues including blood, faeces and ancient DNA. It has all of the basic instrumentation of a modern molecular biology laboratory including equipment for gene cloning, work with genomic libraries, real-time PCR, DNA/RNA quantification (Nanodrop spectrophotometer for µl volumes) and chip-based analysis of DNA, RNA and protein (Agilent Bioanalyzer). In 2008 generic and cost-effective protocols for DNA extraction was developed for the Biomek 2000 automated workstation, and an additional robotic workstation (Biomek 3000) for post-PCR work was acquired. The CEES lab has had 27 users during 2008 (affiliated to CEES/Bio).

Number of samples sequenced in 2008



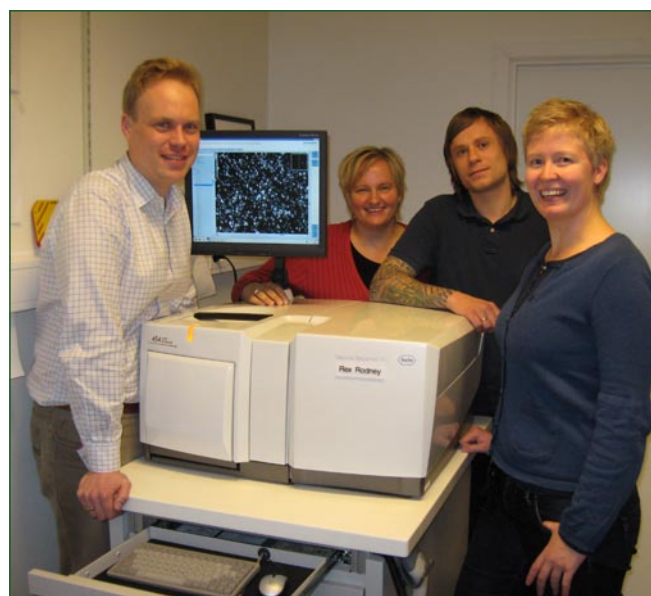
At the CEES we have two ABI 3730 capillary electrophoresis sequencers, each currently equipped with 48 capillaries. The ABI instruments provide DNA sequencing and genotyping and functions as a service lab for CEES, the Department of Biology and users at the Faculty of Mathematics and Natural Sciences (www.bio.uio.no/ABI-lab). The annual turnover of the ABI-service lab exceeded 1 MNOK in 2008 for the first time. The graph on this page shows the number of samples sequenced monthly at the ABI lab.

6.4.2 The FUGE Ultra-high throughput sequencing platform

www.cees.uio.no/utsp

CEES obtained a Roche/454 GS FLX sequencing instrument in November 2007 as part of the FUGE-sponsored Ultra-high Throughput Sequencing Platform UTSP (FUGE - National Technology Platform). The platform is a node in The Norwegian Genotyping and Sequencing consortium (NGSC, <http://www.ngsc.no>).

The UTSP service lab has been functional since January 2008. Using GS-FLX standard chemistry, 79 samples from different research environments were sequenced in 2008. In total, 2.0 gigabases (2000 million bases) of sequence was obtained. In October 2008, the UTSP service lab was upgraded for sequencing using Titanium chemistry, further increasing the throughput of sequencing.



During 2008, we have sequenced different types of samples involved in several projects including:

- *de novo* and re-sequencing of whole genomes (bacteria and eukaryotic organisms)
- sequencing of BACs and plastids
- metagenomics analysis of environmental samples
- transcriptome analysis (sequencing of cDNA samples)
- sequencing of PCR products

In 2008-2009 the UTSP is participating in the Cod Genome Project and contributes to sequencing and assembly of the cod genome. To face the challenge of *de novo* sequencing of this rather big eukaryotic genome, we have upgraded the lab facilities and borrowed another GS FLX instrument from Roche Norway which allows us to accomplish sequencing of the cod genome without negative influence on the sequencing of other samples at the UTSP service platform.

The platform offers bioinformatic analysis of the sequence data. To tackle the challenges of analysing the large amounts of data produced, 256 CPUs were bought and added to the Bioportal, www.bioportal.uio.no/. The Bioportal is a web-based service platform for high-throughput sequence analysis.

In summary, the UTSP lab is successfully up and running. With dedicated personnel operating the instrument and bioinformatic support, we can offer great service to our customers.

6.4.3 The Eco-Flux lab

For 2008 the lab had served several projects and activities. First and foremost a high number of data on carbon, nitrogen and phosphorus contents have been analysed from hundreds of aquatic (mostly plankton) and terrestrial (soil and vegetation) samples. In addition, data from dissolved organic carbon have been analysed from samples taken from outlets of Russian rivers into the Kara Sea, which have been exposed to UV to test for photooxidation. The chemostats have also been running for most of the year to provide fixed outputs of phytoplankton for various experiments. Finally, flow-cytometer use has been employed to begin testing methods for DNA quantification and ploidy levels in phytoplankton and metazoans. This will become part of a larger study on genome size regulation across taxa and phyla.

6.5 Facilities provided by external parties

Facilities provided to CEES members by external parties includes the Alpine Research Centre at Finse, the Biological Research Station at Drøbak, the Flødevigen Research Station, the Landscape Ecology Field Station of Evenstad, the University of Oslo research vessels, the Aquarium and animal facilities, the Phytotron and the Bioportal. For more information on these facilities, see our web pages.



Cod | Photo © Bastiaan Star

7 FINANCES

7.1 Accounting principles

Funding to the CEES is derived primarily from RCN (approximately 10 MNOK core-funding per year to the CEES), UiO (2 MNOK per year plus several positions) as well as funding through other sources defined as own funding. Our own funding can be divided into EU-funding and other international funding, funding from other RCN projects, other national public funding and that from commercial companies.

Expenditures are divided into salary costs, indirect costs, equipment, travel and representation, R&D services and other expenses (mainly running expenses to laboratory and fieldwork).

In addition to revenues and expenditures that are accounted for, we also have non-accounted revenues and expenditures mainly defined as the costs of personnel working within CEES, who receive their salaries from other parties. The value of these services is calculated using the official UiO budgeting procedures.

In this report we present accounting figures for 2008 and the budget for 2009.



Revenues and expenditures 2008/Budgeted revenues and expenditures 2009

Total funding													
Figures 2008				Budget 2009		Accounted revenues			Non accounted revenues 2008				
Figures 2008				Budget 2009		Figures 2008		Budgeted figures 2009		Figures 2008		Budgeted figures 2009	
RCN-CoE			6 338		12 455		6 338		12 455				
UiO			32 517		28 110		5 293		5 516		27 224		22 594
RCN – CEES related projects			43 247		46 470		43 247		46 100				370
Other national public funding			1 771		103				85		1 771		19
International funding			15 428		2 872		6 784		2 872		8 644		
Funding from commercial companies			1 366		1 014		1 366		1 014				
Transferred revenues from 2007			8 584		14 487		8 584		14 487				
Total funding			109 251		105 511		71 612		82 529		37 639		22 983
Accounted expenses 2008 (blue)/Budgeted expenses 2009 (white)													
	Total	RCN-CoE		UiO		RCN - CEES related projects		Other national public fund.		International funding		Funding from comm. comp.	
		2008	2009	2008	2009	2008	2009	2008	2009	2008	2009	2008	2009
Salary expenses	28 730	30 640	7 818	2 113	3 297	17 848	16 263	204	123	3 590	2 812	1 048	327
Indirect costs	6 093	7 567	546	1 153	853	4 470	4 971	82	24	385	396	359	170
R&D services	13 855	12 837	67	100	50	13 583	12 787			95		10	
Equipment	486	1 348	410	200		76	1 148						
Running costs	6 550	21 956	1 335	3 060	861	3 242	16 766	6		355	994	669	275
Travel and representation¹	1 412	1 850	826	100	586	1 750							
Total	57 126	76 198	7 111	12 331	3 993	6 811	51 935	292	147	4 425	4 202	2 086	772
Non-accounted expenses 2008 (blue)/Budgeted non-accounted expenses 2009 (white)²													
Salary expenses	19 113	11 856		13 567	11 467		370²	943	19²	4 603			
Indirect costs	18 526	11 127		13 657	11 127			828		4 041			
Total	37 639	22 983		27 224	22 594		370	1 771	19	8 644			
Balance 2008 (blue)/Budgeted Balance 2009 (white)													
Revenues	100 667	91 024	6338	12 455	28 110	43 247	46 470	1 771	103	15 428	2 872	1 366	1 014
Transf. revenues	8 584	14 486	2 154	1 380	263	1 563	5 599	9 627	395	-914	1 446	1087	367
Total expenses	94 765	99 181	7 111	12 331	31 217	29 405	39 219	52 305	2 063	13 069	4 202	2 086	772
Balance	14 486	6 330	1 381	1 504	1 563	268	9 627	3 792	103	1 445	116	367	609

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8.1 CEES-members

8.1.1 Core scientific staff

Name	Nationality	Position	Period	Funding	CEES share(%)
Brysting, Anne K	Norway	Assoc. Professor	Oct 07 -	UiO-Bio	75
Hansen, Thomas F	Norway	Professor	Oct 07 -	UiO-Bio	75
Hessen, Dag O	Norway	Professor	Oct 07 -	UiO-Bio	75
Hjort, Nils L	Norway	Professor	Oct 07 -	UiO-Math	25
Houle, David	USA	KB Professor	May 08 - Jun 09	UiO-Bio/ RCN-CoE	44
Jakobsen, Kjetill S	Norway	Professor	Oct 07 -	UiO-Bio	75
Kishino, Hirohisa	Japan	KB Professor II	Jan 08 - Dec 09	RCN-CoE	15
Lampe, Helene M	Norway	Professor	Oct 07 -	UiO-Bio	75
Mysterud, Atle	Norway	Professor	Oct 07 -	UiO-Bio	75
Nesbø, Camilla L	Norway	Researcher	Oct 07 - Aug 12	Dalhousie Univ/RCN	33
Ottersen, Geir	Norway	Senior Scientist	Oct 07 -	IMR	25
Rueness, Eli Knispel	Norway	Researcher / Dep Chair	Oct 07 - Sep 12	RCN-CoE	100
Schweder, Tore	Norway	Professor	Oct 07 -	UiO-Econ	65
Slagsvold, Tore	Norway	Professor	Oct 07 -	UiO-Bio	75
Stenseth, Nils Chr.	Norway	Professor, CEES Chair	Oct 07 -	RCN-CoE	100
Storvik, Geir	Norway	Professor	Oct 07 -	UiO-Math	38
Sætre, Glenn-Peter	Norway	Professor	Oct 07 -	UiO-Bio	75
Van Donk, Ellen	Netherlands	Assoc Professor II	Oct 07 -	UiO-Bio	20
Viljugrein, Hildegunn	Norway	Researcher	Oct 07 -	Vet.inst.	20
Vøllestad, L Asbjørn	Norway	Professor	Oct 07 -	UiO-Bio	75

8.1.2 Post docs and Researchers

Name	Nationality	Position	Period	Funding	CEES share (%)
Brinch, Christian	Norway	Researcher	Jan 08 - Dec 09	UiO-CEES	20
Donali, Espen	Norway	Researcher	May 08 - Mar 09	RCN	100
Durant, Joel Marcel	France	Researcher	Oct 07 - Apr 11	RCN	100
Durif-Latour, Caroline Marie	France	Researcher	Nov 04 - Jun 08	UiB/DN	50
Edeline, Eric	France	Researcher	May 08 - Aug 10	RCN	43
Espelund, Mari	Norway	Researcher	Oct 07 - Aug 09	RCN	100
Færøvig, Per Johan	Norway	Researcher	Jan 08 - Dec 08	RCN	80
Gabrielsen, Tove M	Norway	Researcher	Oct 07 - Feb 08	RCN	17
Grimholt, Unni	Norway	Researcher	Oct 07 - Dec 10	RCN	100
Gundersen, Hege	Norway	Researcher	Dec 08 - Sep 12	UiO	4

