Coastal Zone Research:

for value creation and diversity

The Research Council of Norway

Foreword

The Research Council of Norway appointed a working group for the period 15.1.03 - 30.6.03, giving it the task of drawing up a planning document for coastal zone research. The background for this study was the initiative taken by the Research Council to promote the coastal zone as an important component of efforts in marine research, as well as submissions from a number of relevant professional and scientific bodies. As one of its points of departure, the working group has based its work on inputs received from research institutions in response to an invitation extended by the Research Council. The mandate of the working group and the documentation that has formed the background for its work are presented in Appendix 1.

The working group has had the following membership:

Professor Abraham Hallenstvedt, Norwegian College of Fisheries: chairman
Section manager Arne Egereide, Directorate of Nature Management
Section manager Kari Grundvig, Directorate of Fisheries, Skagerrak Coast Region
Director R & D, Aquaculture Kjell Maroni, National Association of Fisheries and Aquaculture Industries
Research Director Erlend Moksness, Institute of Marine Research
Research manager Kari Nygaard, Norwegian Institute of Water Research
Adviser Anne SÊ terdal, Norwegian Institute of Nature Research and Norwegian Institute for Cultural Heritage Research
Adviser Edel ≈sjord, Norwegian Fishermenís Association

Research scientist Trine Bekkeby, Norwegian Institute for Nature Research: secretary.

From the Research Council of Norway:
Adviser Nina Hedlund
Adviser Eli Ragna TÊ rum.

The working group submitted its report on June 30, 2003. The report was submitted to the Research Councilís Board of the new Division of Strategic Priorities at its meeting October 22, 2003.

Oslo, October 2003
The Research Council of Norway

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1. Summary

Challenges in the coastal zone - The coastal zone has great potential for the creation of value, and our coasts, both in Norway and in an international context, are currently facing major changes. A number of natural, social and cultural conditions form the basis of the creation of economic value. Processes of change may have significant consequences for nature, culture and society on the coast. The growing process of internationalisation and a sharper focus on a combination of use and conservation are bringing forth a series of challenges. Dealing with these will require a process of upgrading of institutions and management systems, the development of knowledge-based and participatory decision-making processes and an integrated knowledge scenario.

In international terms, the coastal zone is under great pressure. Coastal zone management is near the head of the agenda of a number of international organisations, as well as in the development of international agreements and regulations. Coastal zone research will help to raise the level of international knowledge generation. Norway needs to be an active participant in this process if it is to be in a position to:

- look after Norwegian interests in connection with the development of agreements in fields that could have repercussions for Norwayís situation
- generate the knowledge needed to fulfil its international obligations
- contribute to, and benefit from, the knowledge generated by other countries.

It is of great importance for society that we develop integrated coastal zone management processes that will enable us to prevent conflicts and make decision in an efficient and predictable manner. This will require more knowledge. Both the experience-based and traditional knowledge of the people who live on the coast and research-based knowledge are essential if the level and availability of knowledge are to be improved.

Objectives and priorities - A coastal zone research programme as outlined here ought to shed light on direct internal interactions between sea- and land-based uses, the interactions that take place in the ecology of the coastal zone and the mutually dependent interactions between the natural systems of the coastal zone and cultural, social and economic patterns of use. The coastal zone research programme should help place Norway at the international frontier of knowledge by:

- strengthening the knowledge base for sustainable use and management of the coastal zone by increasing our knowledge of:

    - integrated tools/instruments that will be capable of guiding activities in the coastal zone in the direction of increased value creation and lower levels of conflict
    - natural and anthropogenic prerequisites for activities in the coastal zone
    - the consequences of such activities for species and habitats
    - the consequences of such activities for society and culture (including cultural landscapes and environments)

- developing a dynamic knowledge system by:
    - raising our level of knowledge (e.g. by financing a larger number of post-graduate and post-doctoral fellowships)
    - improving the utilisation of our knowledge of the coastal zone by integrating experience-based and research-based knowledge
    - establishing knowledge bases that will improve the availability of existing and newly won knowledge
    - contributing to better communication and network development by the parties involved in the process
    - strengthening international cooperation and efforts.

The core of coastal zone research lies in overarching problems which relate human activities, nature, society and culture, and which are based on conditions, consequences and methods adopted in integrated approaches. This perspective should form the basis for the way in which research in this field is prioritised.

Central R & D tasks - Coastal zone research is intended to bring new perspectives, fields of knowledge and methods to science, management and industry. Relevant problems include those that arise where nature and the human community interact and which are relevant to human activities. The working group emphasises the following aspects:

- Needs for knowledge related to prerequisites for activities:
    - Sustainable use of nature and culture
    - Coastal communities and the coast itself as arenas for the creation of value

- Needs for knowledge related to the consequences of activities:
    - For habitats, living areas, species and stocks
    - For coastal communities, cultural sites and monuments and cultural environments

- Needs for knowledge related to planning and management:
    - International frameworks
    - Models.

Development of competence and upgrading of expertise - The proposed programme will make great demands of cooperative efforts between professional and research groups. Such cooperation must be ensured via networking and the establishment of joint arenas. The programme should place relatively strong emphasis on post-doc. positions. Such an emphasis will enable young researchers with good basic knowledge of relevant subjects to develop their expertise rapidly in areas of relevance to important problems in the coastal zone.

Information and communication - A rapid, goal-oriented flow of knowledge is a demanding but important ambition. Coastal zone research involves several disciplines, and is employed by a number of diverse user groups. Both the need for and the range of knowledge are in rapid development. The research programme should help to identify types of organisation and operation appropriate for a dynamic knowledge system for the coastal zone. This will require the establishment of networks of coastal zone researchers and of researchers and actors in coastal communities.

In order to present the activity of the programme at national and international level, and to disseminate new findings in coastal zone research, an active bilingual service should be set up on the Internet, on which all newly started, ongoing and completed projects would present their objectives and results. Such a service would have to be marketed and made known to the various target groups involved.

Organisation and financing - The proposed research programme will interface with, and partially overlap, other ongoing research financed by the Research Council. For this reason, coastal zone research must be characterised by a policy of openness vis-‡-vis other research groups and by cooperation among relevant inter-sectoral groups.

The working group suggests developing regional integrated projects which, as well as shedding light on shared challenges, would deal with variations in the coastal zone and the dominant regional challenges involved.

The working group strongly suggests that the Research Council should organise the programme in the form of a small number of major integrated multi- and interdisciplinary projects, in which R & D groups in possession of different backgrounds would commit themselves to collaborate. The programme should be given a reasonably long-term perspective, e.g. a ten-year time-scale, and might well include a mid-term evaluation.

The working group estimates that a level of funding of NOK 20 million in 2004, increasing to MNOK 30 in 2005 and an annual funding level of MNOK 50 from 2006 onwards, would make it possible to establish a separate programme at a realistic level.

2. Introduction

Norway has a number of vital coastal communities which historically can point to versatile local utilisation of their marine and terrestrial resources. Fishing and hunting have always been important industries for people who live on the coast. The past few decades have seen the emergence of a rapidly expanding aquaculture industry. We also find a wide variety of other types of activity, including agriculture, industry, land and marine transportation, outdoor life, leisure activities and tourism.

It is in the coastal zone that we find the greatest number of cultural landscapes and environments, traces of the life and activities of previous eras. The coastal zone possesses a wide range of species and habitats, and the shallow waters of the coastal seas are among the biologically most productive types of natural environment in the world. The coastal zone comprises various types of habitat such as river mouths, shallow-water regions and wetlands, where important species and stocks are produced and where they grow up.

There is currently a growing movement of people to coastal regions and to large and medium-sized cities. We can expect to see an increase in the industrial creation of value related to the fishing and aquaculture industries, at the same time as coastal areas are experiencing an expansion of petroleum-related activities, an increasing flow of tourists and a growth in leisure activities. All in all, these can be expected to lead to greater competition for the resources of the coast, not least in terms of land use.

The planning and decision-making processes that deal with use and conservation in the management of areas and resources are often complex and full of conflicts. The processes available to us today are rather designed to cope with land-based activities, and systems of rights, responsibilities and cooperative models are not adapted to the special challenges of the coastal zone and the participants involved. For this reason, it is of great importance for society to develop an integrated coastal zone management model capable of preventing conflicts and making decisions in an efficient and predictable way. This will have to be a knowledge-based model, in which equal emphasis is given to research-based and experience based knowledge. The aim should be for a management model of this sort to be implemented within the framework of sustainable development, in such a way that industrial activities and other user interests are balanced against the need to conserve biological diversity and our cultural heritage. Norwegian participation in international agreements concerning the coastal zone will place severe demands on our competence. It is particularly important that we should have access to sufficient knowledge to enable us to evaluate the impact of agreements with other countries on Norwegian nature and society, before such binding agreements are made. A number of Norwegian projects involve encroachments on the coastal zone. Norway should take responsibility for building up a knowledge base for international coast-related questions and development projects in our partner countries.

3. The coastal zone

3.1 Limits of the coastal zone

The coastal zone can be roundly defined as being bounded in the sea by the chart ìdatum lineî used in local authority planning according to the Planning and Building Act, or one nautical mile beyond the ground line as defined in the EUís Water Framework Directive. On the land side, the coastal zone can be bounded by the 100 m belt.

An alternative to a zoning concept delimited by a fixed distance from the coastline is the functionally determined concept of the ìshore zoneî, which refers, according to the Planning and Building Act, to the land and sea areas that interact with each other in terms of ecology and/or use. The EUís Water Framework Directive also employs a functional delimitation of the coastal zone, in which the precipitation field sets the boundary on the land side and one nautical mile beyond the datum line is the outer limit in the sea.

The coastal zone as defined for our purposes: A zone that comprise the sea and land areas that interact with each other in terms of ecology and/or use and whose outer limit is set at one nautical mile beyond the datum line.

3.2 Diversity and dynamics of the coastal zone

Characteristics of the coastal zone include the diversity and relationships that make it essential to study it as a dynamic system. The diversity of the coastal zone has been influenced by the human beings who have lived within it and by the ways in which they have made their living: fishing, agriculture, reindeer herding, maritime activities and marine transportation. A new aquaculture industry has also grown out of traditional industrial activities, and this has established itself as a distinct branch of industry with expectations of further expansion. We operate a differentiated fishing fleet that consists of several different types of vessel, which operate in different areas using various types of gear.

