

Annual report 2009

Marine strategic area Marine Coastal Development



NTNU – Trondheim
Norwegian University of
Science and Technology

The Norwegian University of Science and Technology (NTNU) is a university with a broad academic scope. It has been given the national responsibility for graduate engineering education in Norway. NTNU's research has an international focus and can be characterized by being at the leading edge in specific areas of technology, with a broad disciplinary scope and an interdisciplinary approach.

It is anticipated that the answers to the complex questions of the future must be searched for through interactions across the classical disciplines. NTNU established six thematic strategic areas as arenas and support processes for facilitation of interdisciplinary research and education:

- Energy and petroleum – resources and environment
- Information and communication technology
- Marine and maritime technology
- Materials
- Medical technology
- Globalization

More information about the strategic areas at:

www.ntnu.no/strategicareas

ABOUT MARINE COASTAL DEVELOPMENT

The Strategic Focus Area "Marine and Maritime Research" has two main pillars:

1. Centre for Ships and Ocean Structures (CeSOS), Centre of Excellence, funded by the Research Council of Norway and NTNU
2. NTNU Marine Coastal Development (NTNU MCD)

The main roles of NTNU MCD are:

- to stimulate interactions between social sciences, humanities, natural sciences, and engineering sciences
- to facilitate cooperation between researchers that are experts within their own discipline
- to promote a sustainable use of renewable marine resources, both socially, environmentally, economically and energy-wise
- to focus on system thinking, with integration of knowledge from strong individual disciplines
- to support, beside fundamental research, also innovation with impact for society and industry
- to further develop and deepen the strategic cooperation with SINTEF

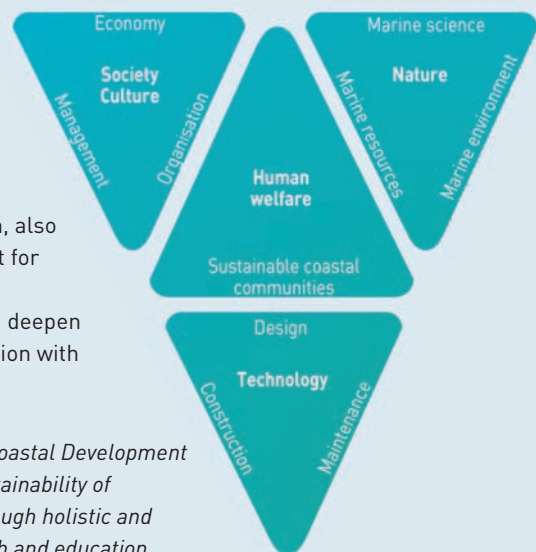


Figure 1: NTNU Marine Coastal Development will contribute to the sustainability of coastal communities through holistic and multidisciplinary research and education.

Visit us at: www.ntnu.no/marine

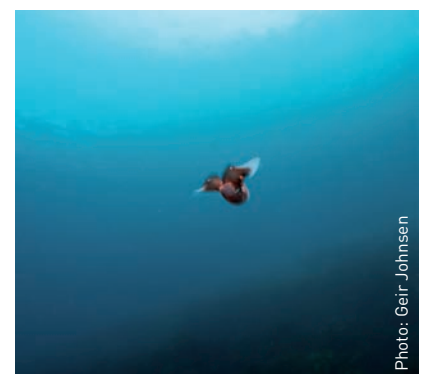
MANAGEMENT

Director: Prof. Yngvar Olsen, Dept. of Biology
 Director Deputy: Prof. Harald Ellingsen, Dept. of Marine Technology
 Manager: Ir. Alexandra Neyts, Dept. of Marine Technology

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 Contact: Alexandra.Neyts@ntnu.no

VISION – Excellence in research and higher education supporting sustainable coastal development



MARINE COASTAL DEVELOPMENT – CORE ACTIVITIES

The marine strategic area covers the three main domains along the marine value chain:



Photo: Isak Skjerpeseth

OCEAN SPACE RESEARCH:
methodological and technological development for research on living and non-living resources



Photo: Ernn Victor Willumsen

FISHERIES AND AQUACULTURE:
science, engineering and societal research



Photo: Jan Ove Eivjehø

MARINE RESOURCE PROCESSING:
sustainable marine resource processing and technology

OCEAN SPACE RESEARCH

Ocean Space Research

- Marine surveillance systems
- Energy from the ocean
- Marine ecosystems
- Eco-toxicology
- Marine archaeology and cultural history
- Coastal zone development and infrastructure

