SUPPLEMENTARY INFORMATION for the call for proposals with the deadline 31 August 2011 at 1:00 pm

Funding is available for the following application types: Researcher Project, Personal Overseas Research Grant, Personal Visiting Researcher Grant and Support for Events.

To ensure the highest possible quality of the research activities, project funding will be awarded on a competitive basis. Scientific merit is a requirement for all programme activities, and will be given priority as a criterion in the allocation of research grants. Grant applications will be submitted to external referees for scientific assessment. The referees will meet as a panel to discuss and issue a unified assessment of each grant proposal. Grant applications will also be assessed in relation to the assessment criteria stipulated for the relevant application type (www.forskningsradet.no/english > Apply for funding > Application information > Application types).

The Research Council administration and the HAVKYST programme board will assess the relevance of the grant proposal relative to the primary and secondary objectives of the programme and this call for proposals when ranking applications for funding. Assuming all other conditions and quality-related factors are equal, priority will be given to projects led by women project managers.

A total of NOK 17.5 million is available for allocation in 2012 under this call for proposals.

Language:
The Norwegian-language call for proposals is the legally binding version. All grant applications are to be submitted in English.

General:

- Grant applications that do not fulfil the general requirements for the relevant application type and/or the requirements stipulated for this call for proposals will be rejected.
- The programme board has defined priority research areas for the individual sub-programmes and cross-cutting activities encompassed by this call for proposals. Please refer to the descriptions of the priority research areas listed below and the HAVKYST work programme for further details relating to the sub-programmes. Grant applications for projects that do not lie within these areas will be rejected.
- The project description may not exceed the number of pages stipulated for the relevant application type. Please refer to the description of the application type for further details. Please note that the eSøknad electronic application submission system does not allow uploading of files that exceed the page total stipulated. The project description may be maximum 10 pages for Researcher Projects and maximum five pages for Personal Overseas Research Grants, Personal Visiting Researcher Grants and Support for Events. The standard page format is A4, single spaced, with 2 cm margins and a 12 point font.
- The amount of funding sought must not exceed the amount available for the specific sub-programme. Applicants may not propose a low budget for the first year of the project with substantial budget increases in the subsequent years of the project period, unless this is a natural component of the project implementation.
- All grant applications must target a specific sub-programme. In cases where the proposed project is interdisciplinary and of relevance to several sub-programmes, this

must be noted in the application form (under the item Placement/Supplementary info from applicant). Applicants are asked to select the sub-programme that best fits the project.

In response to increasing pressure relating to exploitation of the Arctic resources, focus will be placed on research on and within the Arctic region under the programme.
The programme will employ research projects and other activities to facilitate the optimal use of international funding instruments. International cooperation should be viewed in the context of the need for greater expertise in areas of national and international interest. International exchange for both fellowship-holders and researchers alike is encouraged. The programme will provide support to cooperative projects within the EU framework provided these are successful in the competition for research funding under the programme.

Sub-programme I – Marine ecosystems (MAROKO)
Budget: NOK 4 million is available for start-up of two to four new projects in 2012.

Priority research areas:

From organisms to ecosystems – drivers and sub-processes

This area will focus on the structures and functions of marine ecosystems and on acquiring basic knowledge about the physical, chemical and biological drivers and sub-processes that affect these ecosystems.

To better understand and manage the living marine resources in Norwegian waters and other northern ecosystems, it is vital to identify and generate more knowledge about the effects of physical, chemical and biological factors on these ecosystems. For example, more knowledge is needed about how the ocean climate provides a framework for the production of phyto- and zooplankton, about the impact it has on the variation between predator and prey within the annual cycle and about its role as a controlling factor in the migration, growth and recruitment of fish stocks.

There is a need for greater understanding of evolutionary processes, particularly concerning the application of the latest generations of tools for genomics and transcriptional genomics, life history and diversity analysis of commercial and non-commercial species. This type of knowledge must also be applied in general ecological research, where certain species may prove to be key species within the ecosystems.