Natural conditions, industry and social conditions display a wide range of variations along the coast. Nevertheless, the coastal zone faces a number of challenges in common. These primarily concern fishing and communications, including harbours, seaways and marine-related activities. Several such challenges vary in their impact and frequency on different parts of the coast. The pressure produced by vacation, leisure and maritime activities in this context is greatest in the Oslofjord region, but is currently spreading to other parts of the coast. While public access to the shore zone is a ìhotî topic in southern coastal areas, it is less of a problem in more northerly regions,

where questions of use and conservation have become a central topic of discussion.

Various coastal zone activities such as industry, aquaculture, fishing, shipping and tourism all affect the cultural and natural environment. This in turn influences the activities as these are exercised at present. In the rich diversity of historical remains in the coastal zone we can also read and experience the story of life on the coast and the powerful processes of change that have taken place in the course of time.

Nature in the coastal zone is dynamic, an arena for interactions between complex biological, chemical and physical processes. This is particularly true of the interface between the land and the sea, but also of places where freshwater, brackish water and seawater meet, as of the interfaces between shallow waters and the deep sea and between the seabed and the water column. In this picture, the presence or absence of an archipelago, together with the varying influences of the wind and of coastal and ocean currents, add their characteristics to the coastal zone. Climatic conditions vary from land to the coast and to the sea, as well as from the north to the south, and are continually changing. Biological and non-biological material is spread by the currents, and in conjunction with the high degree of mobility of many organisms, this connects up large areas.

The working group does not wish to go in for an unambiguous regionalisation with respect to research challenges, but suggests rather that the programme should be able to select research locations that will be capable of shedding light on both particular regional challenges and national and international problems of a more general nature.

4. Challenges of the coastal zone: why is coastal zone research important?

The coastal zone has great potential for the creation of value both at present and in the future; creation of value in a wide perspective based on the nature, culture and communities of the coast (see Appendix 2 for a discussion of values and creation of value in the coastal zone). Increased value-adding is emphasised as the overarching aim of Norwegian fisheries policy (see for example the Ministry of Fisheriesí strategic plan for 2001 - 2003 ìValue from the Sea - the Future of Norwayî, and White Paper no. 39, 1998 - 99 ìResearch on the threshold of a new eraî). Visions for creation of value in the marine sector have been presented in a number of reports from research institutions and consulting companies.

The fishing industry is our second biggest exporter, with annual exports worth more than NOK 30 billion. Around 60% of this turnover is derived from wild-caught fish. We operate a differentiated, efficient fishing fleet, with a wide range of types of vessel in terms of size and type of operation. This fleet has a need for flexible use of marine areas. In the aquaculture industry, we can

expect to witness a period of major growth, with the cultivation of new marine species and the relatively permanent use of the sea surface. Norway is thus facing major challenges with regard to its ability to release the value-adding potential of its coastal zone within the framework of sustainable development, by which we mean the ecologically, economically, culturally and socially responsible utilisation of resources. This will involve ensuring the quality of life and well-being of present-day society without reducing the range of options available to future generations.

Given the rapidly rising level of activity in the coastal zone we can expect to experience more conflicts of interest between different industries, activities, wishes and evaluation related to the use and conservation of natural and cultural values. In this connection, coastal zone management and planning, face great challenges. The coastal zone is a complex ecological system. Even though we possess a certain amount of knowledge of individual elements of conditions in the coastal zone, we possess only a limited understanding of some important interrelationships. Furthermore, a wide range of uses of the natural and cultural resources of the coast create the conditions that determine standards and styles of living on it. The maintenance of vital local communities and the availability of manpower and knowhow are the prerequisites of creation of value. The interaction between the biological base on which industry depends and social and economic organisation is an important field of knowledge. The dynamic character of the coastal zone includes a high degree of unpredictability, and whatever measures are adopted will involve a high degree of risk. This situation offers challenges to our management and knowledge skills.

Creation of value in the coastal zone, a growing degree of internationalisation and the combination of use and conservation also introduce a number of challenges. The creation of economic value is based on a range of natural, social and cultural prerequisites. The process will also involve significant consequences for the nature, culture and communities of the coastal region. Dealing with these challenges will require a well-organised, knowledge-based and participatory decision-making process and a well integrated knowledge base.

4.1 Globalisation requires an international research profile

The process of globalisation is becoming more evident by the day in the shape of a world society, and global conditions define the framework and potential of our thinking and our activities. The inhabitants and industries of the coastal zone themselves, have received and passed on impulses and tendencies to change via their wide experience of contact with the rest of the world. Examples of this process include the development of the petroleum and energy sector, national and international structural changes in fisheries and the fishing industry and the processes of change and growth in the travel industry. For this reason, we cannot simply think in national and regional terms. There is a need for research-based knowledge of how to deal with both the cross-border environmental consequences of our activities and of

international conventions and treaties regarding the management of resources and the environment. Knowledge of developing countries, both in their role as international market members and as regional actors in such areas as contingency planning for food shortages, sustainability and resource management, is also essential.

The borders of the nation-state have traditionally formed the most prominent boundaries of research on and management of the coastal zone. In recent years a number of new areas of activity have come into the picture, and new international agreements are making it easier to cooperate in the planning and management of the nature, culture and space in the coastal zone. New challenges related to the principles of how these resources should be managed as part of the international arena are emerging, a number of new actors are taking part and there is a growing need for planning, steering and conflict resolution.

A number of international processes and treaties are relevant to the development of the coastal zone. Even when they are not legally binding, obligations based on written agreements may have important political consequences for the Norwegian authorities in the shape of political declarations adopted by international fora. Norway is responsible for following these up. It is also extremely important for us to be active in international processes. If we are to able to influence these we must be in possession of knowledge of what is being done at international level, and what other countries regard as problems. See Appendix 3 for more information about international cooperation.

There are several reasons why coastal zone research needs to relate to international processes and research, e.g.

- in order to defend Norwegian interests in connection with the development of agreements in areas that can consequences for Norwayís situation
- in order to generate the knowledge needed to meet our international commitments
- in order to contribute to and benefit by the knowledge produced by other countries.

Globalisation and internationalisation lead to economic, technological and cultural changes that influence to a great extent how we negotiate and adapt ourselves in national and regional terms to frame conditions and the potential for development. The coast has always been, as it still is, a multifunctional area. Interactions among the major tendencies towards change, a growing rate of change and national and regional strategies for adaptation are all in themselves important topics of research.

4.2 Creation of value in practice requires knowledge

It is important that the great potential of the coast that results from its natural and cultural resources should be used to create value for the benefit of the

people of today and the society of tomorrow. This will require research on the interactions that take place between the resource base, active use, the limits of tolerance and integrated planning and decision-making processes that create suitable conditions for, and draw up the frame conditions for, our activities.

Mapping and monitoring the coast are important aspects of the process of forming a picture of our natural and cultural resources and of how these should be protected. Knowledge of the consequences of decisions taken regarding use or conservation is still fragmented, and often lacks overall assessments, due to a lack of balance in our knowledge.

The range of challenges related to the use and conservation of the coastal zone will require new knowledge. Unfortunate developments resulting from a short-term horizon and lack of knowledge could lead to major environmental and social costs and wide-ranging damage which would have consequences for the present generation as well as for those still to come. There is a need for knowledge that will enable us to implement desirable activities and encroachments without causing unnecessary damage to natural and cultural values, prevent conflicts between various interests and repair such damage as has already been done.

4.3 Integrated coastal zone management requires upgrading of rights and management systems

Changes in the coastal zone are taking place rapidly and on a large scale, and many different types of functions and cultures have to work together. Integrated coastal zone management and planning will require current management systems and regimes to be renewed and upgraded. The tasks of future management systems will include an emphasis on socio-economic forces, adaptation to international requirements, and increasing the efficiency of legal, economic and administrative instruments, user participation and the improvement of planning tools. This will place great demands on the knowledge base for important decision-making processes that affect developments in the coastal zone. For this reason, it is important to integrate both experience-based and research-based knowledge, so that both the quality of knowledge and its availability are improved.

Rights systems are very different on land and at sea. The marine rights system is regulated through custom and time-honoured use, is informal in character, is related to how resources are used and harvested, and is extremely vulnerable to abuse. The rights system on land is fixed by law and publicly given binding force, and is thus tolerant of change and is extremely predictable. In the coastal zone zone these two systems of rights meet, presenting a challenge to integrated planning and management. Competition raises the level of conflict. This requires a knowledge-based participatory management system that captures the essence of the informal rights system.

The planning apparatus experiences problems in tackling the sudden processes of change that we can observe in the coastal zone. There also exist many different interests and fields of conflict. There is also a weak tradition of research capable of putting knowledge acquired from different subjects and sectors into an more general perspective. Integrated decision-making processes that make clear demands of the knowledge base will be important. This will require knowledge to be available and capable of being utilised by decision makers, and that it should be integrated into the social processes that are required for planning, conflict resolution, operation and management. We will need a wide-ranging knowledge base to which many research disciplines; the humanities, social sciences, natural sciences, technology, agriculture and fisheries all contribute. An overall perspective, based on a multi- and interdisciplinary approach and balanced, neutral knowledge, will largely be required to solve the problems of the future.

If we are to acquire an integrated knowledge scenario of practical importance, it will not be sufficient to improve our level of knowledge and to integrate available knowledge; we must also make both existing and new knowledge more easily accessible. A major challenge will be to ensure ongoing access to the knowledge generated in such a way that the knowledge system itself learns and will be capable of building on what has already been learned. This will require the establishment of efficient systems and databases, as well as access to updated information. Common knowledge platforms and open flow of knowledge are important key concepts in this connection.

5. Coastal zone research: definition and objectives

5.1 Definition

In our definition of the coastal zone, we have focused on internal direct interactions in the coastal zone, in sea/land-related uses or ecosystems. Topics that deal with such internal direct interactions, in ecological terms or terms of usage, represent the core of coastal zone research. It is important to carry out research that will improve our understanding of relationships between various factors and the activities that take place in the zone. The coastal zone is characterised by a basic set of interactions between natural systems and the cultural, social and economic patterns of use, in mutually dependent interaction. Topics that shed light on such mutually dependent interactions will be central aspects of the coastal zone research programme.

