

MareLife

The Oslo regions's contribution to growth and innovation within marine life sciences in Norway

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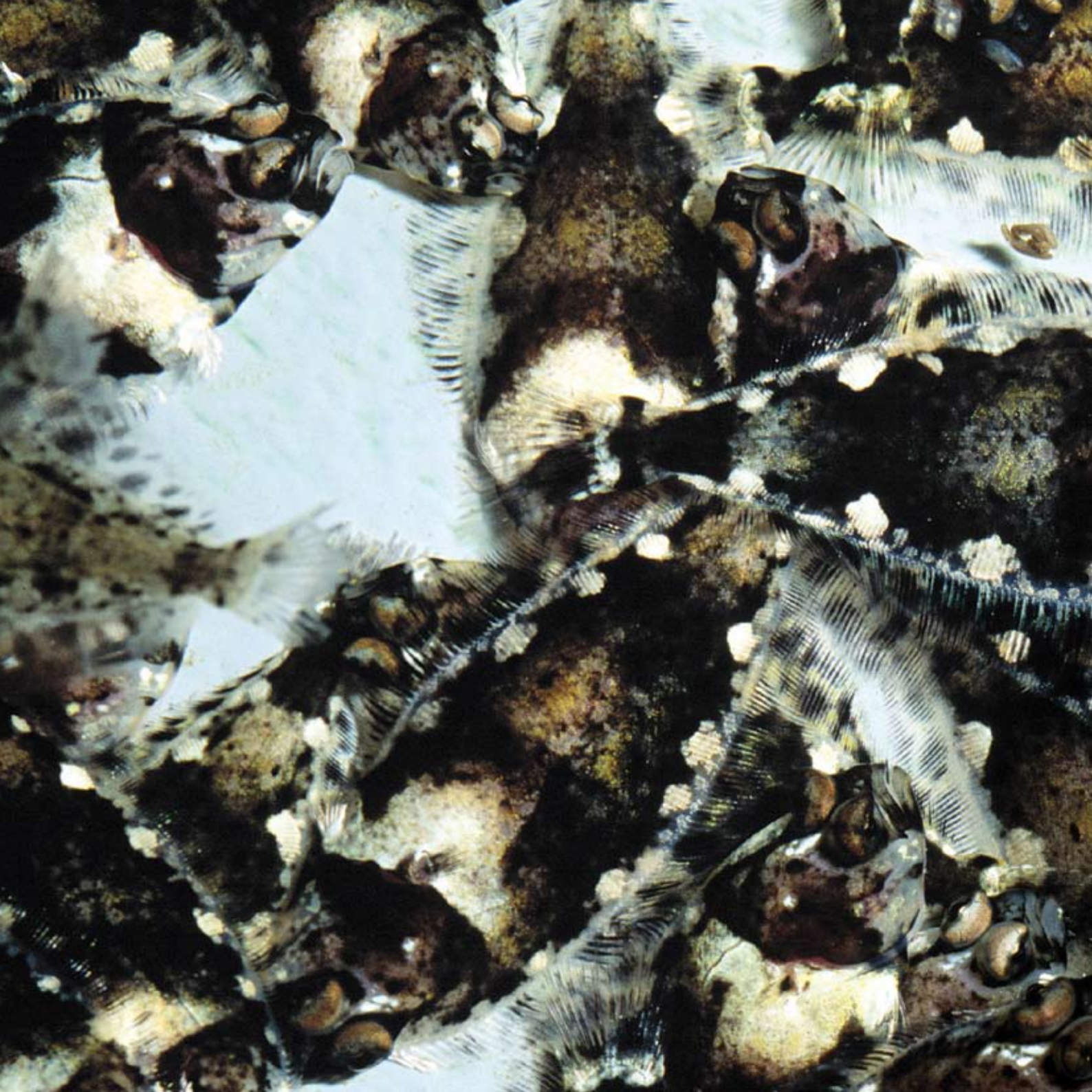
Preface

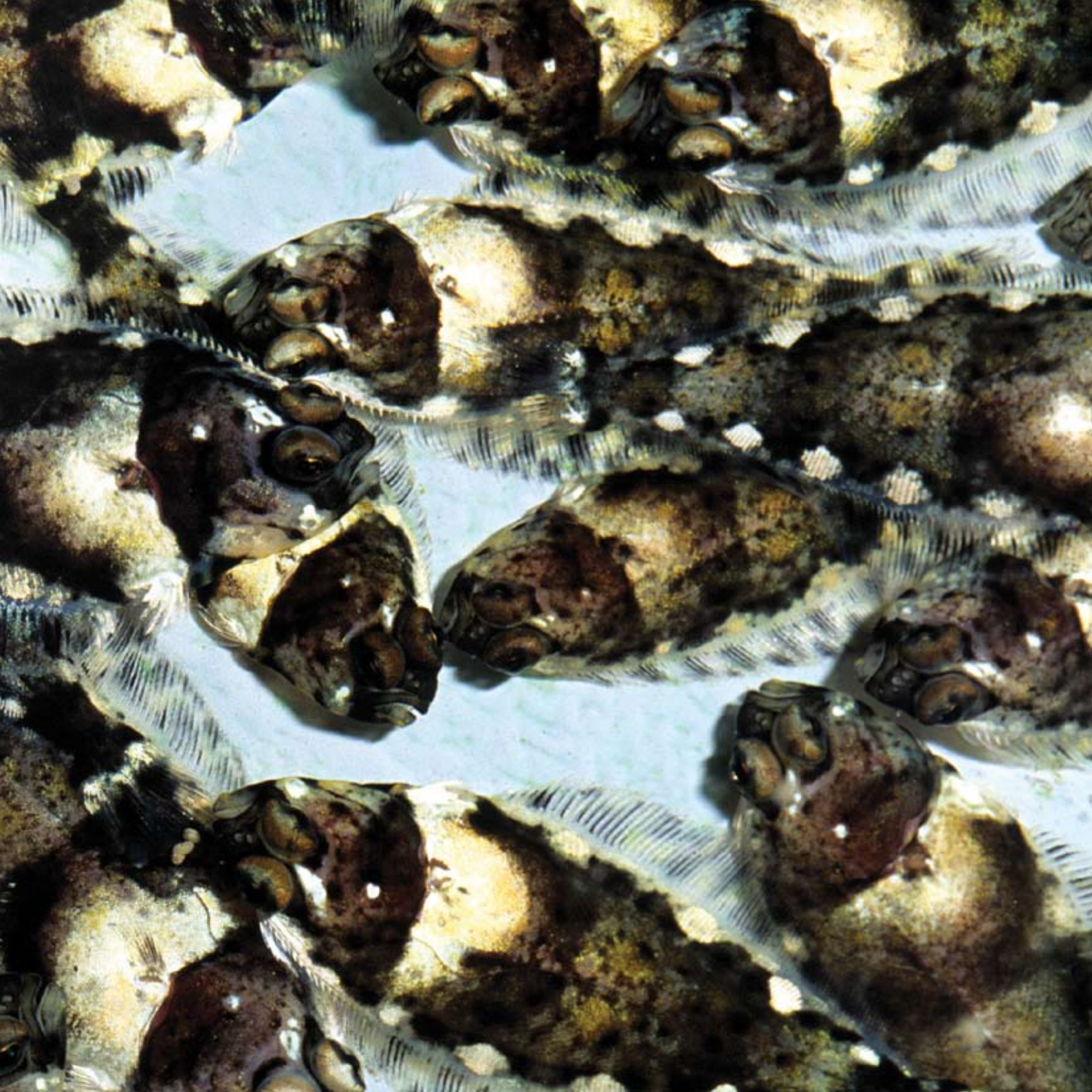
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Oslo Teknopol
September 2006

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1 Executive Summary

Global aquaculture has been growing tremendously over the last decade, now amounting to almost 40 million tons and a corresponding value of approx. 350 billion NOK (Source: FAO 2004). New biological insights are resulting in quantum leaps in breeding, fish health and sophisticated disease control systems – to the extent that we are experiencing a paradigm shift in aquaculture. Norway and especially the Oslo region are playing a pivotal role in this development, contributing with scientific and commercial innovations that are changing the whole premise of global aquaculture.

Since its humble beginning in the late 60's, early 70's, fish farming in Norway has grown into an export business currently exceeding NOK 15 billion yearly (Source: Seafood Council of Norway). The Oslo region was instrumental in launching

and implementing modern breeding and disease control systems. The region maintains an important position with internationally recognised R&D activities as well as commercial operations ranging from Canada and South America in the west to Japan and the Philippines in the east.

In this report, Chapter 3 (page 8) will detail this unrivalled regional expertise within marine life sciences:

- AKVAFORSK and AKVAFORSK Genetic Center AS with their breeding programmes and genetic enhancement achievements in a variety of species (page 10).
- University of Life Science at Ås and the CIGENE network leading the international marine genomes sequencing race (page 10).

- The Norwegian School of Veterinary Science and the National Veterinary Institute chairing the world fish health society (page 11).
- The University of Oslo pioneering the field of marine ecosystems studies and pursuing “new” fields like bioprospecting and bioenergy (page 12).

Challenges and opportunities are discussed in Chapter 4 (page 16): How international trade policy bottlenecks resulted from lack of memberships (e.g. EU), unfavorable regulatory regimes being implemented by the importing country (USA, EU) or international trading organizations (GATT, WTO), the use of instruments such as anti dumping measures and tax barriers seriously restricting the market access for Norwegian biomarine products.

However, this is balanced by recent events such as the acquisition by Pan Fish of world leader Marine Harvest which is of great importance to the strategic position of Norwegian aquaculture.

In chapter 5 (page 22) we present a SWOT analysis giving a schematic overview of strengths, weakness, opportunities and threats. In the final chapter (page 24) several courses of action are suggested with the purpose of reinforcing development, growth and international recognition of the biomarine sector. Main suggestions are to make a coherent marketing strategy, to assist innovation initiatives, as well as establish a state/private investment fund that will provide a real basis for a robust industry in the future. Finally, the appendix (page 54) provides a comprehensive overview of marine life sciences in the Oslo region.





2 Background & Objectives

In 2005 the Norwegian Government initiated a call for regional projects in Norway as a step towards its goal of Norway becoming one of Europe's most innovative nations by 2010. In the Oslo region this project was called the "Capital City Project" and Oslo Teknopol was appointed as project manager. Stakeholders and key players from the life science cluster were invited to contribute in the Capital City Project as a reference group for the sector. This reference group identified five areas where the potential for growth, innovation and business development were considered high. Responsibility for continuation of these projects has been placed with a collaborative network called Oslo Bio.

Oslo Bio aims to strengthen the cluster and contribute to long term growth within life sciences through marketing, initiating and facilitating development projects, and promoting international collaboration. Oslo Teknopol acts as the secretariat for Oslo Bio.

2.1 MareLife

Marine Life Sciences (MareLife) was one of the areas identified, by the reference group, as important for Norwegian life sciences. A project group was established with participants from:

- Akvaforsk
- GenoMar ASA
- Innovation Norway
- MedCoast Scandinavia
- Norwegian Bioindustry Association
- Norwegian School of Veterinary Science
- The Research Council of Norway
- University of Life Science/CIGENE
- University of Oslo/CEES and EMBIO

The objective of MareLife is to contribute to a long-term and strong biomarine sector with science, diversity and adaptability as its major characteristics. MareLife will identify and profile the strengths and opportunities of the Oslo region and foster collaborative networks between stakeholders from academia, industry and innovation centers. MareLife will connect the dynamic environment in the region to national initiatives and thus contribute to the accelerated national consolidation of currently fragmented R&D activities.

This document, including the comprehensive appendix, is designed to meet the objectives as described above, and act as the first step towards a life science-driven trend within the biomarine sector.



3 Introduction to marine life science in the Oslo region

3.1 A paradigm shift in global aquaculture

Global aquaculture has grown tremendously the last decades, now amounting to almost 40 million tons and a corresponding value of approx. 350 billion NOK. Currently the volume of landed seafood from wild catch is fluctuating at around 90-100 mill tons, amounting to approx 550 billion NOK first hand value. Per capita estimates and prognoses show that the increased demand from human population growth has to be met by aquaculture, since the corresponding growth from capture fisheries is likely to be incompatible with sustainable exploitation (FAO 2004).

However, with a more robust science-based approach to using marine resources such as the Oslo region's (CEES) multidisciplinary efforts, together with improved management and taxation regimes for wild resources, it is most likely

that capture fisheries could in the future contribute more than the current 100 million tons. Aquatic and marine genetic resources are virtually unlimited. This diverse and renewable gift from nature, when combined with sustainable life science assisted cultivation, offers a clear cut solution filling the gap between supply and demand for food in all markets. However, most operators, especially in aquaculture, are still working with medium to small margins, high investment and operation costs, and high risks due to inferior seeds and disease problems.

New challenges, but also opportunities, have been exposed by the recent enforced focus on food safety issues. The increasing demand for aquatic proteins together with stronger customer and industry focus on food safety require new solutions to improve both production efficiency and quality assurance systems. These are challenges which can be met with contem-

porary life science tools to improve disease control systems, and advance and optimise breeding and feeding regimes, together with wild stock management. Furthermore, genetic traceability, molecular pathogen screening and other food safety actions can also be applied. The current rapidly developing field of fish genomics with Pufferfish (*Fugu rubripes*) and model fish (e.g. Zebrafish, *Danio Rerio*) genome sequence drafts and industrial fish (e.g. tilapia, salmonids, cod, shrimp etc) targeted for completion in the near to mid-term future (2-5 years), will provide substantial new biological insight. The resulting quantum leap in breeding and various enhancement regimens and sophisticated disease control systems in fish will in effect lead to a paradigm shift in aquaculture.

Norway, and especially the Oslo region, has played a pivotal role, both at the academic and commercial levels, in changing the premise of global aquaculture. This has especially been the case when it comes to the industrialisation of major species. The main reasons behind this impact have been pioneering the implementation of critical cost-cutting solutions. These have included advanced breeding, disease control systems, feeds and feed ingredient management systems together with life cycle and larvae culture studies for culturing new species in captivity. Research and industrialisation has embraced important species such as salmon and trout, halibut, cod, turbot, wolf fish, sea bass, carp, tilapias, shrimp and a variety of shellfish.

3.2 The Oslo region: Europe's aquaculture Capital

Norwegian aquaculture is a real success story, especially in terms of return on R&D investment, with salmonids as the pioneering species since industrial farming began in the early 1970's. The Oslo region played a critical role in the launch and still maintains its world-leading position in terms of both R&D and implementation of modern breeding and disease control systems.

From its humble beginnings in the late 60's and early 70's, fish farming in Norway has grown into an export business currently exceeding NOK 15 billion per year (Source: Seafood Council of Norway). While the coastal industry has had to weather some turbulent decades, the robust biological and fish farming knowledge base has helped Oslo-based aquaculture make huge strides in recent years. Today Oslo's aquaculture research organisations and biotech companies play a key role in research projects and industrial initiatives from Canada and South America in the west to Japan and the Philippines in the east.

From 1987 to 2004, annual production volumes at Norwegian fish farms increased ten fold; in the same period, the overall use of antibiotics decreased by fifty times (from fifty metric tons per year to just over one ton). The Norwegian Research Council has acknowledged the tremendous potential of sustainable aquaculture, and the associated challenges. Hence it was no surprise that the Council's very first foresight proj-

ect in 2003-04 concerned aquaculture, and they have granted NOK 77-105 million annually from 2005 to 2010 to aquaculture research (Source: The Research Council of Norway). Norwegian and regional based R&D institutions are also aggressively pushing for increased aquaculture research in the EU's 7th framework programme.