Additionally, it is important to gain a deeper understanding of trophic connections and how the benthos affects the structures, functions and dynamics of benthic ecosystems.

Biological diversity

This area will focus on generating knowledge about the extent, condition, variation (both naturally occurring variation and that which is due to human pressures) and development of biological diversity as a basis for ecosystem-based management. Development of expertise in taxonomy is also an objective of the programme.

Species knowledge and knowledge about the species' biogeography are essential to solving a number of challenges relating to Norway's management of marine ecosystems, from the shoreline to deep waters. Too little is known about deepwater biodiversity, taxonomy,

systematics and biogeography. A stronger focus on these areas will provide important background information that will be useful, not least to the petroleum industry should it move into deeper waters.

There is a need for greater understanding of the impacts of climate change, ocean acidification and various forms of human activity on biological diversity. This will make it possible to discover changes in biological diversity at an early stage. Knowledge about how viruses, bacteria and disease cause changes in biological diversity is also vital. Greater focus should be placed on research on guiding principles and commitments relating to the Norwegian Nature Diversity Act, threatened species and biological diversity. In this context it will be important to continue research activities involving non-commercial species. Methods for analysing and aggregating population data from various time series as well as reliable indicators to aggregate uncertainty need to be developed.

Sub-programme II – Effects on ecosystems (OKOSYS)
Budget: NOK 3.4 million is available for start-up of two to four new projects in 2012.

Priority research areas:

Clean seas and environmentally hazardous substances

This area will focus on generating new knowledge about how environmentally hazardous substances from nearby and remote anthropogenic sources are introduced, dispersed and accumulated in marine food chains.

The export of safe seafood is contingent upon documenting that Norway's ocean areas are clean. Ensuring a healthy environment and uncontaminated waters requires monitoring and documentation of the sources and contaminants that can compromise the marine environment and lead to negative repercussions for the fisheries industry. There is also a great need to understand how various hazardous substances accumulate in seafood.

More knowledge is needed about the effects of radioactivity and of old and new chemicals hazardous to human health and the environment at the individual, population and ecosystem levels. There is also a need for knowledge about the sources, occurrence, effects and dispersal of new persistent, bioaccumulative and toxic substances, as well as methods for assessing "new" effects. Moreover, it is important to learn more about how climate change and ocean acidification affect the transport, conversion and uptake of environmentally hazardous substances.

It is important to gain a greater understanding of the discharge and transport of anthropogenic substances such as hormone-disrupting chemicals, nanoparticles and radionuclides, as well as their accumulation, ecotoxicity, and potential effects on species in the ecosystems. Knowledge is also lacking about bioavailability in the marine environment and about uptake routes and effect patterns in marine fish and invertebrates. Identifying and monitoring the biological effects of free nanoparticles is another research challenge.

In order to quantify the total strain on individual species and ecosystems, it is important to examine the long-term effects of environmentally hazardous substances and the effects of multiple stressors and interaction between pollutants and other pressures. A greater focus is needed on the interacting effects of multiple environmentally hazardous substances at relevant

doses of exposure. It is furthermore important to map how combinations of environmentally hazardous substances can interact with other environmental factors such as climate change and ocean acidification.

There is a general need for knowledge about ecosystem management related to changes in chemical stress levels on various organisms and in different contaminated marine recipients, and about how reducing such pressures affects the biota.

Recent research shows that environmentally hazardous substances are not uniformly dispersed in the environment, but rather that local conditions can lead to high concentrations in certain "hot spots". More knowledge is needed about how these hot spots arise and the potential effects they may have.

Climate change and ocean acidification can lead to changes in the exposure to, conversion and uptake of environmentally hazardous substances, which in turn may bring about new effects or effects in other organisms and other places than where currently found. Much is not known about the effects of long-range transboundary, environmentally hazardous substances in Arctic ecosystems; greater knowledge is needed in this area to facilitate international efforts to reduce or prohibit discharge of the most polluting compounds.