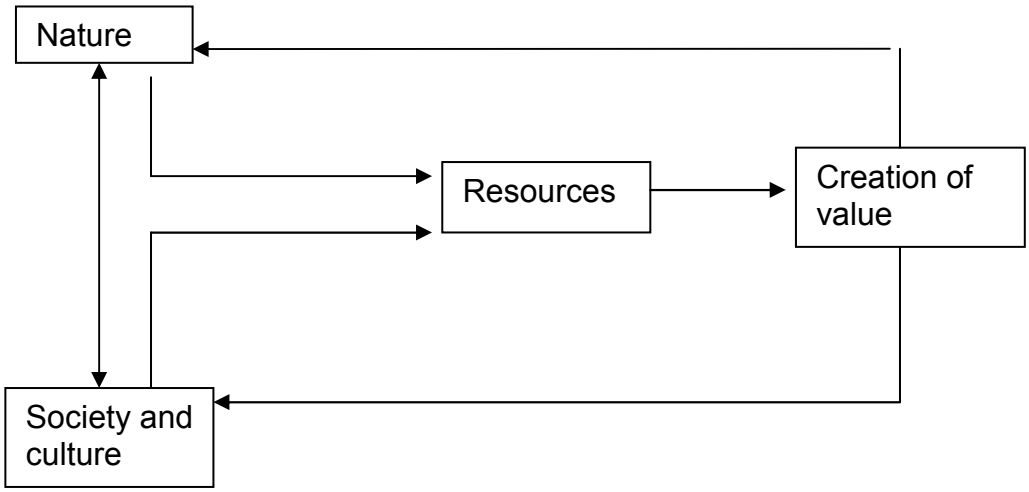
Coastal zone research defined: Research that sheds light on internal direct interactions that take place in land/sea-related use, interactions in the ecology of the coast and the mutually dependent interaction between the natural systems of the coast and cultural, social and economic patterns of use.

The coastal zone research programme should have a particular responsibility for bringing new perspectives, knowledge and methods to the practice of science, management and industry. Problems that arise where natural and cultural values and other social considerations, meet are of relevance for this research. The perspectives, knowhow and methods generated should be relevant to evaluations of whether new activities should be started up or existing activities should change their form or be brought to an end. Relevant activities include those that have consequences for, or are dependent on, marine species and habitats, or cultural landscapes and environments in the coastal zone.

5.2 Objectives

The point of increasing our efforts in coastal zone research should be to establish the knowledge we need to meet the challenges related to the coastal zone, including integrated, long-term management, creation of value and challenges in national and international contexts as seen in the light of the special character of the coast.

This must be done via research into the relationships between the natural and cultural resources of the coast, creation of value and social development, as illustrated in the figure below. The understanding of the processes of change and their effects is a central aspect of this process.



Principal objectives and sub-goals

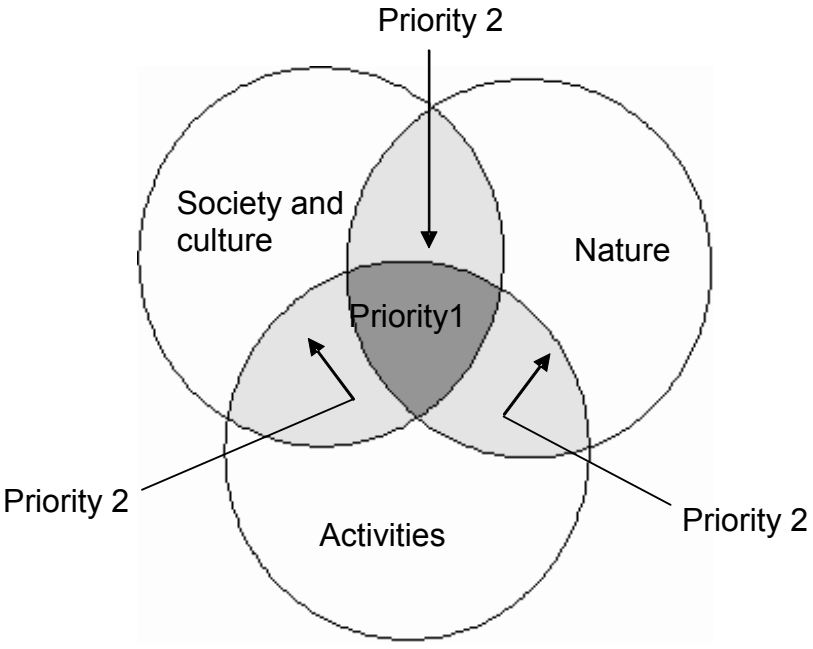
The proposed coastal zone research programme is intended to place Norway at the forefront of international research by strengthening the knowledge base needed for sustainable use and management of the coastal zone and developing a dynamic knowledge system.

Principal objective no. 1: Research efforts will aim to improve the knowledge base needed for sustainable use and management of the coastal zone by increasing our knowledge of:

- Sub-goal 1: integrated methods capable of steering activities in the coastal zone in the direction of increased value-adding and a reduced level of conflict
- Sub-goal 2: natural and anthropogenic prerequisites for activities
- Sub-goal 3: consequences of activities for species and habitats
- Sub-goal 4: consequences of activities for society and culture (including cultural landscapes and environments)

Principal objective no. 2: Research efforts will aim to develop a dynamic knowledge system by:

- Sub-goal 5: raising the level of competence of the R & D system, particularly multi- and interdisciplinary competence (including more post-grad. and post-doc. fellowships)
- Sub-goal 6: raising the level of integration of local and experience-based knowledge and research-based knowledge
- Sub-goal 7: establishing knowledge bases that will improve access to existing and newly generated knowledge
- Sub-goal 8: contributing to better communication and network-building among the various participants involved
- Sub-goal 9: strengthening the internationalisation of research and Norwayís role in international research cooperation.



The model, as presented in the above figure, illustrates the relationships and priorities of the coastal zone research programme:

- Priority 1: this is the core of the coastal zone research programme, insofar as it represents overarching problems that link activities, nature, society and culture
- Priority 2: this refers to problems that concern interactions between society/culture and nature, activities and nature, or activities and society/culture.
- Not prioritised: isolated studies of natural and fish resources in the marine zone; activities in the coastal zone and coastal culture and community will therefore lie outwith the scope of the coastal zone research programme as defined here.

6. Central R & D tasks

The need for knowledge to support integrated coastal zone management has many facets. In addition to knowledge of the diversity of nature, and of cultural landscapes and environments, we need contributions from all disciplines that are oriented in the direction of coastal problems, both at sea and on land. This comprises knowledge of coastal ecology and industry, innovation processes, bio-economic models, change processes, trends, management and planning systems, judicial systems, conditions of use, living conditions, infrastructure, coastal communities and culture. The working group does not regard it as realistic to present a complete overview of knowledge of the many complex fields that will be relevant to the coastal zone research programme. Appendix 4 offers a brief status report on our knowledge.

The impression of the group is that in many respects, Norway possesses a great deal of knowledge of topics relevant to the coastal zone, but that this knowledge is fragmented, that there is a lack of knowledge in several areas and that our knowledge is sector-oriented and not well integrated or sufficiently general. It is also important to shed light on how such knowledge is used in planning and decision-making processes and what conservation and/or use will mean for activities at individual and community level. As far as the coastal zone research programme is concerned, the challenge will lie in connecting up the different types of knowledge and examining their relationships and interactions. Integrated coastal zone research has only a short tradition, as has research on local authority coastal zone management. Developments in the coastal zone will also lead to quite new problems for the coastal zone research programme.

6.1 Natural and anthropogenic prerequisites for activities

6.1.1 Need for knowledge that will permit the sustainable use of natural and cultural resources, and prerequisites for activities

Major challenges exist with respect to the knowledge base of types of marine nature and their significance for the diversity of species in our immediate environment, from primary producers to top predators. There are still gaps in our understanding of the diversity of nature and of how to prevent destruction and reverse instances of damage. Coastal and sea areas have only to a limited extent been mapped in terms of habitats and organisms, and at present no overview exists of trends in the areas occupied by individual types of natural life. We have only limited insight into the factors that determine the extent of habitats, their structure and function and the environmental and ecological conditions that permit them to exist.

It is important for future coastal zone planning that we should possess more knowledge of the population genetics, extent, migrations and distribution and habitat requirements of individual species. This includes knowledge of the size of individual coastal stocks, how they are divided up in geographical terms and the degree of exchange among stocks. Knowledge of the nature of local spawning grounds and nursery areas, and of how they function as spawning grounds and nursery areas, is vital. Only a few ecological studies of stocks in local coastal and fjord areas have been carried out, and it will be necessary to define stock structures and obtain a better understanding of the effects of local out-takes.

The coastal zone and coastal waters are heterogeneous environments. Knowledge of the behaviour, physiology, ecology, and environmental and habitat requirements of individual species could be used to understand the size, growth and diminution of stocks. How do they find food? What types of habitat are important? What types of shelter are important for growing individuals? How do they respond to individual environmental stimuli, and how do they respond to changes in these stimuli? Knowledge of this sort will also contribute to the development of sensitive indicators of environmental change, and identify which activities in the coastal zone ought to be limited in scope and which should be encouraged in order to ensure long-term sustainable use of the available resources.

Our knowledge of interactions between coastal zone species is also limited. We also know little about how short-term variations in the climate or other environmental conditions affect production, recruitment and survival. For example, large parts of the kelp forests on the coast of North Norway have been eaten up by sea urchins in the course of the past 30 years, but we know nothing of the underlying cause and effect relationships.

Aquaculture is one of the fastest-growing industries on the coast, and its future development raises a number of questions. To what extent will it be possible to exploit the natural conditions in a sustainable manner to raise production? What are the possibilities of polyculture operations in our coastal waters, so that species interactions can be exploited to increase the production potential in a sustainable way? If the potential of new forms of aquaculture is to be released, we will need greater insight into the interactions that take place between human activities and natural and cultural environments in the coastal zone, including knowledge of population genetics, migration and distribution, habitat requirements, vulnerability and tolerance limits.

