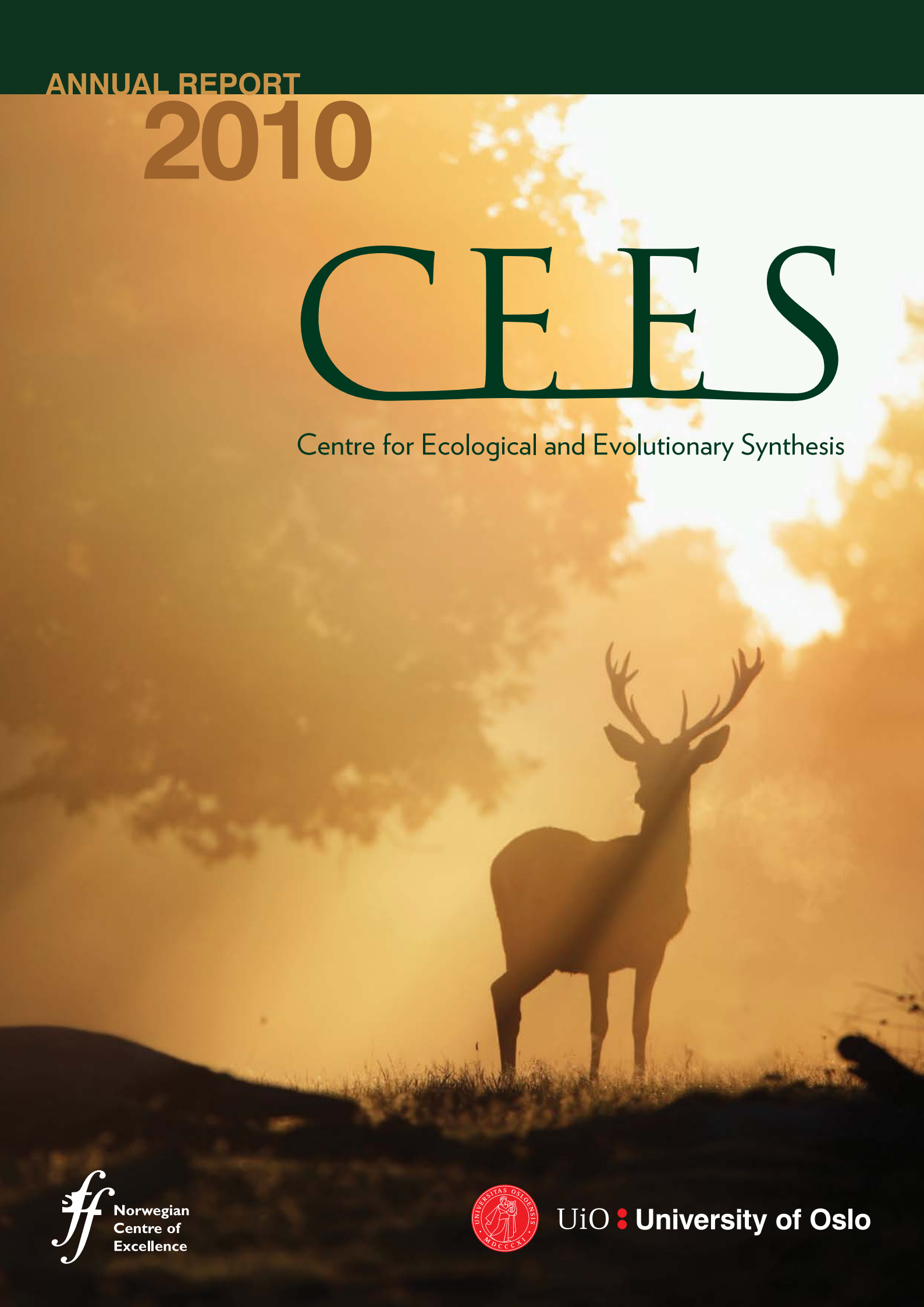
ANNUAL REPORT

2010

CEES

Centre for Ecological and Evolutionary Synthesis



Norwegian Centre of Excellence

UiO : 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 2010 CEES consists of 156 members including students, researchers, technical and administrative personnel. The centre has a core group of 21 employees of which 12 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 and one by the Institute of Marine Research. One employee is a visiting scientist at the University of Alberta, Canada, and two Kristine Bonnevie Professors (from Florida State University, USA, and the Norwegian University of Life Sciences) has been working with us. The CEES staff represented 27 nationalities in 2010.

CEES members published 4 book chapters and 132 articles in peer reviewed journals in 2010. The majority of these results lie within the core scope of CEES. 90 invited talks and presentations at conferences were conducted by CEES members at various international fora. The centre hosted 61 guest speakers, primarily from abroad and received 58 international and national visitors (staying at least one week).

Approximately 44 MNOK of the total 2010 budget of 113,7 MNOK came from the 52 externally funded research projects conducted by CEES in 2010. Most of these were funded through the Research Council of Norway. CEES is also involved in various EU-funded projects. 12 CEES projects were funded by the private sector. 13 new projects were started in 2010.

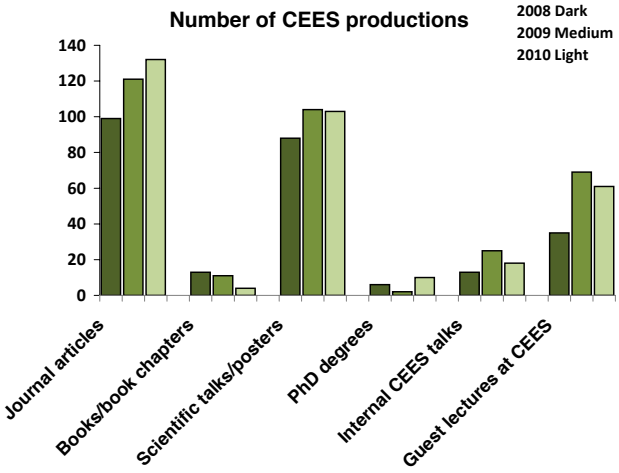
The CEES maintained a high level of visibility in 2010, both in scientific journals and in the media.

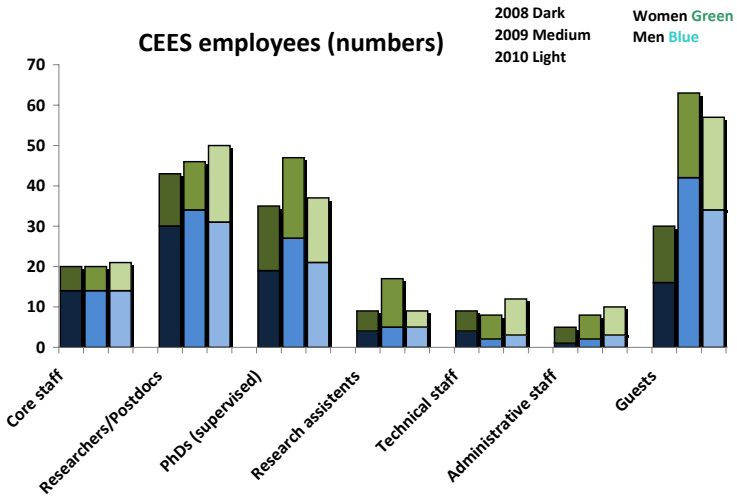
The work of CEES is, as originally planned, structured into *Colloquia* and *Themes*, the former being focused projects each lasting for three years and the latter consisting of ongoing, long-term work that is accommodated within the centre. This year *Colloquium* 1 ('Selection and evolvabilty: concepts measurements and statistics') completed the major part of its work and *Colloquium* 2 ('Bridging the gap between genomics and evolutionary biology') started up with a kick-off meeting 11-12 November. *Colloquium* 2 is expected to be important in regard to the overall goal of bringing ecology and evolution closer together – as well as bridging the gap between genomics and evolutionary biology.

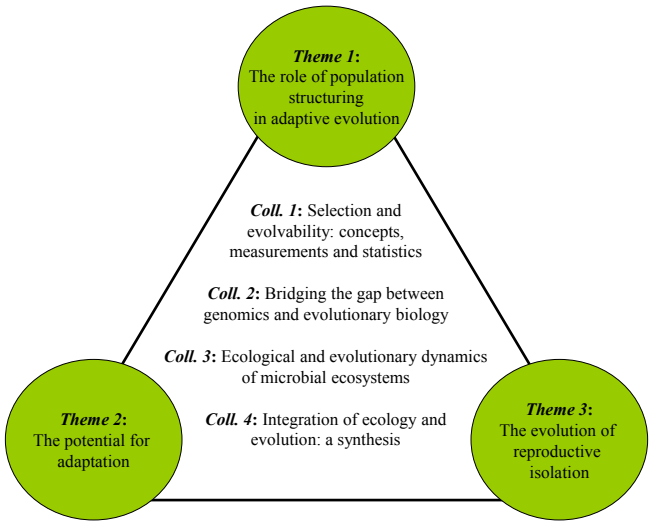
The completion of the full genome sequence of the Atlantic cod, using our two 454-sequencing machines, received widespread global attention. With the full genome sequence we have a basis for addressing many interesting biological questions at a detailed genetic level, such as what makes some individuals mature at an earlier age and smaller size – questions relating directly to our more theoretical work on harvest-induced evolution. We expect to make full use of this data and anticipate that the centre will greatly benefit from it in the coming years; the completion of the Atlantic cod genome and the opportunities that arise from it provide a system in which to interlink all three CEES Themes, forming a model for *Colloquium* 2: 'Bridging the gap between genomics and evolutionary biology'. This will further implement our goal of an integrated centre.

CEES supervised 26 Master and 33 PhD students in 2010, and was also involved in the teaching of 14 PhD/Master courses and 7 Bachelor courses. 6 new PhD student was employed, and 10 PhD student and 6 master students completed their degrees. The CEES graduate school held its yearly conference at Holmen Fjordhotell with 120 delegates.

CEES IN BRIEF CONT.







The structure of the scientific work within CEES.

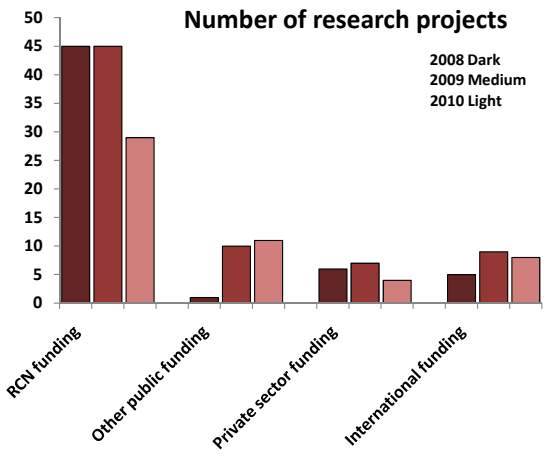


TABLE OF CONTENTS

1 THE CHAIR'S COMMENTS

2010 was the third full year for CEES, a productive year that saw the centre further develop as a consolidated Centre of Excellence with a good body of publications, new scientific advances and exciting topical events. We have generated much media interest in our work, both national and international. CEES is stabilising at a size of around 150 members and with an annual budget of 110-120 million NOK. Personally, I feel that this is a good size: sufficiently large to maintain a broad spectrum of expertise and avoid intellectual isolation, whilst remaining manageable to lead and administrate effectively. Collaborative interaction has improved within the centre: CEES is a unified centre.

The main activities of *Colloquium* 1 ('Selection and evolvability: concepts, measurements and statistics') were completed during the Spring term of 2010 with the finalising of several papers, of which I would particularly like to highlight two: Firstly, the theme of Günter P. Wagner's article 'The measurement theory of fitness' in *Evolution* (volume 64, pp. 1358-1376) has been central to the progress of this *colloquium*; your contributions to CEES are greatly appreciated – thanks, Günter. Secondly, I hope that the article 'Measurement and Meaning in Biology' (*The Quarterly Review of Biology* 86[2], pp. 3-34, accepted for publication at the end of 2010 and published in March the following year) will attract much attention within the field of evolutionary biology. The *colloquium* has exposed many problems in how ecologists and evolutionary biologists approach quantitative measurements. In particular, the numerical demands of statistical models often perplex the biological meaning of measurements. *Colloquium* 1 has developed a language for identifying and analysing such problems that will prove useful in a much wider context. I would like to thank all members of *Colloquium* 1 for their contributions, directly and indirectly, to this work, with special thanks to David Houle (Kristine Bonnevie Professor within *Colloquium* 1) and Thomas F. Hansen: your dedicated work at CEES is greatly appreciated.

***Colloquium* 2** ('Bridging the gap between genomics and evolutionary biology'), led by Stig W. Omholt (Kristine Bonnevie Professor within *Colloquium* 2) and Kjetill S. Jakobsen, started with a kick-off meeting in autumn 2010. Experts in various fields including ecology, evolution, genomics, theoretical biology and statistics attended. It is expected that work within this *colloquium* will contribute to the increased use of molecular information (such as the genome of Atlantic cod and other fish and vertebrates) in the ecological and evolutionary studies that are conducted at the centre. Research evolving from the completion of the full cod genome will be a key element in the work of *Colloquium* 2.

The sequencing of the entire Atlantic cod genome was highlighted in the annual report for 2009. We have not yet reported this fully in a scientific journal; assembly, functional annotation, sequence variation and comparative analyses are time-consuming activities – particularly true in this case since cod is the first large genome to be sequenced with a pure 454-sequencing approach. Nevertheless, work on this project has been a highlight of the year. The bioinformatic analyses conducted in 2010 have revealed that Atlantic cod have unusual immune systems. Cod lacks the normal MHC II pathway for defence against extracellular microbial infections and parasites and have an expanded MHC I repertoire. In addition, the innate immune system is unusual in how bacterial pathogens are handled. Our findings have implications for functional and evolutionary understanding of the vertebrate immune system. These results are highlighted in an article that was written in 2010 and due to be published in 2011. I will elaborate on this in the next annual report.

CEES's work on the Atlantic cod in the Barents Sea/Lofoten system continues to deliver insightful results that link ecology, evolution and bioeconomics. Studies have shown that an evolutionary focus may help to explain changes in maturation of cod, and that evolutionary ef-

Chair Nils Chr. Stenseth © Eva C. Simensen

fects can influence economic outcomes and the optimal quota. Furthermore, these studies indicate that potentially larger gains can be made by significantly enlarging the current mesh sizes, and conclude that the careful selection of catch equipment should be recognised as an important tool for fisheries management. Climate change and its important role in the Barents Sea is one of the main focuses of CEES; our researchers have been able to identify some of the key mechanisms of how climate directly and indirectly affects this important fishing ground. For instance, by combining historical data from Russian and Norwegian surveys, our researchers have recently been able to deduce how the survival of young fish is affected by temperature in several ways: by affecting body growth and the abundance of predators and prey (zooplankton). We have recently embarked on an ambitious project on the ecology, evolution and management of marine ecosystems in close collaboration with the Institute of Marine Research.

The ecology and evolution of ungulate populations is an area of research that continues to yield exciting results at CEES. Our researchers have demonstrated that, to a large extent, climate determines the behaviour of deer. Behavioural studies provide critical information when attempting to predict future effects of global climate change, as they enable us to foresee when effects may reach critical thresholds, for example when ice sheets cover areas so large that reindeer are no longer able to buffer effects by relocating their homerange.

Our work on the ecology of microbial systems (primarily gut bacterial communities) continues to generate encouraging results and openings for new research questions. The time-series approach that was developed at CEES has been applied to microbial communities both in the laboratory and in *in vivo* settings. The analytical techniques we use have enabled us to decipher how microbes interact in community settings. We are currently

extending these studies to incorporate genomic features, and how they affect biotic interactions. This work also links to our research on plague systems. In 2010, this research was expanded to focus more on the pathogen itself, whilst still employing our ecological modelling approach, which continues with collaborative links to Chinese research groups.

Training of young researchers is an integral part of our work. In this respect 2010 was a very good year, with a total of 10 PhD students successfully defending their thesis. The Dean of the Faculty of Mathematics and Natural Science commended the high number of successful PhD defences within CEES during the doctoral creation ceremony at the end of the year.

Supporting the young members of CEES is given high priority. In 2010 we organised a 'Young Researcher's Day' ('De unges dag' in Norwegian) to provide an arena for the young members of the centre, without the presence of the older, tenured members. The day contained activities designed to promote synthesis and collaboration between members, along with discussions and workshops. Suggestions made by participants, such as a daily communal CEES coffee break, were noted and put into action. I am very thankful to Eli K. Rueness, the Deputy Chair, for her superb orchestration of this event, and to all the participants for their contributions to this event and to CEES as a whole.

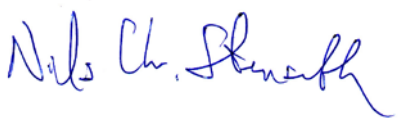
Press coverage of the centre continues to be comprehensive, with a wide scope across diverse national and international media. In each month of 2010, numerous media items involving CEES members were published/broadcast, including regular appearances in the national daily newspapers (e.g. *Aftenposten, Dagsavisen, Morgenbladet*) and research press (e.g. *forskning.no, forskningsradet.no, Teknisk Ukeblad*), along with popular radio broadcasts (Norwegian *NRK P2* and Swedish *P4*) and items in international media outlets including *ScienceNews, BBC, The Economist* and *The Telegraph*, to name a few. The dissemination of the centre's work and science in general to a broad audience is greatly facilitated by such coverage and something we encourage.

CEES, together with 9 other Nordic research groups, secured funding for a new Nordic Centre of Excellence, NorMER (the Nordic Centre for Research on Marine Ecosystems and Resources under Climate Change) with CEES as its governing institution. 30.5 million NOK was pledged by Nordforsk, with a further 35.5 million NOK coming from the collaborating institutions. NorMER will train 15 new PhD students and 5 Postdocs over the next 5 years, all of whom will focus, directly or indirectly, on cod. CEES's competence in both classical biological disciplines and genome sequencing will be of great value to this work. Marine ecosystems are under increasing pressure from both high exploitation rates and anthropogenic climate change. NorMER will develop advanced tools to update and inform biological population models, which will be used by scientists and policy makers to adapt economic and fishery harvest models so healthy stocks of cod can be maintained under changing climatic and socioeconomic conditions. Through this new centre, a new generation of interdisciplinary researchers will be established with experience in combining physical, biological, social and economic aspects of ecosystem management.

The midterm review of CEES was prepared during the autumn of 2010. This involved taking stock of the centre's achievements and carefully reviewing our strategies on how best to proceed, assuming the centre is allowed to continue (which we expect to be the case). Whilst we concluded that no major changes are necessary at this stage, we recognised a need for further actions to be implemented in order to bring together the broad spectrum of competence within CEES, to better consolidate the centre and synthesize ecology and evolution. The conclusions of the midterm review process are not yet finalised, but I can say at the time of writing that we are encouraged by some of the comments made by our scientific reviewers, for example: "*There is no doubt that CEES is considered to be a very attractive place to work as it has a critical mass of good researchers, which does not exist to the same extent in many other places in the world*". I will return to this topic in the next annual report, when the conclusions of this review process are complete.

The Scientific Advisory Board (SAB) had its annual meeting on 3-4th September 2010. Whilst CEES's achievements and "*tremendous potential*" were emphasised, the SAB expressed continued concern that further measures are required to encourage synthesis of CEES's ecological and evolutionary components. One of the actions taken in response to this has been an increased focus on 'harvesting-induced evolution'; this involves bringing together CEES's broad expertise to apply a combined theoretical and empirical (field and molecular) approach, using both marine fish and terrestrial mammals as examples. Also worth mentioning in this regard is our internal lunch-to-lunch seminar 'Merging of genomics and life history biology' (March 2010). Thanks to the contributions from the young researchers in particular, this seminar resulted in a proposal – and subsequent RCN funding of a project on fisheries induced evolution and climate change, combining our more classical marine work with genomics. The SAB further recommended that we try to integrate the fast (typically ecological) and slow (typically evolutionary) processes into a unified conceptual model framework. We are approaching this both through our work on the ecological and evolutionary effects of harvesting mentioned above, and through our research on the evolution of virulence in a dynamic ecological system.

Thanks. Again, it is my great pleasure to thank all of the scientists, at all levels, at CEES for the dedication and hard work that make CEES the Centre of Excellence that it is. Thanks to the Board and the SAB for their valued expertise and guidance and a final thank you to CEES's technical and administrative staff for your vital contributions to the running of the centre.



2 MANAGEMENT AND ADMINISTRATION

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

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 CEES, and to provide a good cooperative relationship between our host, the Department of Biology, 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. The Chair and the Head of Administration at CEES are also part of the management team at the Department, participating in weekly meetings with the Department head and his team.

The CEES Core consists of the faculty members that have committed to allocating their research time to the centre. The Core serve as an advisory group for the Chair. Within this advisory group we find the *Theme* and *Colloquia* leaders, who are responsible for the scientific progress within their respective *Themes*/*Colloquia*.

Professor Atle Mysterud has been appointed to be in charge of running administration of fieldwork related resources, while a CEES Lab Board has been appointed to administrate the running of the CEES laboratories. In 2010 the lab board consisted of Kjetill S. Jakobsen, Eli K. Rueness, Anne K. Brysting, Ave Tooming-Klunderud and Nanna W. Steen. For the full mandate, see the CEES website.

In 2010 the CEES administration was led by Katinka E. Grønli. The administration prepares general correspondence, the budget, accounting figures and reports. It is in charge of the daily routines, is involved in handling the CEES personnel and assists in general communication, the development of proposals for external funding and in running the CEES website.

The Department of Biology has allocated two full-time Advisors in research administration to the centre. In 2010 Gry Gundersen and Kari Beate Rygg held 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 and implementing projects, developing proposals and in the reporting of existing projects. They also assist in all matters related to the administrative support functions within the centre. Both Gry Gundersen and Kari Beate Rygg have been on maternity leave parts of 2010, with most of the responsibility for their tasks going to Katinka E. Grønli during this period. Additionally, the Department of Biology has allocated one full-time Advisor in research administration, responsible for coordinating the cod genome project and general administration of the sequencing activities at the Norwegian Sequencing Centre. In 2010 Sissel Jentoft held this position.

Principal Executive Officer Eva I. Grøttland is employed to provide personnel and financial support functions to the centre. Higher Executive Officers Tore Wallem and Jayne Lambrou are employed to maintain and development our website, organise scientific outreach events, and to facilitate meetings, conferences, seminars and short courses at the centre, as well as providing general administrative support to the centre and its staff.

