

Evaluation of Marine Research at the University of Bergen (UiB)

Self-Assessment Report 2004-2013

Department/centre at UiB to be included in the evaluation:

The Department of Biology (BIO) is one of eight departments at UiB's Faculty of Mathematics and Natural Sciences (MN) at UiB. Marine Research represents one of two major focus areas of our university. While BIO is currently organised into 13 research groups, 12 of these perform marine-related research. One of the groups is the cross disciplinary group that constitutes the Centre of Geobiology (a Center of Excellence) which is defined to be a separate evaluation unit in this process. Hence 11 of the 12 research groups with marine activities have been included in BIO's self-assessment. The Sea Lice Research Centre, a Centre for Research-based Innovation is part of the Fish Disease Research group, but as SLRC is also a separate evaluation unit, the SLRC activities are not reported in BIO's self-assessment.

For the purpose of this report and ease of presentation, we have categorized the groups under 4 major research topics (Fig. 1). With the department's marine biological focus in mind, a wide breadth of expertise exists. While divergent, these also share commonalities, upon which a multitude of alternative categorizations are possible. The division presented here however was chosen to reflect the department's fundamental shift from traditional organism and biome-based studies towards more process and system-oriented disciplines such as developmental biology, evolutionary biology and ecology. This new, integrative biology approach encourages interdisciplinary collaboration with the natural sciences such as physics, chemistry, geology and medicine while emphasizing mathematics, computational biology and bioinformatics. More importantly, it generates fundamental new knowledge to help resolve today's major global challenges (i.e. marine health, climate change etc.). It should be noted this categorization in no way reflects a ranking or prioritization of the research groups, topics or individual researchers.

FISHERIES ECOLOGY AND MARINE ECOSYSTEM DYNAMICS

- Evolutionary Fisheries Ecology Research Group (EFERG)
- Marine Microbiology Research Group (MMRG)
- Theoretical Ecology Research Group (TERG)
- Aquatic Behavioral Ecology Research Group (ABERG)

MARINE AND ENVIRONMENTAL HEALTH

- Marine Developmental Biology Research Group (MDBG)
- Environmental Toxicology Research Group (ETRG)
- Ecological and Environmental Change Research Group (EECRG)

AQUACULTURE AND FISH HEALTH

- Fisheries Ecology and Aquaculture Research Group (FEARG)
- Fish Disease Research Group (FDRG)
- Fish Immunology Research Group (FIRG)

MARINE BIODIVERSITY

- Marine Biodiversity Research Group (MBRG)

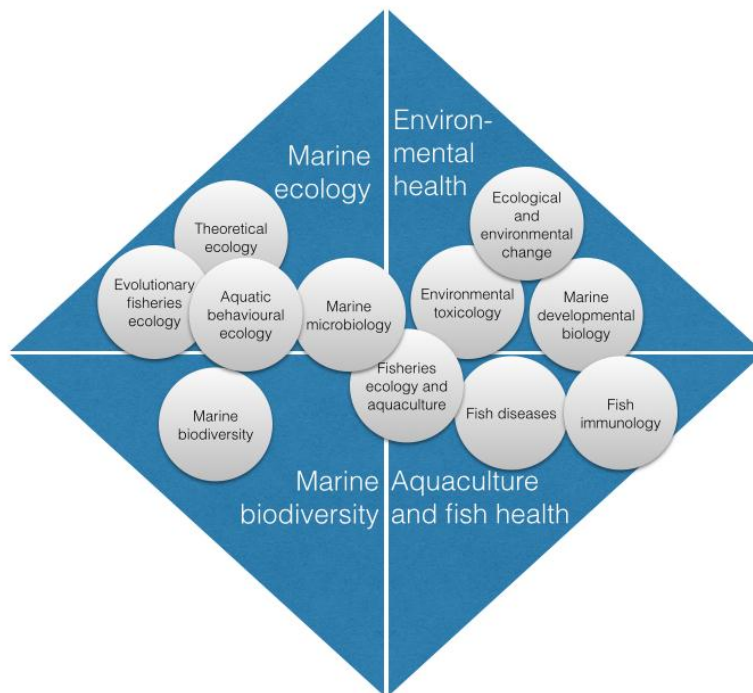


Figure 1. Schematic representation of BIO’s research groups involved in Marine Research and where the groups belong in relation to the 4 main thematic areas presented in this self-assessment report. As illustrated, a large degree of overlap exists across the research groups as well as the thematic areas.

Introduction and general instructions

The present evaluation is initiated by the University of Bergen (UiB) in order to have a systematic review and assessment of the strategic priority area marine research at UiB. Whereas marine research has been a strategic priority at the university since the 1980s, the focus of the evaluation is on the last ten-year period (2004-2013).

The evaluation is conducted by an international evaluation panel, appointed by UiB, with secretarial help from NIFU. The panel is mandated to evaluate the quality and relevance of the scientific production and educational programmes (at master and doctoral level) within marine research at UiB, as well as the dissemination activities, cooperation with institutions in UiB's periphery (*randseinstitusjoner*) and international activities of the associated academic communities.

In order to do so, we need a wide set of information about the activities of the units conducting marine research at UiB. Against this background, we ask the departments/centres involved in marine research to fill in this self-assessment report template. The self-assessment template follows the Terms of Reference (ToR) for the evaluation. Each item in the template quotes the ToR-questions to be addressed, and asks for relevant information about the unit/its activities in the ten-year period to be evaluated, as well as the unit's experiences and assessments.

Your department/centre should return only one self-assessment report. However, if you have several major research topics/research groups within marine research, we ask you to provide information specified by research topic/research group where this is relevant.

To avoid double counting, please coordinate your reporting with other departments/centres involved in marine research at UiB. As a general rule, you should report the activities of researchers holding a main position at your unit.

The self-assessments will, together with other data sources, form the basis for a review and assessment of the strategic priority area marine research at UiB as a whole. There will not be separate evaluations of the research units.

Please send the completed self-assessment to NIFU by 11 August 2014 (siri.aanstad@nifu.no). The self-assessments will not be published or distributed to other parts of UiB.

1 Background information: thematic areas and resources

Please use the boxes in each section to specify your activities and views.

a) Thematic areas of marine research: In the table below, list your major research topics/research groups and projects (2004-2013).

Major research topics/Research groups (2004-2013)	Major research projects (2004-2013)
<u>FISHERIES ECOLOGY AND MARINE ECOSYSTEM DYNAMICS</u>	
<p>Evolutionary Fisheries Ecology Research Group</p>	<p>2006–2010, Norwegian Research Council, “Sustainable harvesting of marine resources: interactions between demographic, ecological and evolutionary effects of fishing”, NOK 6,458,000 (Heino)</p> <p>2007–2011, Bergen Research Foundation, “Evolutionary Fisheries Ecology”, NOK 8,000,000 (Heino)</p> <p>2008–2011, Norwegian Research Council, “Socio-economic effects of fisheries-induced evolution”, NOK 9,023,000 (Heino)</p> <p>2012–2015, Norwegian Research Council, “An experimental evaluation of fisheries induced evolution”, NOK 11,386,000 (Heino)</p> <p>2011-2012: Life-history strategies in an extreme marine environment: behavioural and physiological adaptations. UiB FRIFORSK; 300.000 NOK (Salvenes)</p> <p>2011-2012: Behavioural and molecular mechanisms behind the Benguela goby's (<i>Sufflogobius bibarbatus</i>) adaptation to naturally occurring hypoxia. The Meltzer-foundation; 400.000 NOK (Salvenes)</p> <p>2010-2011: <i>Causes of the Benguela goby's success among jellyfish and toxic sediments in a heavily overfished ecosystem</i>; The Meltzer-foundation; 300.000 NOK (Salvenes)</p> <p>2007-2010: <i>Gobies and hake in the hypoxic waters of the Benguela up-welling current</i>; The Norwegian Research Council; 1.5 mill NOK (Utne-Palm, Salvenes, Gibbons, Kaartvedt, Nilsson, Currie)</p> <p>2003-2005: Ecology of the goby <i>Sufflogobius bibarbatus</i> in the Benguela upwelling ecosystem; Norway and South Africa Research Councils; NOK 1.0 mill. (Salvenes, Utne-Palm, Gibbons, Currie)</p>

<p>Marine Microbiology Research Group</p> <p>Main topic:</p> <ul style="list-style-type: none"> • <i>Microbial Ecology</i> 	<p>BASICS: Bacterial single-cell approaches to the relationship between diversity and function in the Sea. EU 2002-2005.</p> <p>MIRACLE: Microbial Marine Community Diversity: from culture to function. EU 2002-2005.</p> <p>The Deep Biosphere of the Ocean Crust. RCN 2004-2006</p> <p>*** Patterns in Biodiversity: Blooms versus stable coexistence in the lower part of marine food webs. (Strategic University Programme). RCN 2004-2007.</p> <p>Bioprospecting Huge Marine Algal Viruses. RCN 2004-2007.</p> <p>METAOCEANS: Meta-analysis of the ocean. EU 2005-2009.</p> <p>AEROBACTICS: Assessment of the quantity, identity, viability, origin and dispersion of airborne micro-organisms for application in crisis management tools. EU 2006-2009.</p> <p>MICROBAIR: Quantification and Characterization of Microbial Communities in Air. RCN 2007-2009.</p> <p>*** PAME Nor: DOC turnover in polar microbial food webs (IPY) RCN 2007-2010.</p> <p>NUTRITUNNEL: 'Nutrient tunnelling' and other alternative pathways for mineral nutrients through the microbial food web to copepods. RCN 2008-2010.</p> <p>INTERACT: Interactions between eutrophication, oil and contaminants in marine ecosystems. RCN 2008-2011.</p> <p>EPOCA: European Project of Ocean Acidification. EU 2008-2011.</p> <p>MERCLIM-BIO - Marine Ecosystem Response to a changing CLIMate. RCN 2008-2011.</p> <p>VIPMAP - Viral lysis and programmed cell death in marine phytoplankton. RCN 2008-2011.</p> <p>HAPTODIV: Diversity and Dynamics of Marine Haptophytes. RCN 2009-2012.</p> <p>*** MESOAQUA Network of leading MESOCosm facilities to advance the studies of future AQUATIC ecosystems from the Arctic to the Mediterranean. EU 2009-2012.</p> <p>*** MINOS: ERC Advanced Investigator Grant. Microbial Network Organization. EU 2011-2016.</p> <p>BallastFlow: Real-time monitoring of ballast water by Flow Cytometry. RCN 2011-2014.</p> <p>PHAEONIGMA: A novel cross-disciplinary approach to solve an old enigma: the food-web transfer of the mass-blooming</p>
--	--

	<p>phytoplankter Phaeocystis. RCN 2011-2014.</p> <p>Arctic Microorganisms: Microorganisms in the arctic: major drivers of biogeochemical cycles and climate change. RCN 2013-2016.</p> <p>OceanCertain: Ocean Food web Patrol – Climate Effects: Reducing Targeted Uncertainties with an Integrated Network. EU 2013-2017.</p> <p>*** MicroPolar: Processes and Players in Arctic Marine Pelagic Food Webs - Biogeochemistry, Environment and Climate Change. RCN 2013-2017.</p> <p>MIRACLES: Multi-product Integrated bioRefinery of Algae: from Carbon dioxide and Light Energy to high-value Specialties. EU 2013-2017.</p> <p>*** <i>largest, most prestigious projects</i></p>
--	---

<p>Theoretical Ecology Group</p> <p>Main topic:</p> <ul style="list-style-type: none"> • <i>Marine ecosystem dynamics and modelling</i> 	<p><i>ETHOFISH – The effect of turbidity and hypoxia on the behaviour coastal marine fishes.</i> 2002-2005. EU. Team leader of work package 6 Modelling. (2 post-docs, 2 technicians, 3400 KNOK). (Aksnes/Fiksen)</p> <p><i>Models of optimal energy allocation, maturation strategies and skipped spawning in cod.</i> 2002-2005. NFR. 1452 KNOK (1 PhD). (Fiksen)</p> <p><i>ADAPT – Adaptation to the ecosystem: Co-evolution of life histories of Calanus and herring in the Norwegian Sea.</i> 2003-2006. NFR. 1938 KNOK, of total project grant 6200 KNOK (1 PhD). (Giske/Fiksen)</p> <p><i>ECOBE – Effects of North Atlantic climate variability on the Barents Sea ecosystem.</i> 2003-2006. NFR. 2920 KNOK, of total grant 22000 KNOK. Leader of Module 3: Larval and juvenile transport, growth and survival (1 PhD, 1 post-doc). (Fiksen)</p> <p><i>CLIMAR – Climate and production of marine resources.</i> 2004-2006. In charge of the UoB contribution (1 post-doc, 1531 KNOK). (Giske/Fiksen)</p> <p><i>EUROCEANS. The loophole hypothesis of anchovy recruitment in Bay of Biscay.</i> (1 PhD student, 1500 KNOK). (Fiksen)</p> <p><i>Sustainable harvesting of renewable resources.</i> (2006-2010, NFR project, collaboration with IMR). In charge of about 3000 KNOK of total 6450 KNOK (1 PhD, 1 technician, the UoB contribution). (Heino/Jørgensen/Fiksen)</p> <p><i>FRIMEDBIO: Trait-based ecosystem models: from individuals to biodiversity in aquatic communities.</i> (2009-2012). Project leader. 4550 KNOK. Two researchers. (Fiksen/Giske)</p> <p><i>NFR FRIMEDBIO: Female infidelity promotes male cooperation in collective predator defense or sharing of resources.</i> (2009-2012). 7000 KNOK. (Eliassen)</p> <p><i>Havet og Kysten: Coastal water darkening causes eutrophication symptoms.</i> (2009-2010). 2000 KNOK. (Aksnes)</p> <p><i>EGGVALUE. Towards operational models of fish eggs and larvae along the Norwegian coast</i> (2011-2014). 6700 KNOK. (Jørgensen/Fiksen)</p> <p><i>Nordic Centre of Excellence (NCoE) 2011- 2016: The Nordic Centre for Research on Marine Ecosystems and Resources under Climate Change NorMer.</i> Bergen node – 2 PhD students. 5000 KNOK. (Jørgensen/Fiksen)</p> <p><i>NFR FRIMEDBIO: Promiscuity and the Evolution of Cooperative Neighborhoods.</i> 2013-2017. 8000 KNOK (Eliassen/Jørgensen)</p>
---	--

<p>Aquatic behavioral ecology</p> <p>Main topics:</p> <ul style="list-style-type: none"> • <i>Fish population biology</i> • <i>Spatial dynamics</i> • <i>Schooling dynamics and collective behaviour</i> • <i>Aquaculture: Behaviour, cognition and welfare</i> • <i>Ontogeny and escapees</i> • <i>Fish behaviour in relation to fishing gear</i> 	<p>NFR-project "Interactions between wild and farmed Atlantic cod: non-lethal impacts of escapees on wild populations" 2006-2008. (Fernø)</p> <p>NFR-project "Vertical distribution: Hybridisation barrier between escapee and wild cod" 2006-2008. (Fernø)</p> <p>Partner: Strategic program NFR (SFI) "Centre for Research-based Innovation in Sustainable fish capture and Preprocessing technology (CRISP)" 2011-2018. (Fernø)</p> <p>Partner: NFR project "Salmon dynamics: Behaviour and coping of individual salmon in farm environments with fluctuating oxygen and hydrodynamics" 2011-2013. (Fernø)</p> <p>Partner: NFR-project "Exposed farming: Exposed salmon farming in high currents and waves" 2011-2013. (Fernø)</p>
<p><u>MARINE AND ENVIRONMENTAL HEALTH</u></p>	
<p>Marine Developmental Biology -</p> <p>Main Topics:</p> <ul style="list-style-type: none"> • <i>Smoltification, osmoregulation</i> • <i>Early life stages, salmon and marine fish</i> • <i>Growth, sexual maturation</i> • <i>Digestive function and appetite in developing larval fish</i> • <i>Nutritional physiology and growth of teleosts</i> • <i>Chromatin and Cell Cycle Dynamics in Urochordates</i> • <i>Cellular templating of complex extracellular structures</i> • <i>Marine trophodynamics, climate change and environmental monitoring</i> • <i>Low trophic marine biomass for feed, biofuel and manufacturing applications</i> • <i>Development and function of the visual system in fish larvae.</i> • <i>Deep brain photoreception, development and function</i> • <i>Skeletal development salmon, skeletal deformities salmon</i> • <i>Notochord development, salmon</i> 	<p>NFR 165331 'Environmental impact and molecular regulation of the osmoregulatory gill during parr-smolt transformation in Atlantic salmon', 2005 – 2007</p> <p>NFR 172504 'Nitric oxide regulation of development in fish: emphasis on the light-brain-pituitary axis and gill during salmon smoltification', 2006 – 2008</p> <p>NFR 165239 'Sjøvannsinnblanding i intensiv smoltproduksjon: effekter på helse, velferd og risiko for vintersår', 2005 – 2007</p> <p>NFR 172514 'Moderne settefiskproduksjon av laks - normal utvikling og velferd i intensive oppdrettssystemer', 2006 - 2009</p> <p>NFR 184997 'Optimal smolt production and post smolt performance in the High North - Seawater intermixing, low temperatures and intensive rearing' (NORMOLT), 2008 – 2011</p> <p>NFR 199800 'The smolt probe - novel tools for assessment of smolt quality and marine performance in Atlantic salmon', 2010 – 2012</p> <p>NFR 217502 'Optimalisert postsmolt: et paradigmeskifte for norsk lakseindustri', 2012 – 2014</p> <p>NFR 199482 'Cod Development CODE', 2010 – 2014 (Task 4.10. Osmo and ions)</p> <p>NFR 1722630 'Progressive, modern production of juvenile Atlantic cod' (PROCOD), 2006 – 2009</p> <p>NFR 190469 'Fish welfare assessment through brain function: Impacts of environmental stress on brain plasticity and behaviour', 2009 – 2011</p> <p>NFR 222215 'The smolt brain model: Unravelling nature's</p>

	<p>regulation of neural plasticity', 2013 - 2015</p> <p>NFR 163429 'Optimisation of harvested halibut by lowering maturation, increasing growth and improving flesh quality' 2005 – 2007</p> <p>NFR 199518 'Early puberty in salmon males in seawater - causes and consequences for hypo-osmoregulatory ability and welfare', 2010 – 2013</p> <p>EU, FP7-KBBE-2007-2A, 222719, LIFECYCLE—Building a biological knowledge-base on fish lifecycles for competitive, sustainable European aquaculture (01.03.2009 – 28.02.2013)</p> <p>NFR #174229 (2006-07): CodGut - Digestive function in Atlantic cod larvae- effects of intensive and extensive rearing systems and correlation with peaks in mortality</p> <p>NFR #187281 (2008-09): Distended gut syndrome (DGS) in larval Atlantic cod (<i>Gadus morhua</i>) - do the larvae suffer from diarrhea?</p> <p>NFR #190019 (2009-11): GutFeeling. New feeding strategies for Atlantic halibut and cod larvae to increase the output of high quality juveniles in production systems.</p> <p>EU- FP7-KBBE-2007-2A (2009-13): LIFECYCLE. Building a biological knowledge-base on fish lifecycles for competitive, sustainable European aquaculture.</p> <p>NFR # 199482 (2010-2014): CODE- a knowledge platform for the early stages of Atlantic cod</p> <p>NFR #165203 (2005-08): Differential protein expression in relation to dietary AA composition: a proteomic approach towards understanding growth in fish Helse Vest & UoB (2005-09): NettMett. Bioactive peptides.</p> <p>NFR #172548 (2006-08): Leptin in fish – exploring the actions of a novel hormone and its role in control of appetite, growth and puberty in Atlantic salmon and cod</p> <p>NFR # 190043 (2009-12): BIOplus. Innovative use of bioactive marine ingredients as strategy to sustain growth in fish farming production and to improve fish flesh quality</p> <p>NFR # 208352 (2011-2014): Integrated amino acid requirement in Atlantic salmon</p> <p>146653/431 NFR Biotech, 6.2M (2002-06) Developmental Genomics of <i>Oikopleura</i>, a marine architect at the invertebrate/vertebrate transition. (OIKOGEN)</p> <p>183690/S10 NFR-FUGE, 5.3M (2007-10) Systems biology in the Marine Tunicate <i>Oikopleura dioica</i></p> <p>204891/F20 NFR-FRIBIO 4.1M (2011-14) Genome-wide</p>
--	--

	<p>chromatin regulatory signatures in an ultra-compact chordate genome</p> <p>17541/S10 NFR-FUGE, 4.9M (2006-09) Cellular Mechanisms Templating Complex Extracellular Structures via Cellulose Scaffolds: the Oikopleura House</p> <p>190265/S40 NFR-KMB, 10M (2010-14) Phylogenetic microarrays and high-throughput sequencing: A new tool for biodiversity assessment in Northern Norway</p> <p>204040/E40 NFR-HK 4.9M (2011-15) Response of pelagic food webs to warmer, acidified oceans.</p> <p>199624 NFR-FORNY, 1M (2010) Efficient 2nd generation marine feedstock for bio-fuel</p> <p>209075/O30 NFR-FORNY 1.9M (2011-12) Tunicol: A New Environmentally Friendly Biofuel</p> <p>217241/O30 NFR-FORNY+ 5.8M (2012-14) Tunicol – Environmentally friendly biomass for biofuels and animal feed</p> <p>226138/O30 NFR-BIOTEK2021 3.3M (2013-14) Bioactive peptides in tunicate biomass</p> <p>236517 NFR-FORNY+3.6M (2104-15) Tunikater, -utvikling av en effektiv høste- og prosessmetode</p> <p>NFR #190019 (2009-11): GutFeeling. New feeding strategies for Atlantic halibut and cod larvae to increase the output of high quality juveniles in production systems</p> <p>NFR # 199482 (2010-2014): CODE- a knowledge platform for the early stages of Atlantic cod</p> <p>Start-up grant University of Bergen</p> <p>Effects on extreme exercise on salmon vertebral column</p> <p>Functional genetics of vertebral organogenesis</p>
--	---

<p>Environmental toxicology</p> <p>Main topics:</p> <ul style="list-style-type: none"> • <i>environmental pollutants and impacts on marine and Arctic organisms</i> • <i>environmental pollutants and human health</i> • <i>marine environmental pollutants and obesity-linked disorders</i> • <i>mechanisms of action of endocrine-disrupting chemicals on ocean and human health</i> 	<p><u>at MBI 2004- 2009</u></p> <p>Effects of produced water on Atlantic cod; Mechanistic studies and biomarker development with proteomics based methods (NFR-PROOF 2005-2007)</p> <p>NFR 164423 Effect of produced water... (gjennom Uni Research AS) 2005-2008 (Goksøyrr)</p> <p>NFR 140293 Proteom- og ekspresjonsstudier av biomarkører 2002-2008 (Grøsvik)</p> <p>SFT/6006147 Opptak av kvikksølv og metylkvikksølv... 2006-2007 (Goksøyrr)</p> <p>NIFES 159197/I20 Stress genes in the Atlantic cod 2005-2005 (Goksøyrr)</p> <p>TotalFinaElf, contract no 2565.02 2003-2006 (Grøsvik)</p> <p>iCod: Integrative environmental genomics of cod (Gadus morhua) (NFR-SUP 2008-2012)</p> <p>EASYRING (ENVIRONMENTAL AGENTS SUSCEPTIBILITY ASSESSMENT UTILISING EXISTING AND NOVEL BIOMARKERS AS RAPID NONINVASIVE TESTING METHODS), EU/QLK-4-CT-202-02286 , 2003-2005</p> <p>NFR 18188/S30 Nuclear receptor targets for endocrine. 2007-2011. (Goksøyrr/Rusten)</p> <p>NFR 192441/I30 iCod:integrative environmental genomics of cod 2009-2012 (Goksøyrr/Karlsen)</p> <p><u>At BIO 2010-2014</u></p> <p>“POLARISATION: Polar cod metabolism and disruption by polycyclic aromatic hydrocarbons”. NFR, project no.: 214184 (coordinator: UiT)</p> <p>Do environmental pollutants interact with stress responses? " NFR, project no.: 213076 (coordinator: NVH)</p> <p>NFR 196239/S30 Forurens 3rd Norw.Environmental Tox. 2009-2011 (Goksøyrr)</p> <p>NFR 196193 3rd Norwegian Toxicology Symp. 2010-2011 (Goksøyrr)</p> <p>2014-2018 Role of Xenobiotics in Metabolic Diseases: A Translational Approach. NFR FRIPRO Young Research Talents 7,000,000 NOK.</p> <p>2013 Environmental pollutants and diabetes. Financed by Grieg Foundation. 200,000NOK</p>
---	--

	<p>2013-2016 Signaling Impairments GeNerated by Endocrine Disruptors. Environmental Exposures and Health Outcomes programme 6,000,000NOK.</p> <p>2011-2013: Searching the origin of the insulin resistance syndrome. Environmental Exposures and Health Outcomes programme 2,000,000NOK.</p>
--	--

<p>Ecological and Environmental Change Research Group</p> <p>Main Topic:</p> <ul style="list-style-type: none"> • <i>Marine Palaeoecology and palaeoclimate</i> 	<p>PES: Palaeoecological reconstructions of marine soft bottom Ecologic Status and in situ references conditions. Led by Elisabeth Alve, University of Oslo</p> <p>Funded by NFR - 63,100 kr for 2009 and 64,700 kr for 2010 PalaeoDrivers: Quantifying the Drivers of Palaeoecological Change. Led by Richard Telford, University of Bergen. Funded by NFR - 2,781,000 kroner from 2012 to 2015 (877,000 in 2012; 903,000 in 2013; 930,000 in 2014; 959,000 in 2015)</p>
<p><u>AQUACULTURE AND FISH HEALTH</u></p>	
<p>Fisheries Ecology and Aquaculture</p> <p>Main Topics:</p> <ul style="list-style-type: none"> • <i>Fish population biology</i> • <i>Fish nutrition and development</i> • <i>Shellfish production</i> • <i>Juvenile fish production</i> • <i>Animal health and water quality</i> • <i>Food quality and traceability</i> • <i>Trophic ecology and life history biology</i> • <i>Larval fish ecology</i> • <i>Climate and environmental impact</i> • <i>Otolith growth and composition studies</i> • <i>Fisheries ecology and management</i> 	<p>Mare Minimum (2005-) Funding by UiB (BIO, Meltzer foundation (2006 & 2010) and IMR.</p> <p>BioBullets for Enhanced Sustainable Shellfish Yield E17995 (BESSY). NFR project 228019/O30. EUREKA High Level Group, EUROSTAR project (UK, Norway) 2013-2016</p> <p>Partner; SEA-on-a-CHIP, Real-time monitoring of SEA contaminants by an autonomous Lab-on-a-chop biosensor. EU-project, Collaborative project FP7-OCEAN-2013 no 614168. 14 partners (RTD, SME), budget 5,7 mill euro. 2014-2017</p> <p>Bioactive peptides in tunicate biomass (TUNIPeP). Project leader. BIOTEK21, project no 226138/O30 (UiB, IRIS, EWOS, BTO, Uni R), NFR 3 mill nok 2013-2014</p> <p>New marine biomass, diverse TUNICOL prosjekter fra FORNY programmet med BTO, UIN R og BIO. Herunder to patenter og en anmeldt. 5-6 mill nok, 2011-2014</p> <p>VAMP: Water quality for marine hatcheries. (UiB and SMEs). Vestlandsrådet (1 mill nok). 2011-2012</p> <p>Partner. REPROSEED: REsearch to improve PROduction of SEED of established and emerging bivalve species in European hatcheries. Proposal acronym: REPROSEED. Funding scheme: Small or medium-scale focused research project. Work programme topic: KBBE-2009-1-2-11: Improving mollusc seed production in hatcheries, 3 mill euro. UiB/BIO partner with 9 RTDs in Europa. High score 13/15. 2010-2014</p> <p>Bivalve conditioning and settlement – keys to competitive hatchery production (SETTLE). EU-project. Type of funding scheme: Research for SMEs. Capacities - Research for the Benefit of Specific Groups (in particular SMEs). Call FP7-SME-2007-1. Partners 5 RTDs and 5 SMEs in Norway, Spain, France og Ireland. 1,4 mill euro. UiB coordinator. 2008-2010</p> <p>EU Framework 5 Q5RS-2001-01697 “CODTRACE - Establishing traceability for cod (<i>Gadus morhua</i>): determining location of spawning and harvest” 2002 – 2004 €308,000</p> <p>EU Framework 5 Q5RS-2002-01610 “IBACS - Integrated</p>