The Oslo region is home to a number of leading aquaculture and aquamedicine research communities. There are two hubs of R&D and commercialisation centred around the University of Oslo and Norwegian School of Veterinary Science, both in Oslo, and the University of Life Sciences at Ås, 30 km outside Oslo.

3.2.1 Akvaforsk and Akvaforsk Genetics Center

Breeding programmes and outstanding genetic enhancement achievements in a variety of species nationally and internationally

Since 1960, AKVAFORSK (Institute of Aquaculture Research) has been one of the world's leading research institutions in developing selective breeding programmes for aquaculture species. Its research into breeding and genetics, feed and feeding, product quality and marine species is at the top of the field, and the nearly 100 staff, have carried out ground-breaking work with 26 species in 35 different countries. AKVAFORSK is co-located with the University of Life Sciences in Ås, Norway, and collaborates closely with research teams at the Aquaculture Protein Centre (APC) and CIGENE.

AKVAFORSK established AKVAFORSK Genetics Center (AFGC) in 1999 to commercialize breeding programmes on a worldwide basis. The combination of AKVAFORSK's knowledge and the genetic center's project work has produced phenomenal results. A breeding program for Atlantic salmon resulted in potential savings worldwide of USD 200 million in feed costs for global production of one million tons. A similar programme on tilapia led to a growth rate in the target population of almost two times the original after only five generations. AFGC is also a leading provider of applied genetic improvement services to aquaculture industries worldwide, serving large-scale selective breeding programs for a variety of species.

The blue-green food alliance

For the purpose of strengthening Norwegian research and innovation within the seafood sector, the Ministry of Fisheries and Coastal Affairs has recently initiated a consolidation of AKVAFORSK, Fiskeriforskning, Matforsk and Nofima AS into one entity, with the working title Nofima AS. This blue-green food alliance will play an important role in the future.

3.2.2 The University of Life Sciences

Together with the CIGENE network, leading the international marine genomes sequencing race

The Ås community combines research groups within the University of Life Science and the AKVAFORSK research institute, which specialise in breeding programmes, fish feed, and prod-

uct quality. The Aquaculture Protein Centre is a national centre of research excellence located at Ås, but also involving research groups at the Norwegian School of Veterinary Science and throughout the country. Its research into PAM (Protein and amino acid metabolism), GH (gut health) and FIP (feed ingredients and processing) is funded by NOK 100 million in grants annually from 2003 to 2007 (Source: Research Council of Norway).

CIGENE is a functional genomics centre, hosting a national high through-put genotyping and sequencing facility sponsored by the Norwegian Research council's functional genomics program, FUGE. CIGENE aims at contributing to a deep causal understanding of complex genetic characters in fish, plants and animals for scientific and commercial exploitation based on an integrated genetics approach. This group is a world leader in research into the fish genome, and work closely together with a number of international research communities in Canada, USA, UK and France. Cooperation with Genome Canada has produced a prestigious project aiming at sequencing the genomes of all salmonids (cGRASP: Consortium for Genomic Research on All Salmonids Project).

3.2.3 The Norwegian School of Veterinary Science and The National Veterinary Institute

Chairing the world fish health society

From the advent of national and international industrialised aquaculture, The Norwegian School of Veterinary Science (NSVS) and The National Veterinary Institute (VI) have been providing substantial inputs into improving one of the single most important measures for cost efficient aquaculture - disease control. They also developed to proof of concept stage the world's first molecular vaccine against the most aggressive virus in international aquaculture, ISAV. The vaccine was developed together with GenoMar and subsequently purchased by the leading marine pharma company, Intervet. NSVS co-operates closely with VI to study fish aquamedicine with the emphasis on fish pathology, immunology, epidemiology and vaccinology. A current major initiative from NSVS is a private public partnership vaccine research project, FishVac. This aims to develop the molecular vaccines of the future which will offer full protection without the current adverse side effects.

3.2.4 University of Oslo

Pioneering marine ecosystems studies, pursuing “new” fields of bioprospecting and bioenergy

By international standards, the University of Oslo (UiO) together with its collaborating institutes and corporations represents a very strong life science environment, reflected in several centers of excellence and through an inter-faculty steering board called EMBIO. EMBIO is a steering committee appointed by the University of Oslo to stimulate and coordinate research in molecular biology, biotechnology and bioinformatics, one of the priority areas at the university. A group of specially appointed scientists has been given funding and authority to promote this field and coordinate facilities for the benefit of researchers across traditional departmental borders from medicine to chemistry. EMBIO's activity is closely linked with the national program for research in functional genomics FUGE.

The milieu centered around the University of Oslo is leading the study of marine ecosystems, and is pursuing fields such as bioprospecting (systematic search for exploitable processes and substances) and bioenergy.

Marine ecosystems: the alpha and omega of sustainable sea harvesting and aquaculture

The Centre for Ecological and Evolutionary Synthesis (CEES) at UiO chairs an international network called MarEGene. The MarEGene network includes several marine research units around Skagerrak, and their collaboration projects target

the bio resources with by far the largest potential, such as marine wild stocks and ecosystems. CEES also has a strong interest in the North Sea, Norwegian Sea and Barents Sea, with the objective of studying and mapping population structures and dynamics, along with multi-species interplay through the integration of several scientific fields and technologies such as ecology, molecular genetics and population biology.

This scientific activity is targeting northern areas of Norway, currently one of the highest priority issues in the Norwegian Ministry of Foreign Affairs due to the conflicting agenda of politics, petroleum resource exploitation, and the delicate balance between the latter and the sustainable management of the abundant but vulnerable marine bioresources. MarEGene/CEES is setting the international standard by using a multidisciplinary scientific network approach in order to understand and predict the dynamics of these vital systems upon which the world depends. NIVA is also adding substantial competence to this field through its long standing research into coastal habitats, limnology, marine ecology and environmental impact on these systems.

3.2.5 The next blue waves

The ongoing industrial restructuring and consolidation of both Norwegian and international aqua and marine culture together with the rapid developments in genomics and bioprospecting is paving the way ultimately for the sustainable exploitation of aquatic and marine resources. The

Norwegian industry spans from affordable fish to high-end market branded products targeting exclusive restaurant dishes, from the fillet industry to by-products such as silage, from meal and oil to refined products and molecules to be used in a wide area of fields including medicine, food enrichment, the process industry and research. This vibrant life science-driven development is also paving the way for the next “blue waves”, notably bioprospecting, single cell-based production of substances and energy, e.g. micro algae based concerted production of food, feed, ingredients like astaxanthin and last, but not least, the ultimate fuel, hydrogen.

Norway, with the Oslo Region in the lead, is internationally in the forefront of many of these emerging fields. Both academia and biotech companies are involved, notably within:

- Marine genomics: CIGENE and Norwegian University of Veterinary Sciences through the cGRASP project (sequencing the salmon genome)
- Breeding and genetic enhancement systems in a series of aquatic species (AKVAFORSK and GenoMar)
- Molecular vaccinology and disease control systems (the company Pharmaq and the Norwegian School of Veterinary Sciences through FishVac in collaboration with the company Intervet)
- Genetic traceability (GenoMar, AKVAFORSK and CIGENE)
- Microalgae and hydrogen technology (NIVA)
- Nutrition, novel feed and feed ingredients (Aquatic Protein Center, University of Life Science and Norwegian School of Veterinary Sciences)
- Bioprospecting (Biotech Pharmacon)





4 Challenges & Opportunities

4.1 Framework & Environment

Norwegian aquaculture: a business with both challenges and opportunities

The current export value of Norwegian aquaculture (15 bill NOK) is mostly made up of salmonids, but species such as Norwegian white halibut, Atlantic cod, Wolf fish and various shell fish are increasing their share of the total (Source: Seafood Council of Norway). Fishery based aquaculture, using marine species from wild catch and feeding the fish up to market size, will increase in coming years. By value, Atlantic cod is expected to become the next big wave from Norway. Norwegian expertise in aquaculture, breeding, feeds, disease control, management, technical solutions and equipment is enjoying undoubted success on the international export market, via technology, expertise, gear sales and exports as well as through internationalisation of own commercial operations.

Norwegian aquaculture has been through a series of dramatic ups and downs, the downs mainly related to struggles maintaining margins (product price versus production costs), market bottlenecks and market exclusion due to heavy

taxation or anti-dumping measures. Another obstacle is related to the fact that once Norway moves fish raw material into value added products, it faces severe import taxation in the international marketplace, not least in the EU, but also in the USA. This also applies to wild catch fish resources. To illustrate this with figures:

If Norway made value added products out of most of its fish and at the same time was able to communicate to the market the overall superior quality of its non-refined raw material, the export value of the country's aquaculture and wild catch would have multiplied manifold the current values of approx. 32 bill. NOK early (Source: Seafood Council of Norway).

Over the last year, however, the sector has been both booming and blooming, characterised by substantial consolidations including the acquisition by Pan Fish (Pan Fish and Fjord Seafood) of the world's largest operator, Marine Harvest, making Pan Fish the largest international player. In fact this is the biggest "buy home action" since Dutch giant Nutreco acquired the Norwegian flagship, Hydro Seafood, and renamed it Marine Harvest. Pan Fish headquarters will be located to Oslo.

In several respects, the Marine Harvest acquisition and recent events in the biomarine sector are of great importance to the strategic position of Norwegian aquaculture.

Firstly, the sheer size of this one single player in itself gives Norwegian aquaculture sufficient market power to compensate for the long-standing challenges in the EU market and elsewhere. Secondly, this also potentially strengthens Norwegian powers of innovation. Having such a world player with enormous financial strength and influence based in Oslo, will facilitate efforts to create private-public partnerships in science-driven innovation through instruments like SFIs and large scale investment funds.

The latter also taps into the Norwegian state's considerable financial resources through the petroleum investment fund which is among the world's largest. Finally, recent consolidation will add a new dimension to our biomarine sector, which formerly consisted of only SME's in addition to supply industries. Moreover, "blue" biotech companies and R&D groups will benefit from having larger and more demanding customers.

In essence the above challenges and inherent opportunities may be summarized as follows: International trade politics bottlenecks related to lack of memberships (e.g. EU), unfavorable regulations implemented by importing countries (USA, EU) or international trade organizations (GATT, WTO) using instruments such as anti-dumping measures and tax barriers are seriously

restricting the market access of Norwegian biomarine products.

It is clear from history and the events of recent years that there is room for considerable strengthening of both the market and marketing professionalism of the Norwegian biomarine sector. This is related to communication, branding or lack of differentiated branding, documentation, quality control and traceability. Also, in addition to competence and experience in marketing and branding, it takes financial strength when aiming to establishing a robust series of branded products in the international highly competitive marketplace. There is probably also a lack of aggressive strategies aimed at addressing and accessing alternative and new geographic markets.

The biomarine sector is to some extent suffering from the failure to address the emerging competence based markets rather than the traditional raw material markets. There are also hurdles to establishing more science-based companies that will address these new markets. Moreover, acquisition or the overseas establishment of Norwegian flagships may cause a value drain in the biomarine sector. However, the "buy back" of Marine Harvest and public listing of Cermaq will provide increased international standing.

The greatest opportunity resides in the possibility to remove some of the obstacles through political incentives and changes in general framework for business and commercialization.

4.2 Science & Technology

Establishing a new competitive advantage - filling the “knowledge gap”

The biomarine sector is seeing the need to regain the science and technology based competitive edge that Norway used to have. Today science and technology are more or less exported or sold out either through IP “leak” or through emigration of high value or competence industries.

Some proposed key issues to address the above needs might be as follows:

- New, science-based solutions for feed and feed regimes (i.e. micro-algae based). These are relevant due to the fact that the rapidly growing aquaculture carnivore species- based industry is depleting vulnerable marine resources (lipids etc).
- New vaccine and disease control systems with the same or even better protection but without current side effects or adverse effects. Moreover, develop new genetic enhancement systems assisting traditional breeding regimes through the strengthening of genomics and functional genomics efforts.
- Assist marketing efforts, support and protect differentiated brands, and capture new markets, as well creating higher margins through life science-based quality control, documentation and traceability systems, so-called “DNA branding”.

- Clear scientific base for accelerating the culturing of new species, the bottlenecks being larvae culture, life cycle control, breeding, feeding, management, disease control. Also support the scientific and explorative activities driving the marine bioprospecting field to find new products and target an even wider array of products for employment in food, food enrichment, feed ingredients, pharma, process industry and laboratory techniques.
- Finally, there is a substantial need for increased knowledge about our most important resource, the marine ecosystems, and to improve the quality of management regimes.

4.3 The Oslo Region as innovation motor in a Global Context

The Oslo region can take the lead through a number of actions:

- Mobilise scientific flagship projects (e.g cGRASP, FishVac, MarEGene etc), as well as stimulating the initiation of new ones. Facilitate international collaboration by maximizing the attraction of such projects to leading foreign scientists, life science companies and financing sources.
- Speed the innovation rate through the fostering of holistic networking and collaboration between stakeholders such as leading industries, tech companies (solution providers),

authorities, public sector innovation and grant systems such as The Research Council of Norway and Innovation Norway, academia, Technology Transfer Offices, venture capital and other capital resources.

- Identify and enhance the main success factors of common interest to the stakeholders in the biomarine cluster, society and government. Optimise political premises and general frameworks and strengthen the reputation and perception of the biomarine industry among consumers. Increase levels of professionalism, especially in terms of quality control and marketing.
- Achieve consensus, supported by comprehensive historical benchmarking, that the only road to long-term success is long-term planning with the emphasis on robust R&D efforts and adequate risk capital.

This latter fact is to some extent a cultural challenge to the Norwegian society. Hence, we would propose maximum exploitation of the state's capital strength, both for R&D support and for the establishment of intelligent and robust risk capital systems/funds. In the preparatory process of developing a national master plan for innovation, we need to identify the weak points and the competitive advantages of our innovation structures, powerful state capital strength, branding strategy etc., and address them through efforts and measures such as the initiatives of the Forum

for Innovation and the Biomarint Forum. These organisations have proposed the establishment of private/state based investment funds and stimulation of a long-term effort to establish robust internationally competitive knowledge-based industries. These suggestions can in turn fulfil the current goal that Norwegian industries' or the private sector's share of R&D investment moves to or above OECD standard, perhaps even tripling within, approximately 10 years from now. Only when we have employed and experienced the effects of the above measures can we expect the private sector to invest in R&D on such a scale, since by then they would have established a culture with its own interests and need to carry out the long term R&D.

Knowledge and capital are mutually dependent
Capital alone can not create long-term values without the production of science-based ideas and inventions. Correspondingly, there is no innovation without adequate long term intelligent risk capital being available to commercialise ideas. One obstacle to long term risk taking, not only in Norway but also internationally, is the lack of adequate instruments to validate intangible assets such as knowledge and leading scientific personnel. In the current post-industrial society where the idea production and invention rate is very high and the life span of inventions is getting shorter and shorter, there is no doubt that the value of a creative scientific group with adequate incentives has a higher value than a simple invention in the field.

It should also be noted that whilst capital is supplied with accurate tools to validate market values or future estimated revenues from inventions, there is as yet no such validation system available for intelligence and creativity.

