

Annual Report 2011

Department of Biology

DEPARTMENTAL BOARD



Head of Department

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Deputy Head of Department

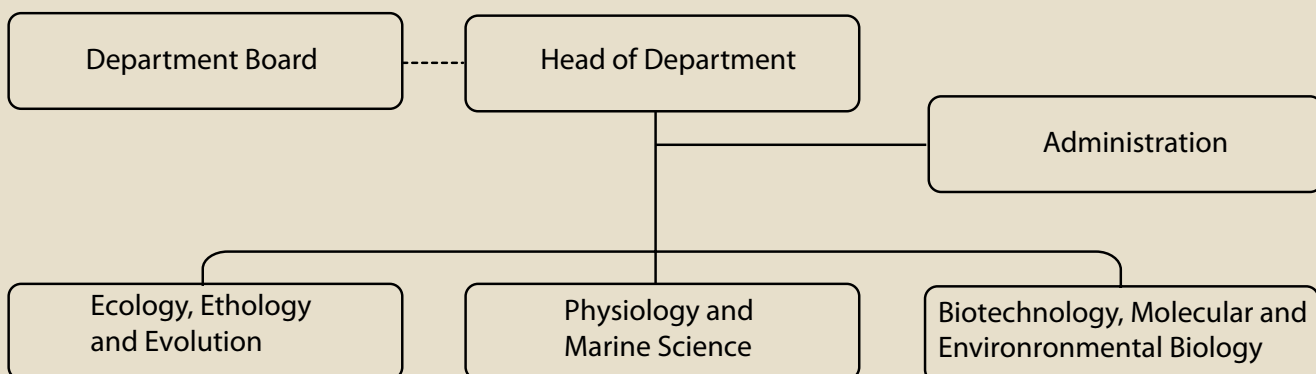
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Heads of Scientific Sections

<u>Physiology, Environmental Toxicology and Biotechnology</u>	<u>Professor Augustine Arukwe</u>
<u>Ecology, Ethology & Evolution</u>	<u>Associate Professor Christophe Pélabon</u>
<u>Marine Science</u>	<u>Professor Elin Kjorsvik</u>

Department Board

External members	Professor Hans Stenøien, Vitenskapsmusset, NTNU Senior Advisor Else Løbersli, Direktoratet for naturforvaltning
Substitute	Associate professor Kaare Aagaard, Vitenskapsmusset, NTNU
Seniorrådgiver	Lisbeth Gederaas, Artsdatabanken, NTNU
Permanent scientific staff member	Professor Trond Amundsen
Associate Professor	Associate professor Bente Jessen Graae
Temporary scientific staff member	PhD candidate Thomas Kvalnes
Substitute	PhD candidate Marian Førde
Technical/administrative staff member	Executive officer Ingunn Yttersian
Substitute	Staff engineer Per Harald Olsen
Student members	Silje Helene Waagaard Linn Haugen



Foreword

IBI's strategic focus is on environmental biology. IBI's vision is: "Understand life, preserve the environment", which reflects our educational and scientific profiles. As a University department we have an obligation to provide a broad education in biology. Thus, IBI's strategy is to provide high-quality research-based education within ecology (including evolution and ethology), physiology, cell and molecular biology, faunistics and floristics in order to give the students a broad basic background in biology with focus on environmental biology. According to NTNU's strategy of not duplicating research groups, research in systematics (faunistics and floristics) is not prioritized by the IBI, but by the Museum.

IBI's scientific activity is based on the basic biological sciences (cell and molecular biology, evolution, physiology, ecology), which provide the basis for a relatively large research activity within applied biological issues related to global environmental challenges (nature management, biodiversity, conservation biology, marine sciences, food, pollution) and interdisciplinary initiatives. This is in accordance with the mission and strategy of the Faculty, which is to "Contribute to the development of a global sustainable society through research, education, dissemination, and innovation". IBI's strategy is to take advantage of replacement positions to build up academically strong, viable and sustainable research groups.

During 2011, the staff at IBI consisted of 33 professors/associate professors, 3 adjunct professors, 31 technicians and administrative staff, 35 scientists/postdocs, 9 temporary technicians, and 68 PhD fellows.

This year Executive officer Tove Tronvold retired from her position, and was replaced by Maja Haaker. As Tove was, Maja is in charge of the Department expedition, and is our face to the world. The administrative staff was increased with one position, Lisa Sjöbratt was employed to assist us with our Human Resources. At the end of the year, Professor Helge Reinertsen and Professor Tor-Henning Iversen also retired from their positions, while Dr. Jenny Hagenblad and Dr. Bård Pedersen ended their employment with NTNU to take a position at Linköping University and NINA, respectively. Sadly, associate professor Ole Petter Thangstad passed away on the sixteenth of December, 2011. Ole Petter started as a student in biology at Roseborg and graduated as a Dr. Scient in botanical cell biology in 1993. He had a position as an associate professor at the Department from 2008.

In 2011, 19 PhD fellows graduated from IBI. In 2011 IBI had 198 registrated MSc students, and 56 of these graduated. The number of publications in international scientific journals or books authored by the staff and students from IBI were 179.

The evaluation of Norwegian Bioscience and Healthscience was very good news for several research groups at the Department. The quality of the research at the Center for Conservation Biology was evaluated as "Excellent", within Environmental Toxicology the research quality was evaluated as "Very good to Excellent", and within Behavior, Evolution and Life History Strategy, the quality was evaluated as "Very good".

Trondheim 2011, Bjørn Munro Jensen

Location

The research and teaching activities of the Department take place at five locations:

- Natural Sciences Building (Realfagsbygget, Gløshaugen)
- NTNU-Sealab (Brattørkaia)
- Trondheim Biological Station (Trolla)
- The Plant Biocentre (Dragvoll)
- The Neuroscience Unit (Medical-Technical Research Centre, Øya)

The Natural Sciences Building is situated at the main NTNU campus in the city centre. The majority of the staff at the Department of Biology work here and this is also the centre for teaching and the location of most facilities. Marine and aquatic research, including aquaculture, is carried out at NTNU-Sealab and Trondheim Biological Station.

Economy

The Department income consists of university funding and overheads from external projects. In 2011 the income was MNOK 59, of which approx 80 % was used for salaries of permanent staff. In addition, the Department has a high externally funded activity. In 2011 the external income was MNOK 41 and the number of external projects exceeded 120. Most of the projects were funded by The Research Council of Norway.