	<p>Approach to the Biological Basis of Age Estimation in Commercially Important Fish Species” 2002 – 2005 £97,525</p> <p>EU Framework 5 Q5RS-2002-01056 “WESTHER - A multidisciplinary approach to the identification of herring (<i>Clupea harengus</i> L.) stock components west of the British Isles using biological tags and genetic markers” 2002 -2005 £158,306</p> <p>EU Framework 5 Q5CA-2002-01891 “TACADAR - Towards accreditation and certification of age determination of aquatic resources” 2002 - 2005</p> <p>EU Accompanying Measures Q5AM-2002-00527 “FIFS – International Symposium on the Role of Flatfishes in Benthic Ecosystems” 2002 – 2004 €92,452</p> <p>NFR – PROOF programme – “Effects of Production Water on reproductive success of cod “ 2004-2006</p> <p>NFR – PROOF programme – “Study of long-term effect in Atlantic Herring (<i>Clupea harengus</i>) there have been eating oil polluted <i>Calanus finmarchius</i>. Effects of trophic transfer of hydrocarbons after oil spill on the reproduction and immune systems of herring “ 2007-2009</p> <p>EU Framework 6 SSP-022717 “UNCOVER - Understanding the Mechanisms of Stock Recovery” 2006 – 2010</p> <p>Meltzer Fund – “JELLY STONES: statolith tools for jellyfish biogeography and population ecology” 2007-2008</p> <p>EU - Framework 7 – “FishPopTrace” - The structure of fish populations and traceability of fish and fish products 2008 – 2011</p> <p>EU - Framework 7 – “CalMarO” - Calcification of Marine Organisms - A Marie Curie ITN (Initial Training Network) concerned with understanding biomineralization and the effects of ocean acidification on calcifying organisms 2008 – 2011</p> <p>NFR - HAVKYST - PRIBASE: Pollution Risk and Impact Analysis for the Barents Sea Ecosystem 2009-2011</p> <p>EEA - Managing effects of global climate on estuarine biodiversity and productivity, network project PT0010, Norway-the Netherlands-Portugal 2008-2012</p> <p>Participant “Herring genetics” project 2013-2014 (ref. L. Andersson Uppsala University), 0.57 mill. NOK)</p> <p>Participant “KILO” project 2012-1013 (ref. S. Sundby, IMR Bergen, 0.4 mill. NOK)</p> <p>Participant in NFR project “Progressive, modern production of juvenile Atlantic cod” (PROCOD), 2006-2008 (ref. A.K. Imsland, UiB) (UiB budget 2.2 mill. NOK).</p>
--	--

	<p>Participant in NFR project “The occurrence of skipped spawning and its importance for population dynamics in Northeast Arctic gadoids”, 2009-2011 (ref. R.D.M. Nash, IMR Bergen)</p> <p>Project leader of Meltzer project 2005-2006. “High latitude climate variability and its effect on human settlement and fishery resources as revealed by fossil otoliths (0.4 mill NOK)</p> <p>Participant in NFR project “Optimization of growth performance of juvenile cod by applying environmental regulation and water quality control”, 2003-2005 (ref. A.K. Imsland, UiB) (UiB budget 0.93 mill NOK).</p> <p>Partner in EU project “Association of Physical and Biological Processes acting on Recruitment and Post-Recruitment stages of Anchovy” (ANREC), 2002-2005 (ref. Dr. A. Kallianiotis, Kavala, Greece) (UiB budget 0.14 mill EUR).</p> <p>Regional Research Fund "Lice Interventions and Mucosal Mapping on farmed Salmon (LIMM)" Project nr 236379 (start 2013)</p> <p>Innovation Norway "Establishment support" Project nr 2013/110399 (start 2014)</p> <p>Research Council of Norway "Alpha to Omega 3" Project nr 234057/E40 (start 2014)</p> <p>EU Cost Action "Larvanet" FA0801 2009-2012</p> <p>Produs Aqua "Salsoy" and "Slime" (2010-2013)</p> <p>“Arrested development: the endocrine and molecular basis of flatfish metamorphosis” (ARRDE; Q5RS-2002-01192)) 2004-2006 EU project</p>
<p>Fish Disease Research Group</p>	<p>2002-2007 “Function of genes and gene products in the specific immune system of Atlantic salmon”. RCN-project (<i>FUGE</i>) (7.45 mill Nok)</p> <p>Collaborative project with other research groups in Norway – coordinated by Dr. Unni Grimholt, NVH. “Function and expression of disease related genes in Atlantic salmon” (SalEx) (Approx. 38 mill Nok)</p> <p>2006 “Molecular characterization of T cell markers in salmonid fish”. RCN-project (<i>Aquaculture; Production of aquatic organisms/ FUGE</i>), International collaboration/travel grant (150.000 Nok)</p> <p>2007-2009 Marie Curie Transfer of Knowledge (ToK) project at University of Valencia, Spain (3 x 2 months); Pathogen Research in Mediterranean Aquaculture (PATHMEDA)</p> <p>2009 “Antistoffrespons hos laks og ørret: Karakterisering av ulike isotyper og genene som koder for disse.” Meltzer, UoB; (100.000</p>

	<p>Nok)</p> <p>2008-2011 “Genolice; Salmon louse genome sequencing and functional studies on host parasite interactions” Project leader: Prof. Frank Nilsen</p> <p>2014 Study leave spring 2014; University of Tasmania (UTAS), Professor Barbara Nowak’s research group, AMC. RCN; Personal Overseas Grant (<i>Aquaculture – Production of aquatic organisms</i>).</p>
<p>Fish Immunology Research Group</p>	<p>2000 2006 Strategic project, NFR.” Smolting in atlantic salmon: the interrelationship between physiological, endocrine and immunological changes, and their genetic regulation”. Collaboration between Sigurd Stefansson, Heidrun I. Wergeland both from Institute of Fisheries and Marine Biology and Daniel Chourrout, Sars Centre. (Total 9.3 mill NOK) NFR project no 136260.</p> <p>2002-2005 ”Infeksiøs pankreas nekrose virus (IPNV) infeksjon – en immunologisk utfordring”. NFR/FHF (Total 1.75 mill NOK), NFR project no. 152051/120</p> <p>2002-2006 “Impact of smoltification on salmon immune responses (Total 1.98 mill NOK), NFR orject no. 146858/S40.</p> <p>2003 “Etablering av real-time reverse transcription polymerase chain reaction (RT-PCR) for kvantifisering av ekspresjon av cytokiner I vev og celler fra laks” Meltzer Høyskolefond, (total 0.1 mill NOK), project no.480245. (Runnings costs)</p> <p>2007-2010 Francisella sp. infection in Atlantic cod (<i>Gadus morhua</i>) – study of pathogen and host immune cells interactions, NFR.</p> <p>2008-2011 Studies of salmon phagocytic cells- key cells in cellular immune responses, NFR</p> <p>2008-2013 Fish patogens and vaccine development related projects, one NUFU and one NORAD funded (partner/fish health)</p> <p>2013- 2014: Challenge models and immune responses – Lumpsucker , FHF funded</p> <p>2013 - 2017 PROAQUA partner, funding Danish Council for Strategic Research</p> <p>2014 – Vaccines to lumpsucker, funded by Pharmaq</p>

Marine Biodiversity Research Group

Main Topics:

- *The ecology of the shore crab, *Carcinus maens**
- *Norwegian cumaceans*
- *Species inventory of the Sognefjord*
- *Minor fondings:*
- *“Effects of a newly introduced benthic red alga on biodiversity and community structure in the coastal zone of Norway”*
- *Leader of WP3 Seaweeds of the Hardangerfjord, part of the EPIGRAPH project (Institute of Marine Research).*
- *“Causes and consequences of a large-scale shift from sugar kelp (*Saccharina latissima*) to ephemeral algae and implications for management”*

2009 The Carlsberg Foundation (3.500.000 Dkr)

2010 The Norwegian Species Databank (2100.000 Nkr)

2013 The Norwegian Species Databank (3100.000 Nkr)

2014 Tilskudd til kvalitetssikring og tilrettelegging av stedfesta artsdata (artsdatabanken) (180.00 Nkr)

2010 The Norwegian Science Academy (80.000 Nkr)

2009 The Meltzer foundation (212.000 Nkr)

2009 The Norwegian Science Academy (100.000 Nkr)

2003–04: The Research Council of Norway, project no ‘154192/720

2008-2011: The EPIGRAPH project was funded by The Ministry of Fisheries and Coastal Affairs and The Research Council of Norway.

2013 – 2016: Coordinator of “Invasive seaweeds in rising temperatures: impacts and risk assessments (INVASIVES)” (Funded by Seas-Era, The Research Council of Norway)

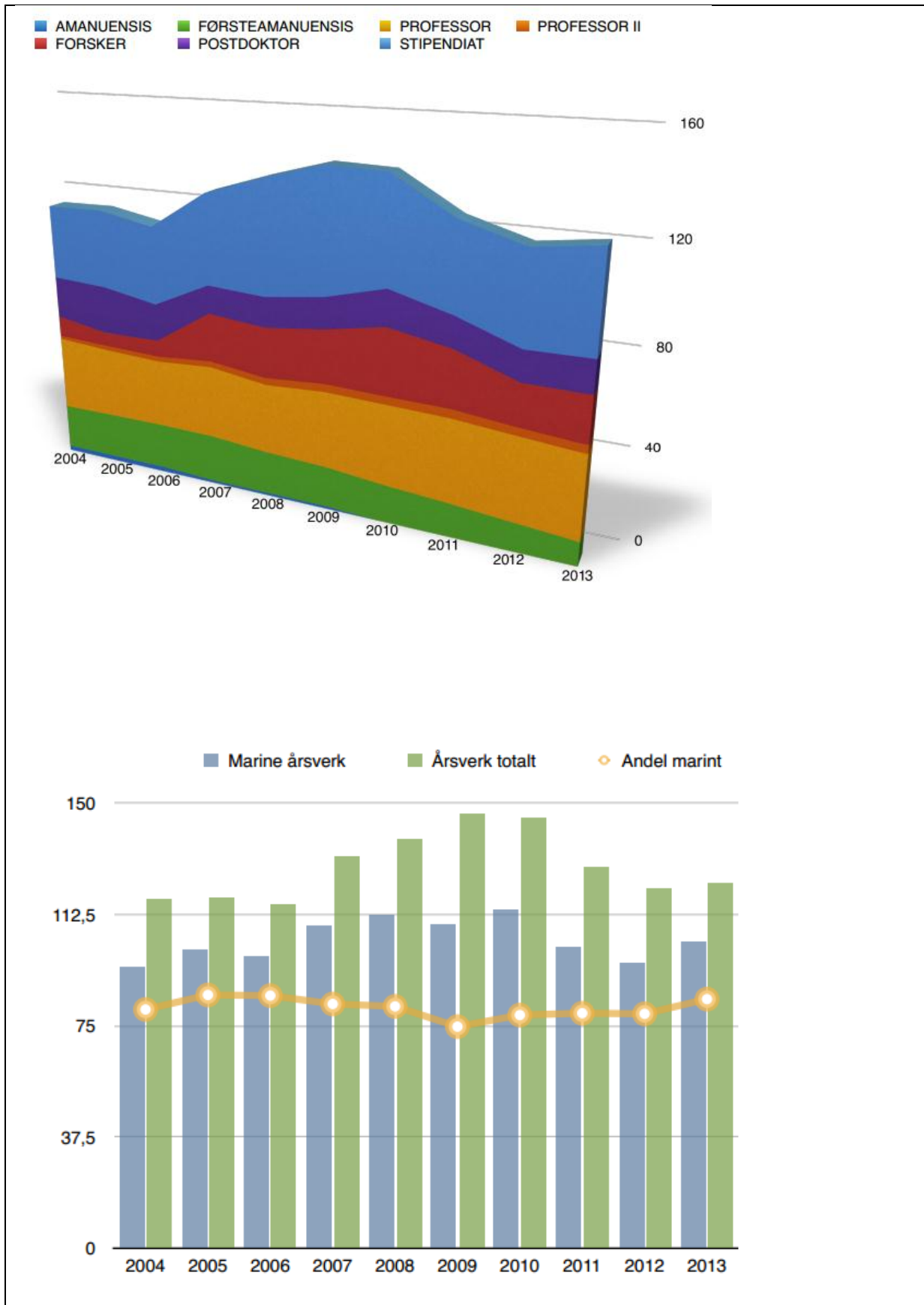
2007-2010: The Research Council of Norway

b) The department/centre's academic personnel in marine studies (research and/or teaching)

	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Total number of staff involved	101	104	105	119	130	131	131	124	117	123
Number of staff involved in the field more than 50% of their time	98	101	102	115	125	127	128	120	113	120
Full time equivalents (FTEs) in the field:										
<ul style="list-style-type: none"> • Professors (<i>professor/førsteamanuensis/andre førstestillinger</i>) 	37,1	39,5	40,1	42,3	39,6	40,9	40,1	39,5	39,1	40,4
<ul style="list-style-type: none"> • Other permanent academic staff 	0	0	0	0	0	0	1	1	1	1
<ul style="list-style-type: none"> • Postdoc fellows 	11	15	13	10	13	11	9,5	11,5	10,5	9
<ul style="list-style-type: none"> • PhD fellows 	27,3	27,5	27	30	35	38	36	28,75	31,75	34,75
<ul style="list-style-type: none"> • Researchers 	16,1	12	11,8	18,9	19,75	18,55	23,7	21,1	14,7	17,5

If relevant, please specify the size of your major research topics/research groups within marine research relative to the size of the department/centre and describe the main developments in academic personnel (growth/reduction) for these topics/groups in the period 2004-2013.

During the last ten years the overall marine activity at the department reached its highest level in the period of 2007-2010 (measured in FTEs). Between 75 % and 85 % percent of BIO's permanent and non-permanent scientific staff have during the evaluation period been involved in marine research and education. The proportion of faculty involved has been relatively stable throughout the last ten years, but the proportion of prof. II and post docs engaged in marine activities have gradually increased. Even though the proportion has been relatively stable across the groups, within the groups there has been some variation in disciplines covered.



c) Funding of research activities: Fill in the department/centre's total expenditure for marine research by funding source (in 100 000 NOK).

Source	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Institutional core funding (total)*	532	565	631	686	713	767	779	746	801	824
- funding received from UiB's strategic priority of marine research	28	28	28	43	55	31	26	20	31	40
Grants from the Research Council of Norway	215	194	203	252	246	253	303	297	240	347
Other Norwegian public funding (ministries, directorates/agencies, etc.)	143	169	173	156	150	76	134	63	50	37
Private domestic sources (industry or NGOs)	14	14	15	15	33	33	41	44	27	29
Funding from abroad	152	122	35	37	36	47	111	118	82	69
Sum**	1056	1064	1057	1146	1178	1176	1368	1268	1200	1306

*) Operating expenses for the use of research vessels are funded centrally from the MN Faculty and the costs are not split between the user departments. The total costs for each year 2004-2013 (in 100 000 NOK): 2004: 195; 2005: 200; 2006: 211; 2007: 204; 2008: 237; 2009: 214; 2010: 238; 2011: 253; 2012: 260; 2013: 270. The Industrial and Aquatic Laboratory (www.ilab.uib.no) in the Marineholmen Science Park provides climate- and water-quality-controlled laboratory facilities for the scientific environment and the aquaculture industry, and a large proportion of the costs for the use by marine researchers and students at UiB are covered by UiB centrally.

The UiB has also funded the new BIO buildings at Marineholmen and renovated the research infrastructure on the 1st, 3rd and 4th floor in the High Technology Centre (Bioblokken), and a large proportion of this is used for marine research and education.

**) It should also be noted that these are historic numbers from BIO's accounts which therefore have not been adjusted for inflation.

If relevant, please describe the main developments in research funding (growth/reduction) per major research topic/research group in the period 2004-2013.

Marine research and training at Master and PhD level requires external funding. Although being competitive and attracting external funding a common trend across all the research groups constituting the department has been the increased challenge to secure dependable funding for core research activities. Lack of predictability to secure basic funding has hampered lab- as well as field-based research activity. Application success rates of EU and RCN funds have been limited, at least in part, by many programme-oriented calls focusing on problem-solving rather than integrative biology. Our dependence on the funding of positions (PhD, post-docs) rather than fractions of researcher positions also hampers our participation in EU-projects. The limited opportunities for blue sky research in many of the RCN research programmes has also been addressed in the national evaluation of biology and medicine in 2010 and by the committee appointed by RCN to suggest following up actions. While the department recognizes the importance of practicing proactive approach to apply for research funding, it has been particularly challenging to rhyme the challenges of narrow programme calls with the continuously increasing need to maintain up-to-date research facilities in addition to means and opportunities for

operating it. As a competing research department, we are dependent upon the infrastructure in order to be able to maintain high quality research output and remain competitive in the funding competition.

However, numerous examples exist to illustrate the impact that financial investment in UiB's strategic areas has had on its academic and research performance. The investments made in the state-of-the-art infrastructure of the marine biology station for instances have served as the basis for prestigious EU projects, an ERC Advanced Grant as well the Møbius prize from NFR. Furthermore, UiB, the faculty's and BIO's strategic focus and financial support regarding fish health research and other interdisciplinary marine activities have resulted in, among other things, one Centre for Research-based Innovation (SFI; the SLRC) and one Norwegian Centre of Excellence (SFF; the CGB). In addition, BIO has had one successful Bergen Forskingsstiftelse (BFS) candidate who is now a professor at BIO within the priority field of marine research.

2 Scientific production

ToR: "On the basis of international standards to assess the quality and relevance of the scientific production within marine research based on the combined production of publications and theses, with emphasis on the last 10 years."

The panel will assess UiB's overall scientific production within the field based on bibliometrics/publication lists extracted from Cristin and Web of Science. As additional information and background to interpret the bibliometric data we would like input on what you consider the department/centre's most significant publications within the field. Five to ten publications per major research topic/research group should be listed.

Please provide full references to each publication.

The most significant publications per major research topic/research group, 2004-2013:

With the department's primary focus on marine research over decades, its greatest expertise lies naturally in the research themes constituting the four greater research topics defined here. Consequently, this has resulted in numerous publications perceived by the research groups as among their most significant publications within the field. While some have selected more than the requested 5-10 publications, the reader is referred to Cristin or Web of Science for BIO's full list of publications.

FISHERIES ECOLOGY AND MARINE ECOSYSTEM DYNAMICS

Evolutionary Fisheries Ecology Research Group

1. Dieckmann, U., and M. Heino. 2007. Probabilistic maturation reaction norms: their history, strengths, and limitations. *Marine Ecology Progress Series* 335:253–269. doi: 10.3354/meps335253.
2. Dunlop, E. S., M. Heino, and U. Dieckmann. 2009. Eco-genetic modelling of contemporary life-history evolution. *Ecological Applications* 19:1815–1834. doi: 10.1890/08-1404.1.
3. Enberg, K., C. Jørgensen, E. S. Dunlop, M. Heino, and U. Dieckmann. 2009. Implications of fisheries-induced evolution for stock rebuilding and recovery. *Evolutionary Applications* 2:394–414. doi: 10.1111/j.1752-4571.2009.00077.x.

4. Enberg, K., C. Jørgensen, E. S. Dunlop, Ø. Varpe, D. S. Boukal, L. Baulier, S. Eliassen, and M. Heino. 2012. Fishing-induced evolution of growth: concepts, mechanisms, and the empirical evidence. *Marine Ecology* 33:1–25. doi: 10.1111/j.1439-0485.2011.00460.x.
5. Heino, M., and U. Dieckmann. 2008. Detecting fisheries-induced life-history evolution: an overview of the reaction norm approach. *Bulletin of Marine Science* 83:69–93.
6. Jørgensen, C., E. S. Dunlop, A. F. Opdal, and Ø. Fiksen. 2008. The evolution of spawning migrations: state dependence and fishing-induced changes. *Ecology* 89:3436–3448.
7. Jørgensen, C., K. Enberg, E. S. Dunlop, R. Arlinghaus, D. S. Boukal, K. Brander, B. Ernande, A. Gårdmark, F. Johnston, S. Matsumura, H. Pardoe, K. Raab, A. Silva, A. Vainikka, U. Dieckmann, M. Heino, and A. D. Rijnsdorp. 2007. Managing evolving fish stocks. *Science* 318:1247–1248. doi: 10.1126/science.1148089.
8. Jørgensen, C., B. Ernande, and Ø. Fiksen. 2009. Size-selective fishing gear and life history evolution in the Northeast Arctic cod. *Evolutionary Applications* 2:356–370. doi: 10.1111/j.1752-4571.2009.00075.x.
9. Jørgensen, C., and Ø. Fiksen. 2010. Modelling fishing-induced adaptations and consequences for natural mortality. *Canadian Journal of Fisheries and Aquatic Sciences* 67:1086–1097. doi:10.1139/F10-049.
10. Laugen, A. T., G. H. Engelhard, R. Whitlock, R. Arlinghaus, D. J. Dankel, E. S. Dunlop, A. M. Eikeset, K. Enberg, C. Jørgensen, S. Matsumura, S. Nusslé, D. Urbach, L. Baulier, D. S. Boukal, B. Ernande, F. D. Johnston, F. Mollet, H. Pardoe, N. O. Therkildsen, S. Uusi-Heikkilä, A. Vainikka, M. Heino, A. D. Rijnsdorp, and U. Dieckmann. 2014. Evolutionary impact assessment: accounting for evolutionary consequences of fishing in an ecosystem approach to fisheries management. *Fish and Fisheries* 15:65–96. doi: 10.1111/faf.12007.
11. Salvanes, A.G.V., Bartholomae, C., Yemane, D., Gibbons, M.G., Kainge, P., Krakstad, J.-O., Rouault, M., Staby, A., Sundby, S. (in press) Spatial dynamics of the bearded goby and its key fish predators off Namibia varies with climate and oxygen availability. *Fisheries Oceanography*
12. Skrypzeck, H. Salvanes, A.G.V., Currie, B., Kotze, A. (2014) First records of reproductive behaviour and early development for the bearded goby *Sufflogobius bibarbatus*. *J Fish Biology* 84: 1256-1261
13. Gunawickrama K.B.S., Westgaard J.-I., Salvanes A.G.V., Johansen T. (2012) Characterization of polymorphic microsatellite markers for the bearded goby *Sufflogobius bibarbatus*. *Conservation Genetics Resources*. 4: 187-189; DOI 10.1007/s12686-011-9505-5
14. Cedras, R.B., Salvanes, A.G.V. and Gibbons, M.J. (2011) Investigations into the diet and feeding ecology of the bearded goby, *Sufflogobius bibarbatus*, off Namibia. *African Journal of Marine Science* 33: 313-320 <http://dx.doi.org/10.2989/1814232X.2011.600431>
15. Salvanes A.G.V., Utne-Palm A.C., Currie B., Braithwaite V.A. (2011). Behavioural and physiological adaptations of the bearded goby: a key fish species of the extreme environment of Benguela. *Marine Ecology Progress Series* 425: 193-202. <http://www.int-res.com/abstracts/meps/v425/p193-202/>
16. Utne-Palm AC, Salvanes AGV, Currie B, Kaartvedt S, Nilsson GE, Braithwaite V, Stecyk JAW, Hundt M, van der Bank M, Flynn B, Sandvik GK, Klevjer TA, Sweetman, AK, Brüchert, V, Pittman K, Peard KR, Lunde IG, Strandabø RAU, Gibbons MJ (2010) Trophic structure and community stability in an overfished ecosystem. *Science* 329: 333-336 <http://www.sciencemag.org/content/329/5989/333.full?sid=3ecac9ca-691f-4d4e-9cf8-714309bf2935>

17. Gunawickrama K.B.S., De Silva P.M.C.S., Johansen T., Salvanes A.G.V., Nævdal G. (2010) Preliminary evidence for genetic heterogeneity of the goby (*Sufflogobius bibarbatus*) in the Benguela ecosystem. *Journal of Applied Ichthyology* 26: 110-112 <http://onlinelibrary.wiley.com/doi/10.1111/j.1439-0426.2009.01370.x/abstract>
18. Hundt, Matthias; Utne-Palm, Anne Christine; Gibbons, Mark J. Cross-shelf observations of diet and diel feeding behaviour of the bearded goby *Sufflogobius bibarbatus* off Namibia. *South African Journal of Marine Science* 2011 ;Volum 33.(1) s. 119-126

Marine Microbiology Research Group

- *Microbial Ecology*

1. Thingstad TF, Krom MD, Mantoura RF, Flaten GA, Groom S, Herut B, Kress N, Law CS, Pasternak A, Pitta P, Psarra S, Rassoulzadegan F, Tanaka T, Tselepidis A, Wassmann P, Woodward EM, Riser CW, Zodiatis G, Zohary T (2005) Nature of phosphorus limitation in the ultraoligotrophic eastern Mediterranean. **Science**. Aug 12;309(5737):1068-71
2. Martiny JBH, Bohannan BJM, Brown JH, Colwell RK, Fuhrman JA, Green JL, Horner-Devine MC, Kane M, Krumins JA, Kuske CR, Morin P, Naeem S, Øvreås L, Reysenbach A-L, Smith VA, Staley J (2006). Microbial biogeography: putting microorganisms on the map. **Nature Reviews Microbiology** 4: 102-112.
3. Horner-Devine MC, Silver JM, Leibold MA, Bohannan BJM, Colwell RK, Fuhrman JA, Green JL, Kuske CR, Martiny JBH, Muyzer G, Øvreås L, Reysenbach A-L, Smith VH (2007). A comparison of taxon co-occurrence patterns for macro- and microorganisms. **Ecology** 88: 1345-1353.
4. Thingstad TF, Bellerby RGJ, Bratbak G, Borsheim KY, Egge JK, Heldal M, Larsen A, Neill C, Nejstgaard J, Norland S, Sandaa R-A, Skjoldal EF, Tanaka T, Thyrhaug R, Topper B (2008) Counterintuitive carbon-to-nutrient coupling in an Arctic pelagic ecosystem. **Nature** 455: 387-U337.
5. Rodriguez-Valera F, Martin-Cuadrado AB, Rodriguez-Brito B, Pasic L, Thingstad TF, Rohwer F, Mira A (2009) OPINION Explaining microbial population genomics through phage predation. **Nature Reviews Microbiology** 7: 828-836.
6. Sandaa R-A, Gomez-Consarnau L, Pinhassi J, Riemann L, Malits A, Weinbauer MG, Gasol JM, Thingstad TF (2009) Viral control of bacterial biodiversity - evidence from a nutrient-enriched marine mesocosm experiment. **Environ. Microbiol.** 11: 2585-2597.
7. Ogata H, Ray J, Toyoda K, Sandaa R-A, Nagasaki K, Bratbak G, Claverie J-M (2011). Girus-encoded MutS subfamilies abundant in the marine environment. **The ISME Journal** DOI:10.1038/ismej.2010.210
8. Jorgensen, SL, Hannisdal B, Lanzen A, Baumberger T, Flesland J, Fonseca R, Øvreås L, Steen IH, Thorseth IH, Pedersen RB, Schleper C (2012). Correlating microbial community profiles with geochemical data in highly stratified sediments from the Arctic Mid-Ocean Ridge. **PNAS USA** 109(42): E2846-E2855.
9. Bengtsson MM, Sjøtun K, Lanzén A, Øvreås L (2012). Bacterial diversity in relation to secondary production and succession on surfaces of the kelp *Laminaria hyperborea*. **The ISME Journal** doi: 10.1038/ismej.2012.67.
10. Vardi, A, Haramaty L, Van Mooy BAS, Fredricks HF, Kimmance SA, Larsen A, Bidle KD (2012). Host-virus dynamics and subcellular controls of cell fate in a natural coccolithophore population. **PNAS USA** 109(47): 19327-19332.