While waiting for such tools or standards to be developed, Norway can better exploit its state capital strength for R&D support and risk capital through the establishment of risk reduction private-public investment funds like Argentum, but on a much higher scale. In a paper from the three parties forming the new Norwegian coalition government in 2005, it is stated that the government will look into the possibilities of establishing a state-owned investment fund for the marine sector (Source: Soria Moria paper 13. October 2005).

The Oslo region is equipped with both contemporary R&D and capital management environments able to absorb and manage new scales of funds effectively. They are also able to take the lead in developing a paradigm shift in innovation and an increased innovation rate, ultimately fostering science and commercialisation through risk capital interplay with private sector.

The biomarine science sector, with the Oslo region in a pivotal role, could act as an excellent model for piloting such an innovative paradigm shift. Although recently blessed with considerable consolidation and public listing of both traditional aquaculture as well as blue biotech companies, the sector is still deficient in science-based industries and hence correspondingly low in its own R&D efforts. A drastic improvement could be achieved by increasing the public grant support for science and interfacing new innovation instruments such as the Centres for Research-based Innovation, Centres of Excellence, Norwegian Centres of Expertise and Technology Transfer Offices. Some of these measures are also included in the “Grand Design” of Biomarint Forum.

Combined with sustainable production and wild resource management systems and enhanced professionalism of marketing: communication (differentiated branding improved documentation, quality control and traceability) the future of the Norwegian biomarine sector would seem bright, with an excellent opportunity to maintain its international leadership.



5 SWOT

Strengths

- Academic strength
- Formalized scientific collaborative constructions at regional, national and international levels
- Company HQs
- Founding processes, i.e. easy access to resources, such as know-how, finance, network
- Capital City
- Infrastructure
- Environment
- Attractive for science interaction abroad
- Projects and public funding well connected
- Venture Capital firms
- Science Parks / TTOs

Opportunities

- Strong R&D
- Synergies between Blue and Green Bio
- Recognized as a key player
- Great prospects for growth and innovation
- Attracting (international) knowledge, competencies and finance
- Cluster development
- Collaboration between academics, businesses and financial players

Weaknesses

- Distance to operational facilities
- Lack of competent capital
- Lack of risk relief instruments
- Seed capital restrictions
- Business Angels
- Too few industrial engines
- Lack of entrepreneurship culture and commercial facilitators
- Lack of instruments to validate intangible assets such as front scientists
- Shortage of managerial talent and competencies
- Lack of branding strategies

Threats

- Political Agenda
- Regional Policy
- Innovation Policy
- Difficult Market Access
- Not EU member
- WTO
- Customs barriers to value added products
- Vulnerable branding strategy
- General framework conditions such as taxation, Permits, Incentives, IPR
- Innovation Structure & Dynamics
- Losing ground to international players
- Emigration and “brain-drain”
- Export of our competitive edge



6 Action Plan

To reinforce the efforts made in this document to highlight regional strengths and raise important issues related to marine life sciences, the reference group of MareLife and the authors would like to propose several actions and steps. The steps are suggestions towards a national consensus-based decision being made on strengthening the marine life science sector.

Marketing the marine life science sector and “scientific flagships”

Make a coherent national effort to market the biomarine sector and scientific flagships internationally. The first steps of identifying our strengths are outlined in this document. A parallel step would be to identify the most important target groups, nationally and internationally, as well as to identify important international events and exhibitions for the sector. In addition, establishing regional and national meeting places where companies, R&D and investors can meet will generate new innovations and collaborations in the future. Moreover, exploiting life science tools to support traceability, branding and brand protection will also contribute to growth, development and successful branding.

Assist the general national R&D and innovation initiatives – advise on core strategic issues

Allocate more resources to both basic and applied research. More resources to R&D will ensure and maintain innovative and robust long term development. Both basic and applied research will pave the way for potentially new quantum leaps in existing commercial activities and create entirely new commercial activities.

Both decision makers and the biomarine environment itself need to look into the development of new biomarine fields such as targeting new species (e.g shellfish), as well as accelerating fields such as bioprospecting, algae technology and bioenergy. Aquaculture is more than salmon and cod and we will need to enhance the professional skills involved in marketing the products in our biomarine industry.

Finally, establishment of a state/private (50% state risk reduction) investment fund on the scale of NOK 100 billion will significantly strengthen innovation structures and provide a real foundation for a robust and science-based biomarine industry in the future.



7 Appendix: An overview of marine life sciences in the Oslo region

This appendix contains an overview of the Marine Life Science sector in the Oslo Region.

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- B)** University & institutional projects
- C)** SkatteFUNN
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- F)** Financial environment
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Below follows an outline and explanations of the content in this appendix.

The main institutions in the Oslo region relative to the Marine Life Science sector are listed in the first section. It contains a description and the number of man-years and expenditures to be able to compare the institutions. Most of the data comes from NIFU STEP and their Institute catalogue, and the rest from Norwegian Social Science Data Services. The abbreviations are used in chapter 2 - the research projects.

The research projects are divided into five broad categories to make it easier for the reader to find what they are looking for. The categories were chosen in collaboration with the Research Council of Norway (NFR). The fields of research categories are Aquaculture related, Fish health, Marine biology, Marine molecular biology, and Other. The 'local institution' column gives the name of the most relevant institution(s) in the Oslo region responsible for or managing the different projects. The 'duration' column is based on information given from the respective institution or the projects web sites. Since NFR is financing a majority of these projects, it was reasonable to include a column with the NFR funding. The amount is given in NOK since this is most relevant for this paper's target group.

The vast majority of the research projects do not have their own project web sites, so whenever possible the projects are being linked to sites where it is possible to get more information, either within their respective institutions or to the NFR funded Norwegian Research Data-

base (NFI). Some of the projects have just been approved and cannot be located on the web; these will be linked to the parent organisation. The final list is sorted by the ‘field of research’ categories, then by the ‘local institution(s)’.

“SkatteFUNN” is a scheme for tax deduction of R&D expenses in all enterprises, which are eligible for Norwegian taxation. The scheme is administered by The Research Council of Norway with assistance from Innovation Norway. The list in this appendix contains approved projects and their respective companies within the Marine Life Science sector from 2002 until the end of 2005. It should be noted that the projects may be terminated or that the firms may no longer exist, at least in their original form. For more information, see www.skattefunn.no.

For the list of commercial companies within Marine Life Sciences, the categories used in the field of operation are in accordance with the primary and secondary categories used in NorBio-Base.no – a database over Norwegian Biotechnology companies (Source: Innovation Norway and The Research Council of Norway).

The companies which cannot be found in NorBio-Base.no are categorised and given a description based on their respective web page, and placed in the framework of the database. Qualifying companies must be related to the Oslo region and to the Marine Life Science sector.

The organisations sheet consists of a list of the most relevant industry organisations, competence centres, national platforms, and other links such as web portals, publications and databases. The organisations are given a description and a relevant web page.

Following organisations is a section providing an overview over the financial environment for institutions and companies. It contains a list of public support systems, investment firms and science parks/TTO’s especially relevant for researchers and companies in this industry. A list of strategic initiatives and documents follows the financial environment overview. The list is divided between documents specific to the Marine Life Science industry and documents that are more general, but still relevant to this industry.

Finally, it should be noted that this appendix is put together in the most comprehensive and coherent way possible considering the time frame and the information available at the time. Some information is still lacking, and the authors apologise for any incorrect information and/or for any entities lacking in this appendix.

A) Main institutions with abbreviations

ABBREVIATION / URL	NAME / DESCRIPTION	TOTAL NO R&D PERSONS	TOTAL EXPENDITURE	LOCATION
AKVAFORSK www.akvaforsk.no	Institute of Aquaculture Research The goal of AKVAFORSK is to provide and publish knowledge about aquaculture, contributing to a strong, profitable industry and to a sustainable global food production.	50-99	67 mil. NOK (2004)	Akershus
FNI www.fni.no	Fridtjof Nansen Institute Research connected to Fridtjof Nansen's interests, and the management of Nansen's home "Polhøgda".	10-24	22 mil. NOK (2004)	Akershus
MATFORSK www.matforsk.no	Matforsk Norwegian Food Research Institute MATFORSK's primary goal is to contribute to increase the competitiveness in the food industry through food research and development at an internationally recognised level.	50-99	121 mil. NOK (2004)	Akershus
NFR www.forskningsradet.no	The Research Council of Norway NFR has an annual budget of more than NOK 5 billion and plays a central role in Norwegian research. The mandate of the Council is to promote and support basic and applied research in all areas of science, technology, medicine and the humanities.	NA	NA	Oslo
NILF www.nilf.no	Norwegian Agricultural Economics Research Institute To contribute to a high level of knowledge in society and a solid decisionmaking basis for its customers through a combination of research, studies, documentation and consultancy about economic conditions in agriculture, industry associated with agriculture and the food sector.	25-49	42 mil. NOK (2005)	Oslo
NILU www.nilu.no	Norwegian Institute for Air Research To explore technical, economical, hygienic and other environmental issues in connection with air pollution and the purification of polluted air.	100-299	107 mil. NOK (2004)	Akershus

Main institutions continued

ABBREVIATION / URL	NAME / DESCRIPTION	TOTAL NO R&D PERSONS	TOTAL EXPENDITURE	LOCATION
NIVA www.niva.no	Norwegian Institute for Water Research To carry out R&D and studies on the use and preservation of water and disseminate information. This work is done using longterm perspectives with emphasis on multidisciplinary issues.	100-299	152 mil. NOK (2004)	Oslo
NVH www.veths.no	The Norwegian School of Veterinary Science NVH is the sole institution educating veterinary surgeons and veterinary nurses in Norway.	195*	321 mil. Nok (2005)	Oslo
SIFO www.sifo.no	National Institute for Consumer Research To generate, administer and disseminate knowledge for consumers through research, experiments and studies, with special emphasis on practical results which can support consumers' position in the market, increase public authorities' knowledge about important consumer issues and influence the improvement of goods and services.	25-49	36 mil. NOK (2005)	Oslo
UiO www.uio.no	The University of Oslo UiO is Norway's largest and oldest institution of higher education.	2990*	4,5 billion NOK (2005)	Oslo
UMB www.umb.no	The University of Life Sciences UMB is a leading international centre of knowledge, focused on higher education and research within environmental- and biosciences.	436*	715 mill. NOK (2205)	Akershus
VI www.vetinst.no	National Veterinary Institute Norway's key veterinary scientific diagnostic institution and the agricultural authorities' most important advisory agency for the control of disease in animals, fish and game. The laboratory is also a national centre for fodder and food microbiology/chemistry.	50-99	207 mil. NOK (2004)	Oslo

* Educational and Research Positions

B) University & institutional projects

AQUACULTURE

PROJECT HEADING / INSTITUTION & DURATION / CONTACT & COLLABORATION / NFR-FUNDING

Reduction of malformations in farmed fish species (FINE FISH)

AKVAFORSK 2004 - 2008 EU's Sixth Framework Programme. Funding: 3,02 mill Euro. www.akvaforsk.no

Quality and processing of farmed cod

AKVAFORSK This project is developing methods and technologies about how to improve attributes of fish products (based on wild and farmed) like smell, tast, colour, consistence, durability, etc. The project will enable design of new fish products and functional food. www.akvaforsk.no

New techniques to achieve more cost efficient selective breeding for improved consumer acceptance of aquaculture products

AKVAFORSK 2006 - 2009 Project manager: Kari Kolstad. Financed by NFR. Total funding from NFR: 13,4 mill. NOK. www.akvaforsk.no

Improved methodology for analyzing survival data in fish breeding programs

AKVAFORSK 2003 - 2006 Project manager: Ingrid Olesen. Financed by NFR. Total funding from NFR: 2,7 mill. NOK. <http://dbh.nsd.uib.no/nfi/rapport/?keys=28564>

Halibut breeding. How to improve halibut farming by controlling the sex of Atlantic halibut; towards production of monosex all-female stocks

AKVAFORSK www.akvaforsk.no

Feed for cod farming. The project is developing efficient feed for cod farming, providing growth, normal development and quality

AKVAFORSK www.akvaforsk.no

Fatty acids in feed. The project is studying new cost efficient ingredients which are bio-active

AKVAFORSK www.akvaforsk.no

Energy utilization in fish: consequences for the economy and environment

AKVAFORSK 2002 - 2006 Project manager: Barbara Grisdale-Helland. Financed by NFR. Total funding from NFR: 12,7 mill. NOK. www.akvaforsk.no

Carp. Design of improved Carp breeding program

AKVAFORSK www.akvaforsk.no

Implementation of TACs in the North Atlantic Fisheries

NILF 2006 - 2007 Project manager: Stig Strandli Gezelius. Financed by NFR. Total funding from NFR: 2,27 mill. NOK. www.ifm.dk/projects.html

Ecosystem Approach for Sustainable Aquaculture (ECASA)

NIVA 2004 - 2008 From Akvaplan-niva AS. EU's Sixth Framework Programme. 16 partners from 13 member states. Funding: 2,49 mill Euro. www.ecasa.org.uk

A hyperintensive fish farming concept for lasting competitiveness and superior production (RACEWAYS)

NIVA 2004 - 2008 From Akvaplan-niva AS. EU's Sixth Framework Programme. Funding: 0,89 mill Euro. www.niva.no

Welfare and health in sustainable aquaculture (WEALTH)

NVH 2004 - 2007 EU's Sixth Framework Programme. Funding: 2,54 mill Euro. Collaboration with HI. Project manager: Geir Lasse Taranger (HI). Project responsible at NVH: Øystein Evensen. 13 European partners. <http://wealth.imr.no>

Immediate responses to pain in Atlantic salmon (Salmo salar) - novel study models and methods

NVH 2004 - 2006 Project manager: Tor Einar Horsberg. Financed by NFR. Total funding from NFR: 2,1 mill NOK. <http://dbh.nsd.uib.no/nfi/rapport/keys=28666&language=no>

Fjord til bord (Farm-to-Table)

NVH Collaboration with Nutreco NIFES, Norwegian Institute of Public Health and Ullevål Hospital, Project manager: Grethe Rosenlund (Skretting - Nutreco). Project responsible at NVH: Øystein Evensen. Financed by NFR. www.aquamedicine.no/projects.asp?prosjekt=173

FASTFISH - On farm assessment of stress level in fish

NVH 2006 - 2008 Collaboration with HI. Project manager: Tore Kristiansen (HI). Project responsible at NVH: Øystein Evensen. 4 international partners. Financed by the EU Government. www.aquamedicine.no/projects.asp?prosjekt=189

A dynamic model for fish feed development

NVH 2003 - 2007 Collaboration with BioMar and NTNU. Project manager: Trygve Sigholt (BioMar). Project responsible at NVH: Åshild Krogdahl. <http://dbh.nsd.uib.no/nfi/rapport?keys=28613>

Nutrition for sustainable cod and trout production

NVH, AKVAFORSK, UiO 2004 - 2006 Collaboration with BioMar. Project manager: Marie Hillestad (BioMar). Project responsible at NVH: Åshild Krogdahl. Financed by NFR. Total funding from NFR: 2,14 mill. NOK. <http://dbh.nsd.uib.no/nfi/rapport?keys=28704>

University & institutional projects / Aquaculture continued

The APC-EWOS link

NVH, UMB, AKVAFORSK 2005 - 2007 Collaboration with EWOS. Project manager: Simon Wadsworth (EWOS). Project responsible at NVH: Åshild Krogdahl. Financed by EWOS, NFR www.apc-coe.no

Aquaculture Protein Centre – Centre of excellence – Gut & Health group

NVH, UMB, AKVAFORSK 2003 - 2008 Project manager: Åshild Krogdahl (NVH). Collaboration with numerous institutions worldwide. Financed by NVH, NFR. www.apc-coe.no