Another important research area is algal toxins and their effects on molluscs and other food products from ocean and coastal areas. In addition, there is a need for greater knowledge about the effects of algal toxins on the organisms living in marine ecosystems and about the interactions that algal toxins can set off as a result of altered nutrient conditions.

Marine eutrophication

This area will focus on the need for better knowledge regarding the transport, dispersal and effects of nutrients over distances or interfaces (e.g. soil – lakes – sea).

Efforts relating to marine eutrophication and transport from freshwater to the sea have become more important as a result of the EU Water Framework Directive, the EU Marine Strategy Framework Directive and the decline of sugar kelp in the Skagerrak strait and off Norway's western coast. Increased transport of nutrients can lead to increased growth of algae which in turn can exert negative effects on species and ecosystems. The natural species composition is altered and more organic particles may be produced in the water. High particle density reduces visibility, leads to sedimentation of benthic flora and fauna, reduces photosynthetic activity and the depth distribution of algae, and affects the vision of fish. The ecological aspects of eutrophication are the core issue, but societal aspects in relation to economics and recreation will also be affected.

There is a need for research on how fjords and inshore waters are affected by changes in nutrient concentrations due to transport from runoff from land, deposition from the atmosphere, via ocean currents, and from activities in the fjords and coastal waters – including aquaculture. The effects of eutrophication can be serious; they must be viewed in context with other stressors such as climate change and ocean acidification. There is a need to map out all the effects on species and ecosystems in selected areas, as this will make it possible to establish optimal cause-and-effect chains as a basis for management measures. This is critical for issues such as the decline of sugar kelp mentioned above. Targeted research should be launched with the aim of developing a first-generation eutrophication model for the coastal zone.

EU Water Framework Directive

Norway implements the EU Water Framework Directive and national Water Management Regulations, thereby undertaking obligations to manage water as a cohesive ecological whole. Satisfactory environmental status must be maintained or achieved for all bodies of water in Norway. Environmental status is measured on the basis of ecological and chemical conditions, and there are stringent requirements for monitoring. Research in this area is intended to bolster the knowledge base for integrated water management.
Key research topics include:

- Further development and testing of classification systems for the most important biological quality elements (bioindicators) in coastal waters, with special focus on types of water bodies in Norway.
- Relationships between physical-chemical quality elements and biological quality elements.
- Monitoring methodologies: which type and amount of data sets are required to provide an adequate body of knowledge for resource management.

Increased CO_2 absorption and ocean acidification

This area will focus on what happens when oceans absorb more CO_2 from fossil fuel combustion. This is a highly important scientific field that can be of great significance for the marine ecosystem as a whole.

Far too little is known about the effects of these chemical changes on marine life. Potential effects need to be mapped, and prognoses must be established regarding what effects to expect so that management can be tailored to anticipated developments. Most of the existing data on biological effects relates to greater changes in pH than what is expected in the near future – which is why more needs to be learned about the effects of environmental acidification in the coming decades. It is also important to focus on the effects of moderate changes in species composition and succession patterns in plankton communities, as well as reproductive processes and survival of eggs, fry and adult individuals of the major animal groups in the food chain. Raised levels of dissolved CO_2 will have impacts at the levels of population, species and ecosystem. A key factor is the effect on organisms with shells or skeletons of calcium carbonate and the significance of this for the entire ecosystem. Special attention should be paid to effects on shells and coral reefs. Changes in the carbon chemistry will also affect conversion and the impacts of ocean acidification. Greater understanding is needed about how a more acidic ocean will affect the transport, conversion, uptake and effects of environmentally hazardous substances on individual species, food chains and ecosystems, including the commercial species.

Sub-programme III – Long-term effects of discharges to the sea from petroleum-related activities (PROOFNY)

Budget: No funding announcement will be issued during 2012.