11. Moore, CM, Mills MM, Arrigo KR, Berman-Frank I, Bopp L, Boyd PW, Galbraith ED, Geider RJ, Guieu C, Jaccard SL, Jickells TD, La Roche J, Lenton TM, Mahowald NM, Marañón E, Marinov I, Moore JK, Nakatsuka T, Oschlies A, Saito MA, Thingstad TF, Tsuda A, Ulloa O (2013) Processes and patterns of oceanic nutrient limitation. **Nature Geoscience** 6:701-710 doi:10.1038/NCEO1765
12. Urich T, Lanzén A, Stokke R, Bayer C, Pedersen RB, Thorseth I, Schleper C, Steen IH, Øvreas L (2013) Microbial community structure and functioning in marine sediments associated with diffuse hydrothermal venting assessed by integrated meta-omics. **Environ Microbiol.** Sep 20. doi: 10.1111/1462-2920.12283.
13. Vaage S, Storesund JE, Thingstad TF (2013). "SAR11 viruses and defensive host strains." **Nature** 499 (7459): E3-E4.
14. Thingstad TF, Våge S, Storesund JE, Sandaa R-A, Giske J (2014) A theoretical analysis of how strain-specific viruses can control microbial species diversity. **PNAS USA**,111(21) 7813–7818, doi: 10.1073/pnas.1400909111

Theoretical Ecology Research Group

1. Jarl Giske, Sigrunn Eliassen, Øyvind Fiksen, Per J. Jakobsen, Dag L. Aksnes, Marc Mangel and Christian Jørgensen. (2014) The emotion system promotes diversity and evolvability. *Proceedings of the Royal Society B -Biological Sciences*. 281: 20141096. <http://dx.doi.org/10.1098/rspb.2014.1096>
2. Eliassen S, Jørgensen C. 2014. Extra-pair mating and evolution of cooperative neighbourhoods. *PLoS One*. 9: e99878. [doi:10.1371/journal.pone.0099878]
3. Jarl Giske, Sigrunn Eliassen, Øyvind Fiksen, Per J. Jakobsen, Dag L. Aksnes, Christian Jørgensen, and Marc Mangel. 2013. Effects of the Emotion System on Adaptive Behavior. *The American Naturalist* 182:689-703.
4. Aksnes DL, Cao FJ. 2011. Inherent and apparent traits in microbial nutrient uptake. *Marine Ecology Progress Series*. 440: 41-51. [doi:10.3354/meps09355]
5. Jørgensen C, Enberg K, Dunlop ES, Arlinghaus R, Boukal DS, Brander K, Ernande B, Gårdmark A, Johnston F, Matsumura S, Pardoe H, Raab K, Silva A, Vainikka A, Dieckmann U, Heino M, Rijnsdorp AD. 2007. Managing evolving fish stocks. *Science*. 318: 1247-1248.
6. Fiksen Ø, Jørgensen C, Kristiansen T, Vikebø F, Huse G (2007). Linking behavioural ecology and oceanography: how behaviour determines growth, mortality and dispersal. *Marine Ecology Progress Series* **347**: 195-205
7. Varpe Ø, Jørgensen C, Tarling GA, Fiksen Ø. 2007. Early is better: seasonal egg fitness and timing of reproduction in a zooplankton life-history model. *Oikos*. 116: 1331-1342. [doi:10.1111/j.2007.0030-1299.15893.x]
8. Jørgensen C, Ernande B, Fiksen Ø, Dieckmann U. 2006. The logic of skipped spawning in fish. *Canadian Journal of Fisheries and Aquatic Sciences*. 63: 200-211.
9. Grimm V, Berger U, Bastiansen F, Eliassen S, Ginot V, Giske J, Goss-Custard J, Grand T, Heinz SK, Huse G, Huth A, Jepsen JU, Jørgensen C, Mooij WM, Müller B, Pe'er G, Piou C, Railsback SF, Robbins AM, Robbins MM, Rossmanith E, Rüger N, Strand E, Souissi S, Stillman RA, Vabø R, Visser U, DeAngelis DL. 2006. A standard protocol for describing individual-based and agent-based models. *Ecological*

Modelling. 198: 115-156. [doi:10.1016/j.ecolmodel.2006.04.023] (This paper came out from a workshop held in Bergen, arranged by our research group.)

10. Aksnes DL, Nejstgaard J, Sædberg E, Sørnes T. 2004. Optical control of fish and zooplankton populations. *Limnology and Oceanography*. 49: 233-238.

Aquatic Behavioral Ecology Research Group

- *Fish population biology*

1. Johannessen, A., Skaret, G., Langård, L., Slotte, A., Husebø, Å. and Fernö, A. 2014. The Dynamics of a Metapopulation: Changes in Life-History Traits in Resident Herring that Co-Occur with Oceanic Herring during Spawning. *PLoS ONE* 9(7): e102462. doi:10.1371/journal.pone.0102462

- *Spatial dynamics*

2. Langøy, H., Nøttestad, L., Skaret, G. Broms, C. and Fernö, A. 2012. Overlap in distribution and diets of Atlantic mackerel (*Scomber scombrus*), Norwegian spring-spawning herring (*Clupea harengus*) and blue whiting (*Micromesistius poutassou*) in the Norwegian Sea during late summer. *Marine Biology Research* 8, 442-460.
3. Huse, G., Utne, K.R. and Fernö, A. 2012. Vertical distribution of herring and blue whiting in the Norwegian Sea. *Marine Biology Research* 8, 488-501.

- *Schooling dynamics and collective behavior*

4. Nøttestad, L. Fernö, A., Misund, O.A. and Vabø, R. 2004. Understanding herring behaviour: Linking individual decisions, school patterns and population distribution. In: Skjoldal, H.R., Sætre, R., Fernö, A., Misund, O.A. and Røttingen, I. (Editors). *The Norwegian Sea Ecosystem*. Tapir. Trondheim.
5. Huse, G., Fernö, A. and Holst, J. 2010. Establishment of novel wintering areas in herring co-occurs with peaks in the 'first time/repeat spawner' ratio. *Marine Ecology Progress Series* 409, 189-198.

- *Aquaculture: Behaviour, cognition and welfare*

6. Kristiansen, T., Fernö, A., Holm, J.C., Privitera, L., Bakke, S. and Fosseidengen, J.E. 2004. Swimming behaviour as an indicator of low growth rate and impaired welfare in Atlantic halibut (*Hippoglossus hippoglossus* L.) reared in three stocking densities. *Aquaculture* 230, 137-151.
7. Nilsson, J., Kristiansen, T.S., Fosseidengen, J.E., Fernö, A. and van den Bos, R. 2008. Learning in cod (*Gadus morhua*): long trace interval retention. *Animal Cognition* 11, 215-222.
8. Nilsson, J., Kristiansen, T.S., Fosseidengen, J.E., Stien, L.H., Fernö, A. and van den Bos, R. 2010. Learning and anticipatory behaviour in a "sit-and-wait" predator: the Atlantic halibut. *Behavioural Processes* 85, 257-266.
9. Fernö, A., Huse, G., Jakobsen, P.J., Kristiansen, T.S. and Nilsson, J. 2011. Fish Behaviour, Learning, Cognition and Welfare in Aquaculture and Fisheries. In: *Fish Cognition and Behaviour*. Second edition (editors C. Brown, K. Laland and J. Krause). Blackwell Publishing.
10. Meager, J.J., Fernö, A., Skaeraasen, J.E., Järvi, T., Rodewald, P., Sverdrup, G., Winberg, S. and Mayer, J. 2012. Multidimensionality of behavioural phenotypes in Atlantic cod, *Gadus morhua*. *Physiology and Behaviour* 106, 462-470.

- *Ontogeny and escapees*

11. Meager, J.J., Skjæraasen, J.E., Fernö, A., Løkkeborg, S., Karlsen, Ø., Michalsen, K. and Utskot, S.O. 2009. Vertical dynamics and reproductive behaviour of farmed and wild Atlantic cod, *Gadus morhua*. *Marine Ecology Progress Series* 389, 233-243.

12. Skjæraasen, J.E., Meager, J.J., Karlsen, Ø., Hutchings, J.A., and Fernö, A. 2011. Extreme spawning-fidelity in Atlantic cod. *ICES Journal of Marine Science*, 68, 1472-1477.
 - *Fish behaviour in relation to fishing gear*
13. Løkkeborg, S., Fernö, A. and Humborstad, O.B. 2010. Fish Behaviour in Relation to Longlines. In *Behaviour of Marine Fishes: Capture Processes and Conservation* (editor P. Hi). Blackwell Publishing Ltd.
14. Rosen, A., Engås, A., Fernö, A. and Jørgensen, T. 2012. The reactions of shoaling cod to a pelagic trawl: implications for commercial trawling. *ICES Journal of Marine Science* 69, 303-312.
 - *Other*
15. Braithwaite, V.A. & Salvanes, A.G.V. 2010. Aquaculture and restocking: implications for conservation and welfare. *Animal Welfare* 19: 139-149
16. Gunawickrama, K.B.S., De Silva, P.M.C.S., Johansen, T., Salvanes, A.G.V. & Nævdal, G. 2010. Preliminary evidence for genetic heterogeneity of the goby (*Sufflogobius bibarbatus*) in the Benguela ecosystem. *Journal of Applied Ichthyology* 26: 110-112
17. Strand, D.A., Utne-Palm, A.C., Jakobsen, P.J., Braithwaite, V.A. & Salvanes, A.G.V. 2010. Enrichment promotes learning in fish. *Marine Ecology Progress Series* 412: 273-282.
18. Utne-Palm A.C., Salvanes A.G.V., Currie, B., Kaartvedt, S., Nilsson, G.E., Braithwaite, V.A., Stecyk, J., Hundt, M., van der Bank, M., Flynn, B., Sandvik, G.K., Klevjer, T.A., Sweetman, A.K., Brüchert, V., Pittman, K., Peard, K.R., Lunde, I.G., Strandabø, R.A.U., & Gibbons, M.J. 2010. Trophic Structure and Community Stability in an Overfished Ecosystem. *Science* 329: 333-336
19. Groison, A-L., Suquet, M., Cosson, J., Mayer I., Severe, A., Bouquet, J-M., Geffen, A.J. Utne-Palm, A.C., & Kjesbu, O.S. 2010. Sperm motility in European hake, *Merulicus merulicus*, and characterization of its spermatozoa concentration and volume, spermatocrit, osmolality and pH. *Aquaculture* 301: 31-36
20. Huse, G., Fernö, A. & Holst, J. 2010. Establishment of novel wintering areas in herring cooccurs with peaks in the 'first time/repeat spawner' ratio. *Marine Ecology Progress Series* 409: 189-198.
21. Kennedy, J., Skjæraasen, J.E., Nash, R.D.M., Thorsen, A., Slotte, A., Hansen, T. & Kjesbu, O.S. 2010. Do capital breeders like Atlantic herring (*Clupea harengus* L.) exhibit sensitive periods of nutritional control on ovary development and fecundity regulation *Canadian Journal of Fisheries and Aquatic Science* 67: 16-27
22. Korsøen, Ø.J., Dempster, T., Fosseidengen, J-E., Fernö, A., Heegaard, E. & Kristiansen, T.S. 2010. Behavioural responses to pressure changes in cultured Atlantic cod (*Gadus morhua*): defining practical limits for submerging and lifting sea-cages. *Aquaculture* 308: 106-115
23. Langård, L., Øvredal, J.T., Johannesen, A., Nøttestad, L., Skaret, G., Fernö, A. and Wahlberg, M. (2008) Sound production in pre-spawning herring, cod and haddock in a naturally enclosed ecosystem. *Bioacoustics* 17: 38-40.
24. Meager, J.J., Moberg, O., Strand, E. & Utne-Palm, A.C. 2010 Effects of light intensity on visual prey detection by juvenile Atlantic cod. *Marine and Freshwater Behaviour and Physiology*. 43(2): 99-108
25. Meager, J.J., Skjæraasen, J.E., Fernö, A. & Løkkeborg, S. 2010. Reproductive interactions between fugitive farmed cod and wild cod in the field. *Canadian Journal of Fisheries and Aquatic Sciences* 67: 1221-1231.
26. Nilsson, J., Kristiansen, T.S., Fosseidengen, J.E., Stien, L.H., Fernö, A. & van den Bos, R. 2010. Learning and anticipatory behaviour in a "sit-and-wait" predator: the Atlantic halibut. *Behavioural Processes* 83: 257-266

27. Skjæraasen, J.E. & Hutchings, J.A. 2010. Shifting reproductive success in a shoal of Atlantic cod, *Gadus morhua* L. *Environmental Biology of Fishes* 88:311-318
28. Skjæraasen, J.E., Kennedy, J., Thorsen, A., Nash, R.D.M., Nilsen, T. & Kjesbu, O.S. 2010 Liver energy, atresia and oocyte stage influence fecundity regulation in Northeast Arctic cod. *Marine Ecology Progress Series* 404:173-183
29. Skjæraasen, J.E., Meager, J.J., Karlsen, Ø., Mayer, I., Dahle, G., Rudolfson, G., Haugland, T. & Fernö, A. 2010. Mating competition between farmed and wild cod: wild females choose wild males. *Marine Ecology Progress Series* 412: 247-258.
30. Skjæraasen, J.E., Meager, J.J. & Hutchings, J.A. 2010. A cost of reproduction in male Atlantic cod (*Gadus morhua*). *Canadian Journal of Zoology* 88(6): 595-600.
31. Stiansen, S., Fernö, A., Jørgensen, T., Furevik D. & Løkkeborg, S. 2010. Horizontal and vertical odor plume trapping of red king crabs explains the different efficiency of top and side entrance pot designs. *Transactions of the American Fisheries Society* 139: 483-490.
32. Kristoffersen, J.B. & Salvanes, A.G.V. 2009. Distribution, growth, and population genetics of the glacier lanternfish (*Benthoosema glaciale*) in Norwegian waters: contrasting patterns in fjords and the ocean. *Marine Biology Research* 5: 596-604
33. Johannesen, A., Nøttestad, L., Fernö, A., Langgård, L. & Skaret, G.. 2009. Two components of Northeast Atlantic herring within the same school during spawning: support for the existence of a metapopulation? *ICES Journal of Marine Science* 66: 1740-1748.
34. Meager, J.J., Skjæraasen, J.E., Fernö, A., Karlsen, Ø., Løkkeborg, S., Michalsen, K. & Utskot, S.O. (2009) Vertical dynamics and reproductive behaviour of farmed and wild cod (*Gadus morhua*). *Marine Ecology Progress Series* 389: 233-243.
35. Skjæraasen, J.E., Kennedy, J., Thorsen, A., Fonn, M., Njøes-Strand, B., Mayer, I. & Kjesbu, O.S. 2009. Mechanisms regulating oocyte recruitment and skipped spawning in the Northeast Arctic cod (*Gadus morhua* L.). *Canadian Journal of Fisheries and Aquatic Science* 66:1582-1596
36. Skjæraasen, J.E. Mayer, I. Meager, J.J., Rudolfson, G., Karlsen, Ø., Haugland, T., & Kleven, O. 2009. Sperm characteristics and competitive ability in farmed and wild cod. *Marine Ecology Progress Series* 375: 219-228.
37. Skjæraasen, J.E., Nilsen, T., Meager, J.J., Herbert, N.A., Moberg, O., Tronci, V., Johansen, T. & Salvanes, A.G.V. 2008. Hypoxic avoidance behaviour in cod (*Gadus morhua* L.): The effect of temperature and haemoglobin genotype. *Journal of Experimental Marine Biology and Ecology* 358: 70-77.
38. Kainge, P., Kjesbu, O.S., Thorsen, A. & Salvanes, A.G.V. 2007. *Merluccius capensis* spawn in Namibian waters, but do *M. paradoxus*? *African Journal of Marine Science* 29: 379-392
39. Mqoqi, M., Lipinski, M.R. & Salvanes, A.G.V. 2007. The ecology of *Sepia australis* (Cephalopoda : Sepiidae) along the south coast of South Africa *ICES Journal of Marine Science* 64: 945-955.
40. Salvanes, A.G.V., Moberg, O. & Braithwaite, V.A. 2007. Effects of early experience on group behaviour in fish. *Animal Behaviour* 74: 805-811.
41. Doksæter, L., Olsen, E., Nøttestad, L. & Fernö, A. 2008. Distribution and feeding ecology of dolphins along the Mid-Atlantic Ridge between Iceland and the Azores. *Deep-sea Research* 55: 243-253.
42. Hardie, D., Renaud, C., Ponomarenko, V.P.P., Mukhina, N.V., Yaragina, N.A., Skjæraasen, J.E. &

- Hutchings, J.A. 2008. The Isolation of Atlantic cod, *Gadus morhua* (Gadiformes), populations in northern meromictic lakes - A recurrent arctic phenomenon. *Journal of Ichthyology* 48: 230-240.
43. Meager, J.J. & Utne-Palm, A.C. 2008. Effect of turbidity on habitat preference of juvenile Atlantic cod, *Gadus morhua* and turbidity. *Environmental Biology of Fishes* 81: 149-155.
44. Nilsson, J., Kristiansen, T.S., Fosseidengen, J.E., Fernö, A. & van den Bos, R. 2008. Learning in cod (*Gadus morhua*): long trace interval retention. *Animal Cognition* 11: 215-222.
45. Nilsson, J., Kristiansen, T.S., Fosseidengen, J.E., Fernö, A. & van den Bos, R. 2008. Signand goal-tracking in Atlantic cod (*Gadus morhua*). *Animal Cognition* 11: 651-659.
46. Rowe, S., Hutchings, J.A., Skjæraasen, J.E., de Mestral Bezanson, L. 2008. Phenotypic and behavioural correlates of individual variation in male Atlantic cod reproductive success. *Marine Ecology Progress Series* 354: 267-276.
47. Skjærrasen, J.E., Meager, J.J. & Karlsen, Ø. 2008. Expression of secondary sexual characteristics in recruit and repeat spawning farmed and wild cod. *ICES Journal of Marine Science* 65: 1710-1716.
48. Stiansen, S., Fernö, A., Furevik, D., Jørgensen, T. & Løkkeborg, S. 2008. Efficiency and catch dynamics of collapsible square and conical crab pots used in the red king crab (*Paralithodes camtschaticus*) fishery. *Fishery Bullentin* 106: 40-46.
49. Jørgensen, T., Løkkebørg, S., Fernö, A. & Hufthammer, M. 2007. Walking speed and area utilization of red king crab (*Paralithodes camtschaticus*) introduced to the Barents Sea coastal ecosystem. *Hydrobiologica* 582: 17-24.
50. Kristiansen, T. and Fernö, A. (2007) Individual behaviour and growth of halibut (*Hippoglossus hippoglossus* L.) fed sinking and floating food: evidence of different coping styles. *Applied Animal Behaviour Science* 104, 236-250.
51. Meager, J.J. & Batty, R.S. 2007. Effects of turbidity on the spontaneous and prey searching activity of juvenile Atlantic cod (*Gadus morhua*). *Philosophical Transactions of the Royal Society of London Series B* 362: 2123-2130.
52. Rowe, S., Hutchings, J.A. & Skjæraasen, J.E. 2007. Non-random mating in a broadcast spawner: mate size influences reproductive success in Atlantic cod (*Gadus morhua*). *Canadian Journal of Fisheries and Aquatic Sciences* 64: 219-226.
53. Salvanes, A.G.V. & Braithwaite, V.A. 2006. The need to understand the behaviour of fish we rear for mariculture or for restocking. *ICES Journal of Marine Science*. 63: 346-354
54. Meager, J.J., Domenici, P., Shingles, A. & Utne-Palm, A.C. 2006. Escape responses in juvenile Atlantic Cod (*Gadus morhua* L.): the effects of turbidity and predator speed. *Journal of Experimental Biology* 209: 4174-4184.
55. Michalsen, K., Fernö, A. & Nilsson, J. 2006. Synchronous vertical dynamics of individual cod (*Gadus morhua* L.) at the spawning ground. *Journal of Fish Biology* 69, 59.
56. Skjæraasen, J.E., Nilsen, T. & Kjesbu, O.S. 2006. Timing and determination of potential fecundity in Atlantic cod (*Gadus morhua*). *Canadian Journal of Fisheries and Aquatic Sciences* 63: 310-320.
57. Skjæraasen, J.E., Rowe, S. & Hutchings, J.A. 2006. Sexual dimorphism in pelvic fin length of Atlantic cod. *Canadian Journal of Zoology* 84: 865-870.
58. Utne-Palm, A.C. & Bowmaker, J.K. 2006. Spectral sensitivity of the two-spotted goby (*Gobiusculus flavescens*): a physiological and behavioural study. *Journal of Experimental Biology* 209: 2034-2041.

59. Braithwaite, V.A. & Salvanes, A.G.V. 2005. Environmental variability in the early rearing environment generates behaviourally flexible cod: implications for rehabilitating wild populations. *Proceedings of the Royal Society, London Series B*. 272: 1107-1113.
60. Salvanes, A.G.V. & Braithwaite, V.A. 2005. Exposure to variable spatial information in the early rearing environment generates asymmetries in social interactions in coastal cod. *Behavioral Ecology and Sociobiology* 59: 250-257.
61. Artigas, M.L., Skjæraasen, J.E., Utne-Palm A.C. & Nilsen, T. 2005. Recovery from handling stress in cod (*Gadus morhua* L.). *Journal of Fish Biology* 67: 384-391.
62. Meager, J.J., Solbakken, T., Utne-Palm, A.C. & Oen, T. 2005. Effects of turbidity on the reactive distance, search time and foraging success of juvenile Atlantic cod (*Gadus morhua*). *Canadian Journal of Fisheries and Aquatic Sciences* 62: 1978-1984.

MARINE AND ENVIRONMENTAL HEALTH

Marine Developmental Biology Research Group

- *Smoltification, osmoregulation*

1. Nilsen, T. O., Ebbesson, L. O. E., Madsen, S. S., McCormick, S. D., Andersson, E., Björnsson, B. Th., Prunet, P. and Stefansson, S. O., 2007. Differential expression of gill Na⁺,K⁺-ATPase α - and β -subunits, Na⁺,K⁺,2Cl⁻-cotransporter and CFTR anion channel in juvenile anadromous and landlocked Atlantic salmon *Salmo salar*. *J. Exp. Biol.*, 210, 2885-2896.
2. Stefansson, S.O., Haugland, M., Björnsson, B.Th., McCormick, S.D., Holm, M., Ebbesson, L.O.E., Holst, J.C., Nilsen, T.O., 2012. Growth, osmoregulation and endocrine changes in wild Atlantic salmon post-smolts during marine migration. *Aquaculture*, 362-363, 127-136. doi:10.1016/j.aquaculture.2011.07.002

- *Early life stages, salmon and marine fish*

3. Angotzi, A. R., Ersland, K. M., Mungpakdee S., Stefansson, S. and Chourrout, D., 2008. Independent and dynamic reallocation of pitx gene expression during vertebrate evolution, with emphasis on fish pituitary development. *Gene*, 417, 19-26.
4. Angotzi, A. R., S. Mungpakdee, S. Stefansson, R. Male, D. Chourrout, 2011. Involvement of Prop1 homeobox gene in fish pituitary early development. *Gen. Comp. Endocrinol.*, 171, 332–340. doi:10.1016/j.ygcen.2011.02.026

- *Growth, sexual maturation*

5. Kling, P., Jönsson, E., Nilsen, T. O., Einarsdottir, I. E., Rønnestad, I., Stefansson, S. O. and Björnsson, B. Th., 2012. The role of growth hormone in growth, lipid homeostasis, energy utilization and partitioning in rainbow trout: interactions with leptin, ghrelin and insulin-like growth factor I. *Gen. Comp. Endocrinol.*, 175, 153-162 (doi.org/10.1016/j.ygcen.2011.10.014).
6. Koedijk R. M., Le Francois N. R., Blier P. U., Foss, A., Folkvord, A., Ditlecadet, D., Lamarre, S. G., Stefansson, S. O. and Imsland, A. K., 2010. Ontogenetic effects of diet during early development on growth performance, myosin mRNA expression and metabolic enzyme activity in Atlantic cod juveniles reared at different salinities. *Comp. Biochem. Physiol.*, 156, 102-109.

- *Development and function of the visual system in fish larvae*

7. Valen, R., R.B. Edvardsen, A.M. Sjøviknes, Ø. Drivenes and J.V. Helvik. (2014). Molecular evidence that only two opsin families, the blue light- (SWS2) and green light-sensitive (RH2), drive color vision in Atlantic cod (*Gadus morhua*). *PLOS ONE* (in revision)

8. Helvik JV, Drivenes Ø, Næss TH, Fjose, A and Seo, HC (2001). Molecular cloning and characterisation of five opsin genes from the marine flatfish Atlantic halibut (*Hippoglossus hippoglossus*) *Visual Neuroscience* 18 767-780
 - *Deep brain photoreception, development and function*
9. Eilertsen, M., Ø. Drivenes, R. B. Edvardsen, C. A. Bradley, L. O.E. Ebbesson and J.V. Helvik. (2014). Melanopsin and exorhodopsin in the pineal complex of Atlantic halibut (*Hippoglossus hippoglossus*). *J. Comp. Neurol.*, 2014 (In Press)
10. Sandbakken, M., L. Ebbesson, S.O. Stefansson and J. V. Helvik (2012). Isolation and characterization of melanopsin photoreceptors of Atlantic salmon (*Salmo salar*). *J. Comp. Neurol.*, 520:3727-44.
 - *Digestive function and appetite in developing larval fish*
11. Gomes, A.S., Y Kamisaka, T. Harboe, D. Power, I. Rønnestad. 2014. Functional modifications associated with gastrointestinal tract organogenesis during metamorphosis in Atlantic halibut (*Hippoglossus hippoglossus*) - *BMC Developmental Biology*. 14: 11.
 - *Nutritional physiology and growth of teleosts*
12. Rønnestad, I., K. Murashita, G. Kottra, A-E. Olderbakk Jordal, C Jolly, S. Narawane, H. Daniel, T. Verri. 2010. Molecular cloning and functional expression of Atlantic salmon Peptide Transporter 1 in *Xenopus* oocytes reveals efficient intestinal uptake of lysine-containing and other bioactive di- and tripeptides in teleost fish. *J. Nutrition*. 140: 893-900.
13. Rønnestad, I., T.O. Nilsen, K. Murashita, A.R. Angotzi, A-G. Gamst-Moen, S.O. Stefansson, P. Kling, T.B. Björnsson and T. Kurokawa. 2010. Leptin and leptin receptor genes in Atlantic salmon: cloning, phylogeny, tissue distribution and expression correlated to long-term feeding status. *Gen. Comp. Endocrinol.*, 168: 55-70
 - *Chromatin and Cell Cycle Dynamics in Urochordates*
14. Campsteijn C, Øvrebø JI, Karlsen BO and EM Thompson (2012). Expansion of cyclin D and CDK1 paralogs in *Oikopleura dioica*, a chordate employing diverse cell cycle variants. *Mol. Biol. Evol.* 29: 487-502.
15. Denoeud F, Henriot S, Mungpakdee S, Aury JM, Da Silva C, Brinkmann H, Mikhaleva J, Olsen LC, Jubin C, Cañestro C, Bouquet JM, Danks G, Poulain J, Campsteijn C, Adamski M, Cross I, Yadetie F, Muffato M, Louis A, Butcher S, Tsagkogeorga G, Singh S, Jensen MF, Cong EH, Eikeseth-Otteraa H, Anthouard V, Kachouri-Lafond R, Nishino A, Ugolini M, Chourrout P, Nishida H, Aasland R, Huzurbazar S, Westhof E, Delsuc F, Lehrach H, Reinhardt R, Weissenbach J, Roy SW, Artiguenave F, Postlethwait JH, Manak JR, Thompson EM, Jaillon O, Du Pasquier L, Boudinot P, Liberles DA, Voff JN, Philippe H, Lenhard B, Crollius HR, Wincker P and D Chourrout (2010). Plasticity of animal genome architecture unmasked by rapid evolution of a pelagic tunicate. *Science* 330, 1381-1385.
 - *Cellular templating of complex extracellular structures*
16. Sagane Y, Hosp J, Zech K and EM Thompson (2011). Cytoskeleton-mediated templating of complex cellulose-scaffolded extracellular structure in the urochordate *Oikopleura*. *Cell. Molec. Life Sci.* 68, 1611-1622.
17. Sagane Y, Zech K, Bouquet JM, Schmid M, Bal U and EM Thompson (2010). Functional specialization of cellulose synthase genes of prokaryotic origin in chordate larvaceans. *Development* 137, 1483-1492.
 - *Marine trophodynamics, climate change and environmental monitoring*
18. Hadziavdic K, Lekang, K, Lanzen, A; Jonassen, I, Thompson, EM and C Troedsson (2014). Characterization of the 18S rRNA Gene for Designing Universal Eukaryote Specific Primers. *PLoS ONE*, 9: e87624.