Aquaculture Protein Centre – APC

NVH, UMB, AKVAFORSK 2002 - 2012 APC director: Trond Storebakken. Financed by NFR. See also under Organizations-Competence Centers. Total funding from NFR: 50 mill NOK. www.apc-coe.no

Neuroendocrine and environmental control of puberty in fish

UiO 2005 - 2008 Project manager: Olav Sand. Financed by NFR. Total funding from NFR: 3 mill NOK. <http://dbh.nsd.uib.no/nfi/rapport?keys=29399&language=no>

Selection for reduced stress responsiveness in Atlantic salmon (*Salmo salar*): Role for animal welfare and sustainability in aquaculture

UMB 2006 - 2008 Project manager: Bjarne Olai Braastad. Financed by NFR. Total funding from NFR: 3,8 mill NOK. www.umb.no

FISH HEALTH

PROJECT HEADING / INSTITUTION & DURATION / CONTACT & COLLABORATION / NFR-FUNDING

Marker-assisted selection for IPN-resistance in Atlantic salmon

AKVAFORSK, NVH 2005 - 2008 Project manager: Thomas Moen (AKVAFORSK). Project responsible at NVH: Unni Grimholt. Collaboration with Aqua Gen AS. Financed by NFR. Total funding from NFR: 2,93 mill NOK. <http://dbh.nsd.uib.no/nfi/rapport?keys=29728>

Predicting chronic effects in Fish from sublethal markers (PredFish)

NIVA, NVH, UiO 2005 - 2008 Project manager: Peter Alestrom. Co-ordinator: Ketil Hylland, NIVA/UiO. Financed by NFR. Total funding from NFR: 5,03 mill NOK. www.alestrom.zebrafishlab.no

The importance of bacterial interactions for winter ulcer and the potential use in control of fish diseases

NVH 2006 - 2008 Project manager: Henning Sørum. Financed by NFR. Financed by NFR. Total funding from NFR: 5,03 mill NOK. www.aquamedicine.no/project.asp?prosjekt=193

Optimizing the nutritional value of non-marine protein sources in extruded fish feed

UMB 2006 - 2009 Project manager: Birger Svihus. Financed by NFR. Total funding from NFR: 4 mill NOK. www.umb.no

Atlantic salmon - our most important raw material for food production: Knowledge basis for increased pre-rigor processing in Norway

UMB 2003 - 2008 Project manager: Magny S. Thomassen. Financed by NFR. Total funding from NFR: 15 mill NOK. www.umb.no/?viewID=6666

Jern og toksiske blandsoner i norske settefiskanlegg - bruk av silikat-lut som tiltaksmiddel

UMB 2006 - 2008 Project manager: Brit Salbu. Financed by NFR. Total funding from NFR: 3,75 mill NOK. www.umb.no/?viewID=12781

Hurtig, ikke-destruktiv bestemmelse av tørrstoff/vanninnhold i torsk vha computertomografi, - videreutvikling og fenotypisk variasjon

UMB 2004 - 2006 Project manager: Magny S. Thomassen. Financed by NFR. Total funding from NFR: 622.000 NOK. <http://dbh.nsd.uib.no/nfi/rapport?keys=28692>

Changes in muscle temperature.

New indicators for stress and animal welfare in cultured fish

UMB 2002 - 2006 Project manager: Svein Olav Fjæra. Project responsible: Per Olav Skjervold. Financed by NFR. Total funding from NFR: 1,8 mill NOK. <http://dbh.nsd.uib.no/nfi/rapport?keys=26820>

Study of early, cellular responses to IPN virus infection in salmonids

NVH 2003 - 2006 Project manager: Øystein Evensen. Collaboration with University of Maryland, Academia Sinica, Taiwan PRC. Financed by NFR. Total funding from NFR: 2,44 mill NOK. www.aquamedicine.no/project.asp?prosjekt=105

Studies of immunophysiological reactions following vaccination in marine fish - with emphasis on basic immune mechanisms in cod

NVH 2001 - 2006 Project manager: Øystein Evensen. Financed by NFR. Total funding from NFR: 2,02 mill NOK. <http://dbh.nsd.uib.no/nfi/rapport?keys=24428>

Persistent infection with IPN virus in Atlantic Salmon - Relevance of physiological status and stress

NVH 2004 - 2006 Partnership with the University of Gothenburg. Project manager: Beate Julie Thu (Gothenburg). Financed by NFR. Total funding from NFR: 1,6 mill NOK. <http://dbh.nsd.uib.no/nfi/rapport?keys=103>

Novel strategies for immunisation against intracellular pathogens of Atlantic salmon

NVH 2006 - 2009 Collaboration with the Norwegian College of Fishery Science (NFH), the University of London, the University of Aberdeen, Marine Lab. Project manager: Jarl Bøggwald (NFH). Project responsible at NVH: Øystein Evensen. Financed by NFR. www.veths.no

Marine algal toxins - source organisms, accumulation and depuration in mussels, expanding profiles, and toxicology

NVH 2006 - 2008 Project manager: Tore Aune. Financed by NFR. Total funding from NFR: 4,8 mill. NOK. www.veths.no

Improvement of methods for infectious pancreatic necrosis virus (IPNV) screening and control in Atlantic salmon broodfish

NVH 2005 - 2008 Collaboration with VESO AS and Aqua Gen AS. Project manager: Paul Midtlyng (VESO). Project manager: Øystein Evensen (NVH). Financed by NFR. www.aquamedicine.no/project.asp?prosjekt=179

Improved immunity of aquacultured animals (IMAQUANIM)

NVH 2004 - 2010 EU's Sixth Framework Programme. Partnership with DFVF - Denmark. Project manager: Niels Lorenzen (DFVF). Project responsible at NVH: Øystein Evensen. 22 European partners. EU funding: 8,02 mill Euro. Financed by NFR. Total funding from NFR: 350.000 NOK. www.aquamedicine.no/project.asp?prosjekt=177

Heart and skeletal muscle inflammation (HSMI) in Atlantic salmon - virus characterisation and immune prevention

NVH 2005 - 2007 Collaboration with PHARMAQ. Project manager: Kjersti Gravningen (PHARMAQ). Project responsible at NVH: Øystein Evensen. User-directed financed by NFR. www.aquamedicine.no/project.asp?prosjekt=178

Evaluation of the possible transmission of prions (scrapie and BSE) to different fish species (TSE and Fish)

NVH 2002 - 2007 EU project - collaboration with institutions in Italy and Spain. Project responsible at NVH: Mohasina Syed. www.veths.no/templates/Page.aspx?id=1081

An investigation of myocardial and skeletal inflammation (HSMI) in Atlantic salmon

NVH Project manager: Espen Rimstad. Financed by Novartis Animal Vaccines Ltd. www.veths.no

Vibrio & virus i norsk sjømat

NVH Project manager: Mette Myrnel, Liv Marit Rørvik. Financed by the Norwegian Food Safety Authority. www.veths.no

Dynamics of spread of ISAV in infected farms

NVH Project manager: Espen Rimstad. Financed by FHF. www.veths.no

Zebrafish as a model for effect studies of persistent organic pollutants (POPs) in aquatic ecosystems (ZEBPOP)

NVH, UiO 2005 - 2007 Project manager: Peter Alestrom (NVH). Co-ordinator: Erik Ropstad, ProdMed-NVH. Kjetill S. Jakobsen (UiO). Financed by NFR. www.alestrom.zebrafishlab.no

Development of a pathogen epitope prediction program, and evaluation of its usefulness in designing fish vaccines (PeptidEx)

NVH, UiO 2002 - 2006 Part of EU's Fifth Framework Programme. Responsible scientist Iain Shaw (National Diagnostics Centre, University of Ireland, Galway, Ireland), partner J.Kaufman (Institute for Animal Health, Compton, England). Project manager: Tor Gjølven (UiO). Project responsible at NVH: Unni Grimholt. EU funding: 1,6 mill Euro. www.farmasi.uio.no/forskning/PeptidEx

SVINN - Loss and Mortality in Norwegian Salmon Production

NVH, VI 2005 - 2009 Project manager: Rolf Bjerke Larssen. www.aquamedicine.no/project.asp?prosjekt=181

Development of cost-effective tools for risk management and traceability systems for marine biotoxins in seafood (BIOTOX)

NVH, VI 2004 - 2008 EU's Sixth Framework Programme. 12 European partners. Project responsible at NVH: Tore Aune. EU funding: 3,01 mill Euro. www.biotox.org

Molecular mechanisms of viral disease in Atlantic salmon (Salmon salar L)

NVH, VI, UiO 2003 - 2007 Project manager: Siri Mjaaland. Financed by NFR. Total funding from NFR: 19,5 mill. NOK. www.aquamedicine.no/project.asp?prosjekt=51

Taxonomy, phylogeny and distribution of Gyrodactylus spp. with emphasize on parasites from Norwegian salmonids

UiO 2001 - 2006 Part of the Gyrodactylus research group at the National Centre for Biosystematics (NCB), UiO. Project manager: Tor Andreas Bakke. Financed by NFR. Total funding from NFR: 2,67 mill. NOK. www.toyen.uio.no/gyrodactylus/subpages/Projects_main.htm

Virological investigations on emerging disease conditions in domestic animals and fish

VI 2001 - 2006 Project manager: Birgit Helene Dannevig. Financed by NFR. Total funding from NFR: 19,5 mill. NOK. <http://dbh.nsd.uib.no/nfi/rapport/?keys=24483>

The parasite fauna of wild and reared cod: transmission of parasites?

VI 2006 - 2008 Project manager: Peter Andreas Heuch. Financed by NFR. Total funding from NFR: 1,5 mill. NOK. www.vetinst.no

Saprolegnia sp. infection in Atlantic salmon - studies of occurrence, mycological characteristics and virulence mechanisms

VI 2004 - 2007 Project manager: Ida Skaar. Financed by NFR. Total funding from NFR: 2,2 mill. NOK. <http://dbh.nsd.uib.no/nfi/rapport/?keys=28675>

Rapid diagnostic test for infectious pancreatic necrosis virus (IPN)

VI 2003 - 2006 Project manager: Atle Lillehaug. Financed by VI. www.vetinst.no

Proliferative gill inflammation in Atlantic salmon - identification of aetiology

VI 2005 - 2007 Project manager: Knut Falk. Financed by NFR. Total funding from NFR: 4,5 mill. NOK. <http://dbh.nsd.uib.no/nfi/rapport/?keys=29374>

Pancreas disease in Atlantic salmon and rainbow trout; pathogenesis and risk factors

VI 2006 -2008 Project manager: Torunn Taksdal. Financed by NFR. Total funding from NFR: 6 mill. NOK. www.aquamedicine.no/project.asp?prosjekt=191

Molecular typing of Aeromonas salmonicida - the cause of serous disease in farmed marine fish

VI 2005 - 2006 Project manager: Duncan John Colquhoun. Financed by NFR. Total funding from NFR: 1,8 mill. NOK. www.aquamedicine.no/project.asp?prosjekt=175

Molecular epidemiology of infectious pancreatic necrosis virus (IPNV) in Norway

VI 2005 - 2007 Project manager: Birgit H. Dannevig. Financed by FHF/ NFR. Total funding from NFR: 2,4 mill. NOK. <http://dbh.nsd.uib.no/nfi/rapport/?keys=29394>

Infection with Parvicapsula (Myxosporea) in farmed Atlantic salmon. Taxonomy, epizootiology, pathology and biology

VI 2003 - 2007 Project manager: Erik Sterud. Financed by NFR. Total funding from NFR: 2,09 mill. NOK. <http://dbh.nsd.uib.no/nfi/rapport/?keys=288553>

Host selection and infection strategies in Caligus elongates

VI 2002 - 2006 Project manager: Peter Andreas Heuch. Financed by NFR. www.aquamedicine.no/project.asp?prosjekt=65

Heart and skeletal muscle inflammation (HSMI)

VI 2003 - 2006 Project manager: Torunn Taksdal. Financed by NFR. Total funding from NFR: 2,8 mill. NOK. www.vetinst.no/inet_no/index.asp?prosjekt=40

Genetic studies of diplomonad flagellates from fish

VI 2002 - 2006 Project manager: Erik Sterud. Financed by NFR. www.aquamedicine.no/project.asp?prosjekt=40

Diagnosis of parasitic diseases and zoonoses in terrestrial animals and fish

VI 2002 - 2006 Strategic institute programme funded by NFR. Includes 6 projects. Project manager: Tor Atle Mo. www.vetinst.no

Diagnosis and characterisation of intra-cellular Gram-negative pathogens of marine and salmonid fish

VI 2004 - 2008 Project manager: Duncan Colquhoun. Financed by NFR. www.aquamedicine.no/project.asp?prosjekt=145

Cardiomyopathy (CMS) in Atlantic salmon: pathogenesis and experimental transmissibility

VI 2006 - 2008 Project manager: Torunn Taksdal. Financed by NFR. Total funding from NFR: 3 mill. NOK. www.aquamedicine.no/project.asp?prosjekt=192

Alternative treatment to malachite green of Saprolegnia sp. infection in Atlantic salmon

VI 2002 - 2006 Project manager: Ida Skaar. Financed by NFR. <http://dbh.nsd.uib.no/nfi/rapport/?keys=26946>

Bacterial challenges in aquaculture of marine fish species

VI, NVH 2004 - 2008 Project manager: Duncan Colquhoun (VI). Project responsible at NVH: Henning Sørum. Collaboration with Institute of Marine Research and the Norwegian Institute of Fisheries and Aquaculture (NIFA). Financed by NIFA & NFR. Total funding from NFR: 15 mill. NOK. www.aquamedicine.no/project.asp?prosjekt=137

MARINE BIOLOGY

PROJECT HEADING / INSTITUTION & DURATION / CONTACT & COLLABORATION / NFR-FUNDING

Skeletal malformations in farmed salmon and cod: a functional approach to determine causalities and mechanisms

AKVAFORSK 2006 - 2009 Project manager: Grete Bæverfjord. Financed by NFR. Total funding from NFR: 16 mill. NOK. www.akvaforsk.no

Skeletal deformities and cardiac growth dynamics in underyearling Atlantic salmon smolts (out-of-season, O+ smolts)

AKVAFORSK 2005 - 2007 Project manager: Grete Bæverfjord. Financed by NFR. Total funding from NFR: 2 mill. NOK. <http://dbh.nsd.uib.no/nfi/rapport/?keys=29673>

Control of malformations in the production of Atlantic cod (Gadus morhua L.) by optimizing temperature and light conditions

AKVAFORSK 2005 - 2006 Project manager: Ingrid Lein. Financed by NFR. Total funding from NFR: 1 mill. NOK. <http://dbh.nsd.uib.no/nfi/rapport/?keys=29670>

New Fish in a New Environment: Challenges to a Comprehensive Management of Fish, Environments and Human Beings

NILF 2006 - 2010 Project manager: Kristin Asdal. Financed by NFR. Total funding from NFR: 2,03 mill. NOK. www.nilf.no

Tracking the atmospheric sources of selected POPs to contaminated coastal zones

NILU 2006 - 2008 Project manager: Martin Schlabach. Financed by NFR. Total funding from NFR: 600.000 NOK. www.nilu.no

Assessment of risk posed by high levels of the brominated flame retardant hexabromocyclododecane in the Norwegian fjord Åsefjorden (BromRisk)

NILU 2006 - 2009 Project manager: Espen Mariussen. Financed by NFR. Total funding from NFR: 4,49 mill. NOK. www.nilu.no

Parameterisation of the environmental impacts on bottom fauna of water-based drilling fluids and cuttings

NIVA 2005 - 2009 Project manager: Frode Olsgard. Financed by NFR. Total funding from NFR: 4,07 mill. NOK. <http://dbh.nsd.uib.no/nfi/rapport/?keys=29343>

Marine coastal habitat typology - how to model and classify habitats

NIVA 2003 - 2006 Project manager: Trine Bekkby. Financed by NFR. Total funding from NFR: 2,65 mill. NOK. <http://dbh.nsd.uib.no/nfi/rapport/?keys=28548>

Marine biodiversity and ecosystem functioning (MARBEF)

NIVA 2004 - 2008 From Akvaplan-niva AS. EU's Sixth Framework Programme. Funding: 8,71 mill Euro. www.marbef.org

Inputs of Chemicals from Recreational Activities to the Norwegian Coastal Zone 1. Summer Pilot Study

NIVA 2006 - 2006 Project manager: Katherine Langford. Financed by NFR. Total funding from NFR: 435.000 NOK. www.niva.no

NIVA - SIP: Development of methods for biological classification of ecological status in limnic and marine environments

NIVA 2003 - 2006 Project manager: Merete Ulstein. Financed by NFR. Total funding from NFR: 2,8 mill. NOK. <http://dbh.nsd.uib.no/nfi/rapport/?keys=27785>

Dinoflagellates- the main threat to too large scale efforts in shellfisk culture

NIVA 2001 - 2006 Project manager: Kari Nygaard. Financed by NFR. Total funding from NFR: 1,24 mill. NOK. <http://dbh.nsd.uib.no/nfi/rapport/?keys=24095>

Sticklebacks (Gasterosteus aculeatus L.) on the Norwegian coast: fresh water colonisation, divergence rates and adaptive speciation

UiO 2006 - 2009 Project manager: Leif Asbjørn Vøllestad. Financed by NFR. Total funding from NFR: 2,69 mill. NOK. www.uio.no

Population processes in commercially important marine fish species. Ecology, population genetics and dynamics of cod, mackerel and blue whiting.