Infrastructure

- RV Gunnerus
- Trondhjem Biological Station
- Marine Technical Laboratory
- ACE
- NTNU and SINTEF Sealab

Monitoring of the marine environment and its resources through observations and measurements has evolved into a new scientific era with the generation of multiple data of high accuracy. NTNU has contributed to this development through research on surveillance technology and communication systems. Mounted on sub-sea installations or mobile platforms like the Gunnerus research vessel, remote operated vehicles, autonomous underwater vehicles and gliders they offer complete marine observation systems. New tools become hence available both to marine ecologists and archaeologists. A sustainable management of the marine ecosystem also requires a better knowledge of the marine processes, such as species diversity, genetic resources, biology, hydrodynamics, chemistry and ecology, and of societal issues related to coastal zone development. The understanding of the effects of marine food web exposure to toxic compounds and CO₂, in particular in polar areas, has received special attention.

APPLIED UNDERWATER ROBOTICS LABORATORY

In 2009, the Applied Underwater Robotics Lab (AURL) was established as a research and education basis for the development and use of new applications for environmental monitoring and mapping of the marine ecosystem. This includes surveillance of biogeochemical objects, marine archaeology, and deepwater operations, ecology research and mineral extraction. The involved research group represents the complete value chain from technology suppliers, vessels, vehicles, instruments, operators to end-users. It involves key researchers from the Departments of Marine Technology, Biology, Archaeology and Religious Studies, and Engineering Cybernetics. Contacts: Geir.Johnsen@bio.ntnu.no, Asgeir.Sorensen@ntnu.no, Fredrik.Soreide@hf.ntnu.no

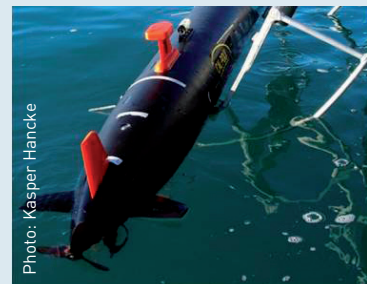


Photo: Kasper Hancke

EUR-OCEANS

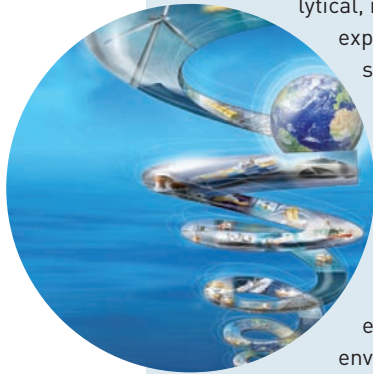
After finalisation of the EUR-OCEANS Network of Excellence (FP6), a EUR-OCEANS consortium and project office was established. NTNU Marine Coastal Development is a founding member of this scientific network, which aims at harmonising European research efforts related to ocean ecosystems undergoing anthropogenic and natural forcings. This will be achieved by three main tools, i.e. Flagships (2-year projects), Foresight workshops and Conferences. Contact: Egil.Sakshaug@bio.ntnu.no
www.eur-oceans.eu

CESOS

CeSOS is the national Centre of Excellence for Ships and Ocean Structures, located at the NTNU Marine Technology Centre. Research at CeSOS aims at developing fundamental knowledge about how ships and other structures behave in the ocean environment, using analytical, numerical and experimental studies. This knowledge is vital, both now and in the future, for the design of safe, cost effective and environmentally friendly structures as well as in the planning and execution of marine operations. The engineering research carried out by the technology outlook, in a 20-25 years perspective, covers the following thematic areas:

- Wave induced motions and strongly nonlinear loads
- Structural load effects
- Ship operations
- Stationary marine operations
- Slender marine structures
- Aquacultural facilities
- Wave and offshore wind energy conversion
- Very Large Floating Structures

Contact: coe@marin.ntnu.no
www.cesos.ntnu.no



BLUE BIOTECHNOLOGY

In August 2009, a joint meeting of the rectors from NTNU and the University of Gent (BE), the rector representative of the University in Wageningen (NL) and the director of SINTEF Fisheries and Aquaculture resulted in a formalisation of the collaboration between these institutes. This alliance was of particular relevance to the researchers in the field of blue biotechnology, who share the interest in joining their complementary competences and skills. The initial meeting was followed up by discussions in Gent and Wageningen in order to identify common research priorities on a European level. Contact: Sergey.Zotchev@biotech.ntnu.no