19. Troedsson C, Bouquet JM, Lobon CM, Novac A, Nejtgaard JC, Dupont S, Bosak S, Jakobsen HH, Romanova N, Pankoke LM, Isla A, Dutz J, Sazhin AF and EM Thompson (2012). Effects of ocean acidification, temperature and nutrient regimes on the appendicularian *Oikopleura dioica*: A mesocosm study. *Mar. Biol.* [special issue on ocean acidification], 160: 2175-2187.
 - *Skeletal development salmon, skeletal deformities salmon*
20. Norvik, K., Kryvi, H., Totland, G. K., Grotmol, S. 2005. The salmon vertebral body develops through mineralization of the preformed tissues that are encompassed by two layers of bone. *J. Anat.* 206, 103-114.
21. Grotmol, S., Kryvi, H., Totland, G. K. 2005. Deformation of the notochord by pressure from the swim bladder may cause malformation of the vertebral column in cultured Atlantic cod *Gadus morhua*: a case study. *Diseas. Aquat. Org.* 65, 121-128.
 - *Notochord development, salmon*
22. Wang, S., Furmanek, T., Kryvi, H., Krossøy, C., Totland, G. K., Grotmol, S., Wargelius, A. 2014. Transcriptome sequencing of Atlantic salmon (*Salmo salar* L.) notochord prior to development of the vertebrae provides clues to regulation of positional fate, chordoblast lineage and mineralization. *BMC genomics* 15, 141-155.
23. Sagstad, A., Grotmol, S., Kryvi, H., Krossøy, C., Totland, G.K., Malde, K., Wang, S., Hansen, T. Wargelius, A. 2013. Identification of *vimentin*- and *elastin*-like transcripts specifically expressed in developing notochord of Atlantic salmon (*Salmo salar* L.). *Cell Tissue Res.*, 346, 191-202.

Environmental Toxicology Research Group

1. Nilsen BM, Berg K, Eidem JK, Kristiansen SI, Brion F, Porcher JM, Goksøy A. Development of quantitative vitellogenin-ELISAs for fish test species used in endocrine disruptor screening. *Anal Bioanal Chem.* 378:621-33 (2004).
2. Bemanian, V; Male, R. & Goksøy, A. The Aryl hydrocarbon receptor-mediated disruption of vitellogenin synthesis in the fish liver: Cross-talk between AHR- and ER α -signaling pathways. *Comparative Hepatology* 3:2 (2004), <http://www.comparative-hepatology.com>.
3. Hasselberg L., Goksøy A., Grøsvik B.E. Celander M Interactions between xenoestrogens and ketoconazole on CYP1A and CYP3A in juvenile Atlantic cod (*Gadus morhua*). *Comparative Hepatology*, 4:2 (2005).
4. Goksøy A. Endocrine disruptors in the marine environment: mechanisms of toxicity and their influence on reproductive processes in fish. *J. Toxicol. Environ. Health part A*, 69:175-184 (2006).
5. Eidem, JK, Kleivdal H, Kroll K, Denslow N, van Aerle R, Tyler C, Panter G, Hutchinson T, Goksøy A. Development and validation of a direct homologous quantitative sandwich ELISA for fathead minnow (*Pimephales promelas*) vitellogenin. *Aquat. Toxicol.* 78:202-206 (2006).
6. Luigi Viganò, Emilio Benfenati, Anne van Cauwenberge, Janne K. Eidem, Claudio Erratico, Anders Goksøy, Werner Kloas, Silvia Maggioni, Alberta Mandich, Ralph Urbatzka. Estrogenicity profile and estrogenic compounds determined in river sediments by chemical analysis, ELISA and yeast assays. *Chemosphere* 73:1078-1089 (2008).
7. Jasmine Nahrgang, Lionel Camus, Patrice Gonzalez, Anders Goksøy, Jørgen Schou Christiansen & Haakon Hop. PAH biomarker responses in polar cod (*Boreogadus saida*) exposed to benzo(a)pyrene. *Aquatic Toxicology*, 94:309-319 (2009).
8. Anneli Bohne Kjersem, Arnfinn Skadsheim, Anders Goksøy & Bjørn Einar Grøsvik. Candidate biomarker discovery in plasma of juvenile cod (*Gadus morhua*) exposed to crude North Sea oil, alkyl

phenols and polycyclic aromatic hydrocarbons. *Marine Environ. Res.* 68:268-277 (2009).

9. Berntssen, M.H.G., Olsvik, P.A., Torstensen, B.E., Julshamn, K., Midtun, T., Goksøyr, A., Johansen, J., Sygholt, T., Joerum, N., Jakobsen, J.-V., Lundebye, A.-K., Lock, E.-J. Reducing persistent organic pollutants while maintaining long chain omega-3 fatty acid in farmed Atlantic salmon by use of decontaminated fish oils during a full cycle production. *Chemosphere*, 81:242-252 (2010).
10. Berg, K., Puntervoll, P., Valdersnes, S. and Goksøyr, A. Responses in the brain proteome of Atlantic cod (*Gadus morhua*) exposed to methylmercury. *Aquat. Toxicol.*, 100:51-65 (2010).
11. Meier, S., H.C. Morton, G. Nyhammer, B.E. Grøsvik, V. Makhotin, A. Geffen, S. Boitsov, K.A. Kvestad, A. Bohne-Kjersem, A. Goksøyr, A. Folkvord, J. Klungsøyr and A. Svardal, Development of Atlantic cod (*Gadus morhua*) exposed to produced water during early life stages: Effects on embryos, larvae, and juvenile fish. *Mar. Environ. Res.*, 70:383-394 (2010).
12. Schwesig, David; Borchers, Ulrich; Chancerelle, Laure; Dulio, Valeria; Eriksson, Ulla; Farre, Marinella; Goksoyr, Anders; Lamoree, Marja; Leonards, Pim; Lepom, Peter; Leverett, Dean; O'Neill, Anne; Robinson, Rod; Silharova, Katarina; Slobodnik, Jaroslav; Tolgyessy, Peter; Tutundjian, Renaud; Wegener, Jan-Willem; Westwood, David. A harmonized European framework for method validation to support research on emerging pollutants. *Trends Anal. Chem.* 30:1233-1242 (2011).
13. Olsvik, Pål A., Brattås, Marianne, Lie, Kai K., and Goksøyr, Anders. Transcriptional responses in juvenile Atlantic cod (*Gadus morhua*) after exposure to mercury-contaminated sediments obtained near the wreck of the German WW2 submarine U-864, and from Bergen Harbor, Western Norway. *Chemosphere*, 83:552-563 (2011).
14. Yadetie F, Butcher S, Førde HE, Campsteijn C, Bouquet JM, Karlsen OA, Denoed F, Metpally R, Thompson EM, Manak JR, Goksøyr A, Chourrout D. Conservation and divergence of chemical defense system in the tunicate *Oikopleura dioica* revealed by genome wide response to two xenobiotics. *BMC Genomics*. 2012 Feb 2;13:55.
15. Karlsen OA, Puntervoll P and Goksøyr A. Mass spectrometric analyses of microsomal cytochrome P450 isozymes isolated from β -naphthoflavone-treated Atlantic cod (*Gadus morhua*) liver reveal insights into the cod CYPome. *Aquatic Toxicology*, 2012. Feb;108:2-10.
16. Fekadu Yadetie, Odd Andre Karlsen, Anders Lanzén, Karin Berg, Pål Olsvik, Pål Puntervoll, Christer Hogstrand, Anders Goksøyr. Global transcriptome analysis of Atlantic cod (*Gadus morhua*) liver after in vivo methylmercury exposure suggests effects on energy metabolism pathways. *Aquat Toxicol.* 2013 Jan 15;126:314-25
17. Karlsen OA, Sheehan D, Goksøyr A. Alterations in the Atlantic cod (*Gadus morhua*) hepatic thiol-proteome after methylmercury exposure. *Journal of Toxicology and Environmental Health, part A.* 2014. 77(9-11):650-62.
18. Fekadu Yadetie, Odd Andre Karlsen, Marta Eide, Karin Berg, Christer Hogstrand, Anders Goksøyr.
19. Liver transcriptome analysis of Atlantic cod (*Gadus morhua*) exposed to PCB 153 indicates effects on cell cycle and lipid metabolism. *BMC Genomics*, 2014 Jun 17. 15(1):481.
20. Eide M, Karlsen OA, Kryvi H, Olsvik PA, Goksøyr, A. Precision-cut liver slices of Atlantic cod (*Gadus morhua*): an in vitro system to study effects of environmental contaminants. *Aquatic Toxicology* 153: 110–115 (2014).
21. Bains A, Kubota A, Goldstone JV, Lille-Langøy R, Karchner SI, Hahn ME, Goksøyr A, and Stegeman JJ. Functional Characterization of a Full Length Pregnane X Receptor, Expression in vivo, and Identification of PXR Alleles in Zebrafish (*Danio rerio*). *Aquatic Toxicology* 142-143:447-457 (2013).
22. Castelli MG, Rusten M, Goksøyr A, Routti H. mRNA expression of genes regulating lipid metabolism in

ringed seals (*Pusa hispida*) from differently polluted areas. *Aquat. Toxicol.* 146:239-246 (2014).

23. Eide M, Rusten M, Jensen KH, Male R, Goksøyr A. The ZFL cell line is non-responsive to environmental estrogens – a characterization of in vitro liver cell models for the zebrafish (*Danio rerio*). *Aquat. Toxicol.* 147:7-17 (2014).
24. MM Ibrahim, E Fjære, EJ Lock, D Naville, H Amlund, E Meugnier, B Le Magueresse Battistoni, L Frøyland, L Madsen, N Jessen, S Lund, H Vidal, and J Ruzzin. 2011. Chronic consumption of diet with farmed salmon containing persistent organic pollutants causes insulin resistance and obesity in mice. *PLoS ONE*, 6: e25170 (IF:4.53)
25. J Ruzzin. 2012. Public health concern behind the exposure to persistent organic pollutants and the risk of metabolic diseases. *BMC Public Health*, 12:298-302 (IF:2.36)
26. J Ruzzin, DH Lee, DO Carpenter, D Jacobs Jr. 2012. Reconsidering metabolic diseases: the impacts of persistent organic pollutants. *Atherosclerosis*, 224:1-3 (IF:4.15)
27. J Ruzzin and DR Jacobs Jr. 2012. The secret story of fish: decreasing nutritional value due to pollution? *British Journal of Nutrition*, 108:397–99 (IF:3.40)
28. MM Ibrahim, E Fjære, EJ Lock, H Amlund, L Frøyland, N Jessen, S Lund, H Vidal, and J Ruzzin. 2012. Metabolic impacts of high dietary exposure to persistent organic pollutants in mice. *Toxicology Letters*, 215:8-15 (IF:3.60)
29. DR Jacobs Jr, J Ruzzin, and DH Lee. 2014. Environmental pollutants: downgrading the fish food stock affects chronic disease risk. *Journal of Internal Medicine* (IF:6.55).
30. M-S Gauthier, R Rabasa-Lhoret, D Prud'homme, A Karelis, D Geng, B van Bavel, and J Ruzzin. 2014. The metabolically healthy but obese phenotype is associated with lower plasma levels of persistent organic pollutants as compared to the metabolically abnormal obese phenotype. *The Journal of Clinical Endocrinology and Metabolism*, 99(6):E1061-6 (IF:6.43).

Ecological and Environmental Change Research Group

1. Kemp, AC, **Telford, RJ**, Horton, BP, Anisfeld, SC, Sommerfield, CK. 2013. Reconstructing Holocene sea level using salt-marsh foraminifera and transfer functions: lessons from New Jersey, USA. *Journal of Quaternary Science*, 28, 617-629
2. **Telford RJ**, Li C, Kucera M. 2013. Mismatch between the depth habitat of planktonic foraminifera and the calibration depth of SST transfer functions may bias reconstructions. *Climate of the Past*, 9, 859-870
3. Bouchet VMP, Alve E, Rygg B, **Telford RJ**. 2012. Benthic foraminifera provide a promising tool for ecological quality assessment of marine waters. *Ecological Indicators*, 23: 66-75
4. Austin WEN, **Telford RJ**, Ninnemann US, Brown L, Wilson, LJ, Small DP, Bryant CL. 2011. North Atlantic reservoir ages linked to high Younger Dryas atmospheric radiocarbon concentrations. *Global and Planetary Change*, 79: 226-233
5. Lloyd J, Moros M, Perner K, **Telford RJ**, Kuijpers A, Jansen E, McCarthy D. 2011. A 100 yr record of ocean temperature control on the stability of Jakobshavn Isbrae, West Greenland. *Geology* 39: 867-870
6. Andersson C, Pausata FSR, Jansen E, Risebrobakken B, **Telford RJ**. 2010. Holocene trends in the foraminifer record from the Norwegian Sea and the North Atlantic Ocean. *Climate of the Past* 6, 179–193

AQUACULTURE AND FISH HEALTH

Fisheries Ecology and Aquaculture Research Group

- *Fish population biology*

1. Geffen AJ (2009) Advances in herring biology: from simple to complex, coping with plasticity and adaptability. ICES Journal of Marine Science 66: 1688–1695
2. Geffen AJ, Nash RDM, Dau K, Harwood AJP (2011) Sub-cohort dynamics of O-group plaice, *Pleuronectes platessa* L., in the Northern Irish Sea: settlement, growth and mortality. Journal of Experimental Marine Biology and Ecology. 400 (1-2):108-119. DOI:10.1016/j.jembe.2011.02.030
3. Geffen AJ, Nash RDM, Dau K, Harwood AJP (2011) Sub-cohort dynamics of O-group plaice, *Pleuronectes platessa* L., in the Northern Irish Sea: settlement, growth and mortality. Journal of Experimental Marine Biology and Ecology. 400 (1-2):108-119. DOI:10.1016/j.jembe.2011.02.030
4. Johannessen A, Skaret G, Langård L, Slotte A, Husebø Å, Fernø A (2014) The Dynamics of a Metapopulation: Changes in Life-History Traits in Resident Herring that Co-Occur with Oceanic Herring during Spawning. PLoS ONE 9(7): e102462. doi:10.1371/journal.pone.0102462
5. Johannessen, A., Nøttestad, L., Fernø, A., Langård, L. and Skaret G. 2009. Two components of Northeast Atlantic herring within the same school during spawning: support for the existence of a metapopulation? – ICES Journal of Marine Science, 66 (8): 1740–1748
6. Langård, L., A. Johannessen, , A. Fernø, L. Nøttestad, G. Skaret, A. Slotte, J. Røttingen and J. T. Øvredal 2012. Acoustic tagging: A suitable method for the study of natural herring behaviour around spawning? In A.N. Popper and A. Hawkins (eds.), The effects of noise on aquatic life, Advances in Experimental Medicine and Biology 730, DOI 10.1007/978-1-4419-7311-5_87. Springer Science+Business Media, LLC
7. Silva, F., A. Slotte, A. Johannessen, J. Kennedy, OS. Kjesbu 2012. Strategies for partition between body growth and reproductive investment in migratory and stationary populations of spring spawning Atlantic herring (*Clupea harengus* L.). Fisheries Research 138: 71– 79

- *Fish nutrition and development*

8. Hamre K, M Moren, J Solbakken, I Opstad, K Pittman, 2005. The impact of nutrition on metamorphosis in Atlantic halibut (*Hippoglossus hippoglossus* L.). Aquaculture. 250, 555-565.
9. Kjørsvik E, K Pittman, D Pavlov, 2004. From fertilisation to the end of metamorphosis - functional development.
10. Pittman K, M Yúfera, M Pavlidis, AJ Geffen, W Koven, L Ribeiro, JL Zambonino Infante, A Tandler, 2013. Fantastically plastic: fish larvae equipped for a new world. Reviews in Aquaculture. 5, S224-S267.
11. Power DM, IE Einarsdottir, K Pittman, GE Sweeney, J Hildahl, MA Campinho, N Silva, Ø Sæle, M Galay-Burgos, H Smaradottir, BT Björnsson, 2008. The Molecular and Endocrine Basis of Flatfish Metamorphosis. Reviews in Fisheries Science. 16, 95-111.
12. Sæle Ø, JS Solbakken, K Watanabe, K Hamre, K Pittman, 2003. The effect of diet on ossification and eye migration in Atlantic halibut larvae (*Hippoglossus hippoglossus*). Aquaculture. 220, 683-696.
13. Sæle Ø, KA Pittman, 2010. Looking closer at the determining of a phenotype? Compare by stages or size, not age. Journal of Applied Ichthyology. 26, 294-297.

- *Shellfish production*

14. Andersen, S, G. Christophersen, T. Magnesen. 2013. Implications of larval diet concentration on post-larval yield in a production scale flow through system for scallops (*Pecten maximus* Lamarck) in Norway." *Aquaculture International* 21 (2), 435-452.
15. Andersen, S., G. Christophersen, T. Magnesen. 2011. Great scallop (*Pecten maximus* L.) spat production; a rollercoaster. A review. *Canadian Journal of Zoology* 89:585-604.
16. Andersen, Ø., Torgersen, J.S., Pagander, H.H., Magnesen, T. Johnston, I.A. 2009. Gene expression analyses of essential catch factors in the smooth and striated adductor muscles of postlarval and adult great scallop (*Pecten maximus*). *Journal of Muscle Research and Cell Motility* 30:233-242.
17. Jacobsen, A. Otto Grahl-Nielsen, Thorolf Magnesen. 2012. Effects of reduced diameter of bag cultures on content of essential fatty acids and cell density in a continuous algal production system? *Journal of Applied Phycology*: 24 (1):109-116.
18. Jacobsen, Anita, Otto Grahl-Nielsen, Thorolf Magnesen. 2010. Does large scale continuous algal production system provide a stable supply of fatty acids to bivalve hatcheries? *Journal of Applied Phycology* 22 (6):769-777
19. Magnesen, T and G. Christophersen. 2008. Reproductive cycle and conditioning of translocated scallops (*Pecten maximus*) from five broodstock populations in Norway. *Aquaculture* 285, 109-116.

- *Juvenile fish production*

20. Imsland AK, A Foss, R Koedijk, A Folkvord, SO Stefansson, TM Jonassen, 2006. Short- and long-term differences in growth, feed conversion efficiency and deformities in juvenile Atlantic cod (*Gadus morhua*) started on rotifers and zooplankton. *Aquaculture Research*. 37, 1015-1027.
21. Larsen SV, AK Imsland, P Lohne, K Pittman, A Foss, 2011. Stepwise temperature regulation and its effect on growth, feeding and muscle growth patterns of juvenile Atlantic halibut (*Hippoglossus hippoglossus* L.). *Aquaculture International*. 19, 825-837.
22. Lohne P, AK Imsland, S Larsen, A Foss, K Pittman, 2012. Interactive effect of photoperiod and temperature on the growth rates, muscle growth and feed intake in juvenile Atlantic halibut. *Aquaculture Research*. 43, 187-197.

- *Animal health and water quality*

23. Magnesen T., Erga S.R, Christophersen G,. 2010. Growth of scallop spat in raceway nursery during autumn conditions in western Norwegian coastal waters. *Journal of Shellfish research* 29 (1): 1-10
24. Magnesen, T. and A. Jacobsen 2011. 2012. Effect of water recirculation on seawater quality and production of scallop (*Pecten maximus*) larvae. *Aquacultural Engineering* 47:1-6
25. Pittman K, A Pittman, S Karlson, T Cieplinska, P Sourd, K Redmond, B Ravnoy, E Sweetman, 2013. Body site matters: an evaluation and application of a novel histological methodology on the quantification of mucous cells in the skin of Atlantic salmon, *Salmo salar* L. *Journal of Fish Diseases*. 36, 115-127.
26. Sandaa, R.-A., Brunvold, L., Magnesen, T. and Bergh, Ø. 2008. Monitoring the opportunistic bacteria *Pseudoalteromonas* LT-13 in a great scallop, *Pecten maximus* hatchery. *Aquaculture* 276:14-21.

- *Food quality and traceability*

27. Grahl-Nielsen, Otto, Anita Jacobsen, Gyda Christophersen, Thorolf Magnesen. 2010. Fatty acid composition in spat adductor muscle from five Norwegian king scallop (*Pecten maximus*) populations reared in the same environment. *Biochemical Systematics and Ecology* 38 (4):478-488
28. Higgins RM, Danilowicz BS, Balbuena JA, Danielsdóttir AK, Geffen AJ, Meijer WG, Modin J, Montero F,

Pampoulie C, Perdiguero D, Schreiber A, Stefánsson MO, Wilson B. (2010) Multi-disciplinary Fingerprints Reveal the Harvest Location of Cod (*Gadus morhua*) in the Northeast Atlantic. Marine Ecology Progress Series 404: 197–206 DOI: 10.3354/meps08492

29. Redmond, K., Magnesen, T, Hansen, P.K., Strand, Ø 2010. Stable isotopes and fatty acids as tracers of the assimilation of salmon fish feed in blue mussels (*Mytilus edulis*). Aquaculture 298:202-210.

- *Trophic ecology and life history biology*

30. Folkvord A, C Jørgensen, K Korsbrekke, RDM Nash, T Nilsen, JE Skjæraasen, 2014. Trade-offs between growth and reproduction in wild Atlantic cod. Canadian Journal of Fisheries and Aquatic Sciences. 71, 1106-1112.

31. Gibbons, 2011. Dietary success of a 'new' key fish in an overfished ecosystem: evidence from fatty acid and stable isotope signatures. Marine Ecology Progress Series. 428, 219-233.

32. Magnesen, Thorolf; Redmond, Kirsten Jayne. 2012. Potential predation rates by the sea stars *Asterias rubens* and *Marthasterias glacialis*, on juvenile scallops, *Pecten maximus*, ready for sea ranching. *Aquaculture International* 20 (1):189-199.

33. Utne-Palm AC, AGV Salvanes, B Currie, S Kaartvedt, GE Nilsson, VA Braithwaite, JAW Stecyk, M Hundt, M van der Bank, B Flynn, GK Sandvik, TA Klevjer, AK Sweetman, V Bruchert, K Pittman, KR Peard, IG Lunde, RAU Strandabo, MJ Gibbons, 2010. Trophic Structure and Community Stability in an Overfished Ecosystem. Science. 329, 333-336.

- *Larval fish ecology*

34. Folkvord A, 2005. Comparison of size-at-age of larval Atlantic cod (*Gadus morhua*) from different populations based on size- and temperature-dependent growth models. Canadian Journal of Fisheries and Aquatic Sciences. 62, 1037-1052.

35. Folkvord A, Ø Fiksen, H Høie, A Johannessen, E Otterlei, KW Vollset, 2009. What can size distributions within cohorts tell us about ecological processes in fish larvae? *Scientia Marina*. 74, 119-130.

36. Kristiansen T, Ø Fiksen, A Folkvord, 2007. Modelling feeding, growth, and habitat selection in larval Atlantic cod (*Gadus morhua*): observations and model predictions in a macrocosm environment. Canadian Journal of Fisheries and Aquatic Sciences. 64, 136-151.

37. Vollset KW, A Folkvord, HI Browman, 2011. Foraging behaviour of larval cod (*Gadus morhua*) at low light intensities. *Marine Biology*. 158, 1125-1133.

38. Vollset KW, IA Catalán, Ø Fiksen, A Folkvord, 2013. Effect of food deprivation on distribution of larval and early juvenile cod in experimental vertical temperature and light gradients. Marine Ecology Progress Series. 475,

- *Climate and environmental impact*

39. Frommel AY, RH Maneja, DM Lowe, A Malzahn, A Geffen, A Folkvord, U Piatkowski, T Reusch, C Clemmesen, 2012. Ocean acidification effects on larvae of a commercially important fish species, Atlantic cod (*Gadus morhua*). *Nature Climate Change*. 2, 42-46.

40. Geffen AJ, Høie H, Folkvord A, Hufthammer, AK, Andersson, C, Ninemann U, Pedersen, RB, Nedreaas K (2011) High latitude climate variability and its effect on fishery resources as revealed by fossil otoliths. *ICES Journal of Marine Science*. 68: 1081-1089. DOI:10.1093/icesjms/FSR017

41. Hufthammer AK, H Høie, A Folkvord, AJ Geffen, CA Andersson, US Ninnemann, 2010. Seasonality of human site occupation based on stable oxygen isotope ratios of cod otoliths. *Journal of Archaeological Science*. 37, 78-83.

- *Otolith growth and composition studies*

42. Chang M-Y, Geffen AJ. (2013) Taxonomic and environmental influences on fish otolith microchemistry. *Fish and Fisheries*. 14: 458-492. DOI: 10.1111/j.1467-2979.2012.00482.x
43. Folkvord A, Johannessen, E Moksness, 2004. Temperature dependent otolith growth in Norwegian spring spawning herring (*Clupea harengus*) larvae. *Sarsia*. 89, 297-310.
44. Høie H, E Otterlei, A Folkvord, 2004. Temperature-dependent fractionation of stable oxygen isotopes in otoliths of juvenile cod (*Gadus morhua* L). *ICES Journal of Marine Science*. 61, 243-251.
45. Tomas, J., Geffen, A.J., Allen, I.S., & Berges, J. (2004) Analysis of the soluble matrix of vaterite otoliths of juvenile herring (*Clupea harengus*): do crystalline otoliths have less protein? *Comparative Biochemistry and Physiology - Part A: Molecular & Integrative Physiology*, 139, 301-308
 - *Fisheries ecology and management*
46. Garcia, S. E., Kolding, J., Rice, J., Rochet, M.-J., Zhou, S., Arimoto, T., Beyer, J. E., Borges, L., Bundy, A., Dunn, D., Fulton, E. A., Hall, M., Heino, M., Law, R., Makino, M., Rijnsdorp, A., Simard, F., and Smith, A. 2012. Reconsidering the consequences of selective fisheries. *Science* 335:1045-1047.
47. Kolding, J. and van Zwieten, P.A.M. 2011. The tragedy of our legacy: how do global management discourses affect small-scale fisheries in the South? *Forum for Development Studies* 38(3): 267-297.
48. Law, R., Kolding, J. and Plank, M.J. 2013. Squaring the circle: Reconciling fishing and conservation of aquatic ecosystems. *Fish and Fisheries*, online 7 September. Doi: 10.1111/faf.12056
49. Law, R., Plank, M.J and Kolding, J. 2012. On balanced exploitation of marine ecosystems: results from dynamic size spectra. *ICES Journal Marine Sciences* 69:602-614. doi: 10.1093/icesjms/fss031.