Mutual interactions between atmosphere, land, coast and sea are complex, and they encompass a wide range of spatial and temporal scales. We need more knowledge of these, on both coarse and fine scale levels. The same can be said of interactions between the seabed and the water column. We have little knowledge of the energy budgets of such systems, and such knowledge as we do have is fragmentary and scarcely quantified. We need a better understanding of what triggers individual occurrences and mechanisms, and of the effects that major changes in oceanic fish stocks will have on coastal ecosystems.

In spite of the social importance of the coastal zone and its rich cultural tradition, much more emphasis has hitherto been laid on the agricultural culture and landscape. For this reason, there is a need for greater knowledge of the distribution of cultural landscapes and environments on the coast, and of their vulnerability. At present, we do not possess a complete overview of what is available. Documentation and registers are in short supply, and many cultural remains lie hidden in the earth or under water. Nor is our knowledge base good enough to enable us to say anything certain about the extent of annual losses of valuable cultural artefacts and milieux as a result of human encroachments, the establishment of activities or the disappearance or restructuring of traditional types of operation. A few small-scale studies have been made that show that significant losses are probably taking place, due to lack of knowledge and a lack of clarity in planning and decision-making processes. Knowledge of criteria for conservation and prioritisation are also important, so that these can be incorporated in decision-making processes in efficient, predictable ways. When cultural artefacts with high priority are brought into practical use, there is a need for methods and models for monitoring them so that they do not gradually deteriorate or become lost.

The coast has the highest density of cultural landscapes and environments in the country. Cultural artefacts do not occur in isolation, but are integrated into activities all along the coast; seafaring, fishing, different types of combined operation, business and communication, technological activities and defence installations. When we change the industrial bases and activities of the coastal zone it is vital to protect cultural artefacts and milieux and wherever possible, bring them into use as important social resources. This is the case for both historical and prehistorical cultural landscapes and environments, including those of the Sami population. There is also a need to develop

methods of investigation incorporating studies in the sea and ashore, which will make it easier to understand and recognise cultural artefacts which exist at the interface between the sea and the land.

6.1.2 Need for knowledge related to coastal communities and the coast as a field for the creation of value

Given the developments that are expected in the coastal zone, we will experience strong elements of competition, including competition for the use of surface area. It will therefore be necessary to identify ìarea economicî forms of production and competence for the rational use of natural and spatial resources. If we are to do so we will need better understanding of the surface area requirements of the various industries concerned, the spatial needs of species and ecosystems and of the boundaries of protected cultural environments. It will be necessary to develop models that reconcile the spatial requirements of individual interests in the coastal zone, in order to allow multiple and shared use and prioritise individual uses of space. Problems of general public access, privatisation processes and the transition from multiple and shared use to sole use, will require process studies if they are to be better understood. We also need more knowledge of how to solve conflicts over the distribution of resources between traditional and new activities.

Questions regarding the use of space are central to all types of activity in the coastal zone. This requires studies of dynamic developments in the use of the coast for local industry, housing with local and external employment and leisure activities with seasonal housing requirements. Studies of spatial requirement conflicts will play a central role in this respect, as will studies of cultural conflicts at the interface between the cultures of the coast and its guests.

Space is vital for animal and plant life in the coastal zone, as it is for human activities such as fishing, aquaculture, sea ranching, agriculture, industry, housing, shipping, recreation and tourism. Problems of conservation of the diversity of natural and cultural resources in the coastal zone are also largely related to the availability of physical space.

Central R & D tasks concern our understanding of how local and regional production systems, coastal culture, knowledge systems and entrepreneurship create the premises for development and innovation. More research is needed to improve our insight into interactions between the foundations of natural and culturally based industries and local and regional social and economic organisation. We need studies of the coastal infrastructure, including travel and transport. The knowledge base and innovative ability of the coast as prerequisites for the creation of value are important topics of research. What is needed to maintain and develop these? What are the characteristics of sustainable coastal communities? The interaction of cultural milieux and local and regional identities, organisation

and the creation of value related to these aspects are important fields of knowledge.

Developments in the coastal zone bring in their wake basic changes in the legal situation, with increasing tension between established multiple use rights and new special rights. Legal predictability is a prerequisite for the realisation of the value-adding potential of the coast, and is thus an important challenge as regards knowledge generation.

6.2 Consequences of activities for natural and man-made resources

6.2.1 Need for knowledge related to consequences of activities for habitats and living areas, species and stocks

Many of the unresolved conflicts between environmental interests and industrial development are caused by a lack of knowledge of relationships in the natural sphere and how human activities affect them. In order to prevent serious user conflicts and unacceptable encroachments on nature, we need better basic documentation regarding the role played by various habitats in ecological and hydrological processes. We also need to understand the combined effects of human impacts resulting from different kinds of use and how the marine ecosystem responds to these. Such an understanding demands knowledge of relationships between physical and chemical conditions, the exchange of biological material among organisms and the mechanisms that control the growth and species diversity of these groups. There is a need to clarify the limits of tolerance of individual species and habitats, and how they respond to environmental stimuli or anthropogenic pressure. We ought also to improve our level of knowledge regarding interactions involving fisheries, aquaculture, predators, introduced species and the natural environment, and regarding the relationships between the environmental impacts of human activities and natural variations.

Kelp trawling and fishing on the coast are the basis of important industrial activities, and more knowledge of what levels of harvesting nature is capable of tolerating is needed. How important are the consequences of individual industries such as coastal fisheries, angling, and tourism for the species involved; not only those that are actually taken but also other species? How do they affect each other? We ought to know more about the effects of new management policies, e.g. the introduction of protected areas and their allocation to various user groups.

Aquaculture ties up large areas of the coastal zone, and a great deal of attention is being paid to the farming of new species, which will also require large areas. Experience gained in salmon farming has shown that parasites and disease, for example, may cause serious problems in both financial and ecological terms. However, it has proved difficult to measure the extent of such effects because we lack knowledge of historical levels of infection. We

need more knowledge of potential ìproblem speciesî in aquaculture if we are to be able to analyse processes of change in the populations of wild species as a result of the growth of the aquaculture industry.

Several introduced species have been observed in the coastal environment. The spread of non-native species is the result of direct releases to the sea and ballast-water discharges from vessels, and is also caused by aquaculture. Climate change may also result in the spread of species to new waters. The ecological and economic consequences of such species introductions (whether as a resource or as a threat) and the possible costs of removing them are not clear. How much spreading can we expect? How are biological diversity and existing ecosystems affected?

We lack sufficient knowledge of terrestrial area use and freshwater management. We need more knowledge of how changes in the timing of discharges of freshwater from regulated rivers affect fjord and near-coast environments, what sort of effects are caused by changes in nutrient salt levels, how sediment transport is affected by different types of human activity and the short- and long-term environmental effects of such changes. We also need more information about how the relationships between the water column and the seabed are affected by factors such as increased additions of nutrient salts and changes in the climate.

6.2.2 Need for knowledge related to consequences of activities for coastal communities and culture

One notable feature of developments on the coast in recent years has been a powerful regional centralisation of human settlement patterns. There are certain indications that the processes of development in the coastal zone will have important effects on where people live and on the composition of the work-force on the coast in the course of the next few decades.

The processes of change that are taking place in in agriculture, fisheries and other types of industry may lead to the weakening of the foundations of viable coastal communities and the loss of cultural remains and milieux. These changes often take place as a result of our acceptance of individual cases, as ìbit by bitî encroachments, in which there is insufficient control of the whole picture and the sum of small changes may lead to an overall result that no-one regards as desirable. When parts of the coast suffer from emigration and depopulation, the process is also a major challenge to the continuation of our cultural heritage. Cultural artefacts and milieux deteriorate and disappear, the people who carry on this heritage die out, just as old crafts, industries and activities die out. We do not know enough about these processes or about the implications of such losses.

The relationship between demographic processes on the coast and the realisation of its potential for creation of value are important subjects of research. This field also includes identification of the prerequisites for the

recruitment and availability of manpower and competence. What are the institutional, public-sector and organisation frameworks for activities that will ensure recruitment and the mobilisation of competence?

It is important to generate knowledge about the relationships between coastal culture, cultural artefacts and milieux and the creation of value in coastal communities. It would be interesting to have an overview of how such values are protected and adopted and how they create value. How they can be given weight in important decision-making processes and what will have to be done to enable us to allocate priorities as far as possible on the basis of knowledge when opposing interests face each other.

Encroachments on the coastal zone and the establishment of industrial activity change the landscape and lead to the loss of cultural landscapes and environments. New industries in expansion look to the coastal zone, putting severe pressure on the use of space, both ashore and in the sea. Other sectors are expanding as well as aquaculture; these include the travel industry and the leisure sector. The heavy pressure on the use of land in the Oslofjord region during the past 30 or 40 years has primarily been due to the increase in the popularity of the leisure sector. For this reason a wide range of initiatives aimed at the preservation of cultural sites and monuments and cultural environments and coastal landscapes.

The cultural sites and monuments and cultural environments of the coast as physical structures are especially liable to suffer, since changes in types of activity often mean that they lose their original functions and become less useful. This leads to conflict situations in which the desire for new facilities and activities needs to be balanced against the need to conserve historical remains, buildings and site. Conflicts may also arise in connection with the desire to study the past through archaeological or marine archaeological excavations on sites where new types of activity are to be established. Such conflicts can be avoided by carrying out good surveys well in advance.

6.3 Instruments for integrated coastal zone planning and management

The objective of integrated coastal zone management requires the cooperation of the management institutions, sectors and areas of expertise involved. Adaptations to international agreements and regulations that are relevant to coastal zone management add to the complexity of decision-making processes. Demands for integrated coastal zone management will make it necessary to upgrade management institutions and develop good management models. What we need are models to coordinate sectoral legislation and which take the informal legal system of the coast into account. We also need models that establish criteria for weighing competing interests and needs, and which help to encourage participation and conflict resolution.

6.3.1 Need for knowledge related to international frameworks for coastal zone planning and management

There is a need for knowledge relevant to systems of international law and guidelines derived from international treaties for the implementation and organisation of coastal zone management and planning. In this connection it is important that Norway should be at the forefront of competence and knowhow. Studies with a comparative international perspective on rights to coastal resources and areas will be extremely useful. Norway will follow up international conventions and the country needs knowledge and experience from the coastal zone in order to meet its obligations and to be able to influence future developments in this field.