Name	Nationality	Position	Period	Funding	CEES share (%)
Hidalgo Roldan, José Manuel	Spain	Researcher	May 08 - Apr 09	UiO/RCN-CoE	67
Hjermann, Dag Øystein	Norway	Researcher	Oct 07 - Jan 11	VISTA/RCN	100
Johannessen, Lars Erik	Norway	Researcher	Oct 07 - Jun 08	RCN	100
Jorde, Per Erik	Norway	Researcher	Oct 07 - Dec 09	RCN-CoE	100
Knutsen, Halvor	Norway	Researcher	Oct 07 - Dec 09	RCN/IMR	5
Labra, Antonieta	Chile	Researcher	Oct 07 - Jul 09	RCN-CoE	100
Le Bohec, Celine	France	Researcher	Oct 08 - Nov 08	RCN	17
Liow, Lee Hsiang	Singapore	Researcher	Oct 07 - Dec 08	UiO/RCN-CoE	100
Loe, Leif Egil	Norway	Researcher	Oct 07 - Dec 11	RCN	100
Sæther, Stein Are	Norway	Researcher	Oct 07 - Dec 11	UiO-Bio/ RCN-CoE	100
Star, Bastiaan	Netherlands	Researcher	Sep 08 - Sep 09	RCN	29
Stige, Leif Christian	Norway	Researcher	Oct 07 - Mar 10	RCN	88
Trosvik, Pål	Norway	Researcher	Oct 08 - Oct 09	UiO-Bio	21
Vik, Jon Olav	Norway	Researcher	Oct 07 - Feb 08	UiO-CEES	17
Auterives, Chrystelle	France	Postdoc res. fellow	Oct 07 - Sep 08	RCN	75
Barson, Nicola Jane	UK	Postdoc res. fellow	Oct 07 - Oct 09	RCN	100
Borge, Thomas	Norway	Postdoc res. fellow	Oct 07 - Aug 08	RCN	67
Edeline, Eric	France	Postdoc res. fellow	Oct 07 - Apr 08	RCN	40
Guillot, Gilles	France	Postdoc res. fellow	Aug 07 - May 10	RCN	100
Hansen, Bo Terning	Norway	Postdoc res. fellow	Oct 07 - Dec 08	RCN	100
Holen, Øistein Haugsten	Norway	Postdoc res. fellow	Oct 07 - Jun 12	RCN/UiO	100
Kettle, Anthony James	UK	Postdoc res. fellow	Aug 08 - Jan 09	RCN	29
LeRouzic, Arnaud	France	Postdoc res. fellow*	Oct 07 - Mar 10	RCN/ EU/MC	100
Llope, Marcos	Spain	Postdoc res. fellow*	Oct 07 - Mar 09	EU/MC	100
Marcussen, Thomas	Norway	Postdoc res. fellow	Oct 07 - May 09	RCN	100
Nederbragt, Alexander Johan	Netherlands	Postdoc res. fellow	Oct 07 - Dec 11	GENPOINT/ RCN	100
Østbye, Kjartan	Norway	Postdoc res. fellow	Oct 07 - Feb 09	RCN	100
Otero Villar, Jaime	Spain	Postdoc res. fellow	May 08 - Apr 11	RCN	67
Patil, Vishwanath	India	Postdoc res. fellow	Oct 07 - Mar 08	UMB	25
Pavlicev, Michaela	Slovenia	Postdoc res. fellow	Dec 08 - Nov 10	UiO-Bio	8
Rounge, Trine Ballestad	Norway	Postdoc res. fellow	Aug 08 - Jul 11	RCN	67
Seligmann, Hervé	Luxembourg	Postdoc res. fellow	Aug 08 - Aug 10	UiO-Bio	67
Tooming-Klunderud, Ave	Norway	Postdoc res. fellow	Jan 08 - Jun 11	RCN	100
Askildsrud, Harald	Norway	Assist. lecturer	Jun 08 - Apr 08	RCN	63
Asmyhr, Maria G	Norway	Assist. lecturer	Jul 08 - Jul 09	UiO-CEES	50
Godvik, Inger Maren Rivrud	Norway	Assist. lecturer	Oct 07 - Aug 08	UiO-CEES	67
Hogner, Silje	Norway	Assist. lecturer	Jun 08 - Sep 08	UiO/RCN-CoE	38
Lund, Marthe	Norway	Assist. lecturer	Sep 08 - Nov 08	UiO-Bio	17
Qviller, Lars	Norway	Assist. lecturer	Dec 08 - Nov 09	UiO- Bio	8
Thoresen, Adine G	Norway	Assist. lecturer	Sep 08 - Nov 08	UiO/RCN-CoE	25
Veiberg, Vebjørn	Norway	Assist. lecturer	Oct 07 - Jan 08	UiO-Bio	8
Voje, Kjetil Lysne	Norway	Assist. lecturer	Oct 07 - Jun 08	UiO-Bio	46

* Marie Curie Individual Fellowship

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8.1.3 PhD-students

Name	Nationality	Position	Period	Funding	CEES share (%)
Atichem, Anagaw	Ethiopia	Research fellow	Oct 07 - Oct 11	NUFU	100
Ben Ari, Tamara M	France	Research fellow*	Oct 07 - Jan 10	EU/MC-EST	100
de Muinck, Eric	USA	Research fellow	Oct 08 - Sep 11	Folkehelseinst	25
Diekert, Florian K	Germany	Research fellow	Apr 08 - Jun 11	Hydro/RCN	75
Eikeset, Anne M	Norway	Research fellow	Oct 07 - Mar 09	RCN	100
Eriksen, Ane	Norway	Research fellow	Oct 07 - Sep 10	UiO-Bio	100
Espeland, Sigurd	Norway	Research fellow	Oct 07 - Dec 08	None	5
Godvik, Inger M R	Norway	Research fellow	Sep 08 - Aug 12	UiO-CEES	33
Griffin, Donald	USA	Research fellow*	Oct 07 - Dec 07	EU/MC-EST	100
Hegel, Troy	Norway	Research fellow	Jan 08 - Jun 08	EU/MC-EST	42
Heier, Lise	Norway	Research fellow	Oct 07 - Sep 10	UiO-Bio	100
Holmen, Johannes	Norway	Research fellow	Oct 07 -	None	100
Husek, Jan	Czech Rep.	Research fellow	Oct 08 - Sep 12	UiO-CEES	25
Junge, Claudia	Germany	Research fellow*	Oct 07 - Aug 10	EU/MC-EST	100
Jørgensen, Marte	Norway	Research fellow	Oct 07 - Mar 10	UiO-Bio	100
Kausrud, Kyrre	Norway	Research fellow	Oct 07 - Aug 09	For. and Landsc. Institute/RCN	100
Knudsen, Endre	Norway	Research fellow	Oct 07 - Mar 09	UiO-Bio	100
Meisingset, Erling	Norway	Research fellow	Jan 08 - Dec 08	Bioforsk	25
Minge, Marianne A	Norway	Research fellow	Oct 07 - May 09	UiO-Bio	100
Moe, Therese F	Norway	Research fellow	Oct 07 - Aug 10	UiO-Bio	100
Moland, Even	Norway	Research fellow	Oct 07 - May 09	RCN	100
Rounge, Trine B	Norway	Research fellow	Oct 07 - Jul 08	RCN	58
Rouyer, Tristan A	France	Research fellow*	Oct 07 - Dec 08	EU/MC-EST	100
Sabarro, Philippe S	France	Research fellow*	Oct 07 - Jan 10	EU/MC-EST	100
Sadykov, Alexander	Russia	Research fellow*	Oct 07 - Sep 09	EU/MC-EST	100
Sadykova, Dinara	Russia	Research fellow	Oct 07 - Aug 09	RCN	100
Serbezov, Dimitar	Bulgaria	Research fellow	Oct 07 - Aug 08	RCN/UiO	100
Siddiqui, Huma	Norway	Research fellow	Oct 07 - Feb 09	GENPOINT	100
Skog, Anna	Norway	Research fellow	Oct 07 - Dec 08	None	5
Stüken, Anke C	Germany	Research fellow*	Oct 07 - Aug 08	EU/MC-EST/RCN	61
Svennungsen, Thomas O	Norway	Research fellow	Oct 07 - Jan 10	UiO-Bio	100
Taugbøl, Annette	Norway	Research fellow	Oct 08 - Sep 12	UiO-CEES	25
Trosvik, Pål	Norway	Research fellow	Oct 07 - Oct 08	NOFIMA	80
Van Beest, Floris	Netherlands	Research fellow	Jan 08 - Dec 08	HIHM	50
Voje, Kjetil Lysne	Norway	Research fellow	Aug 08 - Jul 12	UiO- CEES	42
Yashchenko, Varvara	Russia	Research fellow*	Oct 07 - Apr 08	EU/MC-EST	27

* Marie Curie Early Stage Research Training Site

8.1.4 Administrative and technical support staff

Name	Nationality	Position	Period	Funding	CEES share(%)
Bakke, Hege Gilbø	Norway	Principal engineer	Jan 08 - Feb 11	RCN	100
Gaup, Hege Junita	Norway	Head engineer	Jun 08 - May 12	UiO-CEES	58
Herland, Anders	Norway	Principal engineer	Jan 08 -	UiO-Bio	100
Holst, Anne Margrete	Norway	Higher exec. officer	Oct 07 - Dec 08	UiO-CEES	80
Gundersen, Gry	Norway	Advisor	Oct 07 - Sep 11	UiO-Bio	100
Grønli, Katinka E	Norway	Head of Admin.	Oct 07 - Sep 12	RCN-CoE	100
Malmstrøm, Martin	Norway	Principal engineer	Oct 07 - Dec 08	RCN	100
Neerli, Emelita	Norway	Chief research techn.	Oct 07 -	UiO-Bio	50
Rygg, Kari Beate	Norway	Advisor	May 08 - Dec 10	UiO-Bio	61
Solbakken, Monica H	Norway	Principal engineer	Dec 08 - Nov 10	RCN	100
Skage, Morten	Norway	Head engineer	May 08 - Apr 11	RCN	100
Steen, Nanna Winger	Norway	Head engineer	Oct 07 -	UiO-Bio	100
Taugbøl, Annette	Norway	Principal engineer	May 08	RCN	8
Wallem, Tore	Norway	Higher exec. officer	Dec 07 - Mar 10	UiO-CEES	100

8.2 Associated research projects, education and teaching

8.2.1 Research projects

RCN-projects

Name	Project leader	Funding	Start	End
National resources for genomics, functional genomics and health research in Atlantic salmon and Atlantic cod	Grimholt U	RCN	2007	2010
Host-virus interactions in Atlantic salmon	Grimholt U	RCN	2007	2011
Spatial economic analysis in wildlife management	Gundersen H	RCN	2005	2008
Long term consequences of interspecific cross-fostering in the wild	Hansen BT	RCN	2005	2009
Statistical tools for studying genetic architecture	Hansen TF	RCN	2007	2011
Can nuisance growth of the aquatic macrophyte <i>Juncus bulbosus</i> be related to elevated nitrogen deposition as well as hydropower regulations?	Hessen DO, Andersen T	RCN/NIVA	2007	2011
Biogeochemistry in Northern Watersheds, a Reactor in Global Change	Hessen DO	RCN	2005	2010
Evolution of chloroplast replacements	Jakobsen KS	RCN	2004	2009
Evolution of chloroplasts: addressing the genomic processes behind acquisition of secondary and tertiary organelles	Jakobsen KS	RCN	2005	2010
Tools for microbial nucleic acid sample preparation for diagnostic and genomic analyses	Jakobsen KS	Genpoint/ RCN	2005	2009