UiO Project manager: Nils Chr. Stenseth. Collaboration with the Institute of Marine Research (HI). www.uio.no

Marine ecosystem effects of eutrophication: Interactions between small pelagic fish and predators in low oxygen waters

UiO 2006 - 2009 Project manager: Stein Kaartvedt. Financed by NFR. Total funding from NFR: 2,58 mill. NOK. www.uio.no

Magnetoreception and magnetic compass orientation in the long distance migration of the European eel

UiO 2004 - 2006 Project manager: Leif Asbjørn Vøllestad. Financed by NFR. Total funding from NFR: 3,66 mill. NOK. www.cees.no/?option=com_research&projects=32

Genome and plastid evolution of algae and protists. Plastid evolution and the deep branches of eukaryotes are main issues. Phylogenomic approaches are being used. The basic science in this project is likely to have biotechnological potential.

UiO Project manager: Kjetill S. Jakobsen. Collaboration with Oxford University and the University of Maryland. Financed by NFR. www.cees.uio.no

Flagellate biodiversity of marine North Atlantic sandy beaches, Dr.gr.stip/postdr.stip

UiO 2004 - 2006 Project manager: Jahn Thronsen. Financed by NFR. Total funding from NFR: 4,22 mill. NOK. <http://dbh.nsd.uib.no/nfi/rapport/?keys=28478>

Fish behaviour and implications for abundance estimates

UiO 2002 - 2006 Project manager: Stein Kaartvedt. Financed by NFR. Total funding from NFR: 1,73 mill. NOK. www.uio.no

Exposure as a factor for primary and secondary production in a kelp forest

UiO 2005 - 2007 Project manager: Stein Fredriksen. Financed by NFR. Total funding from NFR: 2,65 mill. NOK. <http://dbh.nsd.uib.no/nfi/rapport/?keys=29384>

Environmental effects of oil and gas exploration on the benthic fauna of the Norwegian continental shelf: an analysis using the OLF database

UiO 2005 - 2007 Project manager: John Stuart Gray. Financed by NFR. Total funding from NFR: 1,63 mill. NOK. <http://dbh.nsd.uib.no/nfi/rapport/?keys=29341>

EcoClim - The ecological effects of climate fluctuations and change: a multi-disciplinary and integrated approach

UiO 2001 - 2006 Project manager: Nils Chr. Stenseth. Financed by NFR. Total funding from NFR: 3,5 mill. NOK. <http://dbh.nsd.uib.no/nfi/rapport/?keys=26204>

Bowhead whales - at the edge of extinction in the Northeast Atlantic

UiO 2003 - 2006 Project manager: Øystein Wiig. Financed by NFR. Total funding from NFR: 2,4 mill. NOK. <http://dbh.nsd.uib.no/nfi/rapport/?keys=28555>

Biodiversity of marine benthos: perspective from a global change

UiO 2004 - 2006 Project manager: John Stuart Gray. Financed by NFR. Total funding from NFR: 4,49 mill. NOK. www.uio.no

MareGen. Marine science in the Skagerrak region

UiO, NVH Project manager: Nils Chr. Stenseth. Network building. With Universities of Gothenburg, Copenhagen and Århus. www.cees.uio.no

Prenatal stress in farmed salmon:

Consequences for emotional and cognitive function in offspring

UMB 2006 - 2009 Project manager: Bjarne Olai Braastad. Financed by NFR. Total funding from NFR: 3,25 mill. NOK. www.umb.no

Cognitive and neuroendocrine correlates of stress coping style in fish

UMB 2005 - 2006 Project manager: Øyvind Øverli. Financed by NFR. Total funding from NFR: 162.000 NOK. www.umb.no

Improved methodologies for harvest and purification of algal toxins

VI 2005 -2007 Project manager: Morten Sandvik. Financed by NFR. Total funding from NFR: 3 mill. NOK. <http://dbh.nsd.uib.no/nfi/rapport/?keys=29379>

MARINE MOLECULAR BIOLOGY

PROJECT HEADING / INSTITUTION & DURATION / CONTACT & COLLABORATION / NFR-FUNDING

Vegetable oils in diets for Atlantic salmon; effect of dietary n-6/n-3 fatty acid ratio on eicosanoid production and bone formation

AKVAFORSK 2005 - 2007 Project manager: Gerd Marit Berge. Financed by NFR. Total funding from NFR: 4,2 mill. NOK. <http://dbh.nsd.uib.no/nfi/rapport/?keys=29392>

Tilapia. The project aims at developing further genetic improvement of various tilapia species

AKVAFORSK www.akvaforsk.no

Shrimps. The project aims at developing further genetic improvement of various shrimps species (Wannamei, Monodon)

AKVAFORSK www.akvaforsk.no

Lipid metabolism in Atlantic salmon.

Effect of dietary lipids on gene regulation and membrane function

AKVAFORSK 2003 - 2006 Project manager: Bente Ruyter. Financed by NFR. Total funding from NFR: 3,3 mill. NOK. <http://dbh.nsd.uib.no/nfi/rapport/?keys=28475>

Influence of water temperature and genetic factors on muscle development in farmed cod larvae: consequences for product quality

AKVAFORSK 2004 - 2006 Project responsible: Øivind Andersen. Financed by NFR. Total funding from NFR: 4,2 mill. NOK. <http://dbh.nsd.uib.no/nfi/rapport/?keys=28668>

Hemoglobin polymorphism in Atlantic cod - finally unravelling the old puzzle

AKVAFORSK 2006 - 2008 Project manager: Øivind Andersen. Financed by NFR. Total funding from NFR: 2,98 mill. NOK. www.akvaforsk.no

Exploitation of high-density genetic marker maps in modern fish breeding programs

AKVAFORSK 2004 - 2007 Project manager: Theo Meuwissen. Project coordinator: Anna K. Sonesson. Financed by NFR. Total funding from NFR: 3,9 mill. NOK. www.umb.no/?viewID=6712

Environmental and genetic regulation of muscle growth in scallop

AKVAFORSK 2003 - 2006 Project manager at AKVAFORSK: Øivind Andersen. In collaboration with APC, the University of St. Andrews, University of Bergen and Institute of Marine Research, Bergen. Financed by NFR. Total funding from NFR: 3,78 mill. NOK. www.st-andrews.ac.uk/fmrg/projects.html

Efficient combination of QTL detection and introgression schemes in aquaculture

AKVAFORSK 2005 - 2007 Project manager: Theo Meuwissen. Project responsible: Anna K. Sonesson. Financed by NFR and FHF. Total funding from NFR: 3,6 mill. NOK. www.umb.no/?viewID=8499

Application of genomics tools and resources to selective breeding for improved disease resistance and animal welfare in fish

AKVAFORSK 2006 - 2008 Project manager: Kari Kolstad. Financed by NFR. Total funding from NFR: 6,4 mill. NOK. www.akvaforsk.no

Establishing knowledge within functional genomic and biochemistry for optimal use of future fish feed lipid resources

AKVAFORSK, UMB, UiO 2004 - 2008 Project manager: Hilde Sundvold (AKVAFORSK). Collaboration with NIFES. Financed by NFR. Total funding from NFR: 23 mill. NOK. www.umb.no/?viewID=6746

Knockout zebrafish (KO-ZFISH) model

NVH 2004 - 2009 Project manager: Peter Alestrom. Partnership with Purdue University (USA). Financed by NFR FUGE programme. Total funding from NFR: 11 mill. NOK. www.alestromzebrafishlab.no

Investigation of developmental pathways leading to bone formation and homeostasis by genetic dissection and functional analysis of osteoprotegerin (OPG) in a transgenic fish model on earth and in microgravity environment.

NVH 2001 - 2007 Project manager: Peter Alestrom. Collaboration with Rheinisch-Westfälische Technische Hochschule (RWTH - Germany), ENFORM Consortium (www.pvi.uni-bonn.de/DEFAULT.HTM). Financed by the European Space Agency. www.alestromzebrafishlab.no

Implementation of high-throughput genomic approaches to investigate the functioning of marine ecosystems and the biology of marine organisms (MARINE GENOMICS)

NVH 2004 - 2008 Network of Excellence with 44 partners from 16 countries. EU's Sixth Framework Programme. Project responsible at NVH: Mohasina Syed. Funding: 10 mill. Euro. www.marine-genomics-europe.org

Expression & function of disease related genes in Atlantic salmon (SalEx)

NVH 2002 - 2007 Project manager: Unni Grimholt (NVH). Collaboration with the University of Tromsø and the University of Bergen. Financed by NFR, FUGE. Total funding from NFR: 41 mill. NOK. www.aquamedicine.no/project.asp?prosjekt=31

European Animal Disease Genomics Network of Excellence for Animal Health and Food Safety (EADGENE)

NVH 2004 - 2009 EU's Sixth Framework Programme. 13 partners from 10 European countries. EU funding: 11,52 mill Euro. Project responsible at NVH: Ingrid Olsaker. www.eadgene.org

Development of a cDNA based reverse genetics system for infectious pancreatic necrosis virus (IPNV)

NVH 2004 - 2006 Project manager: Espen Rimstad. Collaboration with the University of Tromsø. Financed by NFR. Total funding from NFR: 1,9 mill. NOK. <http://dbh.nsd.uib.no/nfi/rapport/?keys=28671>

Antibiotikaresistens i marine bakterier - samspillet mellom fiskens og miljøets bakterier

NVH 2002 - 2006 Project manager: Henning Sørum. Financed by NFR. Total funding from NFR: 1,93 mill. NOK. www.aquamedicine.no/project.asp?prosjekt=44

An Atlantic salmon Biobank (SALBANK) - part of the FUGE programme

NVH 2003 - 2007 Project manager: Bjørn Høyheim. Contact: Camilla Røsjø. Total funding from NFR: 10 mill. NOK. www.forskningsradet.ravn.no/fag/andre/fuge/Arkiv/salbank1.html

Genetically modified plant products (GMPP) in feed for Atlantic salmon - A follow-up study on physiological responses and DNA traceability

NVH, VI Partnership with NIFES. Project manager: Gro-Ingunn Hemre (NIFES). Project responsible at NVH: Åshild Krogdahl. Financed by NFR, NIFES, NVH, VI. www.veths.no

Very long chain n-3 fatty acids influence size of adipose depots in rats fed high fat diets

UiO Project manager: Christian A. Drevon www.uio.no

The effect of very long chain n-3 fatty acids on insulin sensitivity among subjects with the metabolic syndrome, and on lipid metabolism in cultured human adipocytes and skeletal muscle cells

UiO Project manager: Christian A. Drevon www.uio.no

Supplement of essential fatty acids (arachidonic and docosahexaenoic acid) affect cognitive function of very premature infants (birth weight below 1.5 kg)

UiO Project manager: Christian A. Drevon www.uio.no

Spatial patterns of benthic biodiversity in the deep Norwegian Sea

UiO 2003 - 2006 Project manager: John Stuart Gray. Financed by NFR. Total funding from NFR: 1,3 mill. NOK. <http://dbh.nsd.uib.no/nfi/rapport/?keys=27689>

Molecular and electrophysiological characterization of the GnRH systems in Atlantic cod

UiO 2005 - 2008 Project manager: Trude Marie Haug. Financed by NFR. Total funding from NFR: 2,02 mill. NOK. <http://dbh.nsd.uib.no/nfi/rapport/?keys=29538>

Effect of ultraviolet radiation on lipids, fatty acids and nutritional quality of Arctic marine algae and zooplankton

UiO 2002 - 2006 Project manager: Dag O. Hessen. Financed by NFR. Total funding from NFR: 6,1 mill. NOK. <http://dbh.nsd.uib.no/nfi/rapport/?keys=27215>

Assessing marine food chains using molecular probes

UiO 2005 - 2007 Project manager: Stein Kaartvedt. Financed by NFR. Total funding from NFR: 1,9 mill. NOK. <http://dbh.nsd.uib.no/nfi/rapport/?keys=29401>

Algal toxins & polyunsaturated fatty acids: a polyketide genomic approach to safe and efficient utilisation of microalgae in bioproduction

UiO 2006 - 2009 Project manager: Kjetill S. Jakobsen. Collaboration with the University of Maryland, USA. Financed by NFR. Total funding from NFR: 3,6 mill. NOK. www.cees.uio.no

GenoCod - a cod FUGE platform. A FUGE Genofisk platform for functional genomics of cod. Major effort are low coverage sequencing of the cod genome and phenotypic plasticity of cod

UiO, NVH, AKVAFORSK Collaboration with UiB and Sars Senteret. Key researchers; Daniel Chourrou (Sars), Kjetill S. Jakobsen (UiO) og Nils Chr. Stenseth (UiO). www.uio.no

The Salmon Genome Project (SGP). Provide a sequence information and genetic maps of the salmon genome

UiO, NVH, UMB Project manager: Bjørn Høyheim (NVH). Also collaboration with the Institute of Marine Science and the University of Bergen. Financed by NFR. www.salmongenome.no

Marine Microalgae - "Trippelliansen". Microalgae have a great potential in bioprospecting and as producers of useful substances such as polyunsaturated fatty acids. The aim of the project is to investigate both harmful and potential useful algae

UiO, UMB, NVH Funding from all three institutions. Three scholarships. www.uio.no

Interaction between alginate and whey proteins

UMB 200 - 2007 Project manager: Thor Langsrud. Financed by NFR. Total funding from NFR: 1,66 mill. NOK. www.umb.no

Development of DNA-microarray technology for functional genomics related to food-production and food quality

UMB 2001 - 2006 Project manager: Ingolf F. Nes. Financed by NFR. Total funding from NFR: 13,6 mill. NOK. <http://dbh.nsd.uib.no/nfi/rapport/?keys=24450>

Degradation of insoluble carbohydrate polymers: how do microbial chitinolytic machineries work?