Norway should also take responsibility for building up a knowledge base for cooperation with developing countries on questions related to the coastal zone. NORAD is already cooperating with Norwegian universities and with a number of research and competence institutions in connection with specific programmes and projects in developing countries. The focus here is on competence institutions that possess expertise on problems of the environment and sustainable development, and on how we can protect our environment and natural resources in practice. Important tools to this end include consequence analyses, regulations, the development of national management organs and coastal zone planning in development aid partner countries.

6.3.2 Need for knowledge related to coastal zone planning processes and management models

A central need in the value creation process in the coastal zone is for better understanding of the formal and informal instruments, methods and tools that are available and are being used in the study and decision-making process in the coastal zone. There is a need to renew and upgrade both the formal institutions and the procedures used in practice. Current planning and management regimes have only managed to a limited extent to deal with the diversity and dynamic character of the coastal zone. There is a need for knowledge of the consequences of current management models and for alternative management and planning models.

In recent years, an increasing amount of attention has been paid to management via partnerships in which public- and private -sector actors cooperate in taking responsibility for management. It is important to evaluate and develop this trend. Partnerships are relevant in connection with coastal zone management, for example in relationship to the need for cooperation involving several local communities and industrial sectors. The governmentís strong promotion of the role of county councils in regional development, which emphasises partnership rather than the exercise of authority, raises a number of questions for research.

The local authorities are the central coordinators of coastal zone planning, and need to reconcile several local and national needs and interests in the way that they allocate land use. Coastal zone research can help provide a better knowledge base for local authority planning responsibility in the coastal zone. We need more knowledge of the premises required by the Planning and Building Act, and of the extent to which there is accordance between local authority practices, the management tasks that have fallen to them and the knowledge resources available to them for this purpose.

6.3.3 Need for knowledge related to legislation and rights

Among other things, the Planning and Building Act is an analytical and decision-making tool for the use of spatial resources. Its aim is to ensure that both politicians at local government level and society as a whole should have the basic information they need to weigh up conflicts of interest and make decisions. Does it work as intended? Is it appropriate for the challenges presented by the coastal zone? Stringent methodology is vital both in the consequence analysis system in the Planning and Building Act and in public-sector land-use planning in general. There is a need for more knowledge of how local and regional government bodies protect the nature, cultural landscapes and landscapes of the coast in their planning, use and conservation of the coastal zone. The Planning and Building Act is currently being revised. The first modifications will come into effect as early as 2003, and the consequences of the changes in the planning systems ought to be followed up by evaluations.

Given our major ambitions for the future development of industrial activity in inshore waters there will be serious competition for the right to utilise resources on land and at sea. This will lead to major challenges to the rights systems that operate in the coastal zone. The use of areas of the sea and the exploitation of resources are traditionally marked by informal regulations and by custom and tradition. The fact that this system has hitherto been only slightly affected by conflict is because the sea has always been available for multiple use. Zones of the sea have been utilised for limited periods of time, and such utilisation has left only slight traces in its wake. We are now, to an increasing extent, experiencing a transition from multiple to sole use, and the length of time that areas of the sea are occupied is increasing. Reallocating multiple-use zones to single use breaks with the tradition of customary use and rights of general accessibility.

The rapid pace of industrial development based on coastal resources and areas will create new problems regarding rights and the boundaries of individual pieces of legislation. One current example is the Sea Ranching Act., which concerns the release and recapture of stationary species such as shellfish and lobsters. Releasing these species requires a permit or concession, which in turn gives its possessor the exclusive right of recapture. This is the very basis of the Act. It has been argued that without such an exclusive right to recapture released individuals, no-one would invest in

releasing them. The meeting between existing and new legal regimes in the coastal zone will require thorough analyses in order to achieve balanced development.

The interfaces between sectoral legislation, environmental legislation and the Planning and Building Act demand the application of legal expertise. Many aspects of this area have still to be clarified and these bring up a need for research-based knowledge.

An important problem concerning the use of area in the coastal zone concerns the types of activity that scarce spatial resources will be used for. In this context it may be appropriate to apply regional economic and localisation theories to the coastal zone, a step which has been taken in very few cases to date. A related question concerns the development of models that incorporate criteria for weighing up various interests against each other.

6.3.4 Need for knowledge related to better tools and methods

The knowledge base for the development of environmental monitoring and analytical methods for national monitoring of the impact of changes on important species and on natural and cultural environments needs to be strengthened. Such a process of improvement might include the development of models of fjord/coast processes, coast/ocean interactions, models of exposure, studies of relationships between biological and non-biological factors and studies of relationships between the natural environment and cultural landscapes and environments. It will also be important to develop a methodology for identifying vulnerability and tolerance limits that reflect changes and environmental disturbances. Such indicators might be represented by species, groups of species, habitats, ecosystems, types of landscape, physical oceanographic conditions and chemical compounds.

The development of systems and indicators for integrated monitoring of natural and cultural resources in the coastal zone will require research. New knowledge in this area will provide us with better grounds for prioritising areas of special effort, and for evaluations of where encroachments and activities can be permitted. Some factors are suitable for monitoring short-term change, while other are suitable as ways of tracking changes over longer periods of time. We know little about which factors these are, and which of them might be suitable as indicators.

Documentation and registration of locations may help to guide the development of the coastal zone and reduce conflicts. It will be necessary to actually map and register what actually exists of natural resources and cultural sites and monuments, in order to be able to develop good models for drawing up lists of priorities. Today, society wants a knowledge-based administration that solves conflicts of interests by means of predictable decision-making processes that are accessible to, and involve the participation of, all the parties concerned.

7. Development of competence and upgrading of expertise

The proposed programme will require cooperation on a large scale between research centres and will have wide-ranging ambitions for linking up disciplines, research groups and problems. Links must be guaranteed by means of networks and the establishment of joint arenas. The cost of such cooperation must be met by the programme.

Persons who are taking their doctorate in a particular topic will often find it burdensome to spend time on obligatory cooperative efforts that require communication with other research centres. For this reason, the programme should invest relatively heavily in post-doc. positions. This will enable young research personnel with good basic knowledge in relevant disciplines to develop their competence relatively rapidly in the direction of major coastal zone problems. Such people may experience communication with other disciplines in the course of joint projects as a means of gaining competence rather than as a cost.

Post-doc. positions may be short-term or long-term, i.e. lasting from one to three years. Such positions will enable their holders to acquire more detailed knowledge of the field, allowing them to concentrate on over-arching problems, while others hold shorter-term fellowships. This group of research fellows will be able to take their knowhow and experience with them from one research group to another or from one country to another, at the same time as the maintain contact and help to maintain contact with their original group.

The working group suggests that in the course of the ten-year period of the programme, it should aim to provide 40 post-graduate and 60 post-doc fellowships with durations ranging from one to three years. In order to strengthen international cooperation in this field, some funds should be earmarked for periods of stay abroad and for fellowships for visiting scientists.

8. Information and communication

For several reasons, information transfer is a particularly challenging aspect of this field. In the first place, our need for knowledge and the amount of knowledge available are both developing very rapidly, and knowledge quickly goes out of date. Secondly, the proposed research programme will involve a several different disciplines and is aimed at a number of very different user groups. A rapid, targeted flow of knowledge will be important if our ambition to help to improve management and the creation of value is to be achieved. The working group therefore regards it as essential to stimulate dynamic knowledge systems adapted to needs of the various users of the coastal zone in their organisations, in practice and in educational contexts.

The working group has suggested inviting research groups to collaborate in a small number of large-scale projects that would combine national tasks with concrete regional relevance. This would produce a fruitful closeness to the users involved, not only as proposers of problems, but also as recipients of knowledge and as important participants who would test out new knowledge in practice. Such a way of organising projects would simplify communication and cooperation with user groups and knowledge transfer.

The coastal zone research programme must actively communicate the scientific challenges of which it will attempt to improve our knowledge, as well as which activities have been set in motion and what knowledge has emerged from the process. This will entail an active programme of ongoing communication for all the projects that have been launched. An Internet service should be established where all recently launched, ongoing and completed projects would present their objectives, sub-goals, interim results and final results, also in popular form. This service must be publicised and marketed to all the target groups concerned. This service should also be available in English.

The coastal zone programme should organise meetings, in cooperation with relevant activities and organisation in the coastal zone, at which topics from ongoing and recently completed research projects would be presented. One or more congresses aimed at international participants should also be organised.

9. Organisation of the programme

9.1 Interfaces with other research fields and programmes

An integrated, interdisciplinary coastal zone research programme will interface with, and partially overlap, other research currently being financed by the Research Council of Norway. This applies to marine research in the natural sciences, environmental and development research and research in the social sciences and humanities, both basic and industrially oriented. Some of the programmes involved are already nearing completion, and the Research Council will start work on new programmes. Depending on the financial framework of the coastal zone research programme, priorities and evaluations will have to be made with regard to whether this research programme ought to be integrated with one or more ongoing research programmes or, as the working group proposes, should be organised as a separate coastal zone research programme. Irrespective of which strategy is adopted, there are bound to be a number of neighbouring topics in which good interfaces will have to be established, and the possibility of joint advertisements of positions, co-financing, common communication efforts and conferences should be considered.

At the same time, other research programmes and new national and international regulations will provide new knowledge and frame conditions that

will affect a coastal zone research programme. The results of projects in climate and biological research and new international agreements will change important basic parameters of a research programme of this type. For this reason, it is essential that a coastal zone research programme should be open to other relevant scientific groups and should work with these in order to create a robust knowledge base for the coastal zone.

9.2 Establishment of knowledge independent of persons and sectors

With few exceptions, Norwegian research groups are small and vulnerable. A research programme with an obviously applied profile and an ambition to improve decision-making processes in the coastal zone needs to be organised in such a way that competence is accumulated in strong groups and networks that cooperate and share insights at national and international level. Many Norwegian research groups have a relatively clearly defined sectoral relationship with industrial or environmental policy interests. It is important that research groups should be linked up across such sectoral boundaries.

9.3 Organisation

The working group regards it as essential that sufficient funding should be allocated to make it feasible and rational to propose a separate long-term programme of coastal zone research. An allocation of NOK 20 million in 2004, rising to MNOK 30 in 2005 and MNOK 50 annually from 2006 onwards, would make it possible to establish a separate programme. Even so, a programme funded at this level would be relatively modest in scope, so that a sharp focus and stringent prioritisation of research needs would be essential.