Fish Disease Research Group

1. KOPPANG EO, HAUGARVOLL E, HORDVIK I, POPPE TT, BJERKÅS I. Granulomatous uveitis associated with vaccination in the Atlantic salmon. *Veterinary Pathology* 41: 122-130, 2004
2. HORDVIK I, TORVUND J, MOORE L, ENDRESEN C. Structure and organization of the T cell receptor alpha chain genes in Atlantic salmon. *Molecular Immunology* 41: 553-559, 2004
3. FISCHER U, DIJKSTRA JM, KÖLLNER B, KIRYU I, KOPPANG EO, HORDVIK I, SAWAMOTO Y, OTOTAKE M. The ontogeny of MHC class I expression in rainbow trout (*Oncorhynchus mykiss*). *Fish & Shellfish Immunology* 18: 49-60, 2005
4. VAN DÒ T, HORDVIK I, ENDRESEN C, ELSAYED S. Characterization of parvalbumin, the major allergen in Alaska Pollack, and comparison with codfish Allergen M. *Molecular Immunology* 42: 345-353, 2005
5. KOPPANG EO, HORDVIK I, AUNE L, POPPE TT. Vaccine-associated granulomatous inflammation and melanin accumulation in Atlantic salmon, *Salmo salar* L., white muscle. *Journal of Fish Diseases* 28: 13-22, 2005
6. MOORE LJ, SOMAMOTO T, LIE KK, DIJKSTRA JM, HORDVIK I. Characterisation of salmon and trout CD8 alpha and CD8 beta. *Molecular Immunology* 42: 1225-1234, 2005
7. VAN DÒ T, ELSAYED S, FLORVAAG E, HORDVIK I, ENDRESEN C. Allergy to fish parvalbumins: Studies on the cross-reactivity of allergens from 9 commonly consumed fish. *Journal of Allergy and Clinical Immunology* 116: 1314-1320, 2005
8. OLSVIK PA, JORDAL AEO, LIE KK, NILSEN TO, HORDVIK I. Evaluation of potential reference genes in real time RT-PCR studies of Atlantic salmon. *BMC Molecular Biology* (online journal) 6:21, 2005

9. HEVRØY EM, JORDAL A-E, HORDVIK I, ESPE M, HEMRE G-I, OLSVIK PA. Myosin heavy chain mRNA expression correlates higher with muscle protein accretion than growth in Atlantic salmon, *Salmo salar*. *Aquaculture* 252: 453-461, 2006
10. MORRISON RN, KOPPANG EO, HORDVIK I, NOWAK BF. MHC class II+ cells in the gills of salmon experimentally infected with amoebic gill disease. *Veterinary Immunology and Immunopathology* 109: 297-303, 2006
11. DIJKSTRA JM, SOMAMOTO T, MOORE LJ, HORDVIK I, OTOTAKE M, FISCHER U. Identification and characterization of a second CD4-like gene in teleost fish. *Molecular Immunology* 43: 410-419, 2006
12. JORDAL A-E, HORDVIK I, PELSERS M, BERNLOHR D, TORSTENSEN BE. FABP3 and FABP10 in Atlantic salmon (*Salmo salar* L.)—General effects of dietary fatty acid composition and life cycle variations. *Comparative Biochemistry and Physiology B, Biochemistry & Molecular Biology* 145: 147-158, 2006
13. LIU Y, MOORE L, KOPPANG EO, HORDVIK I. Characterization of the CD3 α , CD3 β and CD3 δ subunits of the T cell receptor complex in Atlantic salmon. *Developmental and Comparative Immunology* 32: 26-35, 2008
14. HAUGARVOLL E, BJERKÅS I, NOWAK BF, HORDVIK I, KOPPANG EO. Identification and characterization of a novel intraepithelial lymphoid tissue in the gills of Atlantic salmon. *Journal of Anatomy* 213: 202-209, 2008
15. MOORE L, DIJKSTRA JM, KOPPANG EO, HORDVIK I. CD4 homologous in Atlantic salmon. *Fish & Shellfish Immunology* 26: 10-18, 2009
16. ØVERGÅRD AC, HORDVIK I, NERLAND AH, EIKELAND G, PATEL S. Cloning and expression analysis of Atlantic halibut (*Hippoglossus Hippoglossus*) CD3 genes. *Fish & Shellfish Immunology* 27: 707-13, 2009
17. KOPPANG EO, FISCHER U, MOORE L, TRANULIS MA, DIJKSTRA H, KÖLLNER B, AUNE L, JIRILLO E, HORDVIK I. Salmonid T cells assemble in the thymus, spleen and in novel interbranchial lymphoid tissue (ILT). *Journal of Anatomy* 217: 728-739, 2010
18. TADISO TM, LIE KK, HORDVIK I. Molecular cloning of IgT from Atlantic salmon, and analysis of the relative expression of α , β and δ in different tissues. *Veterinary immunology and immunopathology* 139: 17-26, 2011
19. TADISO TM, KRASNOV A, SKUGOR S, AFANASYEV S, HORDVIK I, NILSEN F. Gene expression analyses of immune responses in Atlantic salmon during early stages of infection by salmon louse (*Lepeophtheirus salmonis*) revealed bi-phasic responses coinciding with the copepod-chalimus transition. *BMC Genomics* 12: 141, 2011
20. KAMIL A, FALK K, SHARMA A, RAAE A, BERVEN F, KOPPANG EO, HORDVIK I. A monoclonal antibody distinguishes between two IgM heavy chain isotypes in Atlantic salmon and brown trout: Protein characterization, 3D modeling and epitope mapping. *Molecular Immunology* 48: 1859-1867, 2011
21. TADISO TM, SHARMA A, HORDVIK I. Analysis of polymeric immunoglobulin receptor- and CD300-like molecules from Atlantic salmon. *Molecular Immunology* 49: 462-473, 2011
22. YOUSAF MN, KOPPANG EO, SKJØDT K, KÖLLNER B, HORDVIK I, ZOU J, SECOMBES C, POWELL MD. Cardiac pathological changes of Atlantic salmon (*Salmo salar* L.) affected with heart and skeletal muscle inflammation (HSMI). *Fish Shellfish Immunol.* 33: 305-15, 2012
23. LARSEN HA, AUSTBØ L, MØRKØRE T, THORSEN J, HORDVIK I, FISCHER U, JIRILLO E, RIMSTAD E, KOPPANG EO. Pigment-producing granulomatous myopathy in Atlantic salmon: A novel inflammatory response. *Fish Shellfish Immunol.* 33: 277-85, 2012

24. WIJK-NIELSEN J, LØVOLL M, FRITSVOLD C, KRISTOFFERSEN AB, HAUGLAND Ø, HORDVIK I, AAMELFOT M, JIRILLO E, KOPPANG EO, GROVE S. Characterization of myocardial lesions associated with cardiomyopathy syndrome in Atlantic salmon, *Salmo salar* L., using laser capture microdissection. *Journal of Fish Diseases*, 35: 907-916, 2012
25. YOUSAF MN, KOPPANG EO, SKJØDT K, HORDVIK I, ZOU J, SECOMBES C, POWEL MD. Comparative cardiac pathological changes of Atlantic salmon (*Salmo salar* L.) affected with heart and skeletal muscle inflammation (HSMI), cardiomyopathy syndrome (CMS) and pancreas disease (PD). *Vet Immunol Immunopathol*. 151: 49-62, 2013.
26. KAMIL A, RAAE A, FJELLDAL PG, KOPPANG EO, FLADMARK KE, HORDVIK I. Comparative analysis of IgM sub-variants in salmonid fish and identification of a residue in m3 which is essential for MAb4C10 reactivity. *Fish Shellfish Immunol*. 34: 667-672, 2013.
27. KAMIL A, FJELLDAL PG, HANSEN T, RAAE A, KOPPANG EO, HORDVIK I. Vaccination of Atlantic salmon leads to long-lasting higher levels of serum immunoglobulin and possible skewed ratios of two distinct IgM isotypes. *ABB Special issue on Antibodies 4*: 85-90, 2013

Fish Immunology Research Group

1. Rønneseth, A., Pettersen, E.F. & Wergeland, H.I. 2005. Leucocytes of anadromous and landlocked strains of Atlantic salmon (*Salmo salar* L.) in the smolting period. *Fish & Shellfish Immunology*. 19: 229-239.
2. Pettersen, E.F., Bjørnløw, I., Hagland, T.J. & Wergeland, H.I. 2005 Effect of seawater temperature on leucocyte populations in Atlantic salmon post-smolts. *Veterinary Immunology and Immunopathology*. 106: 65-76.
3. Rønneseth, A., Pettersen, E.F. & Wergeland, H.I. 2006 Neutrophils and B-cells in blood and head kidney of Atlantic salmon (*Salmo salar* L.) challenged with infectious pancreatic necrosis virus (IPNV). 20:610-620.
4. Ingerslev, H-C., Cunningham, C & Wergeland, H.I. 2006. Cloning and expression of TNF- α , IL-1 and COX-2 in an anadromous and landlocked strain of Atlantic salmon (*Salmo salar* L.) during the smolting period. *Fish and Shellfish Immunology* 20: 450-461.
5. Ingerslev, H-C, Pettersen, E.F., Jakobsen, R.A, Bie, P.C. & Wergeland, H.I. 2006. Expression profiling and validation of reference gene candidates in immune relevant tissues and cells from Atlantic salmon (*Salmo salar* L.) *Molecular Immunology* 43:1194-1201.
6. Rønneseth, A., Wergeland, H.I. & Pettersen, E.F. 2007 Neutrophils and B-cells in Atlantic cod (*Gadus morhua* L.). *Fish & Shellfish Immunology* , 23: 493-503.
7. Rønneseth, A, Wergeland, H.I., Devik, M, Evensen, Ø & Pettersen, E.F. 2007 Mortality after IPNV challenge of Atlantic salmon (*Salmo salar* L.) differs based on developmental stage of fish or challenge route. *Aquaculture* 271 :100–111.
8. Nguyen T.T.T., Nguyen H.D. & H.I. Wergeland 2009. Characterization of *Vibrio parahaemolyticus* causing the ulcerative disease in orange-spotted grouper (*Epinephelus coioides*) cultured in Vietnam. A Scientific Collection of Research Institutes for Aquaculture No. III between 2004-2009. Agriculture Publishing house. 863 pp. (In Vietnamese with English abstract).
9. Pettersen, E.F, Ingerslev, H-C, Stavang, V, Egenberg, M & Wergeland, H.I. 2008 A highly phagocytic cell line TO from Atlantic salmon is CD83 positive and M-CSFR negative, indicating a dendritic-like cell type. *Fish and Shellfish Immunology* 25: 809–819.

10. Ingerslev H-C., Rønneseth ,A., Pettersen E F.& Wergeland,H.I.2009 Differential expression of immune genes in Atlantic salmon (*Salmo salar* L.) infected intraperitoneally or by cohabitation with IPNV.: Scandinavian Journal of Immunology. 69:90-98.
11. Øverland, S.H., Pettersen, E.F. ,Rønneseth, A. & Wergeland, H.I. 2010. Phagocytosis by B-cells and neutrophilic granulocytes in Atlantic salmon (*Salmo salar* L.) and Atlantic cod (*Gadus morhua* L). Fish & Shellfish Immunology, 28: 193-204
12. Haugland,GT., Pettersen, FE, Sviland,C., Rønneseth, A. & Wergeland, H.I. 2010 Immunostaining of Atlantic salmon (*Salmo salar* L.) leucocytes. Journal of Immunological Methods 362:10-21
13. Furevik, A., Pettersen, E.F., Colquhoun,D. & Wergeland, H.I. 2011 The intracellular lifestyle of *Francisella noatunensis* in Atlantic cod (*Gadus morhua* L.) leucocytes. Fish & Shellfish Immunology 30: 488-494
14. Kalgraff, C.A.K., Wergeland, H.I.& Pettersen, E.F. 2011 Flow cytometry assays of respiratory burst in Atlantic salmon (*Salmo salar* L.) and in Atlantic cod (*Gadus morhua* L.) leucocytes. Fish & Shellfish Immunology 31: 381-388.
15. Nguyen Thi Thanh Thuy, Nguyen Huu Dung, H.I. Wergeland 2011. The immune response of orange spotted grouper (*Epinephelus coioides*) to pathogen bacteria *Vibrio parahaemolyticus*. Journal of biotechnology 10/2011 (In Vietnamese with English abstract).
16. Martens, L.G., Fjellidal, P.G., Lock, E.J., Wargelius, A., Wergeland, H., Witten, P.E., Hansen, T., Waagbo, R., & Ornsrud, R. 2012. Dietary phosphorus does not reduce the risk for spinal deformities in a model of adjuvant-induced inflammation in Atlantic salmon (*Salmo salar*) postsmolts. Aquac. Nutr. 18: 12-20.
17. Fraser, T.W.K., Rønneseth, A., Haugland, G.T., Fjellidal, P.G., Mayer, I.& Wergeland H.I.. 2012 The effect of triploidy and vaccination on neutrophils and B-cells in the peripheral
18. blood and head kidney of 0+ and 1+ Atlantic salmon (*Salmo salar* L.) post-smolts. Fish & Shellfish Immunology, 33:60-66..
19. D'Alvise, P.W., Lillebø, S., Prol-Garci, M.J. Wergeland , H.I., Nielsen, K. F.,Bergh Ø & Gram, L. 2012 *Phaeobacter gallaeciensis* eliminates *Vibrio anguillarum* in cultures of microalgae and rotifers, and prevents vibriosis in cod larvae. PLOS ONE, 8:e43996.
20. Haugland, G.T., Jakobsen, R.AA., Vestvik, N., Ulven, K., Stokka, L & Wergeland,H.I. 2012 Phagocytosis and respiratory burst activity in lump sucker (*Cyclopterus lumpus* L.) leucocytes analysed by flow cytometry. PLOS ONE, Volume 7| Issue 10 e47909
21. Haugland GT, Jordal AE and Wergeland HI. 2012 Characterization of small, mononuclear blood cells from salmon having high phagocytic capacity and ability to differentiate into dendritic like cells. PLOS ONE. Volume 7 Issue 11 e49260
22. Rønneseth, A, Pettersen, EF, Wergeland, HI, 2012. Flow cytometry assay for intracellular detection of Infectious Pancreatic Necrosis virus (IPNV) in Atlantic salmon (*Salmo salar* L.) leucocytes. Fish &Shellfish Immunology 33:1292.1302.
23. D'Alvise, PW, Lillebø, S, Wergeland, HI, Gram, L, Bergh, Ø 2013 Protection of cod larvae from vibriosis by *Phaeobacter* spp.: A comparison of strains and introduction times 2013 Aquaculture 384-387: 73-82
24. Hich TV, Quyen VDH, Dung NH & HI Wergeland, 2013. Experimental *Streptococcus iniae* infection in barramundi (*Lates calcarifer*) cultured in Vietnam. International Journal of Aquatic Science: 4, 3-12

25. Nguyen TTT , Dung HN & HI. Wergeland 2013 Specific humoral immune response and protection against *Vibrio parahaemolyticus* in orange-spotted grouper *Epinephelus coioides*. *International Journal of Aquatic Science*: 4, 24-35
26. Rønneseth A, Haugland, G.T. & Wergeland H.I. 2013 Flow cytometry detection of Infectious Pancreatic Necrosis Virus (IPNV) within subpopulations of Atlantic salmon (*Salmo salar* L.) leucocytes after vaccination and during the time course of experimental infection. *Fish Shellfish Immunol.* 34(5):1294-305
27. Vestvik N, Rønneseth A, Kalgraff CAK, Winther-Larsen HC, Wergeland HI & Haugland GT *Francisella noatunensis* subsp. *noatunensis* replicates within Atlantic cod (*Gadus morhua* L.) leucocytes and inhibit respiratory burst activity. *Fish Shellfish Immunol* 35 (3): 725-33
28. Kaldestad M, Haugland GT, Rønneseth A, Wergeland HI & Samuelsen OB (2014) Antibiotic uptake by cultured Atlantic cod leucocytes and effect on intracellular *Francisella noatunensis* subsp. *noatunensis* replication. *Dis Aquat Organ* 108: 11-21
29. Haugland GT, Rønneseth A & Wergeland HI (2014). Flow cytometry analyses of phagocytic and respiratory burst activities and cytochemical characterization of leucocytes isolated from wrasse (*Labrus bergylta* A.). *Fish and shellfish Immunol.* 39:51-60.

MARINE BIODIVERSITY

1. Glenner H; Winther M; Hansen A; Huelsenbeck JP; Ronquist F; Willerslev; E (2005). Bayesian inference of the Metazoan evolution based on combined morphological and molecular data. *Curr. Biol.* 14, 1644-1649.
2. Glenner H; Winther M; Hansen A; Huelsenbeck JP; Ronquist F; Willerslev E (2005). Bayesian inference of the metazoan phylogeny: A combined molecular and morphological approach (vol 12, pg 1828, 2004). *Curr. Biol.* 15: 392-393.
3. Glenner H; Hebsgaard MB (2006). Phylogeny and Evolution of Life History Strategies of the Parasitic Barnacles (Crustacea, Cirripedia, Rhizocephala). *Mol. Phyl. Evol.* 41, 528-538.
4. Glenner H; Thomsen PF; Hebsgaard MB; Sørensen MV; Willerslev E (2006). Origin of Insects. *Science.* 314: 1883 – 1884.
5. Glenner H; Grygier MJ; Fujita Y; Høeg JT. (2008). Induced metamorphosis in the crustacean γ -larvae. *BMC Biology.* 6:21.
6. Glenner, H., J.T. Hoeg, A.V. Rybakov, Thomsen P.,F., and B. Galil. (2008). The phylogenetic position of the parasitic barnacle *Heterosaccus dollfusi*; a Lessepsian migrant species now spreading in eastern Mediterranean waters (Cirripedia: Rhizocephala; Sacculinidae). *Israel Journal of Zoology.* 54 (2), 223-238.
7. Høeg, JT; M Pérez-Iosada; H Glenner; GA Kolbasov and KA Crandall. (2009). Evolution of morphology, ontogeny and life cycles within the Crustacea Thecostraca. - *Arthropod Systematics & Phylogeny*, 67 (2): 199-217.
8. Steeman EM; MB Hebsgaard; RE Fordyce; SYW Ho; DLL Rabosky; R Nielsen; C Rahbek; H Glenner; MV Sørensen and E Willerslev. (2009). Radiation of Extant Cetaceans Driven by Restructuring of the Oceans. *Syst. Biol.* 58(6): 573–585.

9. Kristensen T, Nielsen AI, Jørgensen AI, Mouritsen KN, Glenner H, Christensen JT, Lützen J, Høeg JT. (2012) The selective advantage of host feminization: a case study of the green crab *Carcinus maenas* and the parasitic barnacle *Sacculina carcini*. *Marine Biology* Volume: 159 Issue: 9 Pages: 2015-2023 DOI: 10.1007/s00227-012-1988-4 Published: SEP 2012.
10. Rees DJ, Noever C, Høeg JT, Ommundsen A, Glenner H (2014) On the Origin of a Novel Parasitic-Feeding Mode within Suspension-Feeding Barnacles. *CURBIO*, 24, 1429–1434.
11. Bengtsson MM, Sjøtun K & Øvreås L (2010). Seasonal dynamics of bacterial biofilms on the kelp *Laminaria hyperborea*. *Aquatic Microbial Ecology* 60: 71-83
12. Coyer J, Hoarau G, Sjøtun K, Olsen JL (2008). Being abundant is not enough: a decrease in effective population size over eight generations in a Norwegian population of the seaweed, *Fucus serratus*. *Biology Letters* 4: 755-757
13. Eilertsen M, Norderhaug KM & Sjøtun K (2011). Does the amphipod fauna associated to epiphytes on kelp (*Laminaria hyperborea*) change with depth? *Marine Biology Research* 7: 224-234
14. Heldal HE & Sjøtun K (2010). Technetium-99 (99Tc) in annual growth segments of knotted wrack (*Ascophyllum nodosum*). *Science of the Total Environment* 408: 5575-5582
15. Husa V & Sjøtun K (2006). Vegetative reproduction in "*Heterosiphonia japonica*" (*Dasyaceae*, *Ceramiales*), an introduced red alga on European coasts. *Botanica Marina* 49: 191-199
16. Husa V, Sjøtun K, Brattenborg N & Lein TE (2008). Changes of macroalgal biodiversity in sublittoral sites in southwest Norway: impact of an introduced species or higher temperature? *Marine Biology Research* 4: 414-428
17. Husa V, Steen H, Sjøtun K (2014). Historical changes in macroalgal communities in Hardangerfjord (Norway). *Marine Biology Research* 10: 226-240
18. Husa V, Kutti T, Ervik A, Sjøtun K, Kupka Hansen P, Aure J (2014). Regional impact from fin-fish farming in an intensive production area (Hardangerfjord, Norway). *Marine Biology Research* 10: 241-252
19. Sjøtun K, Christie H & Fosså JH (2006). The combined effect of canopy shading and sea urchin grazing on recruitment in kelp forest (*Laminaria hyperborea*). *Marine Biology Research* 2: 24-32.
20. Sjøtun K, Eggereide SF & Høisæter T (2007). Grazer-controlled recruitment of the introduced *Sargassum muticum* (*Phaeophyceae*, *Fucales*) in northern Europe. *Marine Ecology Progress Series* 342: 127-138.

3 Education at master and doctoral level

ToR: "Evaluate the quality and relevance, including the development of expertise and level of execution, of the area's combined educational programs at the master and doctorate level with emphasis on the last 10 years."

Please list the names of the educational programmes in marine studies (at master and doctoral level) your department/centre has been involved in in the period 2004-2013.

Educational programmes in marine studies, 2004-2013:

Master programmes:	Ph.D. programmes/research schools:
Master's Programme in Fisheries Biology and Management*	Ph.D. Programme
Master's Programme in Marine Biology	MCB – Molecular and Computational Biology Research School - http://www.uib.no/en/rs/mcb
Master's Programme in Aquaculture	Bergen Summer Research School - http://www.uib.no/fs/bsrs
Master's Programme in Biology**	Nordic Marine Academy (2005-2010) http://armauer.uib.no/nma/
Master's Programme in Nutrition - Marine	
Integrated Master's Programme in Aquamedicine	
Master's Programme in Water and Coastal Management (2003-2007)***	
*) Also offered as a NORAD Programme until 2008 **) Includes several specializations, including microbiology, environmental toxicology, geobiology, cell biology etc. ***) Water and Coastal Management was also offered as a Joint Degree with European partners.	

Describe and comment on how these educational programmes have developed in the period 2004-2013 (scope of programmes, recruitment of students, completion and other relevant issues).

On average the Master's Programmes within Marine Sciences at BIO have recruited approximately 40-45 students per year. Approximately the same number of students have graduated with MSc each year. The recruitment of students to these programmes has been quite stable over the period 2004-2013, but varied some between the different specializations. Although the organization of the programme offered has changed over the last 10 years, the most important topics are still; aquaculture, fisheries biology and management, aquamedicine, marine biology (ecology and biodiversity), microbiology, cell biology and physiology. On average, a little over 80% of MSc graduated from BIO are within the Marine Sciences.

Please indicate the proportions of Ph.D.-candidates from these programmes employed by higher education institutions/research institutes and industry respectively, and provide examples of typical career trajectories of the candidates.

At the Department of Biology, 190 Ph.D. candidates successfully obtained their degree during the assessed period (2004-2013) and of these, approx. 80% were in the fields of marine science. While BIO has not kept a complete record of their further employment or career development, below are some examples of current positions held by former BIO PhD candidates to illustrate their typical career trajectories:

- Paco Cardenas, Postdoctoral researcher at Department of Medicinal Chemistry, Division of Pharmacognosy, University of Uppsala, Stockholm (research)
- Mia M Bengtsson, Postdoc at Department of Limnology and Oceanography, University of Vienna (research)
- Sophia Fortunato, Post doc researcher at the Sars Center at the University of Bergen, Norway, (research)
- Vivian Husa. Researcher, Institute of Marine Research. Bergen, Norway (research)
- Ainao Laila Hosia, researcher, University Museum in Bergen, Norway (administration/research)
- Binh Dang Thuy, Vice Director, Institute for Biotechnology and Environment Nha Trang University, Vietnam, (research/management)
- Fabian Zimmermann, postdoc at UiB (research)
- Olav Moberg: PhD 2010, then short-term contracts with various research projects at UiB, Senior Advisor, Directorate of Fisheries (management)
- Arved Staby, short-term contracts with various research projects at UiB, , Researcher Institute of Marine Research (research)
- Vidar Aspehaug, Business Director PatoGen Analyse AS (industry)
- Aril Slotte, Researcher, Institute of Marine Research. Bergen, Norway (research)
- Christofer Troedsson, Researcher, UNI research. Bergen, Norway (research)
- Geir Olav Melingen, Business Manager Aqua in MSD Animal Health, Norway. Bergen, Norway
- Knut Wiik Vollset, Researcher, UNI Environment (research)
- Kari Nordvik, Senior Research Advisor, The Faculty of Mathematics and Natural Sciences, UiB (administration).
- Anita Sagstad, Senior Advisor, The Directorates of Fisheries (administration)
- Anne Christine Knag, Environmental Coordinator - Statoil?

Master Degrees within Marine research - Department of Biology										
	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Master's Programme in Fisheries Biology and Management	12	5	17	3	10	2	6	7	3	3
Integrated Master's Programme in Aquamedicine	3	8	1	4	7	11	6	12	8	7
Master's Programme in Aquaculture	6	4	9	5	4	4	6	7	6	7
Master's Programme in Marine Biology	8	6	10	11	12	16	5	7	8	13
Water and Coastal Management/Water studies	NA	9	9	14	5	3	NA	NA	NA	NA
Master's Programme in Nutrition - Marine	1	2	9	3	3	7	5	1	3	4
Master's Programme in Biology	5	12	10	9	7	6	6	9	4	4
	35	46	65	49	48	49	34	43	32	38

4 The significance of UiB's strategic priority of marine research

ToR: "With the additional resources that accompany being a main focus area in mind, give a combined assessment of the strategic added value/utility this has provided."

Please describe the types of added resources your department/centre has received through UiB's strategic priority of marine research in the period 2004-2013 (e.g. Ph.D.-positions, infrastructures). Refer to amounts reported in section 1 c) where relevant, and comment on the added value of these resources for your research and education activities; that is, what results you would not have achieved without the additional resources.

Due to UiB's strategic priority of marine research in the period 2004-2013, the department has received added resources of various types. These include, but are not limited to:

- Recruitment of staff/personnel (PhD scholarships, postdoctoral fellowships within research projects, permanent scientific positions)
- New BIO buildings and renovation of existing facilities at Marineholmen, incl. funds for some scientific equipment
- Accompanying new research facilities (e.g. boats, vessels, wet labs and associated UiB funding)
- Annual UiB financial contributions to maintain or upgrade existing facilities such as ILAB, which in turn has enabled their continual use for educational and research purposes
- Annual UiB financial contributions for scientific equipment

BIO is dependent on investments from UiB in order to maintain and continuously develop scientific quality and maintain state-of-the-art facilities so that our researchers are attractive as research partners and continues to be competitive and attract external funding.

5 Cooperation with academic communities in UiB's periphery (*randsonen*)

ToR: "Evaluate the associated academic communities' cooperation with relevant academic communities in UiB's periphery, including organization, participation in projects, ability to generate resources and networking."

If relevant, please report separately for your major research topics/research groups in this section.

Describe how your cooperation with relevant academic communities in UiB's periphery (*randseinstitusjoner*) has developed in the period 2004-2013, and comment on how such cooperation has affected your ability to generate resources and build networks.

In the fields of marine science, cooperation with UiB's periphery is of vital importance to BIO's marine research and education activities. In the period of 2004-2013, the Department of Biology's cooperation with relevant academic communities in UiB's periphery (*randseinstitusjoner*) has continued to develop. Each in turn has affected the department's ability to generate resources and build networks at the groups' as well as the departmental level. The most prominent peripheral academic communities with which the research groups collaborate are described below. As the descriptions show, cooperation with the below-named academic communities, has contributed towards increased accessibility to expertise, resources, facilities and funding opportunities. In addition, it has been paramount to successful development and support of academic network and centers, of which the two recent initiatives towards Centre of Research-driven Innovation (SFI) "Centre for Research-based Innovations in Controlled-environment Aquaculture (CtrlAQUA)" (BIO, Nofima and Uni Research) and "Centre for Innovation and Research in Ocean Health (CIROH)" (BIO, Uni, IMR, IRIS etc.) are prime examples, illustrating collaborative efforts between BIO and institutions in the UiB periphery.