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Name	Project leader	Funding	Start	End
Algal toxins & polyunsaturated fatty acids: a polyketide genomic approach to safe and efficient utilisation of microalgae in bioproduction	Jakobsen KS	RCN	2006	2009
Allopolyploid evolution in plants: patterns and processes within the genus <i>Viola</i>	Jakobsen KS	RCN	2006	2009
Ultra-high throughput sequencing platform	Jakobsen KS	RCN	2007	2013
Genome sequencing of cod by exclusive uses of ultra high-throughput sequencing technology	Jakobsen KS	RCN	2008	2011
Processes in the life history and dynamics of managed ungulate populations	Mysterud A	RCN	2004	2010
Natural and farmed habitat as a basis for production of red deer in Norway	Mysterud A	RCN	2007	2012
Land: Long-term ecological effects of sheep grazing in alpine ecosystems and its integration with management	Mysterud A	RCN	2008	2012
Biogeographic and population analyses of Thermotogales bacteria from hydrocarbon-rich environments	Nesbø C	RCN	2008	2013
Integrated statistical analysis based on likelihood and confidence: applications to the hare-lynx cycles and the status of bowhead whales	Schweder T	RCN	2005	2010
Hybridization in birds as studied by cross-fostering in the wild	Slagsvold T	RCN	2004	2009
Møbius 2000/NCS-Price/NFR-Aurora	Stenseth NC	RCN	2000	2009
ErNoclima - Collaborative network - French-Norwegian Climate-Ecology	Stenseth NC	RCN	2004	2009
Economically and ecologically sustainable fisheries management: optimising fish harvest while conserving seabird diversity	Stenseth NC	RCN	2005	2009
Long-term effects of oil accidents on the pelagic ecosystem of the Norwegian and Barents Seas	Stenseth NC	RCN	2006	2010
Spatiotemporal dynamics of introduced bark beetles: resource competition, invasion risk and management	Stenseth NC	RCN/	2006	2009
MPAs in coastal Skagerrak: a model system for understanding lobster demography and successful introduction of MPAs in temperate waters	Stenseth NC	RCN	2006	2009
Fishery- Induced Changes in Vital Components of a Large Pike Population	Stenseth NC	RCN	2006	2009
Functional genomics of phenotype plasticity of cod: a national consortium - GENOFISK	Stenseth NC	RCN	2007	2010
Linking physics and biology - Structuring of cod populations in the North Sea/Skagerrak water system	Stenseth NC	RCN	2007	2010
The possible role of zooplankton in modulating ecosystem effects of acute oil spills in the Norwegian and Barents Seas	Stenseth NC	RCN	2007	2010
Ultra High throughput sequencing national platform	Stenseth NC	RCN	2007	2009
Unravelling population connectivity for sustainable fisheries in the Deep Sea (EuroDEEP)	Stenseth NC	RCN	2007	2010
The genetic architecture of reproductive isolation	Stenseth NC	RCN	2008	2009

Name	Project leader	Funding	Start	End
I kjølvannet av ideen som forandret verden (Darwin 2009)	Stenseth NC	RCN	2008	2009
Oceanography and match-mismatch	Stenseth NC	RCN	2008	2011
Match-mismatching and trophic levels as a structuring force of ecosystems	Stenseth NC	RCN	2008	2011
Darwinjubileet 2009 – temakvelder	Stenseth NC	RCN	2008	2010
Signal evolution: adaptation and constraint	Sætre GP	RCN	2006	2009
Magnetoreception and magnetic compass orientation in the long distance migration of the European eel	Vøllestad LA	RCN	2004	2009
Integrated ecological and genetic approach to infer the spatio-temporal population-structure dynamics in small salmonoid populations	Vøllestad LA	RCN	2004	2008
Sticklebacks (<i>Gasterosteus aculeatus</i> L.) on the Norwegian coast: fresh water colonisation, divergence rates and adaptive speciation	Vøllestad LA	RCN	2006	2009
The early stages of adaptive divergence: the speed of evolution	Vøllestad LA	RCN	2007	2010
Modelling ecosystems under climate change: Windermere as a model lake system	Vøllestad LA	RCN	2008	2013
Declining long-term trends in Atlantic salmon abundance: inferring mechanisms using catch data for Norway and Scotland	Vøllestad LA	RCN	2008	2011

Other national public funding

Name	Project leader	Funding	Start	End
Sustainable use of husbandry: Ecological effects of sheep grazing in alpine habitats	Mysterud A	Municipalities/ Statskog	2000	2009
Socio-economic effects of fisheries-induced evolution	Stenseth NC	UiB/RCN	2008	2011
Analysis of eel time series from Norway	Vøllestad LA	DN	2007	2009

Projects funded by commercial companies

Name	Project leader	Funding	Start	End
Marine Ecosystem Response to a Changing Climate	Hessen DO	UNIFOB AS/RCN	2008	2011
Effects of oil spills in the water column. Economic consequences for the fisheries	Stenseth NC	HYDRO	2007	2009
Population dynamics and management of Norwegian Arctic Cod	Stenseth NC	HYDRO	2004	2010
Pandalus modell studie - BioSea II	Stenseth NC	IRIS	2008	2009
Risk assessment of fish stocks under oil exploration	Stenseth NC	Det Norske Veritas AS	2007	2008

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International projects

Name	Project leader	Funding	Start	End
Statistical Tools for studying genetic architecture	Hansen TF	EU-Marie Curie-Intra European Fellowship	2008	2011
Ecological and evolutionary response to climatic variation - Marie Curie Early Stage Research Training in Oslo (CEES-MCO)	Stenseth NC	EU-Marie Curie-EST	2006	2011
Plankton dynamics and global change: the North Sea regime shift	Stenseth NC	EU-Marie Curie-Intra European Fellowship	2007	2010
Fisheries-induced evolution (FinE)	Stenseth NC	EU-IAASA Østerrike	2007	2011
Regime shift in the Black Sea: a population dynamics and wavelet approach.	Stenseth NC	EU-Marie Curie-Intra European Fellowship	2008	2009

8.2.2 Education and teaching

Course name	Teaching services provided by:
BIO 1000: Elementary Biology	Hansen T, Knudsen E, Taugbøl A
BIO 1200: Biodiversity	Brysting AK, Godvik IMR, Lampe H, Sætre GP
BIO 2100: General Ecology	Hessen DO, Hjermann DØ, Slagsvold T
BIO 2110: Experimental Ecology	Mysterud A
BIO 2120: Evolutionary Biology	Brysting AK, Hansen TF, Sætre GP
BIO 2130: Bio Statistics	Heier L
BIO 3081: Animal Behaviour 1	Lampe HM, Slagsvold T
BIO 3100: Human Behavioural Ecology	Slagsvold T
BIO 4091: Animal Behaviour 2	Slagsvold T
BIO 4140: Life History and Climate	Ergon T, Hessen DO, Mysterud A, Vøllestad LA
BIO4200: Molecular Evolution	Sætre GP
BIO 4210/9210: Classification and Phylogeny	Brysting AK, Jørgensen MH
BIO 4220: Natural Selection and Adaptive Evolution	Holen ØH, Svenningsen TO, Sætre GP
BIO 4250: Evolution and Systematics of Organismal Groups: The Plant Kingdom	Brysting AK
BIO 4310: Limnology I	Hessen DO
BIO 4371: Fish Ecology	Vøllestad LA
BIO 5000: Introductory Course for Master Students	Hessen DO
BIO 9910: Adaptive Dynamics	Holen ØH, Kisdi E
ECON2130: Statistics 1	Schweder T
ECON4135: Applied Statistics and Econometrics	Schweder T
STK4020: Bayesian Statistics	Hjort NL
STK403: Modern Data Analysis	Storvik GO
STK4150: Environmental and Spatial Statistics	Hjort NL

CEES members supervised 36 master students in 2008; 15 of these completed their degree in this period.

8.3 CEEs events

8.3.1 Scientific events

Colloquium 1 Kick-off-meeting. The Norwegian Academy of Science and Letters, Oslo, 13-14 March 2008

CEES student conference. Hankø Fjordhotel, Oslo, 3-5 September 2008

Red Queen meeting. The Norwegian Academy of Science and Letters, Oslo, 18-19 August 2008

8.3.2 Public events

Darwin Day. Nils Chr. Stenseth: "Darwin's influence on our understanding of communication in animals and man". Andrew Carstairs McCarthy: "Flaws in language as clues to its prehistory". Simone Pika: "Our gesturing cousins: One approach to the evolution of language". Ulrike Aust: "Levels of categorization in animals and humans". Juliane Bräuer: "I know what you see: Visual perspective taking in apes and dogs". Tecumseh Fitch: "Language Evolution: The comparative approach and Darwin's contribution". 12 February 2008.

The Kristine Bonnevie Lecture on Evolutionary Biology. Geir Ellingsrud: "Opening remarks". Tora Aasland: "Gender balance at the University: Expectations to Universities and authorities". Rita R. Colwell: "Cholera, climate, and genomics: The saga of *Vibrio cholerae*". 2 September 2008.

8.3.3 Seminars with invited speakers

Name	Title and date of presentation
Flatt, Thomas	"Endocrine-genetic network regulation of drosophila life history" 4 Jan
Leimar, Olof	"A re-examination of the MacArthur-May theory of species packing" 18 Jan
Gyllenberg, Mats	"Adaptive dynamics of structured (meta) populations" 25 Jan
Henderiks, Jorijntje	"Plankton size matters: An evolutionary perspective" 1 Feb
Geritz, Stefan	"Resident-invader dynamics and the outcome of an invasion event" 8 Feb
Metz, Hans	"The geometry of macro-evolution: Links between Evo-Devo and adaptive dynamics" 15 Feb
Edeline, Eric	"Pathogen invasion generates a synergy with predators: Interplay between evolution and ecology" 22 Feb
Diekmann, Odo	"An etude concerning the evolution of virulence" 29 Feb
Möllmann, Christian	"Climate and ecosystem change in the Baltic Sea: Implications for fish stock recruitment" 7 Mar
Grindeland, John M	"Effects of plant polyploidy on plant-animal interactions" 13 Mar
Pavlicev, Mihaela	"Measuring evolutionary constraints by the dimensionality of the (phenotypic) matrices" 14 Mar
Brannström, Åke	"Modelling the structure and evolution of food webs" 28 Mar
Bouma, Menno	"Global epidemiology of malaria and plague: Do rising global temperatures really matter?" 4 Apr
Hoelzel, Rus	"Looking backwards to look forward: Conservation genetics in a changing world" 11 Apr
Omholt, Stig	"Why are salmonids pink?" 18 Apr
McNamara, John	"The importance of individual differences in the interaction between animals" 9 May
Cury, Philippe	"Ecosystem oceanography for global change in fisheries" 23 May

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Name	Title and date of presentation
Crone E, Elizabeth	"Pollen limitation and synchronous mast-seeding in a perennial wildflower" 30 May
Pelletier, Fanie	"Sexual selection, harvesting and eco-evolutionary feedbacks of wild populations" 6 Jun
Emerson, JJ	"Natural selection shapes genome wide patterns of copy number polymorphism in <i>D. melanogaster</i> " 10 Jun
Daily, Gretchen C	"The value of nature: Aligning economic forces with conservation" 11 Jun
Liebhold, Andrew	"Spatial dynamics of gypsy moth outbreaks" 13 Jun
Lie, Hanne	"Genetic diversity revealed in human faces" 17 Jun
Matthysen, Erik	"Landscape structure constrains the dispersal of a mobile songbird: a paradox?" 20 Jun
Sutherland, WJ	"Making conservation more effective" 22 Aug
Tomaiuolo, Maurizio	"Frequency, density and binding-affinity interactions can describe gamete recognition protein polymorphism" 29 Aug
Wolfenbarger, Lillian LaReesa & McCarty, John P	"Conservation, birds, agriculture, and plans to develop ecological forecasting using lessons from fisheries, forestry, and climate change biology" 12 Sep
Ptácnik, Robert	"The pool rules - metacommunities control diversity in aquatic microbes" 19 Sep
Foote, Michael	"On the evolution of geographic range" 26 Sep
Oxelman, Bengt	"Hierarchical and reticulate evolution in plants, with examples from <i>Sileneae</i> " 7 Oct
Piccolo, John	"Depth, velocity, and foraging success in two sympatric stream salmonids: implications for habitat selection and segregation" 10 Oct
ten Tusscher, Kirsten	"The role of genome and gene regulatory network architecture in the evolution of multi-trait polymorphism and sympatric speciation. Canalization increases the robustness to recombination" 24 Oct
Richter, Andries	"The evolution of social norms for common pool resource harvesting" 14 Nov
Taylor, EB	"Contact zones in char (<i>Salvelinus</i>) and sticklebacks (<i>Gasterosteus</i>): Implications for speciation" 21 Nov
Loeschcke, Volker	"Thermal adaptation and environmental stress: From selection experiments to gene expression studies and field releases" 28 Nov
Rahbek, Carsten	"Climate and large-scale patterns of diversity" 5 Dec