Project expenses are mainly salaries for the over 128 temporary scientific staff (PhD students, Post docs, researchers) and technicians.

Financing

Source	Amount (knok)	Amount (knok)	%
Financial contribution from the Government budget			
	Salary budget: 43824		
	Operating budget: 15148		
Total from the Government budget		58972	59
External Sources:			
The Research Council of Norway	projects 30344		
Other Norwegian sources	projects 8363		
EU	projects 1749		
Other international sources	projects 763		
Total from External sources		41219	41
Total		100191	100



Photo: Per Harald Olsen/NTNU

Sadly, associate professor Ole Petter Thangstad passed away on the sixteenth of December, 2011.

Staff

Permanent scientific staff	33
Temporary scientific staff	35
Permanent Technical/adm. Staff	31
PhD candidates	68
Adjunct Professor	3
Other temporary staff	9
Total	179

ADMINISTRATIVE SECTION (AS)

Permanent administrative staff

Aune, Lisbeth, Senior Executive Officer
Baggerud, Carolyn, Senior Engineer
Haaker, Maja Caroline, Executive Officer
Jakobsen, Hans Jakob, Head of Administration
Moseng, Anne Beate, Executive Officer
Rø, Helge Dyrendal, Higher Executive Officer
Sjöbratt, Lisa, Higher Executive Officer
Sæterhaug, Berit, Executive Officer
Tronvold, Tove, Executive Officer
Yttersian, Ingunn, Executive Officer
Zvizdic, Jasenka, Higher Executive Officer

ECOLOGY, ETHOLOGY AND EVOLUTION (EEE)

Scientific staff, permanent

Amundsen, Trond, Professor
Berg, Ole Kristian, Professor
Einum, Sigurd, Professor
Graae, Bente Jessen, Associate Professor
Hagenblad, Jenny, Associate Professor
Moksnes, Arne, Professor
Pedersen, Bård, Associate Professor
Pélabon, Christophe, Professor
Ringsby, Thor Harald, Associate Professor
Rosenqvist, Gunilla, Professor
Røskaft, Eivin, Professor
Sandlund, Vera, Assistant Professor
Sæther, Bernt-Erik, Professor
Söderström, Lars, Professor
Wright, Jonathan, Professor

Scientific staff, temporary

Armbruster, William Scott, Adjunct Professor
Billing, Anna, Post doc.
Grøtan, Vidar, Researcher
Hansen, Brage Bremset, Post doc.
Hilmo, Olga, Researcher
Herfindal, Ivar, Researcher
Jensen, Henrik, Researcher
Lande, Russell, Adjunct Professor
Langhamer, Olivia, Post. doc.
Melis, Claudia, Researcher
Pedersen, Åsa Alexandra Borg, Post. doc.
Pärn, Henrik, Post doc.
Sandvik, Hanno, Researcher
Stokke, Bård Gunnar, Researcher

Technical staff, permanent

Lindmo, Sigrid, Senior Engineer
Skjærvø, Gine, Senior Engineer
Olsen, Per Harald, Staff Engineer
Vaagland, Henriette, Staff Engineer

Technical staff, temporary

Boström, Erik
Martinussen, Pål Anders

PhD candidates

Antonsen, Liv
Aronsen, Tonje
Begum, Sajeda
Bjørkvoll, Eirin
Bjørneraas, Kari
Bolstad, Geir Hysing
Christensen-Dalsgaard, Signe
Dahl, Espen Lie
De Jong, Karen
Dunfjeld, Sigbjørn
Egset, Camilla Kalvatn
Falahati-Anbaran, Mohsen
Holand, Anna Marie
Holand, Håkon
Huisman, Jisca
Jackson, Craig
Kraabøl, Morten
Larsen, Line-Kristin
Lee, Aline Magdalena
Linnerud, Marit
Markussen, Stine Svalheim
Myhre, Lise Catz
Puffer, Michael
Ratikainen, Irja Ida

Robertsen, Grethe
Rolandsen, Christer Moe
Rosvold, Jørgen
Sarker, Raihan
Solem, Øyvind
Teichert, Maxim
Wacker, Sebastian

The Section for Ecology, Ethology and Evolution (EEE) headed by Prof. Christophe Pélabon employed in 2011 a total of 66 people. The section included 15 permanent scientific staff (professors, associate professors and lecturers), 4 permanent technical staff, 14 temporary scientific staff (researchers and post-doc), 2 temporary technical staff and 31 PhD candidates. The group work on ecological, behavioural and evolutionary issues, using both theoretical and empirical studies across a broad range of animal and plant model systems. The focus area of the different research groups at the EEE section ranges from freshwater ecology, plant biology to evolutionary and behavioural ecology. Research spans from basic research that aimed at improving our understanding of nature, to research and development with direct relevance to management and conservation. The EEE Section has a wide network of international contacts and collaborations, and aims at producing science of a high international standard. Members from EEE also form the core of the Centre for Conservation Biology (CCB) including its leader Prof. Bernt Erik Sæther. The aim of the CCB is to develop an interdisciplinary centre for research into dynamic changes in biological diversity at different organismal levels. The EEE section is working towards a closer integration of science and teaching, emphasizing the involvement of students at all levels in our dynamic research environments. The EEE section is organised in the following research groups:

Centre for Conservation Biology

The focus is on predicting effects of human-induced environmental changes and harvest on population viability and future trends in population size and composition of communities, and to identify factors that affect the rate of evolutionary responses to changing environments. The competence of the group is in the interface between mathematical and biological sciences.



Photo: Per Harald Olsen/NTNU

Professor Sigurd Einum was one of the editors for the book Atlantic Salmon Ecology

Behaviour, Evolution and Life History (BEL)

Within behavioural ecology the focus is on understanding major phenomena and processes in behaviour, ecology and evolution, and on using such insight to provide a scientific basis for sustainable nature management and biodiversity conservation. The BEL group consists of five professors (Amundsen, Berg, Einum, Moksnes, Røskoft), two researchers (Fossøy, Stokke) and more than a dozen PhD as well as masters students. The group received a very good evaluation by the NFR evaluation team.