FISHERIES ECOLOGY AND MARINE ECOSYSTEM DYNAMICS

- **Evolutionary Fisheries Ecology Research Group (EFERG)**

The EFERG collaborates with **Uni Research, Institute of Marine Research (IMR)**, and the **Norwegian School of Economics (NHH)/ Samfunns- og næringslivsforskning (SNF)**. Many projects have been carried out in partnership with IMR and this has seen some cross-employment through adjunct positions (i.e. J Devine at BIO and M Heino at IMR). EFERG had one joint project with NHH/SNF and many joint applications.

- **Marine Microbiology Research Group (MMRG)**

The MMRG collaborates and shares members with **Uni Research**. These cooperations are regarded in a positive light given increased access to projects, laboratory facilities, instrumentation and skilled and experienced researchers. In contrast to UiB practice, the latter attests to Uni's regular employment of permanent scientific staff and is greatly appreciated. Despite complications arising from dealings between two different entities, the close collaboration between UiB and Uni Research links academic and applied research and gives the group a larger circle of acquaintances and broader access to different stakeholders and possible funding sources.

- **Theoretical Ecology Research Group (TEG)**

TEG collaborates with **Uni Research, Hjort Centre for Marine Ecosystem Dynamics, Institute of Marine Research (IMR), Norwegian School of Economics and Business Administration** and several local collaborators

within the UiB (e.g. Geophysical Institute and Dept. of Mathematics). TEG's successful establishment of the **Bergen Marine Research Cluster** entails close collaborations with its affiliated members (UiB, IMR, **NERSC, NIFES, CMR, Uni Research and NOFIMA**).

TEG enjoys a successful collaboration with the **Computation Ecology Group at Uni Research**, optimizing reciprocal use of strength between these essentially twin-groups. **The Hjort Centre for Marine Ecosystem Dynamics**, set up in Bergen in 2014, is a collaboration between IMR, UiB, Uni Research, and the Nansen Environmental and Remote Sensing Center. Opened by Prime Minister Erna Solberg, TEG has been central in developing its concept and drafting its Science Plan. Nationally, the group has strongest links to researchers at the **Institute of Marine Research (IMR)**, but also enjoys active links with the **Norwegian School of Economics and Business Administration** (i.e. one joint CoE application and one joint RCN-funded project), Bodø **University College, Statoil**, and **Norwegian Polar Institute** and recently **CEES, UiO** (in a successful joint Nordic Center of Excellence application). Within UiB, TEG has collaborated with numerous research groups within BIO, the Department of Mathematics and the Geophysical Institute. Finally, TEG has been deeply involved in establishing and running **Bergen Marine Research Cluster (UiB, IMR, NERSC, NIFES, CMR, Uni Research and NOFIMA)**, **Bergen International Research School in Marine Biology**, **Bergen Advanced Training Site in Marine Ecology** (an EC Marie Curie Training Site 2001-2005), and **MENTOR** (a planned Marine European Network for Training of Researchers involving Bergen, Brest, Bremen, Bremerhaven, Kiel, and Southampton).

- **Aquatic Behavioral Ecology Research Group**

Relevant academic communities in UiB's periphery (randsoneinstitusjoner) with which ABERG has cooperated in the period 2004-2013, include among others the Institution of Marine Research.

MARINE AND ENVIRONMENTAL HEALTH

- **Marine Developmental Biology Research Group (MDBG)**

MDBG collaborates with **Uni research, IMR, NIFES, Nofima** on early all projects regarding "Smoltification and osmoregulation" and "Growth and maturation". **The recent initiative "Centre for Research-based Innovations in Controlled-environment Aquaculture (CtrIAQUA)"** towards **Centre of Research-driven Innovation (SFI)** is a collaborative effort between **Nofima, Uni and BIO**. Collaborations with **EWOS innovation, NOFIMA, Uni Research and BTO** have helped secure funding from NFR and Regional Forskningsfond to strengthen/develop networks with local, national and international industrial partners. Since 1996, in collaboration with **NIFES**, MDBG has had multiple joint NFR projects, COST programme, NORAD project and shared PhD students. Since 1982, it has had joint NFR projects with **IMR** and shared supervision of Master and PhD students. Within UiB, it collaborated with the Department of Medicine (2005-09) until funding was discontinued. Other MDBG collaborators have included Department of Ophthalmology, **Haukeland University Hospital** and **Phillips BV**, the Netherlands.

- **Environmental Toxicology Research Group (ETRG)**

Cooperation between ETRG and **IMR** has been strong throughout the period 2004-2013 and cooperation with **NIFES** and Uni has developed positively during the latter part of the period. Several major projects and publications have been dependent on these collaborations. The SFI CIROH initiative is a follow-up of these collaborations.

- **Ecological and Environmental Change Research Group**

EERCG has also benefited from a strong collaborations during this period with **Bjerknes Centre for Climate Research**

AQUACULTURE AND FISH HEALTH

- **Fisheries Ecology and Aquaculture Research Group (FEARG)**

FEARG collaborates with **IMR** and within **BIO** on projects relating to fish population biology, reproduction and behavior. It has carried out the sclerochronology projects, including EU FP7 project CalMarO, and Meltzer project in collaboration with colleagues at **UNI, Bjerknes**. Research on New marine biomass for biofuel and animal feed has led to two patents: (1) 2011 WO2011/158215.2011; (2) 2011 UK *Patent Application No. 1121722.1.*) Research on skin mucus cells have led to BTO funded projects

- **Fish Disease Research Group**

During the evaluation period, the FDRG has considerable cooperation with numerous relevant academic communities in UiB's periphery. This has greatly affected their ability to generate resources and build networks. A prime example is the Sea Lice Research Centre (SLRC), a Centre for Research-based Innovation (SFI), appointed by the Research Council of Norway in 2011. While the University of Bergen is the host of the SLRC SFI, the basis for the center lies with three departments at the UIB Faculty of Mathematics and Natural Sciences, including the Department of Biology where it originated from a fruitful collaboration between researchers at the **Institute of Marine Research** and the **Salmon Louse Research Center**. Other members of the center and include the Norwegian University of Life Sciences, and various industrial partners (i.e. **EWOS Innovation AS, Lerøy Seafood Group ASA, Marine Harvest ASA, Novartis International, Animal Health AG, and PatoGen Analyse AS**).

MARINE BIODIVERSITY

- **Marine Biodiversity Research Group (MBRG)**

The MBRG includes members from **NIVA, IMR** and the **BioGeo Center** in Bergen in an integrated research environment sharing projects, laboratory facilities and instrumentation. They collectively strive to operate as one research group with joint responsibility for teaching, labs, equipment and administration. Physical proximity to the large marine research institutions in the vicinity have enable cooperation and collaborations in ways otherwise deemed impossible due to distance.

6 Dissemination activities and international cooperation

ToR: “Evaluate the associated academic communities' dissemination and promotion of their research results domestically and internationally.”

ToR: “Evaluate the associated academic communities' international activities, including project cooperation, participation in conferences, presentations, marketing and networking.”

If relevant, please report separately for your major research topics/research groups in this section.

- a. Describe the major target groups of your research and the major channels for disseminating and promoting your research results domestically and internationally. Please comment on the relative importance of academic/popular and of domestic/international dissemination.

In the marine biological sciences the research communities are international, and the major channels for dissemination of research results are through international journals. We focus on publication as an integral part of the research process, and we encourage targeting of the highest-impact journals. Incentives include featuring new publications in BIO's weekly newsletter and linking part of the research groups' funding to publications. Our researchers and students also participate in international conferences and symposia to disseminate their research findings and seek international collaborators in their research projects. A large part of marine research also holds relevance for industry and government/management, as well as the general audience. Therefore, we also emphasize the necessity to communicate widely towards user groups at local and national seminars, as well as by regional and national media channels, through interviews, commentaries and newspaper articles. While the latter holds true across all of BIO's research groups, examples provided below describe any additional target groups and dissemination channels specific for the individual groups.

FISHERIES ECOLOGY AND MARINE ECOSYSTEM DYNAMICS

- **Evolutionary Fisheries Ecology Research Group (EFERG)**

Target groups are fellow marine and evolutionary scientists as well as resource managers. The first group is reached by being active in conferences and publishing in respected journals. The second group through EFERG presence at the Institute of Marine Research (the biggest Norwegian provider of advice on marine environment) and their contacts, as well as active participation (including a co-chair) in the Working Group on Fisheries-Induced Evolution (WGEVO), an international working group under the auspices of the International Council for the Exploration of the Sea (ICES) headquartered in Copenhagen and main provider of advice on marine environment and resources for the Northeast Atlantic ocean.

- **Marine Microbiology Research Group (MMRG)**

The main target group of one's research is the scientific community and the main channel for dissemination the international peer reviewed journals.

Dissemination to reach the general public (mainly domestic) has been through project webpages, radio interviews (NRK, “Verdt å vite”), popular presentations, “Forskning.no”, “Forskningdagene” and via the visual artist Ellen Karin Mæhlum (<http://www.ellenkarin.no/>). More recently she has been using social media such as Facebook and blogs:

- <https://www.facebook.com/themicropolarproject>,
- <http://micropolar.blogspot.no/>,
- <https://www.facebook.com/oceancertain>

- **Theoretical Ecology Research Group (TERG)**

TERG has a long standing collaboration including numerous long-term visits to Prof. Marc Mangel's lab in Santa Cruz, Center for Stock Assessment Research, University of California. Prof. Mangel has been in Bergen approximately every second year during the last decade and now holds a Prof. II position at UiB, with TERG. TERG also has collaborations with researchers at Scripps Institution of Oceanography, Massachusetts Institute for Technology and Technical University of Denmark. A recent collaboration is now established at University of eastern Australia in Perth, with Leigh Simmons.

MARINE AND ENVIRONMENTAL HEALTH

- **Marine Developmental Biology Research Group (MDBRG)**

Dissemination of results is continuously achieved through publication in peer-reviewed scientific journals, presentations at international meetings, and technical reports submitted to the Research Council of Norway. Focus is on high dissemination activity of group results and endeavours to publish in high impact journals. Several projects generate data of high impact for the commercial producers, particularly for salmon, but also marine fish. For these datasets this audience is specifically targeted in technical reports, popular scientific papers and seminars for commercial producers, meetings with industry representatives, and close collaboration in research projects with user contribution (KMB) or user-led (BIP)

- **Environmental Toxicology Research Group (ETRG)**

The major target groups have been the scientific community, environmental management / government, and industry, in that order of priority. Attempts have been made to disseminate through a number of channels, including national and international scientific meetings and symposia (>100 poster and platform presentations during the period), user oriented meetings with environmental management and industry, as well as popular dissemination to the general public through opinions and interviews in newspapers, books and other media (radio, TV, documentaries, websites).

AQUACULTURE AND FISH HEALTH

- **Fisheries Ecology and Aquaculture Research Group (FEARG)**

The group aims to make active use of the internet. Group member participate in Christie conference. Promotion of the group occurs through teaching, provision of presentation material ("Lindås dagane") and guide for local events (Trip for "Selskapet for Norske Vitenskapere Fremme" 2014). International cooperation takes place through participation in:

- ICES research working groups
- EU and other funded projects
- Serving on review panels (Portugal, Belgium)
- Members of international groups (ELHS, AquaTT)
- EU COST Training School (*Methodological advancements in applied fish reproductive biology*)
- Leadership of Nordic Marine Academy (2005-2010)
- Scientific Board member: International Pectinid Workshop, Physiomar

MARINE BIODIVERSITY

- **Marine Biodiversity Research Group (MBRG)**

The main MBRG target group is the scientific community and their main channels for dissemination are international peer reviewed journals. Dissemination to reach the general public has been through project webpages, newspaper articles and interviews, (most recently upon request from "National Geographic") presentations, "Forskning.no" etc.

- b. Describe and comment on how the dissemination and promotion of your marine research has developed (e.g. increase/decrease in activity level, new dissemination and promotion channels) in the period 2004-2013.

FISHERIES ECOLOGY AND MARINE ECOSYSTEM DYNAMICS

Dissemination and promotion of marine research in groups driving investigation of Fisheries Ecology and Marine Ecosystem Dynamics has remained largely constant in the period 2004-2013. With the main channel for dissemination of scientific results being international peer reviewed journals, groups' joint publication rates have averaged approximately 20-30 publications per year (e.g. MMRG). Increased activity level through social media channels has however taken place through the establishment of Twitter accounts (in 2011 "@EvoFish_UiB") or launch of Facebook promotional pages (in 2013, "evofishgroup"). Past dissemination to the general public was targeted largely towards a general domestic public, but the rise of recent social media channels has broadened these audiences to include the international public. Furthermore noteworthy of mention is a collaborative effort initiated in 2007 by MMRG with visual artist, Ellen Karin Mæhlum (<http://www.ellenkarin.no/>), which has led to a series of plankton organism SEM images-based silkscreen prints named "Plankton Portraits". These have been promoted through exhibition in numerous national and international galleries. To a similar end, SALT, a communication and outreach company specialising on marine issues has been included in the project consortium of a recent Arctic project involving field work and cruise campaigns for public dissemination of the project through primarily Facebook, blogs, YouTube and radio presentations.

MARINE AND ENVIRONMENTAL HEALTH

Dissemination and promotion of marine research in groups driving investigation of Marine and Environmental Health in the period 2004-2013 has been integral to most of the projects. Consequently, involvement of users in projects (MDRG) has increased during the reporting period. Dissemination and promotional activities have been subject to continuous efforts to achieve maximum propagation and efforts have focused on increased dissemination to direct contacts through national and international media channels and address presentations to industrial stakeholders for whom group results are of greatest impact and relevance for their activities. Use of recent social media channels such as Twitter and internet blogs (e.g. palaeoclimatic studies blog by EECRG) have also seen a rise in these groups, although traditional channels such as peer-reviewed publications and conference presentations are still highly valued and employed.

MARINE BIODIVERSITY

Due to unstable number of group members over the years the dissemination activity of our results has been inhomogeneous. With its current stable member status, the group anticipates increased dissemination activity in the years to come.

- c. Please provide a list your most significant *domestic* dissemination activities (apart from scientific publications) in the period 2004-2013 (extracted from Cristin where possible). Categories to be included:
- contribution at conferences
 - popular/user-oriented talks:
 - popular articles
 - media contributions (newspapers, TV, radio, film, blogs, etc.):

Not all groups' members have kept a detailed account of their dissemination activities. Briefly however, all groups partake regularly in domestic conferences, workshops and seminar series through oral and/or poster presentations and contribute to domestic dissemination of scientific activities through popular articles and media appearances (e.g. newspapers, radio, internet, etc.). Listed below are some recent examples from research groups that have recorded their activities.

FISHERIES ECOLOGY AND MARINE ECOSYSTEM DYNAMICS

- **Evolutionary Fisheries Ecology Research Group (EFERG)**

Popular articles and Media contributions:

- Heino, M., T. Svåsand, and O. R. Godø. 2011. Gode gener ut. *Dagens Næringsliv* 5.12.2011: 26–27.
- Andreassen, K.E., 2011. Fiskeri påvirker fiskens gener. *På Høyden*. Available at: http://nyheter.uib.no/?modus=vis_nyhet&id=48924
- Anon, 2011. - Fiskeri påvirker fiskens gener. *Fish.no*. Available at: <http://www.fish.no/fiskeri/4580--fiskeri-pavirker-fiskens-gener.html>
- Anon, 2009. Overfiske fører til turboevolusjon. *Fiskersidens Forum*. Available at: <http://www.fiskersiden.no/forum/index.php?showtopic=49876&st=0&p=542119&hl=turboevolusjon&fromsearch=1&#entry542119>
- Bergstrøm, I.W., 2013. De søte fiskenes undergang. *På Høyden*. Available at: <http://pahoyden.no/2013/10/de-sote-fiskenes-undergang>
- Bråthen, K., 2007a. Fiske fører til evolusjon. *På Høyden*. Available at: http://nyheter.uib.no/?id=38434&modus=vis_nyhet
- Bråthen, K., 2007b. Fiske gjør at fisken endrer seg. *forskning.no*. Available at: http://www.forskning.no/artikler/2007/november/fiske_foerer_til_evolusjon
- Senneset, E., 2009a. Turboevolusjon på norskekysten. *Hubro*, 16(3). Available at: <http://hubro.uib.no/hubro3-2009/turboevolusjon.html>
- Senneset, E., 2009b. Turboevolusjon på norskekysten. *forskning.no*. Available at: <http://www.forskning.no/artikler/2009/oktober/231308>

- **Marine Microbiology Research Group (MMRG)**

popular/user-oriented talks:

- Several contributions at "Forskningsdagane" on plankton, marine organisms and viruses.
- Several popular presentations on microorganisms in the sea (eg. at Tysnes sogelag, Osterøy Senioruniversitet, Kvinnherad Senioruniversitet, Landslaget for offentlige pensjonister, Bergen.)
- 100-years Anniversary for Armauer Hansen. 2012 - Public seminar on Armauer Hansen and Lepa. The seminar and Armauer Hansen was covered in a wide range of newspapers and in a NRK TV interview.
- Christikonferansen 2013. Stand and oral presentation: "Marine Microbes - Why care?"

media contributions (newspapers, TV, radio, film, blogs, etc.):

- Several radio interviews (NRK «Verdt å Vite») about algal blooms and *Emiliana huxleyi*, microbial diversity, marine plastics and mesocosm experiments.
- Contribution of microscope images of marine microorganisms to / for various uses (eg. the film «Fjordens liv» (Manus and regi: Randi Storaas), decoration of the Goliat platform and Eni Norge's operational office in Hammerfest, book on Plankton organisms in Norwegian fjords, Per Flood 2014, UiB Division of Communication)
- Plankton portraits by Ellen Karin Mæhlum (<http://www.ellenkarin.no/>).
- Facebook and blogs from MicroPolar fieldwork (<https://www.facebook.com/themicropolarproject>,

<http://micropolar.blogspot.no/>)

- **Theoretical Ecology Research Group (TERG)**

popular/user-oriented talks:

- Yearly organization of the annual [Darwin-Day lecture](#) since 2007
- Organization of a series of public lectures in 2009 in connection to the 200 years celebration of Darwin (150 years since The Origin of Species). Invited speakers included Daniel Dennett, Kevin Padian, Peter Hammerstein and Geoffrey Miller.
- Establishment of the [Horizons lectures](#) at UiB, which typically attract >100 attendants.

MARINE AND ENVIRONMENTAL HEALTH

- **Marine Developmental Biology Research Group (MDBRG)**

Conference contributions:

- Oral and poster presentations at the bi-annual NFR HAVBRUK conference
- Rønnestad, I., A. Gomes, Y. Kamisaka, K. Olsen, R. Tillner, I. Lukram, A-E. Jordal, L.E.C. Conceição, T. Harboe. 2012. Fôropptak, appetitt og fordøyelse hos kveite- fra startfôring til yngel. Programkonferansen HAVBRUK 2012, Stavanger. Apr 16-18, 2012
- Bouquet JM, Troedsson C, Parida M, Reeve M, Dupont S, Novac A, Skaar KS, Massart W, Manak JR and EM Thompson (2014) Response of the pelagic, gelatinous appendicularian Oikopleura dioica to ocean warming and acidification. IMBER Open Science Conference - Future Oceans, Bergen, Norway
- Lekang K, Hadziavdic K, Thompson EM, Skaar KS and C Troedsson (2014) High throughput molecular methods in environmental monitoring: sample preparation and analytical pipelines IMBER Open Science Conference - Future Oceans, Bergen, Norway
- Bouquet JM, Troedsson C and EM Thompson (2013) Response of pelagic food webs to warmer, acidified oceans: Response of the appendicularian Oikopleura dioica to ocean acidification. Havet og Kysten Meeting, Trondheim, Norway
- Thompson EM (2011). Managing a rapid chordate life cycle through manipulation of cell cycle variants. EvoNet Meeting, Os, Norway.

popular/user-oriented talks:

- Contributions to seminar series arranged by the major aquaculture producers, feed companies etc.,
- Dissemination of novel research findings at aquacultur industry workshops
- Rønnestad, I., Understanding the early stages of marine fish. Sats Marint. Bergen, Norway. 7 Feb, 2013. (Invited lecture)
- Thompson EM (2013) A new marine biomass source. Presentation to Miriade group for Innovation and Economic Development from Basse-Normandie, France, Bergen, Norway
- Thompson EM (2011). Biomass from the Ocean. Norwegian Technology Transfer Meeting, Bergen, Norway

popular articles and media contributions (newspapers, TV, radio, film, blogs, etc.):

- "Fisk med pubertetsproblemer". På Høyden. August 2007
http://nyheter.uib.no/?modus=vis_nyhet&id=37276
- "Fisk med pubertetsproblemer". Fiskaren August. 2007
 - <http://www.fiskaren.no/incoming/article141925.ece>
- "Fisk med pubertetsproblemer". Forskning.no August. 2007
 - http://www.forskning.no/Artikler/2007/august/fisk_med_pubertetsproblemer
- "Fet fisk, fete mennesker". På Høyden. February 2009
 - http://nyheter.uib.no/?modus=vis_nyhet&id=42704
- "EU satser på fiskeoppdrett". På Høyden. February 2009
 - http://nyheter.uib.no/?modus=vis_nyhet&id=42820
- "Holder seg i likevekt". På Høyden. August 2009
 - http://nyheter.uib.no/?modus=vis_nyhet&id=44275
- "Sym like godt uansett" Bergens Tidende-Magasinet, 29 August 2009
- "Kan ha funnet årsak til DGS hos torsk" Fish.no
 - <http://www.fish.no/oppdrett/2428-kan-ha-funnet-arsak-til-dgs-hos-torsk.html>

- "Flaskehals trolig funnet". Nytt fra havbruk / NR 1 / Mars 2010, NFR.
- "Torskelarven under lupen". På Høyden. November 2010
 - http://nyheter.uib.no/?modus=vis_nyhet&id=47537
- "Forskar på torskens barndom"
 - http://www.nifes.no/index.php?page_id=&article_id=3955&lang_id=1
- "Viktig å forske på torsk nå" Nytt fra HAVBRUK Nr. 3-4, 2012
 - http://www.forskningsradet.no/prognett-havbruk/Trykte_nyhetsbrev/1228296458151
- Various articles concerning our research have also appeared in local and national newspapers (e.g. BA, BT) and magazines.

- **Environmental Toxicology Research Group (ETRG)**

Conference contributions:

- Regular contributions at the Norwegian Society for Pharmacology and Toxicology Annual Winter Meetings
- Regular contributions at the Norwegian Environmental Toxicology Symposium Series.
- Grøsvik B.E. and A. Goksøyr. Vintermøtet på Beito. Norsk selskap for farmakologi og toksikologi, Beitostølen, 29/1-1/2 2004. Platform.
- Sandnes K.V. C.C. Tolfsen, A. Goksøyr and B.E. Grøsvik. Annual Meeting of the Norwegian Society of Pharmacology and Toxicology, Beitostølen, 29/1-1/2 2004. Poster.
- Tolfsen, C.C. L.V. Sundbäck, A. Goksøyr and B.E. Grøsvik. Vintermøtet på Beito. Annual Meeting of the Norwegian Society of Pharmacology and Toxicology, Beitostølen, 29/1-1/2 2004. Platform.
- Bohne A. B.E. Grøsvik and A. Goksøyr. Annual Meeting of the Norwegian Society of Pharmacology and Toxicology, Beitostølen, 29/1-1/2 2004. Platform.
- Grøsvik B.E., C.C. Tolfsen, M. Caspersen and A. Goksøyr. Symposium on toxicological research in Norway. Adamstuen, Oslo, 19-20 October 2004. Platform.
- Grøsvik B. E., A. B. Kjersem and A. Goksøyr. PROOF Annual meeting 2004, Orkanger 12-14 October. Platform.
- Goksøyr A. BIOPROSP 2004 Symposium on Marine Bioprospecting. Tromsø Oct. 13-14, 2004. Invited speaker.
- Goksøyr A. Annual Meeting of the Norwegian Society of Pharmacology and Toxicology, Beitostølen, Norway, Jan. 27-29, 2005. Invited speaker.
- Sundbäck L., Tolfsen C.C., Viganò L., Goksøyr A., & Grøsvik B.E. Annual Meeting of the Norwegian Society of Pharmacology and Toxicology, Beitostølen, Norway, Jan. 27-29, 2005. Poster.
- Eidem J.K., Saramäki M. & Goksøyr A. Annual Meeting of the Norwegian Society of Pharmacology and Toxicology, Beitostølen, Norway, Jan. 27-29, 2005. Poster.
- Sjøfteland T., Tolfsen C.C., Viganò L., Goksøyr A. & Grøsvik B.E. Annual Meeting of the Norwegian Society of Pharmacology and Toxicology, Beitostølen, Norway, Jan. 27-29, 2005. Poster.
- Urbatzka R., Kloas W., Benfenati E., Bertolotti R., Bottero S., van Cauwenberge A., Goksøyr A., Grøsvik B.E., Martínez M.P., Porazzi E., Tolfsen C., Viganò L., & Mandich A. Annual Meeting of the Norwegian Society of Pharmacology and Toxicology, Beitostølen, Norway, Jan. 27-29, 2005. Poster.
- Tolfsen C.C., L.V. Sundbäck, T. Sjøfteland, R. Urbatzka, L. Viganò, W. Kloas, E. Benfenati, A. Goksøyr and B. E. Grøsvik. Norsk selskap for farmakologi og toksikologi, Beitostølen, 27/1-29/1 2005. Platform. Abstr. no. T5.
- Grøsvik B.E., C. C. Tolfsen, L. V. Sundbäck, T. Sjøfteland, M. Blø, A. Bohne Kjersem and A. Goksøyr. National Proteomics Conference, Bergen, 18-19/5-2005. Platform.
- Grøsvik, Bjørn Einar; Kjersem, Anneli Bohne; Meier, Sonnich; Sundt, Rolf Christian; Skadsheim, Arnfinn; Sanni, Steinar; Goksøyr, Anders. [Vitenskapelig foredrag]. Langtidsvirkninger av utslipp til sjø fra petroleumsvirksomheten (PROOF) årsmøte 2005 ; 27.09.2005 - 29.09.2005.
- TOLFSEN CC, SUNDBÄCK LV, SjøFTELAND T, URBATZKA R, MAGGIONI S, VIGANÓ L, MANDICH A, KLOAS W, BENFENATI E, GOKSØYR A AND GRØSVIK BE. Norwegian Society of Pharmacology and Toxicology, Beitostølen, Norway, 27-29 January 2006. Platform.
- Kjersem AB, M Blø, KA Aa, T Sjøfteland, S Meier, A Skadsheim, A Goksøyr, BE Grøsvik. Norwegian Society of Pharmacology and Toxicology, Beitostølen, Norway, 27-29 January 2006. Platform.
- Aa KA, A Bohne Kjersem, S Meier, A Goksøyr, BE Grøsvik. Norsk selskap for farmakologi og toksikologi, Beitostølen, 27-29/1 2006. Poster.
- Tolfsen, C.C. T. Sjøfteland, R. Urbatzka, S. Maggioni, S. Schiarea, W. Kloas, E. Benfenati, A. Goksøyr and B.E. Grøsvik. National Proteomics Meeting. 7-8 August 2006.