RESEARCH VESSEL GUNNERUS

In 2009, Gunnerus had an occupation of close to 100 % of its capacity. In total, 1164 students, researchers and other users accessed the vessel. About 80% of vessel time was dedicated to educational and research activities from NTNU and SINTEF, whereas the remaining 20 % was used for commercial purposes. Users statistics show that Gunnerus is utilized as a platform for a wide range of disciplines such as marine technology, biology, chemistry, archaeology and geology. Contact: Svenn.Linde@ntnu.no
www.ntnu.no/marine/gunnerus

PROJECTS AND ACTIVITIES – OCEAN SPACE RESEARCH

ICOAST

This project in the field of integrated coastal area management aims at working out a joint framework for sustainable development in order to reduce the number of conflicts in the coastal zone and its adjacent waters. Three areas in Norway have been selected to develop coastal management solutions through an interdisciplinary wide-spectre study involving environmental, social and economic aspects.

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www.ikyst.no

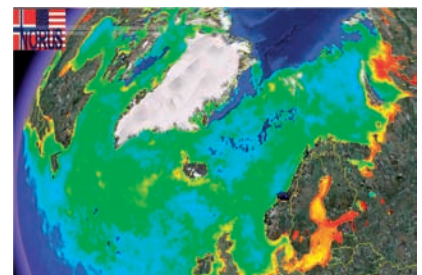


Photo: Isak Kjerpeseth

NORUS

NORUS or "Technology Development for Marine Monitoring and Ocean Observation" is a joint North America – Norway educational program. Master students from NTNU, the University at Svalbard (UNIS), California Polytechnic State University and Rutgers University attended joint workshops and intensive courses on the use of underwater vehicles and sensors for marine studies. At the workshop in California Polytech, students were taught about new underwater robotics and optical technologies that could be used to better understand the changing arctic environment.

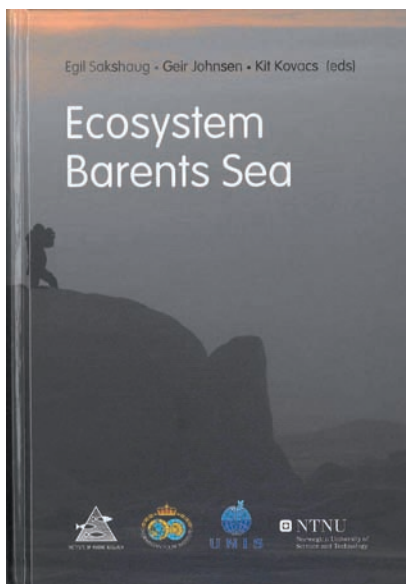
Contact: Geir.Johnsen@ntnu.no
www.norus-science.com



PUBLICATION OF BOOK "ECOSYSTEM BARENTS SEA"

This book contains much new information, and is a substantial upgrade from the previous Ecosystem Barents Sea book from 1991 (reprinted 1994). It is written by 37 experts on physical and biological phenomena related to the marine ecosystem of the Barents Sea. The book is richly illustrated and is expected to be frequently used in research, education and management.

Contact: Egil.Sakshaug@bio.ntnu.no



OPTIMIZING LIPID PRODUCTION BY PLANKTONIC ALGAE (LIPIDO)

LIPIDO is part of a cluster of Nordic and German research groups. The aim is to study the biological and technological aspects of using oil rich microalgae in the production of bio-diesel. Our work within the project is focused on marine algae, and one advantage in using marine algae is the minimal use of freshwater. In addition, cultivation of microalgae requires little land area, and the algae are natural captors of CO₂.

Contact: Olav.Vadstein@biotech.ntnu.no

MARINE ARCHAEOLOGY AT ORMEN LANGE

A shipwreck from the 18th century, located in the vicinity of the Mid-Norwegian off-shore gas field Ormen Lange, is monitored at regular time-intervals to investigate disintegration

processes. Underwater operated vehicles (ROV) are deployed for this purpose. The goal of this archaeological environment monitoring program is to gain more knowledge on how to protect valuable cultural heritage in marine ecosystems.

Contact: Marek.Jasinski@vm.ntnu.no



Photo: Marek Jasinski

HARVEST

There is an increasing demand for products of marine origin, both for human consumption and as a feed source for aquaculture. The zooplankton species *Calanus finmarchicus* (red feed) exists in huge abundances in Northern areas and may be considered as a valuable alternative to wild fish. The goal of the HARVEST project is to improve abundance estimates, to assess stocks of zooplankton and to quantify the ecological consequences of harvesting at a lower trophic level.