CEES and the Department of Biology employ an Executive Officer to deal with the preparation of financial transactions and assist with travel arrangements and reimbursement procedures, housing and general bureaucratic matters for guests and new employees. Morten Kjeldseth Pettersen was temporarily in this post until June 2010. In October 2010 the post was filled by Camilla M. Tømta. Jostein S. Henriksen is temporarily employed (20 %) as extra help at CEES, assisting with miscellaneous tasks.

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

All financial transactions are jointly authorised by Nils Chr. Stenseth and either Katinka E. Grønli or Eva I. Grøttland. The resolutions are executed by the economy section at the Department of Biology, which also provides help with budgets and accounting analysis, reports, etc.

General IT support is provided by the Department of Molecular Biosciences.

All administrative support required for the students (from Bachelor to PhD level) is provided by the Department at which the students are enrolled. For most of our students that is the Department of Biology. An exception is the running of our Marie Curie Early Stage Training Fellows (MC-EST), which in 2010 was supported administratively by Gry Gundersen and Katinka E. Grønli.

Front line personnel support in 2010 was provided by Katinka E. Grønli and Eva I. Grøttland, and professional handling of personnel matters (contracts, payment routines etc.) is provided by the administration services at the Faculty of Mathematics and Natural Sciences.

Orange ladybird (*Halyzia sedecimguttata*) © Øistein Holen

The Board and the Scientific Advisory Board

The CEES Board is an administrative body that meets approximately twice a year to focus on strategic and control functions as well as approving budgets, accounts and annual reports. CEES Board members are listed in the table to the right. For more details, including the board mandate, see the CEES website.

The CEES Scientific Advisory Board (SAB) has been appointed by the CEES Board. The SAB had its annual meeting on 3–4 September 2010, and the advice from the SAB was, as usual, honest, critical and highly constructive.

The Board	Specialisation and home institution
Reidun Sirevåg (Chair)	Microbiologist, University of Oslo
Sven-Axel Bengtson	Ecologist, Lund University, Sweden
Tyge Greibrokk	Professor at the Department of Chemistry and member of the Board of the Faculty of Mathematics and Natural Sciences, University of Oslo
Rolf A. Ims	Ecologist, University of Tromsø, Norway
Trond Schumacher	Chair of the Department of Biology, University of Oslo
Bernt Øksendal	Mathematician, CoE Centre of Mathematics for Applications, University of Oslo

Comments by the Board Chair: Reidun Sirevåg

The CEES board had two meetings in 2010, on 3rd April and 14th October. At these meetings the expenditures and budget were presented and approved. In some cases the budget has been adjusted in accordance with improved knowledge and experience regarding requirements and costs of the centre. This has also been taken into account for the long-term budget. The presentation of the economy was clear and concise, making it easy to grasp.

CEES has its own administrative staff, separate from those at the Department of Biology. In 2010 there were some changes in personnel that resulted in a relatively "flat" structure where each person has his or her main responsibility for the various work areas, e.g. support related to research proposals, devising contracts, drawing up budgets, assistance in financial matters and reporting on the progress of projects.

In 2010 efforts were made by CEES to follow both the general and more specific advice provided by the SAB at their board meetings in 2009 and 2010. The Board is aware that the SAB has emphasised the need for CEES to address the so-called "big questions" within the research fields of the centre, and also to increase collaboration and integration among the groups. Thus, in order to follow up on the suggestions by SAB, special attention has been given to provide a meeting place for the young researchers and Ph.D. students. Accordingly, a 'Young Researcher's Day' ('De unges dag' in Norwegian) was arranged for February 2010. One objective was to promote interdisciplinary thinking among the participants through workshops and other activities. Judging from oral and written reports, these activities were valued highly by the participants.

A major issue in the autumn of 2010 was the CEES mid-term report and self-evaluation, which were submitted to RCN at the end of November as background material for the forthcoming mid-term evaluation of the centre. The Board was invited to discuss this document and also to propose suggestions and input.

The overall impression of the Board is that CEES is highly productive, well organised and well integrated in the mother institution.

Several SAB members commented that although excellent ecological and evolutionary work is being carried out at the centre, synthesis of the two areas is still lacking. The potential of the staff, however, and in particular the postdocs/researchers, was emphasised, as well as that of many of the ongoing projects. It was suggested that CEES consider reducing some activities, and the observation was made that researchers that work actively in groups are generally more excited and creative. The newly introduced one-on-one talks between CEES and SAB members were greatly appreciated and will be part of future SAB meetings. The recommendations from the SAB was given orally to the CEES leader team, followed by a written summary that was distributed to and discussed with the CEES core members.

The Scientific Advisory Board	Specialisation and home institution
Rita R. Colwell (Chair)	Microbiologist, University of Maryland, US
Tim Coulson	Population biologist, Imperial College, London, UK
David R. Brillinger	Statistician, University of California, Berkeley, US
Edward J. Feil	Microbiologist, University of Bath, UK
Barbara Mable	Evolutionary Biologist, University of Glasgow, UK
Anne Magurran	Behavioural Ecologist, University of St. Andrews, UK
Gordon H. Orians (Corresponding member)	Evolutionary Biologist, University of Washington, Seattle, US

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

The CEES team has produced significant findings from its research and published widely and well. The Scientific Advisory Board continues to be highly complimentary to the Chair, Staff, and Scientists of the centre. The quality of the research and its strong focus on selected themes, notably integration of genomics with the major activities of the centre, indicate that the centre team addressed fully the recommendations made to CEES in our earlier report. Genomics was an area highly recommended by the Scientific Advisory Board as an appropriately powerful tool in studies of evolution and ecology. It is being used effectively by the team and some excellent results have been achieved. However, greater integration of ecology and evolution is recommended, as this is a defining objective of CEES and is a key component of its strategic plan. That is, it is a point of uniqueness for the centre and should be highlighted in its work.

The research on plague, notably the bacterial system of *Yersinia pestis* and its ecology and environmental habitat should receive greater attention, as this avenue of study offers a paradigm for understanding ecology and evolution at the microbial level. The work done to date on plague by the centre team has been excellent, reflected in the high quality of journal publications. This work can be woven well into the overall direction of the centre. Integration and synergism are defining characteristics of the centre, as proposed in its founding criteria, and the overall research would benefit from more attention paid to assuring the integration of the themes of research and maximum synergism amongst the researchers and the work itself.

Support for younger members of the centre is critical, as the future of the science rests with them. The young talent that has been recruited to CEES is excellent. An effort made to provide larger conceptual thinking and guidance for these young faculty and staff will bring significant reward to the centre, notably in its becoming recognized as a centre of Excellence for both the country and internationally.

The Scientific Advisory Board continues to urge the centre to follow clearly established priorities, as this will maintain both health and vitality for the centre and to the research undertaken. The midterm assessment is critical and the substantial progress made to date should be reflected in the report. The Scientific Advisory Board finds the centre to be effective in its founding objectives, namely to provide valuable integration of ecology, evolution, and the environment. The centre's productivity is outstanding and the talent represented by the centre team is clearly excellent, measurable by several parameters, notably competiveness, international recognition, and scientific output of the first quality. In summary, the Scientific Advisory Board believes the centre has made truly significant progress and already ranks amongst the best of its peers.

3 SCIENTIFIC ACTIVITY

Organisation of the research

As a team we target numerous obstacles for an ecological and evolutionary synthesis using old and new data from the field and the lab. Our research is organised around three mutually dependent *Themes*: 1) The role of population structuring in adaptive evolution. This year we have focused on effects of habitat fragmentation, on early stages of genetic diversification and on the ecology of microbial communities. 2) The potential for adaptation. In 2010 we particularly focused on human induced evolution, e.g. effects of size selective hunting and fishing. 3) The evolution of reproductive isolation. We have chosen to focus mainly on genetic aspects of reproductive isolation in 2010. Within each research *Theme*, there is a demand for integration of ecological realism into evolutionary theory, and for evolutionary thinking into ecological modelling. In order to face problems of integrative work, such as conceptual and semantic confusion, and to promote communication across the various research fields (that each have their own limiting assumptions), we will assign targeted projects in the form of four multidisciplinary *Colloquia*, each of three-year duration. Here we will bring together staff and visiting scientists with experience from a wide range of biological and methodological systems. Each *Colloquium* will make an excellent setting for inviting highly qualified scientists to collaborate and thus contribute to the overall objectives of the centre. The topics of the *Colloquia* are: 1) Selection and evolvability: Concepts, measurements and statistics. 2) Bridging the gap between genomics and evolutionary biology. 3) Ecological and evolutionary dynamics of microbial ecosystems. 4) Integration of ecology and evolution: A synthesis.

Scientific highlights in 2010

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

This *Colloquium* focuses on conceptual, statistical and theoretical issues concerned with quantification in biology, with special emphasis on evolutionary biology. It has involved the collaboration of David Houle (Florida State University), Günter Wagner (Yale University), and Hirohisa Kishino (Tokyo University). The main activities took place from summer 2008 to summer 2009 when David Houle spent a sabbatical year at Oslo as invited Kristine Bonnevie professor. After this year, the work in the *Colloquium* continued with frequent visits of both Houle and Wagner to Oslo.

While many biological disciplines have achieved a high level of statistical sophistication, biology generally lags behind other scientific fields such as physics, psychometry, and economics in its attention to problems of measurement, i.e. to the relationship between data and reality. Formal measurement theory is a mathematical discipline that studies this relationship, but it has rarely been applied to biology. A sub-goal of the *Colloquium* is to introduce formal measurement theory to ecology and evolutionary biology. More generally, we aim to analyse the quantification of central concepts in evolutionary biology, ecology, and genetics. Concepts such as constraint, evolvability, fitness, rate of evolution, dispersal, and competition are crucial to theory in these fields, and these have all been heavily investigated from theoretical and statistical points of view. What is lacking, however, is attention to the process of quantification of these concepts. How can they be measured in ways that are concordant with their role in theoretical models? For each concept, we examine the theoretical context and models that provide it with meaning, and then investigate the ways in which the concept is quantified, and look at the statistical methods and problems involved in its study.

We discuss problems regarding scaling, transformations, and comparisons across traits and species in meta-analyses and comparative studies. We put particular 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 theoretical meaningfulness may be further obscured by transformations of the data, significance testing, etc.

The scientific output of the *Colloquium* has been rich, but also diffuse in that it is spread across a large number of papers and projects from the *colloquium* members, their students and collaborators. Some of the more focused results to date are: 1) A large review/perspective paper on measurement theory in *Quarterly Review of Biology* by Houle, Wagner, Pélabon, and Hansen. 2) A theory paper in *Evolution* by Wagner on the measurement theory of fitness, which was strongly influenced by his participation in the *colloquium*. 3) A manuscript on evolutionary rates (accepted on the condition of a minor revision) in *PNAS* by Hansen and Stevan Arnold, who participated in the *colloquium* workshop in 2008, and his student Josef Uyeda who spent a semester at CEES. 4) A meta-analysis under review in *Evolutionary Biology* on the effects of scaling on quantitative genetic measures of genetic variation by Hansen, Pélabon, and Houle. 5) A manuscript by Hansen and Krszystof Bartoszek under review in *Systematic Biology* on the effects of measurement error in comparative studies. 6) RCN funding was awarded to the project: '*The evolvability of allometry*' with Christophe Pélabon at NTNU with Hansen and Houle as collaborators. 6) Work on the measurement of allometry involving Hansen, Pélabon, Wagner, Houle, along with CEES PhD student Kjetil Voje and postdoc Trond Reitan. The ideas of the *Colloquium* have also been instrumental in Hansen's RCN-funded project on statistical methods for estimating genetic architecture, which has led to several publications by CEES postdocs Arnaud Le Rouzic and Mihaela Pavlicev.

The work of the *Colloquium* is continuing. Houle is planning another extended visit in summer 2011. Our goal of writing a book on this work remains, though we prefer to make progress with smaller projects at this stage.

Summarised by Coll. 1. leader Thomas F. Hansen.

Further reading:

Hansen, T.F. & **Bartoszek**, K. Interpreting the evolutionary regression: The interplay between observational and biological errors in phylogenetic comparative studies. *Systematic Biology*, in review.

Hansen, T.F., Pélabon, C. & **Houle**, D. Heritability is not evolvability. *Evolutionary Biology*, in review.

Houle, D., Pélabon, C., **Wagner**, G.P. & **Hansen**, T.F. (2011) Measurement and meaning in biology. *Quarterly Review of Biology* **86**, 3–34.

Uyeda, J.C., **Hansen**, T.F., Arnold, S.J. & Pienaar, J. (2011) The million-year question: Why does macroevoutionary divergence wait for a million years of stasis? *PNAS*, Accepted pending minor revision.

Wagner, G.P. (2010) The measurement theory of fitness. *Evolution*, **64–(5)**, 1358–1376.

Colloquium 2: Bridging the gap between genomics and evolutionary biology

The goal of *Colloquium* 2 is to facilitate interactions between the knowledge-base of molecular sciences and classical evolutionary theory. Due to the progress of high-throughput sequencing technologies over the past 4-5 years, and the establishment of the Norwegian Sequencing Centre (NCS) we have modified the original scope of *Colloquium* 2 towards bridging the gap between classical evolutionary thinking and genomics. The *Colloquium* has been operative since August 2010, but was formally launched in November 2010 with an international meeting at the Academy of Science and Letters in Oslo. Experts in various fields such as ecology, evolution, genomics, theoretical biology and statistics attended.

We will use the CEES Friday Seminars in 2011 to invite speakers who have made internationally recognised contributions to *Colloquium* 2-related issues. We plan to use the CEES Late Lunch Talks as an internal event for ongoing *Colloquium* 2 activities. A *Colloquium* 2 reading group will also be set up during spring 2011 to facilitate conceptual thinking on ecological, evolutionary and explanatory issues in a molecular context, which we consider to be of key importance for the whole *Colloquium* 2 enterprise.

The *Colloquium* will take advantage of the of the broad competence profile at CEES in genomics, molecular biology, ecology and evolution. Key issues and phenomena in ecology and evolution will be addressed by linking molecular and genomics information to conceptual and methodological structures that have not yet been significantly influenced by such information – classical evolutionary biology being a prominent example. This will involve more extensive use of genetic markers and genomics information in current life history projects, as well as identifying new projects where this would represent added value. More importantly, the *Colloquium* will focus on finding causative genetic variation underlying focal adaptive events – and thus make use of the genome data for Atlantic cod that was generated at CEES (as well as other fish and vertebrate genomes).

Additionally, we have initiated a new project under the 'umbrella' of Colloquium 2, with the main goal of providing the foundation for a long-term theoretical-experimental research programme addressing the phenomenon of epigenetic inheritance (transgenerational phenotypic plasticity) in a truly integrative way, bridging the mechanistic, ecological and evolutionary explanatory domains associated with the phenomenon.

Summarised by Coll. 2 leader Kjetill S. Jakobsen, Kristine Bonnevie Professor Stig W. Omholt and Coordinator Sissel Jentoft.

Further reading:

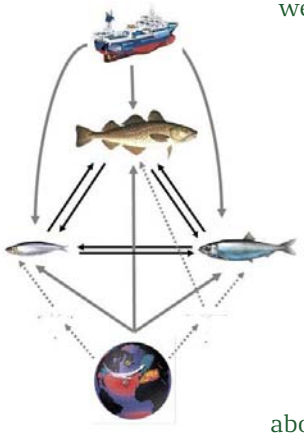
Houle, D., Govindaraju, D.R. & **Omholt**, S. (2010) Phenomics: the next challenge. *Nature Reviews Genetics*, **11**, 855–866.

Martin Malmstrøm sampling cod in Lofoten © Rune R. Hansen

Barents Sea cod in Lofoten © Rune R. Hansen

Ecosystem-based approach to fisheries management

Marine ecosystem and the services which they supply are under threat from a wide range of human activities. In order to achieve sustainability, an ecosystem-based approach to fisheries management (EBFM) that integrates multiple drivers in a common framework is therefore needed. The overarching aim of the article *Preventing the collapse of the Baltic cod stock through an ecosystem-based management approach* published in PNAS 2009, was to develop a decision-support tool fit for achieving EBFM in the Baltic Sea, an ecosystem heavily impacted by overfishing and climate change. To that end, a theoretical approach for modelling multi-species population dynamics was combined with advanced statistical methods in order to develop a stochastic food-web model integrating species interactions, between cod and the forage fish species herring and sprat, with external forcing through commercial fishing, zooplankton and climate effects. Furthermore, by linking models across sectors, i.e., with climate and bio-economical models, we were able to account for management consequences over a wide range of policy objectives and define overall ecologically and economically optimal management solutions. To that end, our coupled modelling tool demonstrates how by adopting an ecosystem approach we may quantitatively forecast the response of Baltic fish stocks to climate change and take appropriate management actions to mitigate negative effects on future fisheries production. Together with co-authors Christian Möllmann, Anders Nielsen and Nils Chr. Stenseth at CEES, the above mentioned article received the 2010 year's Ecological Society of America (ESA) Sustainability Science Award. By presenting the ecological need and economic advantage of our ecosystem-based approach it is our hope and ambition to establish the institutional and political will necessary for successful implementation of EBFM in the Baltic Sea and beyond, a vital first step towards achieving long-term sustainability in marine fisheries worldwide.



Summarised by Martin Lindegren.

Martin Lindegren receiving the Sustainability Science Award from President Mary Power at ESA 2010

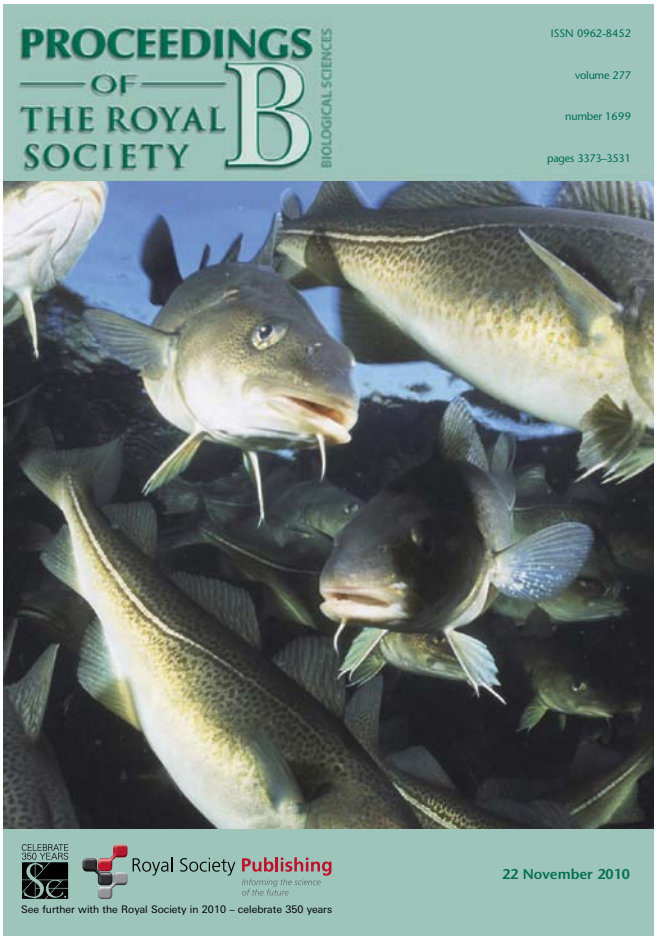
Further reading:

Lindegren, M.O., Möllmann, C., Nielsen, A. & **Stenseth**, N.C. (2009) Preventing the collapse of the Baltic cod stock through an ecosystem-based management approach. *Proceedings of the National Academy of Science of the United States of America*, **106** (34): 14722–14727.

Impacts of climate variation on behaviour, ecology and evolution

Effects of climate variability and change on different aspects of biology is a focus of many of the scientists at CEES. This is reflected by authors at CEES having contributed to no fewer than 22 ISI-listed papers with "climate" in the abstract or keywords in 2010. These papers cover a wide range of systems and species, from (human plague) bacteria to cod and perch, spring-fruiting fungi and evolutionary history of the *Arabidopsis lyrata* complex to interacting effect of wolves and climate on caribou recruitment. Two more detailed examples are given here:

Quantification of climate impact on ecology are complicated by interactions within and between species causing indirect, often delayed, effects. This was demonstrated by a study on the first life stages of key fish species in the Norwegian Sea–Barents Sea ecosystem and their predators, competitors and zooplanktonic prey. By an-



Stige et al. was featured on the front cover of Proceedings B

alysing growth and survival from one life stage to the next (eggs–larvae–juveniles–recruits), evidence for both bottom-up, direct and top-down effects of climate were found. Whilst all species experienced improved growth and feeding conditions in a warm year, cohorts born in the following year will experience increased predation and competition because of increased densities of sub-adult cod and herring, leading to delayed climate effects. These findings exemplify that climate impacts are to some degree propagated to later life stages when density dependence is strong.

Human cases of plague (*Yersinia pestis*) infection originate, ultimately, in the bacterium's wildlife host populations. The epidemiological dynamics of the wildlife reservoir therefore determine the abundance, distribution and evolution of the pathogen, which in turn shape the frequency, distribution and virulence of human cases. Earlier studies have shown clear evidence of 'climatic forcing' on contemporary plague abundance in rodents and humans. A CEES-led study concludes that Central Asian climate fluctuations appear to have had significant influences on regional human plague frequency in the first part of the 20th century, and probably over the past 1500 years. Furthermore, as plague activity in Central Asia seems to have followed climate fluctuations in past centuries, the authors expect global warming to have an impact upon future plague epidemiology, probably sustaining or increasing plague activity in the region.

While the broad scope shown above is one of CEES's strengths it is also a challenge. Cooperation within established disciplinary groups functions well, but there is a need to foster closer collaboration across these groups. Towards this means an Action Group was formed in December 2010. This is an arena for learning about colleague's climate-related work through short presentations and discussions, sharing data and exchanging knowledge on methods, software, literature, journals, and web sites. The Action Group ultimately exists to provide the environment for establishing cross-disciplinary/cross-habitat teams working on common papers.

Summarised by Geir Ottersen.

Further reading:

Stige, L.C., **Ottersen**, G., Dalpadado, P., Chan, K.S., **Hjermann**, D.Ø., Lajus, D., Yaragina, N.A. & **Stenseth**, N.C. (2010) Direct and indirect climate forcing in a multi-species marine system. *Proceedings of the Royal Society of London. Biological Sciences*, **277**, 3411-3420.