- Kjersem AB, Olsvik P, Lanzen A, Puntervoll P, Goksøyr A, Grøsvik BE. 2nd Norwegian Proteomics Meeting. Bergen, August 7-8, 2006. Platform.
- M. Brattås, S. _Tingstad & A. Goksøyr. Norwegian Society of Pharmacology and Toxicology, Beitostølen, Norway, 25-27 January 2007. Poster.
- Kjersem AB, Grøsvik BE, Olsvik P, Nilsen F, Lanzen A, Puntervoll P, Goksøyr A. Norwegian Society of Pharmacology and Toxicology, Beitostølen, Norway, 25-27 January 2007. Platform.
- Anders Goksøyr, Christina Tolfen, Tina Søfteland, Lilian Sundbäck, Janne K. Eidem, Luigi Viganò, Alessandra Massari, Alberta Mandich & Bjørn Einar Grøsvik. Norwegian Society of Pharmacology and Toxicology, Beitostølen, Norway, 24-26 January 2008. Platform.
- ANDERS GOKSØYR, Christina Charlotte Tolfen, ANNELI BOHNE KJERSEM; Torbjørn Midtun; & BJØRN EINAR GRØSVIK. Norwegian Society of Pharmacology and Toxicology, Beitostølen, Norway, 24-26 January 2008. Platform.
- Gunn-Therese Sørland, Roger Lille-Langøy, Marte Rusten, Rune Male, Gunnar Mellgren, & Anders Goksøyr. Norwegian Society of Pharmacology and Toxicology, Beitostølen, Norway, 24-26 January 2008. Poster.
- ANDERS GOKSØYR, Christina Charlotte Tolfen, ANNELI BOHNE KJERSEM; Torbjørn Midtun; & BJØRN EINAR GRØSVIK. Abstract, 2nd Norwegian Environmental Toxicology Symposium, Trondheim, Norway, 2-4 April, 2008 (lecture).
- Pål O. Olsvik, Kai K. Lie & Anders Goksøyr. Are Atlantic cod in Store Abstract, 2nd Norwegian Environmental Toxicology Symposium, Trondheim, Norway, 2-4 April, 2008 (lecture).
- Marte Rusten, Roger Lille-Langøy, Gunn-Therese Sørland, Rune Male, Bruce Blumberg & Anders Goksøyr. Abstract, 2nd Norwegian Environmental Toxicology Symposium, Trondheim, Norway, 2-4 April, 2008 (lecture).
- Marianne Brattås, Silje Tingstad, Frode Uriansrud, Amund Maage and Anders Goksøyr. Abstract, 2nd Norwegian Environmental Toxicology Symposium, Trondheim, Norway, 2-4 April, 2008 (poster).
- Anders Goksøyr. Miljø 2015 – Åpningskonferanse, 18.-19. november 2008 (lecture).
- Karin Berg, Anne Christine Utne Palm, Anne Gro Vea Salvanes, Pål Puntervoll & Anders Goksøyr. Norwegian Society of Pharmacology and Toxicology, Beitostølen, Norway, 22-25 January 2009. Lecture.
- Brattås M, Tingstad S, Zgoda V, Olsvik P, Goksøyr A. Norwegian Society of Pharmacology and Toxicology, Beitostølen, Norway, 22-25 January 2009. Lecture.
- Anders Goksøyr, Roger Lille-Langøy, Marte Rusten, Bruce Blumberg & Rune Male. Norwegian Society of Pharmacology and Toxicology, Beitostølen, Norway, 22-25 January 2009. Lecture.
- Goksøyr A, Lille-Langøy R, Rusten M, Blumberg b & Male R. Norwegian Society of Pharmacology and Toxicology, Beitostølen, Norway, 26-28 January 2010.
- Lille-Langøy R, Rusten M, Blumberg B, Male R & Goksøyr A Norwegian Society of Pharmacology and Toxicology, Beitostølen, Norway, 26-28 January 2010.
- EIDE M, RUSTEN M, MALE M, GOKSØYR A. Norwegian Society of Pharmacology and Toxicology, Beitostølen, Norway, 26-28 January 2010.
- ANTONSEN N V, BRATTÅS M, BERG V, LYCHE J L, GOKSØYR A. Norwegian Society of Pharmacology and Toxicology, Beitostølen, Norway, 26-28 January 2010.
- Rusten M, Lille-Langøy R, Eide M, Bache SM, Davies R, Male R, Blumberg B, Goksøyr A. 3rd Norwegian Environmental Toxicology Symposium, Bergen, Norway, April 14-16, 2010 (lecture).
- Odd André Karlsen, Silje Bjørneklett, Karin Berg, Marianne Brattås, Victor Zgoda, Ingvar Eidhammer and Anders Goksøyr. 3rd Norwegian Environmental Toxicology Symposium, Bergen, Norway, April 14-16, 2010 (lecture).
- Marta Eide, Marte Rusten, Rune Male, Anders Goksøyr 3rd Norwegian Environmental Toxicology Symposium, Bergen, Norway, April 14-16, 2010 (poster).
- Fekadu Yadetie et al. 3rd Norwegian Environmental Toxicology Symposium, Bergen, Norway, April 14-16, 2010 (poster).
- Silje Marie Bache, Marte Rusten, Anders Goksøyr 3rd Norwegian Environmental Toxicology Symposium, Bergen, Norway, April 14-16, 2010 (poster).
- Nina Vadøy Antonsen et al. 3rd Norwegian Environmental Toxicology Symposium, Bergen, Norway, April 14-16, 2010 (poster).
- Silje Bjørneklett et al. 3rd Norwegian Environmental Toxicology Symposium, Bergen, Norway, April 14-16, 2010 (poster).
- Davies R et al. 3rd Norwegian Environmental Toxicology Symposium, Bergen, Norway, April 14-16, 2010

(poster).

- Ole Jakob Nøstbakken et al. 3rd Norwegian Environmental Toxicology Symposium, Bergen, Norway, April 14-16, 2010 (poster).
- Lille-Langøy R et al. 3rd Norwegian Environmental Toxicology Symposium, Bergen, Norway, April 14-16, 2010 (poster).
- Rusten M et al. Norwegian Zebrafish Network Conference, Oslo, November 2010.
- Fekadu Yadetie et al. Norwegian Society of Pharmacology and Toxicology, Beitostølen, Norway, 27-29 January 2011.
- Rusten M et al. Norwegian Society of Pharmacology and Toxicology, Beitostølen, Norway, 27-29 January 2011.
- Lille-Langøy R et al. Norwegian Society of Pharmacology and Toxicology, Beitostølen, Norway, 27-29 January 2011.
- Odd André Karlsen et al. Norwegian Society of Pharmacology and Toxicology, Beitostølen, Norway, 26-28 January 2012.
- Rusten M et al. Norwegian Society of Pharmacology and Toxicology, Beitostølen, Norway, 26-28 January 2012.
- BIOPROSP 2004, Tromsø, 13.-14. oktober 2004.
- NSFT Vintermøte 2005, Beitostølen 27.-30. januar 2005.
- Goksøyr A. International Consensus Meeting: Harmonisation of the Care and Use of Fish in Research, Gardermoen, Norway, 23rd - 26th May 2005 (invited speaker).
- DNVA Symposium on Endocrine disrupters - Occurrence in the bioenvironment and possible effects in animals and humans, Oslo 13.-14. oktober 2005.
- *VISTA-seminar*, (Oslo, 5. februar 2007): "Overvåking av toksiske effekter i havet: utvikling av nye metoder basert på biomarkører".
- *NCE Subsea Workshop, Integrert miljøovervåking – med fokus på nordområdene*, (Bergen 17. april 2007): "Overvåking av miljøeffekter i havet: utvikling av nye metoder basert på biomarkører".
- *Norwegian Society for Pharmacology and Toxicology, the Poulsson Lecture Seminar* (Oslo, December 8, 2009)
- *The Norwegian Academy of Science and Letters (DNVA) seminar "Multiple stressors"* (Oslo, 12. januar 2011)
- *Møteplass Marin: Marin bioteknologi* (Bergen 30. mai 2011): "Marin bioteknologi: hvor kan universitetet bidra?"
- *Norwegian Society for Pharmacology and Toxicology, the Poulsson Lecture Seminar* (Oslo, September 6, 2012)
- *Forum for Offshore Environmental Monitoring* (Oslo, Norway, Oct. 30.-31. 2012)
- *Norwegian Society for Pharmacology and Toxicology, Annual Winter Meeting (Beito Feb. 23-25, 2014*
- *4th National Environmental Toxicology Symposium (NETS)*, Stavanger, Norway, 23-25. October 2014.
- The Norwegian Society of Pharmacology and Toxicology (NSFT), Beitostølen, Norway (January 2014).
- The Norwegian Society of Pharmacology and Toxicology (NSFT), Beitostølen, Norway (2012).
- Environmental Pollution Conference. Norwegian Climate and Pollution Agency and Research Council of Norway, Oslo, Norway (2012).

popular/user-oriented talks:

- *Organiske miljøgifter og sykkelig overvekt*. Invited by the Norwegian Academy of Science and Letters (Vitenskapsakademiet, Komite for geomedisin – mat, miljø, helse).

popular articles and media contributions (newspapers, TV, radio, film, blogs, etc.):

- Contributions to various broadcasted media:
 - On-going documentary on environmental pollutants with TV2
 - Broadcast participation in Schrødingers katt
 - Media contribution to CBS 60 minutes (Canada).
- Contributions to various printed media:
 - Bergens Tidende
 - Dagens Næringsliv

AQUACULTURE AND FISH HEALTH

- **Fish Disease Research Group (FDRG)**

popular articles and media contributions (newspapers, TV, radio, film, blogs, etc.):

- Mjaaland S et al. Hva skjer når laksen får influensa. (www.fuge.no, 17.11.2005)
- Mjaaland S et al. Laksen er lik mennesket. (www.kyst.no, 18.11.2005)
- Mjaaland S et al. Lakseinfluensa. (www.forskning.no, 21.11.2005)
- Hordvik I et al. Bioteknologisk FOU. Innspill fra Fiskesyklusgruppen til Biotek 2012, NRC, 2009
- Hordvik I and Mortensen S. Ville reinsdyr trives best. BT-debattinnlegg, 25.08.2011
- Hordvik I and Lysebo EM. Profesjonsstudiet i Fiskehelse - status og utfordringer. Notat til det Matematisk Naturvitenskapelige fakultet, UoB, oktober 2011
- Hordvik I. INNSIKT-artikkel: Laksen har dobbelt sett med gener. *Bergens Tidende*, Fredag 24. januar 2014

MARINE BIODIVERSITY

- **Marine Biodiversity Research Group (MBRG)**

popular/user-oriented talks:

- NHF Årsmøte, Tromsø november 2008
- Organized a seminar on "introduced aquatic species at Espeland Marine Biological Station", with funding from the Nordic Marine Academy, with 17 participants from 6 countries

- d. Please provide a list your most significant *international* dissemination activities (apart from scientific publications) in the period 2004-2013 (extracted from Cristin where possible). Categories to be included:
- contribution at conferences
 - popular/user-oriented talks
 - popular articles
 - media contributions (newspapers, TV, radio, film, blogs, etc.)

Not all group members have maintained a detailed record of dissemination activities and contributions to conferences and media. Listed below is an illustrative list of recent dissemination activities undertaken by the research groups. Briefly, group members take part in several scientific conference series with oral and poster presentations, contribute to conference series arranged by the major international associations and disseminate recent findings quickly at workshops with the industrial sector.

FISHERIES ECOLOGY AND MARINE ECOSYSTEM DYNAMICS

- **Evolutionary Fisheries Ecology Research Group (EFERG)**

Conference contributions:

- Various conference presentations, including co-organized theme sessions at the International Council for the Exploration of the Sea (ICES) Annual Science Conference in 2002, 2006, 2010, and 2014

Popular articles

- Feature article in *Nature*: Borrell, B. 2013. A big fight over little fish. *Nature* 493:597–598. doi: 10.1038/493597a.
- Feature article in *Science*: “News of the week” in *Science* 55, 2010 - In reference to (Utne-Palm et al. 2010),
- Featured in Alpha Galileo56. In reference to Utne-Palm et al. 2010 *Science*

Media contributions (newspapers, TV, radio, film, blogs, etc.)

- Carpenter, J., 2011. Fish shrinkage probed in lab. *BBC News | Science/Environment*. Available at: <http://www.bbc.co.uk/news/science-environment-14852081>
- Del Gorro del Mundo, *Beatriz y los peces millón*, Available at: <http://gorrodelmundo.com/2012/05/23/del-gorro-del-mundo-56-beatriz-y-los-peces-millon/>.
- Domínguez, N., 2009. El hombre adelanta a Darwin. *Público.es*. Available at: <http://www.publico.es/ciencias/261635/hombre/adelanta/darwin>
- Goldstein, R., 2009. Exploring human induced evolution in fish. *Conservation Maven*. Available at: <http://conservationmaven.com/frontpage/2009/9/28/exploring-human-induced-evolution-in-fish.html> [Accessed September 28, 2009].
- Manning, P., 2013. What Candy Can Tell Us about Fisheries Management. *Bang! Science Magazine*. Available at: <http://www.bangscience.org/2013/12/what-candy-can-tell-us-about-fisheries-management/> [Accessed January 17, 2014].
- Video document: Backlund, B., Sigl, R. & Hartl, M., 2010. *The case of the shrinking cod*, Available at: <http://www.evolution-of-life.com/en/observe/video/fiche/the-case-of-the-shrinking-cod.html>

- **Marine Microbiology Research Group (MMRG)**

Popular/user-oriented talks

- dOCUMENTA (13) in Kassel, Germany 2012: Oral contribution and panes discussion on “Disowning Life: A Conference on Seeds and Multispecies Intra-action”.

Media contributions (newspapers, TV, radio, film, blogs, etc.)

- Plankton portraits by Ellen Karin Mæhlum (<http://www.ellenkarin.no/>).
- Facebook and blogs from MicroPolar fieldwork (<https://www.facebook.com/themicropolarproject>, <http://micropolar.blogspot.no/>)

MARINE AND ENVIRONMENTAL HEALTH

• **Marine Developmental Biology Research Group (MDBRG)**

Conference contributions:

- Rønnestad I et al. (2012) International Symposium on Fish Endocrinology, Buenos Aires, Argentina
- Eilertsen M et al. (2014) Fish Biology Congress, Edinburgh
- Gorissen M et al. (2014) Fish Biology Congress, Edinburgh
- Valen R. et al. (2014). Fish Biology Congress, Edinburgh August 2014.
- Thompson EM (2014). 5th EFOR meeting, Paris, France
- Thompson EM (2013). 1st JAMBIO International Symposium, Tokyo, Japan.
- Bouquet JM et al. BIOPUMP & CONFLUX Meeting, Holbæk, Denmark.
- Øvrebø JI et al. (2011) Cell Growth & Proliferation. Gordon Research Conference, Biddeford, Maine, USA

Media contributions (newspapers, TV, radio, film, blogs, etc.):

- Various newspaper and magazine articles concerning MDRBG research have appeared in international newspapers of the UK, Sweden, Belgium, Netherlands, France, Italy and Brazil

• **Environmental Toxicology Research Group (ETRG)**

Conference contributions:

- Regular contributions at the International Symposium on Pollutant responses in Marine Organisms series.
- Goksøyr A. 19th European Workshop on Drug Metabolism, Kemer, Turkey, October 2004.
- *ISTC Seminar on "New Trends in Chemical Toxicology"* (Moscow, Russia, September, 2008):
- 3rd *Rendezvous a Concarneau, Where academia meets industry* (Concarneau, France, August 2011): "Marine biotech as a future industry: where can the university contribute?"
- *Woods Hole Oceanographic Institution, USA, seminar* (Woods Hole, October 2011): "From toxicogenomics to mechanistic insights - or the other way around? Studies of CYPs and nuclear receptor SXR in fish and marine mammals".
- *CSA Marine Biotech Workshop* (Olhona, Portugal, April 2012): "Marine biotechnology for aquaculture, fish health, and ocean health" (Anders Goksøyr & Hans Kleivdal).
- *Norman workshop at the VU University in Amsterdam on Occurrence, fate and effects of emerging pollutants in the environment – chemical analysis and toxicological assessment* (Amsterdam, November 2012): "Biological tools for effect assessment".
- Jerome Ruzzin. "Linking Persistent Organic Pollutants to the Metabolically Healthy and Abnormal Obese Phenotype". *Gordon Research Seminar on Environmental Endocrine Disruptors*. Lucca, Italy, May, 2014.
- J Ruzzin & A Goksøyr. Translational Research to Decipher the Health Impacts of POPs Present in Fatty Fish: The Case of Farmed Atlantic Salmon. *2014 Oceans and Human Health (OHH) Gordon Research Conference (GRC)*, Biddeford, Maine, June 2014.
- Kleivdal H et al. 6th International Conference on Toxic Cyanobacteria. Bergen, Norway, June, 2004..
- Van Cauwenberge A et al. Ecological Relevance of Chemically Induced Endocrine Disruption in Wildlife. University of Exeter, United Kingdom July 2004. Poster. Abstr. no. P65.
- Bohne Kjersem A. et al. 6th Siena meeting "From genome to proteome: Biomarker Discovery & Imaging Proteomics. Siena, Italy Aug-Sept, 2004. Poster, Abstr no. 26, p. 140.
- Grøsvik BE et al. 13th International Symposium on Pollutant Responses in Marine Organisms (PRIMO 13) Alessandria, Italy, June 2005. Platform.
- Tølfesen CC et al. 13th International Symposium on Pollutant Responses in Marine Organisms (PRIMO 13), Alessandria, Italy, June 2005. Platform.
- Sundbäck LV et al. 13th International Symposium on Pollutant Responses in Marine Organisms (PRIMO 13), Alessandria, Italy, June 2005. Poster.
- Sjøtteland T et al. 13th International Symposium on Pollutant Responses in Marine Organisms (PRIMO 13), Alessandria, Italy, June 2005. Poster.
- Jonsson HD et al. 13th International Symposium on Pollutant Responses in Marine Organisms (PRIMO 13), Alessandria, Italy, June 2005. Poster.
- Eidem J.K. et al. 13th International Symposium on Pollutant Responses in Marine Organisms (PRIMO 13), Alessandria, Italy, 19-22 June 2005. Poster.

- Tolfsen, CC et al. 7th Siena Meeting from genome to proteome: back to the future. September 2006.
- Kjersem AB et al. 7th Siena meeting "From genome to proteome: Back to the Future. Siena, Italy Sept 2006. Poster, Abstr no. 28, p. 149.
- Schwesig D. et al. WFD2007 Conference, Lille, France, March 2007.
- Goksøyr A. et al. Abstract, 13th International Symposium on Pollutant Responses in Marine Organisms (PRIMO 14), Florianopolis, Brazil, May 2007 (lecture).
- Berg K et al. Abstract, 13th International Symposium on Pollutant Responses in Marine Organisms (PRIMO 14), Florianopolis, Brazil, May 2007 (poster).
- Grøsvik BE et al. Abstract, 13th International Symposium on Pollutant Responses in Marine Organisms (PRIMO 14), Florianopolis, Brazil, May 2007 (lecture).
- Nøstbakken OJ et al. Abstract, 13th International Symposium on Pollutant Responses in Marine Organisms (PRIMO 14), Florianopolis, Brazil, May 2007 (poster).
- Brattås M et al. Abstract, 13th International Symposium on Pollutant Responses in Marine Organisms (PRIMO 14), Florianopolis, Brazil, May 2007 (poster).
- Kjersem AB et al. Abstract, 13th International Symposium on Pollutant Responses in Marine Organisms (PRIMO 14), Florianopolis, Brazil, May 2007 (lecture).
- Goksøyr A et al. 3rd NORMAN Workshop, Amsterdam, October 2007.
- Nahrgang J et al. 15th Symposium on Pollutant responses in Marine Organisms (PRIMO 15), Bordeaux, France, May 2009 (poster).
- Grøsvik BE et al. 15th Symposium on Pollutant responses in Marine Organisms (PRIMO 15), Bordeaux, France, Mai 2009 (poster).
- Førde HE et al. 15th Symposium on Pollutant responses in Marine Organisms (PRIMO 15), Bordeaux, France, Mai 2009 (poster).
- Brattås M. et al. 15th Symposium on Pollutant responses in Marine Organisms (PRIMO 15), Bordeaux, France, May 2009 (lecture).
- Berg K et al. 15th Symposium on Pollutant responses in Marine Organisms (PRIMO 15), Bordeaux, France, May 2009 (lecture).
- Lille-Langøy R. et al. 15th Symposium on Pollutant responses in Marine Organisms (PRIMO 15), Bordeaux, France, May 2009 (lecture).
- Goksøyr A et al. 19th Annual meeting, Göteborg, Sweden, June 2009 (lecture).
- Nahrgang J. et al SETAC Europe 19th Annual meeting, Göteborg, Sweden, 2009 (poster).
- Goksøyr A et al et al Nordic Environmental Chemistry Conference, Longyearbyen, Svalbard, Norway, March, 2010 (lecture).
- Berntssen MHG et al. ISFNF2010, China, June 2010.
- Rusten M et al. European Society for Comparative Biochemistry and Physiology Conference, Alessandria, Italy, Sept. 2010.
- Karlsen OA, 27. European Society for Comparative Biochemistry and Physiology Conference, Alessandria, Italy, Sept. 2010.
- Yadetie F et al. 16th Symposium on Pollutant responses in Marine Organisms (PRIMO 15), Long Beach, California, USA, May 2011.
- Brattås M et al. 16th Symposium On Pollutant Responses In Marine Organisms (Primo 15), Long Beach, California, USA, May 2011.
- Karlsen OA et al. 16th Symposium On Pollutant Responses In Marine Organisms (Primo 15), Long Beach, California, USA, May 2011.
- Rusten M. 16th Symposium On Pollutant Responses In Marine Organisms (Primo 15), Long Beach, California, USA, May 2011.
- Karlsen OA et al. International Conference on Environmental Omics, Guangzhou, China, Nov. 2011.
- Ruzzin et al. The 50th Annual Meeting of the European Association for the Study of Diabetes (EASD), Vienne, Austria (2014).
- Ruzzin et al. The Gordon Research Conference in Oceans and Human Health, Biddeford, Maine, USA (June 2014).
- Ruzzin et al. The Gordon Research Seminar in Environmental Endocrine Disruptors, Lucca, Italy (May 2014).
- Ruzzin et al. The 7th Copenhagen Workshop on Endocrine Disruptors (COW2013), Copenhagen, Denmark (2013).
- Ruzzin et al. The 24th Spring Congress of the Korean Diabetes Association, Gwangju, Republic of Korea

(2011).

Media contributions (newspapers, TV, radio, film, blogs, etc.)

- “Elevage en eaux troubles”, Envoyé Spécial (diffused 07.11.2013), FRANCE2. Envoyé Spécial is a documentary programme viewed by 3-7 million people (Source: Wikipedia). “Alimentation : Y a-t-il du Poison dans Nos Assiettes ?”, En quête d’actualité D8
- Various popular articles written in France, Denmark and Sweden.

- **Ecological and Environmental Change Research Group (EECRG)**

Conference contributions:

- Telford, R.J. Pitfalls of using transfer functions to reconstruct sea-ice. PAGES Sea ice Proxy (SIP) working group Sea ice proxy synthesis and data-model comparison; 2014-06-23 - 2014-06-25. Invited presentation.
- Telford, R.J.; Li, C.; Kucera, M. Re-evaluating tropical LGM planktonic foraminifera assemblage-based sea-surface temperature reconstructions. EGU; 2014-04-27 - 2014-05-02

popular articles and media contributions (newspapers, TV, radio, film, blogs, etc.):

- Richard Telford's blog at <http://quantpalaeo.wordpress.com/> averages approximately 2000 page views per month.

AQUACULTURE AND FISH HEALTH

- **Fish Disease Research Group (FDRG)**

popular articles and media contributions (newspapers, TV, radio, film, blogs, etc.):

- Robertsen B, Hordvik I, Jørgensen T. Immunsystemet hos fisk. In: Thomassen M, Gudding R, Nordberg B, Jørgensen L, eds. (NRC) *Havbruksforskning: Fra merd til mat*, ISBN 82-12-02277-3, pages 176-188, 2006
- Robertsen B, Hordvik I, Jørgensen T. The fish immune system. In: Thomassen M, Gudding R, Nordberg B, Jørgensen L, eds. (NRC) *Aquaculture Research: From Cage to Consumption*. ISBN 82-12-02408, pages 185-197, 2007
- Hordvik I. Immunsystemet hos fisk. In: *Vaksinehåndboken* (Intervet NORBIO) pages 37-46, 200
- Hordvik I. Development of the immune system in fish. In: Helvik et al. The fish larva: a transitional life form, the foundation for aquaculture and fisheries. *NRC report from a working group on research on early life stages of fish*; ISBN 978-82-12-02682-7 (pdf), pages 64-66, 2009
- Helvik JV et al. Hvordan kan kartleggingen av laksens genom bidra til å løse utfordringene i norsk havbruksnæring? *Utredning for Fiskeri og Havbruksnæringens Forskningsfond (FHF)*, 2013

MARINE BIODIVERSITY

- **Marine Biodiversity Research Group (MBRG)**

- Conference contributions
- Symposium on Ecological and Environmental Parasitology: “The impact of global change” (2005)
- Sixth International Crustacean Congress, Glasgow, Scotland, UK (2 presentations) (2005)
- 13th International Meiofauna Conference in Recife, Brazil (2007)
- The Crustacean Society. Summer Meeting 2008 in Galveston, USA, June 9-13. (2008)
- The 1st International Congress on Invertebrate Morphology, August 17 – 21. (2008)
- Dansk Havforsker Møde, Fuglsangcentret, Mols, Denmark, January 18 – 20 (2011)
- The Crustacean Society’s Summer Meeting, June 6-9, 2011, Honolulu, Hawaii (2011)
- The Crustacean Society Summer Meeting - 10th Colloquium Crustacea Decapoda Mediterranea conference June 3-7th in Athens (2012)
- University of Denver, Colorado, U. S. A (Invited speaker) (2005)
- National Institute of Water and Atmospheric Science, Wellington, New Zealand (Invited speaker) (2007)
- TCS Tokyo Meeting 20 – 24 September: The Significance of the Stylet in the Evolution of Parasitic Barnacles (Invited speaker) (2009)

- e. List your international projects in the period 2004-2013, and comment on the development in international project cooperation in the period.

FISHERIES ECOLOGY AND MARINE ECOSYSTEM DYNAMICS

Evolutionary Fisheries Ecology Research Group (EFERG)

For a full list of successful grant applications, the reader is referred to question 1 in the survey. In addition to these afore listed projects, there have also been three EU-funded projects hosted by the Institute of Marine Research with spill-over effects to BIO. There has been one unsuccessful attempt to attain EU funding through a Marie Curie Research Training Network application. Almost all activities have included international collaboration, regardless of the funding source.

Marine Microbiology Research Group (MMRG)

International projects have become increasingly important for funding of group research and activity since the first EU Framework Programme (MAST 1). Since then, the group has been engaged in international project cooperation with international activity steadily rising. National RCN-funded projects have been a significant driving force, contributed to this increase as they have become gradually more international with active partners from abroad. To illustrate this rise, 9 international projects had funding in the last half of the period (2009-13) compared to 4 projects in the first half (2004-08):

- BASICS: Bacterial single-cell approaches to the relationship between diversity and function in the Sea. EU 2002-2005.
- MIRACLE: Microbial Marine Community Diversity: from culture to function. EU 2002-2005.
- METAOCEANS: Meta-analysis of the ocean. EU 2005-2009.
- NUTRITUNNEL: 'Nutrient tunnelling' and other alternative pathways for mineral nutrients through the microbial food web to copepods. RCN 2008-2010.
- EPOCA: European Project of Ocean Acidification. EU 2008-2011.
- MERCLIM-BIO - Marine Ecosystem Response to a changing CLIMate. RCN 2008-2011.
- MESOAQUA Network of leading MESOcosm facilities to advance the studies of future AQUatic ecosystems from the Arctic to the Mediterranean. EU 2009-2012.
- MINOS: ERC Advanced Investigator Grant. Microbial Network OrganiSation. EU 2011-2016.
- PHAEONIGMA: A novel cross-disciplinary approach to solve an old enigma: the food-web transfer of the mass-blooming phytoplankter *Phaeocystis*. RCN 2011-2014.
- Arctic Microorganisms: Microorganisms in the arctic: major drivers of biogeochemical cycles and climate change. RCN 2013-2016.
- OceanCertain: Ocean Food web Patrol – Climate Effects: Reducing Targeted Uncertainties with an Integrated Network. EU 2013-2017.
- MicroPolar: Processes and Players in Arctic Marine Pelagic Food Webs - Biogeochemistry, Environment and Climate Change. RCN 2013-2017.
- MIRACLES: Multi-product Integrated bioRefinery of Algae: from Carbon dioxide and Light Energy to high-value Specialties. EU 2013-2017.