Contact: Oystein.Leiknes@bio.ntnu.no



ICT MARINE

In November 2009, a workshop on Marine Sensor Technology was held in Oslo. This meeting was part of the work performed under the ICT Marine network, which is a resource network for the promotion of research and development within the field of marine observation technology. Partners in this network are Kongsberg

Maritime, WesternGeco, StatoilHydro, the Norwegian Defence Research Establishment (FFI), NTNU and SINTEF ICT.

Contact: Jens.M.Hovem@iet.ntnu.no

UNDERWATER ACOUSTIC MONITORING AND COMMUNICATION

This project in the field of underwater acoustic remote sensing and communication is funded by the Research Council of Norway. Its objective is to develop new methods and technologies for observation and monitoring of the marine ecosystem through seabed characterization, target (including fish) detection and localization, underwater channel characterization for underwater acoustic communication and for gathering high-quality data from a broad spectrum of platforms.

Contact: Hefeng.Dong@iet.ntnu.no

WAFOW

Can waste emission from fish farms change the structure of marine food webs? Through a comparative study of coastal ecosystems in Norway and Chile, the project will provide the scientific knowledge to develop a tool for managing anthropogenic waste discharges in coastal waters. It will also enhance the mutual awareness of scientific and societal differences and needs in both regions.

Contact: Murato@nt.ntnu.no



Photo: Lasse Olsen

HOW WILL CLIMATE CHANGE AFFECT AQUATIC PHOTOSYNTHETIC PRODUCTION?

The Norwegian – Czech collaborative project aims at developing instruments and methods for the prediction of the response of phytoplankton,

both in terms of productivity and species composition, to an increased concentration of CO₂.

Contact: Lass.Olsen@bio.ntnu.no
www.alga.cz/nf/

NESSAR – ECOSYSTEM STUDIES OF SUBARCTIC AND ARCTIC REGIONS

Based on data sampled during cruises in 2007 and 2008, researchers at NTNU and SINTEF developed an ecosystem model aiming to improve the understanding of optical and bio-optical characteristics of organisms living in the ocean's photic zone. These results are of high relevance to enhance estimations of primary production, carbon fluxes and remote sensing.

Contact: Kasper.Hancke@bio.ntnu.no
www.ipy.no/prosjekter/Nessar

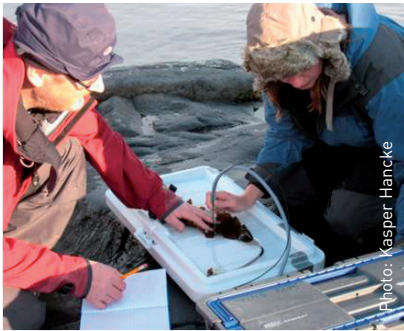


Photo: Kasper Hancke

BEST COMBAT

The project on Beluga sturgeon community-based tourism aims at developing touristic and adventure activities in the Danube Delta as a sustainable alternative to sturgeon fishing. This is to be achieved by bringing together experts from different countries and academic disciplines.

Contact: Oddmund.Otterstad@ntnu.no
www.bestcombat.cc-intro.com



Photo: Oddmund Otterstad

REMOTE SENSING AND LASER TECHNOLOGY

Estimation of fish stock sizes is difficult, time-consuming and costly. Further development of LIDAR (light detection and ranging) technology, i.e. optical radar operated from boats, planes or in situ, and of remote sensing instruments will aid fisheries researchers and managers to survey fish stocks. They can also contribute to fish characterisation, detection of pollution and general monitoring of the marine environment

Contact: Jens.Hjelmstad@iet.ntnu.no

HARMFUL EFFECTS OF SEISMIC WAVES

The impact of seismic waves on fish and marine mammals is evaluated in order to develop regulations for a better co-existence between seismic investigations and fisheries. Based on the findings, a report was published by the Norwegian Department of Fisheries, the Petroleum Directorate and the Climate and Pollution Agency.

Contact: Jens.M.Hovem@iet.ntnu.no

BULGARIA AND CO₂-EMISSIONS

A study on the mitigation of CO₂-emissions in Bulgarian coastal and riparian municipalities was carried out

through an alliance between NTNU and the Bulgarian Ministry of the Environment and Water.

Contact: Oddmund.Otterstad@ntnu.no

HYDRALAB III

Through the EC financed project Hydralab III, European researchers were given the opportunity to access a wide range of unique experimental facilities in the field of hydrodynamics, oceanography, marine ecology, ice engineering and ship dynamics. In 2009, a total of 36 external researchers from UK, Germany, Sweden, Austria, France, Italy, Belgium, Estonia, Portugal and Norway performed experiments using the Sletvik field station, towing tank, ocean basin or Coriolis rotating table in Trondheim. Networking activities resulted in a set of guidelines and best practice within wave, breakwater, sediment and ecological research, and in a joint data management structure.