A future programme board will have to develop and maintain a conscious attitude to which research milieux should participate in the knowledge development process. Not all of them should be involved in all of the topics being studied, and within a few years it should be clear which of them are the driving forces in the individual areas of challenge. This must also be made clear externally to other research centres, companies, the authorities and other parties who seek knowledge of the coastal zone. The knowledge system is important, not only for communication among scientists and research groups, but also for communication with other users.

The programme will have to capture the complex challenges that are being played out in the coastal zone and shed light on relationships with, and dependences on, research-based knowledge. For this reason, multi- and interdisciplinarity will be a trademark of the programme. The working group believes that it will be important to connect research groups with each other and offer them long-term perspectives. Conditions must be created that will promote goal-oriented project cooperation among several R & D milieux on selected individual locations, so that the integration and interactive aspects of ecosystem and social processes of change will be made obvious. It takes time

to develop interdisciplinarity, and attention will need to be paid to this process by both users and the programme board itself. It is for this reason that the programme should be given a certain long-term perspective, e.g. ten years, possibly with a half-term evaluation.

In an international context, a great deal of research on the coastal zone is currently in progress. The research programme should ensure that Norwegian institutions collaborate closely with international colleagues and institutions. This is important in order to assure the quality of the research being done, while it will also enable Norway to both benefit by and contribute to international research in this field. Comparative studies of coastal zone research are an example of such cooperation. Overseas research groups should be invited to take part directly in the projects, and research fellows should be encouraged to carry out parts of their studies abroad.

The R & D challenges presented by the coastal zone have many aspects in common, even though the Norwegian coast is long and both natural and cultural conditions differ along its length. It is important that the research programme should be organised in such a way that the best qualified scientists face the national and international challenges offered by the need for knowledge. At the same time, it will be important to capture the regional differences that exist along the coast, both in order to identify the types of problems that users regard as being dominant in their own areas and to identify the types of strategies for solving these problems that will be appropriate for individual regional situations. We must therefore stimulate the development of integrated regional projects which, as well as shedding light on some of the joint challenges will also be capable of providing in-depth interdisciplinary analyses of the challenges that users of the coastal zone regard as being particularly important in their own regions.

Given this background, the working group strongly suggests that the Research Council should organise the allocation of funds in such a way that most of the programme will consist of a small number of large, integrated multi- and/or interdisciplinary projects, in which R & D centres with particular types of relevant scientific background will commit themselves to collaborate with each other. These projects might consist of a combination of broad international and national topics that are common to the whole coastal zone and more regional problems, which will enable us in combination to identify the most important variations along the coast. In other words, the projects should include certain basic problems and approaches while maintaining a clear profile vis-‡-vis predominantly regional challenges. The projects should also be of a certain duration, e.g. five years. The right conditions should be created to encourage close collaboration within individual projects, and this should also be a requirement.

Experience suggests that a number of factors are necessary for success in multi- and interdisciplinary work:

- that basic knowledge of the field involved is sufficiently good

- that good organisational models are developed, with experienced project management
- that there exists a clear plan for how the multi- and interdisciplinary aspects of the work should be organised
- that scientific objectives, budgets and temporal horizons should take into account the additional efforts required by such a method of working.

The programme management team should play an active role vis-‡-vis the projects and create conditions that encourage inter-project cooperation in the shape of national networks. The large-scale projects must be given an international profile and must further develop their international involvement. The projects must draw up communication and information plans for cooperating with central user groups and for synthesising and communicating the knowledge generated in both scientific and popular form. They should be obliged to organise or cooperate with good communication networks. They should also be given responsibility for synthesising their research results with a view to their application. They should have responsibility for running researcher networks and should cooperate with milieux that are capable of producing doctorates and employing post-docs, as well as being capable of supervising theses.

This could be an exciting model that could be adopted in place of a traditional application process with a large number of small projects. It might be capable of inspiring scientific groups to develop the foundations of long-lasting cooperative processes which would be turned to competitive advantage. Major projects would have an international impact, in turn releasing more funds to the field. The advertisement of projects could become an invitation to competition, with guidelines about major projects, cooperation within certain objectives and frameworks, and taking the R & D programme as its point of departure.

10. Financing

The annual export value of the Norwegian fishing and aquaculture industries is more than NOK 30 billion. These industries originated in or are based on the coastal zone. We also create value in a number of other industries such as shipping, marine transportation, shipbuilding and equipment manufacture (electronics, machinery, etc.) and travel. The development of industry and society in the coastal zone is of great importance for Norwegian society. It is completely essential for industrial development and other aspects of the development of the social community that we have good systems for knowledge-based coastal zone management.

The research programme proposed here would cost an extremely small percentage of the export value of the fishing and aquaculture industries. The research programme wishes to lay the foundations of a process of integrated knowledge development in the coastal zone, a process that would require the

involvement of many departments of public-sector management and which would lead them to acquire new knowledge. This will require several ministries to show interest in this research and to adopt financial responsibility for it. Experience suggests that co-financed programmes of this type can produce good synergy effects and thus greater benefits than smaller, sector-limited efforts.

The following ministries are suggested as sources of finance for the programme:

Ministry of Fisheries (FID)
Ministry of Defence (FD)
Ministry of Local Government and Regional Development (KRD)
Ministry of Agriculture (LD)
Ministry of Environment (MD)
Ministry of Trade and Industry (NHD)
Ministry of Petroleum and Energy (OED)
Ministry of Transport (SD)
Ministry of Foreign Affairs (UD)

The working group does not ignore the possibility that other ministries might also be sources of finance. Examples of research topics that would be relevant to various ministries include:

Ministry	Research topic
FID	International cooperation Use and conservation of ecosystems Structure and functions of ecosystems Effects of encroachments Sustainable harvesting Industrial development Planning and decision-making processes Coastal cultural landscapes and environments Use of the coast for recreation (e.g. angling) Sea transport Harbours Safety at sea
FD	Military exercises New uses of military land Clearance of war remains
KRD	Local authorities - industrial development and conflict resolution Local authorities - planning competence Regional development in the coastal zone County authoritiesí role and tasks as regional development agency Integrated coastal zone management Mutual integration of economic, planning and legal instruments Changes in patterns of human settlement Sustainable development of tourism in the coastal zone
LD	Cultural inheritance/cultivated landscapes Industrial development Original populations/coastal Sami Coastal tourism Housing and rural development in the coastal zone
MD	International cooperation Structure and function of ecosystems Use and conservation of cultural sites and monuments and cultural environments Use and conservation of natural resources Use and conservation of ecosystems and biological diversity Effects of encroachments on natural and cultural resources Leisure activities in the coastal zone Planning and decision-making processes Pollution The shore zone
NHD	Sustainable industrial development/creation of value
OED	Hydropower development Petroleum sector development
SD	Transport systems (sea and land) Structure of harbours
UD	International cooperation Development-oriented research Knowledge development as an aspect of the follow-up of international obligations

Proposed financial plan in NOK million

	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
FiD	6	9	15	15	15	15	15	15	15	15
FD	0	1	1	1	1	1	1	1	1	1
KRD	4	4	5	5	5	5	5	5	5	5
LD	3	3	5	5	5	5	5	5	5	5
MD	6	9	15	15	15	15	15	15	15	15
NHD	0	1	3	3	3	3	3	3	3	3
OED	0	1	3	3	3	3	3	3	3	3
SD	0	1	2	2	2	2	2	2	2	2
UD	1	1	1	1	1	1	1	1	1	1
Sum	**20**	**30**	**50**	**50**	**50**	**50**	**50**	**50**	**50**	**50**

In the view of the group, a first-year allocation of NOK 20 million in 2004, rising to MNOK 30 in 2005 and MNOK 50 annually from 2006 onwards would make it possible to establish a separate programme. Even so, a programme funded at this level would be relatively modest in scope, so that a sharp focus and stringent prioritisation of research requirements would be essential. Meanwhile, efforts should be made to obtain supplementary funding from local and regional private- and public-sector sources at programme and project level.

11. Appendices

Appendix 1: The groupís mandate from the Research Council of Norway

The working group is requested to draw up a plan, including principal objectives and sub-goals, that describes the central problems facing coastal zone research. The plan should include recommendations as to which research tasks should be given priority within a given budgetary limitations. The group should attempt to achieve the best possible correspondence between the budgetary framework and the proposed principal objectives, sub-goals and relevant R & D tasks. The scientific challenges involved are likely to be relevant to several government ministries, and the financing and scientific focus of the programme should be based on sectoral responsibility.

The group is requested to detail the areas in which research-based knowledge is needed, in the light of the challenges facing the coastal zone: the need to create value in this country, the need for integrated long-term resource management and challenges in an international context. This is discussed in more detail in the information on this effort that has been published on the Internet. The plan should adopt an integrated, problem-oriented focus rather than a discipline-oriented approach.

The group is requested to design central strategies with respect to research in the field, as regards quality, basic, user-oriented and applied research, multi- and interdisciplinary research, recruitment and competence development, national and international cooperation, information and communication strategies, etc.

Relevant R & D groups, user groups and the authorities should be drawn into the planning process wherever the group finds this an appropriate way of obtaining a broad spectrum of responses.

The plan should:

- briefly describe the current status of our knowledge and identify the most important needs for knowledge and competence
- describe relevant tasks for research. Needs for research should be prioritised with respect to different possible budgetary levels
- identify areas in which there is a particular need for recruitment and a need to build up competence
- identify areas in which multi- and interdisciplinary research within the field and vis-a-vis other fields would be desirable or necessary
- identify areas in which international cooperation would be particularly appropriate, in particular vis-‡-vis the EU and other central international cooperative programmes,

Relevant background documents

- Political documents:

White paper no. 29 (1996 - 97), ìRegional planning and land-use policyî
White paper no. 39 (1998 - 99), ìResearch at the threshold of a new eraî
White paper no. 43 (1998 - 99), ìConservation and use in the coastal zoneî
White paper no. 24 (2000 - 01), ìThe governmentís environmental protection policy and the state of the Norwegian environmentî
White paper no. 12 (2001 - 02), ìA clean, rich oceanî
White paper no. 25 (2002 - 03), ìThe governmentís environmental protection policy and the state of the Norwegian environmentî
White paper no. 19 (2002 - 03), ìA world of possibilities - the age of globalisation and its challengesî
NOU 2002: 1, ìPast, forms, futureî

- Strategic plans:

The Research Councilís strategic plan: ìThe will to do researchî
The Ministry of Fisheriesí strategic plan for 2001 - 03: ìValue from the sea: the future of Norwayî

- Documentation

The Directorate for Nature Management: ìConservation plan for Norwegian natureî
Planning document: ìThe sea and the coastal zone: sources of wealthî

- The EUís Water Framework Directive

- Inputs submitted by various professional and scientific bodies.