Kausrud, K.L., Begon, M., **Ben Ari**, T.M., **Viljugrein**, H., Esper, J., Büntgen, U., Leirs, H., **Junge**, C., Yang, B., Yang, M., **Xu**, L. & **Stenseth**, N.C. (2010) Modeling the epidemiological history of plague in Central Asia: Palaeoclimatic forcing on a disease system over the past millennium. *BMC Biology*, **8** (112). Open access.

Lofoten viewed from fisherman Børge Iversens´ boat
© Martin Malmstrøm

Economics and biology of harvesting in the Barents Sea

The fishery in the Barents Sea and around Lofoten is of great cultural importance to Norway. The North-East Arctic (NEA) cod stock, which is currently the largest cod stock in the world, has been harvested for thousands of years. Until this day, it has been a source of wealth and will continue to be so if it is harvested in a sustainable manner. Our research suggests ways in which the economic value of this natural resource could be significantly increased, and how improved management could lead to a much more abundant fish stock of better quality. The cod stock of the Barents Sea is shared by Russia and Norway. The performance of the fishery has improved in recent years with the introduction of a harvest control rule by the Joint Russian-Norwegian Fisheries Commission, and the problem of illegal, unreported and unregulated (IUU) fishing appears to have been curbed. Current quotas are large and the spawning stock biomass is at a record high. Does this mean that management has achieved its aims and that our concern has become obsolete? Not quite: although conditions look good on the surface, there have been dramatic changes within the fish stock. It now consists of fewer and younger age-classes; while fish older than eight years made up more than half of the stock's biomass after the Second World War, this share has now dropped to less than 10 %. Additionally, the age at maturation has fallen and there are growing concerns that this has been caused by fisheries induced evolution. Currently, fish are targeted from an age of three to four years. At this age, the value of the cod would continue to increase by approximately 20 % per year; it is therefore a bad investment to harvest the fish at this age. It is this aspect that our studies concentrate on. By combining biology with economics, we have developed a detailed model of the NEA cod fishery. We optimised fishing effort and gear selectivity to find the harvesting pattern which would maximise the profits for the fishery. A fundamental insight from fisheries economics is that optimal management implies a large standing stock, so that many fish can be harvested per unit of effort. This can be achieved by effectively sparing the young fish from being harvested. Our model calculations show that the average annual profits could be more than doubled from 0.93 billion NOK to 2.06 billion NOK. Even at current effort levels, targeting only fish that are older than 8 years leads to average profits of 1.96 billion NOK. The importance of optimal gear selectivity has been largely overlooked in the literature to date.

The second part of our research analyses the forces that could lead to targeting fish that are too young. We model the joint exploitation of Barents Sea cod as a non-cooperative game. Incidentally, the resulting Nash-equilibrium is close to the current harvesting pattern. The fundamental problem is well summarised by the "tragedy of the commons", that is, no nation can be certain that fish left in the ocean as an investment for the future are not taken by the other nation, and therefore each nation has an incentive to overfish. Our research shows that this particularly materialises as "growth overfishing", i.e. catching fish before they have grown to a decent size. It is therefore necessary that gear selectivity is recognised as an important tool for fisheries management. In light of the recent advances in the Barents Sea, there is hope that this issue will be highlighted.

Summarised by Florian K. Diekert.

Further reading:

Diekert, F.K., **Hjermann**, D.Ø., Nævdal, E. & **Stenseth**, N.C. (2010) Spare the young fish: optimal harvesting policies for north-east Arctic cod. *Environmental and Resource Economics*, **47**, 455–475.

Diekert, F.K., **Hjermann**, D.Ø., Nævdal, E. & **Stenseth**, N.C. (2010) Non-cooperative exploitation of multi-cohort fisheries - The role of gear selectivity in the North-East Arctic cod fishery. *Resource and Energy Economics*, **32**, 78–92.

Climate influences on the behaviour of deer

Despite great interest in climate impact on populations and ecosystems, there are few studies of behavioural responses to climate in mammals. Populations of all species of deer are influenced by annual climate variation, but it can be difficult to determine the underlying mechanisms. Using individuals fitted with GPS transmitters that send hourly position data throughout the year, researchers at CEES have conducted a series of analyses on behavioural responses to climate change in red deer, moose and Svalbard reindeer. Red deer increased the size of their home range with increasing temperature in the winter, whilst increasing snow depth decreased movements. During summer, home range size decreased with increasing temperature. This correlation was strongest when measured over longer periods, suggesting that increased temperature results in higher quality and/or more abundant forage, reducing the area that the red deer use to meet their energy needs. Moose, however, were more influenced by ambient temperature, suggesting that the direct effects of warm weather are more important to moose than red deer. During years with icing

events, the pastures of Svalbard reindeer can be virtually "locked" by the ice (i.e. ice layers limit access to forage). Crashes in reindeer populations have been documented during such events, with up to 60 % of the reindeer dying during the winter. Analyses of space use affirm that the reindeer react immediately to icing events by seeking out other areas without ice outside of their normal home ranges. This means that some individuals are able to buffer the effects of local icing by re-locating to favourable, ice-free areas, and survive. If the trend of climate warming continues, the extent of ice sheets may increase. These behavioural studies suggest that reindeer may experience an upper limit at which individuals are no longer able to find ice-free areas within their search radius. If this happens, Svalbard reindeer face an uncertain future. Behavioural studies can therefore provide critical information when attempting to predict future effects of global climate change.

Summarised by Atle Mysterud.

Further reading:

Rivrud, I.M., **Loe**, L.E. & **Mysterud**, A. (2010) How does local weather predict red deer home range size at different temporal scales? *Journal of Animal Ecology*, **79**, 1280–1295.

Stien, A., **Loe**, L.E., **Mysterud**, A., Severinsen, T., Kohler, J. & Langvatn, R. (2010) Icing events trigger range displacement in a high-arctic ungulate. *Ecology*, **91** (3), 915–920.

van Beest, F., **Rivrud**, I.M., **Loe**, L.E., Milner, J.M. & **Mysterud**, A. (2011) What shapes intraspecific variation in home range size across spatiotemporal scales in a large browsing herbivore? *Journal of Animal Ecology*, online early.

Red deer (*Cervus elephas*) stags in Utvik, Sogn og Fjordane © Inger Maren Rivrud

Egg-rejection behaviour in hosts of avian brood parasites

Around 1 % of the world's known bird species are obligate brood parasites, and rely on other bird species to raise their offspring. Hosts often pay a high price when successfully parasitised, since the offspring of many parasite species will kill all host offspring within a nest. The result is a coevolutionary arms race, in which the host evolves new defences against parasitism, and the parasite evolves new tricks by which these defences can be bypassed. A central and particularly well-studied defence against parasitism is the ability of many hosts to reject odd-looking eggs, which in turn has selected for egg mimicry by the parasites. Egg ejection has been thought of as a difficult trait to evolve in hosts, since it seems to require both the ability to recognise eggs and the behaviour needed to remove them. In this study we constructed an optimality model of egg rejection that allowed for a wide range of host behavioural tactics to be used, including the acceptance of all eggs, single-egg ejection, multiple-egg ejection, and nest desertion followed by re-nesting. Experimental studies have revealed that some hosts are more likely to reject parasite eggs after observing adult parasites near the nest, and such effects were also incorporated in the model. The model predicts that egg ejection can be beneficial even when hosts cannot discern between own and parasite eggs, which suggests that egg ejection could evolve as a defence strategy prior to the evolution of egg recognition. The model also demonstrates that within-population variation in egg rejection behaviour may represent flexible and optimal rejection behaviour, and not necessarily maladaptive behaviour or constraints as commonly assumed. For instance, multiple-egg ejection is often explained as the result of accidental damage to other eggs when hosts attempt to eject a single egg. However, multiple egg ejection may in some cases simply be the most effective way to reduce the risk of a parasite being in the nest.

Summarised by Thomas O. Svennungsen and Øistein H. Holen.

Further reading:

Svennungsen, T.O. & **Holen**, Ø.H. (2010) Avian brood parasitism: Information use and variation in egg-rejection behavior. *Evolution*, **64** (5), 1459–1469.

Functional analysis of the gastrointestinal (GI) microbiota

Gut microbiota have been shown to be of great importance to the development and health of animals, humans included. During the last decade tremendous progress has been made in the characterisation of the components of the GI microbiota, and the significance of these components in health and disease. Nevertheless, our understanding of the GI microbiota as an ecological system remains limited at best. Consisting of several hundred species and thousands of strains, a functional analysis of this system is a daunting but worthwhile task; a more complete understanding of the ecology of the GI microbiota would be invaluable in the design and administration of therapeutic strategies, as well as in the prevention of common maladies such as obesity, diabetes and various allergies.

In order to achieve a functional description of the GI microbiota as an ecosystem we need to identify the mechanisms through which its members interact with each other and with their host, and how these interactions impact the dynamics of the system as a whole. The application of ecological modelling may allow us to develop a more detailed understanding of the parameters that determine the dynamical properties of the GI microbiota. Knowing how the growth of one group of community members relates to that of other groups, as well as to more external factors, would enhance our ability explain several phenomena of general interest. Events of considerable medical importance, such as shifts in ecosystem composition that lead from healthy to dysbiotic states, invasion of pathogens into the established community, and the community level impact of therapeutic intervention, are best understood from an ecosystem point of view. A functional ecological model of the GI microflora would potentially allow us to predict under what circumstances the system is susceptible to the occurrence of such events, and to devise new means of countering unfavourable dynamics by restoring system stability.

CEES has a strong and longstanding tradition in the statistical modelling of ecosystem dynamics. Traditionally this kind of modelling is done by analysing time series data of population abundances and other relevant variables relating to environmental conditions, in order to identify and quantify the factors that are the dominant drivers of dynamics. We have applied this approach to microbes, both in laboratory- and *in vivo* settings (Trosvik *et al.*, 2008, 2010, 2010). More recently, we have characterised the population structure of *Escherichia coli* in a cohort of Norwegian mothers and their infants (de Muinck *et al.*, 2011). We are currently studying the interaction parameters that determine colonisation patterns by using population structure information, full genome sequencing and *in vitro* experimental systems. In addition, we are comparing innocuous *E. coli* with strains isolated from sick infants to understand the evolution of pathogenicity.

In general, there are several features of experimental microbial systems that make them especially suitable for addressing basic issues of general biological interest. Short generation times allows for the collection of population data on evolutionary time scales. Large populations grown in small spaces in the lab facilitate experimental replication and manipulation of environmental conditions. Experimental cell samples may be frozen in suspended animation, creating a revivable fossil record. Genomic tools, as well as the means for genetic manipulation, are highly developed and affordable. As such, this kind of system allows us observe, in real time, the interplay between ecological and evolutionary processes.

Summarised by Pål Trosvik and Eric de Muinck.

Trosvik, P., Rudi, K., Næs, T., Kohler, A., Chan, K.-S., **Jakobsen**, K.S. & **Stenseth**, N.C. (2008) Characterizing mixed microbial population dynamics using time-series analysis. *The ISME Journal*, **2** (7), 707–715.

Trosvik, P., Rudi, K., Strætkvern, K.O., **Jakobsen**, K.S., Næs, T. & **Stenseth**, N.C. (2010) Web of ecological interactions in an experimental gut microbiota. *Environmental Microbiology*, **12** (10), 2677–2687.

Trosvik, P., **Stenseth**, N.C. & Rudi, K. (2010) Convergent temporal dynamics of the human infant gut microbiota. *The ISME Journal*, **4**, 151–158.

de Muinck, E., Ø ien, T., Storrø, O., Johnsen, R., **Stenseth**, N.C., Rønningen, K.S. & Rudi, K. (2011) Diversity, transmission and persistence of *Escherichia coli* in a cohort of mothers and their infants. *Environmental Microbiology Reports*, Online.

4 EDUCATION AND RESEARCH TRAINING

CEES aspires to provide excellent education and training facilities for our students to supply outstanding candidates for future positions. Our host Department (the Department of Biology) as well as other units of the University (e.g. Mathematics and Economics) deliver the basic education to our bachelor and master/PhD programmes. In 2010 CEES's permanent scientific staff contributed to the teaching of 7 Bachelor courses and 14 Master/PhD courses. 26 Master students were supervised by CEES members. We provide a stimulating research environment for our students, organising workshops, regular seminars and journal clubs, and frequently inviting top guest speakers to allow our students to stay abreast of their fields, and allow them to interact with prominent researchers.

The student conference at Holmen Fjordhotell

The CEES Annual Student Conference is a compulsory event that provides a good forum for students to hone their communication and presentation skills in a professional setting. This year the conference was held at Holmen Fjordhotell with 120 delegates. 32 students presented their work.

Delegates at the Annual CEES Student Conference, Holmen Fjordhotel

Rearing of salmon eggs © Hans Fredrik Asbjørnsen

The Marie Curie Early Stage Training (EST)

The Marie Curie Early Stage Training on Ecological and Evolutionary Response to Climate Variation (CEES-MCO) has been an important part of our research education programme. A total of 11 PhD students (7 short-term and 4 long-term) stayed at CEES during the 48-month project period from 2006 to 2010. In 2010, 3 full-time PhD students were engaged at CEES-MCO. All of the students have successfully completed their PhD degree in 2010 or earlier, with the exception of two who will finish in 2011.

During 2010 our long-term Marie Curie EST students co-authored a total of 9 published papers, 5 of which as lead author. This programme has effectively promoted international cooperation among our scientists and the home institutions of our visiting PhD students.

Journal Club and discussion group

CEES arranges four different Journal Clubs and one discussion group:

- Evolutionary Ecology Forum: 13 sessions were held in 2010
- Speciation Forum: 5 sessions were held in 2010
- Thursday Lunch Club: 9 sessions were held in spring 2010
- A journal club on evolutionary biology: weekly meetings throughout 2010
- Discussion group for Microbial Ecology and Evolution: 7 sessions were held in spring 2010

These journal clubs encourage critical reading of scientific papers and provide an opportunity for students to keep updated in their field of study, as well as in related scientific fields, thereby also promoting synthesis within the centre. Participating students (including the MC-fellows) select relevant papers that focus on scientific challenges within the field of ecology and evolution.

Late lunch talks

The Late Lunch Talk seminar series is a forum for employees, visiting scientists and students at CEES to present and discuss their work and ideas. The format is informal, with the objective being the facilitation of stimulating, topical discussions. 24 sessions were held in 2010.

NorMER

NorMER – a new Nordic Centre of Excellence

Predicting the consequences of climate change is complicated by the fact that the ecological effects of climate and fishing may change the behaviour of fishers (individual fishermen or nations). Truly cross-disciplinary studies are still rare, but there is an increasing interest in incorporating detail and realism into effect studies. Research and training is primarily conducted by specialists within each field. This tradition for isolated in-depth studies is likely to miss important interaction effects. In order to meet the challenges imposed by the changing climate and the continued high pressure on marine resources, this has to change. Scientists of the future need the cross-disciplinary skills to combine physical, biological, and social/economic science in order to give management advice on the ecosystem level.

On behalf of the Top-level Research Initiative (TRI), Nordforsk in 2010 decided to support a new Nordic Centre of Excellence: Nordic Centre for Research on Marine Ecosystems and Resources under Climate Change (NorMER) to be administered by CEES. This is a cross-Nordic collaborative project starting in 2011 and funded over five years with a total budget of 65.5 million NOK, with 30.5 MNOK contributed by NordForsk and approximately 35.5 MNOK contributed by the participating groups.

This collaborative project combines the expertise of CEES and other internationally recognised research teams from all of the Nordic countries to implement a broad international and multidisciplinary research strategy to explore the biological, economic, and societal consequences of global climate change on fisheries resources in the Nordic region, with a primary focus on the Atlantic cod. NorMER will achieve this through a unique program of primary research, for which 45 researches from 10 Nordic institutions will collaborate in training 15 new PhD students and 5 Postdocs through joint projects that integrate biology, economics, industry, and policy.

5 SCIENTIFIC OUTREACH

CEES works towards increased awareness of science in the general population. CEES regularly organises broadly announced open seminars, both at the University campus and at the public venue 'the House of Litterature'. Among these we would particularly like to highlight our annual Darwin Day and Kristine Bonnevie Lectures on evolutionary Biology, the latter being part of the University anniversary. For the full list of invited guest speakers, see Seminars with invited speakers in Appendices.

The School Laboratory (Biology)

The School Laboratory is operated by the Department of Biology and the Department of Molecular Biosciences. It is a resource centre primarily targeted at schools, offering in-service training for teachers and delivering contemporary biology classes for school groups. The main objective of the Laboratory is to increase understanding of biological concepts, both for students and teachers, via the dissemination of the research of the two departments, whilst developing teaching competence. CEES has been very active in this facility, playing a key role in the development of educational programmes in population genetics and relationships between species.

Anders Herland, Lars Qviller and Anders Nielsen © Atle Mysterud

6 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 loss of women through the academic hierarchy from Master level, through to PhD and postdoc level to tenured scientific staff. At CEES, we use a dual approach to attract and keep female scientists: optimising the conditions for our female students and staff whilst emphasising 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 a lab technician designated specifically to assist female scientists. Furthermore, we have continued our dedication to awarding scholarships for transitional engagements, enabling female candidates to further their scientific careers. In 2010, 7 people received such support from CEES, from 1–4.5 months. 3 Master students were granted a stipend to write manuscripts based on their thesis or for analysing data (Maria Aasen, Kari Kleiven and Cecilia Hoel). 3 PhD students received short-term extensions to their positions (Tamara Ben Ari, Anne Maria Eikeset and Claudia Junge). 1 PhD student (Tamara Ben Ari) received transitional funding from PhD to Postdoc (Ben Ari is currently engaged in a postdoc position at CEES). Lee Hsiang Liow was appointed as a CEES researcher on RCN gender equalising funds; we will use this position as model for future tenure track positions, providing a measure of recruitment strategy for female scientists. In 2010, CEES's Deputy Chair (Eli K. Rueness) and Deputy Chair of the Department (Anne K Brysting) completed the Research Leader Training Programme at the University of Oslo, and Liow attended the UiO Mentor Programme. Furthermore, 6 female CEES members participated in a 2-day career development seminar, in which the objective was to raise awareness of how to manage their own careers. CEES received 287 600 NOK from UiO and 824 000 NOK from RCN in gender equalising funds, and used more than 1.9 million NOK in this context in 2010.

To provide role models for our female staff, both the CEES board and the Scientific Advisory Board are chaired by female scientists. The Deputy Chair is female, 2 of the 3 *themes* are co-chaired by female scientists and 1 of the 4 *colloquia* is chaired by a female scientist. In 2010, Liow and our 3 female Associate Professor II's (Hildegunn Viljugrein, Hege Gundersen and Jorijntje Henderiks, 20 % positions) published 4 and co-authored 5 papers through CEES. These staff have also been involved in supervising students and have participated in both international and internal scientific meetings and conferences, as well as the CEES journal clubs. It is thus hoped that these researchers are good motivators and role models for our female (and male) students.

Oda Bjærke and Annette Taugbøl in the Lab © Hans Fredrik Asbjørnsen

7 EXPERIMENTAL FACILITIES

The CEES DNA Lab (www.cees.uio.no/research/facilities/dna-lab) has an infrastructure consisting of an isolation lab, separate PCR facilities, post PCR and DNA sequencing laboratories (see ABI lab below). In addition there is a dedicated lab for class 2 security research. The lab is fully equipped for DNA and RNA extraction from various types of bacteria, protists, algae, fungi, animal and plant tissues (including blood, faeces and ancient DNA). It contains all of the basic instrumentation of a modern molecular biology laboratory including equipment for gene cloning, genomic libraries, real-time PCR, DNA/RNA quantification (Nanodrop spectrophotometer for *ffil* volumes) and chip-based analysis of DNA, RNA and protein (Agilent Bioanalyzer). The annual turnover of the CEES-lab was 399 000 NOK in 2010 and there has been 58 users of the lab. This is an increase compared to 2009 where the lab had 37 users for the whole year. This is due partly to CEES labs now being open to users from the whole Department of Biology and actively used by researchers from MERG.

The ABI lab (www.bio.uio.no/ABI-lab) is shared between the Departments of Biology and Molecular Biosciences. The lab is situated at CEES and is an equipped laboratory with two ABI 3730 capillary electrophoresis sequencers, each currently equipped with 48 capillaries, providing DNA sequencing and fragment analysis. The ABI lab function as a service lab for the various research groups and institutes at the university, as well as affiliated organisations and departments both nationally and internationally. The ABI service lab has been functional since July 2005. The annual turnover of the ABI-service lab exceeded 1.3 MNOK in 2010. A total of ~42.000 samples was sequenced with an average of 3509 samples every month. Hence, the capacity has increased since 2009 where the ABI-lab sequenced on average 2955 samples every month.

The Ultra-high Throughput Sequencing Platform (UTSP). In 2007, CEES was awarded funding (18.3 mill NOK) to establish the "Ultra-high throughput sequencing platform" – UTSP by the Research Council of Norway (RCN) under the FUGE and AVIT programmes. The platform was further strengthened through a new Infrastructure Program grant from RCN (23 mill NOK) and consolidation with the *Illumina sequencing platform at Institute of Medical Genetics (IMG), Oslo University Hospital* (see Box 1).

The UTSP 454 sequencing service lab has been functional since January 2008. In 2009, 131 samples for different research environments were sequenced (65 % more relative to 2008) in 95 runs. During 2010, the 454 node of the NSC experienced an almost explosive increase in interest and quantity of samples, and a total of 284 different samples from 47 groups of researchers were sequenced.

In 2010, necessary upgrades to the laboratory activities, which include improvements of the protocols, as well as procurement of equipments, were initiated. New, protocols from Roche have been implemented, resulting in faster processing of samples, and a reduced DNA amount requirement for some applications. Additionally, we have obtained a Hamilton liquid handling robot – on which a robotic Enrichment Module (REM) is integrated. This robot is fully tested and in operation today and shortens the time and manual work load during a critical sequencing step. Furthermore an Agilent Bravo robot for DNA library creation and setup of qPCR is purchased. This robot is not yet fully operational – but the test results are very promising. Finally, we have purchased the second 454 machine which we originally had on loan from Roche in connection with the sequencing of the cod genome.

The platform is capable and has experience with all the possible applications, e.g. sequencing of large and small genomes, cDNA/EST and metagenomes (DNA isolated from oceanic sediment etc.; Figure 1). Samples are still mostly from Norway, but also from Austria, Sweden and the Netherlands (Figure 2.)

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.