Professors Ole Kristian Berg and Sigurd Einum constitute the core members of the freshwater ecology group. In addition, the group included 4 PhD students and a number of associate members and MSc students. Maxime Teichert took his PhD in April with the title: "Regulation in Atlantic salmon (*Salmo salar*). The interaction between habitat and density." Group main focus is on the population ecology of salmonid fish. Using these species as model organisms, they address questions concerning the processes that shape population dynamics, such as energetics, cannibalism and competition, and the role of spatial structuring of habitats. In addition to providing insights into general ecological issues, they also concentrate on providing knowledge relevant for management and conservation. To ensure such relevance they maintain a close collaboration with more applied institutions both in Norway (NINA, Sintef, NTNU Museum of Natural History and Archaeology) and abroad (Marine Scotland Science Freshwater Laboratory, USDA Forest Service). These collaborations include both participation in research projects, research seminars, and supervision of master and PhD students. In addition to this general activity the group joined a research centre for environmental friendly energy (FME) funded by the Norwegian Research Council (NFR) and the energy industry during 2009. This centre, named CEDREN (Centre for Environmental Design of Renewable Energy), is providing considerable research opportunity for this group and will involve research cooperation with a number of researchers from Norway, Finland, Germany and USA. The main emphasis within this centre will be given to research on density-dependent processes and long term energetics of salmon populations in rivers utilized for hydropower production.

Prof. Einum was one of the editors for the book *Atlantic Salmon Ecology* (Wiley-Blackwell) which came out in 2011. The book summarizes the recent developments in ecological research on salmonids. In addition, he published 10 scientific papers, and had two of his PhD students defending their thesis. Finally, he submitted a Starting Grant proposal to the European Research Council, which passed through to the second stage of evaluation.

Profs Moksnes, Røskaft and Dr. Stokke, the core members of the brood parasitism group, published a popular book called «Gjøkens forunderlige verden: Historien om gjøken og vitenskapen». This book summarizes 25 years of cuckoo research. The cuckoo group continued its work and Stokke was approved with a research grant from NFR. Sajeda Begum completed her PhD in August.

Røskaft continued with his human behavior work as well as the Conservation of African and Asian protected areas work. Røskaft published 17 scientific papers in 2011 with different coworkers; he had three of his PhD as well as seven of his master's students finishing their degrees. Bård Stokke published 12 scientific papers in 2012. He was at several occasions interviewed in newspapers, TV and radio.

Plant Ecology and Physiology (PEP)

The research focuses on bryophytes, population dynamics of epiphytic lichens, on frost tolerance in tree species, on natural selection in plant traits, and on population and community dynamics. The Plant Ecology and Physiology group consisted in 2011 of one Professor, Lars Söderström and three associate professors, Richard Strimbeck, Bente Jessen Graae and Jenny Hagenblad. Associate professor Bård Pedersen was part of the group until June 30th. The professor II, Scott Armbruster, was associated to the group. Olga Hilmo and Anna Seneca were associated researchers.

Söderström worked mostly within the Early Land Plant Today project aiming to document the biodiversity and distribution of the earliest land plants, the liverworts and hornworts. This is a project in collaboration with the Field Museum in Chicago. Söderström also participated in a larger field research expedition to the Fiji Islands documenting occurrence of cryptogams in a newly identified hot spot for endemic plants. During this expedition many species new to Fiji, or to one of its islands, were discovered in addition to a handful species new for science. Graae started the activities in the Nordforsk funded network Stay or Go hosting two meetings and a Ph.D. course on adaptation, persistence and migration patterns in alpine species. Several activities also took place related to the Belgian funded network, FLEUR, about impact of climate and land use on forest herb species. The main activities related to a Ph.D. project in our group on invasive and native *Impatiens* species in Northwestern Europe. Graae further initiated collaboration with Eivin Røskaft (BEL) and Tanzanian Wildlife Research Institute about the impact of a new



Profs Moksnes, Røskaft and Dr. Stokke, the core members of the brood parasitism group, published a popular book called «Gjøkens forunderlige verden: Historien om gjøken og vitenskapen».

road on nature and society in the Serengeti region. Several master projects took place in collaboration with NINA.

Hagenblad continued her work on the evolution of domestic crops and genetic resources in Fennoscandian land-race crops, primarily working with wheat, barley, pea and potato onion. The work was carried out with the help of a PhD student, two externally funded technicians, a master students and in addition two students affiliated to other groups and researchers at the Swedish Museum of Cultural History and INRA Clairmond – Ferrand. In September Hagenblad hosted a meeting on the History and Evolution of Crop Species that will lead to future collaborative project.

Armbruster conducted fieldwork in Western Australia on his UK Royal Society-funded project on the evolution of floral specialisation and initiated planning for fieldwork in 2012-13 on a collaborative project on biodiversity hotspots in south western China, funded by the Chinese National Science Foundation

In co-operation with national and international project partners Hilmo has worked on the project “The conservation of vulnerable epiphytic lichens in managed boreal forests”. The main activity has been to measure genetic diversity, assess spatial genetic structure, and to estimate gene flow in populations of *Lobaria pulmonaria* in fragments of boreal rainforests in central Norway. The vertical distribution of threatened species in tree canopies, with emphasis on reproduction and juvenile thalli, has also been studied.

Ana Séneca has been developing lab procedures to evaluate the population structure and differentiation of endemic *Sphagnum* tropical species from Réunion Island. The focus is also extended to the relationships with other related specimens collected in Madagascar and South Africa in order to understand their phylogenetic relationships and, if possible migration patterns of these lineages. From five populations ca. 60 sequences from barcoding regions of the chloroplast genome have been analyzed and lab procedure for the amplification of 3-6 microsatellite markers was developed. Herbarium material collected from these areas was studied and catalogued.



Photo: Per Harald Olsen

Bente Jessen Graae

MARINE SCIENCES (MS)

Scientific staff, permanent

Johnsen, Geir, Professor
Kjørsvik, Elin, Professor
Mork, Jarle, Professor
Olsen, Yngvar, Professor
Sakshaug, Egil, Professor
Reinertsen, Helge, Professor

Scientific staff, temporary

Ardelan, Murat Van, Researcher
Evjemo, Jan Ove, Researcher
Hancke, Kasper, Post.doc.
Olsen, Anders, Researcher
Olsen, Lasse, Researcher
Tokle, Nils Egil, Researcher

Technical staff, permanent

Andresen, Kjersti, Senior Engineer
Bardal, Tora, Senior Engineer
Dahl, Kjersti Rennan, Staff Engineer
Killingberg, Frode, Engineer
Østensen, Mari-Ann, Senior Engineer

PhD candidates

Attramadal, Kari
Bergvik, Maria
Blöcher, Nina
Båtnes, Anna
Hancke, Torunn
Handå, Aleksander
Hovland, Erlend K.
Leiknes, Øystein
Li, Keshuai
Miljeteig, Cecilie
Pettersen, Ragnhild
Størdal, Ingvild Fladvad
Valle, Kristin Collier
Varne, Rebekka
Vo, Tu Anh

The Section for Marine Sciences headed by Prof. Elin Kjørsvik employed in 2011 a total of 32 people. The section included 6 permanent scientific staff, 5 permanent technical staff, 6 temporary scientific staff (researchers and post-doc) and 15 PhD candidates. Within marine biology and aquaculture the research focus is on planktonic systems, cultivation, open ocean surveillance, environmental interactions, population genetics, and ecotoxicology. The MS section forms one research group in marine biology and aquaculture.