Appendix 2: Values and creation of value in the coastal zone

What the many reports on the creation of value in the coastal zone have in common is that the content of the ìcreation of valueî concept is not discussed. A dictionary definition of ìcreation of valueî is ìcreating value, whether spiritual or materialî.

In the context of the coastal zone, most people will relate the concept to improving the well-being of the coastal zone population and community. Creation of value can be defined as the realisation of value through inputs of scarce resources. We find the most precise definition of the concept in the national accounts, which link the creation of value concept to economic production. Creation of value is defined as the added value that a manufacturing process brings to a product, whether the product is a physical good or a service. Economic creation of value is thus the difference between the value of the product and the value of the production process.

The problem is that in very many cases, it can be difficult to assign a figure to the value of the product. Similarly, natural resources that do not have a financial value may have been among the inputs involved. If we move on from the national accounts, matters are no longer so simple. We need a definition of the concept that takes into account the fact that value adding takes place both through industrial manufacturing processes and via public-sector services. Improvements in environmental quality, restoration of resources, greater knowledge and artistic activity are all aspects of the creation of value. Nowadays it is often said that public-sector services help create conditions that encourage the creation of value, but we prefer to include such services as part of the process itself. When we adopt such a broadly-based concept for creation of value, the activities of the authorities and of the research sector form part of the total process of creation of value. In the educational sector, we can define creation of value as the extent to which the level of competence is raised relative to the resources put into the educational system.

Both the report drawn up by the Environmental Alliance for the Ministry of Environment ìCultural landscapes and environments as a basis for creation of valueî, White paper no. 29 (1996 - 97), ìRegional planning and land-use policyî and White paper no. 12 (2001 - 02), ìA clean, rich oceanî divide up these values in a similar fashion.

1. Creation of economic values: via the utilisation of resources for the production of goods and services, where the economic benefits can be measured. Under this heading, we need to distinguish between:
direct creation of value related to values that are realised through the use of resources to produce, for example, food, medicines, stimulants, art, clothes, building and fuel, as well as the utilisation of nature and culture for games, recreation, outdoor activities, tourism, teaching and research
indirect creation of value, or what we might call economic downstream effects related to the production of goods and services, such as biological production, soil formation, purification of water and the air.

2. Creation of cultural and environmental value: via the management of resources in accordance with environmental objectives. This is a matter of conservation, care, restoration and management. Such values are not necessarily exploited or even known, but they may form the basis of economic creation of value.
3. Immaterial creation of value. Creation of value of the type that deals with the activation of different values for people; creation of value that is rooted in ethical and moral values, for example related to a wish to know that a species exists, to the possibilities open to, and quality of life of, future generations, and to the desire to look after landscapes and aspects of nature that are a part of our cultural heritage and experience; in this case we are talking about a concept of value that would be difficult to measure in economic terms.

There are no sharply drawn boundaries between these perspectives on creation of value, and the creation of value from a one perspective may be essential for another type of creation of value. Measurement of creation of value can be done at the level of the individual, a company or society as a whole, and in many cases the creation of value at these three levels may well not be identical. For example, we may have positive creation of value at company level which has a negative effect on resources and society.

Appendix 3: International cooperation

The coastal zone is under severe pressure in many parts of the world, and research that examines process of change from an integrated perspective could provide important knowledge to international developments. Coastal zone management is near the top of the agenda of several international organisations, with the development of international agreements and regulations, and in marine researcher networks. Sustainable coastal zone management in developing countries is another important area of knowledge.

Globalisation is of particular importance in the trade and finance sectors as well as for the environment. Environmental questions have acquired greater importance, for example at the UNís conferences on development and the environment: UNCED in 1992 and WSSD in 2002. At regional level, fisheries questions have become of central importance in the framework of the North Sea Conferences, which offer a regional forum for cooperation on improvement of the marine environment. The need for new knowledge about the consequences of globalisation has risen in step with the growing internationalisation of various types of activity in the coastal zone.

International cooperation takes place for the most part as part of bilateral and multilateral agreements and fora. Cooperation with European countries, particularly in Scandinavia, is most relevant. It may be appropriate to cooperate in all four main areas of coastal zone research. However, Norwegian coastal nature and its coastal communities differ in many ways from those of other European countries. For this reason, it is particularly important to have sufficient knowledge available to enable us to evaluate the consequences of agreements with other countries and, for example, EU directives, before binding agreements are signed. The most central agreements and processes are the Oslo-Paris Convention (OSPAR), the EUís Framework Water Directive, the North Sea Conference, the Nordic Cooperative Agreement on Environmental and FIsheries Cooperation and the European Landscape Convention.

Marine legislation is an important field of international cooperation. The Convention on the Law of the Sea makes nation states responsible for the management of the natural resources within their coastal waters. The most important fisheries resources are shared out among several countries, and resources management therefore requires international collaboration. Cooperation on resources management takes place at global, regional and bilateral levels. At global level the central arena is the FAOís Fisheries Committee (COFI), which acts as a workshop for the development of principles for resources management (and trade), particularly through the ìCode of Conduct for Responsible Fisheriesî (1995) and its associated action plans.

At regional level there are a number of central organs, including the International Council for the Exploration of the Sea (ICES), the North-East Atlantic Fisheries Commission (NEAFC), the five-party cooperative agreement on herring management and the North Atlantic Marine Mammals Commission

(NAMMCO). At bilateral level, Norway has agreements with Russia, the EU, Poland, Iceland, Greenland and the Faeroes. It is at regional and bilateral level that the most important decisions regarding resources management are taken. The only organisation at global level that has a mandate to impose concrete resource management measures is the International Whaling Commission (IWC).

Resources management also affects international trade and commerce in the shape of product requirements. This takes place both in regional organisations such as the EU and the global trade organisation WTO.

The strategy of OSPAR with respect to biodiversity is to protect and conserve the ecosystems and biological diversity in marine areas that are liable to be affected by human activity, and to restore areas that have been negatively affected. The central elements of this work are the collection of information on natural conditions (mapping and monitoring species and habitats) and human activities (their scope and their effects on species and habitats), and to evaluate the available information (including following up ecological quality targets, which are drawn up as part of the OSPAR cooperative process) in order to develop such programmes and measures as might be required to achieve these aims.

The principle objective of the EUís Framework Water Directive is to protect and if necessary, improve the quality of freshwater, brackish water, coastal waters and groundwater, and to ensure that water resources are utilised in a sustainable manner. Its range of action at sea is out to one nautical mile beyond the chart datum line. Environmental targets are a completely central aspect of the Directive. The requirement is that all bodies of water must be protected against any deterioration in their quality and, if necessary, restored so as to satisfy the requirements regarding ìgood conditionî by 2015. Mapping, monitoring and action plans containing concrete measures are to be summarised in a management plan that should be available for all catchments by 2009. Such plans are to be drawn up following a broadly based process that ensures participation and ownership of the plan on the part of the authorities and organisations involved.

The aim of the North Sea Conferences is to place political focus on, and intensify international efforts regarding, the marine environment in all the North Sea states. To date, five North Sea Conferences have been organised, and these have resulted in political declarations which it is hoped will stimulate further work in existing international marine conventions.

The aim of the Nordic Environmental and Fisheries Strategy is to increase the integration of environmental considerations in the fisheries sector in order to ensure a positive development in the exploitation of the sea and its living resources, and to guarantee a good marine environment as a basis for conserving or improving biological diversity and thus also for sustainable fisheries, hunting and aquaculture. The Steering Group for the Nordic Environmental and Fisheries Strategy is responsible for implementing the strategy at project level. The strategy supports policy formation projects rather

than research projects. Its principal aim is to influence international processes that are relevant to questions concerning marine natural resources.

The Landscape Convention points out that the landscape is an important arena of general cultural, ecological, environmental and social interest. The landscape is a resource for economic activity, and its conservation, management and planning must be balanced. The Convention wishes to introduce a new set of regulations that will apply solely to the conservation, management and planning of all European landscapes. Procedures will be established to provide for the participation of the public, local and regional authorities and other parties with an interest in landscape policy. The landscape is to be integrated into district and town planning, in culture, environmental protection, agriculture, economics and in the social sector, as well as in other sectors that are capable of affecting the landscape whether directly or indirectly.

Appendix 4: Status of current knowledge in the natural and social sciences

The diversity of nature

The term ìdiversity of natureî refers to the diversity of forms of life, i.e. of plants, animals and micro-organisms, their genetic material and the communities that they form in their interactions with each other and the non-living environment. Geological diversity is defined in terms of variations in the bedrock, sedimentary masses and types of terrain, as well as geological processes. Biological and geological diversity together comprise the diversity of nature and form the most important foundation for the existence of mankind.

Types of nature and ecosystems - dynamics, structure and function

Norwayís coastal landscape ranges from steep, sheer mountain landscapes to low-lying archipelagos, flat beaches and shallows. The coast offers a series of different habitats, ranging from exposed hard seabeds to protective soft sediment bottoms. More than 10% of the area of the seabed in the coastal zone is covered by macrophyte systems dominated by kelp forests, belts of seaweed and eelgrass beds. Coral reefs and kelp forests are two of the most species-diverse marine biotopes.

Tangleweed (Laminaria hyperborea) makes up about 90% of Norwayís kelp forests, and the area off the coast of the counties of M□re og Romsdal and Tr□ndelag are regarded as the richest areas of giant kelp in the world.

Several of the habitats on our coasts are vulnerable or under threat. A large proportion of North Norwayís kelp forests, for example, has been eaten up by sea urchins in the course of the past 30 years. A number of coral reefs have already been destroyed by trawling, and sandy beaches have slipped into the sea following sand extraction.