Sub-programme IV – Management and resolution of conflicts (FORKON)
Budget: NOK 4.6 million is available for start-up of two to four new projects in 2012.

Priority research areas:

Fisheries technology and responsible catch levels

This area will focus on how fisheries technology research significantly contributes to the development of responsible fisheries management practices while offering the marine industries benefits in terms of value creation. This is a matter of establishing new framework conditions for responsible, sustainable harvesting of marine resources.

Norwegian fisheries will have to be able to document conformity to the guiding principles for responsible harvesting – so further efforts are needed for reducing by-catches and unintended killing of marine life while minimising the negative ecosystem effects of harvesting activities. In order to maximise marine value creation, it is important to develop new types of tools that facilitate more diversified harvesting of marine production. Ethical aspects of harvesting natural resources, along with a greater focus on quality and a stable supply of raw materials, will require less obtrusive catch methods and new sales models for the fleet.

Achieving responsible marine catch practices will require new gear design and the development of fishing techniques that improve selectivity in terms of size and species. Catch technology for the conventional fleet must also take considerations relating to ecological and ethical aspects into account more effectively. The effects of potential innovations on resources and the environment will need to be documented.

Environmental quality measures

This area will focus on developing quantitative indicators at the individual, species and population levels, which, in conjunction with indicators of other areas of particular biological or ecological value, reflect the status of the ecosystem.

These indicators may be used to set environmental quality measures that will enable the authorities to assess resource utilisation and other activities in the context of the overall ecosystem. A major research effort will be needed to develop cohesive, functional ecosystem indicators, and to define points of reference in an ecosystem perspective.

Conflicts of interest

This area will focus on the great need for basic legal research on the management and protection of marine resources, including interdisciplinary research in the fields of law, socio-economics and the natural sciences that can form a basis for knowledge-based, sustainable management systems for the marine areas.

The management and protection of ocean areas and marine resources raises some fundamental legal issues, and the law is changing considerably on this matter. Key issues in international law involve the distribution of resources on/in the seabed and of fisheries resources and other living marine resources, as well as rights to genetic resources in the sea.

The manner in which scientific knowledge is applied and utilised through political processes at the national and international level is of great importance, such as how risk is understood and managed by setting quotas from an environmental and management perspective.

Sub-programme V – The basis for value creation (VERDI)
Budget: NOK 2.0 million is available for start-up of two to three new projects in 2012.

Priority research areas:

Socio-economically rational harvesting

This area will focus on promoting a broader understanding of the interplay between the socio-economic system and marine resources, which can lead to a more integrated management regime and promote greater value creation from the harvesting of marine resources.

In this connection, more research is needed on all the value chains related to marine resources. It is important to continue generating basic bio-economic knowledge and modelling tools for the establishment of bio-economic single and multistock models. Bio-economic modelling of fish stocks with stochastic recruitment and of harvesting lower in the food chain are also key elements in this context.

It will be necessary to further develop models that incorporate key economic components, and that outline the consequences of different catch levels, catch patterns, fleet capacity, choice of regulatory tools and market-based regulatory regimes. This area will also help to generate greater understanding of the impacts of different management strategies at the national and international level.

Another important challenge ahead is the application of bio-economic models in order to better understand the interplay between increased aquaculture activities and traditional fisheries. Such models, for instance using cod as a model species, would provide insight into the relationship between biological models, market/financing, socio-economic organisation and sustainability.

In order to ensure that management strategies are sustainable, the models must be suited for analysing the impacts of different harvesting intensities (catch levels). For fish stocks that are harvested by multiple countries, the impacts of cooperative and non-cooperative management regimes ought to be analysed, for example by means of game theory.

The social objectives of resource management and its associated distribution aspects are dynamic, and there is a continual need to create models of rational harvesting strategies with regard to changed objectives and framework conditions. A related component in this context is analysis of control strategies and mechanisms. Bilateral and multilateral agreements are essential for shared stocks, and there is a need for impact assessments of changed migration patterns and national strategies pertaining to international agreements (see also sub-programme IV).