NORWEGIAN SEQUENCING CENTRE

Box 1 The Norwegian High-Throughput Sequencing Centre (NSC)

The Norwegian High-Throughput Sequencing Centre (NSC; www.sequencing.uio.no) is currently the only platform offering the research community of Norway HTS applications. At present, we have four HTS (machines, two GS FLX (454/Roche) located at CEES and one Illumina GA_{II} and one HiSeq2000 at IMG. The main goals of the NSC is to be able to provide HTS services for resequencing, transcriptomics, metagenomics and de novo sequencing for the Norwegian research community and provide costumised bioinformatic analyses of the data.

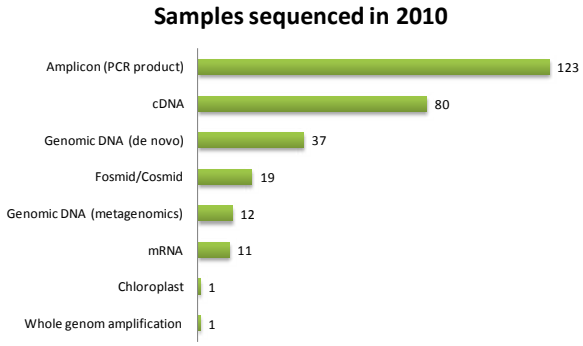


Figure 1

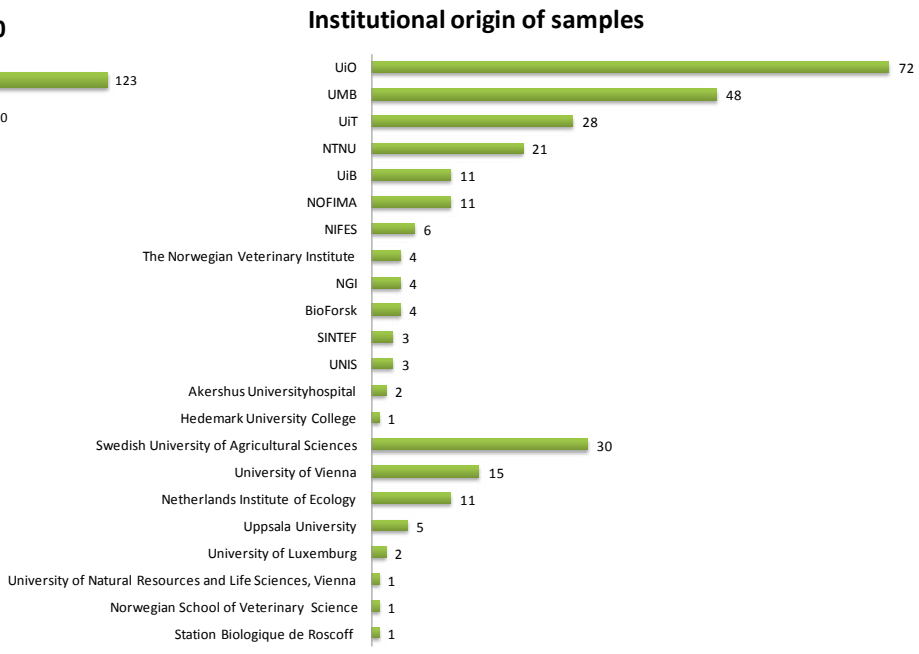


Figure 2

8 FINANCES

Accounting principles

CEES funding is derived primarily from RCN sources (approximately 12 million NOK in core funding per year) supplemented by funds from UiO (2 million NOK per year plus several positions) and other sources defined as "own funding". CEES's own funding can be sub-categorised as EU and other international funding; funding from other RCN projects; other national public funding and that from commercial companies.

Expenditures are sub-categorised into salary costs, indirect costs, equipment, travel and representation, R&D services and other expenses (comprised mainly of running expenses for laboratory and fieldwork).

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

As of 2011, the accounts include total income/expenditure (BOA), as a result of new financial routines that were implemented by UiO in autumn 2009. Future accounting reports will therefore not be fully comparable with those given for 2007-2010.

In this report we present the accounting figures for 2010 and the budget for 2011.

Sheep in the mountains © Atle Mysterud

Revenues and expenditures 2010/Budgeted revenues and expenditures 2011

Total funding			Accounted revenues		Non accounted revenues
	2010	Budget 2011	Figures 2010	Budgeted figures 2011	Non Accounted revenues 2010[1]
RCN-CoE	13 596	12753	13 596	12753	
UiO	30 214	8150	6 642	8150	23 572
RCN – CEES related projects	39 352	38723	39 352	38723	
Other public funding, national	115	325	115	325	
International funding	17 358	4962	593	4962	16 765
Private funding	3 003	2351	3003	2351	
Transferred revenues	10 047	7412	10 047	7 412	
Total funding	**113 685**	**74 676**	**73 348**	**74 676**	**40 337**

Accounted expenses 2010 (Acc 10)/Budgeted expenses 2011 (Bud 11)

	Total		RCN-CoE		UiO		RCN - CEES related proj.		Other public fund. national		International funding		Funding from comm. comp.	
	Acc 10	Bud 11	Acc 10	Bud 11	Acc 10	Bud 11	Acc 10	Bud 11	Acc 10	Bud 11	Acc 10	Bud 11	Acc 10	Bud 11
Salary expenses	35 009	35 266	10 420	10 034	4 219	4 729	16 279	15 328	169	134	2 208	3 508	1 714	1 533
Indirect costs	8 307	7 727	1 459	1 447	978	1 269	5 089	4 164	56	46	226	448	499	353
R&D services	8 160	3 482	0	0	0	0	8 160	3 482	0		0		0	
Equipment	2 387	7 944	96	100	0	0	2 242	7 824	0		18	20	31	
Running costs	10 091	13 358	759	1 777	1 798	2 060	5 975	7 925	72	145	522	986	965	465
Travel and representation[2]	1 982	0	1 407	0	575	0								
Total	**65 936**	**67 777**	**14 141**	**13 358**	**7 570**	**8 058**	**37 745**	**38 723**	**297**	**325**	**2 974**	**4 962**	**3 209**	**2 351**

Non-accounted expenses 2010 (Nacc10)

	Nacc10	Bud 11	Nacc10	Bud 11	Nacc10	Bud 11	Nacc10	Bud 11	Nacc10	Bud 11	Nacc10	Bud 11	Nacc10	Bud 11
Salary expenses	24 068				13 457						10 598			
Indirect costs	16 282				10 115						6 167			
Total[3]	**40 337**				**23 572**						**16 765**			

Balance 2010/Budgeted Balance 2011

	2010	2011	2010	2011	2010	2011	2010	2011	2010	2011	2010	2011	2010	2011
Revenues	103 638	67 264	13 596	12 753	30 214	8 150	39 352	38 723	231	325	17 358	4 962	3 003	2 351
Transf. reveunues	10 047	7 412	959	605	655	-64	5 773	7 380	2	-64	1 379	-1 002	872	666
Total expenses	106 273	67 777	13 950	13 358	31 142	8 058	37 745	38 723	297	325	19 739	4 962	3 209	2 351
Balance	**7 412**	**6 899**	**605**	**0**	**-64**	**28**	**7 380**	**7 380**	**-64**	**-64**	**-1 002**[4]	**-1 002**	**666**	**666**

All figures are given in 1000 NOK.

1) Not posted revenues for 2010. These are mainly defined as the efforts of those personnel that work wirhin CEES, but receive their salaries from other parties

2) Travel and represetation is included in running Costs for all funding sources except RCN-COE and UIO.

3) Not posted expenditures for 2010

4)This applies primarily to EU projects in which a significant proportion of the funding is awarded after project completion. In 2010 there were many projects under this category.

9 APPENDICES

CEES-members

Core scientific staff

Name	Nationality	Position	Period	Funding	CEES share (%)
Brysting, Anne K.	Norway	Assoc. Professor	Oct. 2007–	UiO, Bio	75
Grimholt, Unni	Norway	Researcher	Oct. 2007–Dec. 2011	RCN	100
Hansen, Thomas F.	Norway	Professor	Oct. 2007–	UiO, Bio	75
Hessen, Dag O.	Norway	Professor	Oct. 2007–	UiO, Bio	75
Hjort, Nils L.	Norway	Professor	Oct. 2007–	UiO, Math	25
Houle, David	USA	KB Professor	May 2010–Jun. 2010	UiO, Bio	
Jakobsen, Kjetill S.	Norway	Professor	Oct. 2007–	UiO, Bio	50
Lampe, Helene M.	Norway	Professor	Oct. 2007–	UiO, Bio	75
Mysterud, Atle	Norway	Professor	Oct. 2007–	UiO, Bio	75
Nesbø, Camilla L.	Norway	Researcher	Oct. 2007–Aug. 2012 (on leave)	RCN	100
Omholt, Stig W.	Norway	KB Professor	Sep. 2010–Aug. 2013	RCN, CoE	30
Ottersen, Geir	Norway	Senior Scientist	Oct. 2007–	IMR	25
Rueness, Eli K.	Norway	Researcher /Dep. Chair	Oct. 2007–Apr. 2011	RCN, CoE	100
Schweder, Tore	Norway	Professor	Oct. 2007–	UiO, Econ	65
Slagsvold, Tore	Norway	Professor	Oct. 2007–	UiO, Bio	75
Stenseth, Nils Chr.	Norway	Professor, CEES Chair	Oct. 2007–	RCN, CoE	100
Storvik, Geir	Norway	Professor	Oct. 2007–	UiO, Math	38
Sætre, Glenn-Peter	Norway	Professor	Oct. 2007–	UiO, Bio	75
Van Donk, Ellen	The Netherlands	Assoc Professor II	Oct. 2007–	UiO, Bio	20
Viljugrein, Hildegunn	Norway	Researcher	Oct. 2007–	UiO, Bio	20
Vøllestad, L. Asbjørn	Norway	Professor	Oct. 2007–	UiO, Bio	75

Postdocs and Researchers

Name	Nationality	Position	Period	Funding	CEES share (%)
Ben Ari, Tamara M.	France	Postdoc res. fellow	Oct. 2010–Sep. 2011	RCN, CoE	100
Brinch, Christian	Norway	Researcher	Jan. 2008–Dec. 2011	RCN	10
Bischof, Richard	Germany/ Hungary	Researcher	Aug. 2010–Dec. 2010	RCN	100
Cromsigt, Joris P.G.M.	The Netherlands	Postdoc res. fellow	Jul. 2010–Jun. 2011	EU, MC*	100
de Ayala Monedero, Rosa Mary	Spain	Researcher	Feb. 2009–Feb. 2010	UiO, Bio/RCN, CoE	100
Durant, Joel Marcel	France	Researcher	Oct. 2007–Dec. 2013	RCN	100
Edeline, Eric	France	Researcher	May 2008–Aug. 2010	RCN	30
Eikeset, Anne Maria	Norway	Postdoc res. fellow	Aug. 2010–Jul. 2013	RCN	100
Evans, Anna Kathinka D.	Norway	Researcher	Dec. 2009–Oct. 2010	RCN	100
Fischer, Barbara	Austria	Researcher	Oct. 2010–Sep. 2011	UiO, Bio	100
Gundersen, Hege	Norway	Researcher	Dec. 2008–Sep. 2012	RCN, CoE	20
Harstad, Håvard	Norway	Researcher	Jun. 2010–Jan. 2011	RCN	100
Hedfors, Ida	Norway	Postdoc res. fellow	Jan. 2010–Jan. 2012	RCN	100
Henderiks, Jorijntje	The Netherlands	Researcher	Jun. 2010–Dec. 2013	RCN	20
Hidalgo Roldan, José Manuel	Spain	Postdoc res. fellow	Jun. 2009–May 2011	EU, MC*	100
Hjermann, Dag Ø.	Norway	Researcher	Oct. 2007–Jan. 2014	RCN	100
Holen, Øistein H.	Norway	Researcher	Oct 2007–Sep. 2012	RCN, CoE	100
Hutchings, Jeffrey	Canada	Researcher	Sep. 2010–Sep. 2012	RCN, CoE	20
Jorde, Per Erik	Norway	Researcher	Oct. 2007–Dec. 2011	RCN	100
Kausrud, Kyrre	Norway	Researcher	Jul. 2010–Sep. 2012	RCN, CoE	20
Labra, Antonieta L.	Chile	Postdoc res. fellow	Aug. 2009–Nov. 2012	RCN, CoE	100
Lagesen, Karin	Norway	Postdoc res. fellow	Feb. 2011–Feb. 2013	RCN, CoE	100
Langangen, Øystein	Norway	Postdoc res. fellow Researcher	Mar. 2009–Jul. 2010 Aug. 2010–Dec. 2011	RCN RCN	100 20
Le Bohec, Céline	France	Postdoc res. fellow	Jan. 2010–Jan. 2012	EU, MC*	100
Liow, Lee Hsiang	Singapore	Researcher	Oct. 2007–Dec. 2012	RCN, CoE	100
Loe, Leif Egil	Norway	Researcher	Oct. 2007–Jul. 2010	RCN	100
Minge, Marianne Aa.	Norway	Researcher Post doc res. fellow	Mar. 2010–Oct. 2010 Nov. 2010–Feb. 2011	RCN RCN	100 100
Nederbragt, Alexander Johan	The Netherlands	Researcher (Senior engineer from Jan. 2011)	Oct. 2009–Dec. 2010	RCN	100

Nielsen, Anders	Norway	Post doc res. fellow	Jul. 2009–Jun. 2012	RCN	100
Nilsson, Anna	Sweden	Researcher Post doc res. fellow	Mar. 2010–May 2010 May 2010–Apr. 2013	RCN RCN	100 100
Ohlberger, Jan	Germany	Post doc res. fellow	Apr. 2009–Jul. 2012	RCN	100
Otero Villar, Jaime	Spain	Postdoc res. fellow	May. 2008–Apr. 2011	RCN	100
Pavlicev, Mihaela	Slovenia	Postdoc res. fellow	Dec. 2008–Feb. 2011	RCN	100
Persson, Jonas	Sweden	Postdoc res. fellow	Dec. 2010–Nov. 2011	RCN	100
Reitan, Trond	Norway	Postdoc res. fellow	Feb. 2009–Feb. 2012	RCN, CoE	100
Richter, Andries P.	The Netherlands	Researcher Researcher	Mar. 2010–May 2010 Dec. 2010–Apr. 2011	EU RCN, CoE	50 100
Rounge, Trine B.	Norway	Postdoc res. fellow	Aug. 2008–Apr. 2012	RCN	100
Rouyer, Tristan A.	France	Postdoc res. fellow	Sep. 2009–Aug. 2011	RCN	100
Sadykova, Dinara	Russia	Researcher	Jul. 2010–Dec. 2010	RCN	100
Seligmann, Hervé	Luxembourg	Postdoc res. fellow	Aug. 2008–Apr. 2010	UiO, Bio	100
Star, Bastiaan	The Netherlands	Postdoc res. fellow	Sep. 2009–Sep. 2011	RCN	100
Stige, Leif Chr.	Norway	Researcher	Oct. 2007–Aug. 2013	RCN	100
Svennungsen, Thomas O.	Norway	Researcher	Oct. 2010–Dec. 2010	RCN, CoE	100
Sæther, Stein Are	Norway	Researcher	Oct. 2007–Dec. 2011	RCN, CoE	100
Tooming-Klunderud, Ave	Estonia	Postdoc res. fellow	Jan. 2008–Jan. 2011 (Senior engineer from Feb. 2011)	RCN	100
Trosvik, Pål	Norway	Postdoc res. fellow	Jan. 2009–Dec. 2011	UiO, Bio	100
Vollsnes, Ane	Norway	Researcher	Apr. 2010–Jun. 2010	RCN, CoE/Bio	100
Whittington, Jason	USA	Researcher	Jan. 2010–Sep. 2011	RCN, CoE	
Yedid, Gabriel	Canada	Postdoc res. fellow	Jan. 2010–Dec. 2011	RCN, CoE	100
Østbye, Kjartan	Norway	Researcher Researcher	Mar. 2009–Mar. 2010 Jun. 2010–May 2014	RCN RCN	100 100

** Marie Curie Individual Fellowship*

PhD students

Name	Nationality	Position	Period	Funding	CEES share (%)
Atichem, Anagaw	Ethiopia	Research fellow	Oct. 2007–Oct. 2011	NUFU	100
Ben Ari, Tamara M	France	Research fellow	Oct. 2007–May 2010	EU/MC-EST*/ RCN, CoE	100
Berg, Paul Ragnar	Norway	Research fellow	Oct. 2010–Sep. 2014	UiO, Bio	75
de Muinck, Eric	USA	Research fellow	Oct. 2008–Sep. 2011	The Norw. Inst. of Public Heath	50
Diekert, Florian K	Germany	Research fellow	Apr. 2008–Jun. 2011	RCN	100
Eikeset, Anne M.	Norway	Research fellow	Oct. 2007–Jul. 2010	RCN, CoE	100
Eriksen, Ane	Norway	Research fellow	Oct. 2007–Dec. 2010	UiO, Bio	75
Griffin, Donald	USA	Research fellow	Jan. 2010–Jul. 2010	UiO, CoE	100
Heier, Lise	Norway	Research fellow	Oct. 2007–Mar. 2011	UiO, Bio	75
Helberg, Morten	Norway	Research fellow	Sep. 2010–Aug. 2013	RCN	100
Hermansen, Jo Skeie	Norway	Research fellow	May 2010–Apr. 2014	UiO (MLS)	100
Holmen, Johannes	Norway	Research fellow	Oct. 2007–Dec. 2010	None	100
Husek, Jan	Czech Rep.	Research fellow	Oct. 2008–Sep. 2012	UiO, Bio	75
Jalal, Marwa	Norway	Research fellow	Sep. 2010–Aug. 2013	RCN	100
Junge, Claudia	Germany	Research fellow	Oct. 2007–Apr. 2011	EU/MC-EST*/ RCN, CoE	100
Jørgensen, Marte H.	Norway	Research fellow	Oct. 2007–Jun. 2011	UiO, Bio	75
Kausrud, Kyrre	Norway	Research fellow	Oct. 2007–Jun. 2010	RCN, CoE	100
Knudsen, Endre	Norway	Research fellow	Oct. 2007–May 2011	RCN, CoE	100
Malmstrøm, Martin	Norway	Research fellow	Jan. 2009–Dec. 2012	UiO, EMBIO	75
Mazzarella, Anna Virginia B.	USA	Research fellow	Nov. 2010–Nov. 2013	RCN	100
Mewicha, Berihun	Ethiopia	Research fellow		NUFU	100
Minge, Marianne Aa.	Norway	Research fellow	Oct. 2007–Feb. 2010	UiO, Bio	100
Moe, Therese F.	Norway	Research fellow	Oct. 2007–Jan. 2012	Juncus	100
Moland, Even	Norway	Research fellow	Oct. 2007–Feb. 2010	IMR/RCN	100
Qviller, Lars	Norway	Research fellow	Sep. 2010–Aug. 2014	UiO, Bio	75
Rivrud, Inger M.	Norway	Research fellow	Sep. 2008–Aug. 2012	UiO, Bio	75
Sabarros, Philippe S.	France	Research fellow	Oct. 2007–July 2010	EU/MC-EST*/ RCN, CoE	100
Sadykov, Alexander	Russia	Research fellow	Oct. 2007–May 2011	EU/MC-EST*/ RCN, CoE	100
Sadykova, Dinara	Russia	Research fellow	Oct. 2007–June 2010	RCN	100
Serbezov, Dimitar	Bulgaria	Research fellow	Oct. 2007–Feb 2011		100
Siddiqui, Huma	Norway	Research fellow			
Skog, Anna	Norway	Research fellow			
Solbakken, Monica H.	Norway	Research fellow	Jun. 2010–May 2014	RCN	100
Svennungsen, Thomas O.	Norway	Research fellow	Oct. 2007–May 2010	UiO, Bio/RCN, CoE	75
Taugbøl, Annette	Norway	Research fellow	Oct. 2008–Sep. 2012	UiO, Bio	75
Voje, Kjetil L.	Norway	Research fellow	Aug 2008–Jul. 2012	RCN, CoE	75
Westengen, Ola	Norway	Research fellow	Sep. 2008–Aug. 2012	UiO	50

** Marie Curie Early Stage Research Training Site*

Research Assistants

Name	Nationality	Position	Period	Funding	CEES share (%)
Easterday, William Ryan	USA	Research Assistant	Sep. 2010–May 2011	UiO, Bio	100
Hoel, Cecilia	Norway	Research Assistant	Aug. 2010–Feb. 2011	RCN, CoE	100
Kleiven, Kari	Norway	Research Assistant	Feb. 2010–Sep. 2010	UiO, Bio	
Hermansen, Jo Skeie	Norway	Research Assistant	Mar. 2010–Apr. 2010	RCN, CoE	
Qviller, Lars	Norway	Research Assistant	May 2010–May 2010	RCN	
Pettersen, Christian E.	Norway	Research Assistant	May 2010–Jun. 2010	UiO, Bio/RCN, CoE	50
Svendsen, Helene	Norway	Research Assistant	Jan. 2010–Jun. 2010	RCN	100
Tørresen, Ole Kristian	Norway	Research Assistant	Oct. 2010–Dec. 2010	UiO, Bio	25
Aasen, Maria	Norway	Research Assistant	Jun. 2010–Jun. 2010	UiO, Bio	

Administrative and technical support staff

Name	Nationality	Position	Period	Funding	CEES share (%)
Bakke, Hege G.	Norway	Principal engineer	Jan. 2008–Dec. 2013	RCN	100
Espelund, Mari	Norway	Head engineer/ Senior engineer	Sep. 2009–Jun. 2011	UiO, Bio/RCN	100
Gahr, Anja	Germany	Research Technician	Jun. 2010–Jun. 2010	UiO, Bio	
Gaup, Hege Junita	Norway	Head engineer	Jun. 2008–May 2012	UiO, Bio	100
Gautron, Martin	France	Research Technician	Mar 2010–Mar. 2010	UiO, Bio	
Gundersen, Gry	Norway	Advisor	Oct. 2007–Sep. 2011	UiO, Bio	100
Graceline, Tina	India	Technican	Feb. 2009–Feb. 2012	RCN	50
Grønli, Katinka E.	Norway	Head of Admin.	Oct. 2007–Dec. 2010	RCN, CoE	100
Grøttland, Eva Ingrid	Norway	Principal Executive officer	Apr. 2009–Dec. 2011	UiO, Bio/RCN, CoE	100
Henriksen, Jostein S.	Norway	Secretary	Jun. 2010–May 2011	RCN, CoE	20
Herland, Anders	Norway	Principal engineer	Jan. 2008–	UiO, Bio	100
Jentoft, Sissel	Norway	Advisor	Apr. 2009–Jul. 2011	UiO, Bio	100
Lambrou, Jayne	United Kindom	Higher Executive Officer	May 2009–Oct. 2011	RCN, CoE	80
Neerli, Emelita	Norway	Chief research techn.	Oct. 2007–	UiO, Bio	50
Pettersen, Morten K.	Norway	Executive Officer	Jun. 2009–Jun. 2010	UiO, Bio/RCN, CoE	100
Rygg, Kari Beate	Norway	Advisor	May 2009–Oct. 2011	UiO, Bio	100
Skage, Morten	Norway	Head engineer	May 2008–Apr. 2011	RCN	100
Solbakken, Monica H.	Norway	Principal engineer	Dec. 2008–May 2010	RCN	100
Steen, Nanna W.	Norway	Head engineer	Oct. 2007–	UiO, Bio	100
Svendsen, Helene	Norway	Principal engineer	Jul. 2010–Dec. 2010	RCN	100
Tømta, Camilla Maria	Norway	Executive Officer	Oct. 2010–Oct. 2012	UiO, Bio/RCN, CoE	100
Wallem, Tore	Norway	Higher exec. officer	Dec. 2007–Nov. 2011	RCN, CoE	100