Photo: Maren Stråbel

CREATE

CREATE is a national "Centre for research based innovation in aquaculture technology". Through understanding, innovating and applying, the centre contributes to the creation of technology for cultivation of the sea. Research and development are focused on three main pillars and the integration of knowledge between them: Equipment and constructions; Operation and handling; and Farming intelligence. Industry partners, being market leaders in supplying technology to the sector, have an important evaluating function within the consortium. NTNU is involved in research activities related to the following topics:

- Flow through and around fish cages
(Lars.Gansel@ntnu.no; Dag.Myrhaug@ntnu.no)
 - Modelling and simulation of fish behaviour in aquaculture production facilities
(Martin.Fore@itk.ntnu.no; Jo.Arve.Alfredsen@itk.ntnu.no)
 - Reliability-based design of Aquacultural Plants
(Enni.L.Lubis@ntnu.no; Torgeir.Moan@ntnu.no)
 - Biofouling on marine cage systems
(Nina.Blocher@bio.ntnu.no; Yngvar.Olsen@bio.ntnu.no)
- www.sintef.no/Projectweb/CREATE

Fisheries and Aquaculture

Aquaculture engineering

Sustainable marine aquaculture and societal aspects

Biological basis of marine aquaculture

Marine harvesting technology

Sustainable fisheries

Social strategies of fisheries

FISHERIES AND AQUACULTURE

Aquaculture at NTNU has its main focus on aquaculture engineering of production systems, the sustainability of these systems, and the fundamental biological sciences of aquaculture engineering. By taking full advantage of the knowledge and developments made in other sciences and industries, such as the offshore oil industry, considerable technological progress can be obtained within this young industry. A better understanding and control of environmental impacts is crucial both from a production and a consumer perspective.

The goal of fisheries research at NTNU is to promote active multi-disciplinary problem-solving research, through close interaction among engineering, natural science and social sciences. Through the development of low energy catching technology, improved fishing gear, on board catch handling and flexible logistic- and distribution systems fisheries can gain efficiency. At the same time, it is important to counteract over-fishing problems through improved management strategies, catch monitoring, and sustainability documentation. Scientific approaches for the maintenance of sustainable coastal communities is also a focus area for fisheries research at NTNU.

Infrastructure

NTNU and SINTEF

Sealab Flume tank

RV Gunnerus

ACE

Marine Technical Laboratory

EATiP – EUROPEAN AQUACULTURE TECHNOLOGY AND INNOVATION PLATFORM

The EATiP provides a structure for all relevant stakeholder groups to come together to address issues for assuring a long-term sustainability of the aquaculture sector in Europe. Through a concerted and dedicated approach, the platform aims to:

- enable the stakeholders to identify together the innovation challenges for their collective interests
- develop a strategic research agenda that responds to these challenges
- implement the results through effective dissemination and technology transfer mechanisms

NTNU was highly involved in the initiation of the aquaculture platform and has obtained central positions in the thematic areas of "Integration with the Environment" and "Knowledge Management". In 2009, EATiP was formally established as a non for profit organisation with its thematic areas and working groups, and the 3rd Stakeholder meeting was held in Gent, Belgium (3 February 2009). Contact: Yngvar.Olsen@bio.ntnu.no
www.eatip.eu

AQUACULTURE ENGINEERING – ACE

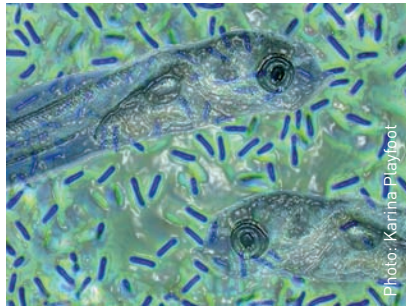
ACE is the new large-scale infrastructure for sea-based aquaculture engineering research and education. It was established as a shareholder company in 2008, with SINTEF (51 %) and NTNU (16 %) as its major owners. ACE will offer large-scale infrastructure, including plants, sites and personnel, for research, development and testing of technology and equipment. When ACE is completed it will consist of ten different experimental facilities for salmon, marine fish, shellfish and for testing new technology. In 2009, an agreement was signed with the aquaculture company SalMar for operating the salmon management test sites. The first sea cages with salmon smolt were set out at Tristeinen to be ready for monitoring and engineering research experiments in 2010. Contact: Alexandra.Neyts@ntnu.no
www.aceaquaculture.com