Value-creating coastal communities

This area will focus on understanding how local and regional production systems, coastal cultures, knowledge systems and entrepreneurship create a framework for development and value creation.

A more intensive research effort is needed to increase insight into the interplay between nature-based industries and culture-based industries, and social and economic organisation both locally and regionally. It will be necessary to focus on value creation in each part of the value chain, which also involves developing healthy industrial groups in coastal communities. This includes analysis of how the development of marine industries relates to broader-ranging regional development dynamics, the relationship between coastal industry sectoral policy and other policy sectors as well as local development strategies. This in turn raises questions about the design and activities of organisations and institutions.

Key research issues will be to identify the unique features of sustainable coastal communities and what needs to be done to develop the knowledge base and innovative capacity that are critical for value creation in the coastal regions. Greater understanding should be sought of how highly innovative individuals influence and develop a coastal community, or how regions are able to build strong groups (clusters) over time that succeed both nationally and internationally. The maintenance and continued development of infrastructure is necessary, including sustainable transport and logistics systems. Also important here is the interplay between cultural environments and local regional identity, local and regional organisation and the value creation activities connected to this.

Cross-cutting activity: Methods, models and technology (MEMOTEK)
Budget: NOK 2.5 million is available for start-up of one to two new projects in 2012.

Priority research areas:

Observation technology

This area will focus on new, more efficient observation methodologies and technology which will generate more knowledge about sustainable management of fisheries and the environment.

The safe, sustainable management of important fish stocks demands good knowledge of how stocks develop. Such knowledge can be gained both through scientific fishery-independent observation methods and through methods based on data acquired in the course of fishing operations. In this connection, it will be important to develop sampling tools and methods that provide an accurate picture of the stocks that are being harvested. Similarly, technological advances will be required to achieve condition reporting that can cover biological diversity in Norway's vast marine areas; new methodologies and technologies that will increase coverage need to be developed. Acoustic methods and laser technology are particularly promising for the monitoring and quantitative measurement of the marine environment and its living resources. New information and communications technology enables us to build a greater number of, and more precise, sensors, multibeam and multifrequency systems and better signal-processing systems. New observation systems should be adaptable for applications onboard research or fishing vessels, autonomous underwater vehicles, satellites, drones or stationary platforms.

Models

This area will focus on quantitative process understanding, population dynamics, and dynamics and changes in marine ecosystems.

Existing ecosystem models are too simplistic, providing limited information about what regulates and affects an ecosystem's function and structure. One new approach is to use different variations of trait-based models in which a continuum of traits can be attributed to the organisms with weighted values. Numerical models that describe ecosystems "continuously" in time and 3D space with assimilation of critical observations are also needed – so it is essential to define what a critical observation is and what is needed for adequate monitoring. There is a growing focus on the possibility that fisheries are affecting species' genetic composition, unintentionally exerting an evolutionary force. There is a need for more model development as well as new analysis of fisheries data to understand this better. Similarly, it should be investigated whether risk assessment tools and monitoring methodologies originally developed for temperate zones can be adapted to Arctic environments.

Furthermore it will be necessary to develop cost-effective methods capable of combining data from scientific surveys and information from commercial fisheries with new basic biological knowledge for the construction of realistic analytical tools and models for population dynamics.

Cross-cutting activity: Research cooperation (FORSKSAM)
Budget: NOK 1 million is available for 2012.

Applications for **Personal Overseas Research Grants, Personal Visiting Researcher Grants** and **Support for Events** will be accepted under this cross-cutting activity.
Applications for Personal Overseas Research Grants and Personal Visiting Researcher Grants may only be submitted in connection with projects that are already receiving funding under the HAVKYST programme.
Projects that are already receiving funding under the HAVKYST programme will be given priority when awarding support for events.