Guests of CEES in 2010

Longer research visits (more than one month)

Name	Nationality	Home institution	Period
Akbari, Akbar	Norway	Dept. of Informatics, University of Oslo	Oct. 2009–Jun. 2010
Alling, Vanja	Sweden	Stockholm University	Jan. 2009–Dec. 2010
Bass, Arthur	USA	Oregon State University	Aug. 2010–Jun. 2011
Bonnet, Timothée	France	Montpellier SupAgro	Sep. 2010–Dec. 2010
Buonaccorsi, John	USA	University of Massachusetts	Apr. 2010–May 2010
Bærum, Kim Magnus	Norway	Hedmark University College	Sep. 2010–Aug. 2012
Cadahia, Luis	Spain	University of Alicante	Jun. 2009–Apr. 2011
Couce, Alejandro	Spain	Centro Nacional de Biotecnología	Jul. 2010–Nov. 2011
Fischer, Barbara	Austria	University of Bern	Jan. 2010–Feb. 2010
Fijarczyk, Ania	Poland	Jagiellonian University in Kraków	Jul. 2010–Oct. 2010
Grzes, Irena	Poland	Jagiellonian University in Kraków	Jan. 2010–May 2011
Harstad, Håvard	Norway	Norwegian School of Veterinary Science	Oct. 2009–May 2010
Haverkamp, Thomas	The Netherlands		Apr. 2009–Oct. 2012
Haas, Fredrik	Sweden	Lund University	Nov. 2009–Dec. 2011
Machu, Eric	France	L'Institut de recherche pour le développement	Mar. 2008–Feb. 2010
Marks, Jessica	Norway	University of Bergen	Jan. 2009–Feb. 2010
McCrackin, Michelle Lynn	USA	Arizona State University	Jun. 2009–May 2010
Mubalegh, Naid	France	ENS - Cachan	Jul. 2010–Sep. 2010
Nilsson, Anna	Sweden	Lund University	Jan. 2009–Mar. 2010
Lindén, Andreas	Finland	University of Helsinki	Jan. 2010–Dec. 2011
Paulsen, Jonas	Norway	Norwegian Radium Hospital	Nov. 2009–May 2010
Poyatos, Juan F.	Spain	Centro Nacional de Biotecnologia	Aug. 2009–Dec. 2010
Rogers, Lauren	USA	University of Washington	Sep. 2009–Mar. 2010
Starrfeldt, Jostein	Norway	University of Helsinki	Sep. 2010–Dec. 2010
Sivertsen, Therese	Norway	University of Oslo	
Tafani, Marion	France	Universite de Lyon	Oct. 2010–Dec. 2010
Tian, Huidong	China	Chinese Academy of Sciences	Dec. 2010–
Toscani, Camille	France	Universite de Rennes	Apr. 2010–Jul. 2010
Traba, Amada Pérez	Spain	The Norwegian Veterinary Institute	Nov. 2010–Nov. 2013
Van Beest, Floris	The Netherlands	Hedmark University College	Jan. 2008–Nov. 2010
Wiebe, Karen	Canada	University of Saskatchewan	Sep. 2010–Nov. 2010
Våge, Dag Inge	Norway	Norwegian University of Life Sciences	Sep. 2010–Aug. 2011
Aas, Eva	Norway	University of Oslo	Nov. 2010–Dec. 2011

Short term guests (more than one week, less than one month)

Name	Nationality	Home institution	Period
Aquisti, Claudia	USA	Arizona State University	Oct. 2010–Oct. 2010
Bartoszek, Krzysztof	Poland	Chalmers University of Technology	Nov. 2010–Dec. 2010
Carlson, Stephanie	USA	University of California, Berkeley	Feb. 2010–Feb. 2010
Caswell, Hal	USA	Woodshole Oceanographic Institution	Sep. 2010–Sep. 2010
Gazelles, Bernard	France	Ecole Normale Supérieure	Jun. 2010–Jun. 2010
Gerecht, Andrea	Italy	Stazione Zoologica Anton Dohrn of Naples	Nov. 2010–Nov. 2010
Hard, Jeffrey	USA	NOAA Northwest Fisheries Science Centre	Feb. 2010–Feb. 2010
Hines, James E.	USA	USGS Patuxent Wildlife Research Center	Sep. 2010–Sep. 2010
Hutchings, Jeffrey	Canada	Dalhousie University	Feb. 2010–Feb. 2010
Levaillant, Maryline	France	Université de Strasbourg	Nov. 2010–Nov. 2010
Le Rouzic, Arnaud	France	Centre national de la recherche scientifique	May 2010–Jun. 2010
Llope, Marcos	Spain	Spanish Institute of Oceanography	Nov. 2010–Nov. 2010
Machu, Eric	France	L'Institut de recherche pour le développement	Jun. 2010–Jun. 2010
Mable, Barbara	United Kingdom	University of St. Andrews	Sep. 2010–Sep. 2010
MacKenzie, Darryl I.	New Zealand	Proteus Wildlife Research Consultants	Sep. 2010–Sep. 2010
Mousing, Erik Askov	Denmark	University of Copenhagen	Dec. 2010–Dec. 2010
Neiman, Maurine	USA	University of Iowa	Oct. 2010–Oct. 2010
Nichols, James D.	USA	USGS Patuxent Wildlife Research Center	Sep. 2010–Sep. 2010
Richter, Andries Peter	The Netherlands	Wageningen University	Jun. 2010–Jun. 2010
Richter, Andries Peter	The Netherlands	Wageningen University	Feb. 2010–Feb. 2010
Rogers, Lauren	USA	University of Washington	Sep. 2010–Sep. 2010
Saroux, Claire	France	University of Strasbourg	Jul. 2010–Jul. 2010
Schmid, Boris	The Netherlands	Utrecht University	Jul. 2010–Jul. 2010
Wagner, Günter	Austria	Yale University	May 2010–May 2010
Weider, Lawrence	USA	University of Oklahoma	Oct. 2010–Oct. 2010

Associated research projects and other services

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, Unni	RCN	2007	2011
Host-virus interactions in Atlantic salmon	Grimholt, Unni	RCN	2007	2011
Statistical tools for studying genetic architecture	Hansen, Thomas F.	RCN	2007	2011
A Measurement-Theoretic Approach to the Estimation of Genetic Architecture and its Effects on Evolvability	Hansen, Thomas F.	RCN	2009	2010
Phytoplankton size: Climate adaption and long-term evolution	Henderiks, Jorijntje	RCN	2010	2013
Genome size, cell size and growth, searching for the casual links	Hessen, Dag O.	RCN	2010	2013
Spatiotemporal variability in mortality and growth of fish larvae in the Lofoten-Barents Sea ecosystem	Hjermann, Dag Ø.	RCN	2010	2013
Ultra-high throughput sequencing platform	Jakobsen, Kjetill S.	RCN	2007	2012
Genome sequencing of cod by exclusive uses of ultra high-throughput sequencing technology	Jakobsen, Kjetill S.	RCN	2008	2011
Translating the cod genome for aquaculture	Jakobsen, Kjetill S.	RCN	2010	2012
Norwegian High-Throughput Sequencing Centre	Jakobsen, Kjetill S.	RCN	2010	2013
Molecular mechanisms of gene regulation in autosomal and X-linked genes by the Y chromosome in Drosophila	Martinsen, Lene	RCN	2010	2011
Natural and farmed habitat as a basis for production of red deer in Norway	Mysterud, Atle	RCN	2007	2011
Land: Long-term ecological effects of sheep grazing in alpine ecosystems and its integration with management.	Mysterud, Atle	RCN	2008	2012
The ecology and economy of sheep production under climate change	Mysterud, Atle	RCN	2009	2012
Biogeographic and population analyses of Thermotogales bacteria from hydrocarbon-rich environments	Nesbø, Camilla	RCN	2008	2012
Integrated statistical analysis based on likelihood and confidence: applications to the hare-lynx cycles and the status of bowhead whales	Schweder, Tore	RCN	2005	2010
The possible role of zooplankton in modulating ecosystem effects of acute oil spills in the Norwegian and Barents Seas	Stenseth, Nils Chr.	RCN	2007	2010
Unravelling population connectivity for sustainable fisheries in the Deep Sea (EuroDEEP)	Stenseth, Nils Chr.	RCN	2007	2010
Linking physics and biology - Structuring of cod populations in the North Sea/Skagerrak water-system	Stenseth, Nils Chr.	RCN	2007	2011
Oceanography and Match-mismatch	Stenseth, Nils Chr.	RCN	2008	2010
Match-mismatching of trophic levels as a structuring force of ecosystems	Stenseth, Nils Chr.	RCN	2008	2011
Norwegian Russian Cooperation in estimating the cost structure of the Northeast Arctic cod	Stenseth, Nils Chr.	RCN	2009	2010

Spatiotemporal dynamics of introduced bark beetles: resource competition, invasion risk and management	Stenseth, Nils Chr.	RCN/The Norwegian Forest and Landscape Institute	2009	2010
Comparison of Marine Ecosystems of Norway and the US (MENU II)	Stenseth, Nils Chr.	RCN/IMR	2009	2012
Flexibility and constraints in animal movement pattern: ecology, evolution and annual cycles	Stenseth, Nils Chr.	RCN	2010	2013
VANN: Declining long-term trends in Atlantic salmon abundance: inferring mechanisms using catch data for Norway and Scotland	Vøllestad, L. Asbjørn	RCN	2008	2011
Modelling ecosystems under climate change: Windermere as a model lake system	Vøllestad, L. Asbjørn	RCN	2008	2012
Tracking signatures of adaptive diversification during postglacial colonisation: the build-up of genomic isolation in three spine stickleback	Vøllestad, L. Asbjørn	RCN	2010	2014

Other public sector based projects

Name	Project leader	Funding	Start	End
Platform for Viral Aqua medicine	Grimholt, Unni	RCN/NVI	2008	2012
Can nuisance growth of the aquatic macrophyte Juncus bulbosus be related to elevated nitrogen deposition as well as hydropower regulations?	Hessen, Dag O. & Andersen, Tom	RCN/NIVA	2007	2010
"Nutrient tunnelling" and other alternative pathways for mineral nutrients through the microbial food web to copepods	Hessen, Dag O.	RCN/UiB	2010	2010
High throughput sequencing of deep sea metagenomes 6503	Jakobsen, Kjetill S.	Statoil/VISTA	2009	2012
Socio-economic effects of fisheries-induced evolution	Stenseth, Nils Chr.	RCN/UiB	2008	2011
National research infrastructure Norwegian Marine Data centre	Stenseth, Nils Chr.	RCN/IMR	2009	2010
Arctic and sub-Arctic climate system and ecological response to the early 20th century warming	Stenseth, Nils Chr.	RCN/NERSC	2009	2011
MARINERA Marine phylogeographic structuring during climate change: the signature of leading and rear edge of range shifting populations (MARINERA)	Stenseth, Nils Chr.	RCN/IMR	2009	2011
PITRO III - Gr2 - Ecological modelling, interdisciplinary methodology and climatic variation in Africa	Stenseth, Nils Chr.	SIU	2009	2012
Investigations of population structure in shrimp (Pandulus borealis) in the North Atlantic – POPBOREALIS)	Stenseth, Nils Chr.	RCN/IMR	2010	2012
ADMAR Adaptive management of living marine resources by integrating different data sources and key ecological processes	Stenseth, Nils Chr.	RCN/IMR	2010	2015

Projects funded by private sector

Name	Project leader	Funding	Start	End
Marine Ecosystem Response to a Changing Climate	Hessen, Dag O.	RCN/BCCR	2008	2011
Combined effects of ocean acidification, climate change and oil related discharges	Hjermann, Dag Ø.	RCN/IRIS	2010	2014
Towards a better understanding of bloom-forming toxic cyanobacteria	Jakobsen, Kjetill S.	RCN/NIVA	2009	2011
A design document for Decision Support Tool (DTS) for Impact Analysis	Stenseth, Nils Chr.	Akvaplan-niva	2009	2010

International projects

Name	Project leader	Funding	Start	End
PIEF-GA-2008 220538 Statistical Tools for studying genetic architecture (stsga)	Hansen, Thomas F.	EU	2008	2010
Ecological and Evolutionary Response to Climatic Variation - Marie Curie Early Stage Research Training in Oslo (CEES-MCO)	Stenseth, Nils Chr.	EU-Marie Curie-EST	2006	2010
Fisheries-induced Evolution (FinE)	Stenseth, Nils Chr.	EU-IAASA Austria	2007	2010
Climate Change Impacts on Pollination Services	Stenseth, Nils Chr.	UN/FAO	2009	2010
PIEF-GA-2008-220947 Spatial Heterogeneity of Resources: a mediator of large herbivore population stability - SPHERE	Stenseth, Nils Chr.	EU	2009	2011
EU 236549 PIEF-GA 2009 Ecological and evolutionary dynamics of juvenescent marine populations EVOLHAKE	Stenseth, Nils Chr.	EU	2009	2011
PIEF-GA-2009-235962 EVOLBIRD - Demographic strategies under climate variation: a study on Arctic and Antarctic seabirds	Stenseth, Nils Chr.	EU	2010	2012
EUR-OCEAN Flagship – Developing seasonal and spatial food web models through novel statistical modelling – tools for constructing scenarios under future global change (EcoScenarios)	Stenseth, Nils Chr.	EUR- OCEANS	2010	2012

CEES events

Scientific events

'Young Researcher's Day' ('De unges dag' in Norwegian). 25 February, The Norwegian Academy of Science and Letters, Oslo

Workshop on measurement theory – Report from Colloquium 1. 10 May, Blindern, Oslo

Names	Titles
Hansen, Thomas (1); Pelabon, Christophe (2); Wagner, Gunter (3); Houle, David (4); Omholt, Stig (5)	(1) Introduction; (2) A measurement-theory perspective on allometry; (3) Measuring fitness: From theory to experiment; (4) Measurement, genomics and phenomics; (5) GWAS contra Galton

Merging of genomics and life history biology – Lunch to lunch seminar. 9–10 March, Soria Moria Hotel, Oslo.

Names	Titles
Stenseth, Nils Chr. (1); Jakobsen, Kjetill S. (2); Nederbragt, Lex; Hjermann, Dag Ø.; Ottersen, Geir; Knutsen, Halvor; Jorde, Per Erik; Rounge, Trine B.; Stige, Leif Chr.; Vøllestad, L.A.; Østbye, Kjartan; Andersen, Øivind; Grimholt, Unni; Star, Bastiaan; Olsen, Esben M.; Omholt, Stig W. (all: 3)	(1) Welcome and opening remarks; (2) The next phase of the cod genome project and further utilisation of the genome sequence; (3) Towards a better understanding of biological aspects by utilisation of a reference genome

High-throughput Sequencing – Applications and Analyses. 11 June, Blindern, Oslo	
Names	**Titles**
Stenseth, Nils Chr. (1); Taberlet, Pierre (2); Jakobsen, Kjetill S. (3,9); Schleper, Christa (4); Lundeberg, Joakim (5); Lyle, Robert (6); Dermitzakis, Emanouil (7); Klungland, Arne (8)	(1) Welcome and opening remarks (2) Next generation sequencers and the ecologist (3) The cod genome project (4) Characterisation of ammonia oxidising archaea by metagenomics and metatranscriptomics (5) Massive sequencing – improvements and applications at SciLifeLab (6) Illumina sequencing at the NSC (7) Cellular Population Genomics (8) piRNA expression in Pachytene (9) Closing remarks

The Annual CEES Student Conference & Banquet. 2–3 November, Holmen Fjord Hotel, Nesbru

(The list of speakers is too long to publish here. Please refer to our website).

Colloquium 2 Kick-off seminar: Bridging the gap between genomics and evolutionary biology. 11–12 November, The Norwegian Academy of Science and Letters, Oslo	
Names	**Titles**
Stenseth, Nils Chr. (1, 15); Omholt, Stig W. (2, 13); Hansen, Thomas F. (3); Mable, Barbara (4); Flatt, Thomas (5); Jones, Felicity (6); Feil, Edward (7)	(1) Welcome and opening remarks; (2) Where are the gaps?; (3) Outstanding problems in theoretical evolutionary genetics – how can they be informed by molecular and developmental biology?; (4) Molecular evolutionary genetics – how does it contribute to evolutionary theory?; (5) The added value of combining the tools of evolutionary genetics, molecular genetics and physiology in life history evolution research; (6) Sticklebacks genomics – how has it expanded our understanding of their life history biology?; (7) Comparative microbial genomics: ecological and evolutionary lessons learned; (8) Key questions in behavioral ecology, population dynamics and conservation biology – when would molecular information make a difference?; (9) Can longitudinal analysis of population persistence and evolutionary demography inform molecular evolutionary work?; (10) Phenomics – the new frontier?; (11) A virtual root developmental model – how will it inform key issues of plant ecology and evolution?; (12) The genetics and mechanisms of epigenetics; (13) Ecological and evolutionary implications of epigenetics; (14) Experimental evolution on yeast; (15) Prokaryotic experimental evolution; (16) Genome-wide association and genomic selection models applied to natural populations: what does it take and what do we get?; (17) Primer for discussion: A molecular geneticist's view.

Seminars with invited speakers

Name	Title and date of presentation
Edeline, Eric	Nonconsumptive impacts of competitors and predators on populations dynamics: chronic social stress in pike. 22 January
Heesterbeek, Hans	Mathematical reasoning as tool to get insight into infection dynamics. 29 January
Harris, Phil	Fleas, Bartonella and the bacterial metagenom. 1 February (Late Lunch Talk)
Jay, Zack	The Yellowstone Metagenomics Project. 2 February (Late Lunch Talk)
Daniel, Pauly (1); Carlson, Stephanie M. (2); Chapman, Lauren J. (3); Coltman, David (4); Hutchings, Jeffrey (5); Hard, Jeffrey J. (6); Eikeset; Anne Maria (7)	(1) Darwin's Fishes: How ichthyology informed evolution; (2) Evolutionary effects of natural and human predators; (3) Fishing and Phenotypic Change in Inland Waters: Lessons of the Lake Victoria Basin; (4) Harvest-induced Darwinian evolution in terrestrial wildlife; (5) The evolution of small fish: Selection against that which we desire most from marine fisheries; (6) Genetics, selection and harvest-induced evolution: Can animals continue to adapt to human exploitation?; (7) The economic repercussions of fisheries-induced evolution. 12 February (Darwin Day)
Nilsen, Hilde	Towards a systems level understanding of responses to oxidative DNA damage in C. elegans: Two-Tiered Compensatory Response to Loss of DNA Repair Modulates Aging and Stress Response Pathways. 22 February (Late Lunch Talk)
Buonaccorsi, John	Observation error in fitting population dynamic models. 5 March
Chivian, Eric	How Human Health Depends on Biodiversity. 11 March
Chivian, Eric	How Human Health Depends on Nature. 12 March
Caswell, Hal	A demographic approach to the population effects of climate change. 19 March
Røskaft, Eivin	The rarity of twins: A result of an evolutionary battle between mothers and daughters – or do they agree? 26 March
Kilner, Rebecca	Cuckoos versus hosts: Australian rules. 9 April
Sirevåg, Reidun	From hot springs to crystals; the confessions of a female scientist. 30 April
Klee, Silke	Characterisation and genome sequence of Bacillus cereus var. anthracis. 11 May
Schindler, David W.	Ecosystem services and biodiversity issues in the Canadian Boreal Biome: The cumulative effects of human disturbance and changing climate. 11 May
Ohlson, Mikael	The boundless carbon cycle in boreal forests. 21 May
Beaubien, Elisabeth	Spring flowering response to climate change over 70 years in central Alberta, Canada.8 June
Myers, Paul Z.	Creationism in America. 16 June
Haccou, Patsy (1); van Dooren, Tom (2);	(1)What do models tell us about invasions? (2) Annual South-American killifish: a model system for comparative eco-evo-devo. 23 June
Fricke, Christel (1); de Waal, Frans (2)	(1) From a Philosophical Point of View: Empathy, Sympathy and the Challenge of Equality (2) Prosocial Primates: Empathy in Animals and Humans. 2 September (The Kristine Bonnevie Lectures on Evolutionary Biology)
de Waal, Frans	Monkey Business: Cooperation and Fairness in Primate Behavior. 3 September
Nichols, James D.	On Valuing Patches: Estimating Relative Contributions to Metapopulation Growth. 17 September
Olsen, Odd-Arne	Transmembrane-anchored DEK1 calpain is a key determinant of the plant epidermis - also a key to the development of differentiated multicellular land plants? 24 September
Caswell, Hal	Beyond R_0. 27 September
Ezard, Thomas H.G.	Species' ecology drives evolutionary diversification. 1 October
Andersen, Ken Haste	Expected rate of fisheries-induced evolution is slow. 8 October
Enebakk, Vidar	Hansteen and the Observatory. 11 October (Late Lunch Talk)
Jesse, Marieke; Schmid, Boris; Wilschut, Liesbeth	Modelling plague persistence on large spatial scales, and Monitoring plague outbreaks from space. 13 October

Pinnegar, John K.	100 years in the North Sea: fundamental changes in the distribution and diet of commercial fish species. 15 October
Thingstad, Tron Frede	When do we need flexible stoichiometry to explain the behaviour of the microbial food web? 25 October
Singh, Simon	Science and the Media - the good, the bad and the ugly. 29 October
Pope, Phillip B.	Learning from the locals: Plant biomass degradation in native herbivores. 5 November
Lavine, Jennie	Natural Immune Boosting in Pertussis Dynamics: the Possibility for Long-term Vaccine Failure. 8 November (Late Lunch Talk)
Hebblewhite, Mark	Ecology, genetics and conservation of partial migration in ungulates. 12 November
Lynam, Christopher	Structural change in marine ecosystems: regime shifts or not? 19 November
Præbel, Kim	Incipient speciation through ecological divergence in subarctic whitefish populations. 22 November
Taranger, Geir Lasse	Puberty control in fishes – underlying mechanism and practical applications. 26 November
Ambur, Ole Herman	How the meningococcus finds the balance between genetic variation and stability. 10 December
Brander, Keith	Reconciling biodiversity conservation and marine capture fisheries production. 17 December

Internal CEES seminars

Name	Title and date of presentation
Langangen, Øystein	Solar physics. 11 January
Nederbragt, Lex	How you can use the GS FLX (454) for your project and why it does not have to be very expensive. 18 January
Yedid, Gabriel	A virtual paleobiologist introduces himself: using digital evolution to examine effects of extinction and recovery on phylogenetic tree shape and community composition. 25 January
Easterday, W. Ryan	Anthrax: phylogeny, tools and strategies for forensic applications. 15 February
Liow, Lee Hsiang	Rise and fall of species and environmental volatility. 1 March
Whittington, Jason	Seductive singers: what makes a male starling sexy? 15 March
Junge, Claudia	CITES – a powerful tool for biodiversity conservation. 22 March
Ottersen, Geir	Integrated marine environmental management of Norwegian water. 26 April
Stüken, Anke C.	Convergent evolution or horizontal gene transfer? 3 May
Griffin, Donald	Software Demonstration: Papers, and iTunes for your journal articles. 26 May
Poyatos, Juan	Epistasis: The molecular systems biology view. 31 May
Griffin, Donald	Evolutionary Dynamics and the Shape of the Genotype-to-Phenotype Map. 7 June
Star, Bastiaan Star; Kausrud, Kyrre L.; Easterday, W. Ryan	Kazakhstan relived: about plague, gerbils, running ticks and a goat... 16 August
Kausrud, Kyrre L.	Climate change: Ecosystem functioning, adaptation and climate-ecosystem interaction. 6 September
Burkey, Tormod V.	Size Matters: An alternative harvesting strategy for top-heavy populations? 20 September
Ohlberger, Jan	Temperature driven regime shifts in size-structured populations. 4 October
Bischof, Richard	The brown treesnake invasion on Guam: history and management. 18 October
Lagesen, Karin; Haverkamp, Thomas	Microbial genome and metagenome annotation using RAST and friends. 13 December

Lars Qviller collecting ticks in Sogn og Fjordane @ Kim Magnus Bærum

CEES participants in the Holmenkollen relay © Inger Maren Rivrud

Production

Books and book chapters

Austrheim, G., Bråthen, K.A., Ims, R.A., **Mysterud**, A. & Ødegaard, F. (2010) Fjell. In: J.A. Kålås, S. Henriksen, S. Skelseth & Å. Viken (eds.) *Miljøforhold og påvirkninger for rødlistearter*. Trondheim: Artsdatabanken pp. 107-119. (ISBN: 978-82-92838-27-3).