8.3.4 Awards and prizes

UiO's formidlingspris (University of Oslo's Research Dissemination Award): Dag O. Hessen. 17 June 2008

UiO's forskningspris (University of Oslo's Annual Research Prize): Tore Slagsvold. 17 June 2008

Honorary Doctor of the University of Oslo: Rita Colwell. 2 September 2008

Riksmålsprisen: Dag O. Hessen. 4 December 2008

8.4 Guests of CEES in 2008

8.4.1 Longer research visits (>1 month)

Name	Nationality	Home institution	Period
Aravena Cuevas, Guillermo	Chile	Universidad del País Vasco	Aug 08 - Nov 08
Birkeland, Erlend	Norway	Hedmark University College	Feb 08 - Mar 08
Boessenkool, Sanne	Netherlands	University of Otago	Nov 08 - Dec 08
Carpentier, Alexandra	France	Centre de Recherche en Écon.et Stat.	Jun 08 - Oct 08
De Ayala, Rosa M	Spain	Spanish National Council for Research	Jan 08 - Dec 08
de Largentaye, Tanguy	France	Centre de Recherche en Écon. et Stat.	Jun 08 - Oct 08
Fierst, Janna	USA	Florida State University	May 08 - Apr 09
Frigstad, Helene	Norway	University of Bergen	Apr 08 - Dec 08
Griffin, Donald	USA	Florida State University	Jul 08 - Dec 08
Hegel, Troy	USA	University of Alaska	Jan 08 - Jun 08
Hidalgo, Manuel	Spain	Institut Mediterrani d'Estudis Avançats	Jan 08 - May 08
Hollis, Brian	USA	Florida State University	Sep 08 - Oct 08
Kisdi, Eva	Finland	University of Helsinki	Jan 08 - Feb 08
Koyano, Hitoshi	Japan	Jochi Daigaku	Aug 08 - Oct 08
Le Bohec, Celine	France	Museum national d'Histoire naturelle	Oct 07 - Sep 08
Machu, Eric	France	Institut de Recherche pour le Développement	Mar 08 - Dec 08
Marks, Jessica	Norway	University of Bergen	Jan 08 - Dec 08
McCarty, John Paul	USA	University of Nebraska – Omaha	Aug 08 - May 09
Milner, Jos	UK	Hedmark University College	Oct 07 - Dec 08
Nilsson, Anna	Sweden	Lund University	Mar 08 - Dec 08
Nævdal, Eric	Norway	Frisch	Oct 07 - Dec 09
Olsen, Esben Moland	Norway	Institute of Marine Research	Oct 07 - Dec 08
Persson, Johnas	Sweden	Uppsala University	May 08 - Apr 09
Rike, Anne Gunn	Norway	Norwegian Geotechnical Institute	Mar 08 - Dec 08
Rouyer, Tristan	France	Institut français de recherche pour l'exploitation de la mer	Oct 07 - Dec 08
Saraux, Claire	France	Ecole polytechnique	Feb 08 - Jun 08
Stüken, Anke Corinna	Germany	Brandenburgische Techn. Univ. Cottbus	Oct 07 - Aug 08
Tian, Huidong	China	Chinese Academy of Sciences	Jul 08 - Jul 09
Veen, Thor	Netherlands	Rijksuniversiteit Groningen	Jan 08 - Feb 08
Wolfenbarger, Lillian La Reesa	USA	University of Nebraska – Omaha	Aug 08 - May 09
Xu, Lei	China	Chinese Academy of Sciences	Jul 08 - Jul 09
Yashchenko, Varvara	Russia	Sankt-Peterburgskij Gosudarstvennyj Univ.	Oct 07 - Apr 08

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8.4.2 Short term guests (>1 week <1 month)

Name	Nationality	Home institution	Period
Bengtson, Sven-Axel	Sweden	Lund University	Sep 08 - Sep 08
Brillinger, David R	USA	University of California, Berkeley	Sep 08 - Sep 08
Ciannelli, Lorenzo	USA	Oregon State University	Mar 08 - Apr 08
Damuth, John	USA	University of Texas at Arlington	Aug 08 - Aug 08
de Jong, Karen	Netherlands	NTNU	Jan 08 - Jan 08 Feb 08 - Feb 08
Foote, Michael	USA	University of Chicago	Sep 08 - Sep 08
Fortelius, Mikael	Finland	University of HelsinkiHelsingin Yliopisto	Aug 08 - Aug 08
Fowler, Mike	Finland	University of HelsinkiHelsingin Yliopisto	Feb 08 - Feb 08
Gavrilets, Sergey		University of Tennessee-Knoxville	Aug 08 - Aug 08
Halgrimsson, Benedikt	Canada	The University of Calgary	Oct 08 - Oct 08
Hendriks, Jorintje	Netherlands	University of Stockholm	Oct 08 - Oct 08 Nov 08 - Nov 08
Hunter-Jones, Eric	USA	Florida State University	Oct 08 - Oct 08
Liebhold, Andrew	USA	The Pennsylvania State University	Jun 08 - Jun 08
Lindén, Andreas	Finland	University of HelsinkiHelsingin Yliopisto	Jan 08 - Jan 08
Mable, Barbara	UK	University of Glasgow	Sep 08 - Sep 08
Orians, Gordon H	USA	University of Maryland	Aug 08 - Sep 08
Pavlicev, Mihaela	Slovenia	Washington University, St. Louis	Sep 08 - Oct 08
Pulido, Fransisco	Spain	Universidad Complutense de Madrid	Aug 08 - Aug 08
Richter, Andreas	Germany	University of Bremen	Nov 08 - Nov 08
Samia, Noelle	USA	Northwestern University	Mar 08 - Apr 08
Simpson, Carl	USA	Duke University	Aug 08 - Aug 08
Steffes, David Michael	USA	Florida State University	Sep 08 - Oct 08
Tackas, Peter		Florida State University	Sep 08 - Oct 08
Tomauiolo, Maurizio	USA	Florida State University	Aug 08 - Aug 08
Wagner, Günter	Germany	Yale University	Sep 08 - Oct 08

8.5 Product lists

8.5.1 Books and book chapters

- Hessen DO.** *Natur - hva skal vi med den?* Gyldendal Litteratur 2008 (ISBN 978-82-05-38231-2) 271 p.
- Labra A, Vidal MA.** *Herpetología de Chile. Chile: Science Verlag* 2008 (ISBN 978-956-319-420-3) 493 p.
- Mysterud I, Mysterud A.** Med lua i hånda. *Festskrift til Ivar Mysterud på 70-årsdagen.* Oslo: Biologisk institutt, Universitetet i Oslo 2008 (ISBN 978-82-90934-77-9) 287 p.
- Edeline E, Dufour S, Elie P** (2008). 'Proximate and Ultimate Control of Eel Continental Dispersal'. In: Van den Thillart, Guido *et al* (eds.). *Spawning Migration of the European Eel.* Amsterdam: Springer pp. 433-461 (ISBN 978-1-4020-9094-3)
- Hessen DO** (2008) 'Hvem skal redde verden?' In: Vetlesen, AJ (ed). *Nytt klima. Miljøkrisen i samfunnskritisk lys.* Oslo: Gyldendal Litteratur pp. 146-172 (ISBN 978-82-05-38473-6)
- Jonzén N, Lindén A, Ergon T, Knudsen E, Vik JO, Rubolini D, Piacentini D, Brinch C, Spina F, Karlsson L, Stervander M, Andersson A, Waldenström J, Lehikoinen A, Edvardsen E, Solvang R, Stenseth NC** (2008). 'Rapid advance of spring arrival dates in long-distance migratory birds'. In: Kennedy D (ed) *Science Magazine's State of the Planet 2008-2009: with a Special Section on Energy and Sustainability.* Washington DC: Island Press pp. 1959-1961 (ISBN 9781597264051)
- Labra A** (2008). 'Sistemas de comunicación en Reptiles'. In: Vidal MA & Labra A (eds.). *Herpetología de Chile.* Chile: Science Verlag pp. 547-577 (ISBN 978-956-319-420-3)
- Labra A, Vidal M** (2008). 'Dieta en anfibios y reptiles'. In: Vidal MA & Labra A (eds.). *Herpetología de Chile.* Chile: Science Verlag) pp. 453-482 (ISBN 978-956-319-420-3)
- Labra A, Vidal M, Solis R, Penna M** (2008). 'Ecofisiología de anfibios y reptiles. In: Vidal MA & Labra A (eds.). *Herpetología de Chile.* Chile: Science Verlag pp. 483-516 (ISBN 978-956-319-420-3)
- Ottersen G** (2008). 'Decline and recovery of Atlantic cod (Gadus morhua) stocks throughout the North Atlantic'. In: Kruse GH *et al* (eds.) *Resiliency of Gadid Stocks to Fishing and Climate Change.* Anchorage: Lowell Wakefield Fisheries Symposium pp. 39-66 (ISBN 978-1-56612-126-2)
- Ottersen G** (2008). 'Oversikt over økosystem Norskehavet'. In: Gjøsæter H *et al* (eds.) *Havets ressurser og miljø: Fisker og havet, særnr. 1-2008.* Bergen: Havforskningsinstituttet pp. 64-65

Stenseth, NC (2008). 'Plague and climate'. In: Relman DA *et al* (eds.) *Global Climate Change and Extreme Weather Events: Understanding the Contributions to Infectious Disease Emergence. Workshop Summary.* Washington: The National Academies Press pp. 130-145 (ISBN 0-309-12402-6)

Stenseth NC, Moe SJ, Kristoffersen AB (2008). 'Lucilia sericata laboratory populations: toxicant effects modified by stage-specific density dependence and stochasticity'. In: Resit Akçakaya H *et al* (eds) *Demographic Toxicity Methods in Ecological Risk Assessment.* Oxford: Oxford University Press pp. 20-39 (ISBN 9780195332964)

8.5.2 Publications in peer reviewed journals

- Akbari A, Marthinsen G, Lifjeld JT, Albrechtsen F, Wennerberg L, Stenseth NC, Jakobsen KS.** Improved DNA fragment length estimation in capillary electrophoresis. *Electrophoresis* 2008; 29(6):1273-1285
- Amrhein V, Johannessen LE, Kristiansen L, Slagsvold T.** Reproductive strategy and singing activity: blue tit and great tit compared. *Behavioural Ecology and Sociobiology* 2008; 62(10): 1633-1641
- Austrheim G, Mysterud A, Pedersen B, Halvorsen R, Hassel K, Evju M.** Large scale experimental effects of three levels of sheep densities on an alpine ecosystem. *Oikos* 2008; 117(6): 837-846
- Ben Ari TM, Gershunov A, Gange KL, Snäll T, Etestad P, Kausrud K, Stenseth NC.** Human plague in the USA: the importance of regional and local climate. *Biology Letters* 2008; 4(6): 737-740
- Bigg GR, Cunningham CW, Ottersen G, Pogson GH, Wadley MR, Williamson P.** Ice-age survival of Atlantic cod: agreement between palaeoecology models and genetics. *Proceedings of the Royal Society of London. Biological Sciences* 2008; 275(1631): 163-U13
- Bischof R, Mysterud A, Swenson JE.** Should hunting mortality mimic the patterns of natural mortality? *Biology Letters* 2008; 4(3): 307-310
- Brochmann C, Brysting AK.** The Arctic - an evolutionary freezer? *Plant Ecology & Diversity* 2008; 1(2): 181-195
- Brysting AK.** The arctic mouse-ear in Scotland - and why it is not arctic. *Plant Ecology & Diversity* 2008; 1(2): 321-327
- Carlson S, Olsen EM, Vøllestad LA.** Seasonal mortality and the effect of body size: a review and an empirical test using individual data on brown trout. *Functional Ecology* 2008; 22(4): 663-673
- Carlson S, Stenseth NC.** Fishery selection across the millennia. *Proceedings of the Royal Society of London. Biological Sciences* 2008; 275(1652): 2657-2658