Cod, day 32.

Physiology, Environmental Toxicology and Biotechnology (PEB)

Scientific staff, permanent

Almaas, Tor Jørgen, Associate Professor
Arukwe, Augustine, Professor (Head of Section)
Bech, Claus, Professor
Bones, Atle M., Professor
Iversen, Tor-Henning, Professor
Jensen, Bjørn Munro, Professor
Johansen, Berit, Professor
Krøkje, Åse, Associate Professor
Kuiper, Marius, Professor
Mustaparta, Hanna, Professor
Nilssen, Kjell, Professor
Strimbeck, Richard, Associate Professor

Scientific staff, temporary

Ahuja, Ishita, Researcher
Bo, Jian, Post doc.
Brembu, Tore, Researcher
Ciesielski, Thomas, Researcher
Eide, Ingvar, Adjunct Professor
Haldrud, Renate, Assistant Professor
Feuerherm, Astrid J., Assistant Professor
Kissen, Ralph, Researcher
Pedersen, Sindre Andre, Assistant Professor
Rohloff, Jens, Researcher
Sørmo, Christopher, Assistant Professor
Sørmo, Eugen Gravingen, Researcher
Thangstad, Ole Petter, Associate professor
Vercruyssen, Steven, Post doc.
Winge, Per, Researcher

Technical staff, permanent

Etter, Siv Anina, Staff Engineer
Halvorsen, Bente Uhre, Staff Engineer
Kvalsvik, Birgitte Grongstad, Staff Engineer
Mironov, Vladimir, Senior Engineer
Salaverria-Zabalegui, Iurgi Imanol, Staff Engineer
Sæther, Mari, Staff Engineer
Tunset, Hanna Maja, Staff Engineer

Technical staff, temporary

Etter, Siv Anina, Staff Engineer
Halvorsen, Bente Uhre, Staff Engineer
Hyldbakk, Elisabeth, Staff Engineer
Mironov, Vladimir, Senior Engineer
Nilsen, Mariann Bakke, Staff Engineer
Raakvaag, Grethe, Staff Engineer
Sparstad, Torfinn, Staff Engineer
Sæther, Mari, Staff Engineer

The Section for Physiology, Environmental Toxicology and Biotechnology (PEB) headed by Prof. Augustine Arukwe employed in 2011 a total of 67 people. The section included 12 permanent scientific staff (professors, associate professors and lecturers), 11 permanent technical staff, 15 temporary scientific staff (researchers and post-doc), 7 temporary technical staff and 22 PhD candidates.

Molecular and Systems Biology (MSB)

In Molecular and Systems Biology, the core scientific areas are plant and marine algae research; lipid signaling and life style diseases in humans, and the development of systems biology approaches for data integration and analysis.

Semantic Systems Biology group

The Semantic Systems Biology group, led by Prof. Martin Kuiper, uses semantic web technologies for data integration and knowledge management. The group has described methodology to increase the expressiveness and knowledge that can be queried in RDF, and have implemented that in their semantic knowledge platform 'BioGateway' (www.semantic-systems-biology.org). The group has exploring proof of concept of this knowledge base by collaborating closely with the Johansen group internally at the Biology Department, and externally with researchers at the Department of Cancer Research and Molecular Medicine at the Medical faculty. In addition, the group has become a member of an NTNU consortium that integrates researchers from the Faculty of Humanities (department of philosophy), into systems biology research, to map out the conditions needed for well designed systems biology research (<http://www.ntnu.edu/crossover-research>).

PLA2 GROUP

The Lipid signalling group (PLA2), led by Prof. Berit Johansen, performs research on inflammatory mechanisms, drug development, and nutritional genomics. The major projects during 2011 have been investigations of molecular signalling mechanisms in cellular models mimicking various human diseases like rheumatoid arthritis, atherosclerosis and psoriasis. Furthermore, the research has provided the foundation for resolving the biology of different phospholipase A2 (PLA2) enzymes in physiological conditions. More specifically, the research has led to new understanding in keratinocyte proliferation, hyperproliferation and the decision making process between proliferation and differentiation and the role of the PLA2-generated eicosanoids in this process. Within the area of nutrigenomics, the competence on inflammatory mechanisms is expanded to understand how metabolic inflammation induced by unhealthy dieting leads to obesity, type 2 diabetes and chronic diseases. A human intervention study, with diets having specific macronutrient compositions, was completed with obese females. All research is based on interdisciplinary collaborations such as between biology, medicine, statistics/mathematics and systems biology, together with local, national and international collaborators. On the Innovation side, the biotech company Avexxin AS, based on technology developed by understanding inflammatory mechanisms, closed a series-A financing round in January 2011 enabling the company to take its lead compound forward through clinical trial phase I/IIa:

The Lipid signalling group (PLA2), led by Prof. Berit Johansen



Photo: Per Harald Olsen

Cell, Molecular Biology and Genomics group

Prof. Atle M. Bones is the head of the CMBG group, which has 25 members: 15 scientific staff (5 researchers, 1 post-doc, 9 PhDs), 1 technician and 8-10 master students. Using primarily *Arabidopsis*, *Brassica napus* and algae as experimental organisms the group studies fundamental cellular and molecular processes related to development, herbivore interaction, signalling and vesicular transport. A wide number of advanced technologies - including metabolite and transcriptional profiling, protein analysis, molecular imaging and bioinformatics - are used in order to reach an integrative and complete understanding of the biological processes. In addition to other research activities, the CMBG groups hosts the Biological Transcriptional Analysis Centre (BTAC) of the Norwegian Microarray Consortium (NMC). In 2011, in collaboration with national and international collaborators, the CMBG group members contributed for publications in journals *BMC Genomics*, *Environmental Science and Technology*, *Journal of Experimental Botany*, *Plant Cell*, *Trends in Plant Science*, *Planta*, *Plos One*, *Phytochemistry*, *PLoS Genetics*, and a book chapter in book *Omics and Abiotic Stress Tolerance*. Ishita Ahuja was awarded the "FUGE Mid-Norway" prize for her paper "Plant Molecular Stress Responses Face Climate Change", which was published in *Trends in Plant Science*.