Brander, K., Botsford, L.W., **Ciannelli**, L., Fogarty, M.J., Heath, M., Planque, B., Shannon, L.J. & Wieland, K. (2010) Human impacts on marine ecosystems. In: M. Barange, J.G. Field, R.P. Harris, E.E. Hoffman, R.I. Perry & F. Werner (eds.) *Marine Ecosystems and Global Change*. Oxford: Oxford University Press pp. 41-73. (ISBN: 978-0-19955-802-5).

*__Edeline__, E., Dufour, S. & Elie, P. (2009) Proximate and Ultimate Control of Eel Continental Dispersal. In: G. van den Thillart, S. Dufour & J.C. Rankin (eds.) *Spawning Migration of he European Eel. Reproduction index, a useful tool for conservation management*. New York: Springer pp. 433-461. (ISBN: 978-1-4020-9094-3)

Gjøsæter, J., Hesthagen, T., Borgstrøm, R., Brabrand, Å., Byrkjedal, I., Christiansen, J.S., Nedreaas, K., Pethon, P., Uiblein, F., **Vøllestad**, L.A. & Wienerroither, R. (2010) Fisk "Pisces". In: J.A: Kålås, Å. Viken, S. Henriksen & S. Skjelseth (eds.) *The 2010 Norwegian Red List for Species*. Trondheim: Artsdatabanken pp. 403-412. (ISBN: 978-82-92838-26-6).

Hessen, D.O. (2010) Som champagne til bokkøl. In: N. Faarlund (ed.) *Arven og gleden – et festskrift til naturen*. Trondheim: Tapir Akademisk Forlag pp. 109-114. (ISBN: 9788251925501).

*__Stenseth__, N.C. (2009) The Importance of TAR-Modelling for Understanding the Structure of Ecological Dynamics: The Hare-Lynx Population Cycles as an Example. In: K.S. Chan (ed.) *Exploration of a Nonlinear World, An Appreciation of Howell Tong's Contributions to Statistics*. Singapore: World Scientific Publishing Co. pp. 365-374. (ISBN: 978-981-283-627-4).

*Published in 2009 but omitted from the CEES Annual Report 2009.

Publications in peer reviewed journals

*Adrian, R., O'Reilly, C.M., Zagarese, H., Baines, S.B., **Hessen**, D.O., Keller, W., Livingstone, D.M., Sommaruga, R., Straile, D. & **van Donk**, E. (2009) Lakes as sentinels of climate change. *Limnology and Oceanography*, **54** (6), 2283-2297.

Akbari, A., Albregtsen, F. & **Jakobsen**, K.S. (2010) Automatic lane detection and separation in one dimensional gel images using continuous wavelet transform. *Analytical Methods*, **2**, 1360-1371.

Alcaide, M., **Cadahía**, L., Lambertucci, S.A. & Negro, J.J. (2010) Noninvasive estimation of minimum population sizes and variability of the major histocompatibility complex in the Andean condor. *The Condor*, **112** (3), 470-478.

Aldrin, M., Storvik, B., Frigessi, A., **Viljugrein**, H. & Jansen, P.A. (2010) A stochastic model for the assessment of the transmission pathways of heart and skeleton muscle inflammation, pancreas disease and infectious salmon anaemia in marine fish farms in Norway. *Preventive Veterinary Medicine*, **93**, 51-61.

Atickem, A., Williams, S., Bekele, A. & Thirgood, S. (2010) Livestock predation in the Bale Mountains, Ethiopia. *African Journal of Ecology*, **48**, 1076-1082.

Backström, N., Lindell, J., Zhang, Y., Palkopoulou, E., Qvarnström, A., **Sætre**, G.P. & Ellegren, H. (2010) A high-density scan of the Z chromosome in *Ficedula* flycatchers reveals candidate loci for diversifying selection. *Evolution*, **64** (12), 3461-3475.

Basedow, S.L., Tande, K.S. & **Stige**, L.C. (2010) Habitat selection by a marine copepod during the productive season in the Subarctic. *Marine Ecology Progress Series*, **416**, 165-178.

Ben Ari, T., Gershunov, A., **Tristan**, R., Cazelles, B., Gage, K. & **Stenseth**, N.C. (2010) Interannual variability of human plague occurrence in the western United States explained by tropical and north Pacific ocean climate variability. *American Journal of Tropical Medicine and Hygiene*, **83** (3), 624-632.

Bernatchez, L., Renaut, S., Whiteley, A.R., Derome, N., Jeukens, J., Landry, L., Lu, G., Nolte, A.W., **Østbye**, K., Rogers, S.M. & St-Cyr, J. (2010) On the origin of species: insights from the ecological genomics of lake whitefish. *Philosophical Transactions of the Royal Society of London. Biological Sciences*, **365**, 1783-1800.

Besnier, F., **Le Rouzic**, A. & Álvarez-Castro, J.M. (2010) Applying QTL analysis to conservation genetics. *Conservation Genetics*, **11**, 399-408.

Bjorbækmo, M.F.M., Carlsen, T., **Brysting**, A.K., Vrålstad, T., Høiland, K., Ugland, K.I., Geml, J., Schumacher, T. & Kauserud, H. (2010) High diversity of root associated fungi in both alpine and arctic *Dryas octopetala*. *BMC Plant Biology*, **10** (244). Open access.

Bjærke, O., **Østbye**, K., **Lampe**, H.M. & **Vøllestad**, L.A. (2010) Covariation in shape and foraging behaviour in lateral plate morphs in the three-spined stickleback. *Ecology of Freshwater Fish*, **19**, 249-256.

Boessenkool, S., **Star**, B., Scofield, R.P., Seddon, P.J. & Waters, J.M. (2010) Lost in translation or deliberate falsification? Genetic analyses reveal erroneous museum data for historic penguin specimens. *Proceedings of the Royal Society of London. Biological Sciences*, **277**, 1057-1064.

Boessenkool, S., **Star**, B., Seddon, P.J. & Waters, J.M. (2010) Temporal genetic samples indicate small effective population size of the endangered yellow-eyed penguin. *Conservation Genetics*, **11**, 539-546.

Bolstad, G.H., Armbruster, W.S., Pélabon, C., Pérez-Barrales, R. & **Hansen**, T.F. (2010) Direct selection at the blossom level on floral reward by pollinators in a natural population of *Dalechampia schottii*: full-disclosure honesty? *New Phytologist*, **188**, 370-384.

Bråte, J., Klaveness, D., Rygh, T., **Jakobsen**, K.S. & Shalchian-Tabrizi, K. (2010) Telonemia-specific environmental 18S rDNA PCR reveals unknown diversity and multiple marine-freshwater colonizations. *BMC Microbiology*, **10** (168). Open access.

Bråte, J., Logares, R., Berney, C., Ree, D.K., Klaveness, D., **Jakobsen**, K.S. & Shalchian-Tabrizi, K. (2010) Freshwater Perkinsea and marine-freshwater colonizations revealed by pyrosequencing and phylogeny of environmental rDNA. *The ISME Journal*, **4**, 1144-1153.

Cadahía, L., López-López, P., Urios, V. & Negro, J.J. (2010) Satellite telemetry reveals individual variation in juvenile Bonelli's eagle dispersal areas. *European Journal of Wildlife Research*, **56**, 923-930.

Chown, S.L., Hoffmann, A.A., Kristensen, T.N., Angilletta, M.J., **Stenseth**, N.C. & Pertoldi, C. (2010) Adapting to climate change: a perspective from evolutionary physiology. *Climate Research*, **43**, 3-15.

Ciannelli, L., Knutsen, H., Olsen, E.M., Espeland, S.H., Asplin, L., Jelmert, A., Knutsen, J.A. & **Stenseth**, N.C. (2010) Small-scale genetic structure in a marine population in relation to water circulation and egg characteristics. *Ecology*, **91**, 2918-2930.

Corbineau, A., **Rouyer**, T., Fromentin, J.M., Cazelles, B., Fonteneau, A. & Ménard, F. (2010) Patterns of variations in large pelagic fish: A comparative approach between the Indian and the Atlantic Oceans. *Progress in Oceanography*, **86**, 276-282.

Diekert, F.K., **Eikeset**, A.M. & **Stenseth**, N.C. (2010) Where could catch shares prevent stock collapse? *Marine Policy*, **34**, 710-712.

Diekert, F.K., **Hjermann**, D.Ø., Nævdal, E. & **Stenseth**, N.C. (2010) Non-cooperative exploitation of multi-cohort fisheries - The role of gear selectivity in the North-East Arctic cod fishery. *Resource and Energy Economics*, **32**, 78-92.

Diekert, F.K., **Hjermann**, D.Ø., Nævdal, E. & **Stenseth**, N.C. (2010) Spare the young fish: optimal harvesting policies for north-east Arctic cod. *Environmental and Resource Economics*, **47**, 455-475.

Drinkwater, K., Beaugrand, G., Kaeriyama, M., Kim, S., **Ottersen**, G., Perry, R.I., Pörtner, H.O., Polovina, J.J. & Takasuka, A. (2010) On the processes linking climate to ecosystem changes. *Journal of Marine Systems*, **79**, 374-388.

Durant, J.M., Crawford, R.J.M., Wolfaardt, A.C., Agenbag, K., Visagie, J., Upfold, L. & **Stenseth**, N.C. (2010) Influence of feeding conditions on breeding of African penguins – the importance of adequate local food supplies. *Marine Ecology Progress Series*, **420**, 263-271.

Durant, J.M., Gendner, J.P. & Handrich, Y. (2010) Behavioural and body mass changes before egg laying in the Barn Owl: cues for clutch size determination? *Journal of Ornithology*, **151**, 11-17.

Edeline, E., Haugen, T., Weltzien, F.A., Claessen, D., Winfield, I.J., **Stenseth**, N.C. & **Vøllestad**, L.A. (2010) Body downsizing caused by non-consumptive social stress severely depresses population growth rate. *Proceedings of the Royal Society of London. Biological Sciences*, **277**, 843-851.

Ekblom, R., **Sæther**, S.A., Fiske, P., Kålås, J.A. & Höglund, J. (2010) Balancing selection, sexual selection and geographic structure in MHC genes of Great Snipe. *Genetica*, **138**, 453-461.

Engh, I.B., Carlsen, T., **Sætre**, G.P., Högberg, N., Doi, S. & Kauserud, H. (2010) Two invasive populations of the dry rot fungus *Serpula lacrymans* show divergent population genetic structures. *Molecular Ecology*, **19**, 706-715.

Engh, I.B., Skrede, I., **Sætre**, G.P. & Kauserud, H. (2010) High variability in a mating type linked region in the dry rot fungus *Serpula lacrymans* caused by frequency-dependent selection? *BMC Genetics*, **11** (64). Open access.

Eronen, J.T., Polly, P.D., Fred, M., Damuth, J., Frank, D.C., Mosbrugger, V., Scheidegger, C., **Stenseth**, N.C. & Fortelius, M. (2010) Ecometrics: The traits that bind the past and present together. *Integrative Zoology*, **5**, 88-101.

Espeland, S.H., Thoresen, A.G., Olsen, E.M., **Stige**, L.C., Knutsen, H., Gjøsæter, J. & **Stenseth**, N.C. (2010) Diel vertical migration patterns in juvenile cod from the Skagerrak coast. *Marine Ecology Progress Series*, **405**, 29-37.

Evju, M., Halvorsen, R., Rydgren, K., Austrheim, G. & **Mysterud**, A. (2010) Interactions between local climate and grazing determine the population dynamics of the small herb *Viola biflora*. *Oecologia*, **163**, 921-933

Fierst, J. & **Hansen**, T.F. (2010) Genetic architecture and postzygotic reproductive isolation: Evolution of Bateson-Dobzhansky-Muller incompatibilities in a polygenic model. *Evolution*, **64** (3), 675-693.

Grémillet, D., Mullers, R.H.E., Moseley, C., Pichegru, L., Coetzee, J., **Sabarros**, P.S., van der Lingen, C.D., Ryan, P.G., Kato, A. & Ropert-Coudert, Y. (2010) Seabirds, fisheries, and cameras. *Frontiers in Ecology and the Environment*, **8**, 401-402.

Haanes, H., Røed, K.H., **Mysterud**, A., Langvatn, R. & Rosef, O. (2010) Consequences for genetic diversity and population performance of introducing continental red deer into the northern distribution range. *Conservation Genetics*, **11**, 1653-1665.

Haas, F., Knape, J. & Brodin, A. (2010) Habitat preferences and positive assortative mating in an avian hybrid zone. *Journal of Avian Biology*, **41**, 237-247.

Hansen, B.T., **Holen**, Ø.H. & Mappes, J. (2010) Predators use environmental cues to discriminate between prey. *Behavioral Ecology and Sociobiology*, **64**, 1991-1997.

Hansen, B.T., Johannessen, L.E. & **Slagsvold**, T. (2010) Interspecific cross-fostering of great tits (*Parus major*) by blue tits (*Cyanistes caeruleus*) affects inter- and intraspecific communication. *Behaviour*, **147** (3), 413-424.

Hegel, T.M., **Mysterud**, A., Ergon, T., **Loe**, L.E., Huettmann, F. & **Stenseth,** N.C. (2010) Seasonal effects of Pacific-based climate on recruitment in a predator-limited large herbivore. *Journal of Animal Ecology*, **79**, 471-482.

Hegel, T.M., **Mysterud**, A., Huettmann, F. & **Stenseth**, N.C. (2010) Interacting effect of wolves and climate on recruitment in a northern mountain caribou population. *Oikos*, **119**, 1453-1461.

Hegland, S.J., Dunne, J., **Nielsen**, A. & Memmott, J. (2010) How to monitor ecological communities cost-efficiently: The example of plant-pollinator networks. *Biological Conservation*, **143**, 2092-2101.

Hemp, C., **Voje**, K.L., Heller, K.G., Warchałowska-Śliwa, E. & Hemp, A. (2010) A new genus of African Acrometopini (Tettigoniidae: Phaneropterinae) based on morphology, chromosomes, acoustics, distribution, and molecular data, and the description of a new species. *Zoological Journal of the Linnean Society*, **158**, 66-82.

*__Hessen__, D.O., Andersen, T., Larsen, S., Skjelkvåle, B.L. & De Wit, H.A. (2009) Nitrogen deposition, catchment productivity, and climate as determinants of lake stoichiometry. *Limnology and Oceanography*, **54** (6), 2520-2528.

Hessen, D.O., Carroll, J., Kjeldstad, B.J., Korosov, A., Pettersson, L.H., Pozdnyakov, D. & Sørensen, K. (2010) Input of organic carbon as determinant of nutrient fluxes, light climate and productivity in the Ob and Yenisey estuaries. *Estuarine, Coastal and Shelf Science*, **88**, 53-62.

Hessen, D.O., Jeyasingh, P.D., **Neiman**, M. & **Weider**, L.J. (2010) Genome streamlining and the elemental costs of growth. *Trends in Ecology & Evolution*, **25** (6), 75-80.

Hessen, D.O., Jeyasingh, P.D., **Neiman**, M. & **Weider**, L.J. (2010) Genome streamlining in prokaryotes versus eukaryotes - Response. *Trends in Ecology & Evolution*, **25**, 320-321.

Hetland, D., Jørgensen, S.M., Skjødt, K., Dale, O.B., Falk, K., Xu, C., Mikalsen, A.B., **Grimholt**, U., Gjøen, T. & Press, C.M. (2010) *In situ* localisation of major histocompatibility complex class I and class II and CD8 positive cells in infectious salmon anaemia virus (ISAV)-infected Atlantic salmon. *Fish and Shellfish Immunology*, **28**, 30-39.

Hjermann, D.Ø., Bogstad, B., Dingsør, G.E., Gjøsæter, H., **Ottersen**, G., **Eikeset**, A.M. & **Stenseth**, N.C. (2010) Trophic interactions affecting a key ecosystem component: a multistage analysis of the recruitment of the Barents Sea capelin (*Mallotus villosus*). *Canadian Journal of Fisheries and Aquatic Sciences*, **67**, 1363-1375.

Houle, D., Govindaraju, D.R. & **Omholt**, S. (2010) Phenomics: the next challenge. *Nature Reviews Genetics*, **11**, 855-866.

Hušek, J., Weidinger, K., Adamík, P., Hlavatý, L., Holáň, V. & Sviečka, J. (2010) Analysing large-scale temporal variability in passerine nest survival using sparse data: a case study on Red-backed Shrike *Lanius collurio*. *Acta Ornithologica*, **45** (1), 43-49.

Iriarte, A., Aravena, G., Villate, F., Uriarte, I., Ibáñez, B., **Llope**, M. & **Stenseth**, N.C. (2010) Dissolved oxygen in contrasting estuaries of the Bay of Biscay: effects of temperature, river discharge and chlorophyll *a*. *Marine Ecology-Progress Series*, **418**, 57-71.

Johnson, D., Büntgen, U., Frank, D.C., **Kausrud,** K.L., Haynes, K.J., Liebhold, A.M., Esper, J. & **Stenseth**, N.C. (2010) Climatic warming disrupts recurrent Alpine insect outbreaks. *Proceedings of the National Academy of Science of the United States of America*, **107** (47), 20576-20581.

Junge, C., Primmer, C.R., **Vøllestad**, L.A., & Leder, E.H. (2010) Isolation and characterization of 19 new microsatellites for European grayling, *Thymallus thymallus* (Linnaeus, 1758), and their cross-amplification in four other salmonid species. *Conservation Genetics Resources*, **2**, 219-223. (Also listed in the CEES Annual Report 2009, when it was published online.)

Kauserud, H., Heegaard, E., Semenov, M.A., Boddy, L., Halvorsen, R., **Stige,** L.C., Sparks, T.H., Gange, A.C. & **Stenseth**, N.C. (2010) Climate change and spring-fruiting fungi. *Proceedings of the Royal Society of London. Biological Sciences*, **277**, 1169-1177.

Kausrud, K.L., Begon, M., **Ben Ari**, T.M., **Viljugrein**, H., Esper, J., Büntgen, U., Leirs, H., **Junge**, C., Yang, B., Yang, M., **Xu**, L. & **Stenseth**, N.C. (2010) Modeling the epidemiological history of plague in Central Asia: Palaeoclimatic forcing on a disease system over the past millennium. *BMC Biology*, **8** (112). Open access.

Kavanagh, K.D., Haugen, T., Gregersen, F., Jernvall, J. & **Vøllestad**, L.A. (2010) Contemporary temperature-driven divergence in a Nordic freshwater fish under conditions commonly thought to hinder adaptation. *BMC Evolutionary Biology*, **10** (350). Open access.

Kellmann, R., **Stüken**, A., Orr, R.J.S., Svendsen, H.M. & **Jakobsen**, K.S. (2010) Biosynthesis and molecular genetics of polyketides in marine dinoflagellates. *Marine Drugs*, **8**, 1011-1048.

Kuijper, D.P.J., **Cromsigt**, J., Jedrzejewska, B., Miścicki, S., Churski, M., Jędrzejewski, W. & Kweczlich, I. (2010) Bottom-up versus top-down control of tree regeneration in the Białowieza Primeval Forest, Poland. *Journal of Ecology*, **98**, 888-899.