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- Cazelles B, Chavez M, Berteaux D, Menard F, Vik JO, Jenouvrier S, **Stenseth** NC. Wavelet analysis of ecological time series. *Oecologia* 2008; 156(2): 287-304
- Ciannelli L, Fauchald P, Chan KS, Agostini VN, Dingsør GE. Spatial fisheries ecology: Recent progress and future prospects. *Journal of Marine Systems* 2008; 71(3-4): 223-236
- Coulson T, Ezard T, Pelletier F, Tavecchia G, **Stenseth** NC, Childs D, Pilkington J, Pemberton J, Kruuk L, Clutton-Brock T, Crawley M. Estimating the functional form for the density dependence from life history data. *Ecology* 2008; 89(6): 1661-1674
- Crawford RJM, **Sabarros** PS, Fairweather T, Underhill LG, Wolfaardt AC. Implications for seabirds off South Africa of a long-term change in the distribution of sardine. *South African Journal of Marine Science* 2008; 30(1): 177-184
- Cury PM, Shin YJ, Planque B, **Durant** JM, Fromentin JM, Kramer-Schadt S, **Stenseth** NC, Travers M, Grimm V. Ecosystem oceanography for global change in fisheries. *Trends in Ecology & Evolution* 2008; 23(6): 338-346
- Durant** JM, **Hjermann** DØ, **Sabarros** PS, **Stenseth** NC. Northeast Arctic Cod population persistence in the Lofoten-Barents Sea system under fishing. *Ecological Applications* 2008; 18(3): 662-669
- Durant** JM, Landys MM, Handrich Y. Composition of the body mass overshoot in European barn owl nestlings (*Tyto alba*): insurance against scarcity of energy or water? *Journal of Comparative Physiology. B, Biochemical, Systemic, and Environmental Physiology* 2008; 178(5): 563-571
- Edeline** E, **Ben Ari** TM, **Vøllestad** LA, Winfield IJ, Fletcher JM, James JB, **Stenseth** NC. Antagonistic selection from predators and pathogens alters food-web structure. *Proceedings of the National Academy of Science of the United States of America* 2008; 105(59): 19792-19796
- Eriksen** A, Wabakken P, Zimmermann B, Andreassen HP, Arnemo JM, **Gundersen** H, Milner J, Liberg O, Linnell JDC, Pedersen HC, Sand H, Solberg EJ, Storaas T. Encounter frequencies between GPS-collared wolves (*Canis lupus*) and moose (*Alces alces*) in a Scandinavian wolf territory. *Ecological Research* 2008
- Espeland** SH, Olsen EM, **Knutsen** H, Gjøsæter J, Danielssen DH, **Stenseth** NC. New perspectives on fish movement: kernel and GAM smoothers applied to a century of tagging data on coastal Atlantic cod. *Marine Ecology Progress Series* 2008; 372: 231-241
- Fewer DP, **Tooming-Klunderud** A, Jokela J, Wahsten M, Rouhiainen L, Kristensen T, Rohrlack T, **Jakobsen** KS, Sivonen K. Natural occurrence of microcystin synthetase deletion mutants capable of producing microcystins in strains of the genus *Anabaena* (Cyanobacteria). *Microbiology* 2008; 154: 1007-1014
- Gregersen** F, Haugen T, **Vøllestad** LA. Contemporary egg size divergence among sympatric grayling demes with common ancestors. *Ecology of Freshwater Fish* 2008; 17(1): 110-118
- Grimholt** U, Johansen R, Smith A. A review of the need and possible uses for genetically standardized Atlantic salmon (*Salmo salar*) in research. *Laboratory Animals. Journal of the Laboratory Animal Science Association* 2009; 43:121-126 (Published online 2008)
- Guillot** G. Inference of structure in subdivided populations at low levels of genetic differentiation – the correlated allele frequencies model revisited. *Bioinformatics* 2008; 24(19): 2222-2228
- Guillot** G, Santos F, Estoup A. Analysing geo-referenced population genetics data with Geneland: a new algorithm to deal with null alleles and a friendly graphical user interface. *Bioinformatics* 2008; 24(11): 1406-1407
- Gundersen** H, Solberg EJ, Wabakken P, Storaas T, Zimmermann B, Andreassen HP. Three approaches to estimate wolf *Canis lupus* predation rates on moose *Alces alces* populations. *European Journal of Wildlife Research* 2008; 54(2):335-346
- Hamdani EH, Lastein S, **Gregersen** F, Døving KB. Seasonal variations in olfactory sensory neurons - Fish sensitivity to sex pheromones explained? *Chemical Senses* 2008; 33(2): 119-123
- Hannellius U, Salmela E, Lappalainen T, **Guillot** G, Lindgren CM, von Döbeln U, Lahermo P, Kere J. Population substructure in Finland and Sweden revealed by the use of spatial coordinates and a small number of unlinked autosomal SNPs. *BMC Genetics* 2008; 9(54)
- Hansen** BT, **Johannessen** LE, **Slagsvold** T. Imprinted species recognition lasts for life in free-living great tits and blue tits. *Animal Behaviour* 2008; 75:921-927
- Hansen** TF. Macroevolutionary quantitative genetics? A comment on Polly (2008). *Evolutionary Biology* 2008; 35: 182-185
- Hansen** TF, **Houle** D. Measuring and comparing evolvability and constraint in multivariate characters. *Journal of Evolutionary Biology* 2008; 21(5): 1201-1219
- Haugen T, Aass P, **Stenseth** NC, **Vøllestad** LA. Changes in selection and evolutionary responses in migratory brown trout following the construction of a fish ladder. *Evolutionary Applications* 2008; 1(2): 319-335
- Hessen** DO. Efficiency, energy and stoichiometry in pelagic food webs; reciprocal roles of food quantity and food quality. *Freshwater Reviews* 2008; 1: 43-57
- Hessen** DO, Anderson TR. Excess carbon in aquatic organisms and ecosystems: Physiological, ecological, and evolutionary implications. *Limnology and Oceanography* 2008; 53(4): 1685-1696

- Hessen DO**, Ventura M, Elser JJ. Do phosphorus requirements for RNA limit genome size in crustacean zooplankton? *Genome* 2008; 51(9): 685-691
- Hessen DO**, Walseng B. The rarity concept and the commonness of rarity in freshwater zooplankton. *Freshwater Biology* 2008; 53(10): 2026-2035
- Hidalgo JMR**, Massuti E, Moranta J, Cartes J, Lloret J, Oliver P, Morales-Nin B. Seasonal and short spatial patterns in European hake (*Merluccius merluccius*, L.) recruitment process at the Balearic Islands (NW Mediterranean): the role of the environment on distribution and condition. *Journal of Marine Systems* 2008; 71(3-4): 367-384
- Hidalgo JMR**, Tomas J, Høie H, Morales-Nin B, Ninnemann U. Environmental influences on the recruitment process inferred from otolith stable isotopes in *Merluccius merluccius* off the Balearic Islands. *Aquatic Biology* 2008; 3: 195-207
- Hoset KS**, Le Galliard JF, **Gundersen G**, Steen H. Home range size and overlap in female root voles: effects of season and density. *Behavioural Ecology* 2008; 19(1): 139-145
- Kausrud H**, **Stige LC**, **Vik JO**, Økland RH, Høiland K, **Stenseth NC**. Mushroom fruiting and climate change. *Proceedings of the National Academy of Science of the United States of America* 2008; 105(10): 3811-3814
- Kausrud K**, **Mysterud A**, Steen H, **Vik JO**, Østbye E, Cazelles B, Framstad E, **Eikeset AM**, Mysterud I, Solhøy T, **Stenseth NC**. Linking climate change to lemming cycles. *Nature* 2008; 456(7218): 93-U3
- Klepaker TO**, **Østbye K**. Pelvic anti-predator armour reduction in Norwegian populations of the threespine stickleback: a rare phenomenon with adaptive implications? *Journal of Zoology* 2008; 276(1): 81-88
- Koenig J**, Boucher Y, Charlebois R, **Nesbø CL**, Zhaxybayeva O, Baptiste E, Spencer M, Joss M, Stokes H, Doolittle F. Integron-associated gene cassettes in Halifax Harbour: assessment of a mobile gene pool in marine sediments. *Environmental Microbiology* 2008; 10(4): 1024
- Le Bohec C**, **Durant JM**, Gauthier-Clerc M, **Stenseth NC**, Park YH, Pradel R, Grémillet D, Gendner JP, Le Maho Y. King penguin population threatened by Southern Ocean warming. *Proceedings of the National Academy of Science of the United States of America* 2008; 105(7): 2493-2497
- Le Galliard JF**, Cote J, Fitze PS. Lifetime and intergenerational fitness consequences of harmful male interactions for female lizards. *Ecology* 2008; 89(1): 56-64
- Le Rouzic A**, Alvarez-Castro JM. Estimation of genetic effects and genotype-phenotype maps. *Evolutionary Bioinformatics* 2008; 4: 225-235
- Le Rouzic A**, Alvarez-Castro JM, Carlborg O. Dissection of the Genetic Architecture of Body Weight in Chicken Reveals the Impact of Epistasis on Domestication Traits. *Genetics* 2008; 179: 1591-1599
- Le Rouzic A**, Carlborg O. Evolutionary potential of hidden genetic variation. *Trends in Ecology & Evolution* 2008; 23(1): 33-37
- Lima M**, Ernest SKM, Brown JH, Belgrano A, **Stenseth NC**. Chihuahuan Desert kangaroo rats: Nonlinear effects of population dynamics, competition, and rainfall. *Ecology* 2008; 89(9): 2594-2603
- Liow LH**, Fortelius M, Bingham E, Lintulaakso K, Mannila H, Flynn L, **Stenseth NC**. Higher origination and extinction rates in larger mammals. *Proceedings of the National Academy of Science of the United States of America* 2008; 105(16): 6097-6102
- Liow LH**, Fortelius M, Lintulaakso K, Mannila H, Flynn L, **Stenseth NC**. Reply to Vilar et al.: Sleep or hide, better for survival anytime. *Proceedings of the National Academy of Science of the United States of America* 2008; 105(35): E57-E57
- Massuti E**, Monserrat S, Oliver P, Moranta J, Lopez-Jurado JL, Marcos M, **Hidalgo JMR**, Guijarro B, Carbonell A, Pereda P. The influence of oceanographic scenarios on the population dynamics of demersal resources in the western Mediterranean: hypotheses for hake and red shrimp off the Balearic Islands. *Journal of Marine Systems* 2008 71(3-4): 421-438
- Moranta J**, Quetglas A, Massuti E, Guijarro B, **Hidalgo JMR**, Diaz P. Spatio-temporal variations in deep-sea communities off the western Mediterranean associated to different fishing exploitation rates. *Journal of Marine Systems* 2008; 71(3-4): 343-366
- Mysterud A**, Austrheim G. The effect of domestic sheep on forage plants of wild reindeer; a landscape scale experiment. *European Journal of Wildlife Research* 2008; 54(3): 461-468
- Mysterud A**, Bonenfant C, **Loe LE**, Langvatn R, Yoccoz NG, **Stenseth NC**. Age-specific feeding cessation in male red deer during rut. *Journal of Zoology* 2008; 275(4): 407-412
- Mysterud A**, Bonenfant C, **Loe LE**, Langvatn R, Yoccoz NG, **Stenseth NC**. The timing of male reproductive effort relative to female ovulation in a capital breeder. *Journal of Animal Ecology* 2008; 77(3): 469-477
- Mysterud A**, Yoccoz NG, Langvatn R, Pettorelli N, **Stenseth NC**. Hierarchical path analysis of deer responses to direct and indirect effects of climate in northern forest. *Philosophical Transactions of the Royal Society of London. Biological Sciences* 2008; 363(1501): 2359-2368