Molecular and Cellular Toxicology/ Physiology Group

Professor Augustine Arukwe is the head of the research group. An integral emphasis of our research is to study the functional and developmental alterations of wildlife caused by exposure to environmental stressors and during physiological changes. In addition and in collaboration with the aquaculture groups at NTNU, we are studying the hormonal and environmental control of oocyte development in fish and the ontogeny of digestive capability and associated endocrine in fish. In collaboration with other international groups and within NTNU, we are performing research using marine mammals, seabirds and amphibians as model organisms on the effects of environmental pollutants. The development of physiological genomics/proteomics response biomarkers in these species is one aspect of the research. A major and pioneering focus has been the development and validation of targeted gene expression analysis for use as sensitive screens for environmental and endocrine stress indicating chemically-induced differential effects via receptor- (i.e. genomics) and non-receptor (i.e. non-genomics) related process and for use in the studies hormonal control of reproductive processes and larvae-microbial interactions. Our immediate and future research focus is to consolidate on past research gains within the past years by developing an integrated research overview towards the understanding of regulatory, functional and developmental aspects of fish oogenesis, larval development, reproductive and general health and the influence of chemical substances. In addition to basic research on understanding the molecular mechanisms behind nuclear receptor regulated processes and how they are influenced by physiology and xenobiotics (including complex chemical mixtures) in organisms.

Current Projects:

- Climate change, emerging pollutants and reproduction dysfunction in fish: Linking quantifiable measures of climate change with pollution and biological consequences. (NFR)
- Cod development – CODE. (NFR)

Zoophysiology

The research in the group represents different areas in zoophysiology: respiration, temperature regulation and energetics (Claus Bech), osmoregulation, cold hardiness in insects (Sindre Andre Pedersen), fish endocrinology (Kjell J. Nilssen) and insect neurobiology (Tor Jørgen Almås and Hanna Mustaparta). Prof. Bech has continued his research on the energetics of the Kittiwakes on Svalbard. One PhD-student (Jannik Schultner) has been involved in the project "Seabird Population Responses to Changes in Food Condition". This is a collaborative project between NTNU and the University of Alaska, in which kittiwakes in the Atlantic and the Pacific are compared in their responses to experimentally induced stress periods resembling. Two other PhD-students (Elin Noreen and Henrik Berntsen) have been studying long-term effects of early developmental conditions, both with respect to temperature and nutrition, in a laboratory population of the zebra finch. The Fish endocrinology group (Kjell Nilssen) used experimental fish endocrinology for the improvement of food security in developing countries.



Photo: Per Harald Olsen

Elin Noreen

Plant Physiology

Assoc. prof. Richard Strimbeck took a sabbatical leave in the Timothy J. Close lab at the University of California Riverside. As part of his work on extreme frost tolerance in boreal conifers, he worked on extraction and purification of dehydrin proteins from the needles of Siberian spruce (*Picea obovata*), and identified and sequenced several dehydrin genes from the same species. He also initiated a new project on winter light stress and chlorosis in Norwegian conifers.

Environmental Toxicology (ET)

Within environmental toxicology, the focus is on effects of pollutants on animals (ecotoxicology), with particular focus on endocrine disruptive effects, and on transport and fate of pollutants in food webs.

MASTER'S DEGREE PROGRAMME

The Department of Biology had 198 MSc students in 2010 (registered prior to 31.12.2011) in the following programmes:

Study programme	MSc
Biotechnology - 2 years	3
Biotechnology - 5 years	7
Cell biology for medical technical personnel	18
Environ. toxicology/Foru.biol.	23
Marine Coastal Development	48
Natural resource management	21
LUR	2
Biology:	
Evolution	2
Cell & molecular biology	14
Ecology	34
Ethology	1
Physiology	25
Total	198

Of the 198 students, 64 completed their master's degrees in 2011:

Study programme MSc

Biotechnology 5 years	2
Cell biology for medical technical personnel	2
Environ. toxicology	11
MACODEV	16
Natural resource management	6
Biology:	
Evolution	1
Cell & molecular biology	7
Ecology	10
Ethology	1
Physiology	8
Total	64

Marealle, Wilfred N. Factors affecting group size and vigilance behaviour of Maasai giraffe



Photo: Per Harald Olsen

MSc Theses

Baardsen, Lisa Furu. Elephants (*Loxodonta africana*) of the Serengeti; responses to human disturbance and habitat quality.

Bentsen, Vidar. Density dependent habitat use of Atlantic salmon, *Salmo salar* L: stranding in hydropower rivers.

Berne, Erlend. Safe, selfish, state-independent mobbing in the cooperatively breeding apostlebirds.

Florø-Larsen, Bjørn Helge. Tidlig livshistorie hos dverg- og kannibalrøye (*Salvelinus alpinus* (L)).

Grimholt, Runa Marie. Identification and characterization of alternative splice variants (ASV) in human ATP-binding cassette (ABC) transporters involved in drug transport.

Hamnes, Froydis Bolme. Size-dependent habitat use in juvenile Atlantic salmon (*Salmo salar* L.).

Holst, Louise-Marie. The invasion success and invasiveness of the introduced *Rana lessonae* and its hybrid associate *Rana kl. esculenta* (Amphibia) in Southwest Norway.

Kerlefsen, Yvonne. Methods for detecting brain damage after decompression: Are biomarkers a useful tool?

Halseth, Christine Kurki. Effects of live feed quality on cod (*Gadus morhua* L.) larval muscle growth and development.

Hansen, Marit Holmvaag. Effects of feeding with copepod nauplii (*Acartia tonsa*) compared to rotifers (*Brachionus ibericus*, Cayman) on quality parameters in Atlantic cod (*Gadus morhua*) larvae.

Kristiansen, Atle Torvik. Genetic variation in a metapopulation of house sparrows: The interplay of population size and dispersal.

Lyamuya, Richard Daniel. Human-carnivore conflict over live-stock in the eastern Serengeti ecosystem with special emphasis on African wild dogs (*Lycaon pictus*).

Lydersen, Astrid Elisabeth van De Wiel. Plasma concentration of adiponectin and serum amyloid A (SAA) in response to a high carbohydrate and a balanced diet.