UMB 2006 - 2009 Project manager: Gustav Vaaje-Kolstad. Financed by NFR. Total funding from NFR: 2,68 mill. NOK. www.umb.no

Characterization and exploration of microbial enzymes for processing of chitin, chitosan and peptidoglycan

UMB 2005 - 2009 Project manager: Vincent Eijsink. Financed by NFR. Total funding from NFR: 5,4 mill. NOK. <http://dbh.nsd.uib.no/nfi/rapport/?keys=29546>

Characterization and engineering of enzymes for the conversion of chitin and related polymers

UMB 2001 - 2007 Project manager: Vincent Eijsink. Financed by NFR. Total funding from NFR: 9,3 mill. NOK. <http://dbh.nsd.uib.no/nfi/rapport/?keys=25799>

cGRASP. The Consortium for Genomics Research on All Salmonids Project (cGRASP) is committed to becoming the international body for organizing and coordinating a whole genome sequencing project for Atlantic salmon that can also be extensively exploited by the rest of the salmonid community

UMB CIGENE project. Collaboration with experts from Canada, Norway, the US and the UK. www.cigene.no

Development of methods for commercial purification of glucosamine glucanases, especially low molecular heparin from fish raw material

UMB 2005 - 2007 Project manager: Ragnar Flengsrud. Financed by NFR. Total funding from NFR: 806.000 NOK. www.umb.no

Traceability and physiological effects of using genetically modified plant ingredients in feed for Atlantic salmon

VI 2000 - 2007 Project responsible at VI: Arne Holst-Jensen. Financed by NFR. <http://dbh.nsd.uib.no/nfi/rapport/?keys=24442>

OTHER

PROJECT HEADING / INSTITUTION & DURATION / CONTACT & COLLABORATION / NFR-FUNDING

Production improvements of salted/cured meat and fish

Matforsk 2003 - 2007 Project coordinator: Oddvin Sørheim. Financed by NFR. Total funding from NFR: 18,5 mill. NOK. www.matforsk.no

Health promoting, safe seafood of high eating quality in a consumer driven fork-to-farm concept (SEAFOODPLUS)

Matforsk 2004 - 2008 EU's Sixth Framework Programme. Collaboration with Trace Tracker Marine AS, Fjord Seafood ASA, Biomar AS, Fiskeriforskning, SINTEF Fisheries and Aquaculture. EU funding: 14,4 mill Euro. www.seafoodplus.org

Food Safety - Forming a European platform for protecting consumers against health risks (SAFEFOODAREA)

NFR 2004 - 2008 EU's Sixth Framework Programme. Funding: 3,74 mill Euro. www.forskningsradet.no

Co-ordination of National and Regional Marine RTD Activities in Europe (MARINERA)

NFR 2004 - 2008 EU's Sixth Framework Programme. Funding: 2,95 mill Euro. www.marinera.net

Coordination of European Transnational Research in Organic Food and Farming (CORE ORGANIC)

NFR 2004 - 2008 EU's Sixth Framework Programme. Funding: 1,2 mill Euro. www.coreorganic.org

For mye eller for lite informasjon? Betydningen av opprinnelse og sporbarhet for forbrukertillit til sjømat.

SIFO 2004 - 2006 Project manager: Arne Dulsrud. Financed by NFR. Total funding from NFR: 1,7 mill. NOK. www.fiskforsk.norut.no/layout/set/print/content/view/full/7626

Long-term Effects of Oil accidents on the pelagic ecosystem of the Norwegian and Barents Seas - LEO

UiO 2006 - 2008 Project manager: Nils Chr. Stenseth. Financed by NFR. Total funding from NFR: 6,98 mill. NOK. www.cees.no/?option=com_research&project=74

Behavioral syndromes in salmonid fish: Ecological and evolutionary implications

UMB 2006 - 2008 Project manager: Morten Bakken. Financed by NFR. Total funding from NFR: 2,19 mill. NOK. www.umb.no/?viewID=14800

C) SkatteFUNN

AQUACULTURE (web site addresses in table D)

Advanced Business Consulting Group AS (Oslo)

- Abc foodstuffs/fish
-

Alvestad Marin AS (Oslo)

- Hatching equipment for salmon
-

Attraqua AS (Oslo)

- Artificial bait
 - Spray for fishing gear
-

CryoProtect AS (Oslo)

- Protection of fish for freezing
-

Det Norske Veritas (Akershus)

- Food Quality and Safety / VeriFish
-

Due Miljø AS (Oslo)

- Develop new technology and market for ingredients from fish blood
-

Fishfeed AS (Akershus)

- Pre-project Unik Laks
 - New technology fish food
-

Fjordland AS (Oslo)

- Fjordland 300411
-

Intravision Arkitektur AS (Oslo)

- Narrow-specter lighting in aquaculture; spawn and fish
-

Intravision Group AS (Oslo)

- Narrow-specter lighting in aquaculture; from eggs to filets
-

Marfloat AS (Oslo)

- New transportation system for live fish
 - Value chain for transport of live fish to international markets
-

Marian Seafood AS (Oslo)

- Distribution of fresh fish packed in modified atmosphere (MAP)
-

MerluNor AS (Oslo)

- Development of a prototype production line for European “lysing” fish , Phase 2
-

Mills DA (Oslo)

- Effective production of high-quality roe products
-

Motion Control Senteret AS (Oslo)

- Steering of fish filleting machine
-

Neraal & Co AS (Oslo)

- Ingredients for production of fish food
 - New products from fish raw materials
-

Nordic Shell Holding AS (Østfold)

- Industrial development of mussels in suspended culture
-

PhotoFish AS (Akershus)

- Quality analysis of salmon through digital image analysis
-

Scan Aqua AS (Akershus)

- Ethical slaughter of farmed salmon
-

Sea-Bell AS (Oslo)

- Consumer packaged fresh seafood
-

Seafood Automation AS (Akershus)

- BaccoTag
 - TracePin
-

Smurfit Norpapp AS (Akershus)

- Development of new packaging for fresh salmon
-

Stolt Sea Farm AS (Oslo)

- Light Cod: effect of light intensity and alternative light spectres on reproductive maturation in cod
-

Team Semin BA (Oslo)

- Freezing of sperm from atlantic salmon and rainbow trout
-

AQUACULTURE

Tiara-cml AS (Oslo)

- From sea to table – use of TraceFish standard in tracking Pelagian fish

TINE BA (Oslo)

- Super-fresh fish

TINE Biomarin AS (Oslo)

- Sea-salami
- Sea-Salami

TINE Biomarin AS c/o TINE BA (Oslo)

- Fresh Cured Salmon - establishing production and pilot facility

FISH HEALTH

ScanVacc AS (Akershus)

- Slaughter quality in salmon - impact of vaccine type and vaccination method
- Vaccine against winter sores in salmon - improving effect and documentation of new vaccine
- Vaccine-induced side effects in farmed arctic salmon

VESO AS (Oslo)

- Further development of infestation model for Infectious Pancreatic Sclerosis in Atlantic salmon
- Efficacy of Zoolac Feed Grade on Survival Rates of Vaccinated and Unvaccinated Cod (*Gadus morhua*)
- Improvement of methods for IPN screening and control in Atlantic salmon broodfish
- Develop new method for documentation of side effects on farmed salmon following vaccination

MARINE BIOLOGY

Aker Seafoods ASA (Oslo)

- Krill Program

Algene Biotech AS (Oslo)

- Isolation of marine algae using magnetic balls

Algetech Produkter AS (Oslo)

- Greenhouse production of algae

BioScenic AS (Akershus)

- New Omega-3

Due Miljø AS (Oslo)

- Advanced fish oil separation by ceramic membranes
- Special peptones for the fermenting industry from fish liver and waste

Fishfeed AS (Akershus)

- Fish oils for use in food and feed industries

FMC BioPolymer AS (Buskerud)

- Biofunctional materials from alginate and other biopolymers (BIOFUNK)
- Larger-scale production of alginate “epimerase and epimeriser” alginate

Hydro Formates AS (Akershus)

- Nitrate diformiat (KDF, Kalium diformiat) as a growth enhancer in salmon feed

Nordox AS (Oslo)

- Bio-availability of copper for marine organisms

Pharmatech AS (Østfold)

- Feed supplement from krill oil

Promar Aqua AS (Oslo)

- Natural astaxanthin from microalgae

Promar AS (Oslo)

- Natural sun filter from microalgae

Pronova Biocare AS (Akershus)

- Fat derivatives
- “Lipasekatalysert omestring” for Omega-3 concentrates
- Omega-3 concentrates using membrane technology
- Omega-3 for foods

MARINE MOLECULAR BIOLOGY

GenoMar ASA (Oslo)

- Use of salmon promoters in expression vectors in various organisms
- Development of all male (YY) tilapia food fish
- Gene discovery for major commercial traits in tilapia
- Gene expression studies in fish
- Gene expression studies II
- Genetic enhancement of traits important for improvement of productivity in tilapia
- Genetic traceability (GenTrack) II
- Genetic traceability system - GenTrack
- Genetic studies of cod
- Identification of gene areas for salt water tolerance in tilapia.
- SALBANK

INOCAP Øystein Falch (Oslo)

- Genetic verification of origin and quality of mackerel

Soløy AS (Oslo)

- Genetic verification of origin and quality of mackerel

Team Semin BA (Oslo)

- Cryo-conservation of “gameter” (?) for sustainable genetic development in farmed atlantic cod

OTHER

Colifast AS (Akershus)

- Develop methods for rapid detection of microbial contamination of water and food
- Develop online surveillance of microbial water quality

Optoflow AS (Oslo)

- Bacteria in water

Reef Systems AS (Vestfold)

- Snøhvit

D) Marine Life Science companies

AQUACULTURE

Pharmaq AS (Oslo) www.pharmaq.no

Animal/fish health, Drug discovery, Biomanufacturing, Pharmaceutical: Global veterinary pharmaceutical company with main focus on aquaculture. Leading company in R&D, production and sales of vaccines for farmed fish. One of Norway's largest biotech companies with state-of-the-art (GMP approved) production facility in Overhalla. Subsidiaries in UK and Chile. www.pharmaq.no

BioBank AS (Hedmark) www.biobank.no

Biobank/breeding: National biobank for fish, farm animal and plants. Owned by Norsvin, Aqua Gen and Geno.

Cryogenetics AS (Hedmark) www.cryogenetics.no

Biobank/breeding: Offering technology, storage and services related to cryopreservation of milt.

Geninova AS (Hedmark) www.norsvin.no

Biobank/breeding: Geninova is responsible for optimizing the Oracle-based breeding data base, computing breeding indexes, and running R&D projects. The main scope is to supply the aquaculture industry with genetically improved starting material based on cutting-edge technology. Owned by Norsvin and Aqua Gen.

GenoMar ASA (Oslo) www.genomar.com

Biobank/breeding: GenoMar is a leading life science breeding operator providing genetically advanced tilapia seeds and a unique concept of genetic verification of seafood origin. The company has an international strong science network and commercial subsidiaries in Singapore, China and The Philippines.

Genova Aqua AS (Oslo)

Biobank/breeding, Animal/fish health, Diagnostics/kits: Animal biobank. developing biotech solutions for improvements in aquaculture.

Det Norske Veritas (Akershus) www.dnv.com

Food safety: DNV Research has a long term perspective and prepares for the development of new and enhanced products and services. Bio Risk Management is one of five research programmes.

CryoProtect AS (Oslo) www.crypprotect.no

Food/feed ingredients: Emphasizing on development and implementation of raw material in the Norwegian seafood industry. Emphasizing on development and implementation of raw material in the Norwegian seafood industry.

EWOS Innovation (Rogaland) www.ewos.no

Food/feed ingredients: The Norwegian branch of Cermaq's R&D division. Active in various aspects of aquaculture R&D, including feed and fish health (mainly salmon). Alliance with Akvaforsk, Ås.

Marian Seafood AS (Oslo) www.marian.no

Food/feed ingredients: Gives you more options to enjoy a fish meal that is easy to prepare, tasty and healthy. Owned by Fjordland AS.

Fishfeed AS (Akershus) www.fishfeed.no

Food/feed ingredients, Consultancy: Offers feed solutions to producers of feed ingredients and additives and to fish farmers worldwide. Also involved in technology development for the aquaculture industry.

Aquaculture continued

Aker Seafoods ASA (Oslo) www.akerseafoods.com

Harvesting, processing and sales: Aker Seafoods is one of Norway's leading producers and exporters of fish products. Most of our harvesting and primary processing is of white fish.

BioScenic AS Omega 3 (Akershus) www.bioscenic.no

Produces and sells Omega 3 pills with capsule made from red sea grass.

Stolt Sea Farm AS (Oslo) www.stoltseafarm.com

Production: International aquaculture company with production of turbot and tuna which are sold throughout the world.

Cermaq (Oslo) www.cermaq.no

Cermaq's vision is to be one of the global leaders in the aquaculture industry, with main focus on sustainable production of feed to, and farming of salmonid species (salmon and trout). Cermaq makes substantial investments in Aquaculture R&D every year.

BIOMED

ScanVacc AS (Akershus) www.scanvacc.com

Animal/fish health: Develops, imports and markets prescriptive drugs to the fish farming industry.

Veterinærmedisinsk Oppdragsenter AS (Oslo) www.veso.no

Animal/fish health: Norway's leading retailer of veterinary vaccines. Distribution of veterinary drugs for farmed fish and health- and pet care products for terrestrial animals. Partner in EU's Sixth Framework programme project called DIPNET.

Intravision Group AS (Oslo) www.intravision.no

Animal/fish health, Medical device: Work with special light systems within four areas: Art & architecture, fish farming, plant growth and microalgae growth. See Promar AS.

Promar AS (Oslo) www.intravision.no

Animal/fish health, Medical device: Biotech company with products based on the use of narrow bandwidth light. Three related companies called; Promar AS (bioreactor for microalgae) with product development in Pharmaceuticals and Intravision Aqua AS (Aquaculture applications) Lumigreen (grass fields) all owned by Intravision Group AS.

Navamedic ASA (Akershus) www.navamedic.com

Drug discovery, Pharmaceutical: Develops and markets pharmaceutical product for osteoarthritis (OA) based on glucosamine HCl, isolated from shrimp waste.

Colifast AS (Akershus) www.colifast.no

Research tool, Diagnostics/kits: Develops and markets pharmaceutical product for osteoarthritis (OA) based on glucosamine HCl, isolated from shrimp waste.

Biotec Pharmacon ASA (Oslo) www.biotecpharmacon.no

Research tool, Drug discovery, Food/feed ingredients: Biotec Pharmacon develops, manufactures, and markets immune modulating compounds and molecular biology grade enzymes, based on own research in immunology and marine biotechnology. Biotec Pharmacon has its own modern production plant with capacity for a significant expansion of product output.

Natural AS (Oslo) www.natural.no

Natural is a biotechnology company focusing on innovation and developing solutions based on the health promoting properties of lipids.

ENVIRONMENT & ENERGY

Due Miljø AS (Oslo) www.duemiljoe.no

Environmental: An independent company developing, purchasing and marketing environment technology and environmentally correct packaging to the process, food, pharma and technical/chemical industry.