PROJECTS AND ACTIVITIES – FISHERIES AND AQUACULTURE

PROMICROBE

Seven international research partners study in this project microbes as positive actors for a more sustainable aquaculture. Through systematic gathering of novel information on microbial interactions in aquaculture ecosystems, new concepts are developed. These will be translated into new or adapted protocols to rear aquaculture organisms in a biologically stable and economically efficient way. Contact: Olav.Vadstein@biotech.ntnu.no www.promicrobe.ugent.be



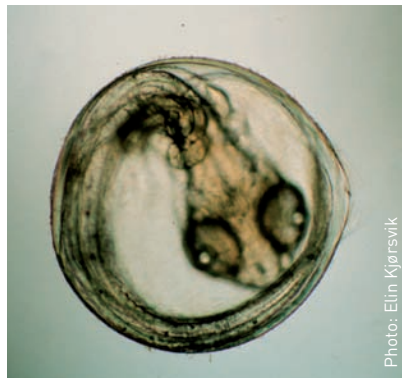
INTEGRATE

A project on integrated open seawater aquaculture, and technology for sustainable culture of highly productive areas was funded by the Norwegian Research Council. The researchers aim at developing technology for multi-trophic aquaculture, which will add to its economical feasibility and environmental sustainability. The project results are to contribute to the next generation of knowledge based policy and management tools for localisation and management of aquaculture in coastal waters. Contact: Aleksander.Handa@bio.ntnu.no



MARINE LARVAL AND PLANKTON TECHNOLOGY CENTRE

A new, interdisciplinary research twin "Gemini" centre was established, involving 6 NTNU departments and SINTEF Fisheries and aquaculture. Joint strategies and a strong working partnership among biological and technological disciplines make it possible to promote a high-level and robust research community within the field of marine larval and plankton culture. Contact: Elin.Kjorsvik@bio.ntnu.no



TECHNOLOGY AKVARENA

Technology akvARENA is a cluster of technology manufacturers, knowledge centres, organisations and aquaculture companies in Mid-Norway. It focuses on the development and use of technology in the fish farming industry. Through joint activities and initiatives, akvARENA aims at promoting closer cooperation and better relationships between the industry and research partners. Contact: Alexandra.Neyts@ntnu.no www.akvarena.no

AQUA-TNET

This European thematic network in the field of aquaculture, fisheries and aquatic resources management is funded under the European Commission Lifelong Learning Programme. It is running from 2008-2011, and aims at reaching a greater compatibility and comparability of the systems of higher education in Europe. The Aqua-tnet web portal contains data bases on mobility opportunities, course databases, and innovative teaching resources. Contact: Elin.Kjorsvik@bio.ntnu.no www.aquatnet.com

LARVANET

LarvaNet is an international network of researchers and producers working with fish larvae. It intends to integrate knowledge obtained in national and European research projects, as well as practical experience, in order to improve the quality of fish larvae used in aquaculture. It is funded through the European Commission COST action. Contact: Yngvar.Olsen@bio.ntnu.no www.larvanet.org

FEEDTAG

A telemetry system for the quantification of individual feeding behaviour in intensive fish cultures is being developed in the Feedtag project. The application of prototype transmitters allows the detection of feeding activity on fish in sea cages. The results will be used to improve feed utilization in intensive cultures. Contact: Jo.Arve.Alfredsen@itk.ntnu.no

NEW MARINE FEED RESOURCES

This Norwegian Research Council funded project involved both national and international institutions and was finalised in 2009. The work at NTNU focused on processing and characterisation of raw material from the red feed copepod (*Calanus finmarchicus*). This included feeding trials using diets containing this raw material as a potential new feed for aquaculture. Contact: Jan.Ove.Evjemo@bio.ntnu.no

MARITIME TRØNDELAG

The national project "Trøndelag i verden" examines social and historical aspects of the maritime activities in the mid-Norway region with an international perspective. Main focus is given to the period from 1814 to 2014. Through creating an increased awareness among public, industry and politicians, the study wishes to address the challenges and possibilities created by globalisation in the marine and maritime sector. Contact: Aud.Tretvik@ntnu.no

Marine Resources Processing

Raw materials for high value products

Process engineering and tailoring

Genetic resources and biopolymers

Energy efficiency

Design methodology for sustainable systems

Value chain management

Infrastructure

SINTEF Sealab

NTNU-SINTEF process laboratories at Gløshaugen

Biopolymer laboratory at Gløshaugen

MARINE RESOURCE PROCESSING

An increasing demand for high quality fresh seafood products, and the high competitiveness on industry level creates new requirements for higher efficiency and optimised design of equipment and systems. NTNU research teams have contributed significantly to innovations on automation, chilling, freezing and drying of marine raw materials through enhanced process engineering and tailoring solutions. In addition, a more efficient management of the supply chain is planned through a holistic approach, involving production processes and traceability systems.