Marealle, Wilfred N. Factors affecting group size and vigilance behaviour of Maasai giraffe (*Giraffa camelopardalis tippelskirchi*) in the Serengeti-Ngorongoro ecosystem, Tanzania.

Norheim, Ida Anette. Effects of live feed quality on cod (*Gadus morhua* L.) larval hepatocyte and enterocyte development.

Ervik Kvalø, Stian. Lipid Composition in Antarctic krill, *Euphausia superba*.

Hagemann, Andreas. Cold storage of eggs of *Acartia tonsa*

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- Pudota, Jayaprabandh. Seasonal Variations in Biofouling and Plankton Community Connected to a Large Scale Salmon Farm.
- Peter Mramba, Rosemary. Nutritional status of children as an indicator of bushmeat utilization in Western Serengeti.
- Pettersen, Rune. Gene Expression Profiles in PCB Exposed Polar Bear (*Ursus maritimus*) Cubs from Svalbard.
- Rosenlund, Håvard. A genetic insight to the population of African savannah elephants (*Loxodonta africana*) in the Serengeti Ecosystem, Tanzania.
- Tessand Baalsrud, Helle. Population characteristics and estimates of effective population size in a house sparrow metapopulation.
- Tingvold, Heidi Gunilla. Does human activities affect stress level in Serengeti elephants (*Loxodonta africana*)?
- Ulvund, John Birger. Size dependency of spatial and temporal patterns of marine migration of sea trout (*Salmo trutta* L.) and Arctic char (*Salvelinus alpinus* L.) in Repparfjord Northern Norway.
- Våge, Vegard Thorset. Effects of high CO₂ concentrations on the early developmental stages of the marine copepod *Calanus finmarchicus* (Gunnerus, 1770).
- Kvistad, Arne Ivar. Why Do Some Areas Have Higher Density of Forest Grouse Than Others?
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- Ims, Stine. The Efficacy and Stress-Reducing Capacity of MS-222, Benzoak and Aqui-S for the Ornamental Cichlid Fish, *Metriacrima estherae*.
- Saunes, Halvor. Do mercury, selenium, cadmium and zinc cause oxidative stress in common eiders (*Somateria mollissima*) from Svalbard?
- Markussen, Stine Svalheim. Variation in recruitment failure of moose (*Alces alces*) - any effects of population condition and climate?
- Mück, Isabel Magdalena. Effects of Nest Spacing on Nest Occupation, Mating Success and Mating Behaviour in the Two-spotted Goby (*Gobiusculus flavescens*).
- Størdal, Ingvild Fladvad. Induction of CYP 1A enzyme activity and genotoxicity from ternary mixtures of produced water relevant compounds, evaluated by in vitro methods.
- Thorsen, Marte Høye. Mutagenicity and induction of CYP1A-enzymes from organic extracts of soil samples from nursery schools, evaluated by in vitro studies.
- Tollefsen, Zandra Margareta. Cost of migration in moose (*Alces alces*) with regard to mortality risk and locomotion.
- Dahlø, Eva Sofie. Variation in chemical composition and genetic differentiation among bilberry (*Vaccinium myrtillus* L.) populations on a latitudinal gradient.
- Ytterdal, Irene Beatrice. Genetic and Phytochemical diversity in Bilberry (*Vaccinium myrtillus*) from a limited Geographical Area.
- Renberg, Julie. Effect of ambient temperature on endurance performance in female cross country skiers.
- Aamot, Inga. How Photosynthesis in *Laminaria digitata* and *Saccharina latissima* is Affected by Water Temperature.
- Norli, Marit. Time-series of Phytoplankton Photosynthesis and Dynamics using PHYTO-PAM and Autonomous Underwater Vehicle.
- Rogin, Raluca Elena. Conservation and sustainable use of wild sturgeon populations of the NW Black Sea and Lower Danube River in Romania.
- Vu Thi Thuy, Mminh. Water quality and production of the calanoid copepod *Acartia tonsa* Dana cultured in a recirculating and a flow through system.
- Holostenco, Daniela Nicoleta. Conservation of genetic diversity in populations of stellate sturgeon (*Acipenser stellatus*) of the NW Black Sea and Lower Danube River.
- Hansen, Kari Ellen. Utvidet studie av PLA2-uttrykk i HaCaT-keratinocytter.
- Østlie, Ingunn. Multicolor Panels for Flow Cytometric Immunophenotyping of B-cell Populations in Blood and Bone Marrow Samples.
- Min, Hojune. Effects of nutrients from fish farms on culture of blue mussel (*Mytilus edulis*).



Haugerud, Anja Johansen. Levels and Effects of Organohalogenated Contaminants on Thyroid Hormone Levels in Glaucous Gulls (*Larus hyperboreus*) from Kongsfjorden, Svalbard.

Rørvik, Siv. Acute Toxicity and Stress Gene Transcription in Two Copepod Species (*Calanus finmarchicus* and *Calanus glacialis*) Exposed to Fresh Crude Oil WSE.

Dhuli, Prianka. Metabolite changes in conifer buds and needles during bud break - Norway spruce (*Picea abies*) and European silver fir (*Abies alba*).

Kirkerud, Nicholas Hagen. Physiological Characterization of Protocerebral Neurons in the Olfactory Network of the Moth, *Heliothis virescens*.

Leeves, Sara Ann. Bioaccumulation of arsenic, cadmium, mercury, lead and selenium in the benthic and pelagic food chain of Lake Baikal.

Hansen, Tor Ivar. Long-term Effects of Seeding in an Alpine Environment.

Holtan, Marte Berg. Plasma melatonin profiles in Common carp (*Cyprinus carpio*) exposed to indoor photoperiods.

Hornslie, Karina. Characterization of three novel genes encoding postulated peptides of the IDA family, and their possible function in plant defense in *Arabidopsis thaliana*.

Johnsen, Ida Egge. The Effect of Persistent Organic Pollutants on Thyroid Hormone Levels in Arctic Breeding Kittiwake (*Rissa tridactyla*).

Siddik, Ahmed. IL-1 β og TNF- α induisert genuttrykk av DKK1 og OPG involverer cPLA2-IV α i SW-982 synoviocytter.

Helsingen, Even Buvarp. Bioaccumulation of chemical elements in grey seals (*Halichoerus grypus*) from the Baltic Sea.

Guttu, Ane Maria. Plasma melatonin profiles in copper mah-seer (*Neolissochilus hexagonolepis*) kept under natural and manipulated photoperiods.