MARINE BI-PRODUCTS

Aminotech AS (Oslo) www.aminotech.com

Food/feed ingredients: Large scale production of protein hydrolysate (free amino acids and peptides) from fish protein, intended initially as food ingredient / health food.

Denomega Nutritional Products (Østfold) www.denomega.no

Food/feed ingredients: Crude oil rendering from marine sources. Oil refining and stabilization.

Maritex AS (Nordland) www.maritex.no

Food/feed ingredients: Wholly owned by TINE with R&D and production related to various marine-based chemicals, e.g. fish peptones, fish oils and enzymes, intended as food and feed ingredients.

Orkla ASA - Borregaard (Østfold) www.borregaard.no

Food/feed ingredients: Borregaard is the world's leading supplier of wood-based chemicals, and holds also strong positions within Ingredients, Fine Chemicals and Energy.

Pronova Biocare AS (Akershus) www.pronova.com

Food/feed ingredients, Pharmaceutical: Pronova is the world leader within the development, production and sales of Omega-3 fatty acids, both as a dietary supplement and as a drug (highly concentrated Omega-3).

FMC BioPolymer AS (Buskerud) www.fmcbiopolymer.com

Reagents & chemicals, Drug discovery: Alginates extracted from brown seaweeds with manufacturing plant in Hauge-sund and Drammen. FMC acquired from Hydro, Pronova Biopolymer in 1999 and Pronova Biomedical in 2002, now named FMC Biopolymer AS and NovaMatrix respectively, the latter a business unit under the former. FMC is a US corporation.

Hepmarin AS (Akershus)

Reagents & chemicals, Pharmaceutical: Medical quality heparin manufactured as bi-product from fish waste.

Alvestad Marin AS (Oslo) www.alvestadmarin.com

Supplier: Alvestad Marin AS is a supplier of products and system solutions to the fish farming business.

OTHER

Smurfit Norpapp AS (Akershus) www.smurfit-norpapp.no

Supplier: Supplier of corrugated paper boxes.

Tiara-cml AS (Oslo) www.tiara-cml.no

Supplier of a full range of coding, marking and labelling products and services providing the 'complete coding solution' to the customer.

Seafood Automation (Akershus) www.seafoodautomation.no

Biomanufacturing: Designs, develops and delivers machines for labeling, sorting and packaging of sea food. Has developed traceability systems.

Addcon Nordic AS (Oslo) www.addconnordic.no

Food/feed ingredients: Addcon Nordic AS is dedicated to the production of formate-based products that provide unique ecological solutions for several industries. Among them, fish preservation. (Former Hydro / Yara Formates.)

Fjordland AS (Oslo) www.fjordland.no

Food/feed ingredients: The corporate image is to develop and strengthen ideas mainly based on the owners' raw materials, in addition to fish and seafood.

Hydro Formates AS (Oslo) www.hydroformates.com

Food/feed ingredients: See Addcon Nordic AS

Mills DA (Oslo) www.mills.no

Food/feed ingredients: Food producer. Makes caviar out of smoked roe from cod.

Neraal & Co AS (Oslo) www.neraal.no

Food/feed ingredients: Supplier of ingredients and seasoning to the food industry.

Pharmatech AS (Østfold) www.pharmatech.no

Food/feed ingredients: Manufacturer of health food-supplements and natural remedies in Norway and Scandinavia.

Sea-Bell AS (Oslo) www.sea-bell.no

Food/feed ingredients: Fresh fish packaging

Reef Systems AS (Vestfold) www.reef-systems.com

Hardware: Deliver products which can enhance aquatic biodiversity. Situated in Tønsberg.

Nordox AS (Oslo) www.nordox.no

Miscellaneous: Leading global supplier of cuprous oxides as fungicides for plant protection products and as an active ingredient to the marine paint industry for the manufacture of antifouling paints.

4bio AS (Oslo) www.4bio.no

Service provider: Business development and interim management for the Life Science sector. Situated in Oslo and London.

Amino AS (Oslo) www.amino.no

Service provider: Scandinavian-based independent advisory firm dedicated to Life Science.

Soløy AS (Oslo) www.soloy.no

Service provider: Life Science based consultancy service.

VESO AS (Oslo) www.veso.no

Service provider - Animal/fish health: The National Centre for Veterinary Contract Research and Commercial Services. VESO is a limited company owned by the Norwegian government with the Ministry of Agriculture acting as its general assembly. VESO comprises three separate profit centres: VESO Vaccines is the only distributor of animal vaccines in Norway; VESO VetResearch negotiates contract research projects in the field of veterinary medicine with clients from public and private institutions alike; VESO Vikan AkvaVet is a highly specialized research station for contract research in the field of infectious fish disease. HQ in Oslo.

D) Regional & national organisations

INDUSTRY ORGANISATIONS

Biomarint Forum www.biomarintforum.no

Nationwide organisation that organises players in the field of marine life science.

Forum for Innovation www.innovaforum.no

Nationwide and collaborative organisation between researchers, businesses, the government and private owners, with the purpose to strengthen the innovation ability in Norway.

MedCoast Scandinavia www.medcoast.org

Swedish/Norwegian networking organisation founded to further strengthen and develop the biomedical sector in the Göteborg-Oslo (GO) region. MedCoast acts as a catalyst for collaboration between scientists, businesses and the public sector, and works to promote entrepreneurship and the commercialisation of innovative ideas. Additionally, MedCoast works to facilitate venture capital in the biomedical sector and to increase foreign investments.

Norwegian Bioindustry Association www.biotekforum.no

The Association is an independent member organisation with the purpose to promote development of Norwegian biotechnological trade and research.

The Norwegian Biotechnology Advisory Board

www.bion.no/index_eng.shtml

The Board is an independent body consisting of 24 members appointed by the Norwegian government. The main task is to evaluate the social and ethical consequences of modern biotechnology and to discuss usage which promotes sustainable development.

The Norwegian Seafood Federation (FHL) www.fhl.no

FHL Represents Norway's largest export industry after oil and gas. FHL covers the entire value chain from fjord to dinner table in the fisheries and aquaculture sectors in Norway. Partner in a EU 6th framework programme project called CRAB.

COMPETENCE CENTERS & NATIONAL PLATFORMS

Aquaculture Protein Centre www.apc-coe.no

Aquaculture Protein Centre is one of Norway's thirteen Centres of Excellence. APC consists of scientists from the Norwegian School of Veterinary Science (NVH), The Norwegian University of Life Sciences (UMB) and the Institute of Aquaculture Research (Akvaforsk).

The Aqua Research Alliance www.akvaforsk-alliansen.no

The Aqua Research Alliance is a formal collaboration between AKVA-FORSK, UMB and Matforsk, on research, development and education in the field of aquaculture.

Functional Genomics Norway (FUGE) www.fuge.no

FUGE comprises a national plan for research in functional genomics in Norway. The plan is designed to strengthen research in this field and bring Norway up to top international standards. FUGE has set up a system for regional cooperation that integrates universities, institutions, colleges, as well as trade and industry - namely FUGE platforms.

FUGE - CAMST www.camst.org

Consortium for Advanced Microbial Sciences and Technologies - a FUGE platform

FUGE - CIGENE www.cigene.no

The Centre for Integrative Genetics (CIGENE) is hosted by UMB and aims to contribute to a deep causal understanding of complex genetic characters in fish, plants and animals for scientific and commercial exploitation based on an integrative genetics approach. As a core facility under the Norwegian Functional Genomics Programme (FUGE), CIGENE is also responsible for providing a national service for detection, typing and interpretation of SNPs (Single Nucleotide Polymorphisms), and for systems-oriented computational biology. Collaboration with several institutions and commercial companies, among them AKVA-FORSK, NVH, and UiO.

FUGE - NARC www.umb.no/?avd=45

The aim of the Norwegian Arabidopsis Research Center (NARC) is to establish a solid basis for basic plant molecular biology, applied plant research and plant breeding in Norway - a FUGE Platform.

LINKS: Governmental institutions & organisations

Akershus University College www.hiak.no

Akershus University College offers a variety of bachelor- and master programmes and one- and two-year extension courses and continuing courses. Approximately 4 000 students.

Directorate for Nature Management www.dirnat.no

The Ministry of the Environment's advisory and executive body in the area of nature management.

Directorate of Fisheries www.fiskeridir.no/fiskeridir/english

The Directorate of Fisheries is the Norwegian government's foremost advisory and executive organ within fisheries administration.

Innovation Norway www.innovasjon norge.no

Innovation Norway promotes nationwide industrial development profitable to both the business economy and Norway's national economy, and helps release the potential of different districts and regions by contributing towards innovation, internationalisation and promotion. Innovation Norway has offices in all the Norwegian counties and in more than 30 countries world wide. Head office in Oslo.

Ministry of Fisheries and Coastal Affairs www.odin.no/fkd

The Ministry of Fisheries and Coastal Affairs is in charge of the fisheries industry, the aquaculture industry, seafood safety and fish health and –welfare, ports, infrastructure for maritime transport and preparedness against acute pollution.

NIFES www.nifes.no

The National Institute of Nutrition and Seafood Research (NIFES), formerly known as the Institute of Nutrition under the Directorate of Fisheries, is a research institute with administrative tasks.

Norwegian Institute for Nature Research www.nina.no

Main objective of NINA is research, studies and documentation within the main areas of nature management. Oslo branch.

Norwegian Institute of Fisheries and Aquaculture

www.fiskforsk.norut.no NIFA performs research and development work for the fishery and aquaculture industry. Situated in Tromsø and Bergen.

Norwegian Seafood Export Council www.seafood.no

Norwegian Seafood Export Council or "Eksportutvalget for fisk AS (EFF)" is marketing Norwegian Seafood to all over the world, on behalf of the fisheries industry.

Oslo University College www.hio.no

Oslo University College offers Norway's widest range of professional higher education programmes. Approximately 10 000 students.

The Industrial Development Corporation of Norway www.siva.no

SIVA builds networks between regional, national and international R&D environments.

Centre for Ecological & Evolutionary Synthesis www.cees.no

CEES focuses on how environmental, ecological and evolutionary processes are interrelated.

The Institute of Marine Research www.imr.no/english

IMR (Havforskningsinstituttet/HI) is a national consultative research institute which is owned by the Ministry of Fisheries and Coastal Affairs. The Institute performs research and provides advisory services in the fields of marine ecosystems and aquaculture. Situated a number of places along the Norwegian coast line.

The Nor-Fishing Foundation www.nor-fishing.no

The Nor-Fishing Foundation was established in 1992 by the Norwegian Ministry of Fisheries and was conferred the exclusive right to organise the international fisheries trade show Nor-Fishing and Aqua Nor.

The Norwegian Coastal Administration www.kystverket.no

The Norwegian Coastal Administration (Kystverket) is the Norwegian national agency for coastal management, marine safety and communication.

The Norwegian College of Fishery Science www.nfh.uit.no

NCFs is situated at 70 degrees north and close to The Barents Sea, has a particular responsibility for the development of fundamental and scientific expertise within all areas of fisheries and aquaculture research in Norway.

The Norwegian Food Safety Authority www.mattilsynet.no

The Norwegian Food Safety Authority is a governmental body.

The University of Bergen www.uib.no

The University of Bergen is recruiting the best researchers nationally and around the world. With around 17 000 students and 2 500 faculty and staff, the University of Bergen is a medium-sized university.

The Norwegian University of Science and Technology www.ntnu.no

NTNU is based in Trondheim and 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 to fine arts.

The University of Tromsø www.uit.no

At a latitude of nearly 70 degrees North, the University of Tromsø (UiT) is the world's northernmost university. UiT is a relatively small university, with around 6000 students and around 1800 staff.

Østfold University College www.hiof.no

Østfold University College offers a range of bachelor's degree programmes and a few master's degree programmes. Approximately 4000 students.

LINKS: Industry, competence & research organisations

Biotechnology Industry organisation (BIO) www.bio.org

BIO is the world's largest biotechnology organisation, providing advocacy, business development and communications services for more than 1,100 members worldwide.

Center of Marine Biotechnology www.umbi.umd.edu/~comb

COMB is a research center of the University of Maryland Biotechnology Institute and is an internationally recognized research laboratory devoted to applying the tools of modern biology and biotechnology to study, protect and enhance marine and estuarine resources. Situated in Baltimore, USA.

InnoMed www.innomed.no

InnoMed is short for "National network for need-driven innovation in healthcare", and their objective is to improve healthcare services through the development of new products and solutions that meet unmet market needs. Situated in Trondheim.

Kunnskapsbyen Lillestrøm www.kunnskapsbyen.no

"Kunnskapsbyen" is a umbrella organisation for knowledge institutions and companies in Nedre Romerike. Includes approximately 5 000 employees and 5 000 students, and the objective is innovation/industry and commercial development in the region. The commercialisation part is taken care of by Campus Kjeller, a science park and innovation centre. Both situated at Kjeller, Akershus.

London Biotechnology Network

www.londonbiotechnology.co.uk

The core focus of LBN is to create effective business forums and communication networks that bring the London biotechnology sector together.

MABIT www.mabit.no

The MABIT-programme is an industrial R&D program for Northern Norway. Contributes to increased value in fishery, aquaculture and biotechnological industry in the region.

Møre Research www.moreforsk.no/en

Møre Research is an independent research foundation established in 1979 by the county of Møre og Romsdal. The foundation cooperates closely with the three university colleges in the county.

Norwegian Seafood Association www.nsl.no

The objective of Norwegian Seafood Association (NSL) is to attract businesses in the fishing industry in order to promote their common interests in the fields of business policy, economy and trade.

ScanBalt www.scanbalt.org

ScanBalt is a network without formal power that will promote knowledge formation, education, research, technology transfer, innovation and economic development within life sciences.

SINTEF www.sintef.no

The SINTEF Group is the largest independent research organisation in Scandinavia, and every year, they support the development of 2000 or so Norwegian and overseas companies via their research and development activity. SINTEF's goal is to contribute to wealth creation and to the sound and sustainable development of society. Consists of several units, among them are Fisheries & Aquaculture and Health Research.

SwedenBIO www.swedenbio.com

The gateway to the Swedish life science industry and homepage of the Swedish Biotechnology Industry organisation.

The BioIndustry Association www.bioindustry.org

The BioIndustry Association (BIA) is the trade association for innovative enterprises in the UK's bioscience sector.

Europa Bio www.europabio.org

The European Association for Bioindustries is the political voice of the biotechnology industry in Europe.

LINKS: Web portals, publications & databases

www.aquamedicine.no This web site is a joint venture between the Norwegian School of Veterinary Science and the National Veterinary Institute of Norway.

www.fisheries.no Norway's official site on seafood safety and resource and aquaculture management. Fisheries.no is a portal for the Norwegian Ministry of Fisheries and Coastal Affairs in cooperation with the Institute of Marine Research, the Directorate of Fisheries, the National Institute of Nutrition and Seafood Research and the Norwegian Food Safety Authority.

www.fiskehelse.no is a start page for fish health, edited by Fiskehelse Nord AS.

www.forskning.no is the Nordic nations largest internet based channel for promotion of Norwegian and international research.

www.intrafish.no IntraFish Media is a division of Norges Handels- og Sjøfartstidende (NHST), an Oslo Norway-based publishing company. The IntraFish Media group produces a range of seafood publications and operates the daily online news

services IntraFish.com and IntraFish.no. In addition, IntraFish Media publishes Industry Reports which provide in-depth analysis of current seafood industry trends.

www.norbiobase.no NorBioBase is a comprehensive database of the Norwegian Life Science Sector established and managed by Innovation Norway and the Norwegian Research Council in close cooperation with all the various companies and their organisations.

www.kyst.no Member magazine and internet news about fish breeding in Norway.

www.norskfisk.no Independent journal of fisheries economics and policies issues.

www.scandinavianlifescience.org Comprehensive database presenting the power of the Scandinavian Life Science industry. The database has become possible through an unique project merging together a number of regional databases in Sweden, Norway and Denmark. The result is a database containing more than 1 500 companies.