Theoretical Ecology Research Group (TERG)

Throughout the project period 2004-2013, TERG has seen increased international cooperation with several members undertaking single or multiple long-term visits to collaborating laboratories abroad (Prof. Marc Mangel's lab in Santa Cruz, California). Reciprocally, throughout the last 10 years, Prof. Mangel, the foreign host, has also visited Bergen every second year and has since been granted a Prof. II position at the TERG, UiB. Similarly, Prof. Aksnes has had a long-standing cooperation with Prof. Marc Ohman at Scripps Institution of Oceanography and Prof. Fiksen spent a sabbatical in 2011-2012, visiting Michael Follows at Massachusetts Institute for Technology, Cambridge, and Boston. Another researcher is currently visiting Leigh Simmons at the

University of Western Australia in Perth for a one-year research visit. The group's large international network is also reflected in their publications.

MARINE AND ENVIRONMENTAL HEALTH

Marine Developmental Biology Research Group (MDBRG)

- EU, QoL, QLRT-2001-01801 'Photoperiod control of puberty in farmed fish: Development of new techniques and research into underlying physiological mechanisms', 2002 - 2005
- COST Action: FA0801- (2008-12) LARVANET- Critical success factors for fish larval production in European Aquaculture: a multidisciplinary network (project proposal preparation, planning and submission)
- NORAD- SRV 2701 (2008- 12) Improving training and Research Capacity at the Nha Trang University, Vietnam- Phase II (UiT, UiB, NTNU, NUT)
- EU- FP7-KBBE-2007-2A. (2009-13) LIFECYCLE. Building a biological knowledge-base on fish lifecycles for competitive, sustainable European aquaculture. (Collaborative project, Large scale Integrating Project, Partner)
- Fund. Ciência e Tecnol. Portugal. (2011-13) Towards fishmeal-independent fish diets: the role of taurine (PTDC/MAR/117047/2010) (part. w/CCMAR)
- Spanish Ministry of Science and Innovation. (2011-14) Assessment of daily rhythm in the feeding activity and the digestive function in reared larvae of marine fish. Improving the feeding protocols. (partner w/ Inst. Ciencias Marinas de Andalucía, Cadiz, Spain)
- NORAD (2013) Norhed Seed Funding: Incorporating Climate Change into Ecosystem Approaches to Fisheries and Aquaculture Management (partner w/ Nha Trang Univ and Univ of Tromsø)

Environmental Toxicology Research Group (ETRG)

- EU/QLK-4-CT-202-02286 Easyring (2003-2005). Partner and WP leader.
- Involvement of PXR (SXR) in the effects of *ortho*-PCB congeners in zebrafish (NIH project w/John Stegeman, WHOI, USA) (2011-2014). Collaborator.
- The iCod and the Nuclear receptor project also involved several international collaborators in Sweden, Denmark, UK, and USA.
- No EU applications have been successfully funded since EASYRING, although the group has maintained continuous efforts to apply for new EU funding. To this end it uses its international network in research collaborations outside of the regular funding schemes. This is a continuous development.

MARINE BIODIVERSITY

Marine Biodiversity Research Group (MBRG)

The number of internationally coordinated projects and associated funding have shown an increasing trend. To illustrate, the list below provides specific examples of international projects in which MBRG has been involved during this period.

- Co-investigator (PI: Andreas Waninger, Biological Institute) "Evolution of animal body plans as inferred by developmental biology, morphology, molecular phylogeny, and palaeontology." HUMAN RESOURCES AND MOBILITY (HRM) ACTIVITY, MARIE CURIE ACTIONS, Host fellowships for Early Stage Research Training (EST) Dkr (2005)
- Co-investigator (PI: Professor Carsten Rahbek, Biological Institute) "Center for Macro-ecology and Evolution: How to explain distribution and life on Earth" (2009)
- The Carlsberg Foundation "The shore crab in its home range (2009)

- Co-investigator (PI: Professor Carsten Rahbek, Biological Institute, Copenhagen) "Center for Macroecology, Evolution and Climate Change" (2010)
- The Norwegian Species Databank "Norwegian cumaceans" (2010)
- The Norwegian Species Databank Species inventory of the Sognefjord (2013)
- Co-investigator: The Norwegian Programme for Capacity Building in Higher Education and Research for development (NORHED), "Climate change impact on marine biodiversity and fisheries aquaculture in Vietnam" (2013)

f. Provide examples of other central international activities, e.g. marketing and networking, and comment on the development in these activities in the period.

FISHERIES ECOLOGY AND MARINE ECOSYSTEM DYNAMICS

- **Marine Microbiology Research Group (MMRG)**

Arrangement of international symposia, workshops and courses has represented a strategic means to obtain international contacts and improve group networking. Examples of central international activities that the group has coordinated or been heavily involved in:

Conferences:

- Sixth International Conference on Toxic Cyanobacteria, 2004.
- Marine Virus Workshop 2007. EUROpean network of excellence for OCEan Ecosystem ANALysis (EUR-OCEANS) & SCOR WG 126 on Role of Viruses in Marine Ecosystems.
- Annual Meeting of the Nordic Microscopy Society - SCANDEM 2012
- 100-years Anniversary for Armauer Hansen. 2012 - International seminar on Armauer Hansen, Lepra and *Mycobacteria*.

Networks:

- EUR-OCEANS network of excellence. Leading Theme 4 "Biogeochemistry"
- MESOAQUA Network of leading MESOcosm facilities to advance the studies of future AQUatic ecosystems from the Arctic to the Mediterranean.
- ESSEM COST Action ES1103: Microbial ecology & the earth system: collaborating for insight and success with the new generation of sequencing tools.
- NENUN Nordic Environmental NUCleotide Network.

Miscellaneous:

- SCOR Working Group 126 on Role of Viruses in Marine Ecosystems. 2005-2009.
- NIMBios (National Institute for Mathematical and Biological Synthesis) Knoxville, Tennessee. Member of working group on "Ocean Viral Dynamics" 2012 - 2014.
- Activity Leader in the IPY project Polar Aquatic Microbial Ecology (PAME) (IPY Activity ID No.71). 2006-2009.
- Group PI served as editor in journal Aquatic Microbial Ecology, Scientific Advisory Board member for establishing the International Society for Virus of Microorganisms (ISVM) and member in the ESF Marine Board Working Group on Marine Microbial Diversity.

MARINE AND ENVIRONMENTAL HEALTH

Marine Developmental Biology Research Group (MDBRG)

MDBRG has had extensive and continuous collaboration with EU, Asian and North American countries. Continuously ongoing collaboration with researchers in Japan and USA since 1980s has resulted in a large number of joint published papers.

Environmental Toxicology Research Group (ETRG)

ETRG has been actively contributing to the development of an international Oceans and Human Health community, through participation in workshops (<http://www.ecehh.org/wp-content/uploads/2013/11/Message-from-Bedruthan.pdf>) and the Gordon Research Conference/Seminar series on Oceans and Human Health. During the latter the group had two invited lectures at the 2014 OHH GRC in Biddeford, Maine, USA, and group PI, Anders Goksøyr was elected vice-chair for the 2016 and co-chair for the 2018 meetings. ETRG researcher, Jerome Ruzzin, was elected co-chair for the 2016 GRS on Environmental Endocrine Disruptors

MARINE BIODIVERSITY

Marine Biodiversity Research Group (MBRG)

Central international activities, e.g. marketing and networking involve the group's continuously ongoing collaborations within colleagues in Scandinavia, EU, Asian and North America. The development of named activities is reflected in the publication records of the group, listed above for the evaluated period.

7 Cross-disciplinarity

ToR: “Consider to which extent cross-disciplinarity and organization in cross-disciplinary centres has contributed to strengthening and developing activities in the focus area.”

If relevant, please report separately for your major research topics/research groups in this section.

Please comment on the degree of cross-disciplinarity of your research activities and education programmes, and the extent to which cross-disciplinarity and organisation in cross-disciplinary centres have contributed to strengthening the research and education activities within marine studies at UiB in the period 2004-2013.

Previous evaluations of Norwegian Research in Biology have recognized the excellence of the numerous research groups at BIO. Given a developing shift from traditional organism and biome-based disciplines towards process and system-oriented studies such as developmental biology, evolutionary biology and ecology, the resultant new integrative biology can be viewed as an overarching, interdisciplinary biology which encourages yet greater interdisciplinary with fields such as physics, chemistry, geology and medicine. It also entails a stronger emphasis on mathematics and informatics through computational biology and bioinformatics. The establishing of BIO 10 years ago involved a boost to cross-disciplinary teaching and research in the biological marine sciences. New research groups were formed with people from all the old departments, and as we moved into new buildings in 2009 this process has continued. The effect of this is that researchers with a wide range of backgrounds are mixed together, with substantial potential for cross-fertilization of ideas, methods and cultures. Each group at the department has seen exciting initiatives towards integrative research, cross-disciplinary collaboration and cooperation across the research groups. This cross-disciplinarity extends beyond the faculty and department levels, however, as exemplified by promising new developments within cross-disciplinary research on fish recruitment dynamics, with links to fisheries, aquaculture and basic developmental biology. BIO has strengthened the fish health area with a research initiative on salmon lice, which led to establishment of The Sea Lice Research Centre, a Centre for Research-based Innovation appointed by the Research Council of Norway. This Centre is hosted by the University of Bergen and started activity in 2011. The latter, a notable example of a new research/educational area that has arisen from cross-disciplinarity within the department and its peripheral academic communities. In turn, this center provides strong potential for further cross-fertilisation between basic and applied research. Also the interdisciplinary research group of geomicrobiology that led to the establishment of the CoE *Center for Geobiology* is prominent example of how interdisciplinary can lead to the development of a new discipline.

Below are examples of interdisciplinary provided by the groups regarding their research activities and education programmes, and the extent to which cross-disciplinarity and organisation in cross-disciplinary centres have contributed to strengthening the research and education activities within marine studies at UiB in the period 2004-2013.

FISHERIES ECOLOGY AND MARINE ECOSYSTEM DYNAMICS

- **Evolutionary Fisheries Ecology Research Group (EFERG)**

The research core lies in evolutionary and population biology but includes most disciplines in marine

science and many other branches of classic biological research, i.e. genetics, physiology, behaviour, and biological oceanography. Outside biology, we are working at the interface with resource economics and resource management. The group's activity in fisheries economics represents a cross-disciplinary activity in itself.

- **Marine Microbiology Research Group (MMRG)**

Marine microbial ecology includes a multi-disciplinary field of research which embraces biology/microbiology, molecular biology, genomics, bioinformatics, chemistry, physics, oceanography and modelling. The group has internal expertise on all of these fields but collaborates extensively with researchers that specialise on marine chemistry and climate research, bioinformatics, marine physics, ecosystem modelling etc.

- **Theoretical Ecology Research Group (TERG)**

TERG is a very cross-disciplinary group, working across the biological domain, from microbes to birds and humans – from small-scale physics and oceanography to the evolution of sociality, mating behavior and economics. This is made possible as they are skilled in theory and modelling while some common principles (evolution) stretch across all these topics.

- **Aquatic Behavioral Ecology Research Group (ABERG)**

Much of the marine research activities and education programmes of the ABERG have shared cross-disciplinarity with the department of mathematics.

MARINE AND ENVIRONMENTAL HEALTH

- **Marine Developmental Biology Research Group (MDBRG)**

Several recent MMRG projects are cross-disciplinary in nature. Projects like 'Moderne settefiskproduksjon av laks - normal utvikling og velferd i intensive oppdrettsystemer' (2006 – 2009), 'Optimal smolt production and post smolt performance in the High North - Seawater intermixing, low temperatures and intensive rearing' (NORSMOLT, 2008 – 2011) and 'Optimalisert postsmolt: et paradigmeskifte for norsk lakseindustri' (2012 – 2014) explore the interface between technology and biology, focusing on the development, physiology and welfare of salmon in intensive production systems, including the novel, closed containment system for post-smolt rearing, currently under development in Norway. Further, our initiative towards an SFI (CtrlAQUA) crosses disciplines of biology, technology, fish health, remote sensing etc. In addition, the group performs cross-disciplinary research on appetite control and digestive function with UiB's, Department of Medicine at UiB (since 2005) and on nutrient sensing, duodenal and stomach function with UCLA's Department of Medicine (since 2013). Cross disciplinary research with Uni Research has led to participation in committees for establishing a cluster for Marine biomass exploitation/bioprospecting, for developing new interdisciplinary Master's program in Energy, and for participation in an EMBRC initiative to upgrade European marine biological stations for research and teaching purposes. Cross disciplinary research with UiB's Department of Medicine and Department of Ophthalmology (since 2007) on the topic cell adhesion and development. Experience and findings from the group's research "trickle down" into the education programmes, and are communicated to students in aquaculture and fish physiology.

- **Environmental Toxicology Research Group (ETRG)**

Cross-disciplinarity is the basis of environmental toxicology, so the group endeavours to provide the students a background in chemistry, molecular biology, ecology, bioinformatics, statistics, etc. ETRG research collaborations mirror the need for cross-disciplinarity, where links have been established to other relevant research groups in the field. The group strives to contribute to the establishment of a

Centre for Ocean and Human Health at the University of Bergen, bringing together all the various aspects of research on this topic at the University, across departments and faculties.

- **Ecological and Environmental Change Research Group (EECRG)**

AQUACULTURE AND FISH HEALTH

- **Fisheries Ecology and Aquaculture Research Group (FEARG)**

Ample examples exist of cross-disciplinary research in the group:

- Hard rock and CalMarO projects (using otoliths as environmental recorders), involve climate researchers/geochemists/modelers/archeologists in addition to a.o. fisheries scientists at IMR.
- Cooperation with fish nutritionists at NIFES
- Cooperation in archaeology and vegetation ecology under application EU INTERREG
- Cooperation with modelers and economists in development of fisheries models (Balanced harvesting), and presentations at various UN and World Bank sponsored fora.
- Collaboration with microbiologists, technologists in development of fish skin based assays for determining fish health.

MARINE BIODIVERSITY

- **Marine Biodiversity Research Group (MBRG)**

The research conducted in the Marine Biodiversity Group is interdisciplinary in nature and includes classic taxonomy/systematics, phylogeny, evolutionary biology, ecology, histological research, developmental biology and molecular biology.

8 UiB's strategic committee for marine research

ToR: "Assess utility value/function of the strategic committee for this focus area."

Please comment on your department/centre's experiences with UiB's strategic committee for marine research, its value/function for developing the field, and if relevant how the organisation of the focus area may be improved.

At the department level, the UiB's strategic committee for marine research mandates are acknowledged, respected and implemented through the capacity of the department leader. Due to the committee members' broad backgrounds of expertise, it has been perceived as a very good forum to discuss marine research inter-disciplinarity across its activities. Among the research groups, however, the strategic committee has been minimally prominent. With regard to the committee's value or function for development of the field, the general consensus among the groups is that the department's activities have ensued, regardless and independent of the committee's input or recommendations. The extent of the committee's influence and/or impact on prioritization and development of marine research areas has also been minimally noticeable to members of the departmental leadership. In summary, therefore, the strategic committee could potentially serve a greater function if revitalized and used and supported by the UiB leadership as a strategic body, but its mandates are followed and the scope of its authority and autonomy supported by the department leadership.

9 Administrative resources and support

ToR: “Assess the associated academic communities combined administrative resources and support functions.”

Please describe the types of administrative resources and support available to your department/centre, and give your opinion on the adequacy/sufficiency of the resources and support, and if relevant what ought to be improved.

After the merger of the 5 previous units into BIO, the researchers report an increased professionalism, competence and capacity of its administrative staff. The Department of Biology’s administrative resources adequately and sufficiently support Marine research and teaching at the Department of Biology. Of the approx. 220 staff members employed at BIO, approximately 27% of these are technical and administrative. Of these, the majority is directly involved in research and teaching support and in the Research Council’s 2010 Evaluation of Norwegian Research in Biology, BIO’s administrative and technical staff were described as “competent and service-minded” and recognized as one of the department’s professional and organizational strengths. Like any university administration however, the same general requirements apply to the administrative services at the Department of Biology. Unlike particularly specialized research areas, Marine Research does not require any additional, specified experience or expertise in the administrative area, although it should be noted that any initiatives (by administrative services or otherwise) to increase the department’s visibility and influence in our public funding bodies, such as the Research Council of Norway would be regarded as a positive development. BIO also utilises the administrative support offered by the faculty and the Department of Research Administration. Technical support, on the other hand, requires to a much larger extent specific competences relevant for different aspects of marine research. The evaluated period has also been characterized by a continuous and rapidly developing state-of-the-art infrastructure, for which the Department of Biology has been able to meet the need for quantitative and qualitative technical support by hiring highly qualified technical staff. It remains a challenge for BIO however to continue to meet this ever-increasing need for competence and to allocate enough resources for technical support.

10 Strengths, weaknesses and challenges

If relevant, please report separately for your major research topics/research groups in this section.

Please describe what you see as the main strengths, weaknesses and challenges for research and education within marine research at UiB, and how the field should be developed further.

Excelling in science and education requires strategic and long term planning. Having had marine research and education as a broad and long term strategic area of commitment UiB it has been possible for UiB's researchers to make a prominent impact in the international marine science research communities and to contribute to important knowledge transfer to the society locally, nationally and internationally.

BIO was established on the 1st of January 2004 by the merger of the former Departments of Botany (BI), Fisheries and Marine Biology (IFM), Microbiology (IM), and Zoology (ZI). The UiB Centre for Environmental and Resource Studies joined BIO in 2006. The scientific foundation for BIO, developed prior to the merger in 2004, states that BIO shall "*have strong research groups within the breadth of biological sciences, [...] be the strongest academic environment for marine biology in Norway, and have a clear plan for development related research.*" There is also an overlap between the marine research area and the development related research as many of the research questions we ask also within the marine area are of importance in the developing countries.

Marine biology and Aquaculture are considered both economically and geographically important for Norway and throughout BIO's ten years' of existence BIO has prioritized basic research in marine biology, through (i) a focus on fostering high quality in marine research (notably marine microbiology, ecological modelling, taxonomy, biodiversity, developmental biology and evo-devo) including prioritizing new positions and facilities for these groups, (ii) establishing a joint microbiology-geology research group (2005) and thereafter a Center of Excellence (CoE) in geobiology, Center for Geobiology (CGB) (2007), (iii) establishing cross-disciplinary fish-rearing facilities to ensure access to research material and strengthen experimental basic research on fish recruitment and development, (iv) stronger focus on marine developmental biology, including establishing a five million NOK zebrafish facility shared with The Department of Molecular Biology, a facility for appendicularians and a facility for salmon lice, (v) taken on coordination of a Nordic research school (the Nordic Marine Academy), (vi) specific actions targeted at improving research quality in aquaculture, fish health and development biology, including merging subcritical groups, encouraging application of computational and molecular methods, and exploiting potential synergies through new collaborations with high-quality basic science environments both within BIO and externally, (vii) established the Sea Lice Research Center, a Center for Research-based Innovation (CoRI) (2011) and (viii) the aim of the merger into BIO was to strengthen research by providing a common structure and culture. In consequence, we have throughout the last ten years seen a rise in the quantity, quality, and scientific relevance of our marine research (ref: National Evaluation of Biology 2010).

BIO has also throughout the evaluation period been a partner in the CoEs *Bjerknes Centre for Climate Research* and *Centre for Integrated Petroleum Research*; one Nordic CoE *Climate Change Effects on Marine Ecosystems and Resource Economics*; and the *The Michelsen Centre for Measurement Science and Technology*, a CoRI. We also coordinated the EU MESOAQUA network of European mesocosm facilities, of which the Marine Biological Station (MBS) at Espeland, Fana, was a part, and BIO received infrastructure funding from the RCN to establish the CODE national knowledge platform for the early stages of marine fish.

One of our professors in marine biology, Thingstad, has obtained an ERC Advanced Investigator Grant and received the RCN Möbius Prize for research that was performed at MBS, among other places. During the evaluation period, BIO has recruited a Bergen Research Foundation Young

Investigator Grant candidate (BFS) within the marine field (Heino - within evolutionary effects of fisheries).

In 2014 BIO was awarded a Centre of Excellence in Education – *bioCEED* – which aims to improve our education in marine as well as other biological areas.

Below please find a SWOT (Strengths – Weaknesses – Opportunities – Threats) analysis within the marine field as seen from the department's and research groups' perspectives:

Strengths

Research and education

- Large scientific milieu with high competence across a broad spectrum of biology; empirically, methodologically, and theoretically
- Research groups (comprising permanent scientific staff, technicians, researchers, post-docs, PhD students and MSc students) with a strong sense of common research goals, and where the complementary expertise and skills of group members are valued and exploited
- Some groups are international leaders within their field: marine and geo-microbiology and marine ecosystem dynamics
- Extensive research and teaching portfolio within the UiB strategic priority of marine sciences and the national priority areas of climate and polar research which also have marine interfaces
- Strong links between research strength and education profile, good recruitment of students at all levels, and a well-functioning research education
- Cross-disciplinary research approach with learning potential across the disciplines;
- Research themes addressing fundamental properties of individuals and populations engage numerous research groups and allow pursuit of many fundamental scientific questions;
- Substantial scientific diversity and strengths related to marine biology in general and fish biology / fisheries / aquaculture / fish health in particular
- Organism biology is essential to all biological disciplines and associated research encompasses a broad comparative developmental approach (Oikopleura – teleosts - human medicine) resulting in applied research topics supported by public interest;
- research orientation in areas with international focus and rapid scientific progress;
- Strong contact and collaboration (i.e. the Bergen Museum and Uni Research, IMR, NIFES) benefits network-building;
- High scientific and publication activity.

Funding

- Competitiveness for external funding nationally and internationally – both due to infrastructure and scientific quality of researchers. ;
- Collaboration with local academic communities increases access to funding sources;
- BIO's broad research focus enables competition for a wide range of programmed funding and attracts collaborative partners.
- Success in excellence schemes such as CoE, NCoE, BFS, CoE in Education, CoRI

Facilities and resources

- Strategic location characterized by a high concentration of marine researchers within a small area, with ready access to equipment and animal resources, providing a solid base for high-quality research. It is imperative in the future to stick to this, and not to spread the human resources on different localities;
- BIO has created opportunities for new collaborations over shared research methods, complementary research approaches, joint lab management, and shared infrastructure

- Extensive innovative drive, industrial contact and collaborative activities linked to ongoing and potential SME businesses
- Excellent infrastructure for research and education: advanced laboratories, field stations and research vessels, and an attractive location for field-based research Strong, broad and active local, national and international networks of collaborations and recognition of our research, scientists and expertise
- Long experience (>30 years) in marine pelagic experimental ecology (mesocosms / microcosms) and other marine fields
- Great diversity of taxonomical expertise
- Extensive collaboration within the groups

Personnel

- Highly competent employees who are enthusiastic about their research fields and who identify emerging challenges and opportunities
- Students are interested, motivated and effectively recruited
- Strong engagement of faculty members on academic/scientific boards and committees
- Affiliation of active and knowledgeable emeriti

Weaknesses

Research

- Untapped potential for integration between research directions: empirical vs. theoretical; applications of biostatistics; modelling; bioinformatics; and molecular methods
- Strong involvement of faculty members on boards and committees limits their academic activities
- Increasing administrative demands (e.g. time sheets for project work, project expense documentation (e.g. shared running costs on instruments according to recorded use).
- Organism biology rarely in fashion at the research council and traditional taxonomy is time consuming

Funding

- insufficient basic funding hinders long term strategic opportunities
- Calls from relevant NFR programmes often address specific short-term, production-driven questions
- limited funding to update equipment with few to no means to budget costs financed by research groups for instrument repair / replacement
- Ship-time for cruises in Arctic regions billed to the projects.
- Low fraction of externally funded pure researchers among the staff.

Facilities and resources

- Research quality would have benefitted from higher investments in maintenance and upgrade in some of our research stations and facilities, and from improved coordination
- Deficiencies regarding data storage and bio-banks frustrate optimal safe-guarding and scientific exploitation of existing, often hard-earned, data and samples
- limited interactions between bioinformatics, whole genome approaches and biology

Personnel

- Lack of expertise/research in some fields e.g. zooplankton ecology and bioinformatics.
- Loss of personnel through retirement without replacement results in loss of expertise.

- Group members, besides the PIs are largely dependent on external or temporary funding. Few possibilities to keep promising master students
- Some groups are small and therefore vulnerable.
- Ageing faculty reduces flexibility and increases the need for BIO to rejuvenate and reinvent itself as an investment-worthy group
- Need for taxonomists in bio-prospecting

Opportunities

Research and Funding

- Open competition pool for some PhD positions could support embryonic ideas leading to downstream external funding as well as keep promising master students
- Research areas (e.g. evolution of biological processes, planktonic trophic interactions) hold synergy with biomedicine
- increased collaboration with academic communities in UiB's periphery (e.g. IMR, the University Museum, NIVA, UniRes, Sars, NIFES and CBU)
- increasing synergy possibilities with national and international industrial partners
- need to keep up with steadily faster research activity of global competitors and/or collaborators (can be a strength if successfully achieved or a weakness if not accomplished)
- Possibilities for exposure in media (everyone loves a good animal story)

Facilities and resources

- Application of zebra fish and molecular tools to marine models
- Synergy from co-localization with other groups at BIO, MBI and Sars
- Additional synergy if MRI is relocated to Marineholmen
- Biodiversity laboratory
- Espesrend Marine biological station for workshops, field and lab experiments and field courses
- Research vessels and unique cruise opportunities
- The unique marine environment literally outside labs and offices
- Culture facilities for marine organisms

Threats

Research and Funding:

- Long-term scientific planning can be distracted by the need to compete for external funding, most of which is programme-oriented, and limited ability to fund long term strategies, limits potential for future funding
- Dependence on external funding for doing experimental research and training PhD and Master students
- Calls from applied NFR programmes often inapplicable, too few and/or too narrow
- great dependence on strategic decisions and structure of the RCN and EU,
- local strategic priorities unclear and poorly funded
- Competition of funding induces a "chasing the money" syndrome (compromising clearly articulated pursuit of long-term institutional vision).
- Large (and prestigious) international projects with many partners and insufficient funding require large "own contribution" or additional national funding.

Facilities and resources

- Uncertainties concerning the future localization of the Marine Biological Field Station and mesocosm facilities.
- mechanisms for obtaining significant, modernized, equipment upgrades are few, laborious and lengthy, reducing opportunities to respond effectively to new research and collaborative opportunities
- Need to maintain and uphold our strategic location and not to spread the human resources to different localities.

Personnel

- Large span in group research activities contributes to less scientific interaction within the group compared to others which follow a more stable-like organization and narrow focused agenda. BIO risks undermining some of their own research groups' profiles by adapting to the research profiles of other larger collaborating institutions.
- Legal constraints in hiring non-permanent labour have negative consequences for post-doctoral researchers' career development and building of strong research groups
- Increased implementation of non-scientific duties

11 Additional information / comments

The box below, although not part of the original self-assessment form, was added in order to provide some additional information for the evaluation panel regarding our responses to some of the previous questions.

In several of the questions stated above (Chapter 6) regarding such issues as major dissemination channels, national and international promotional activities and project development, the same holds true across most, if not all, of the research groups. Generally speaking, in marine biological research communities, the major modes of traditional dissemination apply, namely publication in high-impact peer-review international journals, oral and poster presentations at local and/or international conferences, meetings and symposia. Furthermore, popular scientific channels such as traditional (e.g. newspapers, magazines, radio, television) and social media have become increasingly more common during the assessment period, particularly the latter. In the feedback fields, it should thus be noted that only group responses containing unique information, specific to the group rather than the whole, were included to exemplify BIO's rich diversity.