Terrestrial botanical natural values in the shore zone are more frequently related to the form of different types of nature or vegetation than of individual species. Types of nature or vegetation of this sort may include shore meadows, chalk meadows and coastal heather moors. Many of these nature types have been reduced so much in size that they must be classified as being under threat.

Species habitats in the coastal zone

Species living on the coast of Norway are distributed according to physical conditions such as depth, currents, temperature, salinity, oxygen content and availability of nutrients. Primary producers, especially plankton, seaweeds and kelp, are the foundation of all life in the ocean. The production systems of kelp and seaweed make a significant contribution to the total coastal system and to the creation of value that takes place in the coastal zone. Kelp forests and the sub-littoral in the coastal zone and coastal waters are a heterogeneous milieu, where juvenile fish at their most vulnerable stages of growth seek both food

and shelter. The kelp forests and the sub-littoral zone are also important for crustaceans (including lobster and crab fry), seabirds and coastal species of seals. Much of the production of the kelp forest is transported to deep water, where it enters the food web.

In the course of many years of study, the eel grass beds of the Skagerrak coast have been shown to be important habitats for smaller coastal fish species and fro the fry of important commercial fish species. The energy turnover of these systems has hardly been studied.

Shallow-water areas and shore meadows are important feeding grounds for many species of birds, and river mouths and wetlands in particular are ecological systems of great importance. Several arctic species have their southern limits and many southern species their northern limits in our region, particularly on sandy beaches and in threshold fjords and enclosed small fjords.

Resources and their utilisation

Norway commercially exploits a number of species, including many species of fish, lobsters, crabs, mussels and kelp. Several fish stocks have been seriously reduced in the coastal zone. The many reasons for this include overfishing, river regulation, growth in stocks of predators, environmental toxins and changes in the habitats occupied by the fish. Sea ranching is one possible way of dealing with this problem, for example in order to rebuild stocks of halibut and plaice, etc., that have been fished down. This problem presents challenges on several levels with regard to environmental conditions and population ecology.

Experience from the use of the coastal zone for salmon farming has shown that parasites, particularly the salmon louse, are currently causing the most serious problem in terms of economic consequences and negative effects on wild fish populations. However, it has been difficult to document the effects of parasites because we lack sufficient knowledge of historical levels of infection. It is quite possible that similar problems will arise in future intensive farming of cod (and other marine species) on the coast.

Air-land-coast-sea interactions

Most important fish stocks in our waters spawn on the coast. The spawning migration involves a major transport of energy from the open sea to the coastal ecosystem. In terms of biomass these resources represent large figures and contribute to more than half the added value of Norwegian fisheries. There have been wide variations in the level of this transport; e.g. the fluctuations in herring stocks during the past 50 years.

Seabirds are an important link between the land and the marine environment. Seabirds obtain their food from the ocean, shallow-water areas and the open sea, and nest on the mainland. Norway lies on the migration routes of millions of seabirds that nest in North Norway and winter in the south of Europe and

Africa. Since 1960, a number of seabird populations have fallen in size, possibly as a result of the failure of food supplies, predation and pollution.

The rivers are the link between freshwater and the sea, and variations in river flow affect the coastal zone and marine environmental conditions.

Threats and threat scenarios - quality elements and ecological conditions

Threats of changes in the natural environment may include both natural and anthropogenic components, or a combination of the two. Human activities can affect the natural environment in a number of ways, such as:

- encroachments on land area (e.g. by fragmentation)
- changes in intensity of use (e.g. increases in tourism)
- pollution (over-fertilisation, tipping, discharges to the atmosphere, etc.)
- other changes over and above natural levels (e.g. river regulation, overfishing or the introduction of non-native species in ballast water).

The threat scenario varies along the length of the coast. In the North Sea, the fisheries, organic environmental toxins and nutrient salts appear to be the most important impact factors. Oil pollution, local discharges of heavy metals and organic environmental toxins and introduced species have also been identified as important impact factors. In general, the Norwegian Sea and the Barents Sea are less affected. In these regions the fisheries and long-range transport of organic environmental toxins have the most serious effects on marine ecosystems. Sharper focus is currently being put on ìnewî threat factors such as oil transportation by vessels of varying standard and the introduction of new species into a sensitive ecosystem.

The climate is largely responsible for controlling the frame conditions for marine life and industry on the coast. Potential climatic effects are therefore an important aspect of coastal zone problems. Climatic change can affect temperature conditions, wind patterns and precipitation, leading to changes in environmental conditions such as species composition on the coast. The extent and speed of such changes are determined by a number of factors, especially those that directly influence distribution, fecundity and length of life.

The EUís Water Framework Directive forms a superstructure for the other 20 EU directives that deal with water and provide guidelines for integrated water management for the European Community as a whole and for its individual members. Measures aimed at implementing the Water Directive on the part of the Norwegian authorities will require the development of a methodology for the biological classification of ecological status. A basic aspect of such an effort will be to describe the natural conditions that satisfy the requirements for ìhigh ecological statusî for the (marine) habitats and groups of organisms concerned. At the same time, areas and localities with such a status will be identified, so that these can serve as areas of reference in future monitoring programmes. The limited availability of knowledge and data means that a significant amount of research will have to be put into these efforts, for

example in connection with identifying threshold values for natural variations in the reference areas with high ecological status.

Society and culture
The need for knowledge for integrated coastal zone research has many aspects. Here we are in need of contributions from all branches of social science that are oriented to problems of the coast, whether on shore or at sea. The fact that the need for knowledge is greatest today on the sea side of the coastal zone is related to two factors, the first of which is that the use of inshore coastal waters as areas of production is of relatively recent date. New problems are raised by every species that becomes the object of intensive production techniques. The second factor is that planning the use of areas of the sea is a form of planning that is still in a learning phase, while on the land side we possess a great deal of previous experience on which we can build. Even though the planning system is the same on shore and in the sea, the planning media are so different that knowledge acquired in the course of land-use planning is not necessarily transferable to the sea.

It is becoming ever more clear that decisions regarding localisation and the use of area on land are of both direct and indirect importance for marine resources and the use of sea area. This has become especially evident on our southern coasts, not least through the use of the coast and its resources for leisure purposes. Our knowledge base in this area is relatively limited, and there is a general lack of knowledge about the sum of the loads on the resources of the coast and its area.

Coastal industry and economic creation of value
We have a relatively good knowledge of the social aspects of parts of the fishing and aquaculture industries, but there are also areas in which our knowledge is less well developed. In recent years, for example, conscious efforts have been made to develop a good knowledge base in market research. On the other hand, we lack a great deal of knowledge in the areas of industrial development and innovation in the marine sector, especially in the light of our visions of creation of value in this area. The conditions for new industrial development related to marine or regional industrial clusters are an area of knowledge which is currently being developed, but our knowledge base is still incomplete.

Greater attention has recently begun to be paid to the whole value chain from resources base to consumer. We have relatively good knowledge about the management of fish resources, for example via the use of bio-economic models, while our knowledge of how such management relates to markets and the development of coastal society is poorer.

The adaptation of the marine industrial system to growing competition for marine resources and areas is a demanding area of knowledge, which requires contributions from many disciplines and in which we currently lack knowledge of a number of important areas.

Coastal society and coastal culture
A relatively large number of studies of coastal and fishing communities have been carried out. However, this picture is characterised by a number of notable individual studies which have provided us with knowledge relating to a certain point in time. This is due to a lack of long-term programmes for knowledge development in this field. Since both industry and coastal societies are dynamic systems in the process of rapid change, yesterdayís knowledge will not be sufficient to meet the knowledge challenges of today and tomorrow. This raises the need for follow-up studies of change processes and adaptation to serious trends of change.

It was not least the initial phase of the aquaculture industry that demonstrated the importance of local entrepreneurs for industrial development on the coast. The conditions necessary for realising and maintaining the potential for creation of value represented by coastal societies is an important field of knowledge that is still insufficiently developed.

In comparison with the importance of coastal culture in our history and in the creation of value today, relatively little emphasis has been placed on communicating the cultural history of the coast or on conserving its cultural landscapes and environments. The growing pressure on the use of the resources and area of the coast has also brought about a growing consciousness of the value of coastal culture and the need for its maintenance. Here too, the situation is that our knowledge of this area has certain lacunae. The Research Council is planning, in agreement with the Ministry of Environment, a programme of research on cultural landscapes and environments as part of the programme ìLandscape in changeî, starting in 2004.

Area use planning and nature and resources management
Knowledge of the social science aspects of marine resource management is best developed where major fish stocks are concerned. To a lesser extent there is a demand for knowledge about the management of inshore coastal resources. In coastal communities that are dependent on natural resources there is an obvious relationship between how natural resources are managed and the standard of living. Although individual studies deal with this topic there is still a need for more knowledge. The opposite relationship is less obvious, but is just as important. What is the importance of coastal communities and coastal culture for the management of natural resources, and what role ought they to play in it? Here we possess fragments of knowledge on which to build, and it will be essential to develop a knowledge base for management models that incorporate a resources management system based on partnership.

Legal conditions in the coastal zone lead to a need for specialised expertise. Given the scope of our ambitions regarding the future development of industrial activity in our inshore coastal waters, severe competition is bound to arise for the use of area and the exploitation of natural resources. This will offer major challenges to the rights system in the coastal zone. The informal

rights system of the coastal zone will come under increasing pressure and new rights uses will clash with general rights. Our knowledge base in this field is underdeveloped.

Coastal zone planning is largely a matter of balancing various emerging concerns and interests in the use of sea area. This in turn brings the planning process itself into focus, in addition to the question of how to integrate competing interests, particularly at the interface between the use and conservation of coastal areas. The requirements that are being set with regard to integrated planning bring up the need to develop new knowledge-based management models. Models capable of contributing to the coordination of sectors and management levels, as well as to participation and conflict resolution, will be important.

It will also be necessary to develop knowledge of the professional management culture and the decision-making processes involved in the management of coastal resources and area. Many questions are involved here. How are conflicts of values and interests to be solved? How can we ensure that the interests of industrial development are taken into account along with those of the environment and the value of nature in itself? How are cultural landscapes and environments protected in the coastal zone planning process? Do our ambitions regarding integration and integrated planning match the institutional requirements required by planning of this sort?