Labra, A.L., **Voje**, K.L., **Seligmann**, H. & **Hansen**, T.F. (2010) Evolution of the third eye: a phylogenetic comparative study of parietal-eye size as an ecophysiological adaptation in *Liolaemus* lizards. *Biological Journal of the Linnean Society*, **101**, 870-883.

Lambrechts, M.M. *et al* (including **Slagsvold**, T.) (2010) The design of artificial nestboxes for the study of secondary hole-nesting birds: a review of methodological inconsistencies and potential biases. *Acta Ornithologica*, **45** (1), 1-26.

Lampe, H.M., Balsby, T.J.S., Espmark, Y.O. & Dabelsteen, T. (2010) Does twitter song amplitude signal male arousal in redwings (*Turdus iliacus*)? *Behaviour*, **147** (3), 353-365.

Landys, M.M., Goymann, W., Schwabl, I., Trapschuh, M. & **Slagsvold**, T. (2010) Impact of season and social challenge on testosterone and corticosterone levels in a year-round territorial bird. *Hormones and Behavior*, **58**, 317-325.

Le Rouzic, A., Skaug, H.J. & **Hansen,** T.F. (2010) Estimating genetic architectures from artificial-selection responses: A random-effect framework. *Theoretical Population Biology*, **77**, 119-130.

Lindegren, M.O., Möllmann, C., Nielsen, A., Brander, K., MacKenzie, B.R. & **Stenseth**, N.C. (2010) Ecological forecasting under climate change: the case of Baltic cod. *Proceedings of the Royal Society of London. Biological Sciences*, **277**, 2121-2130.

*Lindholm, M., **Hessen**, D.O. & Ramberg, L. (2009) Diversity, dispersal and disturbance: cladoceran species composition in the Okavango Delta. *African Zoology*, **44** (1), 24-35.

Liow, L.H., Quental, T.B. & Marshall, C.R. (2010) When can decreasing diversification rates be detected with molecular phylogenies and the fossil record? *Systematic Biology*, **59** (6), 646-659.

Liow, L.H., Skaug, H.J., Ergon, T.H. & **Schweder**, T. (2010) Global occurrence trajectories of microfossils: environmental volatility and the rise and fall of individual species. *Paleobiology*, **36** (2), 224-252.

Loe, L.E., **Mysterud**, A., Veiberg, V. & Langvatn, R. (2010) No evidence of juvenile body mass affecting dispersal in male red deer. *Journal of Zoology*, **280**, 84-91.

Lukacs, M.F., **Harstad**, H., **Bakke**, H.G., Beetz-Sargent, M., McKinnel, L., Lubieniecki, K.P., Koop, B.F. & **Grimholt**, U. (2010) Comprehensive analysis of MHC class I genes from the U-, S-, and Z-lineages in Atlantic salmon. *BMC Genomics*, **11** (154). Open Access.

Løvoll, M., Wiik-Nielsen, J., Grove, S., Wiik-Nielsen, C., Kristoffersen, A.B., Faller, R., Poppe, T., Jung, J., Pedamallu, C.S., **Nederbragt**, A.J., Meyerson, M., Rimstad, E. & Tengs, T. (2010) A novel totivirus and piscine reovirus (PRV) in Atlantic salmon (*Salmo salar*) with cardiomyopathy syndrome (CMS). *Virology Journal*, **7** (309). Open access.

Marcussen, T., Oxelman, B., **Skog**, A. & **Jakobsen**, K.S. (2010) Evolution of plant RNA polymerase IV/V genes: evidence of subneofunctionalization of duplicated *NRPD2/NRPE2*-like paralogs in *Viola* (Violaceae). *BMC Evolutionary Biology*, **10** (45). Open access.

Mekonnen, A., Bekele, A., Fashing, P.J., Hemson, G. & **Atickem**, A. (2010) Diet, activity patterns, and ranging ecology of the Bale monkey *Chlorocebus djamdjamensis* in Odobullu Forest, Ethiopia. *International Journal of Primatology*, **31**, 339-362.

Mekonnen, A., Bekele, A., Hemson, G., Teshome, E. & **Atickem**, A. (2010) Population size and habitat preference of the vulnerable Bale monkey *Chlorocebus djamdjamensis* in Odobullu Forest and its distribution across the Bale Mountains, Ethiopia. *Oryx*, **44** (4), 558-563.

Minge, M.A., Shalchian-Tabrizi, K., **Tørresen**, O.K., Takishita, K., Probert, I., Inagaki, Y., Klaveness, D. & **Jakobsen**, K.S. (2010) A phylogenetic mosaic plastid proteome and unusual plastid-targeting signals in the green-colored dinoflagellate *Lepidodinium chlorophorum*. *BMC Evolutionary Biology*, **10** (191). Open access.

Moland, E., Olsen, E.M. & **Stenseth**, N.C. (2010) Maternal influences on offspring size variation and viability in wild European lobster *Homarus gammarus*. *Marine Ecology Progress Series*, **400**, 165-173.

Mysterud, A. (2010) Still walking on the wild side? Management actions as steps towards 'semi-domestication' of hunted ungulates. *Journal of Applied Ecology*, **47**, 920-925.

Mysterud, A., Aaserud, R., Hansen, L.O., Åkra, K., Olberg, S. & Austrheim, G. (2010) Large herbivore grazing and invertebrates in an alpine ecosystem. *Basic and Applied Ecology*, **11**, 320-328.

Mysterud, A., Askilsrud, H., **Loe**, L.E. & Veiberg, V. (2010) Spatial patterns of accumulated browsing and its relevance for management of red deer *Cervus elaphus*. *Wildlife Biology*, **16**, 162-172.

Mysterud, A. & **Bischof**, R. (2010) Can compensatory culling offset undesirable evolutionary consequences of trophy hunting? *Journal of Animal Ecology*, **79**, 148-160.

Nederbragt, A.J., **Rounge**, T.B., **Kausrud**, K. & **Jakobsen**, K.S. (2010) Identification and quantification of genomic repeats and sample contamination in assemblies of 454 pyrosequencing reads. *Sequencing*, **2010**. Open access.

Nedorezov, L.V., **Sadykov**, A. & **Sadykova**, D. (2010) Dynamics of a green oak moth population: application of discrete-continuous models with a nonmonotone density-dependent birth rate. *Journal of General Biology*, **71**, 41-51.

Nesbø, C.L., Kumaraswamy, R., Dlutek, M., Doolittle, W.F. & Foght, J. (2010) Searching for mesophilic *Thermotogales* bacteria: "Mesotogas" in the wild. *Applied and Environmental Microbiology*, **76** (14), 4896-4900.

Nesterova, A.P., **Le Bohec**, C., Beaune, D., Pettex, E., Le Maho, Y. & Bonadonna, F. (2010) Do penguins dare to walk at night? Visual cues influence king penguin colony arrivals and departures. *Behavioral Ecology and Sociobiology*, **64**, 1145-1156.

Nilsson, A.L., Nilsson, J.Å., Alerstam, T. & Bäckman, J. (2010) Migratory and resident blue tits *Cyanistes caeruleus* differ in their reaction to a novel object. *Die Naturwissenschaften*, **97**, 981-985.

Ottersen, G. (2010) A digital temperature atlas for the Norwegian Sea. *ICES Journal of Marine Science*, **67**, 1525-1537.

Ottersen, G., Kim, S., Huse, G., Polovina, J.J. & **Stenseth**, N.C. (2010) Major pathways by which climate may force marine fish populations. *Journal of Marine Systems*, **79**, 343-360.

Papakostas, S., **Vøllestad**, L.A., Primmer, C.R. & Leder, E.H. (2010) Proteomic profiling of early life stages of European Grayling (*Thymallus thymallus*). *Journal of Proteome Research*, **9**, 4790-4800.

Pavlicev, M., **Le Rouzic**, A., Cheverud, J.M., **Wagner**, G.P. & **Hansen**, T.F. (2010) Directionality of epistasis in a murine intercross population. *Genetics*, **185**, 1489-1505.

Pélabon, C., **Hansen**, T.F., Carter, A.J.R. & **Houle**, D. (2010) Evolution of variation and variability under fluctuating, stabilizing, and disruptive selection. *Evolution*, **64** (7), 1912-1925.

Persson, J., Fink, P., Goto, A., Hood, J.M., Jonas, J. & Kato, S. (2010) To be or not to be what you eat: regulation of stoichiometric homeostasis among autotrophs and heterotrophs. *Oikos*, **119**, 741-751.

Pertoldi, C., Kristensen, T.N. & **Stenseth**, N.C. (2010) Contribution to CR Special 21 'Climate and evolutionary physiology'- Preface. *Climate Research*, **43**, 1-2.

Rivrud, I.M., **Loe**, L.E. & **Mysterud**, A. (2010) How does local weather predict red deer home range size at different temporal scales? *Journal of Animal Ecology*, **79**, 1280-1295.

Rounge, T.B., Rohrlack, T., Decenciere, F.B., Edvardsen, B., Kristensen, T. & **Jakobsen**, K.S. (2010) Subpopulation differentiation associated with nonribosomal peptide synthetase gene cluster dynamics in the cyanobacterium *Planktothrix* spp.1. *Journal of Phycology*, **46**, 645-652.

Rouyer, T.A., Fromentin, J.M. & **Stenseth**, N.C. (2010) Environmental noise affects the fluctuations of Atlantic large pelagics. *Progress in Oceanography*, **86**, 267-275.

Schmickl, R., **Jørgensen**, M.H., **Brysting**, A.K. & Koch, M.A. (2010) The evolutionary history of the *Arabidopsis lyrata* complex: a hybrid in the amphi-Beringian area closes a large distribution gap and builds up a genetic barrier. *BMC Evolutionary Biology*, **10** (98). Open access.

Schweder, T., **Sadykova**, D., Rugh, D. & Koski, W. (2010) Population estimates from aerial photographic surveys of naturally and variably marked bowhead whales. *Journal of Agricultural Biological and Environmental Statistics*, **15** (1), 1-19.

Seligmann, H. (2010) Avoidance of antisense, antiterminator tRNA anticodons in vertebrate mitochondria. *BioSystems*, **101**, 42-50.

Seligmann, H. (2010) Do anticodons of misacylated tRNAs preferentially mismatch codons coding for the misloaded amino acid? *BMC Molecular Biology*, **11** (41). Open access.

Seligmann, H. (2010) Mitochondrial tRNAs as light strand replication origins: Similarity between anticodon loops and the loop of the light strand replication origin predicts initiation of DNA replication. *BioSystems*, **99**, 85-93.

Seligmann, H. (2010) Positive correlations between molecular and morphological rates of evolution. *Journal of Theoretical Biology*, **264**, 799-807.

Seligmann, H. (2010) The ambush hypothesis at the whole-organism level: Off frame, 'hidden' stops in vertebrate mitochondrial genes increase developmental stability. *Computational Biology and Chemistry*, **34**, 80-85.

Seligmann, H. (2010) Undetected antisense tRNAs in mitochondrial genomes? *Biology Direct*, **5** (39). Open access.

Serbezov, D., Bernatchez, L., Olsen, E.M. & **Vøllestad**, L.A. (2010) Mating patterns and determinants of individual reproductive success in brown trout (*Salmo trutta*) revealed by parentage analysis of an entire stream living population. *Molecular Ecology*, **19**, 3193-3205.

Serbezov, D., Bernatchez, L., Olsen, E.M. & **Vøllestad**, L.A. (2010) Quantitative genetic parameters for wild stream-living brown trout: heritability and parental effects. *Journal of Evolutionary Biology*, **23**, 1631-1641.

Skonhoft, A., Austrheim, G. & **Mysterud**, A. (2010) A Bioeconomic sheep-vegetation trade-off model: An analysis of the Nordic sheep farming system. *Natural Resource Modeling*, **23** (3), 354-380.

Skånseng, B., Kaldhusdal, M., Moen, B., Gjevre, A.G., Johannessen, G.S., Sekelja, M., **Trosvik**, P. & Rudi, K. (2010) Prevention of intestinal *Campylobacter jejuni* colonization in broilers by combinations of in-feed organic acids. *Journal of Applied Microbiology*, **109**, 1265-1273.

Slagsvold, T., Sonerud, G.A., Grønlien, H.E. & **Stige**, L.C. (2010) Prey handling in raptors in relation to their morphology and feeding niches. *Journal of Avian Biology*, **41**, 488-497.

Speed, J.D.M., Austrheim, G., Hester, A. & **Mysterud**, A. (2010) Experimental evidence for herbivore limitation of the treeline. *Ecology*, **91** (11), 3414-3420.

Steen, R., Løw, L.M., Sonerud, G.A., Selås, V. & **Slagsvold**, T. (2010) The feeding constraint hypothesis: prey preparation as a function of nestling age and prey mass in the Eurasian kestrel. *Animal Behaviour*, **80**, 147-153.

Stenseth, N.C. (2010) The biological consequences of global change. *Integrative Zoology*, **5**, 85-86.

Stien, A., **Loe**, L.E., **Mysterud**, A., Severinsen, T., Kohler, J. & Langvatn, R. (2010) Icing events trigger range displacement in a high-arctic ungulate. *Ecology*, **91** (3), 915-920.

Stige, L.C., **Ottersen**, G., Dalpadado, P., Chan, K.S., **Hjermann**, D.Ø., Lajus, D., Yaragina, N.A. & **Stenseth**, N.C. (2010) Direct and indirect climate forcing in a multispecies marine system. *Proceedings of the Royal Society of London. Biological Sciences*, **277**, 3411-3420.

Stüken, A.C. & **Jakobsen**, K.S. (2010) The cylindrospermopsin gene cluster *of Aphanizomenon* sp strain 10E6: organization and recombination. *Microbiology*, **156**, 2438-2451.

Svennungsen, T.O. & **Holen**, Ø.H. (2010) Avian brood parasitism: Information use and variation in egg-rejection behavior. *Evolution*, **64** (5), 1459-1469.

Sætre, G.P. & **Sæther**, S.A. (2010) Ecology and genetics of speciation in *Ficedula* flycatchers. *Molecular Ecology*, **19**, 1091-1106.

Sønstebø, J.H., Gielly, L., **Brysting**, A.K., Elven, R., Edwards, M., Haile, J., Willerslev, E., Coissac, E., Rioux, D., Sannier, J., Taberlet, P. & Brochmann, C. (2010) Using next-generation sequencing for molecular reconstruction of past Arctic vegetation and climate. *Molecular Ecology Resources*, **10**, 1009-1018.

Tratalos, J.A., Cheke, R.A., Healey, R.G. & **Stenseth**, N.C. (2010) Desert locust populations, rainfall and climate change: insights from phenomenological models using gridded monthly data. *Climate Research*, **43**, 229-239.

Trosvik, P., Rudi, K., Strætkvern, K.O., **Jakobsen**, K.S., Næs, T. & **Stenseth**, N.C. (2010) Web of ecological interactions in an experimental gut microbiota. *Environmental Microbiology*, **12** (10), 2677-2687.

Trosvik, P., **Stenseth**, N.C. & Rudi, K. (2010) Convergent temporal dynamics of the human infant gut microbiota. *The ISME Journal*, **4**, 151-158.

Turtumøygard, T. & **Slagsvold**, T. (2010) Evolution of brood parasitism in birds: constraints related to prey type. *Behaviour*, **147** (3), 299-317.

Tylianakis, J., Laliberté, E., **Nielsen**, A. & Bascompte, J. (2010) Conservation of species interaction networks. *Biological Conservation*, **143**, 2270-2279.

van Beest, F.M., Gundersen, H., Mathisen, K.M., Milner, J.M. & Skarpe, C. (2010) Long-term browsing impact around diversionary feeding stations for moose in Southern Norway. *Forest Ecology and Management*, **259**, 1900-1911.

van Beest, F.M., **Loe**, L.E., **Mysterud**, A. & Milner, J.M. (2010) Comparative space use and habitat selection of moose around feeding stations. *Journal of Wildlife Management*, **74** (2), 219-227.

van Beest, F.M., **Mysterud**, A., **Loe**, L.E. & Milner, J.M. (2010) Forage quantity, quality and depletion as scale-dependent mechanisms driving habitat selection of a large browsing herbivore. *Journal of Animal Ecology*, **79**, 910-922.

van Geest, G.J., Sachse, R., Brehm, M., **van Donk**, E. & **Hessen**, D.O. (2010) Maximizing growth rate at low temperatures: RNA:DNA allocation strategies and life history traits of Arctic and temperate *Daphnia*. *Polar Biology*, **33**, 1255-1262.

van Oers, K., Richardson, D.S., **Sæther**, S.A. & Komdeur, J. (2010) Reduced blood parasite prevalence with age in the Seychelles Warbler: selective mortality or suppression of infection? *Journal of Ornithology*, **151**, 69-77.

Veen, T., Sheldon, B.C., Weissing, F.J., Visser, M.E., Qvarnström, A. & **Sætre**, G.P. (2010) Temporal differences in food abundance promote coexistence between two congeneric passerines. *Oecologia*, **162**, 873-884.

Vik, U., **Jørgensen**, M.H., Kauserud, H., Nordal, I. & **Brysting**, A.K. (2010) Microsatellite markers show decreasing diversity but unchanged level of clonality in *Dryas octopetala* (Rosaceas) with increasing latitude. *American Journal of Botany*, **97** (6), 988-997.

Wagner, G.P. (2010) The measurement theory of fitness. *Evolution*, **64-5**, 1358-1376.

Weladji, R.B., Holand, Ø., Gaillard, J.M., Yoccoz, N.G., **Mysterud**, A., Nieminen, M. & **Stenseth**, N.C. (2010) Age-specific changes in different components of reproductive output in female reindeer: terminal allocation or senescence? *Oecologia*, **162**, 261-271.

Westergaard, K., **Jørgensen**, M.H., Gabrielsen, T., Alsos, I.G. & Brochmann, C. (2010) The extreme Beringian/Atlantic disjunction in *Saxifraga rivularis* (Saxifragaceae) has formed at least twice. *Journal of Biogeography*, **37**, 1262-1276.

Wetten, O.F., **Nederbragt**, A.J., Wilson, R.C., **Jakobse**n, K.S., Edvardsen, R. & Andersen, Ø. (2010) Genomic organization and gene expression of the multiple globins in Atlantic cod: conservation of globin-flanking genes in chordates infers the origin of the vertebrate globin clusters. *BMC Evolutionary Biology*, **10** (315). Open access.

Zhang, Z., **Tian**, H., Cazelles, B., **Kausrud**, K.L., Bräuning, A., Guo, F. & **Stenseth**, N.C. (2010) Periodic climate cooling enhanced natural disasters and wars in China during AD 10-1900. *Proceedings of the Royal Society of London. Biological Sciences*, **277**, 3745-3753.

*Published in 2009 but omitted from the CEES Annual Report 2009.

Thesis defence

Ben Ari, Tamara. 18 Jun. Inferring plague dynamics from epidemiological data. Faculty of Mathematics and Natural Sciences, University of Oslo.

Eikeset, Anne Maria. 25 Jun. The ecological and evolutionary effects of harvesting Northeast Arctic cod - Insights from economics and implications for management. Faculty of Mathematics and Natural Sciences, University of Oslo.

Kausrud, Kyrre. 11 Jun. Population dynamics and adaptive strategies of the spruce bark beetle *Ips typographus*; generalities and particulars of a forest pest. Faculty of Mathematics and Natural Sciences, University of Oslo.

Larsen, Søren. 18 Jun. Carbon, catchment and climate connection – a limnological perspective. Faculty of Mathematics and Natural Sciences, University of Oslo.

Minge, Marianne Aastebøl. 19 Feb. Acquisition and loss of organelles: A driving force in eukaryotic evolution. Faculty of Mathematics and Natural Sciences, University of Oslo.

Moland, Even. 28 May. Ecology of European lobster in a marine reserves context: implications for conservation biology. Faculty of Mathematics and Natural Sciences, University of Oslo.

Espeland, Sigurd Heiberg. 7 May. Connectivity mechanisms in a population complex of coastal cod. Faculty of Mathematics and Natural Sciences, University of Oslo.

Sabarros, Phillippe Sunil. 4 Jun. Patterns and mechanisms of seabird-environment interaction in southern Africa: population and individual studies. Faculty of Mathematics and Natural Sciences, University of Oslo.

Sadykova, Dinara. 16 Apr. Integrating diverse data by a likelihood function based on models of population dynamics and of observational processes: application relevant for managing aquatic resources. Faculty of Mathematics and Natural Sciences, University of Oslo.

Svennungsen, Thomas Owens. 24 Jun. The evolution and maintenance of phenotypic variation in adaptive traits. Faculty of Mathematics and Natural Sciences, University of Oslo.

Dissemination at External Conferences, Seminars and Invited Talks

Posters

Aas, A.B., Carlsen, T., Kauserud, H., **Mysterud**, A. & Vrålstad, T., The effects of animal grazing on species richness and composition of fungal endophytes in a perennial grass. *IMC9 – 9th International Mycological Congress*, Edinburgh, UK. 1–6 Aug.

Brembu, T., Winge, P., **Tooming-Klunderud**, A., **Jakobsen**, K.S. & Bones, A.M., The chloroplast genome of the diatom *Seminavis robusta. 9th Norwegian Arabidopsis Meeting*, Oslo, Norway. 11 Nov.

Dahle, H., Roalkvam, I., Jørgensen, S.L., Hoem, S., Mitra, S., Huson, D., **Tooming-Klunderud**, A., Thorseth, I.H., Pedersen, R.-B. & Steen, I.H., Microbial community structure of biomats and chimney walls of the Loki's Castle hydrothermal field at 73°N. *8th International Congress on Extremophiles*, São Miguel, Portugal. 12–16 Sep.

Dittami, S., Riisberg, I., John, U., Orr, R., Schalchian-Tabrizi, K., **Jakobsen**, K.S. & Edvardsen, B., Analysis of expressed sequence tags from the ichtyotoxic dictyochophyte *Pseudochattonella farcimen. Conference on Harmful Algae*, Crete, Greece. 1–5 Nov.

Egge, E.S., Moe, S.J., Ropstad, E., Andersen, T. & **Stenseth**, N.C., Combined effects of POPs and density dependence: A size-structured population model for laboratory zebrafish. *SETAC Europe 20th Annual Meeting*, Seville, Spain. 23–27 May.

Heier, L., **Storvik**, G.O., Davis, S., **Viljugrein**, H., Ageyev, V., Klassovskaya, E. & **Stenseth**, N.C., Emergence, spread, persistence and fade-out of Sylvatic Plague in Kazakhstan. *International Statistical Ecology Conference 2010*, Kent, UK. 6–9 Jul.