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- Nederbragt** AJ, Balasingham A, Sirevåg R, Utkilen H, **Jakobsen** KS, Anderson-Glenna MJ. Multiple-locus variable-number tandem repeat analysis of *Legionella pneumophila* using multi-coloured capillary electrophoresis. *Journal of Microbiological Methods* 2008; 73(2): 111-117
- Nedorezov LV, Löhr BL, **Sadykova** D. Assessing the importance of self-regulating mechanisms in diamondback moth population dynamics: Application of discrete mathematical models. *Journal of Theoretical Biology* 2008; 254(3): 587-593
- Nedorezov LV, **Sadykova** D. Green oak leaf roller moth dynamics: An application of discrete time mathematical models. *Ecological Modelling* 2008; 212(1-2): 162-170
- Nilsson** A, Alerstam T, Nilsson JÅ. Diffuse, short and slow migration among blue tits. *Journal of Ornithology* 2008; 149(3): 365-373
- Olsen EM, **Knutsen** H, Gjøsæter J, **Jorde** PE, Knutsen JA, **Stenseth** NC. Small-scale biocomplexity in coastal Atlantic cod supporting a Darwinian perspective on fisheries management. *Evolutionary Applications* 2008; 1(3): 524-533
- Ottersen** G. Pronounced long-term juvenation in the spawning stock of Arcto-Norwegian cod (*Gadus morhua*) and possible consequences for recruitment. *Canadian Journal of Fisheries and Aquatic Sciences* 2008; 65(3):523-534
- Pélabon C, **Hansen** TF. On the adaptive accuracy of directional asymmetry in insect wing size. *Evolution* 2008; 62(11): 2855-2867
- Pierotti MER, Knight ME, Immler S, **Barson** NJ, Turner GF, Seehausen O. Individual variation in male mating preferences for female coloration in a polymorphic cichlid fish. *Behavioural Ecology* 2008; 19(3): 483-488
- Ranta E, Kaitala V, Bjorklund M, Lundberg P, Bach LA, **Stenseth** NC. Environmental forcing and genetic differentiation in subdivided populations. *Evolutionary Ecology Research* 2008; 10(1): 1-9
- Rounge** TB, Rohrlack T, Kristensen T, **Jakobsen** KS. Recombination and selectional forces in cyanopeptolin NRPS operons from highly similar, but geographically remote *Planktothrix* strains. *BMC Microbiology* 2008; 8(141)
- Rouyer** TA, Fromentin JM, **Stenseth** NC, Cazelles B. Analysing multiple time series and extending significance testing in wavelet analysis. *Marine Ecology Progress Series* 2008; 359: 11-23
- Rouyer** TA, Fromentin JM, Menard F, Calzelles B, Briand K, Pianet R, Planque B, **Stenseth** NC. Complex interplays among population dynamics, environmental forcing, and exploitation in fisheries. *Proceedings of the National Academy of Science of the United States of America* 2008; 105(14): 5420-5425
- Saino N, **de Ayala** RM, Boncoraglio G, Martinelli R. Sex difference in mouth coloration and begging calls of barn swallow nestlings. *Animal Behaviour* 2008; 75: 1375-1382
- Saino N, **de Ayala** RM, Martinelli R, Boncoraglio G. Male-biased brood sex ratio depresses average phenotypic quality of barn swallow nestlings under experimentally harsh conditions. *Oecologia* 2008; 156(2): 441-453
- Saitoh T, **Vik** JO, **Stenseth** NC, Takanishi T, Hayakashi S, Ishida N, Ohmori M, Morita T, Uemura S, Kadomatsu M, Osawa J, Maekawa K. Effects of acorn abundance on density dependence in a Japanese wood mouse (*Apodemus speciosus*) population. *Population Ecology* 2008; 50(2): 159-167
- Schmickl R, **Jørgensen** MH, **Brysting** AK, Koch M. Phylogeographic implications for the North American boreal-arctic *Arabidopsis lyrata* complex. *Plant Ecology & Diversity* 2008; 1(2): 245-254
- Shalchian-Tabrizi K, Bråte J, Logares R, Klaveness D, Berney C, **Jakobsen** KS. Diversification of unicellular eukaryotes: cryptomonad colonisations of marine and fresh waters inferred from revised 18S rRNA phylogeny. *Environmental Microbiology* 2008; 10(10): 2635-2644
- Shalchian-Tabrizi K, **Minge** MA, **Espelund** M, Orr R, Ruden TA, **Jakobsen** KS, Cavalier-Smith T. Multigene Phylogeny of Choanozoa and the Origin of Animals. *PLoS ONE* 2008; 3(5) Suppl. e2098, 1-7
- Stenseth** NC. Effects of climate change on marine ecosystems PREFACE. *Climate Research* (CR) 2008; 37(2-3): 121-122
- Stenseth** NC. Pestilential complexities – Understanding medieval plague. *Science* 2008; 321(5890): 773-774
- Stenseth** NC. Proceedings B – a journal for organismal and population biological work of broad interest. *Proceedings of the Royal Society of London. Biological Sciences* 2008; 275(1651): 2537-2538
- Stenseth** NC, Atshabar BB, Begon M, Belmain SR, Bertherat E, Carniel E, Gage KL, Leirs H, Rahalison L. Plague: Past, present, and future. *PLoS Medicine* 2008; 5(1): 9-13
- Stenseth** NC, **Rouyer** TA. Destabilized fish stocks. *Nature* 2008; 452(7189): 825-826
- Stenseth** NC, Semenov MA. Climate Research: a focal point for the climate and ecosystem-impact research communities. *Climate Research* (CR) 2008; 37(1): 1-1
- Tooming-Klunderud** A, Fewer DP, Rohrlack T, Jokela J, Rouhiainen L, Sivonen K, Kristensen T, **Jakobsen** KS. Evidence for positive selection acting on microcystin synthetase adenylation domains in three cyanobacterial genera. *BMC Evolutionary Biology* 2008; 8(256)

- Tooming-Klunderud A**, Mikalsen B, Kristensen T, **Jakobsen KS**. The mosaic structure of the *mcvABC* operon in *Microcystis*. *Microbiology* 2008; 154: 1886-1899
- Trosvik P**, Rudi K, Næs T, Kohler A, Chan K-S, **Jakobsen KS**, **Stenseth NC**. Characterizing mixed microbial population dynamics using time-series analysis. *The ISME Journal* 2008; 2(7): 707-715
- van Dijk J, Gustavsen L, **Mysterud A**, May R, Flagstad Ø, Brøseth H, Andersen R, Andersen R, Steen H, Landa A. Diet shift of a facultative scavenger, the wolverine, following recolonization of wolves. *Journal of Animal Ecology* 2008; 77(6): 1183-1190
- van Donk E**, **Hessen DO**, Verschoor AM, Gulati R. Re-oligotrophication by phosphorus reduction and effects on seston quality in lakes. *Limnologica* 2008; 38(3-4): 189-202
- Vidal MA, Ortiz JC, **Labra A**. Intraspecific variation in a physiological thermoregulatory mechanism: the case of the lizard *Liolaemus tenuis* (Liolaeminae). *Revista Chilena de Historia Natural* 2008; 81(2): 171-178
- Vik JO**, **Brinch C**, Boutin S, **Stenseth NC**. Interlinking hare and lynx dynamics using a century's worth of annual data. *Population Ecology* 2008; 50(3): 267-274
- Vøllestad LA**, Olsen EM. Non-additive effects of density-dependent and density-independent factors on brown trout vital rates. *Oikos* 2008; 117(11): 1752-1760
- Watanabe Y, Dingsør GE, Tian Y, Tanaka I, **Stenseth NC**. Determinants of mean length at age of spring spawning herring off the coast of Hokkaido, Japan. *Marine Ecology Progress Series* 2008; 366: 209-217
- Weladji RB, Loison A, Gaillard JM, Holand O, **Mysterud A**, Yoccoz NG, Nieminen M, **Stenseth NC**. Heterogeneity in individual quality overrides costs of reproduction in female reindeer. *Oecologia* 2008; 156(1): 237-247
- Hansen TF**, Pienaar J, Orzack SH. A comparative method for studying adaptation to a randomly evolving environment. *Evolution* 2008; 62(8): 1965-1977
- Bøhn T, Primicerio R, **Hessen DO**, Traavik T. Reduced Fitness of *Daphnia magna* fed a Bt-transgenic maize variety. *Archives of Environmental Contamination and Toxicology* 2008; 55(4): 584-592
- Corbinau A, **Rouyer T**, Cazelles B, Fromentin JM. Time series analysis of tuna and swordfish catches and climate variability in the Indian Ocean (1968-2003). *Aquatic living resources* 2008. 21(3): 277-285
- Hessen DO**, Leu E, **Færøvig P-J**, Petersen SF. Light and spectral properties as determinants of C:N:P-ratios in phytoplankton. *Deep-sea research. Part II, Topical studies in oceanography* 2008; 55(20-21): 2169-2175
- Nævdal E**, Guttormsen AG, Kristofersson D. Optimal management of renewable resources with Darwinian selection induced by harvesting. *Journal of Environmental Economics and Management* 2008; 56(2): 167-179
- Sommer RS, Zachos FE, Street M, Joris O, **Skog A**, Benecke N. Late Quaternary distribution dynamics and phylogeography of the red deer (*Cervus elaphus*) in Europe. *Quaternary Science Reviews* 2008; 27(7-8): 714-733
- Sturner RW, Andersen T, Elser JJ, **Hessen DO**, Hood JM, McCauley E, Urabe J. Scale-dependent carbon:nitrogen:phosphorus seston stoichiometry in marine and freshwaters. *Limnology and Oceanography* 2008; 53(3): 1169-1180
- Zimonja MS, Rudi K, **Trosvik P**, Næs T. Multivariate curve resolution of mixed bacterial DNA sequence spectra: identification and quantification of bacteria in undefined mixture samples. *Journal of Chemometrics* 2008; 22(5-6): 309-322

8.5.3 Theses defence

- Haugen, Arne Sveinson**. 28 March 2008. Values behind biodiversity and moral duties - Development of a conceptual model for ethical environmental accounting using salmon farming as a case study. Unipub forlag 2008 Series of dissertations submitted to the Faculty of Mathematics and Natural Sciences, University of Oslo (710)
- Helland, Ingeborg Palm**. 14 November 2008. Ecology of a sympatric pair of coregonid fish: Species interactions and temperature. Unipub forlag 2008. Series of dissertations submitted to the Faculty of Mathematics and Natural Sciences, University of Oslo (795)
- Riisberg, Ingvild**. 30 May 2008. Genetic characterization of the marine ichthyotoxic flagellate *Pseudochattonella farcimen* (Heterokonta) and phylogenetic relationships among heterokonts. Unipub forlag 2008; 730: 34. Series of dissertations submitted to the Faculty of Mathematics and Natural Sciences, University of Oslo (730)
- Rounge, Trine Ballestad**. 3 June 2008. Evolution of nonribosomal peptide synthetase gene clusters in *Planktothrix*: genomic and population perspectives. Unipub forlag 2008 Series of dissertations submitted to the Faculty of Mathematics and Natural Sciences, University of Oslo (739)
- Smelhus, Anne M**. 23 June 2008. The future impact of nitrogen in the acidification of surface waters; modelling, empirical and experimental studies of changes in nitrogen leaching. Unipub forlag 2008 Series of dissertations submitted to the Faculty of Mathematics and Natural Sciences, University of Oslo (760)
- Trosvik, Pål**. 1 September 2008. Ecology of gut bacteria - microbial community dynamics investigated using an integrated approach. Unipub forlag 2008 Series of dissertations submitted to the Faculty of Mathematics and Natural Sciences, University of Oslo (775)