Freland, John-Are Stokke. Oxygen Consumption, Stress Response and Stress During Aquic Sedation in Goldsinny Wrasse (*Ctenolabrus rupestris*) in Transport Related Experiments.

Andersen, Hanne Kile. Gastropods Associated with *Laminaria hyperborea* and *Saccorhiza polyschides* in a Norwegian Kelp Forest.

Gjengedal, Håkon. The haemoglobin polymorphism of whiting (*Merlangius merlangus* L.) in the northeast Atlantic.

Haugerud, Anja Johansen. Levels and Effects of Organohalogenated Contaminants on Thyroid Hormone Levels in Glaucous Gulls (*Larus hyperboreus*) from Kongsfjorden, Svalbard.

Tunset, Hanna Maja. A Role for GIVA cPLA2 Inhibition in Fighting Rheumatoid Arthritis?

Grande, Ann-Kristin Skjeflo. Reirpredasjon som mulig årsak til bestandendringer av hekkende våtmarksfugler på strandengområder i Trøndelag.

PhD CANDIDATES

The Department of Biology had 68 PhD candidates in 2011 (registered prior to 31.12.2011), in the following programmes:

Scientific section	Number of PhD candidates
MS	15
EEE	31
PEB	22
Total	68

19 PhD fellows graduated from IBI this year.

PhD Theses

Attramadal, Kari. Water treatment as an approach to increase microbial control in the culture of cold water marine larvae. 148 s.

Begum, Sajeda. Brood parasitism in Asian cuckoos: different aspects of interactions between cuckoos and their hosts in Bangladesh. 116 s.

Bjørneraas, Kari. Spatiotemporal variation in resource utilisation by a large herbivore, the moose. 95 s.

Bolstad, Geir Hysing. Evolution of Signals: Genetic Architecture, Natural Selection and Adaptive Accuracy. 100 s.

de Jong, Karen. Operational Sex Ratio and Reproductive Behaviour in the Two-spotted Goby (*Gobiusculus flavescens*). 122 s.

Egset, Camilla Kalvatn. The Evolvability of Static Allometry: A Case Study. 137 s.

Falahati-Anbaran, Mohsen. Evolutionary consequences of seed banks and seed dispersal in *Arabidopsis*. 126 s.

Hancke, Torunn Beate. Use of Pulse Amplitude Modulated (PAM) Fluorescence and Bio-optics for Assessing Microalgal Photosynthesis and Physiology. 122 s.

Kittang, Ann-Iren. *Arabidopsis thaliana* L. adaptation mechanisms to microgravity through the EMCS MULTIGEN-2 experiment on the ISS: The science of space experiment integration and adaptation to simulated microgravity. 118 s.

Larsen, Line-Kristin. Life-History Trait Dynamics in Experimental Populations of Guppy (*Poecilia Reticulata*). The Role of Breeding Regime and Captive Environment. 92 s.

Lee, Aline Magdalena. Stochastic Modeling of Mating Systems and their Effect on Population Dynamics and Genetics. 104 s.

Odden, John. The ecology of a conflict: Eurasian lynx depredation on domestic sheep. 129 s.

Pedersen, Simen. Effects of native and introduced cervids on small mammals and birds. 133 s.

Odden, John. The ecology of a conflict: Eurasian lynx depredation on domestic sheep. 166 s.

Robertsen, Grethe. Relative performance of salmonid phenotypes across environments and competitive intensities. 107 s.

Sarker, Abul Hasnat Mohammad Raihan. Conflict over the conservation of the Asian elephant (*Elephas maximus*) in Bangladesh. 119 s.

Sørmo, Christopher Gravningen. Rho GTPases in Plants: Structural analysis of ROP GTPases; genetic and functional studies of MIRO GTPases in *Arabidopsis thaliana*. 109 s.

Teichert, Maxim A.K. Regulation in Atlantic salmon (*Salmo salar*): The interaction between habitat and density. 105 s.

Villanger, Gro Dehli. Effects of complex organohalogen contaminant mixtures on thyroid hormone homeostasis in selected arctic marine mammals. 185 s.



Photo: Per Harald Olsen

Sarker, Abul Hasnat Mohammad Raihan. Conflict over the conservation of the Asian elephant (*Elephas maximus*) in Bangladesh.

Scientific Publications

Graae, Bente Jessen; Ejrnæs, Rasmus; Lang, SI; Meineri, Eric Pierre F; Ibarra, PT; Bruun, Hans Henrik. Strong microsite control of seedling recruitment in tundra. *Oecologia*; Volum 166.(2) s. 565-576

Haanes, Hallvard; Røed, Knut H.; Solberg, Erling Johan; Herfindal, Ivar; Sæther, Bernt-Erik. Genetic discontinuities in a continuously distributed and highly mobile ungulate, the Norwegian moose. *Conservation Genetics*; Volum 12.(5) s. 1131-1143

Manyanga, Phelex; Söderström, Lars; Hedderson, Terry A. Covariation of life history characters in the family Lophoziaaceae: a multivariate analysis. *The Bryologist*; Volum 114.(3) s. 583-594

Olsvik, Pål Asgeir; Waagbø, Rune; Pedersen, Sindre Andre; Meier, Sonnich. Transcriptional Effects of Dietary Exposure of Oil-Contaminated *Calanus finmarchicus* in Atlantic Herring (*Clupea harengus*). *Journal of Toxicology and Environmental Health*; Volum 74.(7-9) s. 508-528

Séneca, Ana; Söderström, Lars. Sphagnum of the Pacific - a checklist. *Telopea*; Volum 13.(3) s. 503-511

Söderström, Lars; Hagborg, Anders; Pócs, Tamas; Sass-Gyarmati, Andrea; Brown, Elizabeth R.; von Konrat, Matt; Renner, Matt. Checklist of hornworts and liverworts of Fiji. *Telopea*; Volum 13.(3) s. 405-454

Söderström, Lars; Hagborg, Anders; Vána, Jiri; von Konrat, Matt. Land of wood and water: A checklist of liverworts and hornworts of Jamaica. *The Bryologist*; Volum 114.(1) s. 67-91

Thouvenot, Louis; Gradstein, S Robbert; Hagborg, Anders; Söderström, Lars; Bardat, J. Checklist of the liverworts and hornworts of New Caledonia. *Cryptogamie. Bryologie*; Volum 32.(4) s. 287-390

von Konrat, Matt; Naikatini, A; Tuiwawa, Marika; Söderström, Lars; Fife, Alan J; Renner, Matt; Brownsey, Patrick; Perrie, Leon; Hagborg, Anders; Pócs, Tamas; Lumbsch, H. Thorsten; Braggins, John; Séneca, Ana; Brown, E. A brief history of the cryptogams of Fiji and prospects for the future. *Telopea*; Volum 13.(3) s. 361-374

Aarrestad, Per Arild; Masunga, Gaseitsiwe; Hytteborn, Håkan; Pitlagano, Mompoloki L; Marokane, Wilson; Skarpe, Christina. Influence of soil, tree cover and large herbivores on field layer vegetation along a savanna landscape gradient in northern Botswana. *Journal of Arid Environments*; Volum 75.(3) s. 290-297

Aas, Øystein; Einum, Sigurd; Klemetsen, Anders; Skurdal, Jostein. Atlantic salmon ecology. Blackwell Publishing 467 s.