Hermansen, J.S., Elgvin, T.O., **Sæther**, S.A., Borge, T., Hjelle, E. & **Sætre**, G.P., Hybrid speciation in sparrows. *Speciation 2010 – First European Conference on Speciation Research*, Laxenburg, Austria. 13–15 Dec.

Holen, Ø.H., The honesty of warning signals. *13th International Behavioural Ecology Congress*, Perth, Australia. 26 Sep.–1 Oct.

Nederbragt, A.J., The Norwegian High–Throughput Sequencing Centre – The 454 GS FLX node. *North Atlantic Seafood Forum (MareLife)*, Oslo, Norway. 3–4 Mar.

Nederbragt, A.J., The Norwegian High–Throughput Sequencing Centre – The Illumina Genome Analyzer II (GAII) node. *North Atlantic Seafood Forum (MareLife)*, Oslo, Norway. 3–4 Mar.

Taugbøl, A., **Østbye**, K., Quinn, T.P. & **Vøllestad**, L.A., Population structure and trait associations in a salinity gradient of Alaskan Three spine sticklebacks. *Speciation 2010*, Vienna, Austria. 13–15 Dec.

Villar, J.O. *et al*, including **Stenseth**, N.C. & **Vøllestad**, L.A., Environmental effects on ocean entry of Atlantic salmon (*Salmo salar*) smolt across its range of distribution. *ICES Annual Science Conference*, Nantes, France. 20–24 Sep.

Yedid, G., Tree shape "signatures" and erosion of evolutionary history following mass extinction in communities of digital organisms. *Evolution 2010*, Oregon, USA. 25–29 Jun.

Oral Presentations

Boessenkool, S., **Star**, B., Scofield, R.P., Philip, S. & Waters, J.M., Lost in translation or deliberate falsification? Genetic analyses reveal erroneous museum data for historic penguin specimens. *4th International Symposium on Biomolecular Archaeology*, Copenhagen, Denmark. 7–11 Sep.

Brembu, T., Winge, P., **Tooming-Klunderud**, A., **Jakobsen**, K.S. & Bones, A.M., The *Seminavis robusta* genome project. *1st Cell, Molecular Biology and Genomics Seminar*, Trondheim, Norway. 25 Nov.

Diekert, F.K., Growth Overfishing. *4th World Congress of Environmental and Resource Economists*, Montreal, Canada. 28 Jun.–2 Jul.

Durant, J.M., **Hidalgo**, M. & Ciannelli, L., How does exploitation of prey fish affect population growth rate in changing seas? *2010 ICES Annual Science Conference*, Nantes, France. 20–24 Sep.

Eriksen, A. & **Slagsvold**, T., Are mothers models for song learning – an experimental study on great tits. *13th International Behavioural Ecology Conference*, Perth, Australia. 26 Sep.–1 Oct.

Henderiks, J., Hannisdal, B. & **Liow**, L.H., Calcifying phytoplankton biomass and CO2: A striking balance. *EGU General Assembly 2010*, Vienna, Austria. 2–7 May.

Hessen, D.O., Darwins liv og lære. Invited talk, Veterinærhøgskolen, Oslo, Norway. 19 Mar.

Hessen, D.O., De to kulturer. Invited talk, Research Council of Norway, Oslo, Norway. 1 Jun.

Hessen, D.O., En kort historie om nesten alt. Lecture and debate with Bill Bryson. Oslo, Norway. 6 Sep.

Hessen, D.O., En kort reise gjennom 4 milliarder år. Invited talk, Department of Finance, Oslo, Norway. 20 Jan.

Hessen, D.O., Er naturfag bare for nerder? *The National Archives of Norway Dissemination Conference*, Oslo, Norway. 2 Mar.

Hessen, D.O., Ferskvann – bindeleddet mellom land og hav i et klimaperspektiv. *World Water Day, CIENS*, Oslo, Norway. 22 Mar.

Hessen, D.O., Forskere og media. Invited talk, Ministry of Education and Research, Oslo, Norway. 24 Aug.

Hessen, D.O., Forskning i gullrekka. Invited talk, Norwegian University of Science and Technology, Trondheim, Norway. 3 Nov.

Hessen, D.O., Gener, genetisk determinisme og genetisk screening. *The Ethics Programme*, Oslo, Norway. 11 Feb.

Hessen, D.O., Hjernevask. Debate with Harald Eia, *Manifest Breakfast*, Oslo, Norway. 24 Feb.

Hessen, D.O., Hvor objektiv skal forskeren være? *Wild Salmon Commission Jubilee Conference*, Lillestrøm, Norway. 5 May.

Hessen, D.O., Klima, tjæresand og nasjonal moral. *Seminar on Statoil*, Oslo, Norway. 10 May.

Hessen, D.O., Klimadiagnoser, psykologiske perspektiver på klimakrisen. Invited talk, Norwegian Climate Network, Oslo, Norway. 12 Jan.

Hessen, D.O., Klimaeffekter, avrenning og kobling mellom land og vann. Seminar, Norwegian Water Association, Oslo, Norway. 17 Mar.

Hessen, D.O., Mennesket og natur i et dypøkologisk perspektiv. Invited talk, Norwegian Biodiversity Information Centre, Stjørdal. 9 Nov.

Hessen, D.O., Mennesket og natur i et økologisk perspektiv. Seminar, Naturvitenforum, Sundvolden, Norway. 18 Nov.

Hessen, D.O., Naturens grenser – grenser for frihet. *Røros Seminar*, Røros, Norway. 16 Apr.

Hessen, D.O., Norges ansvar for biomangfold ute og hjemme. Invited talk, Friends of the Earth, Oslo, Norway. 29 Sep.

Hessen, D.O., Om biologien og samfunnet. '*Red Lunch*', Oslo, Norway. 23 Mar.

Hessen, D.O., Oslo som økologisk kretsløpsby. *City of Oslo Environmental Seminar*, Oslo, Norway. 4 Jun.

Hessen, D.O., Skal forskere "vite" eller "mene" i klimadebatten? *Partnerforum's Autumn Conference*, Oslo, Norway. 12 Nov.

Hessen, D.O., Tilpasning og klimakonsekvenser. Handover of the 'Klima21' report. Oslo, Norway. 1 Feb.

Hessen, D.O., Trenger vi artene? Om naturmangfold. Seminar, Friends of the Earth, Oslo, Norway. 2 Mar.

Hessen, D.O., Verdien av biologisk mangfold. Invited talk, Ministry of Transport and Communications, Oslo, Norway. 14 Apr.

Hessen, D.O., Verdien av natur. *International Biodiversity Day*, Oslo, Norway. 20 May.

Jakobsen, K.S., Alle torskens gener er kartlagt – hva betyr det? *Cod Network Meeting*, Bodø, Norway. 10–11 Feb.

Jakobsen, K.S., Bioteknologi – et forskningsområde med store anvendelsesmuligheter. Et marint perspektiv. *VISTA 25-Year Jubilee*, Oslo, Norway. 22 Nov.

Jakobsen, K.S., The cod genome project. *Aquaculture Conference*, Trondheim, Norway. 19–21 Apr.

Jakobsen, K.S., Endosymbiosis in dinoflagellates – a key to their evolutionary success? Invited talk, University of Tromsø, Norway. 30 Aug.

Jakobsen, K.S., Marin forskning ved UiO og Senter for økologisk og evolusjonær syntese. *MareLife Seminar*, Bergen, Norway. 15 Jun.

Jakobsen, K.S., Sequencing the cod genome. *Seminar: Merging of genomics and life history biology*, Oslo, Norway. 9–10 Mar.

Jakobsen, K.S., Sequencing the cod genome using 454 pyrosequencing. Invited talk, University of Lund, Sweden. 28 Apr.

Jakobsen, K.S., Torskegenomprosjektet: Sekvensering, teknologi og resultater. *Seminar: Genome Sequencing for Salmon and Cod. From Academic Practice to Industrial Use.* Oslo, Norway. 30 Nov.

Jakobsen, K.S., Translating the cod genome into seafood business – The Atlantic Cod Genome Project. *MareLife Innovation Seminar – The North Atlantic Seafood Forum*, Lillestrøm, Norway. 3–4 Mar.

Kausrud, K.L., **Xu**, L., **Stige**, L.C., **Tian**, H. & **Stenseth**, N.C., Climate change: Ecosystem functioning, adaptation and climate-ecosystem interaction. *Sino-Norwegian cooperation to meet the global challenges: Workshop on Polar, Environmental and Climate Change Research*, Shanghai, China. 9–11 Aug.

Le Bohec, C., Long-term data on unbanded penguins as indicators of climate impact on SubAntarctic and Antarctic ecosystems. Invited lecture, University of Tromsø. 10 Dec.

Liow, L.H., Estimating rates and probabilities of origination and extinction using taxonomic occurrence data: Capture-mark-recapture (CMR) approaches. *Geological Society of America Annual Meeting*, Denver, USA. 31 Oct–3 Nov.

Liow, L.H., Modelling the rise and fall of fossil species. Guest lecture, Imperial College, London, UK. 29 Apr.

Liow, L.H., Occupancy and abundance: being explicit about sampling processes. Guest lecture, Stanford University, California, USA. 6 Jul.

Liow, L.H., Rise and fall of species in the fossil record: Does a species "remember" its beginnings? Guest lecture, University of Cincinnati, USA. 8 Mar.

Liow, L.H., Understanding the strengths and weaknesses of paleontological data. Guest lecture, University of Cincinnati, USA. 9 Mar.

Liow, L.H. & Holland, S., Changing tides and times. Ecological and sampling influences on occupancy in Ordovician seas. *Evolution 2010*, Oregon, USA. 25–29 Jun.

Nederbragt, A.J., The Norwegian Sequencing Centre at the University of Oslo and what it can do for the microbial science community at MatNat. *MatNat Microbiology Day*, Oslo. 17 Mar.

Nederbragt, A.J., Sekvensering, genotyping of bioinformatikk. *Seminar om Tilgjengelig forskningsinfrastruktur og tjenester for bioteknologisk,* Oslo, Norway. 8 Sep.

Nederbragt, A.J., Sequencing the cod genome – with a focus on bioinformatic analyses. *Joint Centre for Bioinformatics Seminar Series,* Oslo, Norway. 21 Apr.

Nederbragt, A.J. & Tooming–Klunderud, A., From next generation reads to genomes: experiences gained from different genome projects. *Nordic GS FLX User Meeting,* Oslo, Norway. 24 Nov.

Nilsson, A., Causes and consequences of partial migration – using ringing recovery data for linking movement strategies with life-histories. *The Ecology and Evolution of Partial Migration Workshop,* Lund, Sweden. 31 Aug.–01 Sep.

Nilsson, A., To make the most of what we have – extracting phenology data from nestling measurements. *Phenology 2010: Climate change impacts and adaptations,* Dublin, Ireland. 14–18 Jun.

Ohlberger, J., An empirically calibrated model of adaptive diversification along an environmental temperature depth gradient. *Evolution of divergence and speciation models of specific systems workshop,* Hólar, Iceland. 3–6 Aug.

Ohlberger, J., Temperature-driven regime shifts in size-structured populations. *Fish and Climate Change,* Belfast, UK. 26–30 Jul.

Reitan, T., **Schweder**, T. & **Henderiks**, J., Modelling Phenotypic Evolution by Stochastic Differential Equations. *International Statistical Ecology Conference 2010*, Kent, UK. 6–9 Jul.

Rueness, E.K. & Låberg, K.T., Fri oss fra Darwinismen! *Fruktbar fredag*, Oslo, Norway. 5 Feb.

Star, B., Fishing for sequence – The Atlantic Cod Genome Project. *Norwegian Biochemical Society Winter Meeting,* Storefjell, Norway. 14–16 Jan.

Stenseth, N.C., Bridging Ecology and Evolution: the importance of long-term basic science. Opening of the Centre for Macroecology, Evolution and Climate, Copenhagen, Denmark. 16 Jun.

Stenseth, N.C., Climate variation and ecological as well as evolutionary consequences. Invited talk, Vienna, Austria. 19 May.

Stenseth, N.C., Darwin før og nå. Kolsås Rotary klubb, Bærum, Norway. 26 Jan.

Stenseth, N.C., Darwin og hans betydning for vitenskapen og menneskeheten. Invited talk, Agder Academy of Science, Kristiansand, Norway. 4 Feb.

Stenseth, N.C., The Eco–epidemiology of the plague system. *Genomic and Genetic Aspects for Human Health and Disease,* Oslo, Norway. 20 Sep.

Stenseth, N.C., Ecological effects of climate change in the Barents Sea: Nordic collaboration with Russia. *ScanBalt Academy Meeting*, Svalbard, Norway. 20 Aug.

Stenseth, N.C., Ecological effects of climate change on marine systems. *FSBI Annual Symposium 2010 on "Fish and Climate Change"*, Belfast, UK. 26–30 Jul.

Stenseth, N.C., EcoScenarios. EcoScenarios kick–off meeting, Oslo, Norway. 19 Nov.

Stenseth, N.C., Et velfungerende forskningssystem: bruker vi talentene optimalt? *Fagerberg Committee Meeting*, Oslo, Norway. 31 May.

Stenseth, N.C., Getting into hot waters: changing dynamic structure of marine food webs under climate warming. *Aqua Shift Workshop/Conference*, Kiel, Germany. 7 Oct.

Stenseth, N.C., Nysgjerrighetsdrevne grunnforskningen og anvendelser av dens resultater. Invited talk, VISTA, Oslo, Norway. 22 Nov.

Stenseth, N.C., Plagues: Past, Present and Future. *Linacre Lecture*, Oxford, UK. 28 Jan.

Stenseth, N.C., Plagues: Past, Present and Future. *Geilo Lecture – an SFF Annual Meeting*, Geilo, Norway. 14 Apr.

Stenseth, N.C., Prokaryotic experimental ecology and evolution: a population biologist's view. *Colloquium 2 Kick-off Seminar*, Oslo, Norway. 12 Nov.

Stenseth, N.C., Sino-Norwegian cooperation at the University of Oslo. Lecture in connection with the visit of President of CAS, Dr. Lu Yongxiang, Oslo, Norway. 8 Sep.

Stenseth, N.C., Structuring of cod populations: a combined ecological and population genetics study. *Institute of Marine Research Joint Programme Seminar*, Bergen, Norway. 5–7 Jan.

Stenseth, N.C., Structuring of cod populations: a combined ecological and population genetics study. *Glasgow Darwin Lecture*, Glasgow, UK. 10 Feb.

Stenseth, N.C., Structuring of cod populations: a combined ecological and population genetics study. *Berkeley Integrative Biology Lecture*, USA. 18 Feb.

Stige, L.C., Interactions between zooplankton, fish and climate in the Barents Sea – ecological effects of acute oil spills. *ScanBalt Academy Meeting,* Svalbard, Norway. 18–20 Aug.

Stige, L.C., Unravelling spatiotemporal dynamics using generalized additive models. *Ocean Sciences Meeting 2010,* Oregon, USA. 22–26 Feb.

Storvik, G.O., **Heier**, L., **Stenseth**, N.C. & Kvaal, B.Ø., Bayesian analysis of plague in Kazakhstan. *Smögen workshop*, Smögen, Sweden. 16–20 Aug.

Storvik, G.O., **Heier**, L., **Viljugrein**, H. & **Stenseth**, N.C., Bayesian analysis of plague in Kazakhstan. *International Statistical Ecology Conference 2010,* Kent, UK. 6–9 Jul.

Sætre, G.P., Evolution of mating preferences. *Eawag Summer School 2010,* Kastanienbaum, Switzerland. 28 Aug–3 Sep.

Sætre, G.P., Hybridization and hybrid speciation. *Eawag Summer School 2010,* Kastanienbaum, Switzerland. 28 Aug–3 Sep.

Tooming-Klunderud, A., 454 sequencing at the Norwegian Sequencing Centre: possibilities, procedures and projects. Guest lecture, Bergen, Norway. 20 May.

Tooming-Klunderud, A., From next generation reads to genomes: experiences gained from different genome projects. *Seminar i mikrobiell genetikk,* Trondheim, Norway. 22 Sep.

Tooming-Klunderud, A., High throughput sequencing at the Norwegian Sequencing Centre: possibilities and procedures. *Seminar i mikrobiell genetikk,* Trondheim, Norway. 22 Sep.

Tooming-Klunderud, A., Planktothrix genome project – from 454 reads to interesting results. *MicroMatNat Work in Progress,* Oslo, Norway. 10 Nov.

Villar, J.O., Jensen, A.J., L'Abée–Lund, J.H., **Stenseth**, N.C., **Storvik**, G.O. & **Vøllestad**, L.A., Contemporary ocean warming and freshwater conditions contribute to delay the completion of maturation in Atlantic salmon throughout the Norwegian range of distribution. *ICES Annual Science Conference,* Nantes, France. 20–24 Sep.

Vøllestad, L.A., Opp og nedganger – bare naturlig svingninger? *Villlaksutvalget 10 år etter,* Lillestrøm, Norway. 4 May.

Vøllestad, L.A., **Serbezov**, D., Bernatchez, L. & Olsen, E.M., Growth rate in the wild: Phenotypic variability and quantitative genetic parameters for wild stream–living brown trout. *Advances in the population ecology of stream salmonids,* Luarca, Spain. 19–23 May.

Reports

Carroll, J., Skeie, G.M., Camus, L., Bogstad, B., Grøsvik, B., **Stige**, L.C. & Smit, M., (2010) Development of an ecosystem based impact assessment & management tool for the oil and gas industry. Case study: Lofoten/Barents Sea. Akvaplan-niva report no. 4800.001. 47 pp.

Gisler, G.R., Celledoni, E., Helgaker, T., Iversen, T., **Jakobsen**, K.S., Jones, C.N., Lipniacka, A., Lundervold, A., Olsen, N.R.B., De Smedt, K., Koster, J. & Høst, G., (2010) The scientific case for eInfrastructure in Norway. The Research Council of Norway.

Gundersen, H., Christie, H. & Rinde, E., (2010) Perspektivstudie av kråkeboller – fra problem til ressurs. Analyse av ressursgrunnlaget for høsting av kråkeboller og vurdering av økologiske perspektiver knyttet til høstingen. Norwegian Institute for Water Research.

Hessen, D.O., (2010) Er biologisk mangfold viktig? In: Nøttekråka, Bærum Naturvernforbund, Nr 2/2010, pp. 3-5.

Hessen, D.O., (2010) Fra land til vann – nedbørfeltets påvirkning på ferskvann og kyst i et klimaperspektiv. In: Vann: 261-264. Norsk Vannforening.

Hessen, D.O. (2010) The need for nature – from an evolutionary perspective. In: Transactions of the international academy of science, pp. 77-82.

Kvassnes, A.J.S., Hobæk, A., Johnsen, T.M., Walday, M.G., Sweetman, A.K., **Gundersen**, H., Rygg, B., Brkljacic, M. & Borgersen, G., (2010) Årsrapport for miljøovervåking rundt AF Miljøbase Vats for 2009. Norsk institutt for vannforskning. ISBN 978-82-577-5663-5. Oslo

Kvassnes, A.J.S., Walday, M.G. & **Gundersen**, H., (2010) AFD2-D-GEN-EG-0001. Environmental Baseline Survey Report. Ekofisk Cessation EPRD Project. Norsk institutt for vannforskning. ISBN 978-82-577-5650-5. Oslo

Mysterud, A., (2010) Konkurranse mellom hjort, elg og rådyr? In: Hjorteviltet: fagtidsskrift om elg, hjort og rådyr. pp. 48-53. ISSN 1502-3729

Natvig, B., Gåsemyr, J.I. & **Reitan**, T., (2010) Bayesian assessment of availabilities and unavailabilities of multistate monotone systems. Statistical research Report No. 3. ISSN 0806 3842, Department of Mathematics, University of Oslo.

Vøllestad, L.A., (2010) Den ville laksen – symbol og ressurs. In: Norsk Fiskeoppdrett: pp. 10-12. ISSN 0332-7132.

Press coverage

CEES receives regular media attention through the activities of the centre and its members. In 2010, more than 300 items featuring CEES members were published/broadcast across a broad array of both national and international media, including newspapers, magazines, radio, television and web-based information channels. Many of these can be viewed at the 'CEES in Media' webpage: www.cees.uio.no/news/cees-in-media.

Awards and prizes

Biodiversity Award. Awarded by the Environment & International Development Minister, Erik Solheim during the UN Biodiversity Day to Dag O. **Hessen**. 20 May 2010

Best Student Paper at the International Institute of Fisheries Economics and Trade (IIFET) conference. Awarded to Florian K. **Diekert** for a paper on growth overfishing. 15 July 2010.

ESA Sustainability Science Award. Awarded to former postdoc at CEES Martin Lindegren et. al. (including Nils Chr. **Stenseth**) for a paper on preventing the collapse of the Baltic cod stock. 2 August 2010.

Academic Prize. Awarded by the Federation of Norwegian Professional Associations to Dag O. **Hessen.** 21 October 2010

Bonnevie Prize. Awarded by the Norwegian Biologist Association to Nils Chr. **Stenseth**. 5 November 2010

Freedom of Expression Tribute. Awarded by Freedom of Expression (Fritt Ord) to Dag O. **Hessen**. 14 December 2010

Field work in Kazakhstan © Bastiaan Star

Norwegian three-spined stickleback (*G. aculeatus*)
© Anna Mazzarella & Annette Taugbøl

CEES

Dept. of Biology
University of Oslo
P.O. Box 1066 Blindern
NO-0316 Oslo, Norway

Phone: +47 22 85 44 00
Fax: +47 22 85 40 01

cees-post@bio.uio.no
www.cees.uio.no

$$A^*(D_1, D_2) = \frac{\partial}{\partial D_1}\left[\frac{\ln[F(D_1)] - \ln[F(D_2)]}{S(D_2) - S(D_1)}\right]$$

$$= \frac{\left(\frac{d}{dD_1}\ln[F(D_1)]\right)(S(D_2) - S(D_1)) + \left(\frac{d}{dD_1}S(D_1)\right)(\ln[F(D_1)] - \ln[F(D_2)])}{(S(D_2) - S(D_1))^2}$$

$$= \frac{\frac{d}{dD_1}\ln[F(D_1)] + \left(\frac{d}{dD_1}S(D_1)\right)\left(\frac{\ln[F(D_1)] - \ln[F(D_2)]}{S(D_2) - S(D_1)}\right)}{S(D_2) - S(D_1)}$$

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