Techniques within blue biotechnology make it possible to extract novel products of high value from marine biomass and macromolecules, and to isolate genetic resources and biopolymers of the oceans. Research groups at NTNU focus on a better exploitation of by-products and unexploited marine organisms, and on bio-prospecting, which involves the search for new exploitable (micro-) organisms .

FOOD FOR LIFE – NATIONAL TECHNOLOGY PLATFORM

NTNU is partner in the Norwegian part of the European Technology Platform, which was established in order to strengthen the research knowledge base in the Norwegian food sector, and hence its competitive ability. On a European plan, the Platform members worked on the development of a Strategic Research Agenda and Implementation Plan, describing how research, training, education and dissemination activities may fulfill the industrial needs. The joint requirements and priorities served as input into the European Commission's 7th Framework Programme and national research councils. Contact: Turid.Rustad@biotech.ntnu.no
www.f4l.np

PROJECTS AND ACTIVITIES – MARINE RESOURCE PROCESSING**COMPETITIVE FOOD PROCESSING IN NORWAY**

The Norwegian food processing industry is strongly involved in this national project, aiming at improving and securing a consumer oriented competitive marine food processing industry. This is to be achieved by developing technologies for more effective processing and resource utilization. The application of innovative, automated superchilling methods and



Photo: Tora Nordtvedt

procedures in the processing of fish filets was tested and evaluated.

Contact: Trygve.M.Eikevik@ntnu.no

CREATIV

A new national research program on energy efficiency, called "CREATIV", was established. It promotes the development and refinement of technologies for efficient industrial energy use and advanced processing, including automation of value added marine products.

Contact: Trygve.M.Eikevik@ntnu.no



Photo: Jan Ove Eijemo

STRESSCOD

The main objectives of the Stresscod project are to determine effects of handling stress combined with storage conditions on quality of farmed cod (*Gadus morhua*), and to determine which biochemical changes that are important for the resulting sensory quality. One of the aims is to determine which proteins and activities of selected proteolytic enzymes that are important for the quality properties and to correlate results from proteome analyses, sensory and instrumental quality evaluation, using multivariate data analysis, to identify biochemical markers of handling stress that may be used for prediction of product quality.

Contact: Turid.Rustad@biotech.ntnu.no



Photo: Olsvik (Codgen project)

EVENTS

AQUACULTURE EUROPE 09 CONFERENCE

Aquaculture Europe 2009 was organised by the European Aquaculture Society (EAS) and Nor-Fishing Foundation and was held at NTNU in Trondheim from August 14-17 2009. Through the theme "New research frontiers - novel approaches for evolving needs", the conference addressed the research challenges of a continuously developing aquaculture industry. It provided an international forum for discussion of the latest research achievements with close to 400 delegates from 51 countries.

Contact: Alexandra.Neyts@ntnu.no
www.easonline.org



Photo: Stéphanie Prades

AQUANOR 2009

Aqua Nor 2009 was arranged from 18 to 21 August in Trondheim, as the 16th international aquaculture exhibition. During the four days of the exhibition, meetings and seminars, AquaNor gathered exhibitors and visitors from a total of 59 different countries, a new record, which clearly marks the international aspect of the industry. NTNU presented its research activities jointly with SINTEF through fact sheets, slides, attractions, and daily demonstrations at the SeaLab centre.

Contact: Alexandra.Neyts@ntnu.no
www.nor-fishing.no

LARVI 2009

The 5th fish and shellfish larviculture symposium, Larvi 2009, was organised in Gent, Belgium, from 7 to 10 October 2009, with support from NTNU Marine Coastal Development. It brought together European and non-European stakeholders, reviewed the latest

progress in the sector, identified problems and explored avenues for future collaboration.

Contact: Yngvar.Olsen@ntnu.no
www.larvi.ugent.be



SEMINAR ON RESEARCH AND EDUCATION

With the aim of mapping the needs of the Norwegian marine sector within research and education, a seminar was organised by NTNU Marine Coastal Development. On 11 February, 45 representatives from the research community, the industry and the authorities discussed the trends and challenges related to the thematic areas and to cross-domain issues, such as energy, bioresources, sustainability and recruitment.