Ahuja, Ishita; Borgen, Birgit Hafeld; Hansen, Magnor Kåre; Honne, Bjørn Ivar; Müller, Caroline; Rohloff, Jens; Rossiter, John Trevor; Bones, Atle M. Oilseed rape seeds with ablated defence cells of the glucosinolate-myrosinase system. Production and characteristics of double haploid MINELESS plants

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Alver, Morten; Storøy, Werner; Bardal, Tora; Overrein, Ingrid; Onsøyen, Mathias Karlsen; Tennøy, Torodd; Øie, Gunvor. Automatic measurement of *Acartia tonsa* nauplii density, and estimation of stage distribution. *Aquaculture*; Volum 313.(1-4) s. 100-106

Anmarkrud, Jarl Andreas; Kleven, Oddmund; Jakob, Augustin; Bentz, Kristofer H; Blomqvist, Donald; Fernie, Kim J; Magrath, Michael J. L.; Parn, Henrik; Quinn, James S; Robertson, Raleigh J; Szép, Tibor; Tarof, Scott; Wagner, Richard H.; Liffield, Jan Terje. Factors affecting germline mutations in a hypervariable microsatellite: a comparative analysis of six species of swallows (*Aves*: Hirundinidae). *Mutation research*; Volum 708.(1-2) s. 37-43

Ansong, Michael; Røskaft, Eivinn. Determinants of attitudes of primary stakeholders towards forest conservation management: a case study of Subri Forest Reserve, Ghana. *The International Journal of Biodiversity Science and Management*; Volum 7.(2) s. 98-107

Antonov, Anton Tinchov; Avilés, Jesús M.; Stokke, Bård Gunnar; Spasova, Velislava; Vikan, Johan Reinert; Moksnes, Arne; Yang, Canchao; Liang, Wei; Røskaft, Eivinn. Egg discrimination in an open nesting passerine under dim light conditions. *Ethology*; Volum 117.(12) s. 1128-1137



Ingerid Brænne Arbo

Arbo, Ingerid Brænne; Halle, Cathinka Lønning; Malik, Darshan; Brattbakk, Hans-Richard; Johansen, Berit. Insulin induces fatty acid desaturase expression in human monocytes. *Scandinavian Journal of Clinical and Laboratory Investigation*; Volum 71.(4) s. 330-339

Armbruster, William Scott; Gong, YB; Huang, SQ. Are Pollination "Syndromes" Predictive? *Asian Dalechampia Fit Neotropical Models*. *American Naturalist*; Volum 178.(1) s. 135-143

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- Arukwe, Augustine; Mortensen, Anne Skjetne. Lipid peroxidation and oxidative stress responses of salmon fed a diet containing perfluorooctane sulfonic- or perfluorooctane carboxylic acids. *Comparative Biochemistry and Physiology - Part C: Toxicology & Pharmacology*; Volum 154.(4) s. 288-295
- Aune, Sigrun; Hofgaard, Annika; Søderstrøm, Lars. Contrasting climate- and land-use-driven tree encroachment patterns of subarctic tundra in northern Norway and the Kola Peninsula. *Canadian Journal of Forest Research*; Volum 41.(3) s. 437-449
- Avilés, Jesús M.; Vikan, Johan Reinert; Fossøy, Frode; Antonov, Anton Tinchov; Moksnes, Arne; Røskaft, Eivind; Shykoff, Jacqui A.; Møller, Anders Pape; Jensen, Henrik; Procházka, Peter; Stokke, Bård Gunnar. The common cuckoo *Cuculus canorus* is not locally adapted to its reed warbler *Acrocephalus scirpaceus* host. *Journal of Evolutionary Biology*; Volum 24.(2) s. 314-325
- Baldwin, Bruce G.; Kalisz, Susan; Armbruster, William Scott. Phylogenetic perspectives on diversification, biogeography, and floral evolution of *Collinsia* and *Tonella* (plantaginaceae). *American Journal of Botany*; Volum 98.(4) s. 731-753
- Begum, Sajeda; Moksnes, Arne; Røskaft, Eivind; Stokke, Bård Gunnar. Factors influencing host nest use by the brood parasitic Asian Koel (*Eudynamys scolopacea*). *Journal of Ornithology = Journal für Ornithologie*; Volum 152. s. 793-800
- Begum, Sajeda; Moksnes, Arne; Røskaft, Eivind; Stokke, Bård Gunnar. Interactions between the Asian koel (*Eudynamys scolopacea*) and its hosts. *Behaviour*; Volum 148. s. 325-340
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- Bjørneraas, Kari; Solberg, Erling Johan; Herfindal, Ivar; Van Moorter, Bram; Rolandsen, Christer Moe; Tremblay, Jean-Pierre; Skarpe, Christina; Sæther, Bernt-Erik; Eriksen, Rune; Astrup, Rasmus. Moose *Alces alces* habitat use at multiple temporal scales in a human-altered landscape. *Wildlife Biology*; Volum 17.(1) s. 44-54
- Blondé, Ward; Mironov, Vladimir; Venkatesan, Aravind; Antezana, Erick; De baets, Bernard; Kuiper, Martin. Reasoning with bio-ontologies: using relational closure rules to enable practical querying. *Bioinformatics*; Volum 27.(11) s. 1562-1568
- Bones, Atle M. Planteforsvar mot insekter – hva kan molekylærbiologi og genomikk bidra med?. *Bioforsk FOKUS*; Volum 6.(2) s. 37-37
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Photo: Per Harald Olsen

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Photo: Per-Harald Olsen

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Photo: Per Harald Olsen

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Pulsatilla vernalis (Spring Pasque flower or Arctic violet)

Annual Report for Department of Biology



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