F) Financial environment

PUBLIC SUPPORT SYSTEM: Innovation Norway

Start-up Funding www.innovasjon Norge.no

2006: 3,75 mill NOK (Oslo) / 3,59 mill NOK (Akershus) Start-up funding supports persons who want to develop and establish their own company. The scholarship gives mainly to a private person, but can also be given to firms in their establishment phase. The process of founding a firm has two phases: development phase and establishment phase, with respectively 100 000 NOK (200 000 NOK outside Oslo) and 200 000 NOK as the maximum frame for each scholarship. Contact: Asbjørn Hol.

Incubator Scholarship www.innovasjon Norge.no

2006: 3,05 mill NOK (Oslo & Akershus) The incubator scholarship is targeting the founders who develop their business idea in an incubator. Business incubators are organisations that support the entrepreneurial process, helping to increase survival rates for start-up companies. Maximum frame is 250 000 NOK. Contact: Hjalmar Lyngmo.

Norwegian Industrial Research & Development (IFU) Contracts

www.innovasjon Norge.no/templates/Page_Meta_56138.aspx
220 mill NOK in total to both IFU and OFU An IFU contract is an agreement between two or more companies to co-operate in the development of a new "state-of-the-art" product, a process or service which one or more of the participants need. In IFU projects one party, called the supplier, must ordinarily be classified as a small or medium-sized development company. A Norwegian IFU contract is a model for co-operation and a strategic tool to create a win-win situation for the parties involved. Contact: Asbjørn Hol.

Norwegian Public Research & Development (OFU) Contracts

www.innovasjon Norge.no

220 mill NOK in total to both IFU and OFU An OFU contract is an IFU contract, except for that it is an agreement between a commercial supplier and the public system as a customer. An OFU contract is a mean for achieving change and market orientation for Norwegian firms, and at the same time contribute to effective public administration. Contact: Asbjørn Hol.

Arena - Innovation in networks www.innovasjon Norge.no

Budget NA The Arena-program stimulates innovation through collaboration and networking between business players, R&D institutions and the public administration. The program offers financial support and know-how for preparation and implementation of long-lasting development projects, and is a co-operation between Innovation Norway, The Research Council of Norway and SIVA (public innovation company). Contact: Hjalmar Lyngmo.

Marine Innovations www.innovasjon Norge.no

2006: 40 mill NOK Support program to strengthen the innovation ability of the marine industry through networking and knowledge sharing. It should also solve specific development tasks, emphasizing on new species in the breeding industry. Used for funding joint initiatives in the fishing industry that leads to increased profitability and value-creation. Contact: Ola Kr. Rusaanes (Oslo/Akershus), Responsible HQ Contact: Peter Ustad. Contact : Aquaculture/Fish farming, breeding HQ: Svein Hallbjørn Steien.

PUBLIC SUPPORT SYSTEM: The Fisheries and Aquaculture Industry Research Fund

Fisheries and Aquaculture Funding www.fiskerifond.no

Based on a levy of 0,3 % on all exported fish and fish products

Funding scheme for industrial research and development work within fisheries and aquaculture. The Research Council of Norway and Innovation Norway are important partners.

PUBLIC SUPPORT SYSTEM: The Research Council of Norway

FUGE www.forskningsradet.no/fuge

2006: 176 mill NOK (2002-2011: 1,5 mrd NOK) The National Programme for Research in Functional Genomics is designed to strengthen research in the field to bring Norway up to top international standards. The successful mapping of the genomes of humans and certain animals, plants and microorganisms has opened new doors for scientists studying biological processes. This new knowledge is expected not only to enhance our understanding of biological systems, but also to spawn a host of new products and production processes. Contact: Steinar Bergseth.

AQUACULTURE www.forskningsradet.no/havbruk

2006: 107 mill NOK The Aquaculture - An industry in growth - research programme aims to promote a sustainable, market-oriented, profitable aquaculture industry and to facilitate the development knowledge of a high international standard in areas important to the advancement of the industry. The programme consolidates and continues the activities under the previous aquaculture programme and other aquaculture-related activities within the Research Council. Contact: Rolf Giske Ødegård.

INVESTMENT FIRMS

Braganza www.braganza.no

Privately held investment company. Diversified portfolio including biotech/life science.

Convexa www.convexa.no

Norwegian venture capital company.

Four Season Venture www.fsv.no

Nordic venture capital firm. Four Seasons Venture invests in the primary venture capital market as well as the secondary direct market where it acquire entire portfolios of direct investments.

The Food Programme: Norwegian Food from Sea and Land

www.forskningsradet.no/matprogrammet

2006: 316 mill NOK The programme will focus on innovation throughout the value chain from consumer to primary production for both agricultural food products and seafood. Norwegian food production must be competitive and market-oriented, based on innovative, healthy products and processes with a high level of knowledge and expertise. Contact: Johs. Kjosbakken.

FORNY www.forskningsradet.no/forny

Budget NA FORNY's target group is comprised of employees and students at scientific facilities who have good, but latent ideas for projects. Scientific facilities are defined as universities, colleges and research institutions. FORNY is designed to encourage students, researchers and research administrators to focus more attention on the potential commercialisation of research results. This could mean that the inventor of the idea and other rightsholders could take part in a commercial success based on the idea at hand. Contact: Ola Børke.

FondsFinans www.fondsfinans.no

Fondsfinans is an independent stockbroker and investment bank in the Norwegian market for financial services. Founded in 1937, Fondsfinans today consists of 45 highly qualified professionals and is active within corporate finance, equity research and stockbroking.

GZ Group www.gzgroup.se

GZ Group focuses on high growth, life science companies in the Nordic region. The investments are made in companies that are in an expansion phase and the GZ Group has a wide venture capital approach regarding the life science space. Situated in Stockholm.

Handelsbanken Capital Markets

www.handelsbanken.com/capitalmarkets

Handelsbanken Capital Markets is Handelsbanken's investment bank. Has a dedicated Healthcare Team.

NeoMed www.neomed.no

International investment management firm specializing in the health care and life sciences industry.

Sarsia www.sarsia.no

Invests in life science and energy related startup companies. Situated in Bergen.

Scandinavian Life Science (SLS) Venture www.slsventure.com

Scandinavian-based venture capital company with the aim of maximising return on investment by supporting small and mid-sized life science companies with a combination of capital, industrial and financial expertise. Offices in Stockholm and Copenhagen.

Teknoinvest www.teknoinvest.no

Scandinavian venture capital company headquartered in Norway. Invests in areas of emerging technologies within the IT/telecom and life sciences sectors.

SCIENCE PARKS / TTO's

Birkeland Innovasjon www.birkelandinnovasjon.no

Birkeland Innovasjon AS is the Technology Transfer Office at the University of Oslo.

Medinnova www.medinnova.no

Medinnova aims to be an attractive partner between the biomedical research sector and commercial businesses. Medinnova actively promote reserach and innovation within the public health service.

Oslo Innovation Center www.forskningsparken.no

Oslo Innovation Center aims to be one of the leading centers in Europe for innovation and industrial development, and it will soon contain more than 140 companies, which means that approx. 1200 people work in the Park.

Bioparken www.bioparken.no

Bioparken was established in 1991 as a knowledge and innovation centre, concentrating on the field of biotechnology. Situated in Ås and owned by the University of Life Sciences and the Research Institutions in Ås, the support program SIVA and Akershus County, and also relevant commercial firms.

The Norwegian Radium Hospital Research Foundation (RF)

www.radforsk.no

RF is an independent organisation founded in 1986 by The Norwegian Radium Hospital (NRH) and the Norwegian Ministry of Health. RF serves as the Office of Technology Transfer (TTO) for the NRH by identifying and promoting research projects and innovations with commercial potential. Protection of intellectual property rights (IPR) falls within the scope of these activities.

G) Strategic initiatives & documents

MARINE LIFE SCIENCE

HEADING / DESCRIPTION / OWNER & PUBLISHER

Grand Design

Action and activities for the marine industry
Biomarint Forum

Aquaculture 2020: Transcending the Barriers - as long as...

A Foresight Analysis, January 2005
NFR

Innovasjonssystemet i norsk havbruksnæring

STEP report - R-16 - 2002
NIFU STEP

Studie av innovasjonssystemer for marine innsatsvarer

STEP report - R-02 - 2002
NIFU STEP

Knowledge intensive service activities and innovation in the Norwegian aquaculture industry - Part project report from the OECD KISA study

STEP report - R-05 - 2004
NIFU STEP

Næringspolitikk for en ny tid - et tredje alternativ 2005

Norsk Investorforum, Forum for Innovasjon, Forum for Reiseliv og Biomarint Forum

Marin næringsutvikling- Den blå åker

St.meld. Nr 19 (2004-2005)
Ministry of Fisheries and Coastal Affairs

CLUSTER MAPPING

HEADING / DESCRIPTION / OWNER & PUBLISHER

Norwegian life sciences

- overview and status

2005, Extracts and comments to www.norbiobase.no
Innovation Norway and The Research Council of Norway

GENERAL BUSINESS DEVELOPEMENT

HEADING / DESCRIPTION / OWNER & PUBLISHER

Leve av, leve med leve for? Vår bioteknologiske fremtid

2005, Berit Johne and Erik Øverland (Red)
Cappelen Akademiske Forlag AS

Hva kan gjøres for å bedre finansieringssituasjonen for Bioteknologibedrifter i Norge?

January 2005
Forum for Bioteknologi

Government incentives to support the commercialization of research - an international benchmarking study

February 2006
Handelshøskolen i Bodø, NTNU Entrepreneurship Center og Nordlands Forskning

Nasjonal strategi for næringsrettet bioteknologi

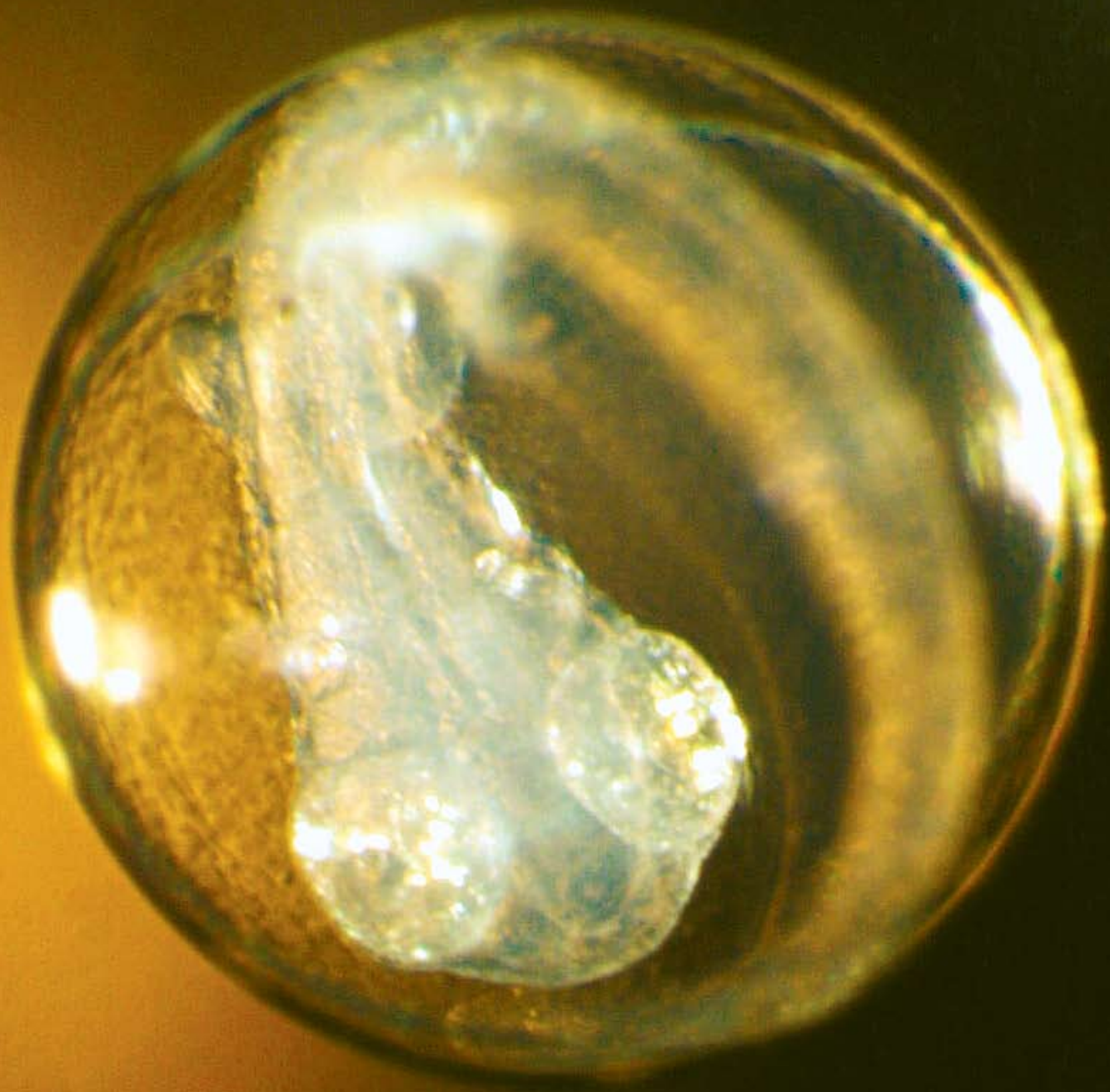
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Ministry of Trade and Industry

Byutvikling - drivkrefter og planleggingsutfordringer

December 2005, Sluttrapport
Norges Forskningsråd (2000-2005 Byforskningsprogrammet)

Norwegian Life Sciences - overview and status

October 2005, Abstract and comments to NorBioBase
www.norbiobase.no, Innovasjon Norge (4bio)



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(FAO 2004) Fishery Information, Data and Statistics Unit

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Internet

Innovation Norway: www.innovasjon norge.no

Norwegian Seafood Federation: www.fhl.no

Soria Moria paper 13. October 2005: www.odin.dep.no

Seafood Council of Norway: www.godfisk.no

The Research Council of Norway: www.forskningsradet.no





Oslo Teknopol is a regional development agency established by the City of Oslo and Akershus County Council. Oslo Teknopol aims to stimulate innovation and attract foreign investment and talent to the Oslo region. As development facilitators in five selected industry clusters in the Oslo region, Oslo Teknopol contributes to public awareness of key industries, closer cooperation between cluster members, and business development within and between clusters. These key industry clusters include Maritime, Energy and Environment, Life Sciences, ICT (Information and Communication Technology) and Culture (Design, Art and Architecture).



Oslo Bio is a collaborative network of stakeholders from the Oslo region life science cluster. Oslo Bio aims to strengthen the cluster and contribute to long term growth through marketing, initiating and facilitating development projects, and international collaboration. Oslo Teknopol acts as the secretariat for Oslo Bio.

osloteknopol

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