Contact: Alexandra.Neyts@ntnu.no

ENVIRONMENT AND CULTURE

Research on the relationship between environment and culture is of growing interest at NTNU. A series of seminars have been initiated to create a common meeting point for this research. NTNU Marine Coastal Development contributed through focusing on aquatic resources, where cross-disciplinary collaboration is considered necessary and therefore specifically encouraged.

Contact: Aud.Tretvik@ntnu.no



Photo: Geir Johnsen

EDUCATION

INTERNATIONAL MASTER OF MARINE COASTAL DEVELOPMENT (MACODEV)

MACODEV is a two-year international multidisciplinary Master of Science programme. It is especially designed to give the students a broad understanding of the complex interactions in the marine sector. The programme offers three specializations:

- Aquaculture
- Fisheries and Marine Resources
- Marine Biology and Biochemistry

In 2009, the Master programme was further developed and adjusted according to the existing Science Plan and the needs to the students. A continued increase in number of students was observed, both Norwegians and students from abroad (see figure 2). In addition those following the complete Master of Science program, individual courses within the programme have become increasingly popular among Master of Technology students.

Obligatoriske fag i masterprogrammet Marine Coastal Development

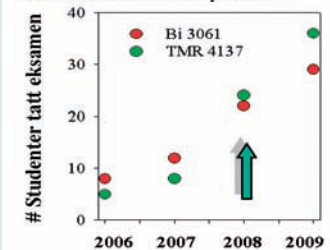


Figure 2: Number of students taking the two obligatory courses in the MACODEV programme



Photo: Fredrik Skoglund

PROJECTS AND ACTIVITIES - EDUCATION

“SETT SJØBEIN”

This national project is set up to increase recruitment, raise competence, develop a more efficient collaboration and better dissemination of new knowledge related to the marine sector. It is a partnership among Norwegian schools, training institutions and universities covering all educational levels within the marine sector. Sett Sjøbein is a three-year project, financed by the Norwegian Ministry of Fisheries and Coastal Affairs.

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UNIVERSITY TECHNOLOGY CENTRE (UTC)

The UTC “Performance in a Seaway” is a co-operation between Rolls-Royce Marine, MARINTEK and NTNU. The centre aims at promoting research with a commercial potential, in particular development of propellers, propulsion systems, ship designs, and various types of ship equipment.

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DEPARTMENTS AT NTNU INVOLVED IN THE MARINE STRATEGIC AREA, AND THEIR MAIN FIELDS OF COMPETENCE (in alphabetical order)

Archaeology and Religious Studies	Marine archaeology, maritime history, cultural heritage
Architectural Design and Management	Harbour architecture
Biology	Marine biology, oceanography, aquaculture, eco-toxicology, coastal ecology, behaviour
Biotechnology	Marine biopolymers, biochemistry, chemical engineering, processing, marine biotechnology
CeSOS	Centre of Excellence for Ships and Ocean Structures
Chemistry	Trace metal chemistry, metal pollution
Centre for Rural Research	Regional policies and development, coastal communities, resource use and management
Civil and Transport Engineering	Coastal engineering, infrastructure, geotechnique
Electronics and Telecommunications	Acoustics, underwater communication
Energy and Process Engineering	Processing engineering, energy and value chain management
Engineering Cybernetics	Aquaculture and fisheries cybernetics, instrumentation, telemetry
Engineering Design and Materials	Design methodologies, sustainability and simulation. Structural integrity, metal forming and composites
Geography	Coastal geography, societies
History and Classical Studies	Fisheries and aquaculture history
Hydraulic and Environmental Engineering	Water processing technologies
Industrial Economics and Technology Management	Value chain management
Interdisciplinary Studies of Culture	Cultural perspectives of coastal communities
Marine Technology	Marine constructions, marine systems and operations, fisheries and aquaculture technology
Mathematical Sciences	Bio-modelling, statistics
Museum of Natural History and	Marine archaeology, maritime history, cultural heritage, marine biodiversity
Archaeology	Organisation studies, work processes and management
NTNU Social Research, Studio Apertura	Marine optics
Physics	Food technology and manufacturing
Production and Quality Engineering	Fisheries politics, risk evaluations
Sociology and Political Science	Ecological based planning of coastal land use
Urban Design and Planning	

Annual report 2009



NTNU – Trondheim
Norwegian University of
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NTNU – The Norwegian University of Science and Technology.

The Norwegian University of Science and Technology (NTNU) in Trondheim represents academic eminence in technology and the natural sciences as well as in other academic disciplines ranging from the social sciences, the arts, medicine, architecture and the fine arts. Cross-disciplinary cooperation results in ideas no one else has thought of, and creative solutions that change our daily lives.

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