8.5.4 Invited talks and external meeting contributions by CEES members

- Barson NJ.** Contemporary evolution of a trade-off between timing of developmental stages and selection for rapid growth in European grayling (*Thymallus thymallus*). 2nd Euro Evo devo Meeting, Ghent, Belgium. 29 Jul - 1 Aug 2008
- Barson NJ.** Contemporary isolation-by-distance, but not isolation-by-time, among demes of European grayling (*Thymallus Thymallus*, Linnaeus) with recent common ancestors. Speciation Symposium, Sheffield, UK. 15 Sep - 17 Sep 2008
- Barson NJ.** Does selection for accelerated growth result in a trade off with predator escape response in divergent Grayling demes? 12th Evolutionary Biology Meeting at Marseilles, France. 24 - 26 Sep 2008
- Barson NJ.** Early stages of adaptive divergence in grayling in Lesjaskogsvatnet. Faglund seminar, NIVA, Oslo. 30 Oct 2008
- Barson NJ.** Early stages of adaptive divergence in grayling in Lesjaskogsvatnet. University of Bern seminar series in aquatic ecology & macroevolution. 16 April 2008
- Bjorbækmo MM, Brysting AK, Carlsen T, Høiland K, Geml J, Schumacher T, Vrålstad T, Kausrud H.** The ectomycorrhizal fungal community associated with alpine and arctic populations of *Dryas octopetala* along a latitudinal gradient. 21st New Phytologist Symposium, The ecology of ectomycorrhizal fungi. 10 - 12 Dec 2008
- Blaalid R, Carlsen T, Kausrud H, Brysting AK, Høiland K.** *Bistorta vivipara* and its mycobionts - a model system for ectomycorrhizal research. 21st New Phytologist Symposium, The ecology of ectomycorrhizal fungi. 10 - 12 Dec 2008
- Brysting AK.** Evolution of RNA polymerase genes in the polyploid *Cerastium alpinum* complex. Xth Symposium of the International Organisation of Plant Biosystematists. 2 - 4 Jul 2008
- Brysting AK.** Hybridization and Polyploidy - important evolutionary mechanism. Examples from alpine-arctic plants. Finse Research Workshop. 14 - 15 Apr 2008
- Budy P, Lobon-Cervia J, Gonzalez G, Vøllestad LA, Becares E.** A cross-continental, bioenergetic comparison of factors limiting the endemic and exotic distribution of brown trout under current and future environmental conditions. American Fisheries Society 138th Annual Meeting. 17 - 21 Aug 2008
- Carlsen T, Kumar S, Blaalid R, Brysting AK, Kausrud H.** Molecular detection of root-associated fungi - Comparing pyrosequencing with Sanger sequencing. The ecology of ectomycorrhizal fungi. 10 - 12 Dec 2008
- Diekert FK.** Strategic constraints on optimal management of the north-east arctic cod fishery. Eaere 2008. 25 - 28 June 2008
- Diekert FK.** Strategic Constraints on the optimal management of the North-East Arctic cod fishery. 15th Ulvön Conference on Environmental Economics. 17 - 19 Jun 2008
- Dingsør GE, Villar JO.** Long-term changes in fishery landings from the Canary-Saharan region. International symposium on Eastern boundary upwelling ecosystems: integrative and comparative approaches. 2 - 6 Jun 2008
- Durant JM.** Match-Mismatch: Trophic interactions and climate change. seminar at The Zoological Society of London. 24 Nov 2008
- Egge ES, Moe SJ, Andersen T, Stenseth NC, Ropstad E.** POPs exposure and population density stress in a 3-generations experiment: Zebrafish populations as a model system. 5th SETAC World Congress. 2 - 6 Aug 2008
- Eriksen A, Lampe HM, Slagsvold T.** Song learning and sexual misimprinting in cross-fostered great tits. ISBE 2008 - 12th International Behavioural Ecology Congress. 9 - 15 Aug 2008
- Espelund M, Gabrielsen TM, Nederbragt AJ, Jakobsen KS.** Kloroplastgenomet til *Karlodinium micrum*. Algesymposium 2008. 16 - 17 Sep 2008
- Fierst J, Hansen TF.** The Genetic Architecture of Reproductive Isolation. Society for Molecular Biology and Evolution Meeting. 9 - 13 Jun 2008
- Grimholt U.** Laksens kamp mot virus. Sluttseminar for Fuge I. 21 May 2008
- Guillot G.** Analysing spatial population genetics data with Geneland: models, algorithms and recent developments. Annual Meeting of the Society of Molecular Biology and Evolution. 5 - 8 Jun 2008
- Guillot G.** Bayesian spatial prediction of weed intensities from exact count data and image-based indices. French-Danish Workshop on Spatial Statistics and Image Analysis in Biology. 13 - 16 May 2008
- Guillot G.** Spatial organization of genetic diversity. ESF summer school in conservation Genetics. 1 - 7 Sep 2008
- Guillot G.** Spatial statistical models for landscape genetics. Third annual Conservation/Population Genetics Course. 9 - 13 Sep 2008
- Guillot G.** Statistical modelling for landscape genetics. Lisbon Museum of natural history course in landscape genetics. 8 - 9 May 2008

- Harstad H, **Bakke** H, Lukacs MF, Kjølglum S, Storset A, Moen T, **Grimholt** U. Assosiasjoner mellom MHC og resistens mot IPN i Atlantisk laks. Havbruk. 7 - 9 Apr 2008
- Harstad H, Lukas MF, Moen T, Kjølglum S, Storset A, **Grimholt** U. MHC and functional haplotypes in Atlantic salmon. MHC Class I Molecules at the Interface Between Biology and Medicine. 4 - 6 Jul 2008
- Junge** C. Population differentiation in recently established grayling populations. 14th Annual European Meeting of PhD Students in Evolutionary Biology. 8 - 13 Sep 2008
- Junge** C, Leder EH, Haugen T, **Barson** NJ, **Vøllestad** LA, Primmer CR. Population differentiation in recently established grayling populations. XX. International Congress of Genetics. 12 - 17 Jul 2008
- Jørgensen** MH. Polyploid evolution: the effect of genome duplication on Self-incompatibility systems in Arabidopsis. AMEGO 2008. 25 - 30 Aug 2008
- Jørgensen** MH, **Brysting** AK, Mable B. Polyploid evolution: the effect of genome duplication on self-incompatibility systems in Arabidopsis. Xth Symposium of the International Organisation of Plant Biosystematists. 2 - 4 Jul 2008
- Knudsen** E. Trekkfugler og klimaendringer: hva skjer, og hvordan kan vi registrere det? Faglig-pedagogisk dag 2008. 3 Jan 2008
- Kohler J, Aanes R, Hansen B, **Loe** LE, Severinsen T, Stien A. Parsimonious snow model explains reindeer population dynamics and ranging behavior. AGU Fall meeting. 15 - 19 Dec 2008
- Labra** A. "Herpetología de Chile": Una actualización necesaria después de 40 años. Simposio: Declinación global de anfibios: el caso de la rana de Darwin. 11 - 12 Sep 2008
- Labra** A. Neuroetología: Una aproximación experimental. Course. 11 Sep 2008
- Labra** A, Vidal M. "Herpetología de Chile": Una actualización necesaria después de 40 años. Sesión especial: "La integración cis-transandina: la puerta abierta dejada por Ceí". IX Congreso Argentino de Herpetología. 7 - 10 Oct 2008
- Labra** A, Vidal M. La integración cis-transandina: la puerta abierta dejada por Ceí. Aportes de José Miguel Ceí a la herpetología de Chile, IX Congreso Argentino de Herpetología. 7 - 10 Oct 2008
- Lampe** HM, Hagen SB, Johnson SCH. The adaptive significance of sound in multimodal warning signals. ISBE 2008. 9 - 15 Aug 2008
- Le Rouzic** A. Measurement of genetic effects. Measuring Evolution. 2 Oct 2008
- Liow** LH. Extinction risk and extinctions: learning from mammals and microfossils. Ecology and Evolution Departmental Seminar. 13 Oct 2008
- Liow** LH. Extinction vulnerability in extinct and recent mammals: body size matters. Guest lecture for MASSEX-TINCT group. 12 Jun 2008
- Liow** LH. Macroecological and macroevolutionary dynamics of marine plankton inferred through microfossils. The Micropalaeontological Society AGM. 19 Nov 2008
- Liow** LH. Modeling the rise and fall of species by using a mixed effects model. A new way of looking at species persistence in the fossil record. Geological Society of America Meeting. 5 - 9 Oct 2008
- Llope** M. Investigating a possible link between zooplankton changes and recent poor recruitment of herring in the North Sea. Linking Herring. 26 - 29 Aug 2008
- Llope** M. Is a changing North Sea environment making sustainable exploitation of herring more difficult? Effects of Climate Change on the World's Oceans. 19 - 23 May 2008
- Llope** M. Modelling the effect of the environmental condition on the seasonal distribution of chlorophyll in the North Sea. Advances in Marine Ecosystem Modelling Research Symposium. 23 - 26 Jun 2008
- Llope** M. Modelling the effect of the North Sea regime shift on the distribution of plankton functional groups and biomass. Advances in Marine Ecosystem Modelling Research Symposium. 23 - 26 Jun 2008
- Llope** M. Sea surface warming in the southern Bay of Biscay modulated by oceanic advection. Effects of Climate Change on the World's Oceans. 19 - 23 May 2008
- Llope** M. The effect of the North Sea regime shift on the distribution of plankton functional groups and biomass. Effects of Climate Change on the World's Oceans. 19 - 23 May 2008
- Minge** MA, Shalchian-Tabrizi K, **Jakobsen** KS. Chimeric proteomes: The plastid evolution of the green dinoflagellate *Lepidodinium chlorophorum*. Algesymposiet 2008. 16 - 17 Sep 2008
- Minge** MA, Silberman J, Orr R, Cavalier-Smith T, Shalchian-Tabrizi K, Burki F, Skjæveland Å, **Jakobsen** KS. Breviata anathema - an unusual Amoebozoa. Protist 2008. 21 - 26 Jul 2008
- Moen T, Kjølglum S, Sonesson A, Storset A, **Grimholt** U, Baranski M, Lien S. QTL og markør-assistert seleksjon for IPN i Atlantisk laks. Havbruk. 7 - 9 Apr 2008

8 APPENDICES

- Nilsson A.** Flyttfåglar och klimatförändringar. Populärvetenskapligt föredrag. 29 Apr 2008
- Ottersen G.** Helhetlig forvaltningsplan for Norskehavet. Ukens orientering. Ukens orientering - Havforskningsinstituttet. 27 Aug 2008
- Ottersen G.** Impacts of climate change on flatfish populations - processes. 7th International Flatfish Symposium Sesimbra. 2 – 7 Nov 2008
- Ottersen G.** Where was there cod during the ice age? Workshop on Cod and Future Climate Change. 17 – 20 Jun 2008
- Patil V, Bråte J, Klaveness D, Kluge R, Shalchian-Tabrizi K, Gislerød HR, Jakobsen KS.** Molecular phylogeny of *Hydrurus*, a fresh water chrysophyte rich in lipids. Havbrukskonferansen Tromsø 2008. 7 – 9 Apr 2008
- Sabarro PS, Durant JM, Crawford RJM, Stenseth NC.** Resource sharing between three seabirds in South Africa. Eastern Boundary Upwelling Ecosystems Symposium. 2 – 6 Jun 2008
- Sadykov A, Stenseth NC.** New approach to community population modelling. Helsinki Summer School on Mathematical Ecology and Evolution. 24 – 31 Aug 2008
- Shalchian-Tabrizi K, **Minge MA, Espelund M, Orr R, Ruden TA, Jakobsen KS, Cavalier-Smith T.** The Choanozoan *Ministeria vibrans*: Multigene Phylogeny and the Origin of Animals. Icrea Conference on The Origin and Early Evolution of Metazoans. 24 – 25 Oct 2008
- Stenseth NC.** CEES - Centre for Ecological and Evolutionary Synthesis. Life Science Seminar, Holmen Fjordhotell. 15 – 16 Apr 2008
- Stenseth NC.** Centre for Ecological and Evolutionary Synthesis (CEES). SFF-samling. 16 Sep 2008
- Stenseth NC.** Centre for Ecological and Evolutionary Synthesis CEES-CoE. SFF Forum. 16 – 17 Jan 2008
- Stenseth NC.** Climate Variation and Climate Change and the Dynamics of Plague Epidemics. Symposium on the Ecology of Plague and its Effects on Wildlife. 4 – 6 Nov 2008
- Stenseth NC.** Darwin's evolusjonslære før og nå. Naturfagkonferansen 2008. 24 Oct 2008
- Stenseth NC.** Ecological effects of climate change: an overview. ICZ-2008. 29 Aug 2008
- Stenseth NC.** Experiences from Marie Curie Actions - Early Stage Training Site (EST). NFR conference - New International Funding Opportunities. 25 Jan 2008
- Stenseth NC.** Forskningsledelse of forventning til administrasjonen. Forskning: Ledelse, administrasjon og organisering. 9 Oct 2008
- Stenseth NC.** Forskningsledelse og forventning til administrasjonen. NUAS konferanse. 13 Jun 2008
- Stenseth NC.** French-Norwegian Observatory for the analyses of the Ecological Impacts of Environmental Changes. French-Norwegian meeting. 20 Aug 2008
- Stenseth NC.** Hvordan lage en god ERC søknad? Infomøte: European Research Councils Starting Grants. 18 Sep 2008
- Stenseth NC.** Systemic Management, Fisheries and Ecosystems Services: From Patterns to Policy. Resilience conference in Stockholm. 16 Apr 2008
- Stenseth NC, Eikeset AM.** The economic repercussions of fishery-induced evolution. American Fishery Society, annual conference. 11 – 26 Aug 2008
- Stenseth NC, Jakobsen KS.** Functional genomics of phenotypic plasticity of cod: a national consortium (169604/S10). GENOFISK-meeting Bergen. 28 – 29 Apr 2008
- Svennungsen TO, Holen ØH.** Optimal egg rejection with external cues. Department seminar series. 6 May 2008
- Sæther SA.** Neutral vs. ecologically relevant variation in conservation genetics: phylogeography and local adaptation in the great snipe. Guest Lecture. 28 Feb 2008
- Vik U, **Jørgensen MH, Kauserud H, Brysting AK.** Phylogeography and population structure of *Dryas octopetala* analysed by microsatellite markers. Xth Symposium of the International Organisation of Plant Biosystematists. 2 – 4 Jul 2008
- Vøllestad LA.** Langtidstrender i fangst av Atlantisk laks i Norge og Skotland. Forskning for en bedre miljøforvaltning - Åpningskonferanse Miljø2015. 18 – 19 Nov 2008
- Vøllestad LA.** Populasjonsdynamikken til en akvatisk toppredator: effekten av høsting og klima. Forskning for en bedre miljøforvaltning - Åpningskonferanse Miljø2015. 19 – 19 Nov 2008
- Vøllestad LA.** Siste nytt om ålen i Norge.. Fagsamling Artsforvaltning 2008. 27 – 29 May 2008
- Vøllestad LA, Haugen T, Aass P, Stenseth NC.** Changes in selection and evolutionary responses in migratory brown trout following the construction of a fish ladder. American Fisheries Society 138th Annual Meeting. 17 – 21 Aug 2008
- Østbye K.** Adaptive radiation in the coastal Norwegian threespine stickleback. 2008. Invited talk related to research stay. University of Laval 2008. 4 May 2008
- Østbye K.** Ecological speciation in northern freshwater fishes: datasets of the European whitefish and the threespine stickleback. Invited talk related to research stay. 23 Apr 2008

Østbye K. Røya i Finsevatn: forskning, forvaltning og fiske. Årsmøte for Finse Skilag. 26 Jul 2008

Vøllestad LA. Lake Windermere pike - the effect of harvesting and environmental change. Invited guest lecture. 27 Nov 2008

Vøllestad LA. Ålen i Norge. Invited guest lecture. 3 Dec 2008

8.5.5 Internal CEES talks

Lindén, Andreas "Irruptive migration and population dynamics in great spotted woodpeckers". 18 Jan

Le Rouzic, Arnaud "Cryptic genetic variation and response to selection". 25 Jan

Guillot, Gilles "Inference of structure in subdivided populations at low levels of genetic differentiation. The correlated allele frequencies model revisited". 10 Nov

Hollis, Brian "Quantifying the effects of sexual selection on adaptation in *Drosophila melanogaster*". 13 Oct

Knudsen, Endre "Population-level plasticity and the dynamics of changing bird migration phenologies". 17 Nov

Seligmann, Hervé "How many functions for tRNAs in human mitochondria". 6 Oct

Helland, Ingeborg Palm "Ecology of a sympatric pair of coregonid fish: Species interactions and temperature". 17 Nov

Kettle, Anthony James "Impact of climate fluctuations on the life cycle of the European eel". 8 Sep

Persson, Jonas "A large scale lake fertilization project (Fi-Pla)". 27 Oct

Liow, Lee Hsiang "Modeling the rise and fall of fossil species". 22 Sep

Leif Egil Loe "Inverse density dependent emigration in male red deer". 1 Dec

Boessenkool, Sanne "Relict or coloniser? Extinction and range expansion of penguins in southern New Zealand". 8 Dec

Slagsvold, Tore "A new hypothesis on sex roles and reversed sexual dimorphism in raptors". 10 Nov

8.5.6 Popular papers

Godvik IMR, Mysterud A, Loe LE, Kleveland K, Veiberg V, Langvatn R. Her finner du hjorten! *Jakt og fiske* 2008; 137(4): 44-46

Godvik IMR, Mysterud A, Loe LE, Kleveland K, Veiberg V, Langvatn R. Hjortens vandring og bruk av leveområdet i Sogn og Fjordane. *Hjorteviltet: fagtidsskrift om elg, hjort og rådyr* 2008; 18: 76-81

Hessen DO. Det naturlige ved naturen. *Bedre Skole* 2008 (2): 86-87

Hessen DO. Mennesket: stein eller leire? *Impuls: Tidsskrift for psykologi* 2008; 62(1): 4-9

Hessen DO. Naturen i mennesket og mennesket i naturen. *Ratatosk (Trondheim)* 2008; 2(3/4): 129-130

Hessen DO. Solar radiation and the evolution of life. *Skrifter og avhandlinger - Det Norske Videnskaps-Akademi II, Hist.-filos klasse* 2008 p. 123-136

Hessen DO. Verden ble aldri den samme. *Museumsnytt* 2008; 56(5/6): 6-6

Holand Ø, Nieminen M, Røed KH, **Mysterud A.** Kalving og klima – kalvingstidspunktet i et skiftende miljø. *Villreinen* 2008; 23: 10-14

Moland E, Dahl E, Knutsen JA, Misund OA, **Vøllestad LA.** Alarmklokkene ringer for ålen. *Fiskaren* 2008 p. 26-26

Mysterud A. Hjortelusflua dreper. *Jeger, Hund og Våpen* 2008; 13(6): 128-128

Mysterud A. Sett rådyr. *Jeger, Hund og Våpen* 2008; 13(6): 128-128

Nederbragt AJ, Jakobsen KS. Genomsekvensering og andre "high throughput" applikasjoner ved hjelp av 454 pyro-sekvensering – en ny FUGE service plattform. *NBS-nytt* 2008; 32(2): 9-13

Vøllestad LA. Fisken i Englands største innsjø studeres. *Klima* 2008; 8(5): 38-39

8.5.7 Press coverage

In 2008, CEES featured in a total of 391 appearances in media, including TV, radio and newspaper articles. All of these can be found on the CEES web pages: www.cees.uio.no/news/cees-in-media/2008/ See also section 4.5 "CEES in media".

8.5.8 Radio and TV

Hessen DO. Ekspertenes vyer for 2033. NRK TV - *Schrødingers katt*. 13 Dec

Moland E. Vil bevare storhummeren. NRK TV – *Distriktsnyheter*. 25 Mar

Slagsvold T. Travle trekkfuglar. NRK TV - *Ut i naturen*. 6 Jun

Hessen DO. Kårer beste fjellbok. NRK TV - *Møre og Romsdal*. 10 Jun

Slagsvold T. Et kjøttetende råskinn. NRK TV - *Ut i naturen*. 7 Jul

Østbye K. Fiskenes Don Juan. NRK1 TV - *Ut i naturen*. 26 Aug

Østbye K. Fisk med dametekke. NRK TV - *Ut i naturen*. 28 Aug

Voje KL. Reportasje om Darwinekspedisjonen. NRK TV - *Schrödingers katt*. 2 Dec

Voje KL. I fotsporene til Darwin. NRK TV - *Newton*. 9 Nov

Minge MA. Superstreng, program nr. 97. Kanal24 Radio. 8 Mar

Stenseth NC. Torskefisket må begrenses. NRK Nordnytt Radio, Troms og Finnmark. 23 Apr

Voje KL. Rett før avreise, Darwinekspedisjonen. NRK Radio - *Verdt å vite*. 18 Sep

Kausrud K. NRK P2 Radio - *Verdt å vite*. 13 Nov

Høiland K, Stenseth NC. Darwin-domene kapret. *Aftenposten*. 13 Oct

Vetlesen AJ, Hessen DO. Handler på førevarprinsippet. *Aftenposten*. 27 Oct

Moland E, Dahl E, Knutsen JA, Misund OA, Vøllestad LA. Alarmklokkene ringer for ålen. Fiskeribladet *Fiskaren*. 12 Nov

Stenseth NC, Kausrud KL, Rueness EK, Wallem T, Eikeset AM, Høiland K. Kritikken mot Darwin. *Dagsavisen*. 20 Nov

8.5.9 Magazines and newspaper articles

Hessen DO. Varm klode, kaldt hode. *Aftenposten*. 19 Feb

Nævdal E. Høyrevridd samfunnsøkonomi. *Dagbladet*. 28 Feb

Hessen DO. Klimaendringer til det bedre? *Aftenposten*. 14 Mar

Stenseth NC, Hjermann DØ, Eikeset AM. *Fedrelandsvennen*. 25 Mar

Moland E, Alf Ring Pettersen. Kaptein Nemos dødsrike. *Bergens Tidende*. 28 Mar

Moland E, Pettersen AR. Verdens fiskerier fortjener oppmerksomhet mer enn noen gang. *Bergens Tidende*. 28 Mar

Natur og Ungdom, Norges Naturvernforbund, WWF, Vetlesen AJ, **Hessen DO**, et al. Hensynet til naturen må komme først. *Vesterålen* 17 Apr

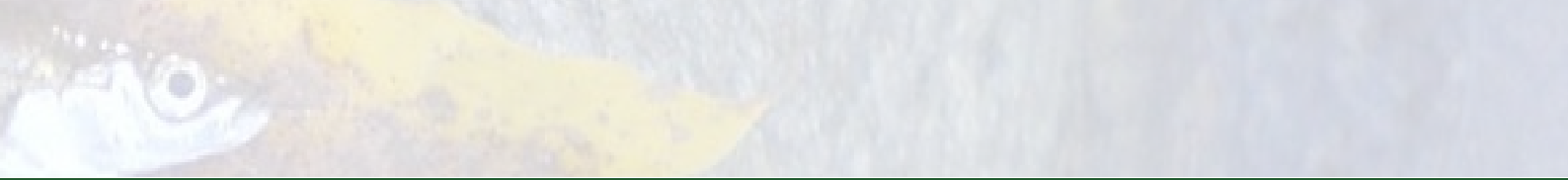
Hessen DO. Kvantitetstyraniet. *Morgenbladet*. 18 Apr

Vetlesen AJ, Hessen DO. To måter å ta feil på. *Aftenposten*. 18 Apr

Hessen DO, Vetlesen AJ. Tvil og viten i klimasaken. *Verdens Gang*. 9 May

Hansen BT. Den postdoktorale tredemølla. *Forskerforum*. Sep

Vetlesen AJ, Hessen DO. Alvoret ved to grader. *Aftenposten*. 24 Sep





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$$\begin{aligned}
 A^*(D_1, D_2) &= \frac{\partial}{\partial D_1} \left[\frac{\ln[F(D_1)] - \ln[F(D_2)]}{S(D_2) - S(D_1)} \right] \\
 &= \frac{\left(\frac{d}{dD_1} \ln[F(D_1)] \right) (S(D_2) - S(D_1)) + \left(\frac{d}{dD_1} S(D_1) \right) (\ln[F(D_1)] - \ln[F(D_2)])}{(S(D_2) - S(D_1))^2} \\
 &= \frac{\frac{d}{dD_1} \ln[F(D_1)] + \left(\frac{d}{dD_1} S(D_1) \right) \left(\frac{\ln[F(D_1)] - \ln[F(D_2)]}{S(D_2) - S(D_1)} \right)}{S(D_2) - S(D_1)} \\
 &= \frac{\frac{d}{dD_1} \ln[F(D_1)] + \left(\frac{d}{dD_1} S(D_1) \right) A^*(D_1, D_2)}{S(D_2) - S(D_1)}
 \end{aligned}$$